



Sun Cluster Data Service for SAP Web Application Server Guide for Solaris OS

SPARC Platform Edition

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Preface

Sun Cluster Data Service for SAP Web Application Server Guide for Solaris OS explains how to install and configure Sun™ Cluster HA for SAP Web Application Server.

This document is intended for system administrators with extensive knowledge of Sun 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 document assume knowledge of the Solaris™ Operating System (Solaris OS) and expertise with the volume manager software that is used with Sun Cluster.

UNIX Commands

This document contains information about commands that are specific to installing and configuring Sun 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 Solaris Operating System
- Solaris Operating System man pages
- Other software documentation that you received with your system

Typographic Conventions

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

TABLE P-1 Typographic Conventions

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

Shell Prompts in Command Examples

The following table shows the default system prompt and superuser prompt for the C shell, Bourne shell, and Korn shell.

TABLE P-2 Shell Prompts

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

TABLE P-2 Shell Prompts (Continued)

Shell	Prompt
Bourne shell and Korn shell superuser prompt	#

Related Documentation

Information about related Sun Cluster topics is available in the documentation that is listed in the following table. All Sun Cluster documentation is available at <http://docs.sun.com>.

Topic	Documentation
Data service administration	<i>Sun Cluster Data Services Planning and Administration Guide for Solaris OS</i> Individual data service guides
Concepts	<i>Sun Cluster Concepts Guide for Solaris OS</i>
Overview	<i>Sun Cluster Overview for Solaris OS</i>
Software installation	<i>Sun Cluster Software Installation Guide for Solaris OS</i>
System administration	<i>Sun Cluster System Administration Guide for Solaris OS</i>
Hardware administration	<i>Sun Cluster 3.0-3.1 Hardware Administration Manual for Solaris OS</i> Individual hardware administration guides
Data service development	<i>Sun Cluster Data Services Developer's Guide for Solaris OS</i>
Error messages	<i>Sun Cluster Error Messages Guide for Solaris OS</i>
Command and function reference	<i>Sun Cluster Reference Manual for Solaris OS</i>

For a complete list of Sun Cluster documentation, see the release notes for your release of Sun Cluster at <http://docs.sun.com>.

Related Third-Party Web Site References

Third-party URLs that are referenced in this document provide additional related information.

Note – Sun is not responsible for the availability of third-party web sites mentioned in this document. Sun does not endorse and is not responsible or liable for any content, advertising, products, or other materials that are available on or through such sites or resources. Sun will not be responsible or liable for any actual or alleged damage or loss caused or alleged to be caused by or in connection with use of or reliance on any such content, goods, or services that are available on or through such sites or resources.

Documentation, Support, and Training

Sun Function	URL	Description
Documentation	http://www.sun.com/documentation/	Download PDF and HTML documents, and order printed documents
Support and Training	http://www.sun.com/supporttraining/	Obtain technical support, download patches, and learn about Sun courses

Product Training

Sun Microsystems offers training in many Sun technologies through a variety of instructor-led courses and self-paced courses. For information about the training courses that Sun offers and to enroll in a class, visit Sun Training at <http://training.sun.com/>.

Getting Help

If you have problems installing or using Sun 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 and serial numbers of your systems
- The release number of the Solaris Operating System (for example, Solaris 8)
- The release number of Sun Cluster (for example, Sun Cluster 3.0)

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

Command	Function
<code>prtconf -v</code>	Displays the size of the system memory and reports information about peripheral devices
<code>psrinfo -v</code>	Displays information about processors
<code>showrev -p</code>	Reports which patches are installed
SPARC: <code>prtdiag -v</code>	Displays system diagnostic information
<code>scinstall -pv</code>	Displays Sun Cluster release and package version information

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

Installing and Configuring Sun Cluster HA for SAP Web Application Server

This chapter explains how to install and configure Sun Cluster HA for SAP Web Application Server.

This chapter contains the following sections.

- “Sun Cluster HA for SAP Web Application Server Overview” on page 13
- “Overview of the Installation and Configuration Process for Sun Cluster HA for SAP Web Application Server” on page 16
- “Planning the Sun Cluster HA for SAP Web Application Server Installation and Configuration” on page 17
- “Installing and Configuring SAP Web Application Server” on page 22
- “Verifying the SAP Web Application Server Installation and Configuration” on page 37
- “Installing the Sun Cluster HA for SAP Web Application Server Packages” on page 46
- “Registering and Configuring Sun Cluster HA for SAP Web Application Server” on page 48
- “Using Alternate Project Identification” on page 65
- “Tuning the Sun Cluster HA for SAP Web Application Server Fault Monitors” on page 65
- “Verifying the Sun Cluster HA for SAP Web Application Server Installation and Configuration” on page 68
- “Debugging Sun Cluster HA for SAP J2EE Engine” on page 76

Sun Cluster HA for SAP Web Application Server Overview

The SAP Web Application Server platform consists of the following components:

- Relational database management system (RDBMS)

- SAP central services, which include these servers:
 - SAP enqueue server
 - SAP message server
 - SAP replica server

The SAP replica server is logically part of the SAP central services, although it always runs on a different node from the other servers in the SAP central services.
- SAP web application server component, in one the following configurations:
 - ABAP engine component
 - ABAP engine component and add-in SAP J2EE™ engine component
 - Stand-alone SAP J2EE engine component

If the configuration includes both the ABAP engine and the SAP J2EE engine, two SAP central services components exist.



Caution – For a detailed description of the SAP Web Application Server platform, see the version of the SAP document *SAP Web Application Server in Switchover Environments, UNIX Platforms* that corresponds to your version of the platform. In particular, study the section that provides an overview of the architecture of the SAP Web Application Server to be certain that you understand the basic concepts of your version of the SAP Web Application Server.

For example, with SAP Netweaver 04, the architecture of the SAP Web Application Server components (such as SAP enqueue server and SAP message server) changed significantly. Therefore, when running in the Sun Cluster environment, these components must be configured differently from previous versions of the platform.

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

The SAP web application server component of the platform can be configured either as a failover or as a scalable data service. The SAP J2EE engine component can also be configured either as failover or as scalable. The other components must be configured as failover data services.

For conceptual information about failover services and scalable services, see the *Sun Cluster Concepts Guide for Solaris OS*.

Each component of the SAP Web Application Server platform has a data service that protects the component in a Sun Cluster configuration, as described in the following table.

TABLE 1 Protection of SAP Web Application Server Components by Sun Cluster Data Services

SAP Web Application ServerComponent	Data Service
SAP enqueue server	Resource type for SAP enqueue server in Sun Cluster HA for SAP Web Application Server. The resource type is SUNW . sapenq.
SAP replica server	Resource type for SAP replica server in Sun Cluster HA for SAP Web Application Server. The resource type is SUNW . saprepl.
SAP message server	Resource type for SAP message server in Sun Cluster HA for SAP Web Application Server. The resource type is SUNW . sapscs.
SAP web application server	Resource type for SAP web application server component in Sun Cluster HA for SAP Web Application Server. The resource type is SUNW . sapwebas.
Stand-alone SAP J2EE engine	The resource for the SAP Web Application Server stack that is designated for Java™ software only. The resource type is SUNW . gds.
Database	The data service for the database that you are using, for example: <ul style="list-style-type: none"> ■ For the SAP DB database, the data service is Sun Cluster HA for SAP DB. See <i>Sun Cluster Data Service for SAP DB Guide for Solaris OS</i>. ■ For the Oracle database, the data service is Sun Cluster HA for Oracle. See <i>Sun Cluster Data Service for Oracle Guide for Solaris OS</i>.
NFS file system	Sun Cluster HA for NFS. For more information about this data service, see <i>Sun Cluster Data Service for NFS Guide for Solaris OS</i> .

Overview of the Installation and Configuration Process for Sun Cluster HA for SAP Web Application Server

The following table summarizes the tasks for installing and configuring Sun Cluster HA for SAP Web Application Server 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 2 Tasks for Installing and Configuring Sun Cluster HA for SAP Web Application Server

Task	For Instructions, Go To ...
Plan the SAP Web Application Server installation	Your SAP documentation <i>Sun Cluster Data Services Planning and Administration Guide for Solaris OS</i> "Planning the Sun Cluster HA for SAP Web Application Server Installation and Configuration" on page 17
Install SAP Web Application Server and configure the application to run in a cluster	"Installing and Configuring SAP Web Application Server" on page 22
Verify the SAP Web Application Server installation and configuration	"Verifying the SAP Web Application Server Installation and Configuration" on page 37
Install the Sun Cluster HA for SAP Web Application Server packages	"Installing the Sun Cluster HA for SAP Web Application Server Packages" on page 46
Register and configure the Sun Cluster HA for SAP Web Application Server data service	"Registering and Configuring Sun Cluster HA for SAP Web Application Server" on page 48
(Optional) Use alternate project identifier (ID)	"Using Alternate Project Identification" on page 65
(Optional) Tune the Sun Cluster HA for SAP Web Application Server fault monitors	"Tuning the Sun Cluster HA for SAP Web Application Server Fault Monitors" on page 65
Verify the Sun Cluster HA for SAP Web Application Server installation and configuration	"Verifying the Sun Cluster HA for SAP Web Application Server Installation and Configuration" on page 68
(Optional) Activate debugging for the SAP J2EE engine	"Debugging Sun Cluster HA for SAP J2EE Engine" on page 76

Planning the Sun Cluster HA for SAP Web Application Server Installation and Configuration

This section contains the information that you need to plan your Sun Cluster HA for SAP Web Application Server installation and configuration.

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

Be sure to read all SAP notes that pertain to your release of SAP Web Application Server.

Configuration Restrictions



Caution – Configuration restrictions are planned and are related to design decisions. 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 Sun Cluster at <http://docs.sun.com>. The following configuration restriction applies only to Sun Cluster HA for SAP Web Application Server.

The following configuration restrictions apply only to Sun Cluster HA for SAP Web Application Server.

- 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 enqueue server 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 enqueue server resource, you must ensure that the value of the `restart_type` extension property for Sun 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 replica server is configured and online on another node, the SAP enqueue server cannot 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 Sun Cluster Data Services” in *Sun Cluster Data Services Planning and Administration Guide for Solaris OS*.

The following configuration requirements apply only to Sun Cluster HA for SAP Web Application Server.

- The fault monitor probe for the resource type of the SAP message server requires the `msprot` program. You must download this binary from `service.sap.com`. Refer to the relevant SAP note for information about obtaining and using the `msprot` program.
- If you are using the SAP Web Application Server stack that is designated for Java only, the following requirement applies.

The Sun Cluster HA for SAP Web Application Server data service provides a configuration file and registration script that ensure that the SAP J2EE engine is configured correctly within Sun Cluster. The configuration file is located in `/opt/SUNWscswa/util/ha_sap_j2ee_config`. The registration script is located in `/opt/SUNWscswa/util/ha_sap_j2ee_register`. This file and this script are used during the registration and configuration of Sun Cluster HA for SAP Web Application Server.

Supported Data Service Configurations

Sun Cluster HA for SAP Web Application Server supports configurations that conform to the requirements that are specified in the previous section.

All configurations of Sun Cluster HA for SAP Web Application Server have the following requirements:

- The SAP enqueue server is configured as a failover resource.

- The SAP replica server is configured as a failover resource.
- The SAP message server is configured as a failover resource.
- The SAP web application server component can be configured either as a failover or as a scalable data service resource.
- The SAP J2EE engine can be configured either as a failover or as a scalable data service resource.
- The SAP enqueue server and the SAP message server are resources in the SAP central services resource group. The SAP replica server is a resource in the SAP replica server resource group.
- The SAP replica server resource is configured to depend on the SAP enqueue server resource. This dependency ensures that the SAP replica server does not attempt to start until the SAP enqueue server is online.
- The SAP central services resource group is configured to have weak *positive* affinity with the SAP replica server resource group. This affinity ensures that, if a hardware or software failure occurs on the node that is mastering the SAP central services resource group, the SAP central services resource group fails over to the node where the SAP replica server resource group is currently running.
- The SAP replica 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.

The following examples show the following supported configurations of Sun Cluster HA for SAP Web Application Server.

- The SAP web application server component is configured as a failover resource.
- The SAP web application server component is configured as a scalable resource.

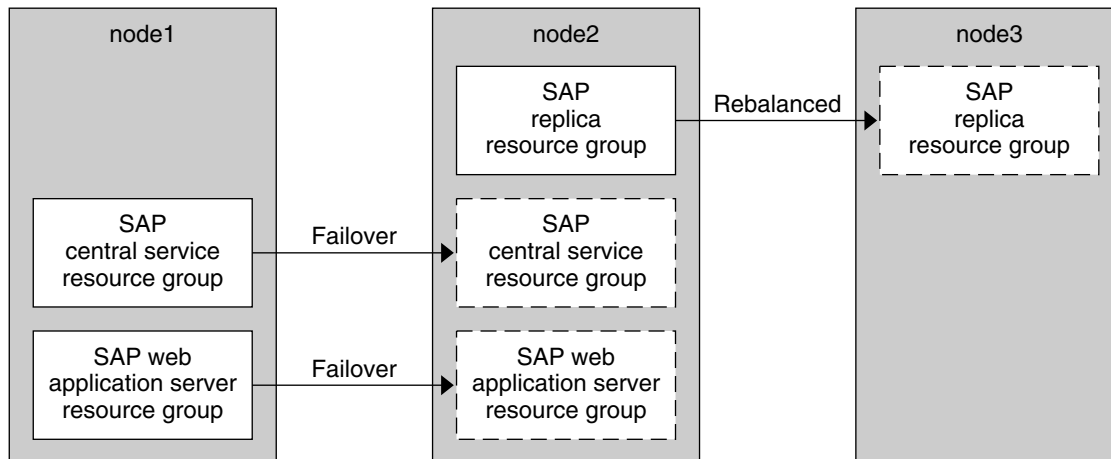
EXAMPLE 1 SAP Web Application Server Component Configured as a Failover Resource

This example shows a standard configuration of Sun Cluster HA for SAP Web Application Server with the SAP web application server component that is configured as a failover resource.

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 replica server resource group consequently moves to another node. The SAP web application server component resource group also fails over.

EXAMPLE 1 SAP Web Application Server Component Configured as a Failover Resource (Continued)

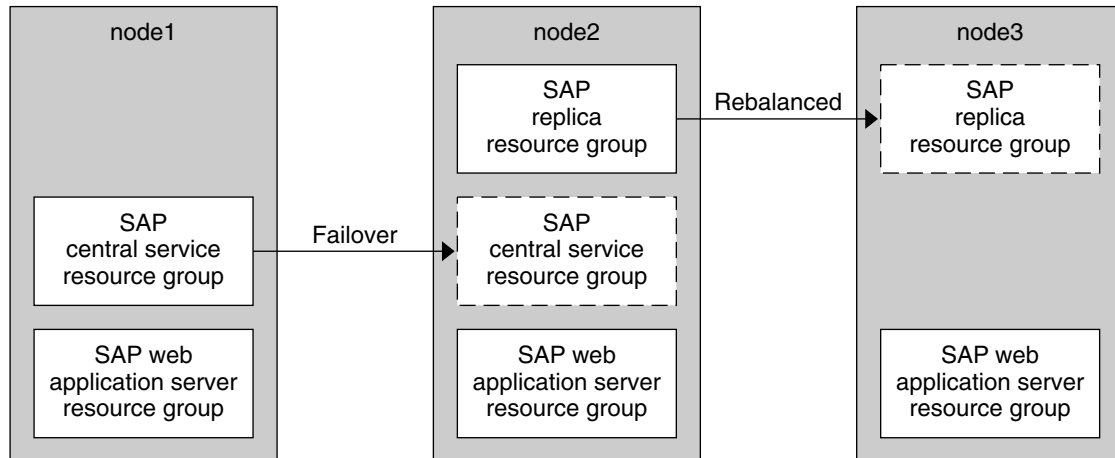


EXAMPLE 2 SAP Web Application Server Component Configured as a Scalable Resource

This example shows a standard configuration of Sun Cluster HA for SAP Web Application Server with the SAP web application server component that is configured as a scalable resource.

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. As in the previous example, the SAP central services resource group fails over, and the SAP replica server resource group consequently moves to another node. Because the SAP web application server component resource group is scalable, it does not fail over, but the corresponding resource groups on the other node continue running.



Configuration Considerations

The following configuration considerations affect the installation and configuration of Sun Cluster HA for SAP Web Application Server.

- 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 Sun Cluster Data Services” in *Sun Cluster Data Services Planning and Administration Guide for Solaris OS*. This section details the advantages and disadvantages of placing the SAP binaries on the local file system or on the cluster file system.
- The default value of the `Retry_count` system property for the SAP enqueue server is 0. This value ensures that the SAP enqueue server fails over after the first failure. If replication is running, do *not* modify this default value because enqueue locks would be lost. When replication is in operation and the Enqueue server is restarted, even on the same node, the locks are no longer valid.
- The resource group for the SAP web application server component can be configured to be a failover resource group or a scalable resource group. If the SAP web application server component is configured to be a scalable resource group, the directory `/usr/sap/SAPSID/INSTANCE_NAME` must be local on each node where the SAP web application server component is installed, as explained in [“How to Modify the Installation for a Scalable SAP Web Application Server”](#)

Component” on page 29. Note that *SAPSID* represents the SAP system identification and *INSTANCE_NAME* represents the name of the SAP web application server instance.

- 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.
- For each new installation, the SAP start and stop scripts are overwritten. Therefore, be sure to modify these scripts as needed at each new installation.

Configuration Planning Questions

Use the questions in this section to plan the installation and configuration of Sun Cluster HA for SAP Web Application Server. Write the answers to these questions in the space that is provided on the data service worksheets in “Configuration Worksheets” in *Sun Cluster Data Services Planning and Administration Guide for Solaris OS*.

- Will you run the SAP web application server component of the application as a failover resource or as a scalable resource?
- Will you run the SAP J2EE engine as a failover resource or as a scalable resource?
- What is the logical host name for clients that will access the data service?
- Where will the system configuration files reside?

See “Configuration Guidelines for Sun Cluster Data Services” in *Sun Cluster Data Services Planning and Administration Guide for Solaris OS* 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 Web Application Server

To enable Sun Cluster HA for SAP Web Application Server to make SAP Web Application Server highly available, additional installation and configuration operations are required. These operations supplement the standard installation and standard configuration of the SAP Web Application Server.

The procedures in this section describe the installation and configuration of the following components of the SAP Web Application Server.

- SAP central services, which include these services:
 - SAP enqueue server

- SAP replica server
- SAP message server
- SAP web application server component
- SAP J2EE engine

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 Sun Cluster Data Services document for the database that you plan to use.

- If you plan to use SAP DB as the database, configure the Sun Cluster HA for SAP DB data service. See *Sun Cluster Data Service for SAP DB Guide for Solaris OS*.
- If you plan to use Oracle as the database, configure the Sun Cluster HA for Oracle data service. See *Sun Cluster Data Service for Oracle Guide for Solaris OS*.

▼ How to Install and Configure the SAP Web Application Server and the SAP J2EE Engine

- Steps**
1. **On one node of the cluster, install the SAP Web Application Server software.**
Refer to the SAP installation documentation.
 2. **On the same node, if you are using the SAP J2EE engine, install the SAP J2EE engine software.**
Refer to the SAP installation documentation.
 3. **Create profiles for the SAP enqueue server and the SAP replica server.**
Refer to the SAP document *SAP Web Application Server in Switchover Environments, UNIX Platforms*.

Note – The SAPHSYSTEM parameter in the SAP enqueue server profile and in the SAP replica server profile must have the same value.

4. **Remove the startup of the SAP enqueue server from the SAP start profile.**
In the Sun Cluster environment, the SAP enqueue server resource starts the SAP enqueue server application. Therefore, if the SAP start profile contains the startup of the SAP enqueue server, remove it. Otherwise, the SAP enqueue server will be started more than once.

5. **If the Process Monitor Facility (PMF) will be used with the SAP web application server component, the `saposcol` program must be started outside of the cluster environment on all the nodes that will run the SAP Web Application Server.**

The `SUNW.sapwebas` resource type represents the SAP web application server component in a Sun Cluster configuration. The extension property `Webas_Use_Pmf` for this resource type determines if PMF will be used with the SAP web application server component.

If PMF is used, you must start the `saposcol` program outside of the cluster environment so that PMF does not stop the `saposcol` program when it stops the resource for the SAP web application server component.

The `saposcol` program must be available to all the nodes that are running the SAP Web Application Server. Therefore, the program must be either in a global file system or in the local file system of each node.

- a. **If the `saposcol` program is on the global file system and you want it to be on the local file systems, copy the program to the local file systems by performing the following actions on each node:**

- On the installation node, if the `saposcol` program was started separately, stop the `saposcol` program.
- If the SAP system is running, stop the SAP system.
- If the file system is not mounted, mount it to the installation node.
- Copy the `saposcol` executable file from the installation node to a local directory on the target node.

```
# cp /usr/sap/SAPSID/SYS/exe/saposcol destination-directory
```

Note that `SAPSID` is the SAP system identification.

- b. **Remove the startup of the `saposcol` program from the SAP start script of the SAP web application server component that will be configured to use PMF. This action is also mentioned in [Step 9](#), together with other modifications to the SAP start and stop scripts.**

- c. **Start the `saposcol` program.**

- If the program is on the global file system, start the program from the global location.
- If the program is on the local file system, start the program from the local directory on each node.

6. **Create a script to return logical host names for the SAP message server and the SAP web application server components.**

Create a script named `loghost`, which returns the logical host names for each instance of both the SAP message server and the SAP web application server components. The script must be located in the directory `$HOME`, where `$HOME`

specifies the home directory of the SAP user. The following commands provide an example of the `loghost` script.

```
if [ "$1" = "DVEBMGS00" ]; then
    echo loghost-1;
fi
if [ "$1" = "SCS01" ]; then
    echo loghost-2;
fi
if [ "$1" = "D02" ]; then
    echo loghost-3;
fi
```

Note – If the SAP web application server component is configured as a scalable resource, you will modify this script in a later section, [“How to Modify the Installation for a Scalable SAP Web Application Server Component”](#) on page 29.

7. If you are using the SAP J2EE engine, modify the `loghost` script to return logical host names for the SAP J2EE engine.

Modify the script `loghost`, which was created in [Step 6](#), to return the logical host names for each instance of the SAP J2EE engine. The script is located in the directory `$HOME`, where `$HOME` specifies the home directory of the SAP user. The following commands provide an example of the modification of the `loghost` script.

```
if [ "$1" = "JC00" ]; then
    echo loghost-4;
fi
if [ "$1" = "SCS02" ]; then
    echo loghost-5;
fi
if [ "$1" = "J02" ]; then
    echo loghost-6;
fi
```

8. Set the file permissions for the script so that it is executable.

```
# chmod 755 $HOME/loghost
```

9. Modify the SAP start and stop scripts as follows:

a. Ensure the uniqueness of the instance names.

Add a `sort -u` command to the end of the line that begins with `INSTANCE=` in the SAP start and stop scripts. This command sorts all the instance names that are found and retains only the unique names.

The original line is the following, where *arg* is the argument number, for example, 1 or 2.

```
INSTANCE=`echo $arg | awk '/SCS[0-9][0-9]/{print $1}
/ASCS[0-9][0-9]/{print $1} /DVEBMGS[0-9][0-9]/{print $1}
```

```
/JC[0-9][0-9]/{print $1} /D[0-9][0-9]/{print $1}
/J[0-9][0-9]/{print $1} /G[0-9][0-9]/{print $1}'`
```

After you add a pipe to a `sort -u` command at the end, the line is the following, where *arg* is the argument number, for example, 1 or 2.

```
INSTANCE=`echo $arg | awk '/SCS[0-9][0-9]/{print $1}
/ASCS[0-9][0-9]/{print $1} /DVEBMGS[0-9][0-9]/{print $1}
/JC[0-9][0-9]/{print $1} /D[0-9][0-9]/{print $1}
/J[0-9][0-9]/{print $1} /G[0-9][0-9]/{print $1}' | sort -u`
```

b. Update the SAP start and stop scripts to call the script that returns logical host names.

In the section for setting `HOSTNAME`, insert the name of the script `$HOME/loghost`, which you created in [Step 6](#). This action is accomplished by replacing the line `HOSTNAME='hostname'` with the lines in the following example.

```
< remove
> add

# Set HOSTNAME
case `uname` in
  OS/390* | z/OS* | AIX* | BOS*)
    HOSTNAME='hostname -s'
    ;;
  *)
    < HOSTNAME='hostname'
    > if [ $# -eq 2 ]; then
    > HOSTNAME='$HOME/loghost $2'
    > else
    > HOSTNAME='hostname'
    > fi
    ;;
esac
```

c. In order to source the user's profile and thus also source the SAP-specific environment files, add the following line as the second line of the SAP start and stop scripts.

```
. $HOME/.profile
```

d. Remove the DB check for the SAP central services components from the SAP start script. The SAP central services components are the SAP enqueue server, the SAP replica server, and the SAP message server.

e. If PMF is used with the SAP web application server, remove the startup of the `saposcol` program from the SAP start script that is used by this SAP web application server. See also [Step 5](#).

10. Modify the file names and contents to use logical host names instead of physical host names.

The standard SAP Web Application Server installation uses the physical host name of the node on which the SAP system is installed. You must modify SAP Web

Application Server to use a logical host name so that SAP Web Application Server works in a Sun Cluster environment.

Note – If the SAP web application server component is configured as a scalable resource, you will make additional modifications in a later section, “How to Modify the Installation for a Scalable SAP Web Application Server Component” on page 29.

- a. **Make sure that the names of the “.” files in the home directory of the SAP user do not contain the physical host name.**

In the following example, the physical host name is removed from the names of the “.” files.

```
for i in `ls -d */*physical-hostname.*`
do
mv $i `echo $i | sed "s/_physical-hostname/"`
done
```

- b. **Make sure that the names and contents of the database “.” files refer to logical host name that is used by the database and not to physical host names.**

- c. **Change the file names and contents of the profile files to use the logical host name corresponding to the individual component instead of physical host names.**

These files are located in `/usr/sap/SAPSID/SYS/profile`, where *SAPSID* is the SAP system identification.

- d. **Add the following logical-host-name entries to each `SAPSID_INSTANCE_NAMESYSTEM_NUMBER_logical-hostname` file that is located in the SAP profile directory. Note that *SAPSID* is the SAP system identification, *INSTANCE_NAME* is the SAP instance name, and *SYSTEM_NUMBER* is the SAP system number.**

```
SAPLOCALHOST=logical-hostname
SAPLOCALHOSTFULL=logical-hostname.domain
```

- e. **Replace the physical host name with the logical host name in the file `/usr/sap/SAPSID/INSTANCE_NAME/igs/conf/igs.xml`. Note that *SAPSID* is the SAP system identification and *INSTANCE_NAME* is the SAP instance name.**

11. **Modify the parameter `enq/serverhost` in the SAP instance profile.**

After installation, the parameter `enq/serverhost` in the SAP instance profile is set to the physical host name. Modify this parameter to contain the name of the logical host on which the SAP enqueue server will be running.

12. If you are using the SAP J2EE engine, modify the SAP J2EE engine settings to reference the logical host name.

a. Determine the location of the configuration scripts.

- If the ABAP engine component is installed without the SAP J2EE engine component, or if the SAP J2EE engine component is installed as a stand-alone component, the scripts are located in the directory `/usr/sap/SAPSID/JCINSTANCE_NUMBER/j2ee/configtool`.
- If The ABAP engine component is installed with the SAP J2EE engine, the scripts are located in the directory `/usr/sap/SAPSID/DVEBMGSINSTANCE_NUMBER/j2ee/configtool`.

b. Run the `configtool.sh` script, which is located in the directory that was determined in [Step a](#). Use this script to change all occurrences of a physical host name to the corresponding logical host name. This action includes setting the instance host and the JDBC URL to point to the logical host for the database.

c. Bring online the database with the logical host for the database.

d. Use the SAP configuration tool to modify the settings in the remaining steps of this procedure.

To start the SAP configuration tool, you can use the script `offlinecfgeditor.sh`, which is located in the directory that was determined in [Step a](#).

e. In the `LockingManager` section, modify `enqu.host` to refer to the logical host name for the SAP enqueue server. Change this entry under all the settings (the general and the instance-specific).

f. In the `LockingManager` section, modify all occurrences of `enq.profile.filename` to use the logical host name. Change this entry under all the settings (the general and the instance-specific).

For example, change `SAPSID_JCINSTANCE_NUMBER_physicalhost` to `SAPSID_JCINSTANCE_NUMBER_logicalhost`. The new file name should be the same as the file name in the file `/sapmnt/SAPSID/profile`.

g. In the `ClusterManager` section, change `instance.ms.host` to refer to the logical host name for the SAP message server. Change this entry under all the settings (the general and the instance-specific).

h. Modify the `instance.properties.IDxxxxxx` to refer to the logical host.

For each `instance.properties.IDxxxxxx`, modify all occurrences of a physical host name to the corresponding logical host name.

i. Ensure that the `enqu.port` parameter and the URL in the `dbpool` parameter have the correct settings.

▼ How to Modify the Installation for a Scalable SAP Web Application Server Component

The SAP web application server component of the SAP Web Application Server platform can be configured either as a failover resource or as a scalable resource.

- If you configure the SAP web application server component as a failover resource, skip this section.
- If you configure the SAP web application server component as a scalable resource, you must perform the following steps.

Steps 1. On each node on which you plan to run the scalable SAP web application server component resource group, create a local file system.

This file system can be defined as you choose, as in the following example.

```
# mkdir /usr/sap/local/SAPSID/INSTANCE_NAME
```

Note that *SAPSID* represents the SAP system identification and *INSTANCE_NAME* represents the name of the SAP web application server instance.

2. Copy the dialog instance from the node where it was installed to the local file systems on the other nodes.

3. Create symbolic links to the dialog instance.

On each node, create a symbolic link to the local file system from the required directory path for the installation, as in the following example.

```
# ln -s /usr/sap/local/SAPSID/INSTANCE_NAME \
/usr/sap/SAPSID/INSTANCE_NAME
```

4. Become the SAP administration user *sapsidadm* in order to perform the remaining steps in this procedure.

- If the SAP Web Application Server software was installed on the global file system, perform the remaining steps on the node where the software was installed.
- If the SAP Web Application Server software was installed on the local file systems, perform the remaining steps on each node on which you plan to run the scalable SAP web application server component resource group.

5. Update the script *\$HOME/loghost* to return the physical host name.

A scalable resource group does not contain a logical host. Therefore, if a resource group for the SAP web application server component is configured to be scalable, you must update the script *\$HOME/loghost* to return the physical host name. In the following example, *D84* is the full name of the dialog instance.

```
if [ "$1" = "D84" ]; then
    echo `hostname`;
fi
```

6. Update the SAP start and stop scripts with unique names for the log files.

When the SAP web application server component resource group is configured to be scalable, multiple instances of the application can be running simultaneously on different nodes. If all instances write to the same log file, they overwrite previously written information. Therefore, change the names of the log files that are specified in the SAP start and stop scripts so that they have unique names. Renaming the log files ensures that each node writes to a unique file. In the following example, the node name is appended to the log file name.

Example of entry in script before updating:

```
LOGFILE=$R3S_LOGDIR/`basename ${0}_${INSTANCE}.log`
```

Example of entry in script after updating:

```
LOGFILE=$R3S_LOGDIR/`basename ${0}_${INSTANCE}`_'`uname -n`.log
```

7. Make sure that the parameter `enq/serverhost` in the SAP instance profile contains the name of the logical host on which the SAP enqueue server is running.

8. Verify the instance parameters.

Start the configuration tool with the script `offlinecfgeditor.sh`, which is located in the directory

```
/usr/sap/SAPSID/JCINSTANCE_NUMBER/j2ee/configtool.
```

- Ensure that the `cluster_data` instance parameter is set to `PropertySheet instance.properties.IDxxxxxx`.
- Ensure that `instance.ms.host` is set to the logical host name.

▼ How to Enable the SAP Web Application Server 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 enqueue server resource
 - SAP message server resource
 - Logical host name for these resources
- SAP replica server resource group, to contain the following resources:
 - SAP replica server resource
 - Logical host name for this resource
- SAP web application server resource group, to contain the following resources:
 - SAP web application server component resource
 - Logical host name for this resource, if the resource is configured as a failover resource

Note that the procedure to enable the SAP J2EE engine to run in a cluster is located in a separate section. See “How to Enable the Stand-Alone SAP J2EE Engine to Run in a Cluster” on page 36.

Steps 1. Become superuser on a cluster node.

2. 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 host name for these resources.

```
# scrgadm -a -g central-rg
```

-a

Specifies that a new resource group is to be added.

-g *central-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.

3. Add a logical-host-name resource to the resource group that you created in Step 2.

```
# scrgadm -a -L -g central-rg -l central-logical-hostname [ -n netiflist]
```

-a

Specifies that a new configuration is to be added.

-L

Specifies that a logical-host-name resource is to be added.

-g *central-rg*

Specifies the logical-host-name resource to be added to the resource group that you created in [Step 2](#).

-l *central-logical-hostname*

Specifies the logical-host name of the SAP central services resource.

-n *netiflist*

Specifies a comma-separated list of network interfaces. All nodes in the node list of the resource group must be represented in the list of network interfaces. Specifying a list of network interfaces is optional. If you omit the list, an attempt is made for each node to discover a network interface on the subnet that the host-name list identifies.

4. Bring online the SAP central services resource group.

```
# scswitch -Z -g central-rg
```

-Z

Specifies that a resource group is to be brought online.

`-g central-rg`
Specifies the name of the resource group to be brought online. This name is the name of the resource group that was created in [Step 2](#).

5. Create a resource group for the SAP replica server.

The SAP replica server resource group is a failover resource group to contain the SAP replica server resource and the logical host name for this resource.

```
# scrgadm -a -g repl-rg
```

`-a`
Specifies that a new resource group is to be added.

`-g repl-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.

6. Add a logical-host-name resource to the resource group that you created in [Step 5](#).

```
# scrgadm -a -L -g repl-rg -l saprepl-logical-hostname [ -n netiflist]
```

`-a`
Specifies that a new configuration is to be added.

`-L`
Specifies that a logical-host-name resource is to be added.

`-g repl-rg`
Specifies the logical-host-name resource to be added to the resource group that you created in [Step 5](#).

`-l saprepl-logical-hostname`
Specifies the logical-host name of the SAP replica server resource.

`-n netiflist`
Specifies a comma-separated list of network interfaces. All nodes in the node list of the resource group must be represented in the list of network interfaces. Specifying a list of network interfaces is optional. If you omit the list, an attempt is made for each node to discover a network interface on the subnet that the host-name list identifies.

7. Bring online the SAP replica server resource group.

```
# scswitch -z -g repl-rg
```

`-z`
Specifies that a resource group is to be brought online.

`-g repl-rg`
Specifies the name of the resource group to be brought online. This name is the name of the resource group that was created in [Step 5](#).

8. Set weak positive affinity between the SAP central services resource group and the SAP replica 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 replica server resource group has been running.

```
# scrgadm -c -g central-rg -y RG_affinities=+repl-rg
```

-c

Specifies that a resource group is to be modified

-g *central-rg*

Specifies the name of the resource group to be modified

-y *RG_affinities=+repl-rg*

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

9. If the SAP central services resource group and the SAP replica server resource group are online on the same node, switch one of them to another node.

The two resource groups must be mastered on different nodes before the strong negative affinity can be set between the resource groups.

```
# scswitch -z -g rg -h node
```

-z

Specifies that a resource group is to be switched to another node.

-g *rg*

Specifies the name of the resource group to be switched. This resource group can be either the SAP central services resource group or the SAP replica server resource group.

-h *node*

Specifies the node to which the resource group is to be switched.

10. Set strong negative affinity between the SAP replica server resource group and the SAP central services resource group.

The strong negative affinity setting ensures that node failover behavior is appropriate. The SAP central services resource group fails over to the node where the SAP replica server resource group has been running. The SAP replica server resource group then fails over to another available node.

The SAP replica server resource group is never brought online nor allowed to remain online on a node on which the SAP central services resource group is online.

```
# scrgadm -c -g repl-rg -y RG_affinities=-central-rg
```

-c

Specifies that a resource group is to be modified

-g *repl-rg*

Specifies the name of the resource group to be modified

`-y RG_affinities=--central-rg`
Specifies that the *repl-rg* resource group has strong negative affinity with the *central-rg* resource group

11. Create a resource group for the SAP web application server component.

The SAP web application server resource group can be configured as a failover or scalable resource group to contain the resource for the SAP web application server component. If the SAP web application server is configured as a failover resource, the logical host name for this resource is also contained in the SAP web application server resource group.

- To create a failover resource group, run the following command.

```
# scrgadm -a -g webas-rg
```

- To create a scalable resource group, run the following command.

```
# scrgadm -a -g scalwebas-rg \  
-y Maximum primaries=value -y Desired primaries=value
```

`-a`
Specifies that a new resource group is to be added.

`-g webas-rg`
Specifies the name of the failover resource group to be added. This name can be your choice but must be unique for the resource groups within the cluster.

`-g scalwebas-rg`
Specifies the name of the scalable resource group to be added. This name can be your choice but must be unique for the resource groups within the cluster.

`-y Maximum primaries=value`
Specifies the maximum number of primary nodes for this scalable resource group.

`-y Desired primaries=value`
Specifies the desired number of primary nodes for this scalable resource group.

12. If the resource group that you created in Step 11 is configured as a failover resource group, add a logical-host-name resource to the resource group.

If the resource group that you created in Step 11 is configured as a scalable resource group, skip this step.

```
# scrgadm -a -L -g webas-rg -l webas-logical-hostname [ -n netiflist]
```

`-a`
Specifies that a new configuration is to be added.

`-L`
Specifies that a logical-host-name resource is to be added.

`-g webas-rg`
Specifies the logical-host-name resource to be added to the resource group that you created in Step 11.

- l *webas-logical-hostname*
Specifies the logical-host name of the SAP web application server component resource.
- n *netiflist*
Specifies a comma-separated list of network interfaces. All nodes in the node list of the resource group must be represented in the list of network interfaces. Specifying a list of network interfaces is optional. If you omit the list, an attempt is made for each node to discover a network interface on the subnet that the host-name list identifies.

13. Bring online the SAP web application server resource group.

- ```
scswitch -Z -g webas-rg
```
- Z  
Specifies that a resource group is to be brought online.
  - g *webas-rg*  
Specifies the name of the resource group to be brought online. This name is the name of the resource group that was created in [Step 11](#).

### 14. (Optional) Consider configuring your cluster to off-load noncritical resource groups.

You might plan to run a noncritical, lower-priority SAP web application server component resource on a node to which a critical, higher-priority SAP central services resource can fail over. In this situation, consider setting strong negative affinity between the resource groups. This setting ensures that, if a higher-priority SAP central services resource fails over to the node where a lower-priority SAP web application server component resource is running, the lower-priority resource is off-loaded, thereby automatically freeing the node's resources to be used for the critical SAP central services resource.

- ```
# scrgadm -c -g webas-rg -y RG_affinities=--central-rg
```
- c
Specifies that a resource group is to be modified.
 - g *webas-rg*
Specifies the name of the resource group to be modified.
 - y *RG_affinities=--central-rg*
Specifies that the *webas-rg* resource group has strong negative affinity with the *central-rg* resource group. If the *central-rg* resource group fails over to the node where the *webas-rg* resource group is running, the *webas-rg* resource group is off-loaded.

15. Copy all system files that were changed during the SAP Web Application Server installation and configuration process to all the nodes that are to run the SAP Web Application Server resources. These files might include the following:

- /etc/passwd
- /etc/group

- /etc/system
- /etc/services

▼ How to Enable the Stand-Alone SAP J2EE Engine to Run in a Cluster

Steps 1. Create a resource group for the SAP J2EE engine.

The SAP J2EE engine resource group can be configured as a failover or scalable resource group to contain the resource for the SAP J2EE engine. If the SAP J2EE engine is configured as a failover resource, the logical host name for this resource is also contained in this resource group.

- To create a failover resource group, run the following command.

```
# scrgadm -a -g j2ee-rg
```

- To create a scalable resource group, run the following command.

```
# scrgadm -a -g j2ee-rg \  
-y Maximum primaries=value -y Desired primaries=value
```

-a

Specifies that a new resource group is to be added.

-g *j2ee-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. Use this name when configuring the SAP J2EE engine resource in [Step 4](#) in “How to Register and Configure a Stand-Alone SAP J2EE Engine Resource” on page 59.

-y *Maximum primaries=value*

Specifies the maximum number of primary nodes for the scalable resource group.

-y *Desired primaries=value*

Specifies the desired number of primary nodes for the scalable resource group.

2. If the resource group that you created in [Step 1](#) is configured as a failover resource group, add a logical-host-name resource to the resource group.

If the resource group that you created in [Step 1](#) is configured as a scalable resource group, skip this step.

```
# scrgadm -a -L -g j2ee-rg -l j2ee-logical-hostname [ -n netiflist]
```

-a

Specifies that a new configuration is to be added.

-L

Specifies that a logical-host-name resource is to be added.

- g *j2ee-rg*
Specifies the logical-host-name resource to be added to the resource group that you created in [Step 1](#).
- l *j2ee-logical-hostname*
Specifies the logical-host name of the SAP J2EE engine resource. Use this name when configuring the SAP J2EE engine resource in [Step 4](#) in “How to Register and Configure a Stand-Alone SAP J2EE Engine Resource” on page 59.
- n *netiflist*
Specifies a comma-separated list of network interfaces. All nodes in the node list of the resource group must be represented in the list of network interfaces. Specifying a list of network interfaces is optional. If you omit the list, an attempt is made for each node to discover a network interface on the subnet that the host-name list identifies.

3. Bring online the SAP J2EE engine resource group.

- ```
scswitch -z -g j2ee-rg
```
- z  
Specifies that a resource group is to be brought online.
  - g *j2ee-rg*  
Specifies the name of the resource group to be brought online. This name is the name of the resource group that was created in [Step 1](#).

---

## Verifying the SAP Web Application Server Installation and Configuration

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

---

**Note** – See Appendix B, “SAP Web AS Compliance Tests,” of *SAP Web Application Server in Switchover Environments, UNIX Platforms*. This appendix describes in detail the recommended tests to verify the functionality of the SAP Web Application Server software.

---

The procedures in this section verify the installation and configuration of the following SAP Web Application Server components.

- SAP central services, which includes these servers:
  - SAP enqueue server
  - SAP replica server
  - SAP message server
- SAP web application server component
- SAP J2EE engine

## ▼ How to Verify the Installation and Configuration of the SAP Enqueue Server and the SAP Replica Server

Perform this procedure on each set of two nodes that can master the SAP central services resource group and the SAP replica server resource group.

For a description of the extension properties for the SAP enqueue server resource type, `SUNW.sapenq`, see “[SUNW.sapenq Extension Properties](#)” on page 79. For a description of the extension properties for the SAP replica server resource type, `SUNW.saprepl`, see “[SUNW.saprepl Extension Properties](#)” on page 82.

### Steps 1. Become the superuser on one node, `Node1`.

### 2. Bring the SAP central services resource group online on `Node1`.

```
scswitch -z -g central-rg -h node1
```

-z

Specifies that a resource group is to be brought online

-g *central-rg*

Specifies the name of the resource group to be brought online

-h *node1*

Specifies the name of the node on which the resource group is to be brought online

### 3. Become the administration user for the SAP enqueue server on `Node1`.

The extension property `SAP_User` for the `SUNW.sapenq` resource type specifies the name of the administration user.

### 4. Start the SAP enqueue server manually on `Node1`.

```
enq_server_cmd pf=enq_profile
```

*enq\_server\_cmd*

Specifies the full path to the SAP enqueue server executable. The extension property `Enqueue_Server` for the `SUNW.sapenq` resource type contains this value. The name of the SAP enqueue server executable file is `enserver`.

`pf=enq_profile`

Specifies the full path to the profile for the SAP enqueue server. The extension property `Enqueue_Profile` for `SUNW.sapenq` resource type contains this value.

**5. Confirm that the SAP enqueue server is up on Node1.**

The name of the SAP enqueue server executable file is `enserver`.

```
ps -ef | grep enserver
```

**6. Verify that the SAP enqueue server has started correctly.**

You can verify that the SAP enqueue server has started correctly in two ways.

- Run the SAP utility `ensmon`.

```
ensmon -H localhost -S port 1
```

```
-H localhost
```

Specifies that the name of the host is `localhost`.

```
-S port
```

Specifies the enqueue port.

```
1
```

Specifies that the probe should check the SAP enqueue server only.

If this command is run on the command line, a return code is returned on the command line.

- Check the log files that are written to the directory that was current when the SAP enqueue server command was run.

**7. On a different node, Node2, log in as superuser.**

**8. Bring the SAP replica server resource group online on Node2.**

```
scswitch -z -g repl-rg -h node2
```

```
-z
```

Specifies that a resource group is to be brought online

```
-g repl-rg
```

Specifies the name of the resource group to be brought online

```
-h node2
```

Specifies the name of the node on which the resource group is to be brought online

**9. Become the administration user for the SAP replica server on Node2.**

The extension property `SAP_User` for `SUNW.saprepl` resource type specifies the name of the administration user.

**10. Start the SAP replica server manually on Node2.**

```
repl_server_cmd pf=repl_profile
```

*repl\_server\_cmd*

Specifies the full path to the SAP replica server executable. The extension property `Replica_Server` for the `SUNW.saprepl` resource type contains this value. The name of the SAP replica server executable file is `enrepsserver`.

*pf=repl\_profile*

Specifies the full path to the profile for the SAP replica server. The extension property `Replica_Profile` for the `SUNW.saprepl` resource type contains this value.

#### 11. Confirm that the SAP replica server is active on Node2.

The name of the SAP replica server executable file is `enrepsserver`.

```
ps -ef | grep enrepsserver
```

#### 12. Verify that the SAP replica server has started correctly.

You can verify that the SAP replica server has started correctly in two ways.

- Run the SAP utility `ensmon`.

```
ensmon -H localhost -S port 2
```

```
-H localhost
```

Specifies that the name of the host is `localhost`.

```
-S port
```

Specifies the enqueue port.

```
2
```

Specifies that the probe should check both the SAP enqueue server and the SAP replica server.

If this command is run on the command line, a return code is returned on the command line.

- Check the log files that are written to the directory that was current when the SAP replica server command was run.

#### 13. Set up a test profile to be used with the `enqt` utility.

In order to create and check enqueue lock entries in [Step 14](#), you must prepare entries in a test SAP profile, including `SAPSYSTEM`, `SAPSYSTEMNAME`, and `INSTANCE_NAME`.

See the SAP document *The SAP Lock Concept (BC-CST-EQ)* for details about all profile parameters. See also *SAP Web Application Server in Switchover Environments, UNIX Platforms*.

#### 14. Confirm that enqueue replication is working by performing the following steps.

##### a. Create some enqueue lock entries.

```
/usr/sap/SAPSID/SYS/exe/run/enqt pf=app_server_profile 11
```

```
SAPSID
```

SAP system ID



*app\_server\_profile*

Specifies the full path to the test SAP profile that you set up in [Step 13](#)

**b. Stop the SAP enqueue server on Node1.**

```
ps -ef | grep enserver
kill -9 pid
```

**c. Stop the SAP replica server on Node2.**

```
ps -ef | grep enrepsserver
kill -9 pid
```

**d. Bring the SAP central services resource group online on Node2.**

```
scswitch -z -g central-rg -h node2
```

**e. Become the administration user for the SAP enqueue server on Node2.**

**f. Start the SAP enqueue server manually on Node2.**

```
enq_server_cmd pf=enq_profile
```

**g. Confirm that no enqueue entries are lost.**

```
/usr/sap/SAPSID/SYS/exe/run/enqt pf=app_server_profile 20
```

SAPSID

SAP system ID.

*app\_server\_profile*

Specifies the full path to the test SAP profile that you set up in [Step 13](#).

## ▼ How to Verify That the Configuration for the SAP Message Server Is Correct for the Data Service

Perform this procedure on each node that can master the SAP central services resource group.

For a description of the extension properties for the SAP message server resource type, `SUNW.sapscs`, see [“SUNW.sapscs Extension Properties”](#) on page 84.

**Steps 1. Bring the SAP central services resource group online on a node.**

```
scswitch -z -g central-rg -h node
```

-z

Specifies that a resource group is to be brought online

-g *central-rg*

Specifies the name of the resource group to be brought online

-h *node*

Specifies the name of the node on which the resource group is to be brought online

**2. Become superuser with superuser environment. Then become the *sapsidadm* user, while retaining the superuser environment.**

Note that, in the first `su` command, the “dash” (-) argument causes the environment to be changed to the environment of superuser. The second `su` command, which is used *without* the “dash” argument, causes the environment to be retained.

```
su - root
su sapsidadm
```

**3. Set the following environment variables:**

- Set the `LD_LIBRARY_PATH` variable to `/sapmnt/SAPSID/exe`.
- Set the `SAPSYSTEMNAME` variable to the appropriate SAP system identification.
- Add the following paths to the `PATH` variable:  
`/usr/sbin:/usr/bin:/usr/cluster/bin`.
- Set the `SAPSYSTEM` variable to the system number configured for the specific instance of SAP which should be handled by the resource.
- Set the `HOME` environment variable to the home directory of the SAP administration user.
- Set the `LOGNAME` variable to `root`.

**4. Run the SAP start script for the SAP message server using the absolute path and the appropriate arguments.**

The following command is an example that runs the SAP start script for the SAP message server. You must run the equivalent command for your installation.

```
/usr/sap/SC3/SYS/exe/run/startsap r3 SCS01
```

**5. After the SAP system starts successfully, run the fault monitor probe for the SAP message server.**

The full path to the probe is specified by the extension property `Msg_Server_Monitor` for the `SUNW.sapscs` resource type. For example, type the following command or the equivalent command.

```
/usr/sap/SC3/SYS/exe/run/msprot -mshost host -msport port
```

**6. Verify that the probe was successful.**

The probe is successful when the return code equals zero.

**7. Run the SAP stop script for the SAP message server to verify that the SAP message server can be stopped.**

Verify that the SAP message server can be stopped correctly. Run the SAP stop script for the SAP message server with the full path and the appropriate

arguments. The following command is an example that runs the SAP stop script. Run the equivalent command for your installation.

```
/usr/sap/SC3/SYS/exe/run/stopsap r3 SCS01
```

## ▼ How to Verify That the Configuration for the SAP Web Application Server Component Is Correct for the Data Service

Perform the following procedure on each node that can master the resource group for the SAP web application server component.

If the SAP web application server component is configured as a scalable resource, the resource runs on all these nodes simultaneously. Therefore, you must execute this procedure on all nodes that can simultaneously master the scalable SAP web application server component resource.

- Steps**
1. If you have configured the resource group for the SAP web application server component as a failover resource group, enable the logical-host-name resource for the resource group.
  2. On the node where the logical-host-name resource is enabled, become superuser, then the *sapsidadm* user with superuser environment.

```
su - root
su sapsidadm
```

3. Set the following environment variables:
  - Set the LD\_LIBRARY\_PATH variable to /sapmnt/SAPSID/exe.
  - Set the SAPSYSTEMNAME variable to the appropriate SAP system identification.
  - Add the following paths to the PATH variable:  
/usr/sbin:/usr/bin:/usr/cluster/bin.
  - Set the SAPSYSTEM variable to the system number configured for the specific instance of SAP which should be handled by the resource.
  - Set the HOME environment variable to the home directory of the SAP administration user.
  - Set the LOGNAME variable to root.
4. Start the database.  
Before running the SAP start script in the next step, you must start the database.
5. Run the SAP start script for the SAP web application server component using the absolute path and the appropriate arguments.

The following command is an example that runs the SAP start script for the SAP web application server component. You must run the equivalent command for your installation.

```
/usr/sap/SC3/SYS/exe/run/startsap r3 D01
```

**6. Change to the home directory of the SAP administration user.**

The `dpmon` utility writes files to the current directory, and this directory must be writable by the SAP administration user. In [Step 3](#) you set the `HOME` environment variable to the home directory of the SAP administration user.

```
cd $HOME
```

**7. After the SAP system starts successfully, run the probe command for the dispatcher of the SAP instance. The following command is an example:**

```
/usr/sap/SC3/SYS/exe/run/dpmon -info
```

**8. Verify that the probe was successful.**

The probe is successful when the return code equals zero.

**9. Run the SAP stop script for the SAP web application server component to verify that the SAP Web Application Server can be stopped.**

Verify that the SAP Web Application Server can be stopped correctly. Run the SAP stop script for the SAP web application server component with the full path and the appropriate arguments. The following command is an example that runs the SAP stop script. Run the equivalent command for your installation.

```
/usr/sap/SC3/SYS/exe/run/stopsap r3 D01
```

## ▼ How to Verify the Installation and Configuration of the SAP J2EE Engine

Perform the following procedure on each node that can master the resource group for the SAP J2EE engine.

If the SAP J2EE engine is configured as a scalable resource, the resource runs on all these nodes simultaneously. Therefore, you must execute this procedure on all nodes that can simultaneously master the scalable SAP J2EE engine resource.

- Steps**
- 1. If you have configured the resource group for the SAP J2EE engine as a failover resource group, enable the logical-host-name resource for the resource group.**
  - 2. On the node where the logical-host-name resource is enabled, become superuser, then the `sapsidadm` user with superuser environment.**

```
su - root
su sapsidadm
```

**3. Set the following environment variables:**

- Set the LD\_LIBRARY\_PATH variable to /sapmnt/SAPSID/exe.
- Set the SAPSYSTEMNAME variable to the appropriate SAP system identification.
- Add the following paths to the PATH variable:  
/usr/sbin:/usr/bin:/usr/cluster/bin.
- Set the SAPSYSTEM variable to the system number configured for the specific instance of SAP which should be handled by the resource.
- Set the HOME environment variable to the home directory of the SAP administration user.
- Set the LOGNAME variable to root.

**4. Start the database.**

Before running the SAP start script in the next step, you must start the database.

**5. Run the SAP start script for the SAP J2EE engine using the absolute path and the appropriate arguments.**

The following command is an example that runs the SAP start script for the SAP J2EE engine. You must run the equivalent command for your installation.

```
/usr/sap/SC3/SYS/exe/run/startsap j2ee D01
```

**6. Change to the home directory of the SAP administration user.**

The probe utility writes files to the current directory, and this directory must be writable by the SAP administration user. In [Step 3](#) you set the HOME environment variable to the home directory of the SAP administration user.

```
cd $HOME
```

**7. After the SAP J2EE engine starts successfully, verify it by deploying and running some examples. See the SAP Web Application Server Installation Guide for instructions.**

**8. Run the SAP stop script for the SAP J2EE engine to verify that the SAP J2EE engine can be stopped.**

Verify that the SAP J2EE engine can be stopped correctly. Run the SAP stop script for the SAP J2EE engine with the full path and the appropriate arguments. The following command is an example that runs the SAP stop script. Run the equivalent command for your installation.

```
/usr/sap/SC3/SYS/exe/run/stopsap j2ee D01
```

---

# Installing the Sun Cluster HA for SAP Web Application Server Packages

The Sun Cluster HA for SAP Web Application Server data service includes resource types for the following components of SAP Web Application Server:

- SAP enqueue server
- SAP replica server
- SAP message server
- SAP web application server component
- SAP J2EE engine

If you did not install the Sun Cluster HA for SAP Web Application Server packages during your initial Sun Cluster installation, perform this procedure to install the packages. Perform this procedure on each cluster node where you are installing the Sun Cluster HA for SAP Web Application Server packages. To complete this procedure, you need the Sun Cluster Agents CD.

If you are installing more than one data service simultaneously, perform the procedure in “Installing the Software” in *Sun Cluster Software Installation Guide for Solaris OS*.

Install the Sun Cluster HA for SAP Web Application Server packages by using one of the following installation tools:

- The Web Start program
- The `scinstall` utility

---

**Note** – If you are using Solaris 10, install these packages *only* in the global zone. To ensure that these packages are not propagated to any local zones that are created after you install the packages, use the `scinstall` utility to install these packages. Do *not* use the Web Start program.

---

## ▼ How to Install the Sun Cluster HA for SAP Web Application Server Packages by Using the Web Start Program

You can run the Web Start program with a command-line interface (CLI) or with a graphical user interface (GUI). The content and sequence of instructions in the CLI and the GUI are similar. For more information about the Web Start program, see the `installer(1M)` man page.

- Steps**
1. **On the cluster node where you are installing the Sun Cluster HA for SAP Web Application Server packages, become superuser.**
  2. **(Optional) If you intend to run the Web Start program with a GUI, ensure that your DISPLAY environment variable is set.**
  3. **Insert the Sun Cluster Agents CD into the CD-ROM drive.**  
If the Volume Management daemon vold(1M) is running and configured to manage CD-ROM devices, it automatically mounts the CD-ROM on the /cdrom/cdrom0 directory.
  4. **Change to the Sun Cluster HA for SAP Web Application Server component directory of the CD-ROM.**  
The Web Start program for the Sun Cluster HA for SAP Web Application Server data service resides in this directory.  

```
cd /cdrom/cdrom0/components/SunCluster_HA_SAPWebAS_1.0
```
  5. **Start the Web Start program.**  

```
./installer
```
  6. **When you are prompted, select the type of installation.**
    - To install only the C locale, select Typical.
    - To install other locales, select Custom.
  7. **Follow the instructions on the screen to install the Sun Cluster HA for SAP Web Application Server packages on the node.**  
After the installation is finished, the Web Start program provides an installation summary. This summary enables you to view logs that the Web Start program created during the installation. These logs are located in the /var/sadm/install/logs directory.
  8. **Exit the Web Start program.**
  9. **Remove the Sun Cluster Agents CD from the CD-ROM drive.**
    - a. **To ensure that the CD-ROM is not being used, change to a directory that does not reside on the CD-ROM.**
    - b. **Eject the CD-ROM.**  

```
eject cdrom
```

**Next Steps** Go to “Registering and Configuring Sun Cluster HA for SAP Web Application Server” on page 48.

## ▼ How to Install the Sun Cluster HA for SAP Web Application Server Packages by Using the `scinstall` Utility

Perform this procedure on all of the cluster members that can master Sun Cluster HA for SAP Web Application Server.

**Before You Begin** Ensure that you have the Sun Cluster Agents CD.

- Steps**
1. **Load the Sun Cluster Agents CD into the CD-ROM drive.**
  2. **Run the `scinstall` utility with no options.**  
This step starts the `scinstall` utility in interactive mode.
  3. **Select the menu option, Add Support for New Data Service to This Cluster Node.**  
The `scinstall` utility prompts you for additional information.
  4. **Provide the path to the Sun Cluster Agents CD.**  
The utility refers to the CD as the “data services cd.”
  5. **Specify the data service to install.**  
The `scinstall` utility lists the data service that you selected and asks you to confirm your choice.
  6. **Exit the `scinstall` utility.**
  7. **Unload the CD from the drive.**

**Next Steps** Go to [“Registering and Configuring Sun Cluster HA for SAP Web Application Server”](#) on page 48.

---

## Registering and Configuring Sun Cluster HA for SAP Web Application Server

To enable the Sun Cluster HA for SAP Web Application Server data service to make SAP Web Application Server 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 `HASStoragePlus` resources.



- Register and configure the SAP central services resources. The SAP central services consist of the following components:
  - SAP enqueue server
  - SAP replica server
  - SAP message server
- Register and configure resources for the SAP web application server component.
- Register and configure the SAP J2EE engine.

The resource groups were created in “[How to Enable the SAP Web Application Server to Run in a Cluster](#)” on page 30 and in “[How to Enable the Stand-Alone SAP J2EE Engine to Run in a Cluster](#)” on page 36.

## Before You Begin

Before performing these procedures, ensure that the Sun Cluster HA for SAP Web Application Server 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.

- If you are using SAP DB as the database, configure the Sun Cluster HA for SAP DB data service before continuing. See *Sun Cluster Data Service for SAP DB Guide for Solaris OS*.
- If you are using Oracle as the database, configure the Sun Cluster HA for Oracle data service before continuing. See *Sun Cluster Data Service for Oracle Guide for Solaris OS*.

Perform these procedures as superuser on a cluster node.

## Setting Sun Cluster HA for SAP Web Application Server Extension Properties

The extension properties for Sun Cluster HA for SAP Web Application Server are described in [Appendix A](#).

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 Sun Cluster HA for SAP Web Application Server requires you to set.

To set an extension property of a resource, include the following option in the `scrgadm(1M)` command that creates or modifies the resource:

`-x property=value`

`-x property`

Identifies the extension property that you are setting

`value`

Specifies the value to which you are setting the extension property

You can also use the procedures in Chapter 2, "Administering Data Service Resources," in *Sun Cluster Data Services Planning and Administration Guide for Solaris OS* to configure resources after the resources are created.

## ▼ How to Register and Configure HAStoragePlus Resources for the SAP Central Services Components

An HAStoragePlus resource is created to ensure the high availability of the global device groups where the components are installed.

### Steps 1. Register the SUNW.HAStoragePlus resource type.

```
scrgadm -a -t SUNW.HAStoragePlus
```

### 2. Create an HAStoragePlus resource for the global device group on which the SAP enqueue server and the SAP message server are installed.

Create this resource in the SAP central services resource group, which is the resource group to which the SAP enqueue server and the SAP message server resources belong.

```
scrgadm -a -j hsp-central-rs -g central-rg -t SUNW.HAStoragePlus \
-x filesystemmountpoints="mountpoint-list" \
-x globaldevicepaths=sapenq-device-group
```

`-a`

Specifies that a new configuration is to be added.

`-j hsp-central-rs`

Specifies the name of the resource that you are creating.

`-g central-rg`

Specifies that the resource is to be added to the SAP central services resource group.

`-t SUNW.HAStoragePlus`

Specifies that the resource is an instance of the SUNW.HAStoragePlus resource type.

`-x filesystemmountpoints="mountpoint-list"`

Specifies a list of valid mount points for the file system. For more information, see the SUNW.HAStoragePlus(5) man page.

`-x globaldevicepaths=sapenq-device-group`  
Specifies the name of the global device group on which the SAP enqueue server software and the SAP message server software are installed.

**3. Enable the `HASStoragePlus` resource that you created in [Step 2](#).**

```
scswitch -ej hsp-central-rs
```

`-ej hsp-central-rs`  
Specifies that the `HASStoragePlus` resource that you created in [Step 2](#) is to be enabled

**4. Create an `HASStoragePlus` resource for the global device group on which SAP replica server is installed.**

Create this resource in the SAP replica server resource group.

```
scrgadm -a -j hsp-repl-rs -g repl-rg -t SUNW.HASStoragePlus \
-x filesystemmountpoints="mountpoint-list" \
-x globaldevicepaths=saprepl-device-group
```

`-a`  
Specifies that a new configuration is to be added.

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

`-g repl-rg`  
Specifies that the resource is to be added to the SAP replica server resource group.

`-t SUNW.HASStoragePlus`  
Specifies that the resource is an instance of the `SUNW.HASStoragePlus` resource type.

`-x filesystemmountpoints="mountpoint-list"`  
Specifies a list of valid mount points for the file system. For more information, see the `SUNW.HASStoragePlus(5)` man page.

`-x globaldevicepaths=saprepl-device-group`  
Specifies the name of the global device group on which the SAP replica server software is installed.

**5. Enable the `HASStoragePlus` resource that you created in [Step 4](#).**

```
scswitch -ej hsp-repl-rs
```

`-ej hsp-repl-rs`  
Specifies that the `HASStoragePlus` resource that you created in [Step 4](#) is to be enabled

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

The SAP enqueue server resource and the SAP message server resource must be in the same failover resource group because they fail over together.

The SAP enqueue server resource is configured to depend on its associated `HASStoragePlus` resource. This dependency ensures that the SAP enqueue server does not attempt to start until its associated `HASStoragePlus` resource is online.

### Steps 1. Register `SUNW.sapenq`, the resource type for the SAP enqueue server.

```
scrgadm -a -t SUNW.sapenq
```

-a

Specifies that a new resource type is to be added.

-t `SUNW.sapenq`

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

### 2. Create an SAP enqueue server resource in the SAP central services resource group.

```
scrgadm -a -j enq-rs -g central-rg -t SUNW.sapenq \
```

```
-x Enqueue_Profile=path-to-enq-profile \
```

```
-x Enqueue_Server=path-to-enq-server-binary \
```

```
-x SAP_User=enq-user \
```

```
-x Enqueue_Instance_Number=enq-instance \
```

```
-y Resource_Dependencies=hsp-central-rs
```

-a

Specifies that a new resource is to be added.

-j `enq-rs`

Specifies the name of the resource to be added.

-g `central-rg`

Specifies the resource group to which the resource is to be added. The SAP central services resource group is configured as a failover resource group.

-t `SUNW.sapenq`

Specifies that the resource is an instance of the `SUNW.sapenq` resource type.

-x `Enqueue_Profile=path-to-enq-profile`

Specifies the full path to the SAP enqueue server profile.

-x `Enqueue_Server=path-to-enq-server-binary`

Specifies the full path to the SAP enqueue server executable.

-x `SAP_User=enq-user`

Specifies the administration user for the SAP enqueue server.

- x Enqueue\_Instance\_Number=*enq-instance*  
Specifies the two-digit instance number for the SAP enqueue server. This number is the value of SAPSYSTEM in the SAP profile for SAP enqueue server.
- y Resource\_Dependencies=*hsp-central-rs*  
Specifies that the HASToragePlus resource for the global device group on which SAP enqueue server is installed must be online in order for the SAP enqueue server to be online.

**3. Verify that the default values for the SAP enqueue server extension properties are acceptable.**

Refer to “SUNW.sapenq Extension Properties” on page 79.

**4. Ensure that SAP enqueue server is *not* already running on the cluster.**

If SAP enqueue server is already running on any node of the cluster, you risk the simultaneous running of multiple SAP enqueue server processes.

**5. Enable the SAP enqueue server resource.**

```
scswitch -ej enq-rs
```

```
-ej
```

Specifies that the specified resource is to be enabled.

```
enq-rs
```

Specifies the name of the resource to be enabled.

## ▼ How to Register and Configure an SAP Replica Server Resource

The SAP replica server resource must be in a *different* failover resource group from the SAP enqueue server resource, because the SAP replica server resource must *not* fail over with the SAP enqueue server resource.

The SAP replica server resource is configured to depend on its associated HASToragePlus resource being online. The SAP replica server resource also depends on the SAP enqueue server resource. These dependencies ensure that the SAP replica server does not attempt to start until both its associated HASToragePlus resource and the SAP enqueue server are online.

**Steps 1. Register SUNW.saprepl, the resource type for the SAP replica server.**

```
scrgadm -a -t SUNW.saprepl
```

```
-a
```

Specifies that a new resource type is to be added.

```
-t SUNW.saprepl
```

Specifies the name of the resource type to be added. This name is predefined for the SAP replica server.

## 2. Create an SAP replica server resource in the SAP replica server resource group.

```
scrgadm -a -j repl-rs -g repl-rg -t SUNW.saprepl \
-x Replica_Profile=path-to-repl-profile \
-x Replica_Server=path-to-repl-server-binary \
-x SAP_User=repl-user \
-y Resource_Dependencies=enq-rs,hsp-repl-rs
```

-a  
Specifies that a new resource is to be added.

-j *repl-rs*  
Specifies the name of the resource to be added.

-g *repl-rg*  
Specifies the resource group to which the resource is to be added. The SAP replica server resource group is configured as a failover resource group.

-t *SUNW.saprepl*  
Specifies that the resource is an instance of the *SUNW.saprepl* resource type.

-x *Replica\_Profile=path-to-repl-profile*  
Specifies the full path to the SAP replica server profile.

-x *Replica\_Server=path-to-repl-server-binary*  
Specifies the full path to the SAP replica server executable.

-x *SAP\_User=repl-user*  
Specifies the administration user for the SAP replica server.

-y *Resource\_Dependencies=enq-rs,hsp-repl-rs*  
Specifies that the following resources must be online before the SAP replica server resource can be online:

- SAP enqueue server resource
- *HAStoragePlus* resource for the global device group on which the SAP replica server is installed

## 3. Verify that the default values for the SAP replica server extension properties are acceptable.

Refer to “[SUNW.saprepl Extension Properties](#)” on page 82.

## 4. Enable the SAP replica server resource.

```
scswitch -ej repl-rs
```

-ej  
Specifies that the specified resource is to be enabled.

*repl-rs*  
Specifies the name of the resource to be enabled.

## ▼ How to Register and Configure an SAP Message Server Resource

The SAP enqueue server resource and the SAP message server resource must be in the same failover resource group because they fail over together.

The SAP message server resource is configured to depend on its associated `HASStoragePlus` resource. This dependency ensures that the SAP message server does not attempt to start until its associated `HASStoragePlus` resource is online.

### Steps 1. Register `SUNW.sapscs`, the resource type for the SAP message server.

```
scrgadm -a -t SUNW.sapscs
```

```
-a
```

Specifies that a new resource type is to be added.

```
-t SUNW.sapscs
```

Specifies the name of the resource type to be added. This name is predefined for the SAP message server.

### 2. Create an SAP message server resource in the SAP central services resource group.

```
scrgadm -a -j msg-rs -g central-rg -t SUNW.sapscs \
```

```
-x SAP_SID=scs-system-ID \
```

```
-x SAP_Instance_Number=scs-instance-number \
```

```
-x SAP_Instance_Name=scs-instance-name \
```

```
-x Msg_Server_Port=msg-server-port \
```

```
-x Scs_Startup_Script=scs-server-startup-script \
```

```
-x Scs_Shutdown_Script=scs-server-shutdown-script \
```

```
-y Resource_Dependencies=hsp-central-rs
```

```
-a
```

Specifies that a new resource is to be added.

```
-j msg-rs
```

Specifies the name of the resource to be added.

```
-g central-rg
```

Specifies the resource group to which the resource is to be added. The SAP central services resource group is configured as a failover resource group.

```
-t SUNW.sapscs
```

Specifies that the SAP message server resource is an instance of the resource type that is named `SUNW.sapscs`.

```
-x SAP_SID=scs-system-ID
```

Specifies the SAP system ID for the SAP message server. This ID is `SAPSYSTEMNAME` in the SAP profile.

```
-x SAP_Instance_Number=scs-instance-number
```

Specifies the instance number for the SAP message server. This number is `SAPSYSTEM` in the SAP profile.

- x `SAP_Instance_Name=scs-instance-name`  
Specifies the instance name for the SAP message server. This name is `INSTANCE_NAME` in the SAP profile.
- x `Msg_Server_Port=msg-server-port`  
Specifies the listen port for the SAP message server.
- x `Scs_Startup_Script=scs-server-startup-script`  
Specifies the full path to the startup script for the SAP message server instance.
- x `Scs_Shutdown_Script=scs-server-shutdown-script`  
Specifies the full path to the shutdown script for the SAP message server instance.
- y `Resource_Dependencies=hsp-central-rs`  
Specifies that the `HASStoragePlus` resource for the global device group on which the SAP message server is installed must be online in order for the SAP message server to be online.

**3. Verify that the default values for the SAP message server extension properties are acceptable.**

Refer to “[SUNW.sapscs Extension Properties](#)” on page 84.

**4. Enable the SAP message server resource.**

- # `scswitch -ej msg-rs`
- ej  
Specifies that the specified resource is to be enabled.
- `msg-rs`  
Specifies the name of the resource to be enabled.

## ▼ How to Register and Configure an SAP Web Application Server Component

An `HASStoragePlus` resource is created to ensure the high availability of the global device groups where the components are installed.

The resource for the SAP web application server component is configured to depend on its associated `HASStoragePlus` resource. The resource for the SAP web application server component also depends on the database resource, as well as the SAP message server resource. These dependencies ensure that the resource for the SAP web application server component does not attempt to start until its associated `HASStoragePlus` resource, the database, and the SAP message server resource are all online.



---

**Note** – The SAP web application server component can be configured to run under PMF or not to run under PMF. See the extension property `Webas_Use_Pmf` in “[SUNW.sapwebas Extension Properties](#)” on page 86. If the component is configured to run under PMF control, and if the network is not available, PMF stops the resource in such a way that no data is lost. However, if the component is configured *not* to run under PMF, and if the network is not available, the resource and the resource group for the SAP web application server component are in the `stop_failed` state and user intervention is required. Because no SAP utility is available to stop all SAP processes, in order to prevent possible data corruption, the data service does not automatically restart the processes.

---

**Steps** 1. Create an `HASStoragePlus` resource for the global device group on which SAP web application server component is installed.

Create this resource in the SAP web application server resource group.

```
scrgadm -a -j hsp-webas-rs -g webas-rg -t SUNW.HASStoragePlus \
-x filesystemmountpoints="mountpoint-list" \
-x globaldevicepaths=sapwebas-device-group
```

-a

Specifies that a new configuration is to be added.

-j *hsp-webas-rs*

Specifies the name of the resource that you are creating.

-g *webas-rg*

Specifies that the resource is to be added to the SAP web application server resource group. This resource group can be failover or scalable.

-t `SUNW.HASStoragePlus`

Specifies that the resource is an instance of the `SUNW.HASStoragePlus` resource type.

-x `filesystemmountpoints="mountpoint-list"`

Specifies a list of valid mount points for the file system. For more information, see the `SUNW.HASStoragePlus(5)` man page.

-x `globaldevicepaths=sapwebas-device-group`

Specifies the name of the global device group on which the SAP web application server component software is installed.

2. Enable the `HASStoragePlus` resource that you created in [Step 1](#).

```
scswitch -ej hsp-webas-rs
```

-ej *hsp-webas-rs*

Specifies that the `HASStoragePlus` resource that you created in [Step 1](#) is to be enabled

**3. Register `SUNW.sapwebas`, the resource type for the SAP web application server component.**

```
scrgadm -a -t SUNW.sapwebas
```

-a

Specifies that a new resource type is to be added.

-t `SUNW.sapwebas`

Specifies the name of the resource type to be added. This name is predefined for the SAP web application server component.

**4. Create a resource for the SAP web application server component.**

The SAP web application server component can be configured either as a failover resource or as a scalable resource by adding the resource to a resource group that was created as a failover or a scalable resource group.

```
scrgadm -a -j webas-rs -g webas-rg -t SUNW.sapwebas \
-x SAP_SID=webas-system-ID \
-x SAP_Instance_Number=webas-instance-number \
-x SAP_Instance_Name=webas-instance-name \
-x Webas_Probe_J2ee=True \
-y Resource_Dependencies=hsp-webas-rs,db-webas-rs,msg-rs
```

-a

Specifies that a new resource is to be added.

-j `webas-rs`

Specifies the name of the resource to be added.

-g `webas-rg`

Specifies the resource group to which the resource is to be added. The SAP web application server resource group can be configured as a failover or a scalable resource group.

-t `SUNW.sapwebas`

Specifies that the resource is an instance of the `SUNW.sapwebas` resource type.

-x `SAP_SID=webas-system-ID`

Specifies the SAP system ID for the SAP web application server component. This ID is `SAPSYSTEMNAME` in the SAP profile.

-x `SAP_Instance_Number=webas-instance-number`

Specifies the two-digit SAP system number for the SAP web application server component instance. This number is `SAPSYSTEM` in the SAP profile.

-x `SAP_Instance_Name=webas-instance-name`

Specifies the instance name for the SAP web application server component. This name is `INSTANCE_NAME` in the SAP profile.

-x `Webas_Probe_J2ee=True`

Specifies that the SAP J2EE engine is to be probed. This property must be set to `True` when the SAP J2EE engine is included.

`-y Resource_Dependencies=hsp-webas-rs, db-webas-rs, msg-rs`

Specifies that the following resources must be online before the resource for the SAP web application server component can be online:

- `HASStoragePlus` resource for the global device group on which the SAP web application server component is installed.
- Database resource. The database resource is created by the relevant data service.
- SAP message server resource.

**5. Verify that the default values for the SAP web application server component extension properties are acceptable.**

Refer to “`SUNW.sapwebas Extension Properties`” on page 86.

**6. Enable the SAP web application server component resource.**

```
scswitch -ej webas-rs
```

`-ej`

Specifies that the specified resource is to be enabled.

`webas-rs`

Specifies the name of the resource to be enabled.

## ▼ How to Register and Configure a Stand-Alone SAP J2EE Engine Resource

**Steps** 1. Become superuser on one of the nodes in the cluster that is to host the SAP J2EE engine.

2. Register `SUNW.gds`, the resource type for the SAP J2EE engine.

```
scrgadm -a -t SUNW.gds
```

`-a`

Specifies that a new resource type is to be added.

`-t SUNW.gds`

Specifies the name of the resource type to be added. This name is predefined for the SAP J2EE engine.

3. Create an `HASStoragePlus` resource for the SAP J2EE engine disk storage.

```
scrgadm -a -j hsp-j2ee-rs -g j2ee-rg -t SUNW.HASStoragePlus \
-x filesystemmountpoints="mountpoint-list"
```

`-a`

Specifies that a new configuration is to be added.

`-j hsp-j2ee-rs`

Specifies the name of the resource that you are creating.

- g *j2ee-rg*  
Specifies that the resource is to be added to the SAP J2EE engine resource group.
- t *SUNW.HAStoragePlus*  
Specifies that the resource is an instance of the *SUNW.HAStoragePlus* resource type.
- x *filesystemmountpoints="mountpoint-list"*  
Specifies a list of valid mount points for the file system. For more information, see the *SUNW.HAStoragePlus(5)* man page.

#### 4. Configure the Sun Cluster SAP J2EE engine resource.

The configuration file for the SAP J2EE engine is  
 /opt/SUNWscswa/util/ha\_sap\_j2ee\_config.

```
#
Copyright 2003 Sun Microsystems, Inc. All rights reserved.
Use is subject to license terms.
#
This file will be sourced in by ha_sap_j2ee_register and the
parameters listed below will be used.
#
These parameters can be customized in (key=value) form
#
RS - Name of the resource for the application
RG - Name of the resource group containing RS
JAVA_HOME - Name of the Java home directory
SAPSID - The SAP System Name
J2EE_INSTANCE - Name of the SAP J2EE Engine instance
LH - Name of the LogicalHostname SC resource
DEPENDENT_RS - Resources on which SAP J2EE SC resource depends
for example, HAStoragePlus, SCS, ENQ, and DB SC resources
SCALABLE - Scalable or not. TRUE/FALSE
#
#
Optional parameters
#
SAP_START - Optional, name of a startsap script within
SAPSIDadm home directory that will be used
instead of the default startsap.
#
SAP_STOP - Optional, name of a stopsap script within
SAPSIDadm home directory that will be used
instead of the default stopsap.
#
SAP_LOGDIR - Optional, where to put the logfiles from
startsap and stopsap. Default is the SAPSIDadm home
directory.
SAPSIDadm must be owner and have write permissions
#
RESOURCE_PROJECT_NAME - Optional, name of a SRM project.
#
The following examples illustrate sample parameters
for SAP J2EE Engine Instance
```

```

#
RS=RES-SAP-J2EE
RG=RG-SAP-J2EE
JAVA_HOME=/usr/java
SAPSID=TST
J2EE_INSTANCE=JC00
LH=j2eelh For Scalable, LH=
DEPENDENT_RS=RES-SAP-J2EE-HAS,RES-SAP-SCS,RES-SAP-ENQ,RES-SAP-DB
#
SAP_START=
SAP_STOP=
SAP_LOGDIR=
RESOURCE_PROJECT_NAME=
SCALABLE=FALSE For Scalable, SCALABLE=TRUE
#
#
RS=
RG=
JAVA_HOME=
SAPSID=
J2EE_INSTANCE=
LH=
DEPENDENT_RS=
SAP_START=
SAP_STOP=
SAP_LOGDIR=
RESOURCE_PROJECT_NAME=
SCALABLE=

```

The SAP J2EE engine can be configured as a failover resource or as a scalable resource. You can edit the `ha_sap_j2ee_config` file as follows.

- If the resource is scalable, set `SCALABLE=TRUE` and set `LH` to null (`LH=`).
- If the resource is failover, set `SCALABLE=FALSE` and set `LH=logical-host resource`.
- Set the resource dependencies.

Set `DEPENDENT_RS=db-rs,enq-rs,msg-rs`.

Before the SAP J2EE engine resource can be online, the following resources must be online:

- Database resource. The database resource is created by the relevant data service.
- SAP enqueue server resource.
- SAP message server resource.
- If `SAP_LOGDIR` is specified, the file must have ownership and write permissions set for the `sapsidadm` user.

## 5. Register the Sun Cluster SAP J2EE engine resource.

```

cd /opt/SUNWscswa/util
./ha_sap_j2ee_register

```

## 6. Enable the Sun Cluster SAP J2EE engine resource.

```
scswitch -ej j2ee-rs
```

-ej

Specifies that the specified resource is to be enabled.

j2ee-rs

Specifies the name of the resource to be enabled.

### More Information

## Registering More Than One Resource

The `ha_sap_j2ee_conf` configuration file and the `ha_sap_j2ee_register` registration script can register only one resource at a time. If you want to register more resources of this type, either for different instances on the same SAP system (with the same SAPSID) or for different SAP systems (with different SAPSIDs), perform either of the following tasks.

- Modify the parameters of the `ha_sap_j2ee_conf` configuration file as needed and run the `ha_sap_j2ee_register` registration script.
- Because the `ha_sap_j2ee_conf` configuration file is local to each node, modify this configuration file on another node and register the resource using the `ha_sap_j2ee_register` registration script.

When registering multiple resources, ensure that all the parameters in the configuration file are set correctly for the resource. In particular, the setting of the `SCALABLE` parameter and the `LH` parameter depend on whether the resource is failover or scalable.

## Examples of Configuring the SAP Web Application Server

The following examples show how the SAP Web Application Server can be configured to be highly available in Sun Cluster. The examples assume that the resource groups have been created, the resource groups are online, and the resource types have been registered.

- Configuring the SAP central services, which consist of the following components:
  - SAP enqueue server
  - SAP replica server
  - SAP message server
- Configuring the SAP web application server component

### EXAMPLE 3 Configuring the SAP Central Services Components

In this example the SAP central services resource group is called `centralrg`, and the SAP replica server resource group is called `replrg`.

**EXAMPLE 3** Configuring the SAP Central Services Components (Continued)

1. To create an `HASStoragePlus` resource called `hspcentralrs` for the global device group `enqdg` in the resource group `centralrg`, the following command is run. The group `centraldg` is the global device group on which the SAP enqueue server is installed, and `centralrg` is the resource group to which the SAP enqueue server resource and the SAP message server resource belong.

```
scrgadm -a -j hspcentralrs -g centralrg -t SUNW.HASStoragePlus \
-x filesystemmountpoints="/global/sapdata" \
-x globaldevicepaths=centraldg
```

2. To enable the `hspcentralrs` resource, the following command is run.

```
scswitch -ej hspcentralrs
```

3. To create an `HASStoragePlus` resource called `hspreplrs` for the global device group `repldg` in the resource group `replrg`, the following command is run. The group `repldg` is the global device group on which SAP replica server is installed, and `replrg` is the resource group to which the SAP replica server resource belongs.

```
scrgadm -a -j hspreplrs -g replrg -t SUNW.HASStoragePlus \
-x filesystemmountpoints="/global/sapdata" \
-x globaldevicepaths=repldg
```

4. To enable the `hspreplrs` resource, the following command is run.

```
scswitch -ej hspreplrs
```

5. To create an SAP enqueue server resource called `enqrs` in the resource group `centralrg`, the following command is run. This resource is dependent on the `hspcentralrs` resource.

```
scrgadm -a -j enqrs -g centralrg -t SUNW.sapenq \
-x Enqueue_Profile=/usr/sap/SC3/SYS/profile/SC3_ASCS07_central-1h \
-x Enqueue_Server=/sapmnt/SC3/exe/enserver \
-x SAP_User=sc3adm \
-x Enqueue_Instance_Number=07 \
-y Resource_Dependencies=hspcentralrs
```

6. To enable the `enqrs` resource, the following command is run.

```
scswitch -ej enqrs
```

7. To create an SAP replica server resource called `replrs` in the resource group `replrg`, the following command is run. This resource is dependent on the `hspreplrs` resource and the `enqrs` resource.

```
scrgadm -a -j replrs -g replrg -t SUNW.saprepl \
-x Replica_Profile=/usr/sap/SC3/SYS/profile/SC3_REP07 \
-x Replica_Server=/sapmnt/SC3/exe/enrepsserver \
-x SAP_User=sc3adm \
-y Resource_Dependencies=hspreplrs,enqrs
```

8. To create an SAP message server resource called `msgrs` in the resource group `centralrg`, the following command is run. This resource is dependent on the `hspcentralrs` resource. The SAP message server resource is an instance of the

**EXAMPLE 3** Configuring the SAP Central Services Components (Continued)

resource type that is named `SUNW.sapscs`.

```
scrgadm -a -j msgrs -g centralrg -t SUNW.sapscs \
-x SAP_SID=SC3 \
-x SAP_Instance_Number=07 \
-x SAP_Instance_Name=ASCS07 \
-x Msg_Server_Port=3607 \
-x Scs_Startup_Script=/usr/sap/SC3/SYS/exe/run/my_startsap \
-x Scs_Shutdown_Script=/usr/sap/SC3/SYS/exe/run/my_stopsap \
-y Resource_Dependencies=hspcentralrs
```

9. To enable the `replrs` resource and the `msgrs` resource, the following command is run.

```
scswitch -ej replrs,msgrs
```

**EXAMPLE 4** Configuring the SAP Web Application Server Component

In this example the resource group for the SAP web application server component is called `webasrg`.

1. To create an `HASStoragePlus` resource called `hspwebasrs` for the global device group `webasdg` in the resource group `webasrg`, the following command is run. The group `webasdg` is the device group on which the SAP web application server component is installed, and `webasrg` is the resource group to which the SAP web application server resource belongs.

```
scrgadm -a -j hspwebasrs -g webasrg -t SUNW.HASStoragePlus \
-x filesystemmountpoints="/global/sapdata" \
-x globaldevicepaths=webasdg
```

2. To enable the `hspwebasrs` resource, the following command is run.

```
scswitch -ej hspwebasrs
```

3. To create a resource called `webasrs` for the SAP web application server component, the following command is run. This resource is created in the failover resource group `webasrg`. This resource is dependent on the `hspwebasrs` resource. The `webasrs` resource is also dependent on the database resource `dbwebasrs`, which has already been created by the relevant data service. In addition, this resource is dependent on the SAP message server resource, which is called `msgrs` in the previous example.

```
scrgadm -a -j webasrs -g webasrg -t SUNW.sapwebas \
-x SAP_SID=SC3 \
-x SAP_Instance_Number=08 \
-x SAP_Instance_Name=D08 \
-y Resource_Dependencies=hspwebasrs,dbwebasrs,msgrs
```

4. To enable the `webasrs` resource, the following command is run.

```
scswitch -ej webasrs
```



---

## 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.

See Cluster Administration and Application Development in *Sun Cluster Concepts Guide for Solaris OS*.

---

## Tuning the Sun Cluster HA for SAP Web Application Server Fault Monitors

Fault monitoring for the Sun Cluster HA for SAP Web Application Server data service is provided by the following fault monitors:

- The fault monitor for the SAP enqueue server
- The fault monitor for the SAP replica server
- The fault monitor for the SAP message server
- The fault monitor for the SAP web application server component
- The fault monitor for the SAP J2EE engine

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

**TABLE 3** Resource Types for the Fault Monitors of Sun Cluster HA for SAP Web Application Server

| Component                            | Resource Type |
|--------------------------------------|---------------|
| SAP enqueue server                   | SUNW.sapenq   |
| SAP replica server                   | SUNW.saprepl  |
| SAP message server                   | SUNW.sapses   |
| SAP web application server component | SUNW.sapwebas |
| SAP J2EE engine                      | SUNW.gds      |

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 Sun 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 Sun Cluster HA for SAP Web Application Server, as described in “[Registering and Configuring Sun Cluster HA for SAP Web Application Server](#)” on page 48.

For detailed information about these tasks, see “[Tuning Fault Monitors for Sun Cluster Data Services](#)” in *Sun Cluster Data Services Planning and Administration Guide for Solaris OS*.

## Operation of the Fault Monitor for the SAP Enqueue Server Resource Type

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

The probe uses the SAP utility `ensmon` to check the health of the SAP enqueue server and the SAP replica server.

```
ensmon -H localhost -S port option
```

```
-H localhost
```

Specifies that the name of the host is `localhost`.

```
-S port
```

Specifies the enqueue port.

```
option
```

Specifies the resources that the probe should check. The possible values of this option are as follows:

- 1 – Check the SAP enqueue server only.
- 2 – Check both the SAP enqueue server and the SAP replica server.

If this command is run on the command line, a return code is returned on the command line.

During a probe, the fault monitor first determines whether both the SAP enqueue server and the SAP replica server are online by running the `ensmon` command with the `option` argument set to 2.

```
ensmon -H localhost -S port 2
```

The result of this command determines the action of the probe, as follows:

1. If the command times out, the SAP enqueue server fault monitor checks whether only the SAP enqueue server is online by running the `ensmon` command with the option set to 1.

```
ensmon -H localhost -S port 1
```

- If this command times out, the SAP enqueue server issues a partial failure. If this timeout occurs one more time within the probe interval period, a failover occurs.
  - If this command succeeds, the SAP enqueue server fault monitor logs a warning message to explain that the SAP enqueue server is online but the status of the SAP replica server is unknown.
  - If this command causes a system error, the SAP enqueue server issues a less serious partial failure. If a system error occurs three more times within the probe interval period, a failover occurs.
  - For all other unsuccessful conditions, the SAP enqueue server triggers a failover.
2. If the command does not time out, the probe checks the value of the return code from the `ensmon` command, as follows:
    - A return code value of 0 indicates that the command is successful, and no further action is taken until the next probe.
    - A return code value of 4 indicates that the enqueue is running, and the replica is configured, but the replica is not running. The probe logs a warning message to indicate that the replica is not running.
    - A return code value of 8 indicates that the enqueue server is not running, and the probe triggers a failover.
    - A return code of 12 indicates an invalid parameter for the command, and the probe triggers a failover.
    - All other return codes are treated as a partial failure. If such a failure occurs three more times within the probe interval period, a failover occurs.

Note that the values for the number of timeouts and the probe interval period are assigned by the SAP enqueue server fault monitor. You cannot change these values.

## Operation of the Fault Monitor for the SAP Replica Server Resource Type

Fault monitor responsibility for the SAP replica server resource type is currently handled by the Process Monitor Facility (PMF) in Sun Cluster.

## Operation of the Fault Monitor for the SAP Message Server Resource Type

The fault monitor probe for the SAP message server resource type requires the `msprot` program. See “[Configuration Requirements](#)” on page 18.

The `msprot` program is not configurable.

## Operation of the Fault Monitor for the SAP Web Application Server Component Resource Type

The fault monitoring for the SAP message server component resource type is performed by the `dpmon` program.

The `dpmon` program is not configurable.

## Operation of the Fault Monitor for the SAP J2EE Engine Resource Type

The fault monitor probe for the SAP J2EE engine resource type requires the `sap_j2ee_probe` program.

The `sap_j2ee_probe` program is not configurable.

---

# Verifying the Sun Cluster HA for SAP Web Application Server Installation and Configuration

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

- Verify the operation of the fault monitor for the SAP enqueue server
- Verify the operation of the fault monitor for the SAP replica server
- Verify the operation of the fault monitor for the SAP message server
- Verify the operation of the fault monitor for the SAP web application server component

- Verify the installation and configuration of the SAP J2EE engine

See “[Tuning the Sun Cluster HA for SAP Web Application Server Fault Monitors](#)” on page 65 for a description of the fault monitors.

## ▼ How to Verify the Operation of the Fault Monitor for the SAP Enqueue Server

Perform this procedure on each set of two nodes where the SAP enqueue server and the SAP replica server can run.

### Steps 1. Log in to a node as superuser.

### 2. Ensure that the SAP replica server resource group is offline on all nodes.

At this point in this procedure you are testing the behavior of the SAP enqueue server resource group *without* the SAP replica server resource group. Therefore, the SAP replica server resource group must be offline on all nodes. Further in this procedure you will test the behavior of the SAP enqueue server *with* the SAP replica server resource group.

### 3. Bring online the resource group to which the SAP enqueue server belongs.

```
scswitch -z -g central-rg -h node
```

-z

Specifies that a resource group is to be brought online.

-g *central-rg*

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

-h *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.

### 4. Abnormally terminate the SAP enqueue server.

#### a. Determine the process ID of the SAP enqueue server, where the name of the SAP enqueue server executable file is **enserver**.

```
ps -ef | grep enserver
```

#### b. Kill the process for the SAP enqueue server.

```
kill -9 pid
```

*pid*

Specifies the process ID of the SAP enqueue server. This ID is the process ID that you determined with the `ps` and `grep` commands.

**5. Confirm that the SAP enqueue server fails over to another node.**

Run the `scstat` command to confirm that the SAP enqueue server resource is offline on the first node and online on the second node.

**6. Again, bring online the resource group to which the SAP enqueue server belongs.**

```
scswitch -z -g central-rg -h node
```

-z

Specifies that a resource group is to be brought online.

-g *central-rg*

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

-h *node*

Specifies the name of the node on which the resource group is to be brought online.

**7. Log in to a different node as superuser. On this node, bring online the resource group to which the SAP replica server belongs.**

```
scswitch -z -g repl-rg -h node
```

-z

Specifies that a resource group is to be brought online.

-g *repl-rg*

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

-h *node*

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

**8. Again, abnormally terminate the SAP enqueue server, as in [Step 4](#).**

**9. Confirm that the SAP enqueue server resource group fails over to the node on which the SAP replica server resource group is running.**

As the SAP enqueue server resource group starts on the node on which the SAP replica server resource group is running, the SAP replica server resource group fails over to another available node. If no node is available, the SAP replica server resource group is offline.

Run the `scstat` command to confirm that the SAP enqueue server resource group is offline on the first node and online on the second node. Confirm also that the SAP replica server resource group is offline on the second node. The SAP replica server resource group can be either online on another available node or offline.

## ▼ How to Verify the Operation of the Fault Monitor for the SAP Replica Server

Perform this procedure on each set of two nodes where the SAP replica server and the SAP enqueue server can run.

### Steps 1. Log in to a node as superuser.

### 2. Bring online the resource group to which the SAP enqueue server belongs.

The SAP replica server resource is configured to be dependent on the SAP enqueue server resource.

```
scswitch -z -g central-rg -h node
```

-z

Specifies that a resource group is to be brought online.

-g *central-rg*

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

-h *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.

### 3. Log in to a different node as superuser.

### 4. Bring online the resource group to which the SAP replica server belongs.

```
scswitch -z -g repl-rg -h node
```

-z

Specifies that a resource group is to be brought online.

-g *repl-rg*

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

-h *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.

### 5. Abnormally terminate the SAP replica server.

#### a. Determine the process ID of the SAP replica server, where the name of the SAP replica server executable file is `enrepsvr`.

```
ps -ef | grep enrepsvr
```

#### b. Kill the process for the SAP replica server.

```
kill -9 pid
```

*pid*

Specifies the process ID of the SAP replica server. This ID is the process ID that you determined with the `ps` and `grep` commands.

**6. Confirm that the SAP replica server either restarts or fails over.**

If the abnormal termination action in [Step 5](#) is repeated a specified number of times within a specified time interval, the SAP replica server fails over to an available node that is not running the SAP enqueue server. If no node is available, the SAP replica server is offline.

If the abnormal termination action is *not* repeated a specified number of times within a specified time interval, the SAP replica server restarts on the same node.

Run the `scstat` command to determine the status of the SAP replica server.

The maximum number of times that the application can be abnormally terminated before failing over is specified with the standard property `Retry_count`. The time interval is specified with the standard property `Retry_interval`. These properties are described in "Resource Properties" in *Sun Cluster Data Services Planning and Administration Guide for Solaris OS*.

## ▼ How to Verify the Operation of the Fault Monitor for the SAP Message Server

Perform this procedure on each node where the SAP message server can run.

**Steps** 1. **Log in to a node as superuser.**

2. **Bring online the resource group to which the SAP message server belongs.**

```
scswitch -z -g central-rg -h node
```

-z

Specifies that a resource group is to be brought online.

-g *central-rg*

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

-h *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.

3. **Specify that failover is to be enabled for the resource group.**

```
scrgadm -c -g central-rg -y Failover_Enabled=True
```

-c

Specifies that an existing configuration is to be modified

-g *central-rg*

Specifies the name of the resource group to be modified



```
-y Failover_Enabled=True
```

Specifies that the resource group is to fail over when `Retry_count` is exceeded during `Retry_interval`

**4. Terminate the SAP message server.**

**5. Confirm that the SAP message server either restarts or fails over.**

If the abnormal termination action in [Step 4](#) is repeated a specified number of times within a specified time interval, the SAP message server fails over to an available node. If no node is available, the SAP message server is offline.

If the abnormal termination action is *not* repeated a specified number of times within a specified time interval, the SAP message server restarts on the same node.

Run the `scstat` command to determine the status of the SAP message server.

Note that the maximum number of times that the application can be abnormally terminated before failing over is specified with the standard property `Retry_count`, and the time interval is specified with the standard property `Retry_interval`. These properties are described in “Resource Properties” in *Sun Cluster Data Services Planning and Administration Guide for Solaris OS*.

**6. Again, bring online the resource group to which the SAP message server belongs, as described in [Step 2](#).**

**7. Specify that failover is to be disabled for the resource group.**

```
scrgadm -c -g central-rg -y Failover_Enabled=False
```

```
-c
```

Specifies that an existing configuration is to be modified

```
-g central-rg
```

Specifies the name of the resource group to be modified

```
-y Failover_Enabled=False
```

Specifies that the resource group is *not* to fail over when `Retry_count` is exceeded during `Retry_interval`

**8. Terminate the SAP message server.**

**9. Confirm that the SAP message server restarts.**

Because the `Failover_Enabled` is set to `False`, the SAP message server always restarts.

## ▼ How to Verify the Operation of the Fault Monitor for the SAP Web Application Server Component

Perform this procedure on each node where the SAP web application server component can run.

**Steps** 1. **Log in to a node as superuser.**

2. **Bring online the resource group to which the SAP message server belongs.**

The SAP web application server component resource is configured to be dependent on the SAP message server resource.

```
scswitch -z -g central-rg -h node
```

-z

Specifies that a resource group is to be brought online.

-g *central-rg*

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

-h *node*

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

3. **Bring online the resource group to which the SAP web application server component belongs.**

```
scswitch -z -g webas-rg -h node
```

-z

Specifies that a resource group is to be brought online.

-g *webas-rg*

Specifies the name of the resource group to be brought online. This group is the resource group to which the SAP web application server component belongs.

-h *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.

4. **Terminate the SAP web application server component.**

5. **Confirm that the SAP web application server component is restarted locally.**

If the abnormal termination action in [Step 4](#) is repeated a specified number of times within a specified time interval, the resulting behavior depends on whether the SAP web application server component resource was configured as a failover or a scalable resource.

- If the SAP web application server component resource was configured as a failover resource, the resource fails over to an available node. If no node is available, the SAP web application server component is offline.

- If the SAP web application server component resource was configured as a scalable resource, the resource is offline on this node.

Run the `scstat` command to determine the status of the SAP web application server component.

Note that the maximum number of times that the application can be abnormally terminated before failing over or becoming offline is specified with the standard

property `Retry_count`, and the time interval is specified with the standard property `Retry_interval`. These properties are described in “Resource Properties” in *Sun Cluster Data Services Planning and Administration Guide for Solaris OS*.

## ▼ How to Verify the Installation and Configuration of Sun Cluster HA for SAP J2EE Engine

**Steps** 1. Become superuser on one of the nodes in the cluster that is to host the SAP J2EE engine.

2. Run the `scstat` command to ensure all the resources are online.

```
scstat
```

For each SAP J2EE engine resource that is not online, run the `scswitch` command as follows.

```
scswitch -e -j j2ee-rs
```

```
-e
```

Specifies that a resource is to be enabled

```
-j j2ee-rg
```

Specifies the name of the resource that is to be enabled

3. Run the `scswitch` command to switch the SAP J2EE engine resource group to another cluster node, such as `node2`.

```
scswitch -z -g j2ee-rg -h node2
```

```
-z
```

Specifies that a resource group is to be brought online

```
-g j2ee-rg
```

Specifies the name of the resource group to be brought online

```
-h node2
```

Specifies the name of the node on which the resource group is to be brought online

---

# Debugging Sun Cluster HA for SAP J2EE Engine

Sun Cluster HA for SAP J2EE Engine can be used by multiple Sun Cluster instances. However, it is possible to activate debugging for all Sun Cluster instances or for a particular Sun Cluster instance.

Each Sun Cluster component has a DEBUG file in `/opt/SUNWscswa/etc`.

This file allows you to activate debugging for all Sun Cluster resources or for a specific Sun Cluster resource on a particular node with Sun Cluster. If you require debugging to be turned on for Sun Cluster HA for SAP J2EE Engine across the entire Sun Cluster, repeat these steps on all nodes within Sun Cluster.

## ▼ How to Activate Debugging for Sun Cluster HA for SAP J2EE Engine

### Steps 1. Edit the file `/etc/syslog.conf`.

In the file `/etc/syslog.conf`, change `daemon.notice` to `daemon.debug`.

```
grep daemon /etc/syslog.conf
*.err;kern.debug;daemon.notice;mail.crit /var/adm/messages
*.alert;kern.err;daemon.err operator
```

Change `daemon.notice` to `daemon.debug` and restart `syslogd`. The command `grep daemon /etc/syslog.conf` issues the following output, which shows that `daemon.debug` has now been set.

```
grep daemon /etc/syslog.conf
*.err;kern.debug;daemon.debug;mail.crit /var/adm/messages
*.alert;kern.err;daemon.err operator
#
pkill -1 syslogd
```

### 2. Edit the file `/opt/SUNWscswa/etc/config`.

In the file `/opt/SUNWscswa/etc/config`, change `DEBUG=` to `DEBUG=ALL` or `DEBUG=resource`.

```
cat /opt/SUNWscswa/etc/config
#
Copyright 2003 Sun Microsystems, Inc. All rights reserved.
Use is subject to license terms.
#
Usage:
DEBUG=<RESOURCE_NAME> or ALL
```

```

DEBUG=ALL
#
```

**More  
Information**

## Deactivating Debugging

To deactivate debugging, perform the steps in this procedure in the reverse order.



# Sun Cluster HA for SAP Web Application Server Extension Properties

---

Extension properties for Sun Cluster HA for SAP Web Application Server resource types are described in the following sections:

- “SUNW.sapenq Extension Properties” on page 79
- “SUNW.saprepl Extension Properties” on page 82
- “SUNW.sapscs Extension Properties” on page 84
- “SUNW.sapwebas Extension Properties” on page 86

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

---

## SUNW.sapenq Extension Properties

The SUNW.sapenq resource type represents the SAP enqueue server in a Sun Cluster configuration. The extension properties of this resource type are as follows:

### Child\_mon\_level

The child process monitoring level for the Process Monitor Facility (PMF). This property is equivalent to the `-C` option of `pmfadm`.

The default value of `-1` indicates that child process monitoring is not to be performed. Positive values indicate the desired level of child process monitoring.

|                  |                  |
|------------------|------------------|
| <b>Data type</b> | Integer          |
| <b>Default</b>   | -1               |
| <b>Range</b>     | No range defined |
| <b>Tunable</b>   | Any time         |

#### Enqueue\_Instance\_Number

The two-digit instance number for the SAP enqueue server. This number is the value of `SAPSYSTEM` in the SAP profile for SAP enqueue server.

|                  |                    |
|------------------|--------------------|
| <b>Data type</b> | String             |
| <b>Default</b>   | No default defined |
| <b>Range</b>     | Not applicable     |
| <b>Tunable</b>   | When disabled      |

#### Enqueue\_Profile

The full path to the SAP enqueue server profile.

|                  |                    |
|------------------|--------------------|
| <b>Data type</b> | String             |
| <b>Default</b>   | No default defined |
| <b>Range</b>     | Not applicable     |
| <b>Tunable</b>   | When disabled      |

#### Enqueue\_Server

The full path to the SAP enqueue server executable.

|                  |                    |
|------------------|--------------------|
| <b>Data type</b> | String             |
| <b>Default</b>   | No default defined |
| <b>Range</b>     | Not applicable     |
| <b>Tunable</b>   | When disabled      |

#### Enqueue\_Server\_Monitor

The full path to the SAP enqueue server monitor executable.

|                  |                                                                                                                                                                                                            |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data type</b> | String                                                                                                                                                                                                     |
| <b>Default</b>   | <i>directory/ensmon</i> , where <i>directory</i> is the full path to the directory where the SAP enqueue server executable is stored, as specified by the extension property <code>Enqueue_Server</code> . |
| <b>Range</b>     | Not applicable                                                                                                                                                                                             |
| <b>Tunable</b>   | When disabled                                                                                                                                                                                              |

#### Log\_Directory

The directory for the startup and monitor log files.

|                  |                                                                                                               |
|------------------|---------------------------------------------------------------------------------------------------------------|
| <b>Data type</b> | String                                                                                                        |
| <b>Default</b>   | The home directory of the administration user, as specified by the extension property <code>SAP_User</code> . |
| <b>Range</b>     | Not applicable                                                                                                |
| <b>Tunable</b>   | When disabled                                                                                                 |



#### Monitor\_retry\_count

The maximum number of restarts by the Process Monitor Facility (PMF) that are allowed for the SAP enqueue server fault monitor.

|                  |                  |
|------------------|------------------|
| <b>Data type</b> | Integer          |
| <b>Default</b>   | 4                |
| <b>Range</b>     | No range defined |
| <b>Tunable</b>   | Any time         |

#### Monitor\_retry\_interval

The interval in minutes between restarts of the SAP enqueue server fault monitor.

|                  |                  |
|------------------|------------------|
| <b>Data type</b> | Integer          |
| <b>Default</b>   | 2                |
| <b>Range</b>     | No range defined |
| <b>Tunable</b>   | Any time         |

#### Probe\_timeout

The timeout value in seconds that the SAP enqueue server fault monitor uses to probe an SAP enqueue server instance.

|                  |                                 |
|------------------|---------------------------------|
| <b>Data type</b> | Integer                         |
| <b>Default</b>   | 120                             |
| <b>Range</b>     | Minimum = 2; no maximum defined |
| <b>Tunable</b>   | Any time                        |

#### SAP\_User

The administration user for the SAP enqueue server.

|                  |                                        |
|------------------|----------------------------------------|
| <b>Data type</b> | String, where letters are in lowercase |
| <b>Default</b>   | No default defined                     |
| <b>Range</b>     | Not applicable                         |
| <b>Tunable</b>   | When disabled                          |

#### Stop\_signal

The signal that is sent to the application to stop the SAP enqueue server application.

|                  |                          |
|------------------|--------------------------|
| <b>Data type</b> | Integer                  |
| <b>Default</b>   | 2 (equivalent to SIGINT) |
| <b>Range</b>     | 1–37                     |
| <b>Tunable</b>   | When disabled            |

---

## SUNW.saprep1 Extension Properties

The SUNW.saprep1 resource type represents the SAP replica server in a Sun Cluster configuration. The extension properties of this resource type are as follows:

### Child\_mon\_level

The child process monitoring level for the Process Monitor Facility (PMF). This property is equivalent to the -C option of pmfadm.

The default value of -1 indicates that child process monitoring is not to be performed. Positive values indicate the desired level of child process monitoring.

|                  |                  |
|------------------|------------------|
| <b>Data type</b> | Integer          |
| <b>Default</b>   | -1               |
| <b>Range</b>     | No range defined |
| <b>Tunable</b>   | Any time         |

### Log\_Directory

The directory for the startup and monitor log files that are created by the SAP replica server application.

|                  |                                                                                                 |
|------------------|-------------------------------------------------------------------------------------------------|
| <b>Data type</b> | String                                                                                          |
| <b>Default</b>   | The home directory of the administration user, as specified by the extension property SAP_User. |
| <b>Range</b>     | Not applicable                                                                                  |
| <b>Tunable</b>   | When disabled                                                                                   |

### Monitor\_retry\_count

The maximum number of restarts by PMF that are allowed for the SAP replica server fault monitor.

|                  |                  |
|------------------|------------------|
| <b>Data type</b> | Integer          |
| <b>Default</b>   | 4                |
| <b>Range</b>     | No range defined |
| <b>Tunable</b>   | Any time         |

### Monitor\_retry\_interval

The interval in minutes between restarts of the SAP replica server fault monitor.

|                  |                  |
|------------------|------------------|
| <b>Data type</b> | Integer          |
| <b>Default</b>   | 2                |
| <b>Range</b>     | No range defined |
| <b>Tunable</b>   | Any time         |

#### Probe\_timeout

Currently unused. The timeout value in seconds that the SAP replica server fault monitor uses to probe an SAP replica server instance. The SAP replica server is started by PMF and monitored by PMF. No additional probing is currently performed by the fault monitor.

|                  |                                 |
|------------------|---------------------------------|
| <b>Data type</b> | Integer                         |
| <b>Default</b>   | 30                              |
| <b>Range</b>     | Minimum = 2; no maximum defined |
| <b>Tunable</b>   | Any time                        |

#### Replica\_Profile

The full path to the SAP replica server profile.

|                  |                    |
|------------------|--------------------|
| <b>Data type</b> | String             |
| <b>Default</b>   | No default defined |
| <b>Range</b>     | Not applicable     |
| <b>Tunable</b>   | When disabled      |

#### Replica\_Server

The full path to the SAP replica server executable.

|                  |                    |
|------------------|--------------------|
| <b>Data type</b> | String             |
| <b>Default</b>   | No default defined |
| <b>Range</b>     | Not applicable     |
| <b>Tunable</b>   | When disabled      |

#### SAP\_User

The administration user for the SAP replica server.

|                  |                                        |
|------------------|----------------------------------------|
| <b>Data type</b> | String, where letters are in lowercase |
| <b>Default</b>   | No default defined                     |
| <b>Range</b>     | Not applicable                         |
| <b>Tunable</b>   | When disabled                          |

#### Stop\_signal

The signal that is sent to the application to stop the SAP replica server application.

|                  |                          |
|------------------|--------------------------|
| <b>Data type</b> | Integer                  |
| <b>Default</b>   | 2 (equivalent to SIGINT) |
| <b>Range</b>     | 1–37                     |
| <b>Tunable</b>   | Any time                 |

---

## SUNW.sapscs Extension Properties

The SUNW.sapscs resource type represents the SAP message server, as well as some associated utilities, in a Sun Cluster configuration. The extension properties of this resource type are as follows:

### Failover\_Enabled

Specifies whether to fail over when `Retry_count` is exceeded during `Retry_interval`. The possible values of this extension property are as follows:

- `True` – Specifies that the resource group is to fail over when `Retry_count` is exceeded during `Retry_interval`
- `False` – Specifies that the resource group is *not* to fail over when `Retry_count` is exceeded during `Retry_interval`

**Data type** Boolean  
**Default** TRUE  
**Range** Not applicable  
**Tunable** Any time

### Monitor\_retry\_count

The maximum number of restarts by the Process Monitor Facility (PMF) that are allowed for the SAP message server fault monitor.

**Data type** Integer  
**Default** 4  
**Range** No range defined  
**Tunable** Any time

### Monitor\_retry\_interval

The interval in minutes between restarts of the SAP message server fault monitor.

**Data type** Integer  
**Default** 2  
**Range** No range defined  
**Tunable** Any time

### Msg\_Server\_Monitor

The SAP message server probe executable.

**Data type** String  
**Default** `/usr/sap/SAPSID/SYS/exe/run/msprot`, where `SAPSID` is the SAP system identification

**Range** Not applicable  
**Tunable** When disabled

`Msg_Server_Port`

The listen port of the SAP message server.

If no value is specified for this property, the initial default value is 0, and a derived default value is calculated to be  $3600 + \text{SAP\_Instance\_Number}$ . Specify a value for this property if the listen port of the SAP message server to be probed is not equivalent to  $3600 + \text{SAP\_Instance\_Number}$ . For example, if two SAP message servers exist, specify a value for this property.

**Data type** Integer  
**Default** 0  
**Range** 0 — 65535  
**Tunable** When disabled

`Probe_timeout`

The timeout value in seconds that the SAP message server fault monitor uses to probe an SAP message server instance.

**Data type** Integer  
**Default** 120  
**Range** Minimum 2  
**Tunable** Any time

`SAP_Instance_Name`

The name of the SAP message server instance. This name is `INSTANCE_NAME` in the SAP profile.

**Data type** String  
**Default** No default defined  
**Range** Not applicable  
**Tunable** When disabled

`SAP_Instance_Number`

The two-digit SAP system number for the SAP message server instance. This number is `SAPSYSTEM` in the SAP profile.

**Data type** String  
**Default** No default defined  
**Range** Not applicable  
**Tunable** When disabled

#### SAP\_SID

The SAP system ID. This ID is *SAPSYSTEMNAME* in the SAP profile.

|                  |                    |
|------------------|--------------------|
| <b>Data type</b> | String             |
| <b>Default</b>   | No default defined |
| <b>Range</b>     | Not applicable     |
| <b>Tunable</b>   | When disabled      |

#### SAP\_User

The administration user for the SAP message server.

|                  |                                                                                                 |
|------------------|-------------------------------------------------------------------------------------------------|
| <b>Data type</b> | String, where letters are in lowercase                                                          |
| <b>Default</b>   | <i>SAPSID</i> adm, where <i>SAPSID</i> is the SAP system identification, converted to lowercase |
| <b>Range</b>     | Not applicable                                                                                  |
| <b>Tunable</b>   | When disabled                                                                                   |

#### Scs\_Shutdown\_Script

The full path to the shutdown script for the instance.

|                  |                                            |
|------------------|--------------------------------------------|
| <b>Data type</b> | String                                     |
| <b>Default</b>   | <i>/usr/sap/SAPSID/SYS/exe/run/stopsap</i> |
| <b>Range</b>     | Not applicable                             |
| <b>Tunable</b>   | When disabled                              |

#### Scs\_Startup\_Script

The full path to the startup script for the instance.

|                  |                                             |
|------------------|---------------------------------------------|
| <b>Data type</b> | String                                      |
| <b>Default</b>   | <i>/usr/sap/SAPSID/SYS/exe/run/startsap</i> |
| <b>Range</b>     | Not applicable                              |
| <b>Tunable</b>   | When disabled                               |

---

## SUNW.sapwebas Extension Properties

The *SUNW.sapwebas* resource type represents the SAP web application server component in a Sun Cluster configuration. The extension properties of this resource type are as follows:

#### Monitor\_retry\_count

The maximum number of restarts by the Process Monitor Facility (PMF) that are allowed for the SAP web application server component fault monitor.

|                  |                  |
|------------------|------------------|
| <b>Data type</b> | Integer          |
| <b>Default</b>   | 4                |
| <b>Range</b>     | No range defined |
| <b>Tunable</b>   | Any time         |

#### Monitor\_retry\_interval

The interval in minutes between restarts of the SAP web application server component fault monitor.

|                  |                  |
|------------------|------------------|
| <b>Data type</b> | Integer          |
| <b>Default</b>   | 2                |
| <b>Range</b>     | No range defined |
| <b>Tunable</b>   | Any time         |

#### Probe\_timeout

The timeout value in seconds that the SAP web application server component fault monitor uses to probe an SAP web application server component instance.

|                  |           |
|------------------|-----------|
| <b>Data type</b> | Integer   |
| <b>Default</b>   | 120       |
| <b>Range</b>     | Minimum 2 |
| <b>Tunable</b>   | Any time  |

#### SAP\_Instance\_Name

The name of the SAP web application server component instance. This name is INSTANCE\_NAME in the SAP profile.

|                  |                    |
|------------------|--------------------|
| <b>Data type</b> | String             |
| <b>Default</b>   | No default defined |
| <b>Range</b>     | Not applicable     |
| <b>Tunable</b>   | When disabled      |

#### SAP\_Instance\_Number

The two-digit SAP system number for the SAP web application server component instance. This number is SAPSYSTEM in the SAP profile.

|                  |                    |
|------------------|--------------------|
| <b>Data type</b> | String             |
| <b>Default</b>   | No default defined |
| <b>Range</b>     | Not applicable     |
| <b>Tunable</b>   | When disabled      |

#### SAP\_SID

The SAP system ID. This ID is SAPSYSTEMNAME in the SAP profile.

|                  |                    |
|------------------|--------------------|
| <b>Data type</b> | String             |
| <b>Default</b>   | No default defined |
| <b>Range</b>     | Not applicable     |
| <b>Tunable</b>   | When disabled      |

#### SAP\_User

The administration user for the SAP web application server component.

|                  |                                                                                  |
|------------------|----------------------------------------------------------------------------------|
| <b>Data type</b> | String, where letters are in lowercase                                           |
| <b>Default</b>   | SAPSIDadm, where SAPSID is the SAP system identification, converted to lowercase |
| <b>Range</b>     | Not applicable                                                                   |
| <b>Tunable</b>   | When disabled                                                                    |

#### Webas\_Probe\_J2ee

Determines if an embedded SAP J2EE engine should be probed. The possible values of this extension property are as follows:

- True – Specifies that an embedded SAP J2EE engine should be probed
- False – Specifies that an embedded SAP J2EE engine should *not* be probed

|                  |                |
|------------------|----------------|
| <b>Data type</b> | Boolean        |
| <b>Default</b>   | FALSE          |
| <b>Range</b>     | Not applicable |
| <b>Tunable</b>   | When disabled  |

#### Webas\_Shutdown\_Script

The full path to the shutdown script for the instance.

|                  |                                     |
|------------------|-------------------------------------|
| <b>Data type</b> | String                              |
| <b>Default</b>   | /usr/sap/SAPSID/SYS/exe/run/stopsap |
| <b>Range</b>     | Not applicable                      |
| <b>Tunable</b>   | When disabled                       |

#### Webas\_Startup\_Script

The full path to the startup script for the instance.

|                  |                                      |
|------------------|--------------------------------------|
| <b>Data type</b> | String                               |
| <b>Default</b>   | /usr/sap/SAPSID/SYS/exe/run/startsap |
| <b>Range</b>     | Not applicable                       |
| <b>Tunable</b>   | When disabled                        |



`Webas_Use_Pmf`

Determines if the startup script process tree is run under PMF. The possible values of this extension property are as follows:

- `True` – Specifies that the startup script process tree is run under PMF
- `False` – Specifies that the startup script process tree is *not* run under PMF

|                  |                |
|------------------|----------------|
| <b>Data type</b> | Boolean        |
| <b>Default</b>   | TRUE           |
| <b>Range</b>     | Not applicable |
| <b>Tunable</b>   | When disabled  |



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