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Preface

Oracle Solaris Cluster Data Service for SAP NetWeaver 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-mananger 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>
<thead>
<tr>
<th>Typeface</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>AaBbCc123</td>
<td>The names of commands, files, and directories, and onscreen computer output</td>
<td>Edit your .login file. Use ls -a to list all files. machine_name% you have mail.</td>
</tr>
<tr>
<td>AaBbCc123</td>
<td>What you type, contrasted with onscreen computer output</td>
<td>machine_name% su</td>
</tr>
<tr>
<td>aabbcc123</td>
<td>Placeholder: replace with a real name or value</td>
<td>Password:</td>
</tr>
<tr>
<td>AaBbCc123</td>
<td>Book titles, new terms, and terms to be emphasized</td>
<td>The command to remove a file is rm filename.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note: Some emphasized items appear bold online.</td>
</tr>
</tbody>
</table>

Shell Prompts in Command Examples

The following table shows UNIX system prompts and superuser prompts for shells that are included in the Oracle Solaris OS. In command examples, the shell prompt indicates whether the command should be executed by a regular user or a user with privileges.

<table>
<thead>
<tr>
<th>Shell</th>
<th>Prompt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bash shell, Korn shell, and Bourne shell</td>
<td>$</td>
</tr>
<tr>
<td>Bash shell, Korn shell, and Bourne shell for superuser</td>
<td>#</td>
</tr>
<tr>
<td>C shell</td>
<td>machine_name%</td>
</tr>
<tr>
<td>C shell for superuser</td>
<td>machine_name#</td>
</tr>
</tbody>
</table>


## 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).

<table>
<thead>
<tr>
<th>Topic</th>
<th>Documentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concepts</td>
<td>Oracle Solaris Cluster Concepts Guide</td>
</tr>
<tr>
<td>Hardware installation and administration</td>
<td>Oracle Solaris Cluster 3.3 3/13 Hardware Administration Manual and individual hardware administration guides</td>
</tr>
<tr>
<td>Software installation</td>
<td>Oracle Solaris Cluster Software Installation Guide</td>
</tr>
<tr>
<td>Data service installation and administration</td>
<td>Oracle Solaris Cluster Data Services Planning and Administration Guide and individual data service guides</td>
</tr>
<tr>
<td>Data service development</td>
<td>Oracle Solaris Cluster Data Services Developer's Guide</td>
</tr>
<tr>
<td>System administration</td>
<td>Oracle Solaris Cluster System Administration Guide</td>
</tr>
<tr>
<td></td>
<td>Oracle Solaris Cluster Quick Reference</td>
</tr>
<tr>
<td>Software upgrade</td>
<td>Oracle Solaris Cluster Upgrade Guide</td>
</tr>
<tr>
<td>Error messages</td>
<td>Oracle Solaris Cluster Error Messages Guide</td>
</tr>
<tr>
<td>Command and function references</td>
<td>Oracle Solaris Cluster Reference Manual</td>
</tr>
<tr>
<td></td>
<td>Oracle Solaris Cluster Data Services Reference Manual</td>
</tr>
</tbody>
</table>

## Access to Oracle Support


## 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.

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

Also have available the contents of the /var/adm/messages file.
Installing and Configuring HA for SAP NetWeaver

This chapter explains how to install and configure HA for SAP NetWeaver.

Note – You can install and configure this data service to run in the non-global zone. HA for SAP NetWeaver is supported in non-global zones.

This chapter contains the following sections.
- “HA for SAP NetWeaver Overview” on page 9
- “Overview of the Installation and Configuration Process for HA for SAP NetWeaver” on page 11
- “Planning the HA for SAP NetWeaver Installation and Configuration” on page 12
- “Installing and Configuring SAP NetWeaver” on page 17
- “Verifying the SAP NetWeaver Installation and Configuration” on page 22
- “Configuring Your Highly Available Database” on page 23
- “Preparing SAP NetWeaver for High Availability” on page 23
- “Registering and Configuring HA for SAP NetWeaver” on page 24
- “Using Alternate Project Identification” on page 35
- “Tuning the HA for SAP NetWeaver Fault Monitors” on page 35
- “Verifying the HA for SAP NetWeaver Installation and Configuration” on page 41
- “Enabling Interaction Between Oracle Solaris Cluster and SAP NetWeaver” on page 45

HA for SAP NetWeaver Overview

The SAP NetWeaver platform consists of the following components:
- SAP central services, which include these servers:
  - SAP enqueue server
  - SAP message server
  - SAP gateway server
- SAP replicated enqueue server
- SAP primary application instance
- SAP additional dialogue instance

Each component can be treated as a specific instance. Each instance has its own controlling process named sapstartsrv.

The SAP NetWeaver platform can be deployed as an ABAP, a JAVA, or a dual stack. In the dual stack, the primary application instance and the dialogue instance combine the ABAP and the JAVA processes in one instance. The central services and the replicated enqueue server implement either the ABAP or the JAVA deployment only.

**Caution** – For a detailed description of the SAP NetWeaver platform in the High Availability environment, see the SAP documentation at [http://service.sap.com/ha](http://service.sap.com/ha). In particular, study the section that provides an overview of the architecture of the SAP NetWeaver to be certain that you understand the basic concepts of your version of the SAP NetWeaver.

To eliminate potential single points of failure in an SAP NetWeaver platform, HA for SAP NetWeaver provides fault monitoring, automatic restart, and automatic failover for the components of the SAP NetWeaver platform.

The primary and additional dialogue instances can be configured as multiple master or failover deployments. All other instances must be failover deployments.

Each component of the SAP NetWeaver platform has a data service that protects the component in an Oracle Solaris Cluster configuration, as described in the following table.

**TABLE 1–1** Protection of SAP NetWeaver Components by Oracle Solaris Cluster Data Services

<table>
<thead>
<tr>
<th>SAP NetWeaver Component</th>
<th>Data Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAP sapstartsrv process</td>
<td>Resource type for the SAP sapstartsrv process. The resource type is ORCL.sapstartsrv.</td>
</tr>
<tr>
<td>SAP central services</td>
<td>Resource type for SAP central services in HA for SAP NetWeaver. The resource type is ORCL.sapcentr.</td>
</tr>
<tr>
<td>SAP replicated enqueue server</td>
<td>Resource type for SAP replicated enqueue server in HA for SAP NetWeaver. The resource type is ORCL.saprepenq.</td>
</tr>
<tr>
<td>SAP primary instance and SAP additional dialogue instance</td>
<td>Resource type for SAP primary instance and SAP additional dialogue instance in HA for SAP NetWeaver. The resource type is ORCL.sapdia.</td>
</tr>
</tbody>
</table>
### Overview of the Installation and Configuration Process for HA for SAP NetWeaver

The following table summarizes the tasks for installing and configuring HA for SAP NetWeaver and provides cross-references to detailed instructions for performing these tasks. Perform the tasks in the order that they are listed in the table.

#### TABLE 1–2  Tasks for Installing and Configuring HA for SAP NetWeaver

<table>
<thead>
<tr>
<th>Task</th>
<th>For Instructions, Go To …</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan the SAP NetWeaver installation</td>
<td>Your SAP documentation</td>
</tr>
<tr>
<td></td>
<td><em>Oracle Solaris Cluster Data Services Planning and Administration Guide</em></td>
</tr>
<tr>
<td></td>
<td>“Planning the HA for SAP NetWeaver Installation and Configuration” on page 12</td>
</tr>
<tr>
<td>Install SAP NetWeaver and configure the application to run in a cluster</td>
<td>“Installing and Configuring SAP NetWeaver” on page 17</td>
</tr>
<tr>
<td>Verify the SAP NetWeaver installation and configuration</td>
<td>“Verifying the SAP NetWeaver Installation and Configuration” on page 22</td>
</tr>
<tr>
<td>Register and configure the HA for SAP NetWeaver data service</td>
<td>“Registering and Configuring HA for SAP NetWeaver” on page 24</td>
</tr>
<tr>
<td>(Optional) Use alternate project identifier (ID)</td>
<td>“Using Alternate Project Identification” on page 35</td>
</tr>
<tr>
<td>(Optional) Tune the HA for SAP NetWeaver fault monitors</td>
<td>“Tuning the HA for SAP NetWeaver Fault Monitors” on page 35</td>
</tr>
</tbody>
</table>
### Planning the HA for SAP NetWeaver Installation and Configuration

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

**Note** – Before you begin, consult your SAP documentation for configuration restrictions and requirements that are not stated in Oracle Solaris Cluster documentation or imposed by Oracle Solaris Cluster software.

Be sure to read all SAP notes that pertain to your release of SAP NetWeaver. For more information, see the SAP documentation at [http://service.sap.com/ha](http://service.sap.com/ha).

**Note** – HA for SAP NetWeaver can be configured to run in a whole root, non-global zone, or zone cluster, if required.

### Configuration Restrictions

**Caution** – Your data service configuration might not be supported if you do not observe these restrictions.

For restrictions that apply to all data services, see the release notes for your release of Oracle Solaris Cluster. The following configuration restriction applies only to HA for SAP NetWeaver.

- The maximum length of the node names depends on the SAP release. Refer to the SAP installation guide for your release of SAP. This limitation is an SAP software restriction.

- Configure the database resource to be in a different resource group from the SAP central services resource, if possible.

  However, if you are using Oracle as the database, and if you must configure Oracle in the same resource group as the SAP central services resource, you must ensure that the value of the `restart_type` extension property for Oracle Solaris Cluster HA for Oracle is set to `RESOURCE_RESTART`. This property setting means that if the response to a fault in the Oracle...
database is to restart the Oracle resource, only the Oracle database is restarted. If this property is set to RESOURCE_GROUP_RESTART, and if the response to a fault in the Oracle database is to restart the Oracle resource, all the resources in the resource group are restarted. However, if the SAP replicated enqueue server is configured and online on another node, the SAP central services must not be restarted locally. Therefore, the restart_type property must be set to RESOURCE_RESTART.

Configuration Requirements

Caution – Configuration requirements represent actions that you must perform. If your data service configuration does not satisfy these requirements, the data service configuration might not be supported.

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.

The following configuration requirements apply only to HA for SAP NetWeaver.

- The fault monitor probe for the resource type require the sapcontrol program. You must download this binary from http://service.sap.com. The download is necessary, if your SAP version does not contain the binary at all. Refer to the relevant SAP note for information about obtaining and using the sapcontrol program.
- If you configure the SAP NetWeaver ABAP stack and the SAP NetWeaver JAVA stack as two separate stacks in the same cluster, you must not mix the JAVA and the ABAP resources within one resource group.
- If you configure the SAP NetWeaver ABAP stack and the SAP NetWeaver JAVA stack as a dual stack, you must put the central services and the corresponding replicated enqueue servers within the same resource groups.

Application Operation Restrictions

Caution – Your application might experience unplanned downtimes if you do not follow the restrictions noted in this section.

- Once a sapstartsrv process is under the control of the cluster, the application operator can only use the RestartService function of the sapcontrol command to manage the sapstartsrv process. Other functions such as StartService and StopService might lead to unplanned application downtime.
Unless you enable the Oracle Solaris Cluster and SAP NetWeaver management integration, starting or stopping an instance manually leads to unplanned instance downtime. Once the management integration is enabled, the application administrator can safely stop and start instances with SAP methods as long as the sapstartsrv service is under the control of the cluster.

Application Operation Requirement

The following application operation requirement applies only to HA for SAP NetWeaver.

- Once you start the sapstartsrv service manually with either the startsap or sapcontrol command, you must stop it before you enable the sapstartsrv resource.

Supported Data Service Configurations

HA for SAP NetWeaver supports configurations that conform to the requirements that are specified in the previous section.

All configurations of HA for SAP NetWeaver have the following requirements:

- The SAP central service is configured as a failover resource.
- The SAP replicated enqueue server is configured as a failover resource.
- The SAP dialogue instances which are primary application instances or additional application instances can be configured either as a failover resource or as a multiple master data service resource.
- Each SAP instance resource must be dependent on a SAP sapstartsrv resource.
- Do not configure central service resources and replicated enqueue resources in the same resource group.
- The SAP replicated enqueue server resource is configured to depend on the SAP central service resource. This dependency ensures that the SAP replicated enqueue server does not attempt to start until the SAP central service is online.
- The SAP central services resource group is configured to have weak positive affinity with the SAP replicated enqueue server resource group. This affinity ensures that, if a hardware or software failure occurs on the node or zone that is mastering the SAP central services resource group, the SAP central services resource group fails over to the node or zone where the SAP replicated enqueue server resource group is currently running.
- If the SAP replicated enqueue server and the SAP central services are running on different instance numbers, you must configure the SAP replicated enqueue preemper resource in the SAP central services resource group. This is to ensure that if the SAP central services resource group fails over to the node running the SAP replicated enqueue server resource
group is off-loaded after the central services are online and the enqueue table is copied to the enqueue server process. This off-load happens once a node is available to host the replicated enqueue server resource group.

- If the SAP replicated enqueue server and the SAP central services are configured to have the same instance number, the SAP replicated enqueue server resource group is configured to have strong negative affinity with the SAP central services resource group. This affinity ensures that, if the SAP central services resource group fails over, the SAP replica server resource group is off-loaded from the node where it is currently running, before the SAP central services resource group is brought online on that same node. The SAP replica server resource group is started on another node, if one is available. This is due to the SAP restriction, that every instance running on one node must have a different instance number.

The following example shows the following supported configurations of HA for SAP NetWeaver.

- The SAP NetWeaver component is configured as a failover resource.
- The SAP NetWeaver component is configured as a multiple master resource.

**EXAMPLE 1–1  SAP NetWeaver Components Configured as a Failover Resources and Multiple Master Resources**

The following example shows a typical SAP NetWeaver HA configuration consisting of central services with enqueue replication in addition a failover primary application instance with multiple master additional dialogue instances.

The boxes that have a solid border represent the location of the resource groups before failover.

The boxes that have a dashed border represent the location of the resource groups after a failover because of a problem on the first node. The SAP central services resource group fails over, and the SAP replicated enqueue server resource group consequently moves to another node. The SAP NetWeaver primary application instance resource group also fails over. Two out of three additional application instances remain available.
Configuration Considerations

The following configuration considerations affect the installation and configuration of HA for SAP NetWeaver.

- The SAP enqueue server and SAP replica server run on different cluster nodes. Therefore, the SAP application files (binary files, configuration files, and parameter files) can be installed either on the global file system or on the local file system. However, the application files for each of these applications must be accessible at all times from the nodes on which these applications are running.

  See “Configuration Guidelines for Oracle Solaris Cluster Data Services” in Oracle Solaris Cluster Data Services Planning and Administration Guide. This section details the advantages and disadvantages of placing the SAP binaries on the local file system or on the cluster file system.

- The resource group for the SAP NetWeaver component can be configured to be a failover resource group or a multiple master resource group. If the SAP NetWeaver component is configured to be a multiple master resource group, the directory `/usr/sap/SAPSID/INSTANCE_NAME` must be local on each node where the SAP NetWeaver component is installed. Note that SAPSID represents the SAP system identification and INSTANCE_NAME represents the name of the SAP NetWeaver instance.

  For more information about the supported configurations, see “Supported Data Service Configurations” on page 14.

- During the installation and configuration process, track any system files that you change, because you need to copy those files to all the nodes that are to run the application.
Configuration Planning Questions

Use the questions in this section to plan the installation and configuration of HA for SAP NetWeaver.

- Will you run the SAP dialogue component of the application as a failover resource or as a multiple master resource?
- What is the logical hostname 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 SAP binaries on the local file system or on the cluster file system.

Installing and Configuring SAP NetWeaver

To enable HA for SAP NetWeaver to make SAP NetWeaver highly available, additional installation and configuration operations are required. These operations supplement the standard installation and standard configuration of the SAP NetWeaver.

The procedures in this section describe the installation and configuration of the following components of the SAP NetWeaver.

- SAP central services
- SAP replicated enqueue server
- SAP replicated enqueue preemper
- SAP sapstartsrv process
- SAP dialogue instance for one of the following engines:
  - ABAP
  - ABAP+J2EE
  - J2EE
  - ABAP single instance

How to Enable the SAP NetWeaver to Run in a Cluster

The following resource groups are created in this procedure.

- SAP central services resource group, to contain the following resources:
  - SAP replicated enqueue preemper
  - SAP central services
  - SAP sapstartsrv
Logical hostname

SAP replicated enqueue server resource group, to contain the following resources:
  - SAP replicated enqueue server
  - SAP sapstartsrv
  - Logical hostname

SAP primary application instance resource group, to contain the following resources:
  - SAP dialogue instance component
  - SAP sapstartsrv
  - Logical hostname for this resource. In the case of a primary application instance it is configured as a failover resource group. Additional dialogue instances can be configured as multiple master resource groups.

**Note** – If your deployment is ABAP single instance, you do not need the SAP central services resource group nor the SAP replicated enqueue server resource group.

---

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

2. **Create the resource group for your storage topology.**
   The SAP NetWeaver requires shared storage so you must make your storage highly available. For example, you can create a resource group containing the `HAStoragePlus` resource managing the global file systems.

   ```
   # cresourcegroup create -S storage-rg
   storage-rg
   ```

   Specifies the name of the resource group to be created. Choose a unique name for each resource group within the cluster.

3. **Register the SUNW.HAStoragePlus resource type.**

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

4. **Create your storage resource.**

   ```
   # cresource create -g storage-rg -t SUNW.HAStoragePlus -p filesystemmountpoints=mountpoint-list hsp-rs
   ```

   -g `storage-rg`
     Specifies that the resource is to be added to the SAP storage resource group.

   -t `SUNW.HAStoragePlus`
     Specifies that the resource is an instance of the `SUNW.HAStoragePlus` resource type.
-p filesystemmountpoints=mountpoint-list
   Specifies a list of valid mount points for the file system. For more information, see the
   SUNW.HAStoragePlus(5) man page.

hsp-rs
   Specifies the name of the resource that you are creating.

The resource is created in the enabled state.

# clresourcegroup online -M storage-rg

5 Create a resource group for the SAP central services.

The SAP central services resource group is a failover resource group to contain the SAP
enqueue server resource, the SAP message server resource, and the logical hostname for these
resources.

# clresourcegroup create central-rg

central-rg
   Specifies the name of the resource group to be created. Choose a unique name for each
   resource group within the cluster.

6 Add a logical hostname resource to the resource group that you created in Step 5.

# clreslogicalhostname create -g central-rg central-logical-hostname

-g central-rg
   Specifies that the logical hostname resource is to be added to the resource group named
   central-rg that you created in Step 5.

central-logical-hostname
   Specifies that the logical hostname of the SAP central services resource is
   central-logical-hostname.

Note – If you require a fully qualified hostname, you must specify the fully qualified name with
the -h option and you cannot use the fully qualified form in the resource name.

7 Bring online the SAP central services resource group.

# clresourcegroup online -M central-rg

-M
   Specifies that the resource group is to be brought over into the managed state.

8 Create a resource group for the SAP replicated enqueue server.

Note – If your deployment is ABAP single instance, you do not need the SAP replicated enqueue
server resource group.
The SAP replicated enqueue server resource group is a failover resource group to contain the SAP replicated enqueue server, a sapstartsrv resource, and the logical hostname for this resource.

```
# clresourcegroup create repl-rg
```

9 Add a logical hostname resource to the resource group that you created in Step 8.

```
# clreslogicalhostname create -g repl-rg saprepl-logical-hostname
```

- **-g repl-rg**
  Specifies the name of the resource group.

- **saprepl-logical-hostname**
  Specifies the logical hostname of the SAP replica server resource.

**Note** – If you require a fully qualified hostname, you must specify the fully qualified name with the `-h` option and you cannot use the fully qualified form in the resource name.

10 Bring online the SAP replica server resource group.

```
# clresourcegroup online -M repl-rg
```

- **-M**
  Specifies that the resource group is to be brought into the managed state.

11 Set weak positive affinity between the SAP central services resource group and the SAP replicated enqueue server resource group.

The weak positive affinity setting ensures that, in case of failover, the SAP central services resource group fails over to the node where the SAP replicated enqueue server resource group has been running. If you want to configure the central services and the replicated enqueue server on the same instance number you must set the strong negative affinities between replicated enqueue resource group and the central service resource group. Do not do this if you run every instance on its own instance number which is the default SAP installation.

```
# clresourcegroup set -p RG_affinities=+repl-rg central-rg
```

- **central-rg**
  Specifies the name of the resource group to be modified.

```
-p RG_affinities=+repl-rg
```

- **repl-rg**
  Specifies that the central-rg resource group has weak positive affinity with the repl-rg resource group.

12 Create a resource group for the SAP dialogue instance component.

The SAP dialogue instance resource group can be configured as a failover or multiple master resource group to contain the resource for the SAP dialogue instance component and its
sapstartsrv resource. If the SAP dialogue instance is configured as a failover resource, the logical hostname for this resource is also contained in the SAP dialogue instance resource group.

■ To create a failover resource group, run the following command:

```
# clresourcegroup create diag-rg
```

■ To create a multiple master resource group, run the following command:

```
# clresourcegroup create \
-p Maximum_primaries=value \
-p Desired_primaries=value \
 diag-rg
```

- `Maximum_primaries=value`
  Specifies the maximum number of primary nodes for this multiple master resource group.

- `Desired_primaries=value`
  Specifies the desired number of primary nodes for this multiple master resource group.

```
diag-rg
```

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

13 If the resource group that you created in Step 12 is configured as a failover resource group, add a logical hostname resource to the resource group.

If the resource group that you created in Step 12 is configured as a multiple master resource group, skip this step.

```
# clreslogicalhostname create -g diag-rg diag-logical-hostname
```

- `diag-rg`
  Specifies the name of the resource group.

```
diag-logical-hostname
```

Specifies the logical hostname `diag-logical-hostname` of the SAP dialogue instance server resource. By default the name of the logical-host resource is set to the same name as this. If you wish to specify a separate name then place the name of the resource at the end of the command listing.

**Note** – If you require a fully qualified hostname, you must specify the fully qualified name with the `-h` option and you cannot use the fully qualified form in the resource name.

14 Bring online the SAP NetWeaver resource group.

```
# clresourcegroup online -M diag-rg
```

- `-M`
  Specifies that the resource group is to be brought into the managed state.
diag-rg

Specifies the name of the resource group that needs to be brought online.

15 Install the SAP NetWeaver software.
Follow the instructions in the SAP NetWeaver installation manual to install the SAP NetWeaver software. To understand the SAP NetWeaver high availability concepts, refer to the SAP documentation at http://service.sap.com/ha.

16 Copy all system files that were changed during the SAP NetWeaver installation and configuration process to all the nodes that are to run the SAP NetWeaver resources.
These files might include the following:
- /etc/user_attr
- /etc/hosts
- /etc/group
- /etc/passwd
- /etc/services
- /etc/project

Verifying the SAP NetWeaver Installation and Configuration

Before you install the HA for SAP NetWeaver packages, verify that the SAP NetWeaver software is correctly installed and configured to run in a cluster. These procedures do not verify that the SAP NetWeaver application is highly available because you have not yet installed your data service.

Note – For more information, see the SAP documentation at http://service.sap.com/ha.

The procedures in this section verify the installation and configuration of the following SAP NetWeaver components.
- SAP central services
- SAP replicated enqueue server
- SAP primary application instance
- SAP additional dialogue instance

▼ How to Verify the Installation of an SAP NetWeaver

On the node where you installed the SAP NetWeaver instance as the root user, do the following:

1 Switch to the SAP NetWeaver administrative user.
   
   # su - sidadm
Stop the SAP NetWeaver instance.
$ stopsap r3 instance name

Kill all remaining processes.
$ pkill -f instance name

Start the instance.
$ startsap r3 instance name

Check if the instance goes online.
$ sapcontrol -nr instance number -function GetProcessList
Repeat this step until all the processes show the GREEN status.

Stop the SAP NetWeaver instance.
$ stopsap r3 instance name

Kill all remaining processes.
$ pkill -f instance name

Configuring Your Highly Available Database
SAP supports various databases. You must configure the resource type, the resource group, and the resources for the database that you plan to use so that the database will be highly available. See details in the appropriate Oracle Solaris Cluster Data Services document for the database that you plan to use.

Preparing SAP NetWeaver for High Availability

- If you configure the JAVA stack, you need to know that the JAVA stack does not detect that a database is running on the remote node. You must disable the database start from the start profile of the application instances.

  # Start_Program_00 = immediate $(_DB)

- To recover the enqueue replication after network outages, add the following line to the instance profile of the enqueue replication server.

  enqueue/enrep/keepalive_count = 1

- If your SAP version supports an integration between the SAP management console and Oracle Solaris Cluster, issue user administration permission to the SAP administrator. On all nodes, execute the following command:

  # usermod -A solaris.cluster.admin sadadm
Registering and Configuring HA for SAP NetWeaver

To enable the HA for SAP NetWeaver data service to make SAP NetWeaver applications highly available, configure the data service as described in the procedures in this section. These procedures perform the following tasks.

- Register and configure the SAP central services resources. The SAP central services consist of the following components:
  - SAP sapstartsrv
  - SAP central services
  - SAP replicated enqueue server
  - SAP replicated enqueue preemtpr
  - SAP dialogue instance
- Register and configure resources for the SAP NetWeaver primary application instance.
- Register and configure the SAP NetWeaver additional dialogue instance.

The resource groups and the storage resource were created in "How to Enable the SAP NetWeaver to Run in a Cluster" on page 17.

Before You Begin

Before performing these procedures, ensure that the HA for SAP NetWeaver data service packages are installed.

The procedures in this section assume that the database resources have been previously created and that these resources are online.

Make your database highly available by following the instructions in the documentation for your database.

Perform these procedures by becoming superuser on a cluster node.

Setting HA for SAP NetWeaver Extension Properties

The extension properties for HA for SAP NetWeaver are described in Appendix A, "HA for SAP NetWeaver Extension Properties."
You can update some extension properties dynamically. You can update other properties, however, only when you create or disable a resource. The Tunable entry indicates when you can update a property.

The instructions for registering and configuring resources explain how to set only extension properties that HA for SAP NetWeaver requires you to set.

To set an extension property of a resource, include the following option in the `clresource` command that creates or modifies the resource:

```
-p property=value
```

- `property` Identifies the extension property that you are setting.
- `value` Specifies the value to which you are setting the extension property.

### Registering and Configuring the HA for SAP NetWeaver by using Oracle Solaris Cluster Command Line Interface (CLI)

The procedures in this section describe the registration and configuration of the following components of the SAP NetWeaver by using Oracle Solaris Cluster CLI.

- Register and configure the SAP central services resources. The SAP central services consist of the following components:
  - SAP sapstartsrv
  - SAP central services
  - SAP replicated enqueue server
  - SAP replicated enqueue preempter
  - SAP dialogue instance
- Register and configure resources for the SAP NetWeaver primary application instance.
- Register and configure the SAP NetWeaver additional dialogue instance.

#### How to Register and Configure an SAP NetWeaver sapstartsrv Resource

The SAP NetWeaver sapstartsrv resource must be configured in the same resource group with each and every other SAP NetWeaver instance resource. These instance resources must depend on their sapstartsrv resource.

The sapstartsrv resource is to configured to depend on its storage resource. This dependency ensures that the sapstartsrv resource does not attempt to start until its associated storage resource is online.
1 Register the ORCL.sapstartsrv resource type.
   # c1resourcetype register ORCL.sapstartsrv
   register
   Specifies that a new resource type is to be added.
   ORCL.sapstartsrv
   Specifies the name of the resource type to be added. This name is predefined for SAP sapstartsrv.

2 Create a sapstartsrv resource.

   Note – You can choose to create a failover resource or a multiple master resource as follows.

   ■ Create a failover sapstartsrv resource.
      # c1resource create -d-g central-rg \n      -t ORCL.sapstartsrv \n      -p sid=system-id \n      -p sap_user=sidadm \n      -p instance_number=instance \n      -p instance_name=instance_number \n      -p HOST=ip-alias \n      -p timeout_return=return_code \n      -p resource_dependencies_offline_restart=hsp-rs{LOCAL_NODE} \n      sapstartsrv-rs

   ■ Create a multiple master sapstartsrv resource.
      # c1resource create -d-g central-rg \n      -t ORCL.sapstartsrv \n      -p sid=system-id \n      -p sap_user=sidadm \n      -p instance_number{node1}=instance1 \n      -p instance_number{node2}=instance2 \n      -p instance_name{node1}=instance_name1 \n      -p instance_name{node2}=instance_name2 \n      -p timeout_return=return_code \n      -p resource_dependencies_offline_restart=hsp-rs{LOCAL_NODE} \n      sapstartsrv-rs
      -g central-rg
      Specifies the resource group to which the resource is to be added. The resource group is confirmed as a failover resource group.

      -t ORCL.sapstartsrv
      Specifies that the resource is an instance of the ORCL.sapstartsrv resource type.

      -p sid=system-id
      Specifies the SAP system identifier.

      -p sap_user=sidadm
      Specifies the administrator user for the SAP installation.
-p instance_number=instance
    Specifies the SAP instance number of the instance to be controlled.

-p instance_name=instance_name
    Specifies the name of the SAP instance to be controlled.

-p HOST=ip-alias
    Specifies the IP alias on which the instance is configured.

-p yellow=return_code
    Specifies the return code on which the resource probe exits by 80% of the probe timeout.

-p resource_dependencies_offline_restart=hsp-rs[LOCAL_NODE]
    Specifies the list of offline restart dependencies.

    sapstartsrv-rs
    Specifies the resource name of the sapstartsrv resource.

3 Verify that the default values for the SAP sapstartsrv extension properties are acceptable.
   Refer to "ORCL.sapstartsrv Extension Properties" on page 55.

4 Enable the SAP sapstartsrv resource.
   
   # clresource enable sapstartsrv-rs
   
   enable
      Specifies that the specified resource is to be enabled.

   sapstartsrv-rs
      Specifies the name of the resource to be enabled.

\[\text{\bf How to Register and Configure an SAP Central Service Resource}\]

The SAP NetWeaver central service resource must be configured in the same resource group
with its sapstartsrv resource. It must depend on this sapstartsrv resource.

The central service resource is configured to depend on its storage resource and on the logical
host resource. These dependencies ensures that the central service resource does not attempt to
start until its associated resources are online.

1 Register the ORCL.sapcentr resource type.
   
   # clresourcetype register ORCL.sapcentr
   
   register
      Specifies that a new resource type is to be added.

   ORCL.sapcentr
      Specifies the name of the resource type to be added. This name is predefined for the SAP
central services.
2  Create a failover `scs-startsrv-rs` for the SAP central services resource.
For information, see "How to Register and Configure an SAP NetWeaver `sapstartsrv` Resource" on page 25.

3  Create a failover central service resource.

```bash
# cresource create -d-g central-rg
  -t ORCL.sapcentr
  -p sid=system-id
  -p sap_user=sidadm
  -p instance_number=instance
  -p instance_name=instance_name
  -p HOST=ip-alias
  -p yellow=return_code
  -p resource_dependencies_offline_restart=hsp-rs{LOCAL_NODE}
  -p resource_dependencies=display-rs,scs-startsrv-rs

  -g central-rg
  Specifies the resource group to which the resource is to be added. The resource group is confirmed as a failover resource group.

  -t ORCL.sapcentr
  Specifies that the resource is an instance of the ORCL.sapcentr resource type.

  -p sid=system-id
  Specifies the SAP system identifier.

  -p sap_user=sidadm
  Specifies the administrator user for the SAP installation.

  -p instance_number=instance
  Specifies the SAP instance number of the instance to be controlled.

  -p instance_name=instance_name
  Specifies the name of the SAP instance to be controlled.

  -p HOST=ip-alias
  Specifies the IP alias on which the instance is configured.

  -p yellow=return_code
  Specifies the return code on which the resource probe exits if a sapcontrol command reports the YELLOW state.

  -p resource_dependencies_offline_restart=hsp-rs{LOCAL_NODE}
  Specifies the list of offline restart dependencies.

  -p resource_dependencies=display-rs,scs-startsrv-rs
  Specifies the list of dependencies.

  `scs-rs` specifies the resource name of the central service resource.
4 Verify that the default values for the SAP central service resource extension properties are acceptable.
For more information about the SAP central service resource extension properties, see "ORCL.sapcentr Extension Properties" on page 47.

5 Enable the `scs-startsrv-rs` resource.
  
  ```
  # cresource enable scs-startsrv-rs
  ```

6 Enable the SAP central service resource.
  
  ```
  # cresource enable scs-rs
  ```
  
  `enable`
  
  Specifies that the specified resource is to be enabled.

  `scs-rs`
  
  Specifies the name of the resource to be enabled.

\▼

### How to Register and Configure an SAP Replicated Enqueue Server Resource

The SAP replicated enqueue server resource must be configured in the same resource group with its `sapstartsrv` resource. It must depend on this `sapstartsrv` resource.

The SAP replicated enqueue server resource is to configured to depend on its storage resource and on the logical host resource, as well as on its central service resource. These dependencies ensure that the SAP replicated enqueue server resource does not attempt to start until its associated resources are online.

1 Register `ORCL.saprepenq`, the resource type for the SAP replicated enqueue server.
  
  ```
  # cresource type register ORCL.saprepenq
  ```
  
  `register`
  
  Specifies that a new resource type is to be added.

  `ORCL.saprepenq`
  
  Specifies the name of the resource type to be added. This name is predefined for the SAP replicated enqueue server.

2 Create a failover `rep-startsrv-rs` for the SAP replicated enqueue server resource.

For information, see “How to Register and Configure an SAP NetWeaver `sapstartsrv` Resource” on page 25.

3 Create a failover SAP replicated enqueue server resource.

  ```
  # cresource create -d -g rep-rg \
  -t ORCL.saprepenq \ 
  -p sid=system-id \ 
  ```
Verify that the default values for the SAP replicated enqueue server extension properties are acceptable.

Refer to "ORCL.saprepenq Extension Properties" on page 52.

Enable the rep-startsrv-rs resource.

```
# c1resource enable rep-startsrv-rs
```
Enable the SAP replicated enqueue server resource.

```
# clresource enable rep-rs
```

enable

Specifies that the specified resource is to be enabled.

rep-rs

Specifies the name of the resource to be enabled.

▼ How to Register and Configure an SAP Replicated Enqueue Preempter Resource

The SAP replicated enqueue preempter resource must be configured in the same resource group with its central service resource. It must depend on this central service resource with an offline restart dependency.

The SAP replicated enqueue preempter resource is to configured to depend on its storage resource and on the logical host resource, as well as on its SAP central services resource. These dependencies ensure that the SAP replicated enqueue preempter resource does not attempt to start until its associated resources are online.

1 Register ORCL.saprepenq_preempt, the resource type for the SAP replicated enqueue preempter.

```
# clresourcetype register ORCL.saprepenq_preempt
```

register

Specifies that a new resource type is to be registered.

ORCL.saprepenq_preempt

Specifies the name of the resource type to be added. This name is pre-defined for the SAP replicated enqueue preempter.

2 Create a failover SAP replicated enqueue preempter resource.

```
# clresource create -d -g central-rg \
-t ORCL.saprepenq_preempt \
-p sid=system-id \
-p sap_user=sidadm \
-p repenqres=resource_name \
-p enq_instr=instance_list \
-p resource_dependencies_offline_restart=rep-rs{LOCAL_NODE},scs-rs \
-p resource_dependencies=db-rs \
-p rep-rs \
-g rep-rs
```

Specifies the resource group to which the resource is to be added. The resource group is confirmed as a failover resource group.

-t ORCL.saprepenq_preempt

Specifies that the resource is an instance of the ORCL.saprepenq_preempt resource type.
-p sid=system-id
  Specifies the SAP system identifier.

- p sap_user=sidadm
  Specifies the administrator user for the SAP installation.

- p enq_instnr=instance_name
  Specifies the name of the SAP replicated enqueue server server resource.

- p enq_instnr=instance_list
  Specifies the comma separated list of SAP central services instance numbers to be
  monitored.

- p resource_dependencies offline_restart=hsp-rs[LOCAL_NODE],scs-rs
  Specifies the list of offline restart dependencies, at least one central services resource must be
  present here.

- p resource_dependencies=dsb-rs
  Specifies the list of dependencies.

preempt-rs
  Specifies the resource name of the SAP replicated enqueue preempter resource.

3  Verify that the default values for the SAP replicated enqueue preempter resource extension
   properties are acceptable.
   Refer to "ORCL.saprepenq_preempt Extension Properties" on page 54.

4  Enable the SAP replicated enqueue preempter resource.
   # clresource enable preempt-rs
   enable
     Specifies that the specified resource is to be enabled.

   preempt-rs
     Specifies the name of the resource to be enabled.

▼ How to Register and Configure an SAP NetWeaver Dialogue Instance Resource

   The SAP NetWeaver dialogue instance resource must be configured in the same resource group
   with its sapstartsrv resource. It must depend on this sapstartsrv resource.

   Use the dialogue instance resource type for the following deployments:
   ■ Primary application instance
   ■ Additional application instance
   ■ Combined instance containing dialogue instance and central services
Configure the dialogue instance resource such that it depends on its storage resource, the logical host resource, the database resource, as well as its central service resource. These dependencies ensure that the dialogue instance resource does not attempt to start until its associated resources are online.

**Note** – If you configure the dialogue instance resource as a single instance resource it must not depend on a central service resource.

1. **Register** ORCL.sapdia, the resource type for the SAP NetWeaver dialogue instance resource.

   ```sh
   # clresourcetype register ORCL.sapdia
   register
   Specifies that a new resource type is to be added.
   ORCL.sapdia
   Specifies the name of the resource type to be added. This name is predefined for the SAP dialogue instance.
   ```

2. **Create a diag-startsrv-rs** for the SAP NetWeaver dialogue instance resource.

   For information, see “How to Register and Configure an SAP NetWeaver sapstartsrv Resource” on page 25.

3. **Create a dialogue instance resource.**

   **Note** – Depending on the topology that you are using for your dialogue instance resource, you can create the dialogue resource using one of the following options:

   - **Create a failover dialogue instance resource.**

     ```sh
     # clresource create -d-g dia-rg \
     -t ORCL.sapdia \ 
     -p sid=system-id \ 
     -p sap_user=sidadm \ 
     -p instance_number=instance \ 
     -p instance_name=instance_number \ 
     -p HOST=ip-alias \ 
     -p yellow=return_code \ 
     -p resource_dependencies_offline_restart=hsp-rs{LOCAL_NODE} \ 
     -p resource_dependencies=db-rs,scs-rs,diag-startsrv-rs \ 
     diag-rs
     ```

   - **Create a multiple master dialogue instance resource.**

     ```sh
     # clresource create -d-g dia-rg \
     -t ORCL.sapdia \ 
     -p sid=system-id \ 
     -p sap_user=sidadm \ 
     -p instance_number{node1}=instance_number \ 
     -p instance_number{node2}=instance_number \ 
     ```
Create a failover combined dialogue instance resource.

```bash
# clresource create -d-g dia-rg \
-t ORCL.sapdia \
-p sid=system-id \
-p sap_user=sidadm \
-p instance_number=instance \
-p instance_name=instance_name \
-p Architecture=comb \
-p HOST=ip-alias \
-p yellow=return_code \
-p resource_dependencies_offline_restart=hsp-rs{LOCAL_NODE} \
-p resource_dependencies=db-rs,diag-startsrv-rs \
-diag-rg
```

- **-p instance_name(node1)=instance_name**
  - Specifies the name of the SAP instance to be controlled.

- **-p instance_name(node2)=instance_name**
  - Specifies the name of the SAP instance to be controlled.

- **-p HOST(node 1)=ip-alias**
  - Specifies the IP alias on which the instance is configured.

- **-p HOST(node 2)=ip-alias**
  - Specifies the IP alias on which the instance is configured.

- **-p timeout_return=return_code**
  - Specifies the return code on which the resource probe exits if a sapcontrol command reports the YELLOW state.

- **-p resource_dependencies=db-rs,scs-rs,diag-startsrv-rs**
  - Specifies a list of resource dependencies.

- **-g dia-rg**
  - Specifies the resource group to which the resource is to be added. The resource group is confirmed as a failover or a multiple master resource group.

- **-t ORCL.sapdia**
  - Specifies that the resource is an instance of the ORCL.sapdia resource type.

- **-p sid=system-id**
  - Specifies the SAP system identifier.

- **-p sap_user=sidadm**
  - Specifies the administrator user for the SAP installation.

- **-p instance_number=instance**
  - Specifies the SAP instance number of the instance to be controlled.

- **-p instance_name=instance_name**
  - Specifies the name of the SAP instance to be controlled.

- **-p Architecture=comb**
  - Specifies the flag to highlight that a combined instance is configured. In this case this value must be comb.

- **-p HOST=ip-alias**
  - Specifies the IP alias on which the instance is configured.

- **-p yellow=return_code**
  - Specifies the return code on which the resource probe exits if a sapcontrol command reports the YELLOW state.

- **-p resource_dependencies_offline_restart=hsp-rs{LOCAL_NODE}**
  - Specifies the list of offline restart dependencies.
-p resource_dependencies_offline_restart=db-rs,logical_host,diag-startsrv-rs
   Specifies the list of dependencies.

diag-rs
   Specifies the resource name of the dialogue instance resource.

4 Verify that the default values for the SAP dialogue instance resource extension properties are acceptable.
   Refer to “ORCL.sapdia Extension Properties” on page 49.

5 Enable the diag-startsrv-rs resource.
   # clresource enable diag-startsrv-rs

6 Enable the SAP dialogue instance resource.
   # clresource enable diag-rs
   enable
      Specifies that the specified resource is to be enabled.

diag-rs
   Specifies the name of the resource to be enabled.

Using Alternate Project Identification

You can create a specific project, that is, an alternate project identification (ID), for the application. Set either RG_project_name or Resource_project_name or both, for the resource group and/or the resource, so that the application is started up under the specified project. Refer to the RGM doc for how to set these system properties.


Tuning the HA for SAP NetWeaver Fault Monitors

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

- The fault monitor for the SAP saps t a r t s r v process
- The fault monitor for the SAP central services
- The fault monitor for the SAP replicated enqueue server
- The fault monitor for the SAP replicated enqueue preempter
- The fault monitor for the SAP dialogue instance

Each fault monitor is contained in a resource whose resource type is shown in the following table.
### Table 1-3 Resource Types for the Fault Monitors of HA for SAP NetWeaver

<table>
<thead>
<tr>
<th>Component</th>
<th>Resource Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAP sapstartsrv</td>
<td>ORCL.sapstartsrv</td>
</tr>
<tr>
<td>SAP central services</td>
<td>ORCL.sapcentr</td>
</tr>
<tr>
<td>SAP dialogue instance</td>
<td>ORCL.sapdia</td>
</tr>
<tr>
<td>SAP replicated enqueue server</td>
<td>ORCL.saprepenq</td>
</tr>
<tr>
<td>SAP replicated enqueue preemtiter</td>
<td>ORCL.saprepenq_preempt</td>
</tr>
</tbody>
</table>

System properties and extension properties of the resource types 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 fault monitors only if you need to modify this preset behavior.

Tuning these 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

Perform these tasks when you register and configure HA for SAP NetWeaver, as described in "Registering and Configuring HA for SAP NetWeaver" on page 24.

In addition, perform the following tasks for tuning the SAP NetWeaver profiles and Oracle Solaris Cluster resources:

- Ensure that the SAP enqueue server is not restarted upon process failures, by changing the `Restart_Program_01 = local $(_EN) pf=$(_PF)` line in the SAP central services profile to `Start_Program_01 = local $(_EN) pf=$(_PF)`. For example:

  ```
  #------------------------------------------------------------------------
  # Start SAP enqueue server
  #------------------------------------------------------------------------
  _EN = en.sap$(SAPSYSTEMNAME) $(INSTANCE_NAME)
  Execute_03 = local rm -f $( EN)
  Execute_04 = local ln -s -f $(DIR_EXECUTABLE)/enserver$(FT_EXE) $( EN)
  Start_Program_01 = local $(_EN) pf=$(_PF)
  ```

- For every SAP central service resource of the type ORCL.sapcentr, set `retry_count` to 0.

  ```
  # clrs set -p Retry_count=0 resource name
  ```

- For every `sapstartsrv` resource of the type ORCL.sapstartsrv, which includes either the SAP central services resource or the SAP replicated enqueue server resource of the type ORCL.saprepenq, you can set `Child_mon_level` to 5. Follow this for only the `sapstartsrv` resource which has the same instance name as the SAP central service and the SAP replicated enqueue server resources.
# clrs set -p Child_mon_level=5 resource name

For detailed information about these tasks, see “Tuning Fault Monitors for Oracle Solaris Cluster Data Services” in Oracle Solaris Cluster Data Services Planning and Administration Guide.

### Operation of the Fault Monitor for the SAP sapstartsrv Resource Type

To determine whether the SAP sapstartsrv process is operating correctly, the fault monitor for the SAP sapstartsrv resource type probes these resources periodically.

The probe uses the sapcontrol command to check the health of the sapstartsrv process.

```bash
# su - sidadm -c "sapcontrol -nr instancenumber -function GetProcessList"
```

- `sidadm` specifies the SAP administrative user.
- `instancenumber` specifies the SAP instance number of the sapstartsrv process.

The return codes 0, 3, and 4 signal a healthy sapstartsrv process. Every other return code indicates a faulty sapstartsrv process.

If the probe command times out, that is if it reaches 80% of the probe_timeout property, the return code of the probe command is determined by the timeout_return property.

The number of tolerated consecutive timeouts within retry_interval seconds is obtained by dividing 100 over timeout_return. If this number is greater than the number you obtain by dividing retry_interval by thorough_probe_interval, then timeouts will be tolerated forever.

For more information, see “Tuning Fault Monitors for Oracle Solaris Cluster Data Services” in Oracle Solaris Cluster Data Services Planning and Administration Guide.

### Operation of the Fault Monitor for the SAP Central Services Resource Type

To determine whether the SAP central services are operating correctly, the fault monitor for the SAP central services resource type probes these resources periodically.

The probe uses the sapcontrol command to check the health of the sapstartsrv process.

```bash
# su - sidadm -c "sapcontrol -nr instancenumber -function GetProcessList"
```
**sidadm**

Specifies the SAP administrative user.

**instance number**

Specifies the SAP instance number of the central service.

The return code indications are as follows:

- 1 signals an internal error.
- 3 signals that everything is running as expected.
- 4 indicates that everything is stopped and a failover is initiated.
- For all other return codes, the output of the `sapcontrol` command is evaluated for the status of the critical processes.

Critical processes are the message server, enqueue server, and the gateway reader, if available. The status of the different processes lead to different actions as shown in the following table.

<table>
<thead>
<tr>
<th>Color</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>GREEN</td>
<td>No action</td>
</tr>
<tr>
<td>YELLOW</td>
<td>The probe command returns with the number specified in the yellow property</td>
</tr>
<tr>
<td>GRAY</td>
<td>The probe indicates a restart</td>
</tr>
<tr>
<td>RED</td>
<td>The probe indicates a failover</td>
</tr>
</tbody>
</table>

If the probe command times out, that is if it reaches 80% of the `probe_timeout` property, the return code of the probe command is determined by the YELLOW property.

The number of tolerated consecutive YELLOW states or timeouts within `retry_interval` seconds is obtained by dividing 100 over `timeout_return`. If this number is greater than the number you obtain by dividing `retry_interval` by `thorough_probe_interval`, then timeouts and YELLOW states will be tolerated forever.

For more information, see "Tuning Fault Monitors for Oracle Solaris Cluster Data Services" in Oracle Solaris Cluster Data Services Planning and Administration Guide.

**Operation of the Fault Monitor for the SAP Replicated Enqueue Server Resource Type**

To determine whether the SAP central services are operating correctly, the fault monitor for the SAP replicated enqueue server resource type probes these resources periodically.

The probe uses the `sapcontrol` command to check the health of the `sapstartsrv` process.

```
# su - sidadm -c "sapcontrol -nr instance number -function GetProcessList"
```
sidadm
   Specifies the SAP administrative user.

instance number
   Specifies the SAP instance number of the SAP replicated enqueue server.

The return code indications are as follows:

- 1 signals an internal error.
- 3 signals that everything is running perfectly.
- 4 signals that everything is stopped and a failover is initiated.
- For all other return codes, the output of the sapcontrol command is evaluated for the status of the critical processes.

The critical process is SAP replicated enqueue server. The status of the process lead to different actions as shown in the following table.

<table>
<thead>
<tr>
<th>Color</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>GREEN</td>
<td>No action</td>
</tr>
<tr>
<td>YELLOW</td>
<td>The probe command returns with the number specified in the yellow property</td>
</tr>
<tr>
<td>GRAY</td>
<td>The probe indicates a restart</td>
</tr>
<tr>
<td>RED</td>
<td>The probe indicates a failover</td>
</tr>
</tbody>
</table>

If the probe command times out, that is if it reaches 80% of the probe_timeout property, the return code of the probe command is determined by the YELLOW property.

The number of tolerated consecutive YELLOW states or timeouts within retry_interval seconds is obtained by dividing 100 over timeout_return. If this number is greater than the number you obtain by dividing retry_interval by thorough_probe_interval, then timeouts and YELLOW states will be tolerated forever.

For more information, see “Tuning Fault Monitors for Oracle Solaris Cluster Data Services” in Oracle Solaris Cluster Data Services Planning and Administration Guide.

### Operation of the Fault Monitor for the SAP Dialogue Instance Resource Type

To determine whether the SAP dialogue instance is operating correctly, the fault monitor for the SAP dialogue instance resource type probes these resources periodically.

The probe uses the sapcontrol command to check the health of the dialogue instance process.

```
# su - sidadm -c "sapcontrol -nr instance number -function GetProcessList"
```
**sidadm**

Specifies the SAP administrative user.

**instance number**

Specifies the SAP instance number of the dialogue instance process.

The return code indications are as follows:

- 1 signals an internal error.
- 3 signals that everything is running perfectly.
- 4 signals that everything is stopped and a failover is initiated.
- For all other return codes, the output of the `sapcontrol` command is evaluated for the status of the critical processes.

The critical processes depend on the deployment variation.

For a pure dialogue instance, the critical processes is as follows:

- `disp+work`, `jstart`, or `jcontrol`

For a combined instance the critical processes are as follows:

- `disp+work`, `jstart`, or `jcontrol`
- Enqueue server
- Message server

The status of a critical process leads to different actions as show in the following table.

<table>
<thead>
<tr>
<th>Status</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>GREEN</td>
<td>No action</td>
</tr>
<tr>
<td>YELLOW</td>
<td>The probe command returns with the number specified in the <code>yellow</code> property</td>
</tr>
<tr>
<td>GRAY</td>
<td>The probe indicates a restart</td>
</tr>
<tr>
<td>RED</td>
<td>The probe indicates a failover</td>
</tr>
</tbody>
</table>

If the probe command times out, that is if it reaches 80% of the `probe_timeout` property, the return code of the probe command is determined by the `YELLOW` property.

The number of tolerated consecutive `YELLOW` states or timeouts within `retry_interval` seconds is obtained by dividing 100 over `timeout_return`. If this number is greater than the number you obtain by dividing `retry_interval` by `through_probe_interval`, then timeouts and `YELLOW` states will be tolerated forever.

For more information, see “Tuning Fault Monitors for Oracle Solaris Cluster Data Services” in *Oracle Solaris Cluster Data Services Planning and Administration Guide*. 
Operation of the Fault Monitor for the SAP Replicated Enqueue Preempter Resource Type

To determine whether the SAP replicated enqueue preempter is operating correctly, the fault monitor for the SAP replicated enqueue preempter service resource type probes these resources periodically.

The probe uses the sapcontrol command to check the health of the sapstartsrv process.

```bash
# su - sidadm -c "sapcontrol -nr instancenumber -function GetProcessList"
```

`sidadm` specifies the SAP administrative user.

`instancenumber` specifies the SAP instance number of the sapstartsrv process.

The return code of 0 indicates that everything is running as expected. All other return codes indicate errors.

If the SAP central services and the SAP replicated enqueue server are running on the same node, the probe evaluates if a giveover is possible. If yes, it will initiate the giveover to reinstate the redundancy of the lock table.

If the probe command times out, that is if it reaches 80% of the probe_timeout property, the return code of the probe command is determined by the YELLOW property.

The number of tolerated consecutive timeouts within retry_interval seconds is obtained by dividing 100 over timeout_return. If this number is greater than the number you obtain by dividing retry_interval by thorough_probe_interval, then timeouts will be tolerated forever.

For more information, see “Tuning Fault Monitors for Oracle Solaris Cluster Data Services” in Oracle Solaris Cluster Data Services Planning and Administration Guide.

Verifying the HA for SAP NetWeaver Installation and Configuration

You have installed, registered, and configured the data service for SAP NetWeaver. Now verify that the data service makes the SAP NetWeaver highly available by performing the following tasks.

- Verify the operation of the fault monitor for the SAP sapstartsrv process
- Verify the operation of the fault monitor for the SAP central services
- Verify the operation of the fault monitor for the SAP replicated enqueue server
- Verify the operation of the fault monitor for the SAP dialogue instance
- Verify the installation and configuration of the SAP replicated enqueue preemtper

See “Tuning the HA for SAP NetWeaver Fault Monitors” on page 35 for a description of the fault monitors.

▼ How to Verify the Operation of the Fault Monitor for the SAP sapstartsrv Process

Perform this procedure on each set of two nodes where the SAP sapstartsrv process can run.

1 Become superuser on a cluster node.

2 Ensure that the resource group hosting the SAP sapstartsrv resource is offline on all nodes.

3 Bring online the resource group to which the SAP sapstartsrv belongs.
   
   # clresourcegroup online -n node central-rg
   
   -n node
   Specifies the name of the node on which the resource group is to be brought online. This node is the node that you have just logged in to.
   
   central-rg
   Specifies the name of the resource group to be brought online. This group is the resource group to which the SAP sapstartsrv belongs.

4 Terminate the SAP sapstartsrv process.
   
   # su - sidadm -c "sapcontrol -nr instance number -function StopService"
   
   Alternatively, kill the SAP sapstartsrv process.

   Once you enable the interaction between SAP NetWeaver and Oracle Solaris Cluster, you must kill the instance processes to achieve a restart.

5 Confirm that the SAP sapstartsrv process gets restarted.
   
   Run the clresource status command to confirm that the SAP sapstartsrv resource is online on the first node.

6 Switch over the resource group hosting the SAP sapstartsrv to another node if the resource group is configured as a failover resource group. If the resource group is configured as a multiple master resource group, skip this step.
   
   # clresourcegroup switch -n node central-rg
   
   -n node
   Specifies the name of the node on which the resource group is to be brought online.
central-rg
  Specifies the name of the resource group to be brought online. This group is the resource group to which the SAP sapstartsrv belongs.

▼ How to Verify the Operation of the Fault Monitor for the SAP Instance Resource Types

This procedure is applicable for the following instance resource types:

- SAP central services
- SAP replicated enqueue server
- SAP dialogue instance

Perform this procedure on each set of two nodes where the SAP instance process can run.

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

2 **Ensure that the resource group hosting the SAP instance resource is offline on all nodes.**

3 **Bring online the resource group to which the SAP instance belongs.**

   ```bash
   # clresourcegroup online -n node instance-rg
   -n node
   ```

   Specifies the name of the node on which the resource group is to be brought online. This node is the node that you have just logged in to.

   ```bash
   instance-rg
   ```

   Specifies the name of the resource group to be brought online. This group is the resource group to which the SAP instance belongs.

4 **Terminate the SAP instance process.**

   ```bash
   # su - sidadm -c "sapcontrol -nr instance number -function Stop"
   ```

   Alternatively, kill the instance processes except the corresponding SAP sapstartsrv process.

5 **Confirm that the SAP instance resource gets restarted.**

   Run the clresource status command to confirm that the SAP instance resource is online on the first node.

6 **Switch over the resource group hosting the SAP sapstartsrv to another node if the resource group is configured as a failover resource group. If the resource group is configured as a multiple master resource group, skip this step.**

   ```bash
   # clresourcegroup switch -n node instance-rg
   -n node
   ```

   Specifies the name of the node on which the resource group is to be brought online.
instance-rg
  Specifies the name of the resource group to be brought online. This group is the resource
group to which the SAP instance belongs.

▼ How to Verify the Operation of the Fault Monitor for the SAP Replicated Enqueue Preempter Resource Type

Perform this procedure on each node where the SAP replicated enqueue preemtper can run.

1 Become superuser on a cluster node.

2 Ensure that the resource group hosting the SAP replicated enqueue preempter resource is
   offline on all nodes.

3 Bring online the resource group to which the SAP replicated enqueue preempter belongs.
   # clresourcegroup online -n node centr-rg
   -n node
     Specifies the name of the node on which the resource group is to be brought online. This
     node is the node that you have just logged in to.
   centr-rg
     Specifies the name of the resource group to be brought online. This group is the resource
     group to which the SAP replicated enqueue preempter belongs.

4 Bring online the resource group to which the SAP replicated enqueue server belongs.
   # clresourcegroup switch -n node2 centr-rg
   -n node2
     Specifies the name of the node on which the resource group is to be brought online. This
     node is the node that you have just logged in to.
   centr-rg
     Specifies the name of the resource group to be brought online. This group is the resource
     group to which the SAP central services belongs.

5 Switch over the resource group hosting the SAP replicated enqueue preempter to the node
   hosting the SAP replicated enqueue server.

6 Confirm that the SAP replicated enqueue server resource group gets restarted on a spare node
   as long as a spare node is available.
   Run the clresource status command to confirm that the SAP replicated enqueue server
   resource is online on the first node.
Enabling Interaction Between Oracle Solaris Cluster and SAP NetWeaver

This section shows how to enable interaction between Oracle Solaris Cluster and SAP NetWeaver

▼ How to Enable Interaction Between Oracle Solaris Cluster and SAP NetWeaver

Before You Begin

- You must have downloaded and installed the latest host agent.
- SAP kernel version must be 7.20_EXT or later.
- Perform the steps in this procedure only after you have created the Oracle Solaris Cluster resources.

1 Configure every instance profile with the following lines, assuming that the saphascriptco.so script is in the /usr/sap/hostctrl/exe/saphascriptco directory.

```
# # SAP HA Script Connector
# service/halib = /usr/sap/hostctrl/exe/saphascriptco.so
service/halib_cluster_connector = \n/opt/ORCLscsapnetw/saphacmd/bin/sap_orcl_cluster_connector
service/halib_debug_level = 1
```

2 Create the /usr/local/bin directory on every node.

3 Create the following symbolic links in the /usr/local/bin directory on every node

```
# ls -la /usr/local/bin
total 8
drwxr-xr-x 2 root root 4 May 29 02:22 .
drwxr-xr-x 3 root root 3 May 29 02:13 ..lwxrwxrwx 1 root root 48 May 29 02:22 \
functions_sap_ha -> /opt/ORCLscsapnetw/saphacmd/bin/functions_sap_ha
rlwxrwxrwx 1 root root 58 May 29 02:14 \
sap_cluster_connector -> /opt/ORCLscsapnetw/saphacmd/bin/sap_orcl_cluster_connector
```

```
# cd /usr/local/bin
# ln -s /opt/ORCLscsapnetw/saphacmd/bin/functions_sap_ha \
./functions_sap_ha
# ln -s /opt/ORCLscsapnetw/saphacmd/bin/sap_orcl_cluster_connector \n sap_orcl_cluster_connector
```

4 Restart the instances and the corresponding sapstartsrv process.

Once you completed this step, the startsap and stopsap commands will always use the Oracle Solaris Cluster methods.
HA for SAP NetWeaver Extension Properties

Extension properties for HA for SAP NetWeaver resource types are described in the following sections:

- "ORCL.sapcentr Extension Properties" on page 47
- "ORCL.sapdia Extension Properties" on page 49
- "ORCL.saprepenq Extension Properties" on page 52
- "ORCL.saprepenq_preempt Extension Properties" on page 54
- "ORCL.sapstartsrv Extension Properties" on page 55

For details about system-defined properties, see the `r_properties(5)` man page and the `rg_properties(5)` man page.

**ORCL.sapcentr Extension Properties**

The extension properties of the ORCL.sapcentr resource type are as follows:

**Debug_level**
This property indicates the level to which debug messages for the SAP NetWeaver resources are logged. When the debug level is increased, more debug messages are written to the system log `/var/adm/messages` as follows:

0 No debug messages
1 Function Begin and End messages
2 All debug messages and function Begin and End messages

You can specify a different value of the debug_level extension property for each node that can master the resource.

**Data type** Integer

**Default** 0
ORCL_sapcentr Extension Properties

Range 0–2
Tunable Any time

Sap_user
This property indicates the administrative user for an SAP NetWeaver installation.

  Data type  String
  Default   None defined
  Range     Not applicable
  Tunable   When disabled

Sid
This property indicates the SAP NetWeaver System Identifier (SID). This is SAPSYSTEMNAME in the SAP profile.

  Data type  String
  Default   None defined
  Range     Not applicable
  Tunable   When disabled

Instance_name
This property indicates the name of the SAP central service component instance. This is INSTANCE_NAME in the SAP profile.

  Data type  String
  Default   None defined
  Range     Not applicable
  Tunable   When disabled

Instance_number
This property indicates the two-digit SAP system number for the SAP central service component instance. This is SAPSYSTEM in the SAP profile.

  Data type  Number
  Default   None defined
  Range     Not applicable
  Tunable   When disabled

Host
This property indicates the host alias on which the central services are configured.

  Data type  String
Default  None defined
Range    Not applicable
Tunable  When disabled

Start_script
This property indicates the full path to the start script for the instance.

Data type  String
Default    None defined
Range      Not applicable
Tunable    When disabled

Stop_script
This property indicates the full path to the stop script for the instance.

Data type  String
Default    None defined
Range      Not applicable
Tunable    When disabled

Yellow
This property indicates the SAP NetWeaver probe return value for the central services YELLOW status.

Data type  Number
Default    10
Range      1–50
Tunable    Any time

ORCL.sapdia Extension Properties

The extension properties of the ORCL.sapdia resource type are as follows:

Debug_level
This property indicates the level to which debug messages for the SAP NetWeaver resources are logged. When the debug level is increased, more debug messages are written to the system log /var/adm/messages as follows:

0  No debug messages
1  Function Begin and End messages
2  All debug messages and function Begin and End messages

**Data type**  Integer
**Default**  0
**Range**  0–2
**Tunable**  Any time

**Sap_user**
This property indicates the administrative user for an SAP NetWeaver installation.

**Data type**  String
**Default**  None defined
**Range**  Not applicable
**Tunable**  When disabled

**Sid**
This property indicates the SAP NetWeaver System Identifier (SID). This is `SAPSYSTEMNAME` in the SAP profile.

**Data type**  String
**Default**  None defined
**Range**  Not applicable
**Tunable**  When disabled

**Instance_name**
This property indicates the name of the SAP central service component instance. This is `INSTANCE_NAME` in the SAP profile.

**Data type**  String
**Default**  None defined
**Range**  Not applicable
**Tunable**  When disabled

**Instance_number**
This property indicates the two-digit SAP system number for the SAP central service component instance. This is `SAPSYSTEM` in the SAP profile.

**Data type**  Number
**Default**  None defined
**Range**  Not applicable
**Tunable**  When disabled
**Host**
This property indicates the host alias on which the central services are configured.

*Data type*  String
*Default*  None defined
*Range*  Not applicable
*Tunable*  When disabled

**Start_script**
This property indicates the full path to the start script for the instance.

*Data type*  String
*Default*  None defined
*Range*  Not applicable
*Tunable*  When disabled

**Stop_script**
This property indicates the full path to the stop script for the instance.

*Data type*  String
*Default*  None defined
*Range*  Not applicable
*Tunable*  When disabled

**Yellow**
This property indicates the SAP NetWeaver probe return value for the dialog instance YELLOW status.

*Data type*  Integer
*Default*  10
*Range*  1–50
*Tunable*  Any time

**Architecture**
A flag to indicate if a dialogue instance is a combined instance or a normal dialogue instance. The valid values are space or comb.

*Data type*  String
*Default*  None defined
*Range*  Not applicable
*Tunable*  When disabled
The extension properties of this resource type are as follows:

**Debug_level**
This property indicates the level to which debug messages for the SAP NetWeaver resources are logged. When the debug level is increased, more debug messages are written to the system log `/var/adm/messages` as follows:

- `0`: No debug messages
- `1`: Function Begin and End messages
- `2`: All debug messages and function Begin and End messages

**Data type** Number
**Default** 0
**Range** 0–2
**Tunable** Anytime

**Sap_user**
This property indicates the administrative user for an SAP NetWeaver installation.

**Data type** String
**Default** None defined
**Range** Not applicable
**Tunable** When disabled

**Sid**
This property indicates the SAP NetWeaver System Identifier (SID). This is `SAPSYSTEMNAME` in the SAP profile.

**Data type** String
**Default** None defined
**Range** Not applicable
**Tunable** When disabled

**Instance_name**
This property indicates the name of the SAP central service component instance. This is `INSTANCE_NAME` in the SAP profile.

**Data type** String
**Default** None defined
**Range** Not applicable
Instance_number
This property indicates the two-digit SAP system number for the SAP central service component instance. This is SAPSYSTEM in the SAP profile.

Data type Number
Default None defined
Range Not applicable
Tunable When disabled

Host
This property indicates the host alias on which the central services are configured.

Data type String
Default None defined
Range Not applicable
Tunable When disabled

Start_script
This property indicates the full path to the start script for the instance.

Data type String
Default None defined
Range Not applicable
Tunable When disabled

Stop_script
This property indicates the full path to the stop script for the instance.

Data type String
Default None defined
Range Not applicable
Tunable When disabled

Yellow
This property indicates the SAP NetWeaver probe return value for the replicated enqueue services YELLOW status.

Data type Number
Default 10
Range 1–50
ORCL.saprepenq_preempt Extension Properties

The extension properties of this resource type are as follows:

**Debug_level**
This property indicates the level to which debug messages for the SAP NetWeaver resources are logged. When the debug level is increased, more debug messages are written to the system log `/var/adm/messages` as follows:

- 0   No debug messages
- 1   Function Begin and End messages
- 2   All debug messages and function Begin and End messages

**Data type**: Number

**Default**: 0

**Range**: 0–2

**Tunable**: Any time

**Sap_user**
This property indicates the administrative user for an SAP NetWeaver installation.

**Data type**: String

**Default**: None defined

**Range**: Not applicable

**Tunable**: When disabled

**Sid**
This property indicates the SAP NetWeaver System Identifier (SID). This is `SAPSYSTEMNAME` in the SAP profile.

**Data type**: String

**Default**: None defined

**Range**: Not applicable

**Tunable**: When disabled

**Repenqres**
This property indicates the name of the SAP replicated enqueue server resource name.

**Data type**: String
Enq_instnr
This property indicates a list of two-digit SAP system numbers for the SAP central service components in this resource group. This instance number is SAPSYSTEM in the SAP profile.

- **Data type**: String array
- **Default**: None defined
- **Range**: Not applicable
- **Tunable**: When disabled

Timeout_return
This property indicated the return code when the probe method reaches 80 percent of the probe timeout.

- **Data type**: Number
- **Default**: 10
- **Range**: Not applicable
- **Tunable**: Anytime

### ORCL.sapstartsrv Extension Properties

The extension properties of this resource type are as follows:

**Debug_level**
This property indicates the level to which debug messages for the SAP NetWeaver resources are logged. When the debug level is increased, more debug messages are written to the system log /var/adm/messages as follows:

- **0**: No debug messages
- **1**: Function Begin and End messages
- **2**: All debug messages and function Begin and End messages

- **Data type**: Number
- **Default**: 0
- **Range**: 0–2
- **Tunable**: Anytime
Sap_user
This property indicates the administrative user for an SAP NetWeaver installation.

- **Data type**: String
- **Default**: None defined
- **Range**: Not applicable
- **Tunable**: When disabled

Sid
This property indicates the SAP NetWeaver System Identifier (SID). This is SAPSYSTEMNAME in the SAP profile.

- **Data type**: String
- **Default**: None defined
- **Range**: Not applicable
- **Tunable**: When disabled

Instance_name
This property indicates the name of the SAP central service component instance. This is INSTANCE_NAME in the SAP profile.

- **Data type**: String
- **Default**: None defined
- **Range**: Not applicable
- **Tunable**: When disabled

Instance_number
This property indicates the two-digit SAP system number for the SAP central service component instance. This is SAPSYSTEM in the SAP profile.

- **Data type**: Number
- **Default**: None defined
- **Range**: Not applicable
- **Tunable**: When disabled

Timeout_return
This property indicates the return code when the probe method of the sapstartsrv process reaches 80 percent of the probe timeout.

- **Data type**: Number
- **Default**: 10
**Host**

This property indicates the host alias on which the central services are configured.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data type</strong></td>
<td>String</td>
</tr>
<tr>
<td><strong>Default</strong></td>
<td>None</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>1–50</td>
</tr>
<tr>
<td><strong>Tunable</strong></td>
<td>When disabled</td>
</tr>
</tbody>
</table>
Deployment Example: How to Configure the Oracle Solaris Cluster HA for SAP NetWeaver Agent

This example shows how to install a dual stack with enqueue replication on a two-node cluster consisting of the nodes pbono1 and pbono2. The chosen enqueue replication model requires different instance numbers between central services and the replicated enqueue server.

In this example, the primary application instance is installed in a failover resource group. Two additional dialog instances are deployed on the physical hosts, pbono1 and pbono2, in a multiple-master resource group.

Pick a database that can be made highly available. Depending on your choice, you might need a different resource group layout for the database.

The logical host are as follows:

- pbono1 — Central services
- pbono2 — Database
- pbono3 — Replicated enqueue server
- pbono4 — Primary application instance

The following instance numbers will be installed.

- 00 — Central services for ABAP
- 01 — Central services for Java
- 10 — Replicated enqueue server ABAP
- 11 — Replicated enqueue server Java
- 02 — Primary application instance
- 03 — Additional dialogue instance on pbono1
- 04 — Additional dialogue instance on pbono2

You need the following resource groups:

- Database — db - rg (failover)
- Central services — s cs - rg (failover/positive affinity for rep - rg)
- Replicated enqueue services — rep - rg (failover)
- Primary application instance — pas - rg (failover)
- Additional application instance — dia-rg (multiple masters)

How to Prepare the Hosts

1. On all hosts, add modifications for SAP to the /etc/system directory and reboot.
   
   ```
   # set rlim_fd_cur=8192
   ```

2. For 7.3, add 40 GBytes swap space per node.

3. Add a fully qualified domain name to all hostnames and logical hosts in the /etc/hosts directory.

4. Add the following groups.

   ```
   # groupadd -g 700 sapinst
   # groupadd -g 701 sapsys
   # groupadd -g 702 sdba
   ```

5. Add the users as follows:

   ```
   # useradd -o -u 0 -g 1 -d / -c "validation" -s /bin/tcsh emroot
   ```
   
   On Oracle Solaris 10:
   
   ```
   # useradd -o -u 699 -g 1 -d / -c "validation" -s /bin/tcsh emroot
   # useradd -u 700 -g 701 -m -d /export/qe3adm \ 
   -c "SAP system administrator" -s /bin/tcsh qe3adm
   # useradd -u 701 -g 702 -m -d /export/sdb \ 
   -c "SAPDB software owner" -s /bin/tcsh sdb
   # useradd -u 702 -g 701 -m -d /export/sqdqe3 \ 
   -c "Owner of the database instance QE3" -s /bin/tcsh sqdqe3
   # useradd -u 703 -g 701 -m -d /export/sapadm \ 
   -c "SAP system administrator" -s /bin/tcsh sapadm
   # useradd -u 704 -g 701 -m -d /export/daaadm \ 
   -c "owner of the instance DAA" -s /bin/tcsh daaadm
   ```

   Depending on the database of your choice, you might need different users other than sdb and sqdqe1.

6. Place all the users except sdb and emroot in the sapinst group.

   You must place sqdqe3 in the sdba group. Whether you need the sdb user or others will depend on the database that you choose.

7. Give daaadm a password that is the same as the master password you will choose later on.

---

**Note** — On all nodes, QE3 is the SAP system name in this example.

---

Do not give a password to the sdb user.

8. Add the users, qe3adm and sapadm, to the sapinst group in the /etc/group directory.

9. Add the user, sqdqe3, to the sdba group in the /etc/group directory.

10. Define the project for QE3 on all the nodes.

   ```
   QE3:223: SAP System QE3:daaadm,emroot,qe3adm,sapadm,\ 
   sdb,sqdqe3::process.max-file-descriptor=(basic,65536,deny) \ 
   ```
11. Define the project in the /etc/user_attr directory on all the nodes.

qe3adm::::project=QE3
sqdqe3::::project=QE3
sdb::::project=QE3
emroot::::project=QE3
sapadm::::project=QE3

12. Give the sidadm user cluster administration rights on all the nodes.

# usermod -A solaris.cluster.admin qe3adm # for 7.30 (kernel 7.20_EXT)

Note – If you want to do the installation as root, root must have project limits of QE3. On Oracle Solaris 10 systems, the alternative to the root user is sudo su as UID 0 will not work for emroot. The alternate user requires a modification in the /etc/sudoers directory.

The following links are assumed on the global mount at /sapstore.

# mkdir /sapstore/sap
# mkdir /sapstore/sapmnt
# mkdir /sapstore/sapdb
# ln -s /sapstore/sapdb /sapdb
# ln -s /sapstore/sap /usr/sap
# ln -s /sapstore/sapmnt /sapmnt

This example is based on a lab storage layout. On production systems, the process will be different. In this example, you need only one HAStoragePlus resource. On production systems, you will need a different layout.

How to Create Resource Groups

1. Create a resource group scs-rg containing the HAStoragePlus resource, and a logical host to contain the central services like the message server, the enqueue server, and a logical host.

2. Ensure that the resource group containing the HAStoragePlus resource is online on the node where you want to install SAP.

3. Set the AffinityOn property to TRUE, if it is not done already.

   # clrt register HAStoragePlus
   # clrg create scs-rg
   # clrslh create -g scs-rg bono-1
   Note: Create the HAStoragePlus resource here, if appropriate.
   # clrg online -eM +

4. Create a resource group with a logical host db-rg, to contain the database.

   # clrg create db-rg
   # clrslh create -g db-rg bono-2
   Note: Create the HAStoragePlus resource here, if appropriate.
   # clrg online -eM db-rg
5. Create a resource group with a logical host rep-rg, to contain the replicated enqueue server.

   # clrg create rep-rg
   # clrlsh create -g rep-rg bono-3
   Note: Create the HASToragePlus resource here, if appropriate.
   # clrg online -eM rep-rg

6. Set the affinity from scs-rg to rep-rg.

   # clrg set -p rg_affinities=+rep-rg scs-rg

7. Create a resource group with a logical host pas-rg, to contain the primary application instance DVBEMGS02.

   # clrg create pas-rg
   # clrlsh create -g pas-rg bono-4
   Note: Create the HASToragePlus resource here, if appropriate.
   # clrg online -eM pas-rg

8. Create a multiple-master resource group dia-rg, for the additional application instances.

   # clrg create -p maximum_primaries=2 -p desired_primaries=2 dia-rg

9. Ensure that no logical host is deprecated.

   For all deprecated interfaces of the logical hosts, do the following:
   ifconfig if deprecated up

Notes about SAP installation

- Install SAP in the layout of your choice.
- Install everything on one node of the cluster and redistribute it when you create the resources. If you run the installation in a VNC session, log in as emroot to get the right project
- Configure all logical hosts as not deprecated.
- All DVDs must be on a local drive. Before you install additional dialog instances, bring the previous instances and the database under cluster control. However, do not test the failover.
- After the installation, copy the /etc/services directory on all nodes.
- Copy all the user home directories to all the nodes, including daadm.
- Set the interfaces of the logical host to deprecated. For example:
  ifconfig nge0:1 deprecated up

Configure SAP for the Java stack

As long as the JAVA stack does not detect that the database is online on a remote node, unset the database start from the application instance's start profile.

   # Start_Program_00 = immediate $(DB)

Configure SAP for the enqueue server
To recover the enqueue replication after network outages, add the following to the instance profile of the enqueue replication server.

```
# enque/enrep/keepalive_count = 1
```

Register the resource types

```
# clrt register sapstartsrv
# clrt register sapcentr
# clrt register saprepenq
# clrt register sapdia
# clrt register saprepenq_preempt
```

Make the database highly available

Follow the instructions in the appropriate Oracle Solaris Cluster documentation. Name the database as db-rs.

Register the SAP resources with the appropriate commands

Follow the instructions in the appropriate Oracle Solaris Cluster documentation. Name the database as db-rs.

Create the sapstartsrv resource for the ABAP central services resource

As qe3adm:

- call stopsap r3 ASCS00 bono-1
- kill the sapstartsrv process for the instance ASCS00

```
# clrs create -d -g scs-rg -t sapstartsrv \    
-p sid=QE3 \    
-p sap_user=qe3adm \    
-p instance_number=00 \    
-p instance_name=ASCS00 \    
-p HOST=bono-1 \    
-p timeout_return=20 \    
-p debug_level=0 \    
-p resource_dependencies_offline_restart=hsp-rs \    
-abapscs-strt-rs
```

Create the ABAP central services resource

```
# clrs create -d -g scs-rg -t sapcentr \    
-p sid=QE3 \    
-p sap_user=qe3adm \    
-p instance_number=00 \    
-p instance_name=ASCS00 \    
-p HOST=bono-1 \    
-p yellow=20 \    
-p debug_level=0 \    
-p resource_dependencies_offline_restart=hsp-rs \    
-p resource_dependencies=db-rs,abapscs-strt-rs \    
-abapscs-rs
# clrg online -eM +
Create the sapstartsrv resource for the JAVA Central Services Resource

As qe3adm:

- call stopsap r3 SCS00 bono-1
- kill the sapstartsrv process for the instance SCS01

```
# clrs create -d -g scs-rg -t sapstartsrv \\
  -p sid=QE3 \\
  -p sap_user=qe3adm \\
  -p instance_number=01 \\
  -p instance_name=SCS01 \\
  -p HOST=bono-1 \\
  -p timeout_return=20 \\
  -p debug_level=0 \\
  -p resource_dependencies_offline_restart=hsp-rs
  javascs-strt-rs
```

Create the JAVA central services resource

```
# clrs create -d -g scs-rg -t sapcentr \\
  -p sid=QE3 \\
  -p sap_user=qe3adm \\
  -p instance_number=01 \\
  -p instance_name=SCS01 \\
  -p HOST=bono-1 \\
  -p yellow=20 \\
  -p debug_level=0 \\
  -p resource_dependencies_offline_restart=hsp-rs
  -p resource_dependencies=db-rs,javascs-strt-rs
  javascs-rs
# clrg online -eM +
```

Create the sapstartsrv resource for the ABAP replicated enqueue service

As qe3adm:

- call stopsap r3 ERS10 bono-3
- kill the sapstartsrv process for the instance ERS10

```
# clrs create -d -g rep-rg -t sapstartsrv \\
  -p sid=QE3 \\
  -p sap_user=qe3adm \\
  -p instance_number=10 \\
  -p instance_name=ERS10 \\
  -p HOST=bono-3 \\
  -p timeout_return=20 \\
  -p debug_level=0 \\
  -p resource_dependencies_offline_restart=hsp-rs
  abaprep-strt-rs
```

Create the ABAP replicated enqueue service resource

```
#/usr/cluster/bin/clrs create -d -g rep-rg -t saprepenq \\
  -p sid=QE3 \\
  -p sap_user=qe3adm \\
```
-p instance_number=10 \  
-p instance_name=ERS10 \  
-p HOST=bono-3 \  
-p debug_level=0 \  
-p resource_dependencies_offline_restart=hsp-rs \  
-p resource_dependencies=abapscs-rs,abaprep-strt-rs \  
abaprep-rs 
# clrg online -eM +

Create the sapstartsrv resource for the JAVA replicated enqueue service

As qe3adm:

- call stopsap r3 ERS11 bono-3
- kill the sapstartsrv process for the instance ERS11

# clrs create -d -g rep-rg -t sapstartsrv \
-p sid=QE3 \
-p sap_user=qe3adm \
-p instance_number=11 \
-p instance_name=ERS11 \
-p HOST=bono-3 \
-p timeout_return=20 \
-p debug_level=0 \
-p resource_dependencies_offline_restart=hsp-rs \
javarep-strt-rs

Create the JAVA replicated enqueue resource

# /usr/cluster/bin/clrs create -d -g rep-rg -t saprepenq \
-p sid=QE3 \
-p sap_user=qe3adm \
-p instance_number=11 \
-p instance_name=ERS11 \
-p HOST=bono-3 \
-p debug_level=0 \
-p resource_dependencies_offline_restart=hsp-rs \
-p resource_dependencies=javascs-rs,javarep-strt-rs \
javarep-rs 
# clrg online -eM +

Create the replicated pre-empter

# /usr/cluster/bin/clrs create -d -g sscs-rg -t saprepenq_preempt \
-p sid=QE3 \
-p sap_user=qe3adm \
-p repenqres=abaprep-rs \
-p enq_instnr=00,01 \ 
-p debug_level=0 \
-p resource_dependencies_offline_restart=hsp-rs,abapscs-rs,javascs-rs \
-p resource_dependencies=db-rs \ 
preempt-rs

Create the sapstartsrv resource for the primary application server resource

As qe3adm:
call stopsap r3 DVEBMGS02 bono-4
kill the sapstartsrv process for the instance DVEBMGS02

# /usr/cluster/bin/clrs create -d -g pas-rg -t sapstartsrv \
-p sid=QE3 \
-p sap_user=qe3adm \
-p instance_number=02 \
-p instance_name=DVEBMGS02 \
-p HOST=bono-4 \
-p timeout_return=20 \
-p debug_level=0 \
-p resource_dependencies_offline_restart=./hsp-rs \
pas-strt-rs

Create the primary application server resource

# /usr/cluster/bin/clrs create -d -g pas-rg -t sapdia \
-p sid=QE3 \
-p sap_user=qe3adm \
-p instance_number=02 \
-p instance_name=DVEBMGS02 \
-p HOST=bono-4 \
-p debug_level=0 \
-p resource_dependencies_offline_restart=./hsp-rs \
pas-rs
# clrg online -eM +

Create the sapstartsrv resource for the additional application server

On the first node, as qe3adm:

- call stopsap r3 D03
- kill the sapstartsrv process for the instance D03

On the second node, as qe3adm:

- call stopsap r3 D04
- kill the sapstartsrv process for the instance D04

# /usr/cluster/bin/clrs create -d -g dia-rg -t sapstartsrv \
-p sid=QE3 \
-p sap_user=qe3adm \
-p instance_number(pbono1)=03 \
-p instance_number(pbono2)=04 \
-p instance_name(pbono1)=D03 \
-p instance_name(pbono2)=D04 \
-p timeout_return=20 \
-p debug_level=0 \
-p resource_dependencies_offline_restart=./hsp-rs \
dia-strt-rs

Create the additional application server resource
# /usr/cluster/bin/clrs create -d -g dia-rg -t sapdia \
- p sid=QE3 \
- p sap_user=qe3adm \
- p instance_number{pbono1}=03 \
- p instance_number{pbono2}=04 \
- p instance_name{pbono1}=D03 \
- p instance_name{pbono2}=D04 \
- p HOST{pbono1}=pbono1 \ 
- p HOST{pbono2}=pbono2 \ 
- p debug_level=0 \ 
- p resource_dependencies_offline_restart=hsp-rs \ 
- p resource_dependencies=db-rs,abapscs-rs,javascs-rs,dia-strt-rs \ 
- p resource_dependencies= dia-rs \
# clrg online -eM +

How to Integrate Oracle Solaris Cluster Management and SAP Instance Management

Download and install the latest hostagent.

1. Configure every instance profile with the following lines, assuming that saphascriptco.co is in the /usr/sap/hostctrl/exe/saphascriptco directory.

   # # SAP HA Script Connector #
   service/halib = /usr/sap/hostctrl/exe/saphascriptco.so
   service/halib_cluster_connector = /opt/ORCLscsapnetw/saphacmd/bin/sap_orcl_cluster_connector
   service/halib_debug_level = 1

2. Create the /usr/local/bin directory on every node.

3. Create the following symbolic links under the /usr/local/bin directory on every node.

   # ls -1a /usr/local/bin
   total 8
   drwxr-xr-x 2 root root 4 May 29 02:22 .
   drwxr-xr-x 3 root root 3 May 29 02:13 ..
   lrwxrwxrwx 1 root root 4 May 29 02:22 /functions_sap_ha -> /opt/ORCLscsapnetw/saphacmd/bin/functions_sap_ha
   lrwxrwxrwx 1 root root 58 May 29 02:14 /sap_cluster_connector -> /opt/ORCLscsapnetw/saphacmd/bin/sap_orcl_cluster_connector

4. Restart the instances and the corresponding sapstartsrv process.

Generic test case

For all sapstartsrv resources, kill the sapstartsrv process. The underlying instance will be restarted as well.

For all instance resources, kill the instance processes. The underlying instance will be restarted or failed over in case of a central service.
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