

## **Oracle® Solaris Cluster Data Service for Oracle Guide**

Copyright © 2000, 2014, Oracle and/or its affiliates. All rights reserved.

This software and related documentation are provided under a license agreement containing restrictions on use and disclosure and are protected by intellectual property laws. Except as expressly permitted in your license agreement or allowed by law, you may not use, copy, reproduce, translate, broadcast, modify, license, transmit, distribute, exhibit, perform, publish, or display any part, in any form, or by any means. Reverse engineering, disassembly, or decompilation of this software, unless required by law for interoperability, is prohibited.

The information contained herein is subject to change without notice and is not warranted to be error-free. If you find any errors, please report them to us in writing.

If this is software or related documentation that is delivered to the U.S. Government or anyone licensing it on behalf of the U.S. Government, the following notice is applicable:

**U.S. GOVERNMENT END USERS.** Oracle programs, including any operating system, integrated software, any programs installed on the hardware, and/or documentation, delivered to U.S. Government end users are "commercial computer software" pursuant to the applicable Federal Acquisition Regulation and agency-specific supplemental regulations. As such, use, duplication, disclosure, modification, and adaptation of the programs, including any operating system, integrated software, any programs installed on the hardware, and/or documentation, shall be subject to license terms and license restrictions applicable to the programs. No other rights are granted to the U.S. Government.

This software or hardware is developed for general use in a variety of information management applications. It is not developed or intended for use in any inherently dangerous applications, including applications that may create a risk of personal injury. If you use this software or hardware in dangerous applications, then you shall be responsible to take all appropriate fail-safe, backup, redundancy, and other measures to ensure its safe use. Oracle Corporation and its affiliates disclaim any liability for any damages caused by use of this software or hardware in dangerous applications.

Oracle and Java are registered trademarks of Oracle and/or its affiliates. Other names may be trademarks of their respective owners.

Intel and Intel Xeon are trademarks or registered trademarks of Intel Corporation. All SPARC trademarks are used under license and are trademarks or registered trademarks of SPARC International, Inc. AMD, Opteron, the AMD logo, and the AMD Opteron logo are trademarks or registered trademarks of Advanced Micro Devices. UNIX is a registered trademark of The Open Group.

This software or hardware and documentation may provide access to or information on content, products, and services from third parties. Oracle Corporation and its affiliates are not responsible for and expressly disclaim all warranties of any kind with respect to third-party content, products, and services. Oracle Corporation and its affiliates will not be responsible for any loss, costs, or damages incurred due to your access to or use of third-party content, products, or services.

---

Ce logiciel et la documentation qui l'accompagne sont protégés par les lois sur la propriété intellectuelle. Ils sont concédés sous licence et soumis à des restrictions d'utilisation et de divulgation. Sauf disposition de votre contrat de licence ou de la loi, vous ne pouvez pas copier, reproduire, traduire, diffuser, modifier, breveter, transmettre, distribuer, exposer, exécuter, publier ou afficher le logiciel, même partiellement, sous quelque forme et par quelque procédé que ce soit. Par ailleurs, il est interdit de procéder à toute ingénierie inverse du logiciel, de le désassembler ou de le décompiler, excepté à des fins d'interopérabilité avec des logiciels tiers ou tel que prescrit par la loi.

Les informations fournies dans ce document sont susceptibles de modification sans préavis. Par ailleurs, Oracle Corporation ne garantit pas qu'elles soient exemptes d'erreurs et vous invite, le cas échéant, à lui en faire part par écrit.

Si ce logiciel, ou la documentation qui l'accompagne, est concédé sous licence au Gouvernement des Etats-Unis, ou à toute entité qui délivre la licence de ce logiciel ou l'utilise pour le compte du Gouvernement des Etats-Unis, la notice suivante s'applique:

**U.S. GOVERNMENT END USERS.** Oracle programs, including any operating system, integrated software, any programs installed on the hardware, and/or documentation, delivered to U.S. Government end users are "commercial computer software" pursuant to the applicable Federal Acquisition Regulation and agency-specific supplemental regulations. As such, use, duplication, disclosure, modification, and adaptation of the programs, including any operating system, integrated software, any programs installed on the hardware, and/or documentation, shall be subject to license terms and license restrictions applicable to the programs. No other rights are granted to the U.S. Government.

Ce logiciel ou matériel a été développé pour un usage général dans le cadre d'applications de gestion des informations. Ce logiciel ou matériel n'est pas conçu ni n'est destiné à être utilisé dans des applications à risque, notamment dans des applications pouvant causer des dommages corporels. Si vous utilisez ce logiciel ou matériel dans le cadre d'applications dangereuses, il est de votre responsabilité de prendre toutes les mesures de secours, de sauvegarde, de redondance et autres mesures nécessaires à son utilisation dans des conditions optimales de sécurité. Oracle Corporation et ses affiliés déclinent toute responsabilité quant aux dommages causés par l'utilisation de ce logiciel ou matériel pour ce type d'applications.

Oracle et Java sont des marques déposées d'Oracle Corporation et/ou de ses affiliés. Tout autre nom mentionné peut correspondre à des marques appartenant à d'autres propriétaires qu'Oracle.

Intel et Intel Xeon sont des marques ou des marques déposées d'Intel Corporation. Toutes les marques SPARC sont utilisées sous licence et sont des marques ou des marques déposées de SPARC International, Inc. AMD, Opteron, le logo AMD et le logo AMD Opteron sont des marques ou des marques déposées d'Advanced Micro Devices. UNIX est une marque déposée d'The Open Group.

Ce logiciel ou matériel et la documentation qui l'accompagne peuvent fournir des informations ou des liens donnant accès à des contenus, des produits et des services émanant de tiers. Oracle Corporation et ses affiliés déclinent toute responsabilité ou garantie expresse quant aux contenus, produits ou services émanant de tiers. En aucun cas, Oracle Corporation et ses affiliés ne sauraient être tenus pour responsables des pertes subies, des coûts occasionnés ou des dommages causés par l'accès à des contenus, produits ou services tiers, ou à leur utilisation.

# Contents

---

<b>Preface .....</b>	9
<b>1   Installing and Configuring HA for Oracle .....</b>	13
Overview of the Installation and Configuration Process for HA for Oracle .....	14
Planning the HA for Oracle Installation and Configuration .....	16
Configuration Requirements .....	16
Configuration Planning Questions .....	18
Preparing the Nodes and Disks .....	19
▼ How to Prepare the Nodes .....	19
▼ How to Configure the Oracle Database Access Using Solaris Volume Manager .....	22
▼ How to Configure the Oracle Database Access Using Veritas Volume Manager .....	23
▼ How to Configure the Oracle Database Access Using Oracle ASM .....	23
▼ How to Configure an Oracle Grid Infrastructure for Clusters SCAN Listener .....	24
Installing the Oracle ASM Software .....	25
Verifying the Oracle ASM Software Installation .....	26
Installing the Oracle Database Software .....	26
▼ How to Install the Oracle Database Software .....	26
▼ How to Set the Oracle Database Kernel Parameters .....	28
Verifying the Oracle Database Installation and Configuration .....	29
▼ How to Verify the Oracle Database Installation .....	29
Creating an Oracle Database .....	29
▼ How to Create a Primary Oracle Database .....	30
Setting Up Oracle Database Permissions .....	31
▼ How to Set Up Oracle Database Permissions .....	31
Installing the HA for Oracle Packages .....	34
▼ How to Install the HA for Oracle Packages .....	34
Registering and Configuring HA for Oracle .....	36
Tools for Registering and Configuring HA for Oracle .....	36

Setting HA for Oracle Extension Properties .....	37
▼ How to Register and Configure HA for Oracle ( <code>clsetup</code> ) .....	37
▼ How to Register and Configure HA for Oracle Without Oracle Grid Infrastructure (CLI) .....	42
▼ How to Register and Configure HA for Oracle With Oracle Grid Infrastructure for a Standalone Server (CLI) .....	50
▼ How to Register and Configure HA for Oracle With Oracle Grid Infrastructure for a Cluster (CLI) .....	54
Verifying the HA for Oracle Installation .....	63
▼ How to Verify the HA for Oracle Installation .....	63
Oracle Clients .....	64
Location of HA for Oracle Log Files .....	65
Tuning the HA for Oracle Fault Monitors .....	65
Operation of the Oracle Server Fault Monitor .....	66
Operation of the Oracle Listener Fault Monitor .....	68
Obtaining Core Files for Troubleshooting DBMS Timeouts .....	69
Customizing the HA for Oracle Server Fault Monitor .....	69
Defining Custom Behavior for Errors .....	70
Propagating a Custom Action File to All Nodes in a Cluster .....	78
Specifying the Custom Action File That a Server Fault Monitor Should Use .....	78
Upgrading HA for Oracle Resource Types .....	79
Upgrading the <code>SUNW.oracle_listener</code> Resource Type .....	80
Upgrading the <code>SUNW.oracle_server</code> Resource Type .....	81
Changing the Role of an Oracle Data Guard Instance .....	82
▼ How to Change the Role of an Oracle Data Guard Instance .....	83
 <b>A HA for Oracle Extension Properties .....</b>	85
<code>SUNW.oracle_server</code> Extension Properties .....	85
<code>SUNW.oracle_listener</code> Extension Properties .....	89
 <b>B Preset Actions for DBMS Errors and Logged Alerts .....</b>	91
 <b>C Sample Configurations for Oracle ASM with HA for Oracle .....</b>	99
Choosing the Appropriate Oracle ASM Instance .....	99
Single Instance Oracle ASM with Separate Disk Groups .....	100

Clustered Oracle ASM with Clustered Disk Groups .....	103
Single Instance Oracle ASM with Separate Disk Groups in a Non-Global Zone .....	108
<b>Index .....</b>	<b>113</b>



# Tables

---

<b>TABLE 1-1</b>	Task Map: Installing and Configuring HA for Oracle .....	14
<b>TABLE 1-2</b>	Task Map: Installing and Configuring HA for Oracle with Single Instance Oracle ASM .....	15
<b>TABLE 1-3</b>	Task Map: Installing and Configuring HA for Oracle with Clustered Oracle ASM .....	15
<b>TABLE 1-4</b>	Resource Types for HA for Oracle Fault Monitors .....	65
<b>TABLE B-1</b>	Preset Actions for DBMS Errors .....	91
<b>TABLE B-2</b>	Preset Actions for Logged Alerts .....	98



# Preface

---

*Oracle Solaris Cluster Data Service for Oracle Guide* explains how to install and configure Oracle Solaris Cluster data services.

---

**Note** – This Oracle Solaris Cluster release supports systems that use the SPARC and x86 families of processor architectures: UltraSPARC, SPARC64, AMD64, and Intel 64. In this document, x86 refers to the larger family of 64-bit x86 compatible products. Information in this document pertains to all platforms unless otherwise specified.

---

This document is intended for system administrators with extensive knowledge of Oracle software and hardware. Do not use this document as a planning or presales guide. Before reading this document, you should have already determined your system requirements and purchased the appropriate equipment and software.

The instructions in this book assume knowledge of the Oracle Solaris operating system and expertise with the volume-manager software that is used with Oracle Solaris Cluster software.

## Using UNIX Commands

This document contains information about commands that are specific to installing and configuring Oracle Solaris Cluster data services. The document does *not* contain comprehensive information about basic UNIX commands and procedures, such as shutting down the system, booting the system, and configuring devices. Information about basic UNIX commands and procedures is available from the following sources:

- Online documentation for the Oracle Solaris operating system
- Oracle Solaris operating system man pages
- Other software documentation that you received with your system

# Typographic Conventions

The following table describes the typographic conventions that are used in this book.

TABLE P-1 Typographic Conventions

Typeface	Meaning	Example
AaBbCc123	The names of commands, files, and directories, and onscreen computer output	Edit your <code>.login</code> file. Use <code>ls -a</code> to list all files. <code>machine_name% you have mail.</code>
AaBbCc123	What you type, contrasted with onscreen computer output	<code>machine_name% su</code> <code>Password:</code>
<i>aabbcc123</i>	Placeholder: replace with a real name or value	The command to remove a file is <code>rm filename</code> .
<i>AaBbCc123</i>	Book titles, new terms, and terms to be emphasized	Read Chapter 6 in the <i>User's Guide</i> . A <i>cache</i> is a copy that is stored locally. Do <i>not</i> save the file. <b>Note:</b> Some emphasized items appear bold online.

# Shell Prompts in Command Examples

The following table shows the default UNIX system prompt and superuser prompt for shells that are included in the Oracle Solaris OS. Note that the default system prompt that is displayed in command examples varies, depending on the Oracle Solaris release.

TABLE P-2 Shell Prompts

Shell	Prompt
Bash shell, Korn shell, and Bourne shell	\$
Bash shell, Korn shell, and Bourne shell for superuser	#
C shell	<code>machine_name%</code>
C shell for superuser	<code>machine_name#</code>

## Related Documentation

Information about related Oracle Solaris Cluster topics is available in the documentation that is listed in the following table. All Oracle Solaris Cluster documentation is available at [http://www.oracle.com/technetwork/indexes/documentation/index.html#sys\\_sw](http://www.oracle.com/technetwork/indexes/documentation/index.html#sys_sw).

Topic	Documentation
Concepts	<i>Oracle Solaris Cluster Concepts Guide</i>
Hardware installation and administration	<i>Oracle Solaris Cluster 3.3 Hardware Administration Manual</i> and individual hardware administration guides
Software installation	<i>Oracle Solaris Cluster Software Installation Guide</i>
Data service installation and administration	<i>Oracle Solaris Cluster Data Services Planning and Administration Guide</i> and individual data service guides
Data service development	<i>Oracle Solaris Cluster Data Services Developer's Guide</i>
System administration	<i>Oracle Solaris Cluster System Administration Guide</i>
	<i>Oracle Solaris Cluster Quick Reference</i>
Software upgrade	<i>Oracle Solaris Cluster Upgrade Guide</i>
Error messages	<i>Oracle Solaris Cluster Error Messages Guide</i>
Command and function references	<i>Oracle Solaris Cluster Reference Manual</i> <i>Oracle Solaris Cluster Data Services Reference Manual</i>

For a complete list of Oracle Solaris Cluster documentation, see the release notes for your version of Oracle Solaris Cluster software.

## Documentation and Support

See the following web sites for additional resources:

- Documentation (<http://www.oracle.com/technetwork/indexes/documentation/index.html>)
- Support (<http://www.oracle.com/us/support/systems/index.html>)

## Oracle Software Resources

Oracle Technology Network (<http://www.oracle.com/technetwork/index.html>) offers a range of resources related to Oracle software:

- Discuss technical problems and solutions on the [Discussion Forums](http://forums.oracle.com) (<http://forums.oracle.com>).
- Get hands-on step-by-step tutorials with [Oracle By Example](http://www.oracle.com/technetwork/tutorials/index.html) (<http://www.oracle.com/technetwork/tutorials/index.html>).

## Getting Help

If you have problems installing or using Oracle Solaris Cluster, contact your service provider and provide the following information.

- Your name and email address (if available)
- Your company name, address, and phone number
- The model number and serial number of your systems
- The release number of the operating environment (for example, Oracle Solaris 10)
- The release number of Oracle Solaris Cluster (for example, Oracle Solaris Cluster 3.3)

Use the following commands to gather information about your system for your service provider.

Command	Function
<code>prtconf -v</code>	Displays the size of the system memory and reports information about peripheral devices
<code>psrinfo -v</code>	Displays information about processors
<code>showrev -p</code>	Reports which patches are installed
<code>prtdiag -v</code>	Displays system diagnostic information
<code>/usr/cluster/bin/clnode show-rev -v</code>	Displays Oracle Solaris Cluster release and package version information for each node

Also have available the contents of the `/var/adm/messages` file.

# Installing and Configuring HA for Oracle

---

This chapter explains how to install and configure Oracle Solaris Cluster HA for Oracle (HA for Oracle).

This chapter contains the following sections.

- “Overview of the Installation and Configuration Process for HA for Oracle” on page 14
- “Planning the HA for Oracle Installation and Configuration” on page 16
- “Preparing the Nodes and Disks” on page 19
- “Installing the Oracle Database Software” on page 26
- “Verifying the Oracle Database Installation and Configuration” on page 29
- “Creating an Oracle Database” on page 29
- “Setting Up Oracle Database Permissions” on page 31
- “Installing the HA for Oracle Packages” on page 34
- “Registering and Configuring HA for Oracle” on page 36
- “Verifying the HA for Oracle Installation” on page 63
- “Tuning the HA for Oracle Fault Monitors” on page 65
- “Customizing the HA for Oracle Server Fault Monitor” on page 69
- “Upgrading HA for Oracle Resource Types” on page 79
- “Changing the Role of an Oracle Data Guard Instance” on page 82

---

**Note** – You can use Oracle Solaris Cluster Manager to configure this data service. See the Oracle Solaris Cluster Manager online help for details.

---

# Overview of the Installation and Configuration Process for HA for Oracle

The following task maps summarize the tasks for installing and configuring HA for Oracle. The tables also provide cross-references to detailed instructions for performing the tasks.

- [Task Map: Installing and Configuring HA for Oracle](#)
- [Task Map: Installing and Configuring HA for Oracle with Single Instance Oracle ASM](#)
- [Task Map: Installing and Configuring HA for Oracle with Clustered Oracle ASM](#)

Perform these tasks in the order that they are listed. If you are using HA for Oracle with Oracle Data Guard, perform these tasks on each cluster where your Oracle Database instances are running.

---

**Note** – Single instance Oracle ASM is not supported with Oracle 11g release 2 or 12c. For these releases, you must only use clustered Oracle ASM.

---

**TABLE 1-1** Task Map: Installing and Configuring HA for Oracle

Task	Cross-Reference
Plan the HA for Oracle installation and configuration	<a href="#">“Planning the HA for Oracle Installation and Configuration” on page 16</a>
Prepare the nodes and disks	<a href="#">“Preparing the Nodes and Disks” on page 19</a>
Install the Oracle Database software	<a href="#">“How to Install the Oracle Database Software” on page 26</a>
Verify the Oracle Database installation	<a href="#">“How to Verify the Oracle Database Installation” on page 29</a>
Create an Oracle database	<a href="#">“How to Create a Primary Oracle Database” on page 30</a>
Set up Oracle database permissions	<a href="#">“How to Set Up Oracle Database Permissions” on page 31</a>
Install the HA for Oracle packages	<a href="#">“Installing the HA for Oracle Packages” on page 34</a>
Register and configure HA for Oracle	<a href="#">“How to Register and Configure HA for Oracle Without Oracle Grid Infrastructure (CLI)” on page 42</a>
Verify the HA for Oracle installation	<a href="#">“Verifying the HA for Oracle Installation” on page 63</a>
Tune the HA for Oracle fault monitor	<a href="#">“Tuning the HA for Oracle Fault Monitors” on page 65</a>
(Optional) Customize the HA for Oracle server fault monitor	<a href="#">“Customizing the HA for Oracle Server Fault Monitor” on page 69</a>
(Optional) Upgrade HA for Oracle resource types	<a href="#">“Upgrading HA for Oracle Resource Types” on page 79</a>

**TABLE 1–1** Task Map: Installing and Configuring HA for Oracle (Continued)

Task	Cross-Reference
(Optional) Change the role of an Oracle Data Guard instance	<a href="#">“Changing the Role of an Oracle Data Guard Instance” on page 82</a>

**TABLE 1–2** Task Map: Installing and Configuring HA for Oracle with Single Instance Oracle ASM

Task	Cross-Reference
Plan the HA for Oracle installation and configuration	<a href="#">“Planning the HA for Oracle Installation and Configuration” on page 16</a>
Prepare the nodes and disks	<a href="#">“Preparing the Nodes and Disks” on page 19</a>
Install the Oracle ASM software	<a href="#">“Installing the Oracle ASM Software” on page 25</a>
Install the Oracle Database software	<a href="#">“How to Install the Oracle Database Software” on page 26</a>
Verify the Oracle Database installation	<a href="#">“How to Verify the Oracle Database Installation” on page 29</a>
Create an Oracle database	<a href="#">“How to Create a Primary Oracle Database” on page 30</a>
Set up Oracle database permissions	<a href="#">“How to Set Up Oracle Database Permissions” on page 31</a>
Install the HA for Oracle packages	<a href="#">“Installing the HA for Oracle Packages” on page 34</a>
Register and configure HA for Oracle	<a href="#">“How to Register and Configure HA for Oracle With Oracle Grid Infrastructure for a Standalone Server (CLI)” on page 50</a>
Verify the HA for Oracle installation	<a href="#">“Verifying the HA for Oracle Installation” on page 63</a>
Tune the HA for Oracle fault monitor	<a href="#">“Tuning the HA for Oracle Fault Monitors” on page 65</a>
(Optional) Customize the HA for Oracle server fault monitor	<a href="#">“Customizing the HA for Oracle Server Fault Monitor” on page 69</a>
(Optional) Upgrade HA for Oracle resource types	<a href="#">“Upgrading HA for Oracle Resource Types” on page 79</a>
(Optional) Change the role of an Oracle Data Guard instance	<a href="#">“Changing the Role of an Oracle Data Guard Instance” on page 82</a>

**TABLE 1–3** Task Map: Installing and Configuring HA for Oracle with Clustered Oracle ASM

Task	Cross-Reference
Plan the HA for Oracle installation and configuration	<a href="#">“Planning the HA for Oracle Installation and Configuration” on page 16</a>
Prepare the nodes and disks	<a href="#">“Preparing the Nodes and Disks” on page 19</a>
Install the Oracle ASM software	<a href="#">“Installing the Oracle ASM Software” on page 25</a>

**TABLE 1-3** Task Map: Installing and Configuring HA for Oracle with Clustered Oracle ASM  
(Continued)

Task	Cross-Reference
Install the Oracle Database software	<a href="#">“How to Install the Oracle Database Software” on page 26</a>
Verify the Oracle Database installation	<a href="#">“How to Verify the Oracle Database Installation” on page 29</a>
Create an Oracle database	<a href="#">“How to Create a Primary Oracle Database” on page 30</a>
Set up Oracle database permissions	<a href="#">“How to Set Up Oracle Database Permissions” on page 31</a>
Install the HA for Oracle packages	<a href="#">“Installing the HA for Oracle Packages” on page 34</a>
Register and configure HA for Oracle	<a href="#">“How to Register and Configure HA for Oracle With Oracle Grid Infrastructure for a Cluster (CLI)” on page 54</a>
Verify the HA for Oracle installation	<a href="#">“Verifying the HA for Oracle Installation” on page 63</a>
Tune the HA for Oracle fault monitor	<a href="#">“Tuning the HA for Oracle Fault Monitors” on page 65</a>
(Optional) Customize the HA for Oracle server fault monitor	<a href="#">“Customizing the HA for Oracle Server Fault Monitor” on page 69</a>
(Optional) Upgrade HA for Oracle resource types	<a href="#">“Upgrading HA for Oracle Resource Types” on page 79</a>
(Optional) Change the role of an Oracle Data Guard instance	<a href="#">“Changing the Role of an Oracle Data Guard Instance” on page 82</a>

## Planning the HA for Oracle Installation and Configuration

This section contains the information that you need to plan your HA for Oracle installation and configuration.

---

**Note** – Unless otherwise stated, instructions and information for Oracle Database 11g apply to both Oracle Database 11g release 1 and Oracle Database 11g release 2.

---

## Configuration Requirements




---

**Caution** – Your data service configuration might not be supported if you do not adhere to these requirements.

---

Use the requirements in this section to plan the installation and configuration of HA for Oracle. These requirements apply to HA for Oracle only. You must meet these requirements before you proceed with your HA for Oracle installation and configuration.

You can configure HA for Oracle to run in non-global zones, with the following conditions:

- You cannot configure Oracle Solaris Cluster HA for Oracle to be controlled by the HA for Solaris Containers data service.
- You must use a highly available local file system.

You can also configure HA for Oracle in a zone cluster.



**Caution** – Raw devices from Oracle Solaris Cluster device groups are not supported in non-global zones.

For requirements that apply to all data services, see “[Configuration Guidelines for Oracle Solaris Cluster Data Services](#)” in *Oracle Solaris Cluster Data Services Planning and Administration Guide*.

- **Oracle Database application files** – These files include Oracle Database binaries, configuration files, and parameter files. You can install these files either on the local file system, the highly available local file system, or on the cluster file system.  
See “[Configuration Guidelines for Oracle Solaris Cluster Data Services](#)” in *Oracle Solaris Cluster Data Services Planning and Administration Guide* for the advantages and disadvantages of placing the Oracle Database binaries on the local file system, highly available local file system, and the cluster file system.
- **Database related files** – These files include the control file, redo logs, and data files. You must install these files on either raw devices or as regular files on the highly available local, ACFS 12c file system, or cluster file system. Raw devices from Oracle Solaris Cluster device groups are not supported in non-global zones.
- **Oracle ASM configuration** – Oracle Automatic Storage Management (Oracle ASM) is a storage option that provides the services of a file system, logical volume manager, and software redundant array of independent disks (RAID) in a platform independent manner. If you are planning to install Oracle ASM, you should choose the appropriate Oracle ASM instance and disk group for your Oracle Database installation. There are two types of Oracle ASM instances, single Oracle ASM instance and clustered Oracle ASM instance. See “[Choosing the Appropriate Oracle ASM Instance](#)” on page 99 for information on choosing the appropriate Oracle ASM instance. For more information on Oracle ASM, see the Oracle Database documentation corresponding to the Oracle Database version you are using.

**Note** – Single instance Oracle ASM is not supported with Oracle 11g release 2 or 12c. For these releases, you must only use clustered Oracle ASM.

If the single instance Oracle Database software is installed on a node using an Oracle ASM disk group, then certain files are not included within the Oracle ASM disk group and they

resided only locally. You should ensure that these files are copied to the other cluster nodes from the node where the Oracle Database single instance is created.

Starting with the Oracle Database 11g release 1 database version, you copy the following directories to other cluster nodes:

- \${ORACLE\_BASE}/diag/rdbms/sid
- \${ORACLE\_BASE}/admin
- \${ORACLE\_HOME}/ dbs/pfile.ora

If you are using an Oracle Database 10g database, you copy the following directories to other cluster nodes:

- \${ORACLE\_HOME}/admin
- \${ORACLE\_HOME}/dbs/initSID.ora

After you copy the necessary directories to the cluster nodes, ensure that the copied directories have the same user and group permissions as on the source system.

- **Oracle ASM with Solaris Volume Manager mirrored logical volumes** – The following behavior might occur when you use Solaris Volume Manager mirrored logical volumes with Oracle ASM:
  - Performance degradation – Oracle ASM does not support Solaris Volume Manager Application Based Recovery (ABR). Instead, use external redundancy of Oracle ASM for Solaris Volume Manager devices. Avoid normal and high redundancy of Oracle ASM for Solaris Volume Manager devices. For additional information, see Article 603825.1 at <https://support.oracle.com>.
  - Failures of the SUNW.ScalDeviceGroup probe – Failures of this probe result in a loss of availability of any service that is dependent on the SUNW.ScalDeviceGroup resource. You can mitigate such failures by increasing the IOTimeout property setting for the SUNW.ScalDeviceGroup resource type.

```
# clresource set -p IOTimeout=time-in-seconds resource-name
```

The default setting for the IOTimeout property is 30 seconds. Depending on your configuration, this value can be much higher and should be determined for each system individually. If you experience failures of this probe, start by setting the IOTimeout property to 240 seconds and adjust the setting further as needed.

## Configuration Planning Questions

Use the questions in this section to plan the installation and configuration of HA for Oracle. Write the answers to these questions in the space that is provided on the data service worksheets in “[Configuration Worksheets](#)” in *Oracle Solaris Cluster Data Services Planning and Administration Guide*.

- What resource groups will you use for network addresses and application resources and the dependencies between them?
- What is the logical hostname (for failover services) or shared address (for scalable services) for clients that will access the data service?
- Where will the system configuration files reside?

See “[Configuration Guidelines for Oracle Solaris Cluster Data Services](#)” in *Oracle Solaris Cluster Data Services Planning and Administration Guide* for the advantages and disadvantages of placing the Oracle Database binaries on the local file system rather than the cluster file system.

- Does your database setup require standby instances?

If you use the `cl setup` utility to register and configure HA for Oracle, some of these questions are answered automatically by the utility.

For information about standby databases, see your Oracle Database documentation.

- Are you planning to use Oracle ASM storage?

If you are planning to use Oracle ASM storage, you should decide if you require single instance or clustered instance Oracle ASM. See “[Choosing the Appropriate Oracle ASM Instance](#)” on page 99 for information on how to choose the appropriate Oracle ASM instance.

For information about standby databases, see your Oracle Database documentation.

## Preparing the Nodes and Disks

This section contains the procedures that you need to prepare the nodes and disks.

- “[How to Prepare the Nodes](#)” on page 19
- “[How to Configure the Oracle Database Access Using Solaris Volume Manager](#)” on page 22
- “[How to Configure the Oracle Database Access Using Veritas Volume Manager](#)” on page 23
- “[How to Configure the Oracle Database Access Using Oracle ASM](#)” on page 23
- “[How to Configure an Oracle Grid Infrastructure for Clusters SCAN Listener](#)” on page 24

### ▼ How to Prepare the Nodes

Use this procedure to prepare for the installation and configuration of Oracle Database software.



**Caution** – Perform all of the steps in this section on all the nodes. If you do not perform all of the steps on all of the nodes, the Oracle Database installation is incomplete. An incomplete Oracle Database installation causes HA for Oracle to fail during startup.

---

**Note** – Consult the Oracle Database documentation before you perform this procedure.

---

The following steps prepare your nodes and install the Oracle Database software.

- 1   Become superuser on all of the cluster members.**
  - 2   Configure the cluster file system for HA for Oracle.**
- 



**Caution** – Raw devices from Oracle Solaris Cluster device groups are not supported in non-global zones.

---

If raw devices contain the databases, configure the global devices for raw device access. See the *Oracle Solaris Cluster Software Installation Guide* for information about how to configure global devices.

If you use the Solaris Volume Manager software, configure the Oracle Database software to use UNIX file system (UFS) logging on mirrored metadevices or raw-mirrored metadevices. See the Solaris Volume Manager documentation for more information about how to configure raw-mirrored metadevices.

If you use the Oracle Solaris ZFS file system for Oracle Database files, configure a highly available local ZFS file system. For more information, see “[How to Set Up the HAStoragePlus Resource Type to Make a Local Solaris ZFS Highly Available](#)” in *Oracle Solaris Cluster Data Services Planning and Administration Guide*.

If you use the Sun QFS file system, configure the Sun QFS file system for using with Oracle Database software. For more information on configuring the Sun QFS file system, see “[Using the Sun QFS Shared File System](#)” in *Oracle Solaris Cluster Data Service for Oracle Real Application Clusters Guide*.

- 3   Prepare the \$ORACLE\_HOME directory on a local or multihost disk.**

---

**Note** – If you install the Oracle Database binaries on a local disk, use a separate disk if possible. Installing the Oracle Database binaries on a separate disk prevents the binaries from overwrites during operating environment reinstallation. When you use Oracle ASM you should create two \$ORACLE\_HOME directories, one \$ORACLE\_HOME directory for Oracle Database and the additional \$ORACLE\_HOME directory for Oracle ASM.

---

**4 On each node or zone, create an entry for the database administrator (DBA) group in the /etc/group file, and add potential users to the group.**

You typically name the DBA group dba. Verify that the oracle users are members of the dba group, and add entries as necessary for other DBA users. Ensure that the group IDs are the same on all of the nodes or zones that run HA for Oracle, as the following example illustrates.

```
dba:*:520:root,oracle
```

If you use Oracle ASM, you should add an additional entry for the DBA group in the /etc/group file for Oracle ASM.

```
dba:*:520:root,oracle,oraasm
```

You can create group entries in a network name service (for example, NIS or NIS+). If you create group entries in this way, add your entries to the local /etc/inet/hosts file to eliminate dependency on the network name service.

**5 On each node or zone, create an entry for the Oracle Database user ID (oracle).**

You typically name the Oracle Database user ID oracle. The following command updates the /etc/passwd and /etc/shadow files with an entry for the Oracle Database user ID.

```
# useradd -u 120 -g dba -d /Oracle_home oracle
```

Ensure that the oracle user entry is the same on all the nodes or zones that run HA for Oracle.

If you use Oracle ASM, you should create an additional Oracle Database user ID for Oracle ASM.

```
# useradd -u 121 -g dba -d /asm-home oraasm
```

**6 If you are using Oracle Database 10.2.0.3 or higher, you should perform the following steps on each Oracle Solaris zone.**

---

**Note** – You must perform these steps while creating a zone. If you fail to perform these steps, it results in an error. To resolve the error, you should set the necessary privileges and then run ORACLE\_HOME/bin/localconfig reset ORACLE\_HOME.

---

```
# zoneadm -z zcname halt
# zonecfg -z zcname info limitpriv
# zonecfg -z zcname set limitpriv=default,proc_prioctl
```

```
# zonecfg -z zcname info limitpriv  
# zoneadm -z zcname boot
```

- 7 If you are using a zone cluster, configure the `limitpriv` property by using the `clzonecluster` command.

```
# clzonecluster configure zcname  
clzonecluster:zcname>set limitpriv="default,proc_priocntl,proc_clock_highres"  
clzonecluster:zcname>commit
```

- 8 On each zone-cluster node, prevent Oracle Clusterware time synchronization from running in active mode.

- a. Log in to the zone-cluster node as root.
- b. Create an empty `/etc/inet/ntp.conf` file.

```
# touch /etc/inet/ntp.conf
```

## ▼ How to Configure the Oracle Database Access Using Solaris Volume Manager

Use this procedure to configure the Oracle database using Solaris Volume Manager.

---

Note – You can run this procedure only in the global zone.

---

- 1 Configure the disk devices for the Solaris Volume Manager software to use.

See [Oracle Solaris Cluster Software Installation Guide](#) for information about how to configure the Solaris Volume Manager software.

- 2 If you use raw devices to contain the databases, run the following commands to change each raw-mirrored metadevice's owner, group, and mode.

If you do not use raw devices, do not perform this step.

- a. If you create raw devices, run the following commands for each device on each node that can master the Oracle Database resource group.

```
# chown oracle /dev/md/metaset/rdsck/dn  
# chgrp dba /dev/md/metaset/rdsck/dn  
# chmod 600 /dev/md/metaset/rdsck/dn
```

`metaset`      Specifies the name of the disk set

`/rdsck/dn`     Specifies the name of the raw disk device within the `metaset` disk set

- b. Verify that the changes are effective.

```
# ls -ll /dev/md/metaset/rdsck/dn
```

## ▼ How to Configure the Oracle Database Access Using Veritas Volume Manager

Use this procedure to configure the Oracle Database software using Veritas Volume Manager software.

---

**Note** – You can run this procedure only in the global zone.

---

### 1 Configure the disk devices for the VxVM software to use.

See the [Oracle Solaris Cluster Software Installation Guide](#) for information about how to configure Veritas Volume Manager.

### 2 If you use raw devices to contain the databases, run the following commands on the current disk-group primary to change each device's owner, group, and mode.

If you do not use raw devices, do not perform this step.

#### a. If you create raw devices, run the following command for each raw device.

```
# vxedit -g diskgroup set user=oracle group=dba mode=600 volume
```

diskgroup      Specifies the name of the disk group  
volume        Specifies the name of the raw device within the disk group

#### b. Verify that the changes are effective.

```
# ls -LL /dev/vx/rdsk/diskgroup/volume
```

#### c. Synchronize the device group with the cluster to keep the VxVM namespace consistent throughout the cluster.

```
# cldevicegroup sync diskgroup
```

## ▼ How to Configure the Oracle Database Access Using Oracle ASM

Use this procedure to configure the Oracle Database access using Oracle ASM. You can use Oracle ASM on VxVM or Solaris Volume Manager.

### 1 Configure the disk devices for the Oracle ASM software to use.

See the “Using Oracle ASM” in [Oracle Solaris Cluster Data Service for Oracle Real Application Clusters Guide](#) for information about how to configure Oracle ASM.

- 2 Set up the permissions for the Oracle ASM disks to be used by Oracle ASM disk groups.
  - a. Run the following commands for each device on each node that can master the Oracle Database resource group.
 

```
# chown oraasm:dba /dev/did/rdisk/dn
# chmod 660 /dev/did/rdisk/dn
```
  - b. Verify that the changes are effective.
 

```
# ls -lhL /dev/did/rdisk/dn
```

## ▼ How to Configure an Oracle Grid Infrastructure for Clusters SCAN Listener

When the HA for Oracle data service is deployed using Oracle Database 11g release 2 or 12c Grid Infrastructure for Clusters, the preferred listener for a single-instance database is an Oracle Grid Infrastructure for Clusters Single Client Access Name (SCAN) listener. To leverage a SCAN in the HA for Oracle configuration, you must modify the Oracle Database 11g release 2 or 12c single-instance database `remote_listener` parameter to reflect the SCAN name and port number.

If you configure a SCAN listener, you can ignore subsequent instructions in this manual about creating an Oracle Database listener resource with the `SUNW.oracle_listener` resource type. An Oracle Database listener resource is unnecessary when the SCAN listener is configured.

For more information about the SCAN, see *Oracle Grid Infrastructure Installation Guide 11g Release 2 (11.2) for Solaris Operating System* ([http://download.oracle.com/docs/cd/E11882\\_01/install.112/e17213/toc.htm](http://download.oracle.com/docs/cd/E11882_01/install.112/e17213/toc.htm)).

The following example procedure shows the commands and sample output to configure the SCAN name and port. Perform this procedure on each node of the cluster.

### 1 Become superuser on the node.

### 2 Configure a SCAN listener.

```
# srvctl config scan
SCAN name: scanname, Network: 1/ipaddress/netmask/adaptername
SCAN VIP name: scanvip, IP: /ipalias/vipaddress

# srvctl config scan_listener
SCAN Listener LISTENER_SCAN1 exists. Port: TCP:portnumber
#
SQL> show parameters listener

NAME          TYPE    VALUE
```

```

-----  

listener_networks    string  

local_listener       string   (DESCRIPTION=(ADDRESS_LIST=(ADDRESS=(PROTOCOL=TCP) (HOST=nodename)  

                                (PORT=portnumber))))  

remote_listener      string  

-----  

SQL>  

SQL> alter system set remote_listener = 'scancode:portnumber' scope=both;  

System altered.  

SQL> show parameters listener  

-----  

NAME          TYPE    VALUE  

-----  

listener_networks  string  

local_listener    string   (DESCRIPTION=(ADDRESS_LIST=(ADDRESS=(PROTOCOL=TCP) (HOST=nodename)  

                                (PORT=portnumber))))  

remote_listener   string   scancode:portnumber  

SQL>

```

## Installing the Oracle ASM Software

Oracle ASM installation consists of installing and creating an Oracle ASM instance and configuring the required Oracle ASM disk groups. An Oracle ASM disk group is a collection of disk devices to store data files that Oracle ASM instances manage as a unit. Oracle ASM instances mount disk groups to make Oracle ASM files available to database instances.

You should decide the type of Oracle ASM instance you want to use. You can use Oracle ASM instance as single instance Oracle ASM or clustered Oracle ASM using Oracle Clusterware instances. For information on how to choose the appropriate Oracle ASM instance, see [“Choosing the Appropriate Oracle ASM Instance” on page 99](#).

---

**Note** – Single instance Oracle ASM is not supported with Oracle 11g release 2 or 12c. For these releases, you must only use clustered Oracle ASM.

---

If you are using clustered Oracle ASM, you should first install the Oracle Clusterware software and then install Oracle ASM. If you are using clustered Oracle ASM on SPARC, you should also install the ORCLudlm package before installing Oracle ASM.

When you run Oracle Universal Installer, you have the option to configure and install Oracle ASM and create disk groups. For detailed information on installing and configuring Oracle ASM, see the Oracle Database documentation corresponding to the Oracle Database version you are using.

When you create the same disk group with Oracle ASM on different cluster nodes, you must create the disk group one node at a time and dismount the disk group before creating the same disk group on another cluster node.

---

**Note** – You should set up and configure the file system, where the Oracle ASM ORACLE\_HOME resides, before performing the Oracle ASM installation. Use only a local file system for the Oracle ASM home.

---

## Verifying the Oracle ASM Software Installation

After installing Oracle ASM software, you can verify that Oracle ASM software is installed and Oracle ASM disk group is mounted on a cluster node by performing the following steps.

```
# sqlplus "/ as sysdba"
sql> select * from v$sga;
sql> select name,state from v$asm_diskgroup;
sql> exit;
#
```

---

**Note** – If you are using Oracle Database 11g or 12c, use **sqlplus "/ as sysasm"** instead of **sqlplus "/ as sysdba"**.

---

## Installing the Oracle Database Software

This section contains the procedure that you need to install Oracle Database software.

### ▼ How to Install the Oracle Database Software

- 1 **Become superuser on a cluster member.**
- 2 **If you plan to install the Oracle Database software on a cluster file system, start the Oracle Solaris Cluster software and become the owner of the device group.**  
If you plan to install the Oracle Database software at another location, omit this step.  
For more information about installation locations, see “[Preparing the Nodes and Disks](#)” on [page 19](#).

### 3 Install the Oracle Database software.

Before you start the Oracle Database installation, ensure that the system resources required for Oracle Database have been configured. Log in as `oracle` to ensure ownership of the entire directory before you perform this step. See the appropriate Oracle Database installation and configuration guides for instructions about how to install Oracle Database software.

You could use Solaris Resource Management (SRM) to ensure that the kernel parameters are set to at least the minimum values that Oracle Database requires. For more information about setting the Oracle Database kernel parameters, see [“How to Set the Oracle Database Kernel Parameters” on page 28](#). After the system resources have been configured for Oracle Database you can start the installation itself.

### 4 (Optional) If you are using HA for Oracle with Oracle Database 10g release 1, prevent the Oracle Database `cssd` daemon from being started.

If you are using HA for Oracle with Oracle Database 10g release 2, omit this step.

Remove the entry for the Oracle Database `cssd` daemon from the `/etc/inittab` file on the node where the Oracle Database software is installed. To remove this entry, remove the following line from the `/etc/inittab` file:

```
h1:23:respawn:/etc/init.d/init.cssd run >/dev/null 2>&1 > /dev/null
```

HA for Oracle does not require the Oracle Database `cssd` daemon. Therefore, removal of this entry does *not* affect the operation of Oracle Database 10g release 1 with HA for Oracle. If your Oracle Database installation changes so that the Oracle Database `cssd` daemon is required, restore the entry for this daemon to the `/etc/inittab` file.



**Caution** – If you are using Oracle RAC 10g release 1, do *not* remove the entry for the `cssd` daemon from the `/etc/inittab` file.

If you remove the entry for the Oracle Database `cssd` daemon from the `/etc/inittab` file, you prevent unnecessary error messages from being displayed. Otherwise, an attempt by the [init\(1M\)](#) command to start the Oracle Database `cssd` daemon might cause such error messages to be displayed. These error messages are displayed if the Oracle Database binary files are installed on a highly available local file system or on the cluster file system. The messages are displayed repeatedly until the file system where the Oracle Database binary files are installed is mounted. These error messages are as follows:

```
INIT: Command is respawning too rapidly. Check for possible errors.  
id: h1 "/etc/init.d/init.cssd run >/dev/null 2>&1 >/dev/null"
```

```
Waiting for filesystem containing $CRSCTL.
```

If you are using HA for Oracle on the x86 platform, unnecessary error messages about the unavailability of the UNIX Distributed Lock Manager (UDLM) might also be displayed.

These messages are displayed if the following events occur:

- A node is running in noncluster mode. In this situation, file systems that Oracle Solaris Cluster controls are never mounted.
- A node is booting. In this situation, the messages are displayed repeatedly until Oracle Solaris Cluster mounts the file system where the Oracle Database binary files are installed.
- Oracle Database is started on or fails over to a node or zone where the Oracle Database installation was *not* originally run. In such a configuration, the Oracle Database binary files are installed on a highly available local file system. In this situation, the messages are displayed on the console of the node or zone where the Oracle Database installation was run.

## ▼ How to Set the Oracle Database Kernel Parameters

The default project is modified to contain the resources required for Oracle Database as the RGM uses the default project for running the data service. If you want to use a specific SRM project for running Oracle Database, you must create that project and configure the system resources in that project using the same procedure. Specify the project name instead of default. When you configure the resource group or resource for the Oracle Database server, specify that project name in the corresponding property of the resource group or resource.

### 1 Display the settings for the default project.

```
phys-X# prctl -i project default
```

### 2 If no kernel parameters are set, or if any kernel parameters are not set to the minimum required value for Oracle Database as shown in the following table, set the parameter.

```
phys-X# projmod -s -K "parameter=(priv,value,deny)" default
```

Oracle Database Kernel Parameter	Minimum Required Value
process.max-sem-nsems	256
project.max-sem-ids	100
project.max-shm-ids	100
project.max-shm-memory	4294967295

See the *Oracle 10g Installation Guide* for more information about these parameters.

### 3 Verify the new settings.

```
phys-X# prctl -i project default
```

# Verifying the Oracle Database Installation and Configuration

This section contains the procedure that you need to verify the Oracle Database installation and configuration.

## ▼ How to Verify the Oracle Database Installation

This procedure does not verify that your application is highly available because you have not yet installed your data service.

**1 Confirm that the owner, group, and mode of the \$ORACLE\_HOME/bin/oracle file are as follows:**

- Owner: oracle
- Group: dba
- Mode: -rwsr-s--x

```
# ls -l $ORACLE_HOME/bin/oracle
```

**2 Verify that the listener binaries exist in the \$ORACLE\_HOME/bin directory.**

**Next Steps** When you have completed the work in this section, go to “[Creating an Oracle Database](#)” on page 29.

# Creating an Oracle Database

After verifying the Oracle Database installation and configuration, create the Oracle databases that you require.

- If you are using Oracle Database *without* standby databases, perform the procedure “[How to Create a Primary Oracle Database](#)” on page 30. This procedure is not required for any additional databases that you might create and configure.
- If you are using Oracle Data Guard, create the following database instances:
  - **Primary database instance.** For instructions for creating a primary database, see “[How to Create a Primary Oracle Database](#)” on page 30.
  - **Standby database instances.** A standby database instance can be either a physical standby database instance or a logical standby database instance. For instructions for creating standby database instances, see your Oracle Database documentation.

## ▼ How to Create a Primary Oracle Database

### 1 Prepare database configuration files.

Place all of the database-related files (data files, redo log files, and control files) on either shared raw global devices or on the cluster file system. See “[Preparing the Nodes and Disks](#)” on page 19 for information about installation locations.

---

**Note** – If the database exists in the non-global zone, do not place the database-related files on the shared raw devices.

Within the `init$ORACLE_SID.ora` or `config$ORACLE_SID.ora` file, you might need to modify the assignments for `control_files` and `background_dump_dest` to specify the locations of the control files and alert files.

---

**Note** – If you use Solaris authentication for database logins, set the `remote_os_authent` variable in the `init$ORACLE_SID.ora` file to True.

### 2 Start the creation of the database by using one utility from the following list:

- The Oracle installer
- The Oracle `sqlplus(1M)` command
- The Oracle Database Configuration Assistant

During creation, ensure that all the database-related files are placed in the appropriate location, either on shared global devices , on the cluster file system, or on a highly available local file system.

### 3 Verify that the file names of your control files match the file names in your configuration files.

### 4 Create the `v$sysstat` view.

Run the catalog scripts that create the `v$sysstat` view. The HA for Oracle fault monitor uses this view. For more information, see your Oracle Database documentation.

**Next Steps** When you have completed the work in this section, go to “[Setting Up Oracle Database Permissions](#)” on page 31.

# Setting Up Oracle Database Permissions



**Caution** – Do not perform the steps in this section for an Oracle Database physical standby database.

Perform the procedure in this section to set up database permissions for an Oracle primary database or an Oracle logical standby database.

## ▼ How to Set Up Oracle Database Permissions

### 1 Enable access for the user and password to be used for fault monitoring.

- To use the Oracle Database authentication method, grant to this user authority on the `v_$sysstat` view and the `v_$archive_dest` view.

```
# sqlplus "/ as sysdba"

sql> create user user identified by passwd;
sql> alter user user default tablespace system quota 1m on system;
sql> grant select on v_$sysstat to user;
sql> grant select on v_$archive_dest to user;
sql> grant select on v_$database to user;
sql> grant create session to user;
sql> grant create table to user;
sql> create profile profile limit PASSWORD_LIFE_TIME UNLIMITED;
sql> alter user user identified by passwd profile profile;

sql> exit;
#
```

You can use this method for all the supported Oracle Database releases.

- To use the Solaris authentication method, perform the following steps:

- a. Confirm that the `remote_os_authent` parameter is set to TRUE.

```
# sqlplus "/ as sysdba"
sql> show parameter remote_os_authent
```

NAME	TYPE	VALUE
remote_os_authent	boolean	TRUE

- b. Determine the setting of the `os_authent_prefix` parameter.

```
# sql> show parameter os_authent_prefix
```

NAME	TYPE	VALUE
os_authent_prefix	string	ops\$

c. Grant permission for the database to use Oracle Solaris authentication.

```
sql> create user prefix user identified by externally default
  tablespace system quota 1m on system;
sql> grant connect, resource to prefix user;
sql> grant select on v_$sysstat to prefix user;
sql> grant select on v_$archive_dest to prefix user;
sql> grant select on v_$database to prefix user;
sql> grant create session to prefix user;
sql> grant create table to prefix user;
sql> exit;
#
```

The replaceable items in these commands are as follows:

- *prefix* is the setting of the `os_authent_prefix` parameter. The default setting of this parameter is `ops$`.
- *user* is the user for whom you are enabling Oracle Solaris authentication. Ensure that this user owns the files under the `$ORACLE_HOME` directory.

---

**Note** – Do not type a space between *prefix* and *user*.

---

2 Configure NET8 for the Oracle Solaris Cluster software.

The `listener.ora` file must be accessible from all the nodes or zones that are in the cluster. Place these files either under the cluster file system or in the local file system of each node or zone that can potentially run the Oracle Database resources.

---

**Note** – If you place the `listener.ora` file in a location other than the `/var/opt/oracle` directory or the `$ORACLE_HOME/network/admin` directory, you must specify the `TNS_ADMIN` variable or an equivalent Oracle Database variable in a user-environment file. For information about Oracle Database variables, see the Oracle Database documentation.

You must also run the `clresource(1CL)` command to set the resource extension parameter `User_env`, which sources the user-environment file. See “[SUNW.oracle\\_listener Extension Properties](#)” on page 89 or “[SUNW.oracle\\_server Extension Properties](#)” on page 85 for format details.

---

HA for Oracle imposes no restrictions on the listener name; it can be any valid Oracle Database listener name.

The following code sample identifies the lines in `listener.ora` that are updated.

```
LISTENER =
  (DESCRIPTION_LIST =
    (DESCRIPTION =
      (ADDRESS_LIST =
        (ADDRESS = (PROTOCOL = IPC) (KEY = EXTPROC))
        (ADDRESS = (PROTOCOL = TCP) (HOST = logical-hostname) (PORT = port-used))
      )
    )
  )
```

The following code sample identifies the lines in `tnsnames.ora` that are updated on client machines.

```
service_name =
.

        (ADDRESS =
            (PROTOCOL = TCP)
            (HOST = logicalhostname)    <- logical hostname
            (PORT = 1527) <- must match port in LISTENER.ORA
        )
    )
(CONNECT_DATA =
    (SID = <SID>)) <- database name, default is ORCL
```

The following example shows how to update the `listener.ora` and `tnsnames.ora` files for the following Oracle Database instances.

Instance	Logical Host	Listener
ora8	hadbms3	LISTENER-ora8
ora9	hadbms4	LISTENER-ora9

The corresponding `listener.ora` entries are the following entries.

```
LISTENER-ora9 =
(ADDRESS_LIST =
(ADDRESS =
    (PROTOCOL = TCP)
    (HOST = hadbms4)
    (PORT = 1530)
)
)
SID_LIST_LISTENER-ora9 =
(SID_LIST =
(SID_DESC =
(SID_NAME = ora9)
)
)
LISTENER-ora8 =
(ADDRESS_LIST =
(ADDRESS= (PROTOCOL=TCP) (HOST=hadbms3) (PORT=1806))
)
SID_LIST_LISTENER-ora8 =
(SID_LIST =
(SID_DESC =
(SID_NAME = ora8)
)
)
```

The corresponding `tnsnames.ora` entries are the following entries.

```
ora8 =
(DESCRIPTION =
```

```
(ADDRESS_LIST =
    (ADDRESS = (PROTOCOL = TCP)
        (HOST = hadbms3)
        (PORT = 1806))
    )
    (CONNECT_DATA = (SID = ora8))
)
ora9 =
(DESCRIPTION =
    (ADDRESS_LIST =
        (ADDRESS =
            (PROTOCOL = TCP)
            (HOST = hadbms4)
            (PORT = 1530)))
    )
    (CONNECT_DATA = (SID = ora9))
)
```

**3 Verify that the Oracle Solaris Cluster software is installed and running on all the nodes.**

```
# cluster status clustername
```

**Next Steps** Go to “[Installing the HA for Oracle Packages](#)” on page 34 to install the HA for Oracle packages.

## Installing the HA for Oracle Packages

If you did not install the HA for Oracle packages during your initial Oracle Solaris Cluster installation, perform this procedure to install the packages. To install the packages, use the `installer` program.

---

**Note** – You need to install the HA for Oracle packages in the global cluster and not in the zone cluster.

---

### ▼ How to Install the HA for Oracle Packages

Perform this procedure on each cluster node where you want the HA for Oracle software to run.

You can run the `installer` program with a command-line interface (CLI) or with a graphical user interface (GUI). The content and sequence of instructions in the CLI and the GUI are similar.

---

**Note** – Even if you plan to configure this data service to run in non-global zones, install the packages for this data service in the global zone. The packages are propagated to any existing non-global zones and to any non-global zones that are created after you install the packages.

---

**Before You Begin** Ensure that you have the Oracle Solaris Cluster installation media.

If you intend to run the `installer` program with a GUI, ensure that your `DISPLAY` environment variable is set.

**1 On the cluster node where you are installing the data service packages, become superuser.**

**2 Load the Oracle Solaris Cluster installation media into the DVD-ROM drive.**

If the Volume Management daemon `vold(1M)` is running and configured to manage DVD-ROM devices, the daemon automatically mounts the DVD-ROM on the `/cdrom` directory.

**3 Change to the installation wizard directory of the DVD-ROM.**

- If you are installing the data service packages on the SPARC platform, type the following command:

```
# cd /cdrom/cdrom0/Solaris_sparc
```

- If you are installing the data service packages on the x86 platform, type the following command:

```
# cd /cdrom/cdrom0/Solaris_x86
```

**4 Start the installation wizard.**

```
# ./installer
```

**5 When you are prompted, accept the license agreement.**

**6 From the list of Oracle Solaris Cluster agents under Availability Services, select the data service for Oracle.**

**7 If you require support for languages other than English, select the option to install multilingual packages.**

English language support is always installed.

**8 When prompted whether to configure the data service now or later, choose Configure Later.**

Choose Configure Later to perform the configuration after the installation.

**9 Follow the instructions on the screen to install the data service packages on the node.**

The installation wizard displays the status of the installation. When the installation is complete, the wizard displays an installation summary and the installation logs.

**10 (GUI only) If you do not want to register the product and receive product updates, deselect the Product Registration option.**

The Product Registration option is not available with the CLI. If you are running the installation wizard with the CLI, omit this step.

- 11 Exit the installation wizard.
- 12 Unload the installation media from the DVD-ROM drive.
  - a. To ensure that the DVD-ROM is not being used, change to a directory that does *not* reside on the DVD-ROM.
  - b. Eject the DVD-ROM.  

```
# eject cdrom
```

## Registering and Configuring HA for Oracle

This section describes how to register and configure the HA for Oracle data service, with or without Oracle Grid Infrastructure (Grid Infrastructure) software installed on the same nodes that run Oracle Solaris Cluster software.

This section provides the following information:

- “Tools for Registering and Configuring HA for Oracle” on page 36
- “Setting HA for Oracle Extension Properties” on page 37
- “How to Register and Configure HA for Oracle (`csetup`)” on page 37
- “How to Register and Configure HA for Oracle Without Oracle Grid Infrastructure (CLI)” on page 42
- “How to Register and Configure HA for Oracle With Oracle Grid Infrastructure for a Standalone Server (CLI)” on page 50
- “How to Register and Configure HA for Oracle With Oracle Grid Infrastructure for a Cluster (CLI)” on page 54

## Tools for Registering and Configuring HA for Oracle

Oracle Solaris Cluster provides the following tools for registering and configuring HA for Oracle:

- **The `csetup(1CL)` utility.** For more information, see “How to Register and Configure HA for Oracle (`csetup`)” on page 37.
- **Oracle Solaris Cluster Manager.** For more information, see the Oracle Solaris Cluster Manager online help.
- **Oracle Solaris Cluster maintenance commands.** For more information, see “How to Register and Configure HA for Oracle Without Oracle Grid Infrastructure (CLI)” on page 42.

The `csetup` utility and Oracle Solaris Cluster Manager each provide a wizard for configuring HA for Oracle. The wizards reduce the possibility for configuration errors that might result

from command syntax errors or omissions. These wizards also ensure that all required resources are created and that all required dependencies between resources are set.

## Setting HA for Oracle Extension Properties

Use the extension properties in [Appendix A, “HA for Oracle Extension Properties,”](#) to create your resources. To set an extension property of a resource, include the option `-p property=value` in the `clresource(1CL)` command that creates or modifies the resource. Use the procedure in [Chapter 2, “Administering Data Service Resources,”](#) in [\*Oracle Solaris Cluster Data Services Planning and Administration Guide\*](#) to configure the extension properties if you have already created your resources.

You can update some extension properties dynamically. You can update others, however, only when you create or disable a resource. The Tunable entries indicate when you can update each property. See the [`r\_properties\(5\)`](#) man page for details about all Oracle Solaris Cluster resource properties.

[`SUNW.oracle\_server` Extension Properties](#) on page 85 describes the extension properties that you can set for the Oracle server.

- If you use Oracle Database version 11g release 2 or 12c with Oracle ASM or with Oracle Grid Infrastructure for Clusters Single Client Access Name (SCAN), you are required to set only the following extension properties for the Oracle server:
  - `ORACLE_HOME`
  - `ORACLE_SID`
  - `Db_unique_name`
- Otherwise, you are required to set only the following extension properties:
  - `ORACLE_HOME`
  - `ORACLE_SID`
  - `Alert_log_file`
  - `Connect_string`

## ▼ How to Register and Configure HA for Oracle (`clsetup`)

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

---

**Note** – The `clsetup` utility does not support configuration of HA for Oracle with ZFS.

---

**Before You Begin** Ensure that the following prerequisites are met:

- If you use a volume manager, the volume manager of the cluster is configured to provide volumes on shared storage that are accessible from any node where Oracle could potentially run.
- If you use a volume manager, the raw devices and file systems on the storage volumes that Oracle will use for its database are created.
- The Oracle software is installed to be accessible from all nodes or zones where Oracle could potentially run.
- Kernel variables for the UNIX operating system are configured for Oracle.
- The Oracle software is configured for all nodes or zones that could potentially run Oracle.
- The data service packages are installed.

Ensure that you have the following information:

- The names of the cluster nodes or zones that master the data service.
- The logical hostname that clients use to access the data service. Normally, you set up this IP address when you install the cluster. See the *Oracle Solaris Cluster Concepts Guide* for details about network resources.
- The path to the Oracle Database application binaries for the resources that you plan to configure.
- The database type.

**1    Become superuser on any cluster node.**

**2    Start the `clsetup` utility.**

```
# clsetup
```

The `clsetup` main menu is displayed.

**3    Type the number that corresponds to the option for data services and press Return.**

The Data Services menu is displayed.

**4    Type the number that corresponds to the option for configuring HA for Oracle and press Return.**

The `clsetup` utility displays the list of prerequisites for performing this task.

**5    Verify that the prerequisites are met, and press Return.**

The `clsetup` utility displays a list of the cluster nodes.

**6    Select the nodes or zones where you require Oracle Database software to run.**

- To accept the default selection of all listed nodes or zones in an arbitrary order, press Return.

- **To select a subset of the listed nodes or zones, type a comma-separated or space-separated list of the numbers that correspond to the nodes or zones. Then press Return.**

Ensure that the nodes or zones are listed in the order in which the nodes or zones are to appear in the node list of the resource group in which the Oracle Database resource is to be placed. The first node or zone in the list is the primary node or zone of this resource group.

- **To select all nodes or zones in a particular order, type a comma-separated or space-separated ordered list of the numbers that correspond to the nodes or zones and press Return.**

Ensure that the nodes or zones are listed in the order in which the nodes or zones are to appear in the node list of the resource group in which the Oracle resource is to be placed. The first node or zone in the list is the primary node or zone of this resource group.

**7 To confirm your selection of nodes or zones, type d and press Return.**

The `clsetup` utility displays the types of Oracle Database components that are to be configured.

**8 Type the numbers of the Oracle Database components you want to configure and press Return.**

The `clsetup` utility lists the Oracle Database home directory.

**9 Specify the Oracle home directory for your installation of the Oracle Database software.**

- **If the directory is listed, select the directory as follows:**

**a. Type the number that corresponds the directory that you are selecting.**

The `clsetup` utility displays a list of Oracle Database system identifiers that are configured on the cluster. The utility also prompts you to specify the system identifier for your installation of Oracle.

- **If the directory is not listed, specify the directory explicitly.**

**a. Type e and press Return.**

The `clsetup` utility prompts you for the Oracle home directory.

**b. Type the full path to the Oracle Database home directory and press Return.**

The `clsetup` utility displays a list of Oracle system identifiers that are configured on the cluster. The utility also prompts you to specify the system identifier for your installation of Oracle Database software.

**10 Specify the Oracle SID of the Oracle database that you are configuring.**

- If the SID is listed, select the SID as follows:

- a. Type the number that corresponds the SID that you are selecting.

The csetup utility displays the properties of the Oracle Solaris Cluster resources that the utility will create.

- If the SID is not listed, specify the SID explicitly.

- a. Type e and press Return.

The csetup utility prompts you for the SID.

- b. Type the SID and press Return.

The csetup utility displays the properties of the Oracle Solaris Cluster resources that the utility will create.

The csetup utility displays the properties of the Oracle Solaris Cluster resources that the utility will create.

**11 If you require a different name for any Oracle Solaris Cluster resources properties, change each name as follows.**

- a. Type the number that corresponds to the name that you are changing and press Return.

The csetup utility displays a screen where you can specify the new name.

- b. At the New Value prompt, type the new name and press Return.

The csetup utility returns you to the list of the properties of the Oracle Solaris Cluster resource that the utility will create.

**12 To confirm your selection of Oracle Solaris Cluster resource properties, type d and press Return.**

The csetup utility displays a list of existing storage resources. If no storage resources are available, the csetup utility displays a list of shared storage types where data is to be stored.

**13 Type the numbers that correspond to type of shared storage that you are using for storing the data and press Return.**

The csetup utility displays the file-system mount points that are configured in the cluster.

**14 Select the file system mount points as follows.**

- To accept the default selection of all listed file-system mount points in an arbitrary order, type a. Then press Return.

- To select a subset of the listed file system mount points, type a comma-separated or space-separated list of the numbers that correspond to the file-system mount points. Then press Return.

The csetup utility displays the global disk sets and device groups that are configured in the cluster.

**15 Select the device groups as follows.**

- To accept the default selection of all listed device groups in an arbitrary order, type a and press Return.
- To select a subset of the listed device groups, type a comma-separated or space-separated list of the numbers that correspond to the device groups and press Return.

The csetup utility returns to you the list of highly available storage resources.

**16 Type a comma-separated or space-separated list of the numbers that correspond to the storage resources that your data service requires, and press Return.**

**17 To confirm your selection of Oracle Solaris Cluster storage resources, type d and press Return.**

The csetup utility displays all the existing logical hostname resources in the cluster. If there are no logical hostname resources available, the csetup utility prompts for the logical hostname that the resource is to make highly available.

**18 Specify the logical hostname and press Return.**

The csetup utility returns to you the list of available logical hostname resources.

**19 Type a comma-separated or space-separated list of the numbers that correspond to the logical hostname resources that your data service requires, and press Return.**

**20 To confirm your selection of Oracle Solaris Cluster logical hostname resources, type d and press Return.**

The csetup utility displays the names of the Oracle Solaris Cluster objects that the utility will create.

**21 If you require a different name for any Oracle Solaris Cluster objects, change each name as follows.**

- Type the number that corresponds to the name that you are changing and press Return.

The csetup utility displays a screen where you can specify the new name.

- At the New Value prompt, type the new name and press Return.

The `clsetup` utility returns you to the list of the names of the Oracle Solaris Cluster objects that the utility will create.

**22 To confirm your selection of Oracle Solaris Cluster object names, type d and press Return.**

**23 To create the configuration, type c and Press Return.**

The `clsetup` utility displays a progress message to indicate that the utility is running commands to create the configuration. When configuration is complete, the `clsetup` utility displays the commands that the utility ran to create the configuration.

**24 Press Return to continue.**

**25 (Optional) Type q and press Return repeatedly until you quit the clsetup utility.**

If you prefer, you can leave the `clsetup` utility running while you perform other required tasks before using the utility again.

## ▼ How to Register and Configure HA for Oracle Without Oracle Grid Infrastructure (CLI)

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

**Before You Begin** Ensure that the following prerequisites are met:

- If you use a volume manager, the volume manager of the cluster is configured to provide volumes on shared storage that are accessible from any node where Oracle Database software could potentially run.
- If you use a volume manager, the raw devices and file systems on the storage volumes that Oracle Database software will use for its database are created.
- The Oracle Database software is installed to be accessible from all nodes or zones where Oracle could potentially run.
- Kernel variables for the UNIX operating system are configured for Oracle Database software .
- The Oracle Database software is configured for all nodes or zones that could potentially run Oracle Database software .
- The data service packages are installed.

Ensure that you have the following information:

- The names of the cluster nodes or zones that master the data service.
- The logical hostname that clients use to access the data service. Normally, you set up this IP address when you install the cluster. See the [Oracle Solaris Cluster Concepts Guide](#) for details about network resources.
- The path to the Oracle Database application binaries for the resources that you plan to configure.
- The database type.

- 1 On a cluster member, become superuser or assume a role that provides `solaris.cluster.modify` and `solaris.cluster.admin` RBAC authorizations.**
- 2 Register the resource types for the data service.**

For HA for Oracle, you register two resource types, `SUNW.oracle_server` and `SUNW.oracle_listener`, as follows.

---

**Note** – For Oracle Database version 11g release 2 or 12c, if you are using an Oracle Grid Infrastructure for Clusters Single Client Access Name (SCAN) listener, omit registration of the `SUNW.oracle_listener` resource type.

---

```
# clresourcetype register SUNW.oracle_server
# clresourcetype register SUNW.oracle_listener
```

- 3 Create a failover resource group to hold the network and application resources.**

This step is not required if you use the Solaris ZFS, because the resource group was created when the highly available local ZFS was configured in “[How to Prepare the Nodes](#)” on page 19. The resources that are created in other steps in this procedure are to be added to this resource group.

You can optionally select the set of nodes or zones on which the data service can run with the `-n` option, as follows.

```
# clresourcegroup create [-n node-zone-list] resource-group
```

`-n node-zone-list`      Specifies a comma-separated, ordered list of zones that can master this resource group. The format of each entry in the list is *node:zone*. In this format, *node* specifies the name or ID of a node and *zone* specifies the name of a non-global Solaris zone. To specify the global zone, or to specify a node without non-global zones, specify only *node*.

The order in this list determines the order in which the nodes or zones are considered primary during failover. This list is optional. If you omit this list, the global zone of each cluster node can master the resource group.

*resource-group*      Specifies the name of the resource group. This name can be your choice but must be unique for resource groups within the cluster.

**4 Verify that all of the network resources that you use have been added to your name service database.**

You should have performed this verification during the Oracle Solaris Cluster installation.

---

**Note** – Ensure that all of the network resources are present in the server's and client's /etc/inet/hosts file to avoid any failures because of name service lookup.

---

**5 Add a logical hostname resource to the failover resource group.**

```
# clreslogicalhostname create -g resource-group [-h logical-hostname] logical-hostname-rs logical-hostname
```

*Specifies a logical hostname. This logical hostname must be present in your name service database. If *logical-hostname* and *logical-hostname-rs* are identical, *logical-hostname* is optional.*

*logical-hostname-rs*

*Specifies the name that you are assigning to the logical hostname resource that you are creating.*

**6 Register the HASStoragePlus resource type with the cluster.**

```
# clresourcetype register SUNW.HASStoragePlus
```

**7 Add a resource of type HASStoragePlus to the failover resource group.**

---

**Note** – If you use the Solaris ZFS for Oracle Database files, omit this step. The HASStoragePlus resource was created when the highly available local ZFS was configured. For more information, see “[How to Prepare the Nodes](#)” on page 19.

---



**Caution** – Raw devices from Oracle Solaris Cluster device groups are not supported in non-global zones.

---

---

**Note** – The HASStoragePlus resource type must be a minimum of version 4 if it is to be supported in non-global zones.

---

```
# clresource create -g resource-group \
-t SUNW.HASStoragePlus \
-p GlobalDevicePaths=device-path \
```

---

```
-p FilesystemMountPoints=mount-point-list \
-p AffinityOn=TRUE hastp-rs
```

You must set either the `GlobalDevicePaths` extension property or the `FilesystemMountPoints` extension property:

- If your database is on a raw device, set the `GlobalDevicePaths` extension property to the global device path.
- If your database is on the cluster file system, specify mount points of the cluster file system and the local file system.

---

**Note** – `AffinityOn` must be set to TRUE and the local file system must reside on global disk groups to be failover.

The resource is created in the enabled state.

#### 8 Bring online the failover resource group in a managed state on a cluster node or zone.

```
# clresourcegroup online -M resource-group
```

`-M` Places the resource group that is brought online in a managed state.

#### 9 Create Oracle Database application resources in the failover resource group.

*Oracle server resource:*

```
# clresource create -g resourcegroup \
-t SUNW.oracle_server \
-p Alert_log_file=path-to-log \
-p Connect_string=user/passwd \
-p ORACLE_SID=instance \
-p ORACLE_HOME=Oracle_home \
-p Restart_type=entity-to-restart \
[-p Dataguard_role=role] \
[-p Standby_mode=mode] \
-p Resource_dependencies_offline_restart=storageplus-resource \
resource
```

*Oracle listener resource:*

```
# clresource create -g resource-group \
-t SUNW.oracle_listener \
-p LISTENER_NAME=listener \
-p ORACLE_HOME=Oracle_home \
-p Resource_dependencies_offline_restart=storageplus-resource \
resource
```

`-g resource-group`

Specifies the name of the resource group into which the resources are to be placed.

`-t`

Specifies the type of the resource to add.

- p **Alert\_log\_file**=*path-to-log*  
Sets the path under \$ORACLE\_HOME for the server message log.
- p **Connect\_string**=*user/passwd*  
Specifies the user and password that the fault monitor uses to connect to the database. These settings must agree with the permissions that you set up in “[How to Set Up Oracle Database Permissions](#)” on page 31. If you use Oracle Solaris authorization, type a slash (/) instead of the user name and password.
- p **ORACLE\_SID**=*instance*  
Sets the Oracle Database system identifier.
- p **LISTENER\_NAME**=*listener*  
Sets the name of the Oracle Database listener instance. This name must match the corresponding entry in `listener.ora`.
- p **ORACLE\_HOME**=*Oracle\_home*  
Sets the path to the Oracle Database home directory.
- p **Restart\_type**=*entity-to-restart*  
Specifies the entity that the server fault monitor restarts when the response to a fault is restart. Set *entity-to-restart* as follows:
  - To specify that only this resource is restarted, set *entity-to-restart* to RESOURCE\_RESTART. By default, only this resource is restarted.
  - To specify that all resources in the resource group that contains this resource are restarted, set *entity-to-restart* to RESOURCE\_GROUP\_RESTART.If you set *entity-to-restart* to RESOURCE\_GROUP\_RESTART, all other resources (such as Apache or DNS) in the resource group are restarted, even if they are not faulty. Therefore, include in the resource group only the resources that you require to be restarted when the Oracle Database server resource is restarted.
- p **Dataguard\_role**=*role*  
Specifies the role of the database instance. Change *role* as follows:
  - To create a resource for a primary database instance that does not have standby instances configured, change *role* to NONE. This value is the default value.
  - To create a resource for a primary database instance that has standby database instances configured, change *role* to PRIMARY.
  - To create a resource for a standby database instance, change *role* to STANDBY.
- p **Standby\_mode**=*mode*  
Specifies the mode for the standby database instance. If you change **Dataguard\_role** to NONE or PRIMARY, the value of the **Standby\_mode** is ignored.
  - To specify a logical standby database, change *mode* to LOGICAL. This value is the default value.
  - To specify a physical standby database, change *mode* to PHYSICAL.

- Beginning with Oracle Database 11g, to specify a snapshot standby database, change mode to SNAPSHOT.

*resource*

Specifies the name of the resource that you are creating.

---

**Note** – Optionally, you can set additional extension properties that belong to the Oracle Database data service to override their default values. See “[Setting HA for Oracle Extension Properties](#)” on page 37 for a list of extension properties.

---

The resources are created in the enabled state.

### Example 1–1 Registering HA for Oracle to Run in the Global Zone

The following example shows how to register HA for Oracle 11g release 1 on a two-node cluster.

*Cluster Information*

*Node names: phys-schost-1, phys-schost-2*

*Logical Hostname: schost-1*

*Resource group: resource-group-1 (failover resource group)*

*HAStoragePlus Resource: hastp-rs*

*Oracle Database Resources: oracle-server-1, oracle-listener-1*

*Oracle Database Instances: ora-lsnr (listener), ora-srvr (server)*

*Create the failover resource group to contain all of the resources*

```
# clresourcegroup create resource-group-1
```

*Add the logical hostname resource to the resource group*

```
# clreslogicalhostname create -g resource-group-1 schost-1
```

*Register the SUNW.HAStoragePlus resource type*

```
# clresourcetype register SUNW.HAStoragePlus
```

*Add a resource of type SUNW.HAStoragePlus to the resource group*

```
# clresource create -g resource-group-1 \
-t SUNW.HAStoragePlus \
-p FileSystemMountPoints=/global/oracle,/global/ora-data/logs,local/ora-data \
-p AffinityOn=TRUE \
hastp-rs
```

*Bring the resource group online in a managed state*

```
# clresourcegroup online -M resource-group-1
```

*Register the Oracle Database resource types*

```
# clresourcetype register SUNW.oracle_server
# clresourcetype register SUNW.oracle_listener
```

*Add the Oracle Database application resources to the resource group*

```
# clresource create -g resource-group-1 \
-t SUNW.oracle_server \
-p Alert_log_file=/global/oracle/message-log \
-p Connect_string=scott/tiger \
-p ORACLE_HOME=/global/oracle \
-p ORACLE_SID=ora-srvr \
-p Dataguard_role=STANDBY \
-p Standby_mode=PHYSICAL \
-p Resource_dependencies_offline_restart=hastp-rs \
oracle-server-1

# clresource create -g resource-group-1 \
-t SUNW.oracle_listener \
-p ORACLE_HOME=/global/oracle \
-p LISTENER_NAME=ora-lsnr \
oracle-listener-1
```

### Example 1-2 Registering HA for Oracle to Run in the Non-Global Zone

The following example shows how to register HA for Oracle 11g release 1 on a two-node cluster. The non-global zone root is located on a local file system and the zone is not configured with the HA for Solaris Containers data service.

*Cluster Information*  
*Node names: phys-schost-1, phys-schost-2*  
*Non-global zone names: sc1zone1, sc2zone1*  
*Logical Hostname: schost-1*  
*Resource group: resource-group-1 (failover resource group)*  
*HAStroragePlus Resource: hastp-rs*  
*Oracle Database Resources: oracle-server-1, oracle-listener-1*  
*Oracle Database Instances: ora-lsnr (listener), ora-srvr (server)*

*Create the failover resource group to contain all of the resources*

```
# clresourcegroup create phys-schost-1:sc1zone1,phys-schost-2:sc2zone1 \
resource-group-1
```

*Add the logical hostname resource to the resource group*

```
# clreslogicalhostname create -g resource-group-1 \
schost-1
```

*Register the SUNW.HAStroragePlus resource type.*

```
# clresourcetype register SUNW.HAStroragePlus
```

*Add a resource of type SUNW.HAStroragePlus to the resource group.*

```
# clresource create -g resource-group-1 -t SUNW.HAStroragePlus \
-p FileSystemMountPoints=/global/oracle,/global/ora-data/logs,local/ora-data \
```

```

-p AffinityOn=TRUE \
hasntp-rs

Bring the resource group online in a managed state
# clresourcegroup online -M resource-group-1

Register the Oracle resource types.
# clresourcetype register SUNW.oracle_server
# clresourcetype register SUNW.oracle_listener

Add the Oracle Database application resources to the resource group
# clresource create -g resource-group-1 \
-t SUNW.oracle_server \
-p ORACLE_HOME=/global/oracle \
-p Alert_log_file=/global/oracle/message-log \
-p ORACLE_SID=ora-srvr \
-p Connect_string=scott/tiger \
-p Dataguard_role=STANDBY \
-p Standby_mode=PHYSICAL \
oracle-server-1

# clresource create -g resource-group-1 \
-t SUNW.oracle_listener -p ORACLE_HOME=/global/oracle \
-p LISTENER_NAME=ora-lsnr \
oracle-listener-1

```

### Example 1-3 Registering HA for Oracle to Run in a Zone Cluster

The following example shows how to register HA for Oracle 11g release 1 in a zone cluster.

*Cluster Information*  
*Node names: phys-schost-1, phys-schost-2*  
*zone cluster names: zonecluster1, zonecluster2*  
*Logical Hostname: zchost-1*  
*Resource group: resource-group-1 (failover resource group)*  
*HAStoragePlus Resource: hasntp-rs*  
*Oracle Database Resources: oracle-server-1, oracle-listener-1*  
*Oracle Database Instances: ora-lsnr (listener), ora-srvr (server)*

*Create the failover resource group to contain all of the resources*  
# clresourcegroup create -Z zonecluster1 resource-group-1

*Add the logical hostname resource to the resource group*  
# clreslogicalhostname create -Z zonecluster1 -g resource-group-1 zchost-1

*Register the SUNW.HAStoragePlus resource type.*  
# clresourcetype register -Z zonecluster1 SUNW.HAStoragePlus

*Add a resource of type SUNW.HAStoragePlus to the resource group.*

```
# clresource create -Z zonecluster1 \
-g resource-group-1 \
-t SUNW.HAStoragePlus \
-p FileSystemMountPoints=/global/oracle,/global/ora-data/logs,local/ora-data \
-p AffinityOn=TRUE \
hastp-rs
```

*Bring the resource group online in a managed state*

```
# clresourcegroup online -Z zonecluster1 -M resource-group-1
```

*Register the Oracle Database resource types*

```
# clresourcetype register -Z zonecluster1 SUNW.oracle_server
# clresourcetype register -Z zonecluster1 SUNW.oracle_listener
```

*Add the Oracle Database application resources to the resource group*

```
# clresource create -Z zonecluster1 \
-g resource-group-1 \
-t SUNW.oracle_server \
-p Alert_log_file=/global/oracle/message-log \
-p Connect_string=scott/tiger \
-p ORACLE_HOME=/global/oracle \
-p ORACLE_SID=ora-srvr \
-p Dataguard_role=STANDBY \
-p Standby_mode=PHYSICAL \
oracle-server-1

# clresource create -Z zonecluster1 \
-g resource-group-1 \
-t SUNW.oracle_listener \
-p ORACLE_HOME=/global/oracle \
-p LISTENER_NAME=ora-lsnr \
oracle-listener-1
```

## ▼ How to Register and Configure HA for Oracle With Oracle Grid Infrastructure for a Standalone Server (CLI)

---

**Note** – Single instance Oracle ASM is not supported with Oracle 11g release 2 or 12c. For these releases, you must only use clustered Oracle ASM.

---

This procedure explains the steps to register and configure single instance Oracle ASM using Oracle Solaris Cluster maintenance commands. The Oracle\_Home for Oracle ASM is on a local file system only.

---

**Note** – Oracle ASM disk group and Oracle database can be configured in different resource groups. If the Oracle ASM disk group and Oracle database are configured in different resource groups, you should set a strong positive affinity (++) between the Oracle ASM disk group resource group and Oracle database resource group.

---

**Before You Begin**

- Ensure that the Oracle Grid Infrastructure for a Standalone Server software is installed on the Oracle Solaris Cluster nodes.
- Ensure that the Oracle Grid Infrastructure for a Standalone Server resource for the Oracle ASM instance and the database instance are configured.
- Ensure that the Oracle Database home directory for Oracle ASM is configured on a local file system on each node. For more information, see “[Preparing the Nodes and Disks](#)” on page 19.

- 1 **On a cluster member, become superuser or assume a role that provides `solaris.cluster.modify` and `solaris.cluster.admin` RBAC authorizations.**
- 2 **Register the Oracle ASM resource types for the data service.**

- a. **Register the scalable ASM instance resource type.**

```
# clresourcetype register SUNW.scalable_asm_instance
```

- b. **Register the ASM disk-group resource type.**

```
# clresourcetype register SUNW.asm_diskgroup
```

- c. **Register the HAStoragePlus resource type.**

```
# clresourcetype register SUNW.HAStoragePlus
```

- 3 **Create a scalable resource group `asm-inst-rg` for the Oracle ASM instance.**

```
# clresourcegroup create -S asm-inst-rg
```

`-S asm-inst-rg`      Specifies the name of the scalable resource group for the Oracle ASM instance.

- 4 **Add a resource of type `SUNW.scalable_asm_instance` to the `asm-inst-rg` resource group.**

```
# clresource create -g asm-inst-rg \
-t SUNW.scalable_asm_instance \
-p ORACLE_HOME=Oracle_home \
-d asm-inst-rs
```

`-g asm-inst-rg`

Specifies the name of the resource group for the Oracle ASM instance.

`-p ORACLE_HOME=Oracle_home`

Sets the path to the Oracle ASM home directory.

---

**Note** – You must use only a local file system for the Oracle ASM home directory.

---

**-d *asm-inst-rs***

Specifies the name of the Oracle ASM instance resource that you are creating.

**5 Bring online the scalable resource group in a managed state on a cluster node.**

```
# clresourcegroup online -eM asm-inst-rg
```

**6 Create an Oracle ASM resource group *asm-dg-rg*.**

```
# clresourcegroup create asm-dg-rg
```

**7 Add a logical hostname resource to the *asm-dg-rg* resource group.**

```
# clreslogicalhostname create -g asm-dg-rg [-h logical-hostname] \  
logical-hostname-rs
```

**-h *logical-hostname***

Specifies a logical hostname. This logical hostname must be present in your name service database. If *logical-hostname* and *logical-hostname-*rs** are identical, *logical-hostname* is optional.

*logical-hostname-*rs**

Specifies the name that you are assigning to the logical hostname resource that you are creating.

**8 Set a strong positive affinity on the Oracle ASM disk group by the resource group *asm-dg-rg*.**

```
# clresourcegroup set -p rg_affinities=++asm-inst-rg asm-dg-rg
```

**9 If the Oracle ASM disk group uses a Solaris Volume Manager disk set or a VxVM disk group, add a resource of type SUNW.HASStoragePlus to the Oracle ASM disk-group resource group.**

```
# clresource create -g asm-dg-rg -t SUNW.HASStoragePlus \  
-p globaldevicepaths=path1,path2 hasp-asm-rs
```

**10 Add a resource of type SUNW.asm\_diskgroup to the *asm-dg-rg* resource group.**

```
# clresource create -g asm-dg-rg -t SUNW.asm_diskgroup \  
-p asm_diskgroups=dgl[,dg...] \  
-p Resource_dependencies_offline_restart=asm-inst-rs,asm-stor-rs \  
-p Resource_dependencies_offline_restart=hasp-asm-rs \  
-d asm-dg-rs
```

**-t SUNW.asm\_diskgroup**

Specifies the type of the resource to add.

**-p asm\_diskgroups=*dg***

Specifies the ASM disk group.

*asm-stor-rs*

Specifies the name of the Oracle ASM storage resource.

*hasp-asm-rs*

Specifies the name of the HAStoragePlus resource.

*-d asm-dg-rs*

Specifies the name of the resource that you are creating.

**11 Bring online the Oracle ASM disk resource group in a managed state.**

```
# clresourcegroup online -eM asm-dg-rg
```

**12 Verify the Oracle ASM installation by issuing the status command.**

```
# clresource status +
```

**13 Register the resource types for the HA for Oracle data service.**

For HA for Oracle, you register the resource types SUNW.oracle\_server and SUNW.oracle\_listener as follows.

```
# clresourcetype register SUNW.oracle_server
# clresourcetype register SUNW.oracle_listener
```

**14 Create Oracle Database application resources in the failover resource group.**

- Oracle server resource:

```
# clresource create -g asm-dg-rg \
-t SUNW.oracle_server \
-p Connect_string=user/passwd \
-p ORACLE_SID=instance \
-p ORACLE_HOME=Oracle_home \
-p Alert_log_file=path-to-log \
-p Restart_type=entity-to-restart \
-p Resource_dependencies_offline_restart=asm-dg-rs \
-d ora-db-rs
```

- Oracle Database listener resource:

```
# clresource create -g asm-dg-rg \
-t SUNW.oracle_listener \
-p LISTENER_NAME=listener \
-p ORACLE_HOME=Oracle_home \
-p resource_dependencies_offline_restart=asm-dg-rs \
-d ora-lsr-rs
```

*-g asm-dg-rg*

Specifies the name of the Oracle ASM disk resource group into which the resources are to be placed.

*-t*

Specifies the type of the resource to add, SUNW.oracle\_server or SUNW.oracle\_listener.

*-p Alert\_log\_file=path-to-log*

Sets the path under \$ORACLE\_HOME for the server message log.

-p Connect\_string=*user/passwd*

Specifies the user and password that the fault monitor uses to connect to the database. These settings must agree with the permissions that you set up in “[How to Set Up Oracle Database Permissions](#)” on page 31. If you use Solaris authorization, type a slash (/) instead of the user name and password.

-p ORACLE\_SID=*instance*

Sets the Oracle system identifier.

-p LISTENER\_NAME=*listener*

Sets the name of the Oracle Database listener instance. This name must match the corresponding entry in `listener.ora`.

-p ORACLE\_HOME=*Oracle\_home*

Sets the path to the Oracle Database home directory.

---

**Note** – Optionally, you can set additional extension properties that belong to the Oracle Database data service to override their default values. See “[Setting HA for Oracle Extension Properties](#)” on page 37 for a list of extension properties.

---

**15 Bring online the Oracle Database server resource.**

```
# clresource enable ora-db-rs
```

▼ **How to Register and Configure HA for Oracle With Oracle Grid Infrastructure for a Cluster (CLI)**

This procedure explains the steps to register and configure HA for Oracle with clustered Oracle ASM instance using Oracle Solaris Cluster maintenance commands.

For Oracle Database 11g release 2 and 12c only, you can optionally use a third-party volume manager to provide candidate disks to clustered Oracle ASM disk groups. For this type of configuration, this procedure manually creates an Oracle Grid Infrastructure (Grid Infrastructure) resource that proxies the Oracle Solaris Cluster `SUNW.ScalDeviceGroup` resource. In this procedure, the Grid Infrastructure resource is named `sun.resource`. You configure `sun.resource` to ensure that the corresponding Oracle ASM disk group is not mounted until `sun.resource` is online. The `sun.resource` resource comes online only if the corresponding `SUNW.ScalDeviceGroup` resource is online. And the `SUNW.ScalDeviceGroup` resource only comes online if the actual volume-manager disk set or disk group is online.

To ensure that the Oracle ASM disk group benefits from this dependency chain, after you define `sun.resource`, you modify the appropriate Grid Infrastructure Oracle ASM disk-group resource so that the hard-start dependency includes `sun.resource`. Modifying the hard-start dependency of the Grid Infrastructure Oracle ASM disk-group resource can only be performed by the `SUNW.scalable_asm_diskgroup_proxy` resource by using the `VALIDATE` method. Therefore,

you must set an offline-restart dependency between the SUNW.scalable\_asm\_diskgroup\_proxy and SUNW.ScalDeviceGroup resources.

#### Before You Begin

- If you are using a volume manager, configure the disk set or disk group for clustered Oracle ASM to use.
  - If you are using Solaris Volume Manager for Sun Cluster, create a multi-owner disk set. Follow procedures in “[How to Create a Multi-Owner Disk Set in Solaris Volume Manager for Sun Cluster for the Oracle RAC Database](#)” in *Oracle Solaris Cluster Data Service for Oracle Real Application Clusters Guide*.
  - If you are using Veritas Volume Manager with the cluster feature, create a shared disk group. Follow procedures in “[How to Create a VxVM Shared-Disk Group for the Oracle RAC Database](#)” in *Oracle Solaris Cluster Data Service for Oracle Real Application Clusters Guide*.
- Ensure that Oracle Clusterware software is installed.
- Ensure that the Oracle Clusterware resource for the Oracle ASM instance and the database instance are configured.
- Ensure that the file system you will use for Oracle\_Home is set up. See “[Preparing the Nodes and Disks](#)” on page 19 for instructions.

- 1 On a cluster member, become superuser or assume a role that provides `solaris.cluster.modify` and `solaris.cluster.admin` RBAC authorizations.
- 2 If you are using a third-party volume manager or NFS as candidate disks for Oracle ASM disk groups, configure Grid Infrastructure.

Oracle ASM candidate disks can be derived from any of the following:

- Solaris Volume Manager disk sets
- Veritas Volume Manager disk groups
- NFS

**a. Create the Grid Infrastructure `sun.storage_proxy.type` resource type.**

```
# /Grid_home/bin/crsctl add type sun.storage_proxy.type -basetype cluster_resource
```

**b. Create a Grid Infrastructure `sun.resource` resource of type `sun.storage_proxy.type`.**

---

**Note** – Ensure that all attribute values are enclosed in single quotes (''). Otherwise, the VALIDATE method of the SUNW.scalable\_asm\_diskgroup\_proxy resource will fail the validation.

---

```
# /Grid_home/bin/crsctl add res sun.scal-asmdgl-rs -type sun.storage_proxy.type \
-attr "ACTION_SCRIPT='/opt/SUNWscor/dsconfig/bin/scproxy_crs_action' \
HOSTING_MEMBERS='node1 node2' \
CARDINALITY='2' \
```

PLACEMENT='restricted' \ ACL='owner:root:rwx,pgrp:oinstall:rwx,other::r--' \ SCRIPT_TIMEOUT='20' \ RESTART_ATTEMPTS='60'"	
sun.scal-asmdg1-rs	The SUNW.ScalDeviceGroup resource name.
-type sun.storage_proxy.type	Specifies the sun.storage_proxy.type resource type.
ACTION_SCRIPT	Specifies the <code>/opt/SUNWscor/dsconfig/bin/scproxy_crs_action</code> action script.
HOSTING_MEMBERS	Specifies the Oracle Solaris Cluster resource group's node list entries that contain the SUNW.ScalDeviceGroup resource.
CARDINALITY	Sets the number of hosts that are defined in HOSTING_MEMBERS.
PLACEMENT	Set to restricted.
ACL	Sets the owner equal to root and the group equal to the ACL group entry for the Oracle ASM disk group. The following command displays the ACL group entry:
# /Grid_home/bin/crsctl stat res ora.DATA1.dg -p   grep ACL=	The example output shows that oinstall is the group entry.
ACL=owner:oragrid:rwx,pgrp:oinstall:rwx,other::r--	
SCRIPT_TIMEOUT	Set to 20.
RESTART_ATTEMPTS	Set to 60.

c. Verify that `sun.resource` is correctly defined.

Output is similar to the following:

```
# /Grid_home/bin/crsctl stat res sun.scal-asmdg1-rs -p
NAME=sun.scal-asmdg1-rs
TYPE=sun.storage_proxy.type
ACL=owner:root:rwx,pgrp:oinstall:rwx,other::r--
ACTION_FAILURE_TEMPLATE=
ACTION_SCRIPT=/opt/SUNWscor/dsconfig/bin/scproxy_crs_action
ACTIVE_PLACEMENT=0
AGENT_FILENAME=%CRS_HOME%/bin/scriptagent
AUTO_START=restore
CARDINALITY=2
CHECK_INTERVAL=60
DEFAULT_TEMPLATE=
DEGREE=1
```

```

DESCRIPTION=
ENABLED=1
FAILOVER_DELAY=0
FAILURE_INTERVAL=0
FAILURE_THRESHOLD=0
HOSTING_MEMBERS=node1 node2
LOAD=1
LOGGING_LEVEL=1
NOT_RESTARTING_TEMPLATE=
OFFLINE_CHECK_INTERVAL=0
PLACEMENT=restricted
PROFILE_CHANGE_TEMPLATE=
RESTART_ATTEMPTS=60
SCRIPT_TIMEOUT=20
SERVER_POOLS=
START_DEPENDENCIES=
START_TIMEOUT=0
STATE_CHANGE_TEMPLATE=
STOP_DEPENDENCIES=
STOP_TIMEOUT=0
UPTIME_THRESHOLD=1h
#

```

**d. Display the current offline-restart dependency.**

```

# /Grid_home/bin/crctl stat res ora.DATA1.dg -p | grep START_DEPENDENCIES
START_DEPENDENCIES=hard(ora.asm) pullup(ora.asm)

# clresource show -p Resource_dependencies_offline_restart asm-data1-rs

===== Resources =====

Resource: asm-data1-rs
Resource_dependencies_offline_restart: asm-inst-rs

-- Standard and extension properties --

```

**e. Set the new dependency.**

- If *asm-data1-rs* already exists, use the following command to set the dependency.

Note that the command includes the plus (+) symbol:

```

# clresource set -p Resource_dependencies_offline_restart+=scal-asmdg1-rs asm-data1-rs
-p Resource_dependencies_offline_restart+=resource
(For an Oracle ASM device group only) Sets the offline restart dependency for the
specified Oracle ASM storage resource.

asm-data1-rs
Specifies the name of the resource that you are modifying.

```

- If *asm-data1-rs* does not yet exist, use the following command to create the resource with the offline-restart dependency:

```

# clresource create -g asm-dg-rg \
-t SUNW.scalable_asm_diskgroup_proxy \

```

---

<b>-p asm_diskgroups=data1 \</b>	
<b>-p Resource_dependencies_offline_restart=asm-inst-rs,scal-asmdg1-rs \</b>	
<b>-d asm-data1-rs</b>	
<b>-g asm-dg-rg</b>	Specifies the name of the Oracle ASM device group into which the resources are to be placed.
<b>-t resource-type</b>	Specifies the type of the resource to add.
<b>-p asm_diskgroups=data1</b>	Sets the name of the Oracle ASM disk group.
<b>-d</b>	Specifies disabling the resource that you create.

**f. Verify the configured dependency.**

```
# /Grid_home/bin/crsctl stat res ora.DATA1.dg -p | grep START_DEPENDENCIES
    START_DEPENDENCIES=hard(ora.asm,sun.scal-asmdg1-rs) pullup(ora.asm)
# clresource show -p Resource_dependencies_offline_restart asm-data1-rs
    === Resources ===

        Resource: asm-data1-rs
        Resource_dependencies_offline_restart: asm-inst-rs scal-asmdg1-rs

        -- Standard and extension properties --
```

**3 Register the resource type for Oracle Clusterware framework.**

---

**Note** – You can alternatively use the `clsetup` utility to perform [Step 3](#) through [Step 5](#) in this procedure.

```
# clresourctype register SUNW.crs_framework
```

**4 Add a resource of type SUNW.crs\_framework to the `rac-fmwk-rg` resource group.**

```
# clresource create -g rac-fmwk-rg -t SUNW.crs_framework \
-p Resource_dependencies=rac-fmwk-rs \
-d crs-fmwk-rs
```

**5 Create a failover resource group `ora-db-rg` for the Oracle database.**

```
# clresourcegroup create ora-db-rg
```

**6 SPARC: If you are using SPARC, perform the following steps. Otherwise go to [Step 7](#).**

---

**Note** – You can perform this step only if you have installed the ORCLudlm package before performing the Oracle ASM software installation.

**a. Register the resource type for Oracle UDLM.**

```
# clresourctype register SUNW.rac_udlm
```

- b. Add a resource of type `SUNW.rac_udlm` to the `rac-fmwk-rg` resource group.

```
# clresource create -g rac-fmwk-rg -t SUNW.rac_udlm \
-p Resource_dependencies=rac-fmwk-rs rac-udlm-rs
```

`-g asm-inst-rg`      Specifies the name of the resource group into which the resource is to be placed.

**7 Register the Oracle ASM resource types for the data service.**

- a. Register the scalable ASM instance proxy resource type.

```
# clresourcetype register SUNW.scalable_asm_instance_proxy
```

- b. Register the appropriate Oracle ASM disk-group resource type.

- For Oracle Database 10g and 11g release 1 only, use the `SUNW.asm_diskgroup` resource type.

```
# clresourcetype register SUNW.asm_diskgroup
```

- For Oracle Database 11g release 2 and 12c only, use the `SUNW.scalable_asm_diskgroup_proxy` resource type.

```
# clresourcetype register SUNW.scalable_asm_diskgroup_proxy
```

**8 Create resource groups `asm-inst-rg` and `asm-dg-rg`.**

```
# clresourcegroup create -S asm-inst-rg asm-dg-rg
```

**9 Set a strong positive affinity on `rac-fmwk-rg` by `asm-inst-rg`.**

```
# clresourcegroup set -p rg_affinities=++rac-fmwk-rg asm-inst-rg
```

**10 Set a strong positive affinity on `asm-inst-rg` by `asm-dg-rg`.**

```
# clresourcegroup set -p rg_affinities=++asm-inst-rg asm-dg-rg
```

**11 Add a resource of type `SUNW.crs_framework` to the `rac-fmwk-rg` resource group.**

```
# clresource create -g rac-fmwk-rg -t SUNW.crs_framework \
-p Resource_dependencies=rac-fmwk-rs \
-d crs-fmwk-rs
```

**12 If you installed `Oracle_Home` for Oracle ASM on a cluster file system, configure resources to use the cluster file system.**

Add resources of type `SUNW.HAStoragePlus` and `SUNW.scalable_asm_instance` to the `asm-inst-rg` resource group and set the appropriate dependencies between the two resources.

```
# clresource create -g asm-inst-rg -t SUNW.HAStoragePlus \
-p FilesystemMountPoints=cluster-file-system \
hastp-rs
```

```
# clresource create -g asm-inst-rg -t SUNW.scalable_asm_instance_proxy \
-p ORACLE_HOME=Oracle_home \
```

```
-p CRS_HOME=grid-home
-p "oracle_sid{node1}"=instance \
-p "oracle_sid{node2}"=instance \
-p Resource_dependencies_offline_restart=hasntp-rs \
-p Resource_dependencies_offline_restart=crs-fmwk-rs \
asm-inst-rs

-p FilesystemMountPoints=cluster-file-system
    Specifies the name of the cluster file system.

hasntp-rs
    Specifies the name of the SUNW.HAStoragePlus resource to create.

-p ORACLE_SID=instance
    Sets the Oracle Database system identifier.

-p ORACLE_HOME=Oracle_home
    Sets the path to the Oracle Database home directory.

-p CRS_HOME=grid_home
    Sets the path to the Oracle Grid Infrastructure for a Cluster home directory.
```

- 13 Add a resource of type **SUNW.scalable\_asm\_instance\_proxy** to the *asm-inst-rs* resource group.

```
# clresource create -g asm-inst-rs \
-t SUNW.scalable_asm_instance_proxy \
-p ORACLE_HOME=Oracle_home \
-p CRS_HOME=grid-home \
-p "oracle_sid{node1}"=instance \
-p "oracle_sid{node2}"=instance \
-p Resource_dependencies_offline_restart=crs-fmwk-rs \
-d asm-inst-rs
```

- 14 Add an ASM disk-group resource to the *asm-dg-rs* resource group.

- For Oracle Database 10g and 11g release 1 only, use the **SUNW.asm\_diskgroup** resource type.

```
# clresource create -g asm-dg-rs \
-t SUNW.asm_diskgroup \
-p asm_diskgroups=dg[,dg...] \
-p Resource_dependencies_offline_restart=asm-inst-rs,asm-stor-rs \
-d asm-dg-rs

-p asm_diskgroups=dg
    Specifies the Oracle ASM disk group.
```

*asm-stor-rs*  
Specifies the name of the Oracle ASM storage resource.

- For Oracle Database 11g release 2 and 12c only, use the **SUNW.scalable\_asm\_diskgroup\_proxy** resource type.

```
# clresource create -g asm-dg-rs \
-t SUNW.scalable_asm_diskgroup_proxy \
```

---

```
-p asm_diskgroups=dg[,dg...] \
-p Resource_dependencies_offline_restart=asm-inst-rs,asm-stor-rs \
-d asm-dg-rg
```

- 15 Bring online the *asm-inst-rg* resource group in a managed state on a cluster node.**

```
# clresourcegroup online -eM asm-inst-rg
```

- 16 Bring online the *asm-dg-rg* resource group in a managed state on a cluster node.**

```
# clresourcegroup online -eM asm-dg-rg
```

- 17 Verify the Oracle ASM installation by issuing the status command.**

```
# clresource status +
```

- 18 Register the resource types for the HA for Oracle data service.**

You register two resource types, `SUNW.oracle_server` and `SUNW.oracle_listener`.

---

**Note** – For Oracle Database version 11g release 2 or 12c, omit registration of the `SUNW.oracle_listener` resource type if you are using an Oracle Grid Infrastructure for Clusters Single Client Access Name (SCAN) listener.

```
# clresourcetype register SUNW.oracle_server
# clresourcetype register SUNW.oracle_listener
```

- 19 Add a logical hostname resource to the failover resource group for Oracle database.**

```
# clreslogicalhostname create -g ora-db-rg [-h logical-hostname] logical-hostname-rs
logical-hostname
```

Specifies a logical hostname. This logical hostname must be present in your name service database. If `logical-hostname` and `logical-hostname-rs` are identical, `logical-hostname` is optional.

*logical-hostname-rs*

Specifies the name that you are assigning to the logical hostname resource that you are creating.

- 20 Bring online the failover resource group in a managed state on a cluster node.**

```
# clresourcegroup online -eM ora-db-rg
```

- 21 Create Oracle Database application resources in the failover resource group.**

---

**Note** – For Oracle Database version 11g release 2 or 12c, if you are using an Oracle Grid Infrastructure for Clusters Single Client Access Name (SCAN) listener, you omit configuration of the `SUNW.oracle_listener` resource.

- For Oracle Database 10g and 11g release 1 only, use the following commands:

*Create the Oracle Database server resource*

```
# clresource create -g ora-db-rg \
-t SUNW.oracle_server \
-p Connect_string=user/passwd \
-p ORACLE_SID=instance \
-p ORACLE_HOME=Oracle_home \
-p Alert_log_file=path-to-log \
-p Resource_dependencies_offline_restart=asm-dg-rs \
-d ora-db-rs
```

*Create the Oracle Database listener resource*

```
# clresource create -g ora-db-rg \
-t SUNW.oracle_listener \
-p ORACLE_HOME=Oracle_home \
-p listener_name=listener \
-p Resource_dependencies_offline_restart=asm-dg-rs \
-d ora-ls-rs
```

- For Oracle Database 11g release 2 and 12c only, use the following command:

*Create the Oracle server resource*

```
# clresource create -g ora-db-rg \
-t SUNW.oracle_server \
-p ORACLE_SID=instance \
-p ORACLE_HOME=Oracle_home \
-p Db_unique_name=db-unique-name \
-p Resource_dependencies_offline_restart=asm-dg-rs \
-d ora-db-rs
```

- p Alert\_log\_file=path-to-log  
(For Oracle Database 10g and 11g release 1 only) Sets the path under \$ORACLE\_HOME for the server message log.
- p Connect\_string=user/passwd  
(For Oracle Database 10g and 11g release 1 only) Specifies the user and password that the fault monitor uses to connect to the database. These settings must agree with the permissions that you set up in “[How to Set Up Oracle Database Permissions](#)” on page 31. If you use Solaris authorization, type a slash (/) instead of the user name and password.
- p Db\_unique\_name=db-unique-name  
(For Oracle Database 11g release 2 and 12c only if using the SCAN listener) Sets the Oracle Database unique name.
- p listener\_name=listener  
Sets the name of the Oracle Database listener instance. This name must match the corresponding entry in `listener.ora`.
- d resource  
Specifies the name of the resource that you are creating.

---

**Note** – Optionally, you can set additional extension properties that belong to the Oracle Database data service to override their default values. See “[Setting HA for Oracle Extension Properties](#)” on page 37 for a list of extension properties.

---

- 22 Bring online the Oracle Database server resource.**

```
# clresource enable ora-db-rs
```

- 23 If configured, bring online the Oracle Database listener resource.**

```
# clresource enable ora-ls-rs
```

**Next Steps** Go to “[Verifying the HA for Oracle Installation](#)” on page 63 after you register and configure Solaris Cluster HA for Oracle.

## Verifying the HA for Oracle Installation

Perform the following verification tests to make sure that you have correctly installed HA for Oracle.

These sanity checks ensure that all the nodes or zones that run HA for Oracle can start the Oracle Database instance and that the other nodes or zones in the configuration can access the Oracle Database instance. Perform these sanity checks to isolate any problems in starting the Oracle Database software from HA for Oracle.

### ▼ How to Verify the HA for Oracle Installation

- 1 Log in as oracle to the node or zone that currently masters the Oracle resource group.**
- 2 Set the environment variables ORACLE\_SID and ORACLE\_HOME.**
- 3 Confirm that you can start the Oracle Database instance from this node or zone.**
- 4 Confirm that you can connect to the Oracle Database instance.**

Use the sqlplus command with the user/password variable that is defined in the connect\_string property.

```
# sqlplus user/passwd@tns_service
```

*tns\_service*

Specifies the network name service provided by the \$ORACLE\_HOME/network/admin/tnsnames.ora file or the value of the TNS\_ADMIN environment variable.

**5 Shut down the Oracle Database instance.**

The Oracle Solaris Cluster software restarts the Oracle instance because the Oracle instance is under Oracle Solaris Cluster control.

**6 Switch the resource group that contains the Oracle Database resource to another cluster member.**

```
# clresourcegroup switch -n node-zone-list resource-group
```

-n *node-zone-list*      Specifies a comma-separated, ordered list of zones that can master this resource group. The format of each entry in the list is *node:zone*. In this format, *node* specifies the name or ID of a node and *zone* specifies the name of a non-global Solaris zone. To specify the global zone, or to specify a node without non-global zones, specify only *node*.

The order in this list determines the order in which the nodes or zones are considered primary during failover. This list is optional. If you omit this list, the global zone of each cluster node can master the resource group.

*resource-group*      Specifies the name of the resource group that you are switching.

**7 Log in as oracle to the node or zone that now contains the resource group.****8 Repeat Step 3 and Step 4 to confirm interactions with the Oracle Database instance.**

## Oracle Clients

Clients must always refer to the database by using the network resource, not the physical hostname. The network resource is an IP address that can move between physical nodes during failover. The physical hostname is a machine name.

For example, in the *tnsnames.ora* file, you must specify the network resource as the host on which the database instance is running. The network resource is a logical hostname or a shared address. See “[How to Set Up Oracle Database Permissions](#)” on page 31.

---

**Note** – Oracle client-server connections cannot survive a HA for Oracle switchover. The client application must be prepared to handle disconnection and reconnection or recovery as appropriate. A transaction monitor might simplify the application. Further, HA for Oracle node recovery time is application dependent.

---

## Location of HA for Oracle Log Files

Each instance of the HA for Oracle data service maintains log files in subdirectories of the /var/opt/SUNWscor directory.

- The /var/opt/SUNWscor/oracle\_server directory contains log files for the Oracle server.
- The /var/opt/SUNWscor/oracle\_listener directory contains log files for the Oracle listener.

These files contain information about actions that the HA for Oracle data service performs. Refer to these files to obtain diagnostic information for troubleshooting your configuration or to monitor the behavior of the HA for Oracle data service.

## Tuning the HA for Oracle Fault Monitors

Fault monitoring for the HA for Oracle data service is provided by the following fault monitors:

- The Oracle server fault monitor
- The Oracle listener fault monitor

---

**Note** – For Oracle Database version 11g release 2 or 12c, if you are using an Oracle Grid Infrastructure for Clusters Single Client Access Name (SCAN) listener, no fault monitoring is provided for the SCAN listener by Oracle Solaris Cluster software.

---

Each fault monitor is contained in a resource whose resource type is shown in the following table.

**TABLE 1–4** Resource Types for HA for Oracle Fault Monitors

Fault Monitor	Resource Type
Oracle server	SUNW.oracle_server
Oracle listener	SUNW.oracle_listener

System properties and extension properties of these resources control the behavior of the fault monitors. The default values of these properties determine the preset behavior of the fault monitors. The preset behavior should be suitable for most Oracle Solaris Cluster installations. Therefore, you should tune the HA for Oracle fault monitors *only* if you need to modify this preset behavior.

Tuning the HA for Oracle fault monitors involves the following tasks:

- Setting the interval between fault monitor probes

- Setting the timeout for fault monitor probes
- Defining the criteria for persistent faults
- Specifying the failover behavior of a resource

For more information, see “[Tuning Fault Monitors for Oracle Solaris Cluster Data Services](#)” in *Oracle Solaris Cluster Data Services Planning and Administration Guide*. Information about the HA for Oracle fault monitors that you need to perform these tasks is provided in the subsections that follow.

Tune the HA for Oracle fault monitors when you register and configure HA for Oracle. For more information, see “[Registering and Configuring HA for Oracle](#)” on page 36.

## Operation of the Oracle Server Fault Monitor

The fault monitor for the Oracle server uses a request to the server to query the health of the server.

The server fault monitor is started through `pmfadm` to make the monitor highly available. If the monitor is killed for any reason, the Process Monitor Facility (PMF) automatically restarts the monitor.

The server fault monitor consists of the following processes.

- A main fault monitor process
- A database client fault probe

This section contains the following information about the server fault monitor:

- “[Operation of the Main Fault Monitor](#)” on page 66
- “[Operation of the Database Client Fault Probe](#)” on page 66
- “[Actions by the Server Fault Monitor in Response to a Database Transaction Failure](#)” on page 67
- “[Scanning of Logged Alerts by the Server Fault Monitor](#)” on page 68

### Operation of the Main Fault Monitor

The main fault monitor determines that an operation is successful if the database is online and no errors are returned during the transaction.

### Operation of the Database Client Fault Probe

The database client fault probe performs the following operations:

1. Monitoring the partition for archived redo logs. See “[Operations to Monitor the Partition for Archived Redo Logs](#)” on page 67.
2. If the partition is healthy, determining whether the database is operational. See “[Operations to Determine Whether the Database is Operational](#)” on page 67.

The probe uses the timeout value that is set in the resource property `Probe_timeout` to determine how much time to allocate to successfully probe Oracle.

## Operations to Monitor the Partition for Archived Redo Logs

The database client fault probe queries the dynamic performance view `v$archive_dest` to determine all possible destinations for archived redo logs. For every active destination, the probe determines whether the destination is healthy and has sufficient free space for storing archived redo logs.

- If the destination is healthy, the probe determines the amount of free space in the destination's file system. If the amount of free space is less than 10% of the file system's capacity and is less than 20 Mbytes, the probe prints a message to `syslog`.
- If the destination is in `ERROR` status, the probe prints a message to `syslog` and disables operations to determine whether the database is operational. The operations remain disabled until the error condition is cleared .

## Operations to Determine Whether the Database is Operational

If the partition for archived redo logs is healthy, the database client fault probe queries the dynamic performance view `v$sysstat` to obtain database performance statistics. Changes to these statistics indicate that the database is operational. If these statistics remain unchanged between consecutive queries, the fault probe performs database transactions to determine if the database is operational. These transactions involve the creation, updating, and dropping of a table in the user table space.

The database client fault probe performs all its transactions as the Oracle user. The ID of this user is specified during the preparation of the nodes or zones as explained in “[How to Prepare the Nodes](#)” on page 19.

## Actions by the Server Fault Monitor in Response to a Database Transaction Failure

If a database transaction fails, the server fault monitor performs an action that is determined by the error that caused the failure. To change the action that the server fault monitor performs, customize the server fault monitor as explained in “[Customizing the HA for Oracle Server Fault Monitor](#)” on page 69.

If the action requires an external program to be run, the program is run as a separate process in the background.

Possible actions are as follows:

- **Ignore.** The server fault monitor ignores the error.
- **Stop monitoring.** The server fault monitor is stopped without shutting down the database.

- **Restart.** The server fault monitor stops and restarts the entity that is specified by the value of the `Restart_type` extension property:
  - If the `Restart_type` extension property is set to `RESOURCE_RESTART`, the server fault monitor restarts the database server resource. By default, the server fault monitor restarts the database server resource.
  - If the `Restart_type` extension property is set to `RESOURCE_GROUP_RESTART`, the server fault monitor restarts the database server resource group.

---

**Note** – The number of attempts to restart might exceed the value of the `Retry_count` resource property within the time that the `Retry_interval` resource property specifies. If this situation occurs, the server fault monitor attempts to switch over the resource group to another node or zone.

---

- **Switch over.** The server fault monitor switches over the database server resource group to another node or zone. If no nodes or zones are available, the attempt to switch over the resource group fails. If the attempt to switch over the resource group fails, the database server is restarted.

## Scanning of Logged Alerts by the Server Fault Monitor

The Oracle software logs alerts in an alert log file. The absolute path of this file is specified by the `alert_log_file` extension property of the `SUNW.oracle_server` resource. The server fault monitor scans the alert log file for new alerts at the following times:

- When the server fault monitor is started
- Each time that the server fault monitor queries the health of the server

If an action is defined for a logged alert that the server fault monitor detects, the server fault monitor performs the action in response to the alert.

Preset actions for logged alerts are listed in [Table B-2](#). To change the action that the server fault monitor performs, customize the server fault monitor as explained in “[Customizing the HA for Oracle Server Fault Monitor](#)” on page 69.

## Operation of the Oracle Listener Fault Monitor

The Oracle listener fault monitor checks the status of an Oracle listener.

If the listener is running, the Oracle listener fault monitor considers a probe successful. If the fault monitor detects an error, the listener is restarted.

---

**Note** – The listener resource does not provide a mechanism for setting the listener password. If Oracle listener security is enabled, a probe by the listener fault monitor might return Oracle error TNS-01169. Because the listener is able to respond, the listener fault monitor treats the probe as a success. This action does not cause a failure of the listener to remain undetected. A failure of the listener returns a different error, or causes the probe to time out.

---

The listener probe is started through `pmfadm` to make the probe highly available. If the probe is killed, PMF automatically restarts the probe.

If a problem occurs with the listener during a probe, the probe tries to restart the listener. The value that is set for the resource property `retry_count` determines the maximum number of times that the probe attempts the restart. If, after trying for the maximum number of times, the probe is still unsuccessful, the probe stops the fault monitor and does not switch over the resource group.

## Obtaining Core Files for Troubleshooting DBMS Timeouts

To facilitate troubleshooting of unexplained DBMS timeouts, you can enable the fault monitor to create a core file when a probe timeout occurs. The contents of the core file relate to the fault monitor process. The fault monitor creates the core file in the `/` directory. To enable the fault monitor to create a core file, use the `coreadm` command to enable `set -id` core dumps.

```
# coreadm -g /var/cores/%f.%n.%p.core -e global -e process \
-e global-setid -e proc-setid -e log
```

For more information, see the [coreadm\(1M\)](#) man page.

## Customizing the HA for Oracle Server Fault Monitor

Customizing the HA for Oracle server fault monitor enables you to modify the behavior of the server fault monitor as follows:

- Overriding the preset action for an error
- Specifying an action for an error for which no action is preset



**Caution** – Before you customize the HA for Oracle server fault monitor, consider the effects of your customizations, especially if you change an action from restart or switch over to ignore or stop monitoring. If errors remain uncorrected for long periods, the errors might cause problems with the database. If you encounter problems with the database after customizing the HA for Oracle server fault monitor, revert to using the preset actions. Reverting to the preset actions enables you to determine if the problem is caused by your customizations.

---

The following sections describe the activities you perform to customize the HA for Oracle server fault monitor:

- “Defining Custom Behavior for Errors” on page 70
- “Propagating a Custom Action File to All Nodes in a Cluster” on page 78
- “Specifying the Custom Action File That a Server Fault Monitor Should Use” on page 78

## Defining Custom Behavior for Errors

The HA for Oracle server fault monitor detects the following types of errors:

- DBMS errors that occur during a probe of the database by the server fault monitor
- Alerts that Oracle logs in the alert log file
- Timeouts that result from a failure to receive a response within the time that is set by the `Probe_timeout` extension property

To define custom behavior for these types of errors, create a custom action file. This section contains the following information about custom action files:

- “Custom Action File Format” on page 70
- “Changing the Response to a DBMS Error” on page 73
- “Changing the Response to Logged Alerts” on page 75
- “Changing the Maximum Number of Consecutive Timed-Out Probes” on page 76

### Custom Action File Format

A custom action file is a plain text file. The file contains one or more entries that define the custom behavior of the HA for Oracle server fault monitor. Each entry defines the custom behavior for a single DBMS error, a single timeout error, or several logged alerts. A maximum of 1024 entries is allowed in a custom action file.

---

**Note** – Each entry in a custom action file overrides the preset action for an error, or specifies an action for an error for which no action is preset. Create entries in a custom action file *only* for the preset actions that you are overriding or for errors for which no action is preset. Do *not* create entries for actions that you are not changing.

---

An entry in a custom action file consists of a sequence of keyword-value pairs that are separated by semicolons. Each entry is enclosed in braces.

The format of an entry in a custom action file is as follows:

```
{
[ERROR_TYPE=DBMS_ERROR|SCAN_LOG|TIMEOUT_ERROR;]
ERROR=error-spec;
[ACTION=SWITCH|RESTART|STOP|NONE;]
[CONNECTION STATE=co|di|on|*;]
[NEW_STATE=co|di|on|*;]
[MESSAGE="message-string"]
}
```

White space may be used between separated keyword-value pairs and between entries to format the file.

The meaning and permitted values of the keywords in a custom action file are as follows:

#### ERROR\_TYPE

Indicates the type of the error that the server fault monitor has detected. The following values are permitted for this keyword:

DBMS_ERROR	Specifies that the error is a DBMS error.
SCAN_LOG	Specifies that the error is an alert that is logged in the alert log file.
TIMEOUT_ERROR	Specifies that the error is a timeout.

The ERROR\_TYPE keyword is optional. If you omit this keyword, the error is assumed to be a DBMS error.

#### ERROR

Identifies the error. The data type and the meaning of *error-spec* are determined by the value of the ERROR\_TYPE keyword as shown in the following table.

ERROR_TYPE	Data Type	Meaning
DBMS_ERROR	Integer	The error number of a DBMS error that is generated by Oracle
SCAN_LOG	Quoted regular expression	A string in an error message that Oracle has logged to the Oracle alert log file

ERROR_TYPE	Data Type	Meaning
TIMEOUT_ERROR	Integer	The number of consecutive timed-out probes since the server fault monitor was last started or restarted

You must specify the ERROR keyword. If you omit this keyword, the entry in the custom action file is ignored.

#### ACTION

Specifies the action that the server fault monitor is to perform in response to the error. The following values are permitted for this keyword:

- NONE      Specifies that the server fault monitor ignores the error.
- STOP      Specifies that the server fault monitor is stopped.
- RESTART    Specifies that the server fault monitor stops and restarts the entity that is specified by the value of the Restart\_type extension property of the SUNW.oracle\_server resource.
- SWITCH     Specifies that the server fault monitor switches over the database server resource group to another node or zone.

The ACTION keyword is optional. If you omit this keyword, the server fault monitor ignores the error.

#### CONNECTION\_STATE

Specifies the required state of the connection between the database and the server fault monitor when the error is detected. The entry applies only if the connection is in the required state when the error is detected. The following values are permitted for this keyword:

- \*      Specifies that the entry always applies, regardless of the state of the connection.
- co     Specifies that the entry applies only if the server fault monitor is attempting to connect to the database.
- on     Specifies that the entry applies only if the server fault monitor is online. The server fault monitor is online if it is connected to the database.
- di     Specifies that the entry applies only if the server fault monitor is disconnecting from the database.

The CONNECTION\_STATE keyword is optional. If you omit this keyword, the entry always applies, regardless of the state of the connection.

#### NEW\_STATE

Specifies the state of the connection between the database and the server fault monitor that the server fault monitor must attain after the error is detected. The following values are permitted for this keyword:

- \* Specifies that the state of the connection must remain unchanged.
- co Specifies that the server fault monitor must disconnect from the database and reconnect immediately to the database.
- di Specifies that the server fault monitor must disconnect from the database. The server fault monitor reconnects when it next probes the database.

The NEW\_STATE keyword is optional. If you omit this keyword, the state of the database connection remains unchanged after the error is detected.

#### MESSAGE

Specifies an additional message that is printed to the resource's log file when this error is detected. The message must be enclosed in double quotes. This message is additional to the standard message that is defined for the error.

The MESSAGE keyword is optional. If you omit this keyword, no additional message is printed to the resource's log file when this error is detected.

## Changing the Response to a DBMS Error

The action that the server fault monitor performs in response to each DBMS error is preset as listed in [Table B-1](#). To determine whether you need to change the response to a DBMS error, consider the effect of DBMS errors on your database to determine if the preset actions are appropriate. For examples, see the subsections that follow:

- “[Responding to an Error Whose Effects Are Major](#)” on page 73
- “[Ignoring an Error Whose Effects Are Minor](#)” on page 74

To change the response to a DBMS error, create an entry in a custom action file in which the keywords are set as follows:

- ERROR\_TYPE is set to DBMS\_ERROR.
- ERROR is set to the error number of the DBMS error.
- ACTION is set to the action that you require.

### Responding to an Error Whose Effects Are Major

If an error that the server fault monitor ignores affects more than one session, action by the server fault monitor might be required to prevent a loss of service.

For example, no action is preset for Oracle error 4031: unable to allocate *num-bytes* bytes of shared memory. However, this Oracle error indicates that the shared global area (SGA) has insufficient memory, is badly fragmented, or both states apply. If this error affects only a single session, ignoring the error might be appropriate. However, if this error affects more than one session, consider specifying that the server fault monitor restart the database.

The following example shows an entry in a custom action file for changing the response to a DBMS error to restart.

**EXAMPLE 1–4** Changing the Response to a DBMS Error to Restart

```
{  
ERROR_TYPE=DBMS_ERROR;  
ERROR=4031;  
ACTION=restart;  
CONNECTION_STATE=*;  
NEW_STATE=*;  
MESSAGE="Insufficient memory in shared pool.";  
}
```

This example shows an entry in a custom action file that overrides the preset action for DBMS error 4031. This entry specifies the following behavior:

- In response to DBMS error 4031, the action that the server fault monitor performs is restart.
- This entry applies regardless of the state of the connection between the database and the server fault monitor when the error is detected.
- The state of the connection between the database and the server fault monitor must remain unchanged after the error is detected.
- The following message is printed to the resource's log file when this error is detected:

Insufficient memory in shared pool.

## Ignoring an Error Whose Effects Are Minor

If the effects of an error to which the server fault monitor responds are minor, ignoring the error might be less disruptive than responding to the error.

For example, the preset action for Oracle error 4030: out of process memory when trying to allocate *num-bytes* bytes is restart. This Oracle error indicates that the server fault monitor could not allocate private heap memory. One possible cause of this error is that insufficient memory is available to the operating system. If this error affects more than one session, restarting the database might be appropriate. However, this error might not affect other sessions because these sessions do not require further private memory. In this situation, consider specifying that the server fault monitor ignore the error.

The following example shows an entry in a custom action file for ignoring a DBMS error.

**EXAMPLE 1–5** Ignoring a DBMS Error

```
{  
ERROR_TYPE=DBMS_ERROR;  
ERROR=4030;  
ACTION=none;  
CONNECTION_STATE=*;  
NEW_STATE=*;  
MESSAGE="";  
}
```

This example shows an entry in a custom action file that overrides the preset action for DBMS error 4030. This entry specifies the following behavior:

**EXAMPLE 1-5 Ignoring a DBMS Error (Continued)**

- The server fault monitor ignores DBMS error 4030.
- This entry applies regardless of the state of the connection between the database and the server fault monitor when the error is detected.
- The state of the connection between the database and the server fault monitor must remain unchanged after the error is detected.
- No additional message is printed to the resource's log file when this error is detected.

## Changing the Response to Logged Alerts

The Oracle software logs alerts in a file that is identified by the `alert_log_file` extension property. The server fault monitor scans this file and performs actions in response to alerts for which an action is defined.

Logged alerts for which an action is preset are listed in [Table B-2](#). Change the response to logged alerts to change the preset action, or to define new alerts to which the server fault monitor responds.

To change the response to logged alerts, create an entry in a custom action file in which the keywords are set as follows:

- `ERROR_TYPE` is set to `SCAN_LOG`.
- `ERROR` is set to a quoted regular expression that identifies a string in an error message that Oracle has logged to the Oracle alert log file.
- `ACTION` is set to the action that you require.

The server fault monitor processes the entries in a custom action file in the order in which the entries occur. Only the first entry that matches a logged alert is processed. Later entries that match are ignored. If you are using regular expressions to specify actions for several logged alerts, ensure that more specific entries occur before more general entries. Specific entries that occur after general entries might be ignored.

For example, a custom action file might define different actions for errors that are identified by the regular expressions `ORA-65` and `ORA-6`. To ensure that the entry that contains the regular expression `ORA-65` is not ignored, ensure that this entry occurs before the entry that contains the regular expression `ORA-6`.

The following example shows an entry in a custom action file for changing the response to a logged alert.

**EXAMPLE 1-6 Changing the Response to a Logged Alert**

```
{  
  ERROR_TYPE=SCAN_LOG;  
  ERROR="ORA-00600: internal error";
```

**EXAMPLE 1–6** Changing the Response to a Logged Alert      (*Continued*)

```
ACTION=RESTART;  
}
```

This example shows an entry in a custom action file that overrides the preset action for logged alerts about internal errors. This entry specifies the following behavior:

- In response to logged alerts that contain the text ORA-00600: internal error, the action that the server fault monitor performs is restart.
- This entry applies regardless of the state of the connection between the database and the server fault monitor when the error is detected.
- The state of the connection between the database and the server fault monitor must remain unchanged after the error is detected.
- No additional message is printed to the resource's log file when this error is detected.

## Changing the Maximum Number of Consecutive Timed-Out Probes

By default, the server fault monitor restarts the database after the second consecutive timed-out probe. If the database is lightly loaded, two consecutive timed-out probes should be sufficient to indicate that the database is hanging. However, during periods of heavy load, a server fault monitor probe might time out even if the database is functioning correctly. To prevent the server fault monitor from restarting the database unnecessarily, increase the maximum number of consecutive timed-out probes.



**Caution** – Increasing the maximum number of consecutive timed-out probes increases the time that is required to detect that the database is hanging.

---

To change the maximum number of consecutive timed-out probes allowed, create one entry in a custom action file for each consecutive timed-out probe that is allowed *except* the first timed-out probe.

---

**Note** – You are not required to create an entry for the first timed-out probe. The action that the server fault monitor performs in response to the first timed-out probe is preset.

---

For the last allowed timed-out probe, create an entry in which the keywords are set as follows:

- `ERROR_TYPE` is set to `TIMEOUT_ERROR`.
- `ERROR` is set to the maximum number of consecutive timed-out probes that are allowed.
- `ACTION` is set to `RESTART`.

For each remaining consecutive timed-out probe except the first timed-out probe, create an entry in which the keywords are set as follows:

- **ERROR\_TYPE** is set to **TIMEOUT\_ERROR**.
- **ERROR** is set to the sequence number of the timed-out probe. For example, for the second consecutive timed-out probe, set this keyword to 2. For the third consecutive timed-out probe, set this keyword to 3.
- **ACTION** is set to **NONE**.

---

**Tip** – To facilitate debugging, specify a message that indicates the sequence number of the timed-out probe.

---

The following example shows the entries in a custom action file for increasing the maximum number of consecutive timed-out probes to five.

**EXAMPLE 1-7** Changing the Maximum Number of Consecutive Timed-Out Probes

```
{
  ERROR_TYPE=TIMEOUT;
  ERROR=2;
  ACTION=NONE;
  CONNECTION_STATE=.*;
  NEW_STATE=.*;
  MESSAGE="Timeout #2 has occurred.";

}

{
  ERROR_TYPE=TIMEOUT;
  ERROR=3;
  ACTION=NONE;
  CONNECTION_STATE=.*;
  NEW_STATE=.*;
  MESSAGE="Timeout #3 has occurred.";
}

{
  ERROR_TYPE=TIMEOUT;
  ERROR=4;
  ACTION=NONE;
  CONNECTION_STATE=.*;
  NEW_STATE=.*;
  MESSAGE="Timeout #4 has occurred.";
}

{
  ERROR_TYPE=TIMEOUT;
  ERROR=5;
  ACTION=RESTART;
  CONNECTION_STATE=.*;
  NEW_STATE=.*;
  MESSAGE="Timeout #5 has occurred. Restarting.";
}
```

This example shows the entries in a custom action file for increasing the maximum number of consecutive timed-out probes to five. These entries specify the following behavior:

**EXAMPLE 1-7** Changing the Maximum Number of Consecutive Timed-Out Probes *(Continued)*

- The server fault monitor ignores the second consecutive timed-out probe through the fourth consecutive timed-out probe.
- In response to the fifth consecutive timed-out probe, the action that the server fault monitor performs is restart.
- The entries apply regardless of the state of the connection between the database and the server fault monitor when the timeout occurs.
- The state of the connection between the database and the server fault monitor must remain unchanged after the timeout occurs.
- When the second consecutive timed-out probe through the fourth consecutive timed-out probe occurs, a message of the following form is printed to the resource's log file:  
*Timeout #number has occurred.*
- When the fifth consecutive timed-out probe occurs, the following message is printed to the resource's log file:  
*Timeout #5 has occurred. Restarting.*

## Propagating a Custom Action File to All Nodes in a Cluster

A server fault monitor must behave consistently on all cluster nodes or zones. Therefore, the custom action file that the server fault monitor uses must be identical on all cluster nodes or zones. After creating or modifying a custom action file, ensure that this file is identical on all cluster nodes or zones by propagating the file to all cluster nodes or zones. To propagate the file to all cluster nodes or zones, use the method that is most appropriate for your cluster configuration:

- Locating the file on a file system that all nodes or zones share
- Locating the file on a highly available local file system
- Copying the file to the local file system of each cluster node or zone by using operating system commands such as the [rcp\(1\)](#) command or the [rdist\(1\)](#) command

## Specifying the Custom Action File That a Server Fault Monitor Should Use

To apply customized actions to a server fault monitor, you must specify the custom action file that the fault monitor should use. Customized actions are applied to a server fault monitor when the server fault monitor reads a custom action file. A server fault monitor reads a custom action file when you specify the file.

Specifying a custom action file also validates the file. If the file contains syntax errors, an error message is displayed. Therefore, after modifying a custom action file, specify the file again to validate the file.



**Caution** – If syntax errors in a modified custom action file are detected, correct the errors before the fault monitor is restarted. If the syntax errors remain uncorrected when the fault monitor is restarted, the fault monitor reads the erroneous file, ignoring entries that occur after the first syntax error.

## ▼ How to Specify the Custom Action File That a Server Fault Monitor Should Use

- 1 On a cluster node, become superuser or assume a role that provides `solaris.cluster.modify` RBAC authorization.
- 2 Set the `Custom_action_file` extension property of the `SUNW.oracle_server` resource.

Set this property to the absolute path of the custom action file.

```
# clresource set -p custom_action_file=filepath server-resource  
-p custom_action_file=filepath  
    Specifies the absolute path of the custom action file.  
server-resource  
    Specifies the SUNW.oracle_server resource.
```

# Upgrading HA for Oracle Resource Types

The existing resource types for the HA for Oracle data service are as follows:

- `SUNW.oracle_listener`, which represents an Oracle listener
- `SUNW.oracle_server`, which represents an Oracle server

**Note** – For Oracle Database version 11g release 2 or 12c, if you are using an Oracle Grid Infrastructure for Clusters Single Client Access Name (SCAN) listener, the `SUNW.oracle_listener` resource type is not used.

In addition to the existing resource types, there are three additional resource types included in HA for Oracle data service for Oracle ASM. These resource types are as follows:

- `SUNW.asm_diskgroup` (Oracle 10g and 11g release 1 only) or `SUNW.scalable_asm_diskgroup_proxy` (Oracle 11g release 2 or 12c only), which represents the single or clustered instance Oracle ASM disk group in an Oracle Solaris Cluster configuration. For more information about the resource type, see [asm\\_diskgroup\(5\)](#) or [SUNW.scalable\\_asm\\_diskgroup\\_proxy\(5\)](#).
- `SUNW.scalable_asm_instance`, which represents the single instance Oracle ASM in an Oracle Solaris Cluster configuration. For more information about the resource type, see [SUNW.scalable\\_asm\\_instance\(5\)](#).

---

**Note** – Single instance Oracle ASM is not supported with Oracle 11g release 2 or 12c. For these releases, you must only use clustered Oracle ASM.

---

- `SUNW.scalable_asm_instance_proxy`, which represents a proxy for the clustered Oracle ASM instance in an Oracle Solaris Cluster configuration. For more information about the resource type, see [SUNW.scalable\\_asm\\_instance\\_proxy\(5\)](#).

Upgrade the existing resource types if you are upgrading from an earlier version of HA for Oracle.

For general instructions that explain how to upgrade a resource type, see “[Upgrading a Resource Type](#)” in *Oracle Solaris Cluster Data Services Planning and Administration Guide*.

## Upgrading the `SUNW.oracle_listener` Resource Type

The information that you require to complete the upgrade of the `SUNW.oracle_listener` resource type is provided in the subsections that follow.

### Information for Registering the New Resource Type Version

To determine the version of the resource type that is currently registered, use one command from the following list:

- `clresourcetype list`
- `clresourcetype show`

The resource type registration (RTR) file for this resource type is `/SUNW.oracle_listener`.

To determine the version of the latest installed version of the `/opt/cluster/lib/rgm/rtreg/SUNW.oracle_listener` resource type, whether it is registered or not, use the following command:

```
# grep -i RT_VERSION /opt/cluster/lib/rgm/rtreg/SUNW.oracle_listener
```

If the version of the latest installed resource type is later than the registered version, migrate to the newer version to ensure full functionality.

---

**Note** – In the global zone, Oracle Solaris Cluster Manager or the Resource Group option of `clsetup` locates for you the available resource type versions you can upgrade to.

---

## Information for Migrating Existing Instances of the Resource Type

The information that you require to edit each instance of the `SUNW.oracle_listener` resource type is as follows:

- You can perform the migration at any time.
- If you need to specify the timeout value in seconds that the fault monitor uses to probe an Oracle listener, set the `Probe_timeout` extension property. For more information, see “[SUNW.oracle\\_listener Extension Properties](#)” on page 89.

The following example shows a command for editing an instance of the `SUNW.oracle_listener` resource type.

**EXAMPLE 1-8** Editing an Instance of the `SUNW.oracle_listener` Resource Type

```
# clresource set -p Type_version=N \
-p probe_timeout=60 oracle-lrs
```

This command edits a `SUNW.oracle_listener` resource as follows:

- The `SUNW.oracle_listener` resource is named `oracle-lrs`.
- The `Type_version` property of this resource is set to `N`, which represents the version number of the resource type you migrated to.
- The timeout value in seconds that the fault monitor uses to probe an Oracle listener is set to 60 seconds.

## Upgrading the `SUNW.oracle_server` Resource Type

The information that you require to complete the upgrade of the `SUNW.oracle_server` resource type is provided in the subsections that follow.

### Information for Registering the New Resource Type Version

To determine the version of the resource type that is registered, use one command from the following list:

- `clresourcetype list`
- `clresourcetype show`

The resource type registration (RTR) file for this resource type is `/opt/SUNWscor/oracle_server/etc/SUNW.oracle_server`.

To determine the version of the latest installed version of the SUNW.oracle\_server resource type, whether it is registered or not, use the following command:

```
# grep -i RT_VERSION /opt/cluster/lib/rgm/rtrreg/SUNW.oracle_server
```

If the version of the latest installed resource type is later than the registered version, migrate to the newer version to ensure full functionality.

---

**Note** – In the global zone, Oracle Solaris Cluster Manager or the Resource Group option of cldsetup locates for you the available resource type versions you can upgrade to.

---

## Information for Migrating Existing Instances of the Resource Type

The information that you require to edit each instance of the SUNW.oracle\_server resource type is as follows:

- You can perform the migration at any time.
- If you customized the behavior of the server fault monitor, set the Custom\_action\_file extension property. For more information, see “[Customizing the HA for Oracle Server Fault Monitor](#)” on page 69.

The following example shows a command for editing an instance of the SUNW.oracle\_server resource type.

**EXAMPLE 1-9** Editing an Instance of the SUNW.oracle\_server Resource Type

```
# clresource set -p Type_version=N \
    -p custom_action_file=/opt/SUNWscor/oracle_server/etc/srv_mon_cust_actions \
oracle-srs
```

This command edits a SUNW.oracle\_server resource as follows:

- The SUNW.oracle\_server resource is named oracle-srs.
- The Type\_version property of this resource is set to N, which represents the version number of the resource type you migrated to.
- Custom behavior for the fault monitor of this resource is specified in the file /opt/SUNWscor/oracle\_server/etc/srv\_mon\_cust\_actions.

## Changing the Role of an Oracle Data Guard Instance

Database role failover or switchover is possible between an Oracle primary database and an Oracle standby database. When you use Oracle commands to change the role of Oracle Data Guard instances, the changes are not propagated to the Oracle Solaris Cluster resources that represent these instances. Therefore, you must also use Oracle Solaris Cluster commands to change extension properties of these resources to ensure that database instances are started in the correct role.

## ▼ How to Change the Role of an Oracle Data Guard Instance

### 1 Prevent Oracle Solaris Cluster from starting the instance in an incorrect role.

If a node or zone fails while you are changing the role of an Oracle Data Guard instance, Oracle Solaris Cluster might restart the instance in an incorrect role. To prevent this possibility, change the Dataguard\_role extension property of the Oracle server resource that represents the instance to IN\_TRANSITION.

```
# clresource set -p Dataguard_role=IN_TRANSITION server-rs
```

### 2 Perform the required operations on the Oracle database to convert the database to a new role.

### 3 Change the following extension properties of the Oracle server resource that represents the instance to reflect the new role of the instance:

- Dataguard\_role
- Standby\_mode

The required combination of Dataguard\_role and Standby\_mode depends on the change of role, as follows:

- To change from a primary database to a physical standby database, run the following command:

```
# clresource set -p Dataguard_role=STANDBY -p Standby_mode=PHYSICAL server-rs
```

- To change from a primary database to a logical standby database, run the following command:

```
# clresource set -p Dataguard_role=STANDBY \
-p Standby_mode=LOGICAL server-rs
```

- To change from a standby database to a primary database, run the following command:

```
# clresource set -p Dataguard_role=PRIMARY server-rs
```

- To change from a physical standby database to a snapshot standby database, run the following command:

```
# clresource set -p Standby_mode=SNAPSHOT server-rs
```



## HA for Oracle Extension Properties

---

The extension properties that you can set for each HA for Oracle resource type are listed in the following sections:

- “[SUNW.oracle\\_server Extension Properties](#)” on page 85
- “[SUNW.oracle\\_listener Extension Properties](#)” on page 89

See the [r\\_properties\(5\)](#) man page and the [rg\\_properties\(5\)](#) man page for details about all of the system-defined properties.

## SUNW.oracle\_server Extension Properties

**Alert\_log\_file** (string)

(Omit for Oracle Database 11g release 2 or 12c with Oracle ASM) Specifies the absolute path of the Oracle alert log file. The Oracle software logs alerts in this file. The Oracle server fault monitor scans the alert log file for new alerts at the following times:

- When the server fault monitor is started
- Each time that the server fault monitor queries the health of the server

If an action is defined for a logged alert that the server fault monitor detects, the server fault monitor performs the action in response to the alert.

Preset actions for logged alerts are listed in [Appendix B, “Preset Actions for DBMS Errors and Logged Alerts.”](#) To change the action that the server fault monitor performs, customize the server fault monitor as explained in “[Customizing the HA for Oracle Server Fault Monitor](#)” on page 69.

**Default:** None

**Range:** Minimum = 1

**Tunable:** Any time

**Auto\_End\_Bkp** (Boolean)

Specifies whether the following recovery actions are performed if an Oracle relational database management system (RDBMS) hot backup is interrupted.

- Recognizing when a database fails to open because of files that remain in hot backup mode. This verification process occurs when HA for Oracle starts.
- Identifying and releasing all files that remain in hot backup mode.
- Opening the database for use.

The permitted values for this property are as follows:

- **False** – Specifies that the recovery actions are *not* performed. This value is the default.
- **True** – Specifies that the recovery actions are performed.

**Default:** False

**Range:** None

**Tunable:** Any time

**Connect\_cycle** (integer)

The number of probe cycles that the server fault monitor performs before disconnecting from the database.

**Default:** 5

**Range:** 0 – 99,999

**Tunable:** Any time

**Connect\_string** (string)

(Omit for Oracle Database 11g release 2 or 12c with Oracle ASM) The Oracle database user ID and password that the server fault monitor uses to connect to the database.

Specify this property as follows:

*userid/password*

As part of the setup of HA for Oracle, you must define the database user ID and password before enabling the server resource and its fault monitor. To use Solaris authentication, type a slash (/) instead of a user ID and password.

**Default:** None

**Range:** Minimum = 1

**Tunable:** Any time

**Custom\_action\_file** (string)

The absolute path of the file that defines the custom behavior of the HA for Oracle server fault monitor.

**Default:** ""

**Range:** None

**Tunable:** Any time

**Introduced in release:** 3.1 10/03

**Dataguard\_role** (string)

The role of the database. The permitted values for this property are as follows:

NONE	Specifies that no standby database instances configured for the database instance
PRIMARY	Specifies that the database is a primary database instance for which standby database instances are configured
STANDBY	Specifies that the database role is standby
IN_TRANSITION	Specifies that the database is undergoing a role reversal process

**Default:** NONE

**Range:** None

**Tunable:** Any time

**Db\_unique\_name** (string)

(For Oracle 11g release 2 or 12c with Oracle ASM only) The unique name of the single-instance Oracle database that is being deployed.

**Default:** NONE

**Range:** None

**Tunable:** Any time

**Debug\_level** (integer)

The level to which debug messages from the Oracle server component are logged. When the debug level is increased, more debug messages are written to the log files. These messages are logged to the file /var/opt/SUNWscor/oracle\_server/message\_log.rs, where rs is the name of the resource that represents the Oracle server component.

**Default:** 1, which logs syslog messages

**Range:** 0– 100

**Tunable:** Any time

**ORACLE\_HOME** (string)

The path to the Oracle home directory.

**Default:** None

**Range:** Minimum = 1

**Tunable:** When disabled

**ORACLE\_SID** (string)

The Oracle system identifier.

**Default:** None

**Range:** Minimum = 1

**Tunable:** When disabled

**Parameter\_file** (string)

The Oracle parameter file. If the Oracle parameter file is not specified, this property defaults to Oracle's default.

**Default:** ““

**Range:** Minimum = 0

**Tunable:** Any time

**Probe\_timeout** (integer)

The timeout value (in seconds) that the server fault monitor uses to probe an Oracle server instance.

**Default:** 300

**Range:** 0– 99,999

**Tunable:** Any time

**Restart\_type** (string)

Specifies the entity that the server fault monitor restarts when the response to a fault is restart. The permitted values for this property are as follows:

RESOURCE\_RESTART      Specifies that only this resource is restarted

RESOURCE\_GROUP\_RESTART      Specifies that all resources in the resource group that contains this resource are restarted

**Default:** RESOURCE\_RESTART

**Range:** None

**Tunable:** Any time

**Standby\_mode** (string)

The mode of the standby database. The permitted values for this property are as follows:

LOGICAL      Specifies a logical standby database

**PHYSICAL** Specifies a physical standby database

**SNAPSHOT** Beginning with Oracle 11g, specifies a snapshot standby database

**Default:** LOGICAL

**Range:** None

**Tunable:** Any time

**User\_env** (string)

A file that contains environment variables to be set before server startup and shutdown. Those environment variables that have values that differ from Oracle defaults must be defined in this file.

For example, a user's *listener.ora* file might not reside under the */var/opt/oracle* directory or the *\$ORACLE\_HOME/network/admin*. directory. In this situation, the *TNS\_ADMIN* environment variable should be defined.

The definition of each environment variable that is defined must follow the format **VARIABLE\_NAME=VARIABLE\_VALUE**. Each of these environment variables must be specified, one per line in the environment file.

**Default:** NULL

**Range:** None

**Tunable:** Any time

**Wait\_for\_online** (Boolean)

Wait in the START method until the database is online.

**Default:** True

**Range:** None

**Tunable:** Any time

## SUNW.oracle\_listener Extension Properties

**LISTENER\_NAME** (string)

The name of the Oracle listener. This name must match the corresponding entry in the *listener.ora* configuration file.

**Default:** LISTENER

**Range:** Not applicable

**Tunable:** When disabled

**ORACLE\_HOME** (string)

The path to the Oracle home directory.

**Default:** No default defined

**Range:** Not applicable

**Tunable:** When disabled

**Probe\_timeout** (integer)

The timeout value in seconds that the fault monitor uses to probe an Oracle listener.

**Default:** 180

**Range:** 1– 99,999

**Tunable:** Any time

**Introduced in release:** 3.1 4/04

**User\_env** (string)

A file that contains environment variables to be set before listener startup and shutdown.

Those environment variables that have values that differ from Oracle defaults must be defined in this file.

For example, a user's `listener.ora` file might not reside under the `/var/opt/oracle` directory or the `$ORACLE_HOME/network/admin` directory. In this situation, the `TNS_ADMIN` environment variable should be defined.

The definition of each environment variable that is defined must follow the format `VARIABLE_NAME=VARIABLE_VALUE`. Each of these environment variables must be specified, one per line in the environment file.

**Default:** ""

**Range:** Not applicable

**Tunable:** Any time

## Preset Actions for DBMS Errors and Logged Alerts

---

Preset actions for DBMS errors and logged alerts are listed as follows:

- DBMS errors for which an action is preset are listed in [Table B–1](#).
- Logged alerts for which an action is preset are listed in [Table B–2](#).

**TABLE B–1** Preset Actions for DBMS Errors

Error Number	Action	Connection State	New State	Message
18	NONE	co	di	Max. number of DBMS sessions exceeded
20	NONE	co	di	Max. number of DBMS processes exceeded
28	NONE	on	di	Session killed by DBA, will reconnect
50	SWITCH	*	di	O/S error occurred while obtaining an enqueue. See o/s error.
51	NONE	*	di	timeout occurred while waiting for resource
55	NONE	*	*	maximum number of DML locks in DBMS exceeded
62	STOP	*	di	Need to set DML_LOCKS in init.ora file to value other than 0
107	RESTART	*	di	failed to connect to ORACLE listener process
257	NONE	*	di	archiver error. Connect internal only, until freed.
290	SWITCH	*	di	Operating system archival error occurred. Check alert log.
447	SWITCH	*	di	fatal error in background process
448	RESTART	*	di	normal completion of background process
449	RESTART	*	di	background process ‘%s’ unexpectedly terminated with error %s
470	SWITCH	*	di	Oracle background process died
471	SWITCH	*	di	Oracle background process died

**TABLE B-1** Preset Actions for DBMS Errors *(Continued)*

Error Number	Action	Connection State	New State	Message
472	SWITCH	*	di	Oracle background process died
473	SWITCH	*	di	Oracle background process died
474	RESTART	*	di	SMON died, warm start required
475	SWITCH	*	di	Oracle background process died
476	SWITCH	*	di	Oracle background process died
477	SWITCH	*	di	Oracle background process died
480	RESTART	*	di	LCK* process terminated with error
481	RESTART	*	di	LMON process terminated with error
482	RESTART	*	di	LMD* process terminated with error
602	SWITCH	*	di	internal programming exception
604	NONE	on	di	Recursive error
705	RESTART	*	di	inconsistent state during start up
942	NONE	on	*	Warning - V\$SYSSTAT not accessible - check grant on V\$_SYSSTAT
1001	NONE	on	di	Lost connection to database
1002	NONE	on	*	Internal error in HA-DBMS Oracle
1003	NONE	on	di	Resetting database connection
1012	NONE	on	di	Not logged on
1012	RESTART	di	co	Not logged on
1014	NONE	*	*	ORACLE shutdown in progress
1017	STOP	*	*	Please correct login information in HA-DBMS Oracle database configuration
1031	NONE	on	*	Insufficient privileges to perform DBMS operations - check Oracle user privileges
1033	NONE	co	co	Oracle is in the shutdown or initialization process
1033	NONE	*	di	Oracle is in the shutdown or initialization process
1034	RESTART	co	co	Oracle is not available
1034	RESTART	di	co	Oracle is not available
1034	NONE	on	di	Oracle is not available

**TABLE B-1** Preset Actions for DBMS Errors *(Continued)*

Error Number	Action	Connection State	New State	Message
1035	RESTART	co	co	Access restricted - restarting database to reset
1041	NONE	on	di	
1041	NONE	di	co	
1045	NONE	co	*	Fault monitor user lacks CREATE SESSION privilege logon denied.
1046	RESTART	*	di	cannot acquire space to extend context area
1050	RESTART	*	di	cannot acquire space to open context area
1053	SWITCH	*	*	user storage address cannot be read or written
1054	SWITCH	*	*	user storage address cannot be read or written
1075	NONE	co	on	Already logged on
1089	NONE	on	di	immediate shutdown in progresss
1089	NONE	*	*	Investigate! Could be hanging!
1090	NONE	*	di	shutdown in progress - connection is not permitted
1092	NONE	*	di	ORACLE instance terminated. Disconnection forced
1513	SWITCH	*	*	invalid current time returned by operating system
1542	NONE	on	*	table space is off-line - please correct!
1552	NONE	on	*	rollback segment is off-line - please correct!
1950	NONE	on	*	Insufficient privileges to perform DBMS operations - check Oracle user privileges
2701	STOP	*	*	HA-DBMS Oracle error - ORACLE_HOME did not get set!
2703	RESTART	*	di	
2704	RESTART	*	di	
2709	RESTART	*	di	
2710	RESTART	*	di	
2719	RESTART	*	di	
2721	RESTART	*	*	
2726	STOP	*	*	Could not locate ORACLE executables - check ORACLE_HOME setting
2735	RESTART	*	*	osnfpmp: cannot create shared memory segment
2811	SWITCH	*	*	Unable to attach shared memory segment

**TABLE B-1** Preset Actions for DBMS Errors *(Continued)*

Error Number	Action	Connection State	New State	Message
2839	SWITCH	*	*	Sync of blocks to disk failed.
2840	SWITCH	*	*	
2846	SWITCH	*	*	
2847	SWITCH	*	*	
2849	SWITCH	*	*	
2842	RESTART	*	*	Client unable to fork a server - Out of memory
3113	RESTART	co	di	lost connection
3113	NONE	on	di	lost connection
3113	NONE	di	di	lost connection
3114	NONE	*	co	Not connected?
4030	RESTART	*	*	
4032	RESTART	*	*	
4100	RESTART	*	*	communication area cannot be allocated insufficient memory
6108	STOP	co	*	Can't connect to remote database - make sure SQL*Net server is up
6114	STOP	co	*	Can't connect to remote database - check SQL*Net configuration
7205	SWITCH	*	di	
7206	SWITCH	*	di	
7208	SWITCH	*	di	
7210	SWITCH	*	di	
7211	SWITCH	*	di	
7212	SWITCH	*	di	
7213	SWITCH	*	di	
7214	SWITCH	*	di	
7215	SWITCH	*	di	
7216	SWITCH	*	di	
7218	SWITCH	*	di	
7219	RESTART	*	*	slspool: unable to allocate spooler argument buffer.

**TABLE B-1** Preset Actions for DBMS Errors *(Continued)*

Error Number	Action	Connection State	New State	Message
7223	RESTART	*	*	slspool: fork error, unable to spawn spool process. - Resource limit reached
7224	SWITCH	*	*	
7229	SWITCH	*	*	
7232	SWITCH	*	*	
7234	SWITCH	*	*	
7238	SWITCH	*	*	slemcl: close error.
7250	RESTART	*	*	
7251	RESTART	*	*	
7252	RESTART	*	*	
7253	RESTART	*	*	
7258	RESTART	*	*	
7259	RESTART	*	*	
7263	SWITCH	*	*	
7269	SWITCH	*	*	
7279	SWITCH	*	*	
7280	RESTART	*	*	
7296	SWITCH	*	*	
7297	SWITCH	*	*	
7306	RESTART	*	*	
7310	SWITCH	*	*	
7315	SWITCH	*	*	
7321	SWITCH	*	*	
7322	SWITCH	*	*	
7324	RESTART	*	*	
7325	RESTART	*	*	
7351	SWITCH	*	*	
7361	RESTART	*	*	

**TABLE B-1** Preset Actions for DBMS Errors *(Continued)*

Error Number	Action	Connection State	New State	Message
7404	SWITCH	*	*	
7414	RESTART	*	*	
7415	RESTART	*	*	
7417	SWITCH	*	*	
7418	SWITCH	*	*	
7419	SWITCH	*	*	
7430	SWITCH	*	*	
7455	SWITCH	*	*	
7456	SWITCH	*	*	
7466	SWITCH	*	*	
7470	SWITCH	*	*	
7475	SWITCH	*	*	
7476	SWITCH	*	*	
7477	SWITCH	*	*	
7478	SWITCH	*	*	
7479	SWITCH	*	*	
7481	SWITCH	*	*	
9706	SWITCH	*	*	
9716	SWITCH	*	*	
9718	RESTART	*	*	
9740	SWITCH	*	*	
9748	SWITCH	*	*	
9747	RESTART	*	*	
9749	RESTART	*	*	
9751	RESTART	*	*	
9755	RESTART	*	*	
9757	RESTART	*	*	

**TABLE B-1** Preset Actions for DBMS Errors *(Continued)*

Error Number	Action	Connection State	New State	Message
9756	SWITCH	*	*	
9758	SWITCH	*	*	
9761	RESTART	*	*	
9765	RESTART	*	*	
9779	RESTART	*	*	
9829	RESTART	*	*	
9831	SWITCH	*	*	
9834	SWITCH	*	*	
9836	SWITCH	*	*	
9838	SWITCH	*	*	
9837	RESTART	*	*	
9844	RESTART	*	*	
9845	RESTART	*	*	
9846	RESTART	*	*	
9847	RESTART	*	*	
9853	SWITCH	*	*	
9854	SWITCH	*	*	
9856	RESTART	*	*	
9874	SWITCH	*	*	
9876	SWITCH	*	*	
9877	RESTART	*	*	
9878	RESTART	*	*	
9879	RESTART	*	*	
9885	RESTART	*	*	
9888	RESTART	*	*	
9894	RESTART	*	*	
9909	RESTART	*	*	

**TABLE B-1** Preset Actions for DBMS Errors *(Continued)*

Error Number	Action	Connection State	New State	Message
9912	RESTART	*	*	
9913	RESTART	*	*	
9919	SWITCH	*	*	
9943	RESTART	*	*	
9947	RESTART	*	*	
9948	SWITCH	*	*	
9949	SWITCH	*	*	
9950	SWITCH	*	*	
12505	STOP	*	*	TNS:listener could not resolve SID given in connect descriptor.Check listener configuration file.
12541	STOP	*	*	TNS:no listener. Please verify connect_string property, listener and TNSconfiguration.
12545	SWITCH	*	*	Please check HA-Oracle parameters. Connect failed because target host or object does not exist
27100	STOP	*	*	Shared memory realm already exists
98765	STOP	*	*	Database role queried from database does not match the Oracle Solaris Cluster resource's dataguard role configuration.
99999	RESTART	*	di	Monitor detected death of Oracle background processes.

**TABLE B-2** Preset Actions for Logged Alerts

Alert String	Action	Connection State	New State	Message
ORA-07265	SWITCH	*	di	Semaphore access problem
found dead multi-threaded server	NONE	*	*	Warning: Multi-threaded Oracle server process died (restarted automatically)
found dead dispatcher	NONE	*	*	Warning: Oracle dispatcher process died (restarted automatically)

## Sample Configurations for Oracle ASM with HA for Oracle

---

This appendix contains diagrams that explain various sample configurations of Oracle Automatic Storage Management (Oracle ASM) with HA for Oracle. The diagrams in this section help you to choose the appropriate Oracle ASM instance and provides information about the dependencies between HA for Oracle resources and Oracle ASM services.

### Choosing the Appropriate Oracle ASM Instance

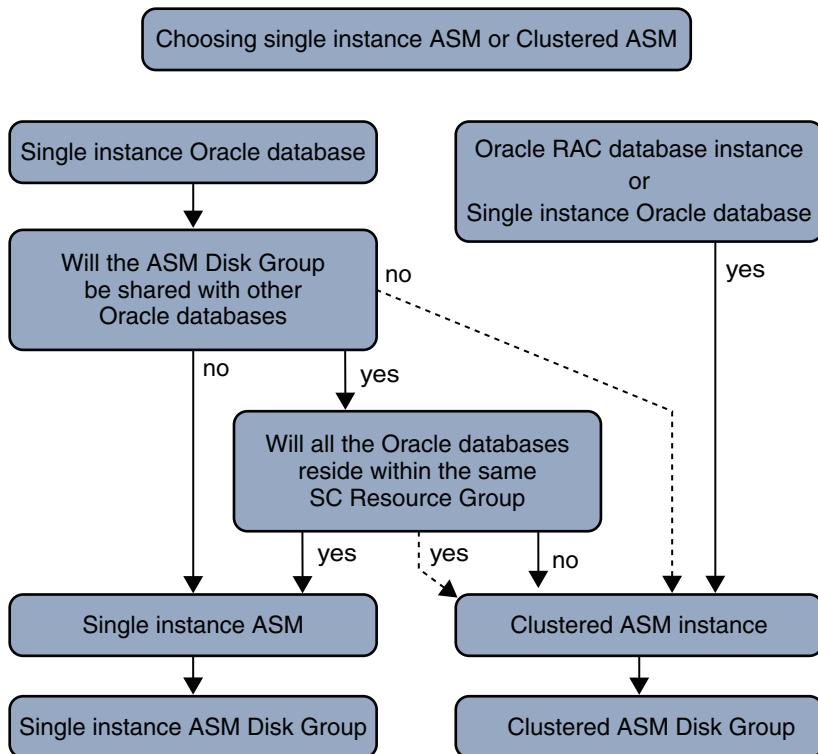
Once you decide to use Oracle ASM with Oracle, you should choose the appropriate Oracle ASM instance. You can use the following diagram to find out if you require single instance Oracle ASM or clustered instance Oracle ASM.

---

**Note** – Single instance Oracle ASM is not supported with Oracle 11g release 2 or 12c. For these releases, you must only use clustered Oracle ASM.

---

FIGURE C-1 Choosing the Appropriate Oracle ASM Instance



## Single Instance Oracle ASM with Separate Disk Groups

This section contains two sample configuration diagrams for single instance Oracle databases with single instance Oracle ASM and single instance Oracle disk groups. The second diagram is a continuation of the first diagram.

---

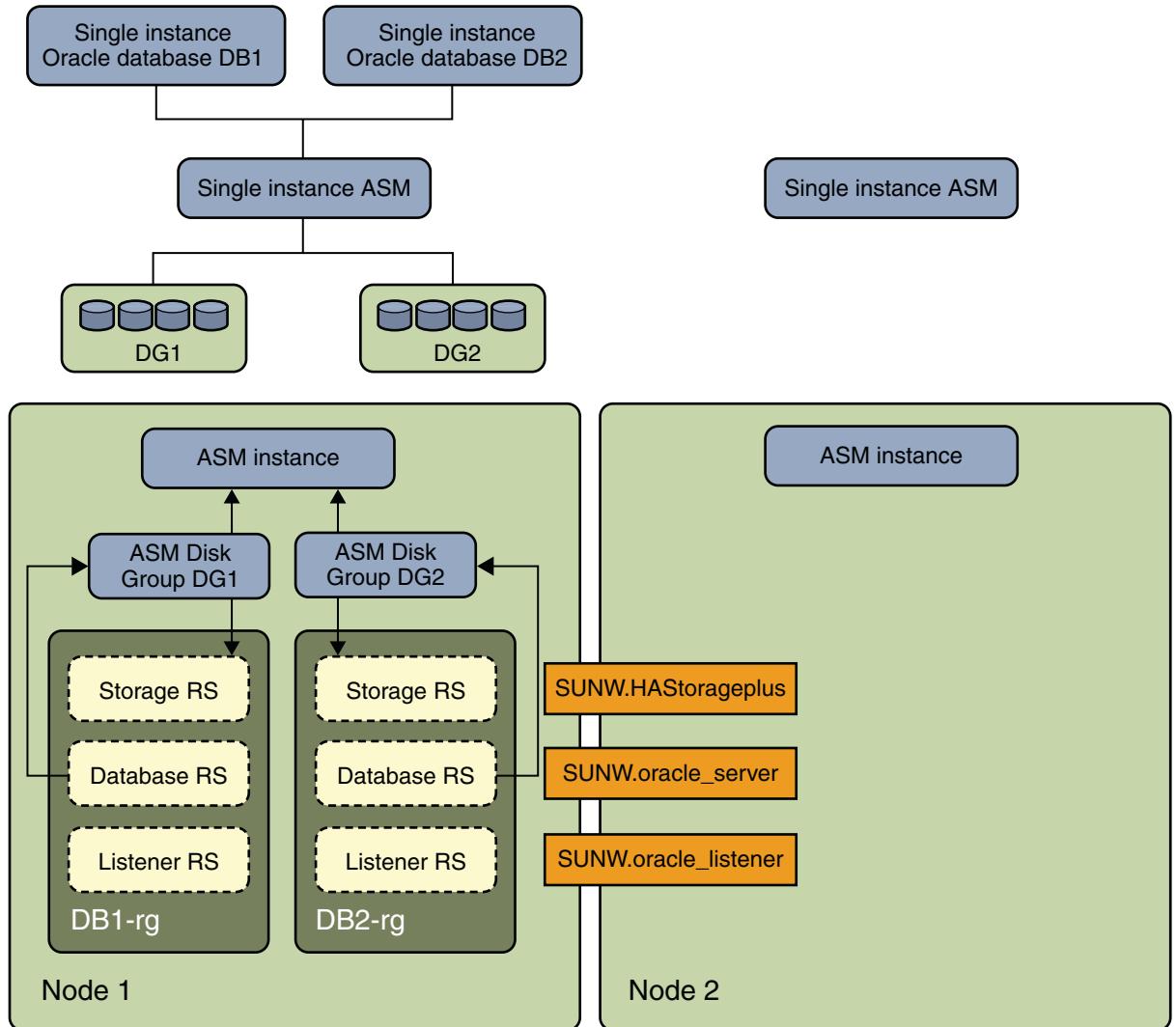
**Note** – Single instance Oracle ASM is not supported with Oracle 11g release 2 or 12c. For these releases, you must only use clustered Oracle ASM.

---

The following diagram represents a single instance Oracle ASM that serves two single instance Oracle databases DB1 and DB2 on a node Node1. The database DB1 exclusively uses an Oracle ASM disk group DG1 and the database DB2 exclusively uses an Oracle ASM disk group DG2. The upper part of the diagram shows the relationships that the Oracle database instances with the single instance Oracle ASM instances on Node1 and Node2. The single instance Oracle ASM manages two Oracle ASM disk groups DG1 and DG2 on Node1. The lower part of the diagram represents the existing Oracle Solaris Cluster resource group and resources for single instance Oracle databases and their functional requirements for single instance Oracle ASM services.

In the diagram the dotted boxes represent existing HA for Oracle resources with new Oracle ASM services. Inside the nodes, new dependencies between HA for Oracle resources and single instance Oracle ASM services are represented using arrows.

FIGURE C-2 Single Instance Oracle ASM with Separate Disk Groups [1]

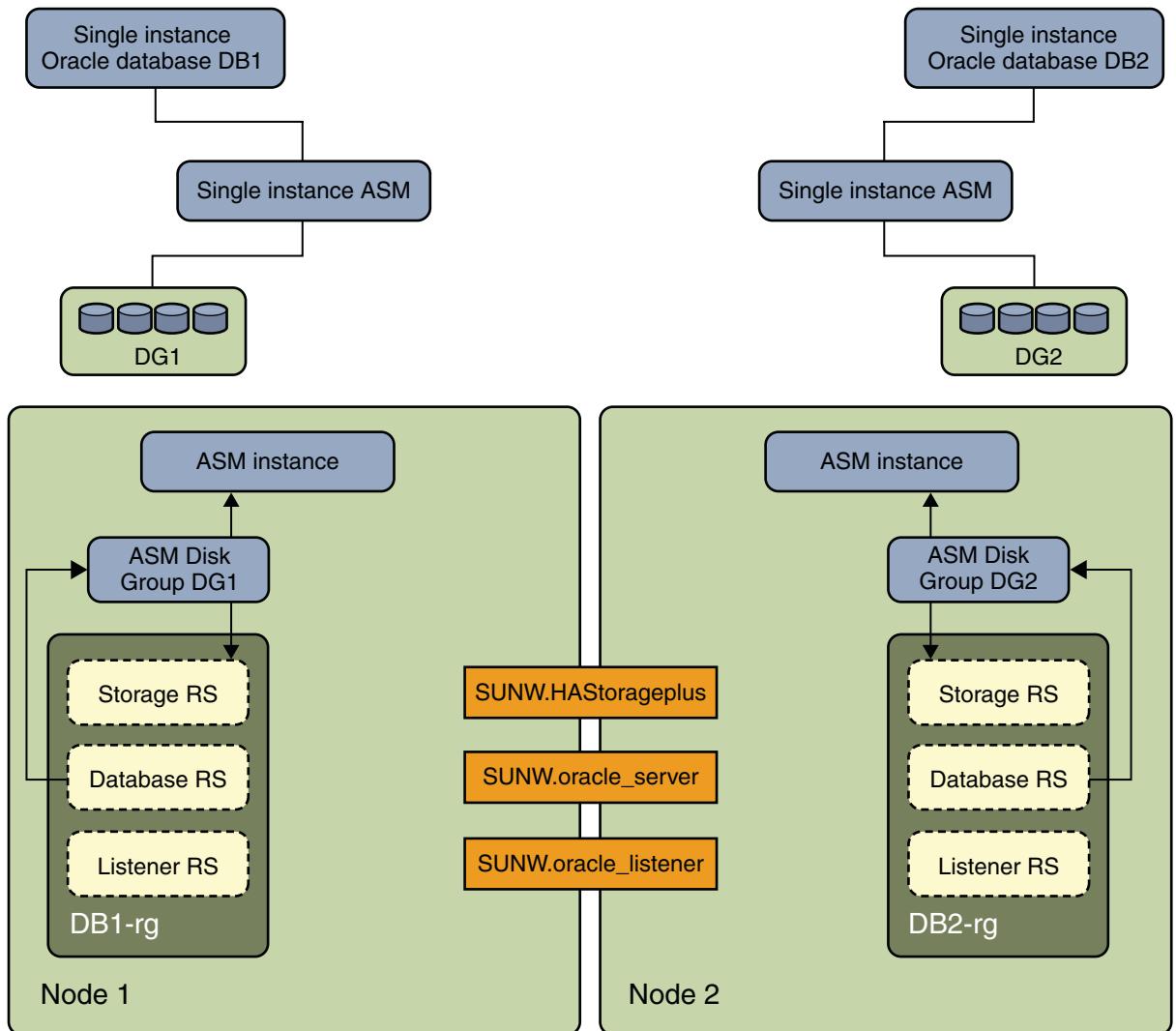


The following diagram is a continuation of the previous diagram in this section. In this diagram, the single instance Oracle database DB2 that exclusively uses Oracle ASM disk group DG2 is running on Node2 after a failover of resource group DB2-rg to Node2. The upper part of

the diagram shows the relationships of the Oracle database instances with the single Oracle ASM instances on Node1 and Node2. The Oracle ASM disk group DG2 is now served from the single instance Oracle ASM on Node2 while Oracle ASM disk group DG1 is served by the single instance Oracle ASM on Node1.

The lower part of the diagram represents the existing Oracle Solaris Cluster resource groups and resources for single instance Oracle databases and their requirement for single instance Oracle ASM services.

FIGURE C-3 Single Instance Oracle ASM with Separate Disk Groups [2]



## Clustered Oracle ASM with Clustered Disk Groups

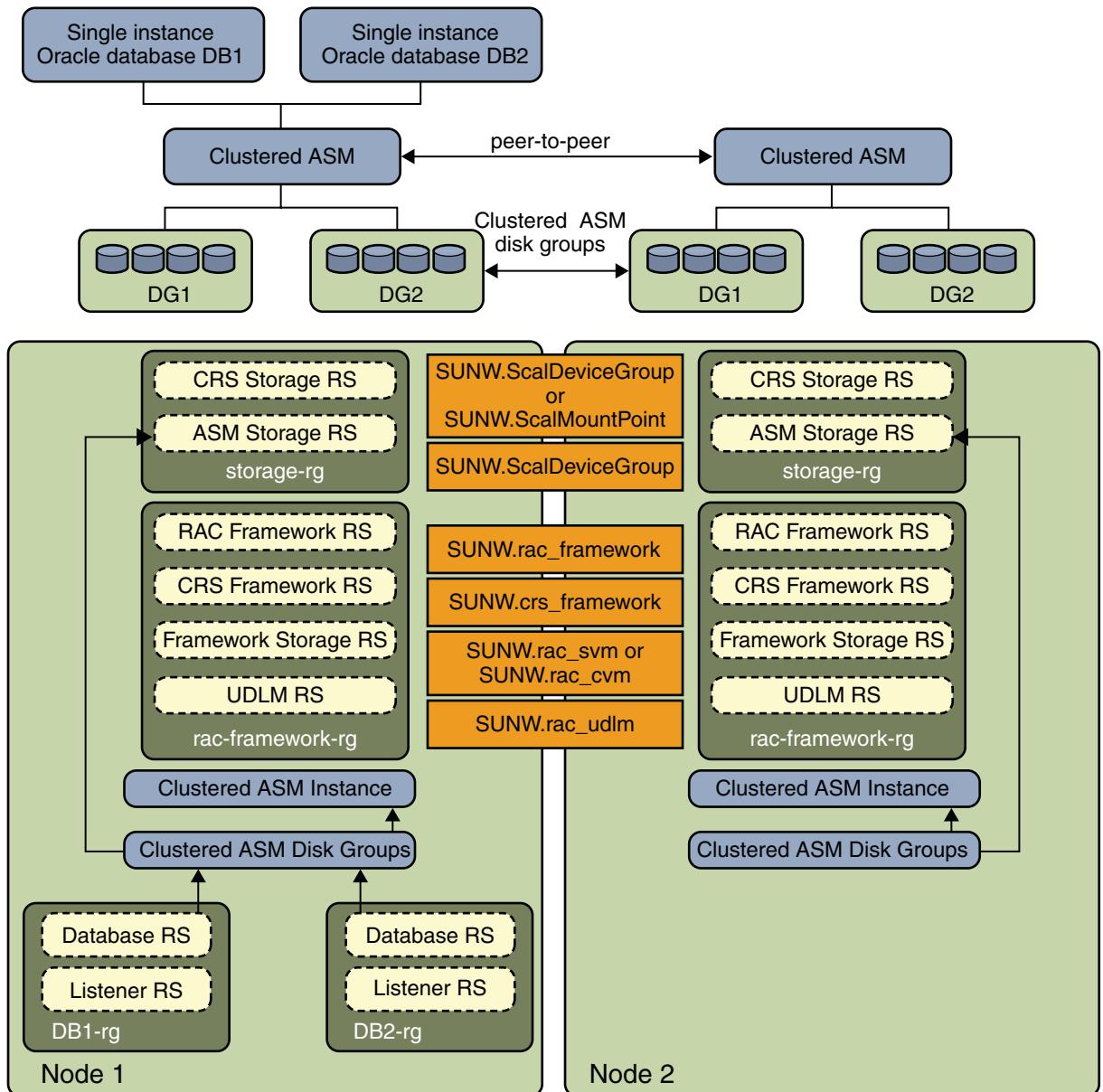
This section contains sample configurations of single instance Oracle databases with clustered Oracle ASM instances and clustered Oracle ASM disk groups. There are two diagrams and the second diagram is a continuation of the first diagram.

The following diagram represents clustered Oracle ASM instances that serve two single instance Oracle databases, DB1 and DB2 on Node1. The databases DB1 or DB2 can use either one of

the Oracle ASM disk groups DG1 and DG2 or both the disk groups as these are clustered Oracle ASM disk groups. The upper part of the diagram shows the relationships of the Oracle database instances with the clustered Oracle ASM instances on Node1 and Node2. The clustered Oracle ASM instances manage two Oracle ASM disk groups on both nodes at the same time. The lower part of the diagram represents the existing Oracle Solaris Cluster resource group and resources for single instance Oracle databases and their requirement for clustered Oracle ASM services.

The dotted box represents existing HA for Oracle resources with the new Oracle ASM resources. The arrows represent new dependencies between HA for Oracle and clustered Oracle ASM services.

FIGURE C-4 Clustered Oracle ASM with Clustered Disk Groups [1]



In the following diagram, a single instance Oracle database DB2 that shares Oracle ASM disk groups DG1 and DG2 is now running on Node2 after a failover of resource groups DB2- rg to Node2. The upper part of the diagram shows the relationships of the Oracle database instances with the clustered Oracle ASM instances on Node1 and Node2. The clustered Oracle ASM

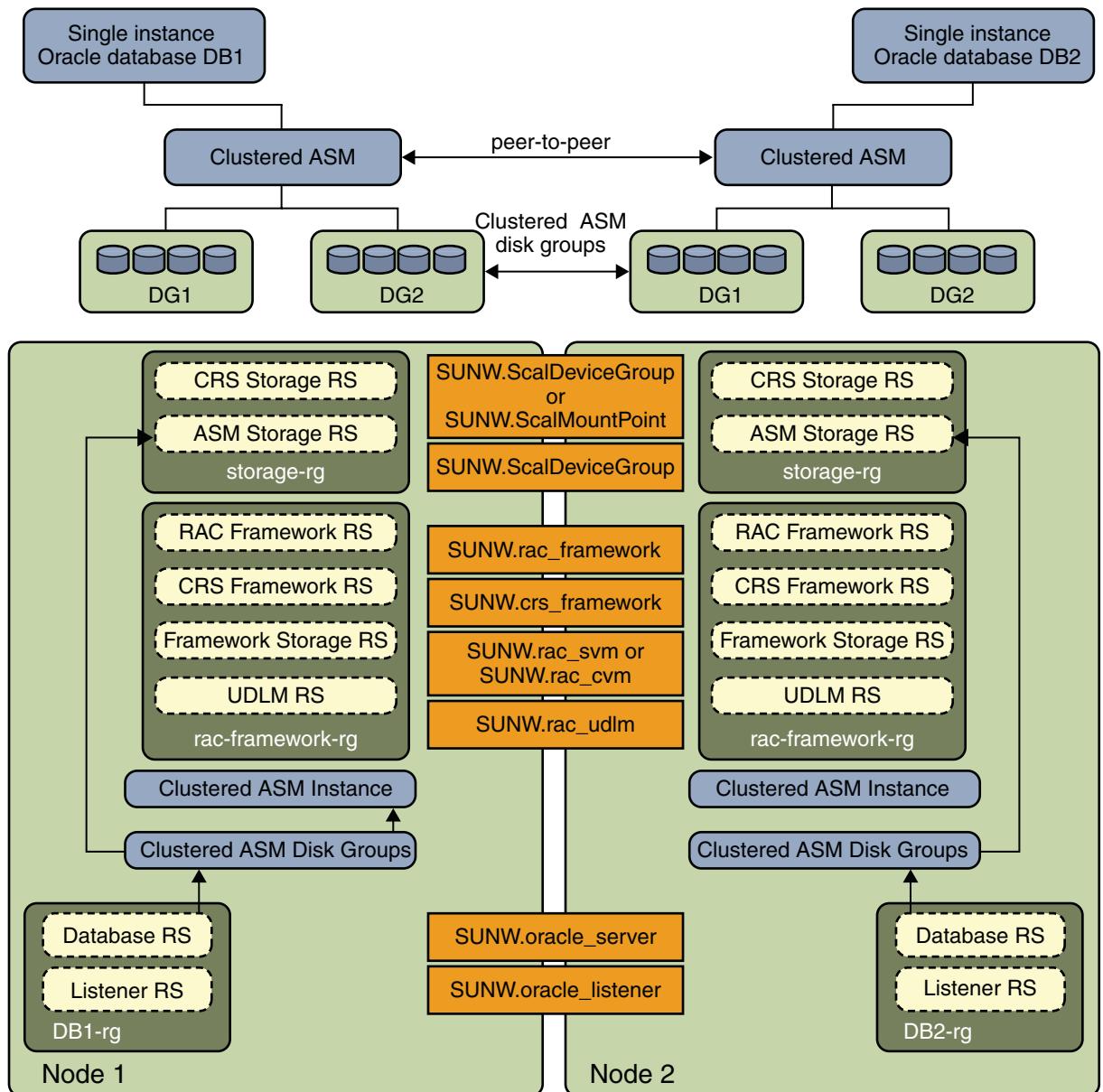
instances manage two Oracle ASM disk groups on both nodes at the same time. The lower part of the diagram represents the existing Oracle Solaris Cluster resource group and resources for single instance Oracle databases and their requirement for clustered Oracle ASM services.

---

**Note** – If the storage type is hardware RAID, the resource types `SUNW.ScaleDeviceGroup`, `SUNW.rac_svm` and `SUNW.rac_cvm` are not required.

---

FIGURE C-5 Clustered Oracle ASM with Clustered Disk Groups [2]



# Single Instance Oracle ASM with Separate Disk Groups in a Non-Global Zone

This section provides information on the dependency requirements for single instance Oracle ASM with single instance Oracle databases and single instance Oracle ASM disk groups in non-global zones. There are two diagrams, where the second diagram is a continuation of the first diagram.

---

**Note** – Single instance Oracle ASM is not supported with Oracle 11g release 2 or 12c. For these releases, you must only use clustered Oracle ASM.

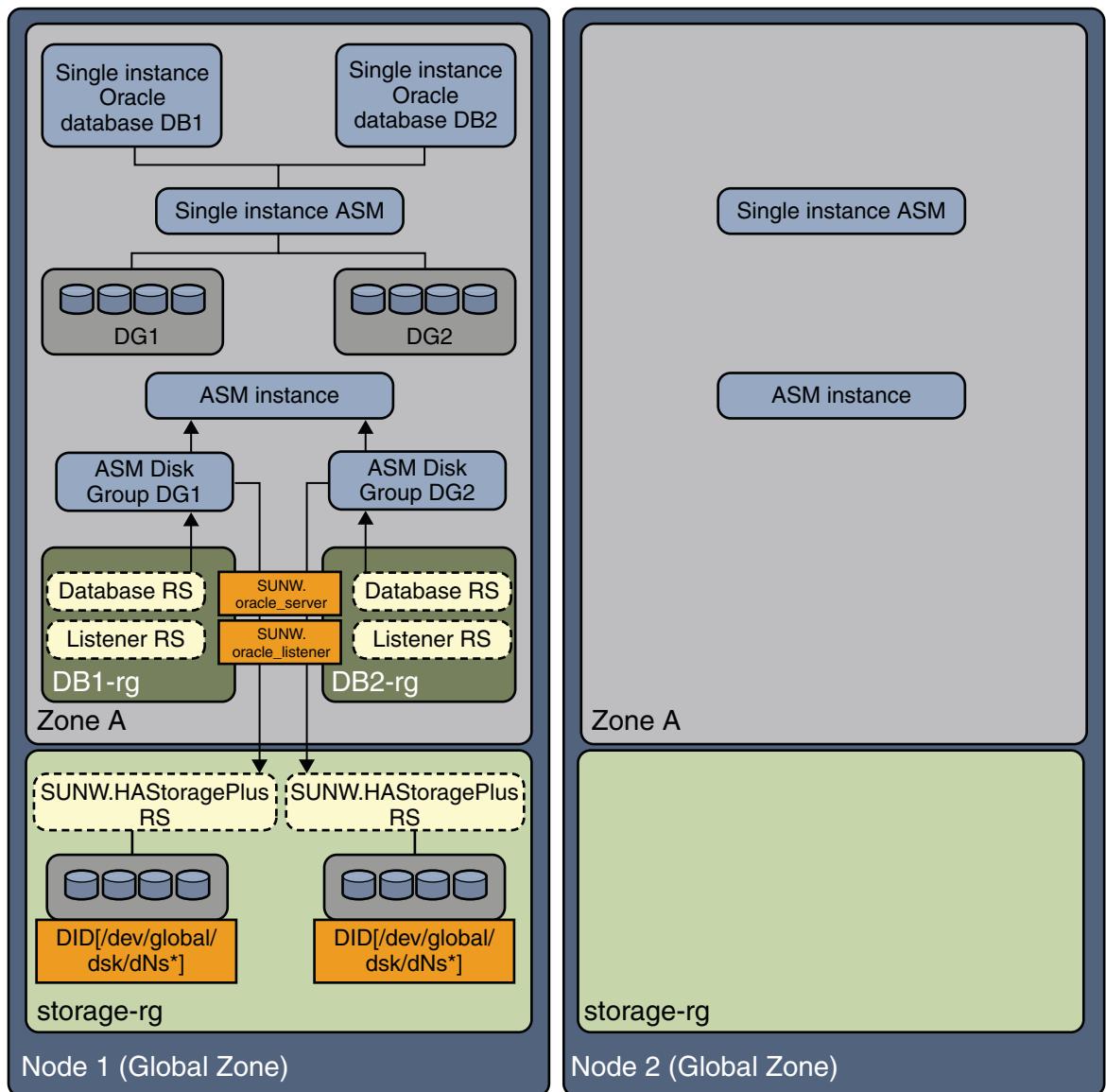
---

The following diagram represents a single instance Oracle ASM that serves two single instance Oracle databases DB1 and DB2 running within a non-global zone ZoneA on Node1. The database DB1 exclusively uses Oracle ASM disk group DG1 and database DB2 exclusively uses Oracle ASM disk group DG2.

The upper part of the diagram shows the relationships of the Oracle database instances with the clustered Oracle ASM instances on Node1 and Node2. The single instance Oracle ASM manages two disk groups DG1 and DG2 on Node1. The lower part of the diagram represents the existing Oracle Solaris Cluster resource groups and resources to independently failover DB1, DG1 or DB2, DG2 to ZoneA on Node2.

In the diagram the dotted boxes represent existing HA for Oracle resources with new Oracle ASM resources. Inside the nodes, new dependencies between HA for Oracle resources and single instance Oracle ASM resources are represented using arrows.

FIGURE C-6 Single Instance Oracle ASM with Separate Disk Groups in a Non-Global Zone [1]

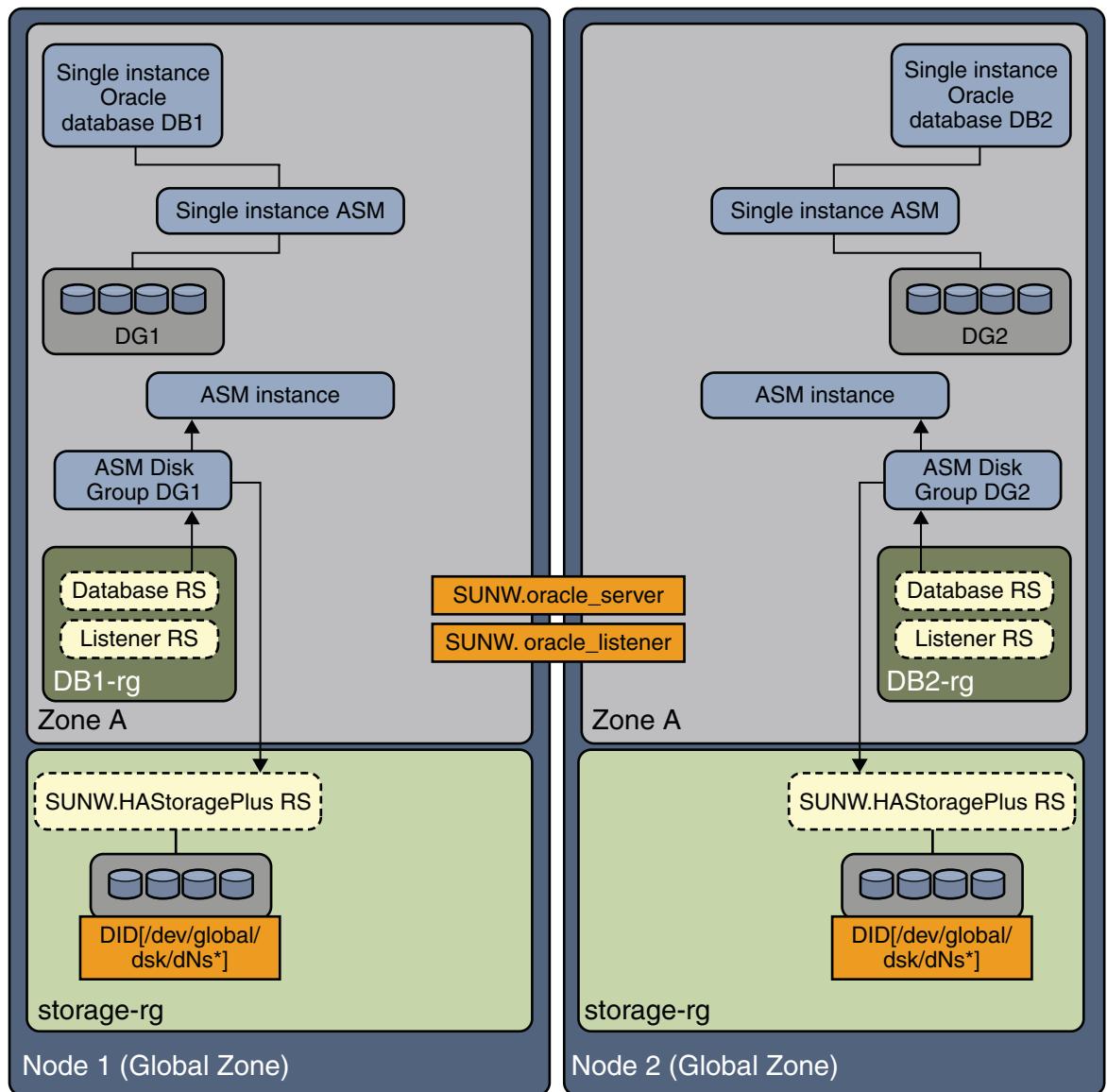


The following diagram is a continuation of the previous diagram. In this diagram, the single instance Oracle database DB2 that exclusively uses Oracle ASM disk group DG2 is running on Node2 after a failover of resource group DB2-rg to Node2. The upper part of the diagram within the non-global zone shows the relationships of the Oracle database instances with the single instance Oracle ASM instances on Node1 and Node2. The Oracle ASM disk group DG2 is now

served from the single instance Oracle ASM in ZoneA on Node2 while Oracle ASM disk group DG1 is served by the single instance Oracle ASM in ZoneA on Node1.

The lower part of the diagram represents the existing Oracle Solaris Cluster resource groups and resources to independently failover DB1, DG1 or DB2, DG2 to ZoneA on Node2.

FIGURE C-7 Single Instance Oracle ASM with Separate Disk Groups in a Non-Global Zone [2]





# Index

---

## A

action file, *See* custom action file  
ACTION keyword, 72  
actions  
  listener fault monitor, 68–69  
  preset for fault monitor, 91–98  
  server fault monitor  
    definition, 67–68  
    modifying, 72  
adding, messages to log files, 73  
Alert\_log\_file extension property, 85  
alert logs  
  modifying response to errors, 75–76  
  use of by fault monitor, 68  
Auto\_End\_Bkp extension property, 85

## C

caution notice, server fault monitor customizations, 70  
changing, *See* modifying  
configuring  
  HA for Oracle  
    performing, 36–63  
    planning, 16–19  
  Oracle database  
    using Oracle ASM, 23–24  
    using Solaris Volume Manager, 22  
Oracle Grid Infrastructure with clustered Oracle  
  ASM, 54–63  
requirements, 16–18  
SCAN listener, 24–25

Connect\_cycle extension property, 86  
Connect\_string extension property, 86  
CONNECTION\_STATE keyword, 72  
core files, fault monitors, 69  
custom action file  
  format, 70–73  
  maximum number of entries in, 70  
  order of entries in, 75  
  propagating to cluster nodes, 78  
  specifying, 78–79  
  validating, 79  
Custom\_action\_file extension property, 86  
customizing, server fault monitor, 69–79

## D

database instance, 46  
database management system (DBMS)  
  errors  
    modifying response to, 73–75  
    preset actions, 91–98  
  timeouts, 69  
database-related files, configuration requirements, 17  
databases, Oracle, 29–30  
Dataguard\_role extension property, 46  
Db\_unique\_name extension property, server, 87  
DBMS (database management system)  
  errors  
    modifying response to, 73–75  
    preset actions, 91–98  
  timeouts, 69

`Debug_level` extension property, server, 87

## E

editing

- listener resource type instances, 81
- server resource type instances, 82

`ERROR` keyword, 71

`ERROR_TYPE` keyword, 71

errors

- in custom action file, 79
- DBMS
  - modifying response to, 73–75
  - preset actions for, 91–98
- ignoring, 74–75
- responding to, 73–74
- SGA, 73
- timeouts
  - core-file creation, 69
  - modifying maximum allowed, 76–78
- types detected by fault monitor, 70

extension properties

- `SUNW.oracle_listener` resource type, 89–90
- `SUNW.oracle_server` resource type, 85–89

## F

fault monitors

  actions

- listener fault monitor, 68–69
- modifying, 72
- server fault monitor, 67–68
- alert logs, 68
- caution notice, 70
- core-file creation, 69
- customizing, 69–79
- error types detected by, 70
- Oracle listener
  - resource type for, 65
- Oracle server
  - resource type for, 65
- preset actions, 91–98
- tuning, 65–69

files

- alert log
  - modifying response to errors in, 75–76
  - use of by fault monitor, 68

core

  fault monitors, 69

custom action

- format, 70–73
- order of entries in, 75
- propagating to cluster nodes, 78
- specifying, 78–79
- validating, 79

database, 17

HA for Oracle logs

- additional messages in, 73
- location, 65

Oracle Database application, 17

RTR

- listener, 80
- server, 81

fragmentation, of memory, 73

## G

global zone, 34

## H

HA for Oracle

*See also* Oracle

configuration

- clustered Oracle ASM, 54–63
- performing, 36–63
- planning, 16–19
- single instance Oracle ASM, 50–54

fault monitors, 65–69

installing, 34–36

- overview of process, 14–16
- planning, 16–19

log files

- additional messages in, 73
- location, 65
- registering, 36–63

**H**  
**HA for Oracle (Continued)**

- software packages, installing, 34–36
  - SUNW.HAStoragePlus** resource type, 44
  - upgrading, 79–82
  - verifying installation, 63–64
- HA for Solaris Containers, restriction, 17
- heap memory, 74
- help, 12
- hot backup mode, 86

**I**

- ignoring, minor errors, 74–75
- installing
- HA for Oracle, 34–36
  - planning, 16–19
  - Oracle ASM software, 25–26
  - Oracle Database software, 23
- insufficient memory errors, 73, 74

**K**

- keywords, custom action file, 71

**L**

- limitpriv** property
- zone clusters, 22
  - zones, 21
- listener, extension properties, 89–90
- listener fault monitor, 68–69
- LISTENER\_NAME** extension property, 89
- local zones, *See* non-global zone
- log files
- HA for Oracle
    - additional messages in, 73
    - location, 65
- logged alerts
- modifying response to, 75–76
  - use of by fault monitor, 68

**M**

- maximum values
- entries in custom action file, 70
  - number of allowed timeouts, 76–78
- memory
- shortage of, 73, 74
- MESSAGE** keyword, 73
- migrating
- listener resource type instances, 81
  - server resource type instances, 82
- modifying
- number of allowed timeouts, 76–78
  - Oracle Data Guard instance role, 83
  - response to DBMS errors, 73–75
  - response to logged alerts, 75–76
  - server fault monitor actions, 72

**N**

- NEW\_STATE** keyword, 72
- non-global zone, 34

**O**

- Oracle
- clients, 64–65
  - database
    - configuring using Oracle ASM, 23–24
    - configuring using Solaris Volume Manager, 22
    - creating, 30
    - setting permissions, 31–34
  - error numbers, 91–98
  - preparing nodes for installation of, 19–22
- Oracle ASM
- clustered configuration with Oracle Grid Infrastructure, 54–63
  - configuration requirements, 17
  - installing, 25–26
- Oracle Data Guard, 29–30
- Dataguard\_role** extension property, 46
  - modifying instance role, 83
  - standby database modes, 46

Oracle Database  
application files, 17  
installing, 23  
verifying installation, 29  
Oracle Grid Infrastructure, configuring with clustered Oracle ASM, 54–63  
`ORACLE_HOME` extension property  
  listener, 89  
  server, 87  
`oracle_listener` resource type, extension properties, 89–90  
`oracle_server` resource type, extension properties, 85–89  
`ORACLE_SID` extension property, 88  
order, entries in custom action file, 75  
overriding, server fault monitor presets, 69–79

## P

packages, 34–36  
`Parameter_file` extension property, 88  
planning, HA for Oracle configuration, 16–19  
preset actions, fault monitor, 91–98  
preventing  
  unnecessary restarts  
    for DBMS errors, 74–75  
    for timeouts, 76–78  
primary database instances, 29–30  
`Probe_timeout` extension property  
  listener, 90  
  server, 88

## R

registering  
  HA for Oracle  
    generally, 36–63  
    clustered Oracle ASM, 54–63  
    single instance Oracle ASM, 50–54  
requirements, configuration, 16–18  
resource type registration (RTR) file  
  listener, 80  
  server, 81

resource types  
  fault monitors, 65  
  migrating instances of  
    listener, 81  
    server, 82  
  `SUNW.oracle_listener`  
    extension properties, 89–90  
  `SUNW.oracle_server`  
    extension properties, 85–89  
responding, to major errors, 73–74  
`Restart_type` extension property, 88  
restarts  
  preventing  
    for DBMS errors, 74–75  
    for timeouts, 76–78  
restrictions  
  HA for Solaris Containers, 17  
  raw devices in zones, 17  
  single instance Oracle ASM, 14  
  zones, 34  
RTR (resource type registration) file  
  listener, 80  
  server, 81

## S

SCAN listener  
  configuring, 24–25  
  omitting `SUNW.oracle_listener` resource type, 43  
server, extension properties, 85–89  
server fault monitor  
  actions  
    definition, 67–68  
    modifying, 72  
  alert logs, 68  
  caution notice, 70  
  customizing, 69–79  
  error types detected by, 70  
  overview, 66–68  
  preset actions, 91–98  
sessions  
  effect of errors on, 73, 74  
SGA (shared global area), errors, 73  
shared global area (SGA), errors, 73

software packages, 34–36  
sqlplus command, 30  
standby database instances, 29–30, 46  
`Standby_mode` extension property, 46, 88  
`SUNW.HAStoragePlus` resource type, 44  
`SUNW.oracle_listener` resource type  
    extension properties, 89–90  
    omitting for SCAN listener, 43  
`SUNW.oracle_server` resource type, extension  
    properties, 85–89  
syntax errors, custom action file, 79  
system properties, effect on fault monitors, 65

**Z**

zone clusters  
    `limitpriv` property, 22  
    time synchronization, 22  
zones, 34  
    `limitpriv` property, 21

**T**

technical support, 12  
time synchronization, zone clusters, 22  
timeouts  
    core-file creation, 69  
    modifying maximum allowed, 76–78  
tuning, fault monitors, 65–69

**U**

upgrading, HA for Oracle, 79–82  
`User_env` extension property  
    listener, 90  
    server, 89

**V**

validating, custom action file, 79  
verifying  
    HA for Oracle installation, 63–64  
    Oracle Database installation, 29

**W**

`Wait_for_online` extension property, 89

