

**Oracle® Solaris Cluster Data Service for
SAP liveCache Guide**

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Using This Documentation

- **Overview** – Explains how to install and configure the Oracle Solaris Cluster HA for SAP liveCache data service
- **Audience** – Technicians, system administrators, and authorized service providers
- **Required knowledge** – Advanced experience troubleshooting and replacing hardware

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Installing and Configuring HA for SAP liveCache

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

This chapter contains the following sections.

- “HA for SAP liveCache Overview” on page 13
- “Installing and Configuring HA for SAP liveCache” on page 15
- “Planning the HA for SAP liveCache Installation and Configuration” on page 16
- “Preparing the Nodes and Disks” on page 18
- “Installing and Configuring liveCache” on page 19
- “Verifying the liveCache Installation and Configuration” on page 22
- “Installing the HA for SAP liveCache Package” on page 23
- “Registering and Configuring the HA for SAP liveCache” on page 25
- “Verifying the HA for SAP liveCache Installation and Configuration” on page 28
- “Tuning HA for SAP liveCache Fault Monitors” on page 30

HA for SAP liveCache Overview

Use the information in this section to understand how Oracle Solaris Cluster HA for SAP liveCache (HA for SAP liveCache) makes liveCache highly available.

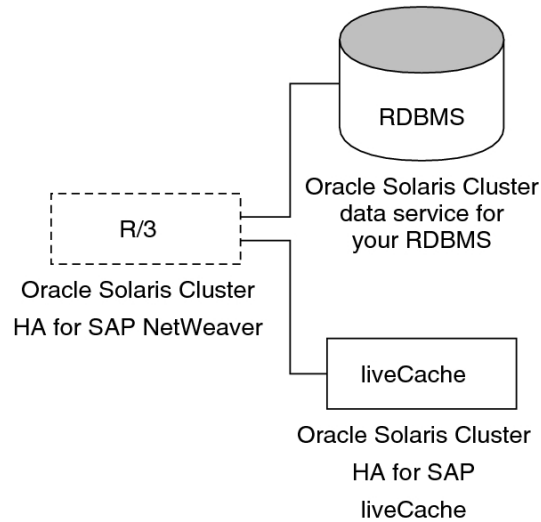
For conceptual information on scalable services, see the [Oracle Solaris Cluster 4.3 Concepts Guide](#) .

To eliminate a single point of failure in an SAP Advanced Planner & Optimizer (APO) System, HA for SAP liveCache provides fault monitoring and automatic failover for liveCache and fault monitoring and automatic restart for SAP xsriver. The following table lists the data services that best protect SAP Supply Chain Management (SCM) components in an Oracle Solaris Cluster configuration. [Figure 1, “Protection of liveCache Components,” on page 15](#) also

illustrates the data services that best protect SAP SCM components in an Oracle Solaris Cluster configuration.

TABLE 1 Protection of liveCache Components

liveCache Component	Protected by
SAP APO Central Instance	Oracle Solaris Cluster HA for SAP NetWeaver The resource type is ORCL.sapdia. For more information on this data service, see Oracle Solaris Cluster Data Service for SAP NetWeaver Guide .
SAP APO database	All highly available databases that are supported with Oracle Solaris Cluster software and by SAP.
SAP APO Application Server	Oracle Solaris Cluster HA for SAP NetWeaver The resource type is ORCL.sapdia. For more information on this data service, see Oracle Solaris Cluster Data Service for SAP NetWeaver Guide .
SAP xserver	HA for SAP liveCache The resource type is SUNW.sap_xserver.
SAP liveCache database	HA for SAP liveCache The resource type is SUNW.sap_livecache.
NFS file system	Oracle Solaris Cluster HA for NFS The resource type is SUNW.nfs. For more information on this data service, see Oracle Solaris Cluster Data Service for NFS Guide .

FIGURE 1 Protection of liveCache Components

Installing and Configuring HA for SAP liveCache

Table 2, “[Task Map: Installing and Configuring HA for SAP liveCache](#),” on page 15 lists the tasks for installing and configuring HA for SAP liveCache. Perform these tasks in the order that they are listed.

TABLE 2 Task Map: Installing and Configuring HA for SAP liveCache

Task	For Instructions, Go To
Plan the HA for SAP liveCache installation	Your SAP documentation “ Planning the HA for SAP liveCache Installation and Configuration ” on page 16
Prepare the nodes and disks	“ How to Prepare the Nodes ” on page 18
Install and configure liveCache	“ How to Install and Configure liveCache ” on page 19 “ How to Enable liveCache to Run in a Cluster ” on page 21
Verify liveCache installation and configuration	“ How to Verify the liveCache Installation and Configuration ” on page 23

Task	For Instructions, Go To
Install HA for SAP liveCache packages	“Installing the HA for SAP liveCache Package” on page 23
Register and configure HA for SAP liveCache as a failover data service	“How to Register and Configure HA for SAP liveCache” on page 25
Verify HA for SAP liveCache installation and configuration	“Verifying the HA for SAP liveCache Installation and Configuration” on page 28
Understand HA for SAP liveCache Fault Monitors	“Tuning HA for SAP liveCache Fault Monitors” on page 30

Planning the HA for SAP liveCache Installation and Configuration

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

Note - If you have not already done so, read your SAP documentation before you begin planning your HA for SAP liveCache installation and configuration because your SAP documentation includes configuration restrictions and requirements that are not outlined in Oracle Solaris Cluster documentation or dictated by Oracle Solaris Cluster software.

Configuration Requirements



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

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

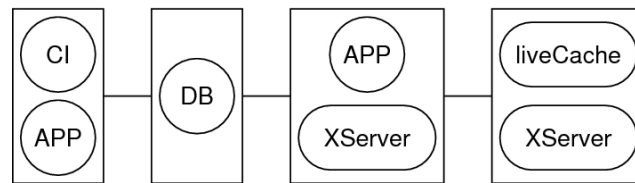
For requirements that apply to all data services, see [Oracle Solaris Cluster 4.3 Data Services Planning and Administration Guide](#).

Standard Data Service Configurations

Use the standard configurations in this section to plan the installation and configuration of HA for SAP liveCache. HA for SAP liveCache supports the standard configurations in this section. HA for SAP liveCache might support additional configurations. However, you must contact your Oracle service provider for information on additional configurations.

Figure 2, “Four-Node Cluster,” on page 17 illustrates a four-node cluster with SAP APO Central Instance, APO application servers, a database, and liveCache. APO Central Instance, the database, and liveCache are configured as failover data services. SAP xserver can be configured *only* as a multiple master data service. APO application servers can be configured as scalable or failover data services.

FIGURE 2 Four-Node Cluster



Configuration Considerations

Use the information in this section to plan the installation and configuration of HA for SAP liveCache. The information in this section encourages you to think about the impact your decisions have on the installation and configuration of HA for SAP liveCache.

- Install liveCache on its own global device group, separate from the global device group for the APO Oracle database and SAP R/3 software. This separate global device group for liveCache ensures that the liveCache resource can depend on the HASStoragePlus resource for liveCache only.
- If you want to run SAP xserver as any user other than user root, create that user on all nodes on which SAP xserver runs, and define this user in the Xserver_User extension property. SAP xserver starts and stops based on the user you identify in this extension property. The default for this extension property is user root.

- If you plan to use the root user as the controlling user for the SAP xserver resource, you must use bash as the login shell for root.

Configuration Planning Questions

Use the questions in this section to plan the installation and configuration of HA for SAP liveCache. See “[Configuration Considerations](#)” on page 17 for information that might apply to these questions.

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

See [Oracle Solaris Cluster 4.3 Data Services Planning and Administration Guide](#) for the advantages and disadvantages of placing the liveCache binaries on the local file system as opposed to the cluster file system.

Preparing the Nodes and Disks

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

▼ How to Prepare the Nodes

Use this procedure to prepare for the installation and configuration of liveCache.

1. **Assume a root role on all of the nodes.**
2. **Configure the `svc:/system/name-service/switch:default` SMF service.**
 - a. **On each node that can master the liveCache resource, include one of the following entries for `group`, `project`, an `passwd` database entries in the `svc:/system/name-service/switch:default` SMF service.**

```
config/database:  
config/database: files
```

```
config/database: files [NOTFOUND=return] nis
config/database: files [NOTFOUND=return] nisplus
config/database: files [NOTFOUND=return] ldap
```

Example:

```
# svccfg -s name-service/switch
svc:/system/name-service/switch> \
setprop config/passwd = astring: "files [NOTFOUND=return] nis"
svc:/system/name-service/switch> exit

# svcadm refresh name-service/switch
# svcadm restart name-service/switch
```

- b. **On each node that can master the liveCache resource, ensure that files appears first for the protocols database entry in the svc:/system/name-service/switch:default SMF service.**

Example:

```
protocols: files nis
```

HA for SAP liveCache uses the `su - user` command and the `dbmcli` command to start and stop liveCache.

The network information name service might become unavailable when a cluster node's public network fails. Implementing the preceding changes to the `svc:/system/name-service/switch:default SMF` service file ensures that the `su` command and the `dbmcli` command do not refer to the NIS/NIS+/LDAP name services.

Installing and Configuring liveCache

This section contains the procedures that you need to install and configure liveCache.

▼ How to Install and Configure liveCache

Use this procedure to install and configure liveCache.

1. **Install and configure SAP APO System.**

See [Oracle Solaris Cluster Data Service for SAP NetWeaver Guide](#) for the procedures on how to install and configure SAP APO System on Oracle Solaris Cluster software.

2. Install liveCache.

Note - Install liveCache by using the physical hostname if you have not already created the required logical host.

For more information, see your SAP documentation.

3. Ensure that the liveCache administrator user is in the `sdba` user group.

The format of the liveCache administrator user's user ID is `lc-nameadm`.

If you are creating the liveCache administrator user manually, add the following entry to the `/etc/group` file:

```
sdba::group-id:lc-nameadm
```

`group-id` The group's unique numerical ID (GID) within the system

`lc-name` Lowercase name of liveCache database instance

For more information about the `/etc/group` file, see the [group\(4\)](#) man page.

4. Become liveCache administrator user, create the `.XUSER.62` file for the SAP APO administrator user and the liveCache administrator user by using the following command.

Note - This user whose home directory contains the `.XUSER.62` file is an internal database user who has permissions to start, stop, and query the database.

```
$ dbmcli -d LC-NAME -n logical-hostname-ususername,passwd
```

`LC-NAME` Uppercase name of liveCache database instance

`logical-hostname` Logical hostname that is used with the liveCache resource



Caution - Neither SAP APO transaction LC10 nor HA for SAP liveCache functions properly if you do not create this file correctly.

5. Copy `/usr/spool/sql` if it exists, from the node, on which you installed liveCache, to all the nodes that will run the liveCache resource.

Ensure that the ownership of these files is the same on all nodes as it is on the node on which you installed liveCache.

Example:

```
# tar cfB /tmp/usr-spool.tar /usr/spool/sql
Log in to the destination node
# scp root@source:/tmp/usr-spool.tar /tmp
# cd /
# tar xfb /tmp/usr-spool.tar
```

source Specifies the node where you installed SAP liveCache

6. **Copy the `/etc/opt/sdb` directory and its contents from the node on which you installed liveCache, to all the nodes where resources for liveCache will run.**

Ensure that the ownership of these files is the same on all nodes as it is on the node on which you installed liveCache.

```
# tar cfB /tmp/opt-sdb.tar /etc/opt/sdb
Log in to the target node
# scp root@source:/tmp/opt-sdb.tar /tmp
# cd /
# tar xfb /tmp/opt-sdb.tar
```

source Specifies the node where you installed SAP liveCache.

7. **Create a link from the `/sapdb/LCA/db/wrk` directory to the `/sapdb/data/wrk` directory as follows:**

```
# ln -s /sapdb/data/wrk /sapdb/LCA/db/wrk
```

8. **Ensure that all the required system files have been copied from the install node to all the nodes that will run the liveCache resource.**

The required files include `/etc/group`, `/etc/passwd`, `/etc/project`, and `/etc/user_attr`.

▼ How to Enable liveCache to Run in a Cluster

During a standard SAP installation, liveCache is installed with a physical hostname. You must modify liveCache to use a logical hostname so that liveCache works in a Oracle Solaris Cluster environment. Use this procedure to enable liveCache to run in a cluster.

Before You Begin Ensure that the `/etc/netmasks` file has IP-address subnet and netmask entries for all logical hostnames. If necessary, edit the `/etc/netmasks` file to add any missing entries.

1. **Create the failover resource group to hold the network and liveCache resource.**

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

2. **Verify that you added all the network resources you use to your name service database.**

3. **Add a network resource (logical hostname) to the failover resource group.**

```
# clreslogicalhostname create -g livecache-resource-group \  
-h lc-logical-hostname lc-logical-hostname
```

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

4. **Enable the failover resource group.**

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

5. **Enable the network resource (logical hostname).**

```
# clresource enable lc-logical-hostname
```

6. **Log on to the node that hosts the liveCache resource group.**

7. **As the liveCache administrator user, start SAP xserver manually on the node that hosts the liveCache resource group.**

```
# su - lc-name adm  
$ x_server start
```

lc-name Lowercase name of liveCache database instance

8. **Log on to SAP APO System by using your SAP GUI with user DDIC.**

9. **Go to transaction LC10 and change the liveCache host to the logical hostname you defined in [Step 3](#).**

liveCache host: *lc-logical-hostname*

Verifying the liveCache Installation and Configuration

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

▼ How to Verify the liveCache Installation and Configuration

Use this procedure to verify the liveCache installation and configuration. This procedure does not verify that your application is highly available because you have not installed your data service yet.

1. **Log on to SAP APO System by using your SAP GUI with user DDIC.**
2. **Go to transaction LC10.**
3. **Ensure that you can check the state of liveCache.**
4. **Ensure that the following dbmcLi commands work as user *lc-nameadm*.**

```
$ dbmcLi -d LC-NAME -n logical-hostname -U DEFAULT db_state
$ dbmcLi -d LC-NAME -n logical-hostname db_enum
```

5. **Confirm that the liveCache administrator user can run the `lcinit restart` command.**

- a. **Become the liveCache administrator user.**

```
# su - lc-name adm
```

lc-name Lowercase name of liveCache database instance

- b. **Run the `lcinit restart` command**

```
$ lcinit lc-name restart
```

Installing the HA for SAP liveCache Package

If you did not install the HA for SAP liveCache package during your initial Oracle Solaris Cluster installation, perform this procedure to install the package.

▼ How to Install the HA for SAP liveCache Package

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

1. **On the cluster node where you are installing the data service package, assume the root role.**
2. **Ensure that the data service package is available from the configured publisher and that the `solaris` and `ha-cluster` publishers are valid.**

```
# pkg list -a ha-cluster/data-service/sap-livecache
# pkg publisher
PUBLISHER                                TYPE      STATUS   P  LOCATION
solaris                                  origin   online   F  solaris-repository
ha-cluster                               origin   online   F  ha-cluster-repository
```

For information about setting the `solaris` publisher, see [“Adding, Modifying, or Removing Package Publishers”](#) in *Adding and Updating Software in Oracle Solaris 11.3*.

Tip - Use the `-nv` options whenever you install or update to see what changes will be made, such as which versions of which packages will be installed or updated and whether a new BE will be created.

If you do not get any error messages when you use the `-nv` options, run the command again without the `-n` option to actually perform the installation or update. If you do get error messages, run the command again with more `-v` options (for example, `-nvv`) or more of the package FMRI pattern to get more information to help you diagnose and fix the problem. For troubleshooting information, see [Appendix A, “Troubleshooting Package Installation and Update,”](#) in *Adding and Updating Software in Oracle Solaris 11.3*.

3. **Install the HA for SAP liveCache software package.**

```
# pkg install ha-cluster/data-service/sap-livecache
```

4. **Verify that the package installed successfully.**

```
$ pkg info ha-cluster/data-service/sap-livecache
```

Installation is successful if output shows that State is Installed.

5. **Perform any necessary updates to the Oracle Solaris Cluster software.**

For instructions on updating your software, see [Chapter 11, “Updating Your Software,”](#) in *Oracle Solaris Cluster 4.3 System Administration Guide*.

Registering and Configuring the HA for SAP liveCache

This section contains the procedures that you need to configure HA for SAP liveCache.

Setting HA for SAP liveCache Extension Properties

Use the extension properties in [Appendix A, “HA for SAP liveCache Extension Properties”](#) to create your resources. Use the following command line to configure extension properties when you create your resource.

```
clresource create -g resource-group -t resource-type -p property=value resource
```

Use the procedure in [“Changing Resource Type, Resource Group, and Resource Properties” in Oracle Solaris Cluster 4.3 Data Services Planning and Administration Guide](#) to configure the extension properties if you have already created your resources. You can update some extension properties dynamically. You can update others, however, only when you create or disable a resource. The Tunable fields in [Appendix A, “HA for SAP liveCache Extension Properties”](#) indicate when you can update each property. See [Chapter 1, “Planning for Oracle Solaris Cluster Data Services,” in Oracle Solaris Cluster 4.3 Data Services Planning and Administration Guide](#) for a list of Oracle Solaris Cluster properties.

▼ How to Register and Configure HA for SAP liveCache

Use this procedure to configure HA for SAP liveCache as a failover data service for the liveCache database and SAP xserver as a multiple master data service. This procedure assumes that you installed the data service packages. If you did not install the HA for SAP liveCache packages as part of your initial Oracle Solaris Cluster installation, go to [“Installing the HA for SAP liveCache Package” on page 23](#) to install the data service packages. Otherwise, use this procedure to configure the HA for SAP liveCache.



Caution - Do not configure more than one SAP xserver resource on the same cluster because one SAP xserver serves multiple liveCache instances in the cluster. More than one SAP xserver resource that runs on the same cluster causes conflicts between the SAP xserver resources. These conflicts cause all SAP xserver resources to become unavailable. If you attempt to start the SAP xserver twice, you receive an error message that says `Address already in use`.

1. **Assume a root role on one of the nodes in the cluster that will host the liveCache resource.**

2. **Copy the `lccluster` file to the same location as the `lcinit` file.**

```
# cp /opt/SUNWsc/c/livcache/bin/lccluster \  
/sapdb/LC-NAME/db/sap
```

LC-NAME Uppercase name of liveCache database instance

3. **Edit the `lccluster` file to substitute the value for `put-LC_NAME`-here.**

- a. **Open the `lccluster` file.**

```
# vi /sapdb/LC-NAME/db/sap/lccluster
```

- b. **Replace `put-LC_NAME`-here with the liveCache instance name.**

The liveCache instance name is the value you defined in the `Livecache_Name` extension property.

```
LC_NAME="liveCache-instance-name"
```

4. **Add the `HASStoragePlus` resource to the liveCache resource group.**

```
# clresourcetype register SUNW.HASStoragePlus  
# clresource create -g livecache-resource-group \  
-t SUNW.HASStoragePlus -p filesystemmountpoints=mountpoint,... \  
-p globaldevicepaths=livecache-device-group \  
-p affinityon=TRUE livecache-storage-resource
```

The resource is created in the enabled state.

Note - `affinityon` must be set to `TRUE` and the local file system must reside on global disk groups to be failover.

For the procedure on how to set up an `HASStoragePlus` resource, see [Oracle Solaris Cluster 4.3 Data Services Planning and Administration Guide](#).

5. **Register the resource type for liveCache database.**

```
# clresourcetype register SUNW.sap_livcache
```

6. **Register the resource type for SAP xserver.**

```
# clresourcetype register SUNW.sap_xserver
```

7. Create a multiple master resource group for SAP xserver. Configure SAP xserver to run on all the potential nodes that liveCache will run on.

Note - Configure SAP xserver so that SAP xserver starts on all nodes that the liveCache resources can fail over to. To implement this configuration, ensure that the *node-list* parameter of the SAP xserver resource group contains all the nodes listed in the liveCache resource groups' *node-list*. Also, the value of *desired primaries* and *maximum primaries* of the SAP xserver resource group must be equal to each other.

```
# clresourcegroup create -n node-list \
-p Maximum_primaries=value \
-p Desired_primaries=value xserver-resource-group
```

8. Add the HASStoragePlus resource to the SAP xserver resource group.

```
# clresource create \
-g xserver-resource-group \
-t SUNW.HASStoragePlus \
-p filesystemmountpoints=mountpoints \
-p affinityon=false xserver-storage-resource
```

The resource is created in the enabled state.

For more information about setting up an HASStoragePlus resource, see [“Enabling Highly Available Local File Systems” in Oracle Solaris Cluster 4.3 Data Services Planning and Administration Guide](#) .

9. Create an SAP xserver resource in this multiple master resource group.

```
# clresource create \
-g xserver-resource-group \
-t SUNW.sap_xserver \
-p resource_dependencies_offline_restart= \
xserver-storage-resource{LOCAL_NODE xserver-resource
```

The resource is created in the enabled state.

See [“Setting HA for SAP liveCache Extension Properties” on page 25](#) for a list of extension properties.

10. Create the liveCache resource.

```
# clresource create -g livecache-resource-group \
-t SUNW.sap_livecache \
-p livecache_name=LC-NAME \
-p resource_dependencies_offline_restart=livecache-storage-resource, \
xserver-resource livecache-resource
```

The resource is created in the enabled state.

11. Ensure that the liveCache resource group is brought online only on the node where the SAP xserver resource group is online.

To meet this requirement, create on the liveCache resource group a strong positive affinity for the SAP xserver resource group.

```
# clresourcegroup set \  
-p rg_affinities=++xserver-resource-group livecache-resource-group
```

12. Enable the liveCache failover resource group.

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

13. (Optional) Consider configuring your cluster to prevent the APO application server resource group from being brought online on the same node as the liveCache resource group.

You might plan to run the APO application server on a node to which the liveCache resource can fail over. In this situation, consider using resource group affinities to shut down the APO application server when the liveCache resource fails over to the node.

To specify this behavior, create on the APO application server resource group a strong negative affinity for the liveCache resource group.

```
# clresourcegroup set \  
-p rg_affinities=--liveCache-resource-group apo-resource-group
```

Verifying the HA for SAP liveCache Installation and Configuration

This section contains the procedure you need to verify that you installed and configured your data service correctly.

▼ How to Verify the HA for SAP liveCache Installation and Configuration

Use this procedure to verify that you installed and configured HA for SAP liveCache correctly. You need the information in the following table to understand the various states of the liveCache database.

State	Description
OFFLINE	liveCache is not running.
COLD	liveCache is available for administrator tasks.
WARM	liveCache is online.
STOPPED INCORRECTLY	liveCache stopped incorrectly. This is also one of the interim states while liveCache starts or stops.
ERROR	Cannot determine the current state. This is also one of the interim states while liveCache starts or stops.
UNKNOWN	This is one of the interim states while liveCache starts or stops.

1. Log on to the node that hosts the resource group that contains the liveCache resource, and verify that the fault monitor functionality works correctly.

a. Terminate liveCache abnormally by stopping all liveCache processes.

Oracle Solaris Cluster software restarts liveCache.

If you do not see this behavior, you might not have correctly performed [Step 2](#) and [Step 3](#) in “[How to Register and Configure HA for SAP liveCache](#)” on page 25.

```
# ps -ef|grep sap|grep kernel
# kill -9 livecache-processes
```

b. Terminate liveCache by using the Stop liveCache button in LC10 or by running the lcinit command.

Oracle Solaris Cluster software does not restart liveCache. However, the liveCache resource status message reflects that liveCache stopped outside of Oracle Solaris Cluster software through the use of the Stop liveCache button in LC10 or the lcinit command. The state of the liveCache resource is UNKNOWN. When the user successfully restarts liveCache by using the Start liveCache button in LC10 or the lcinit command, the HA for SAP liveCache Fault Monitor updates the resource state and status message to indicate that liveCache is running under the control of Oracle Solaris Cluster software.

If you do not see this behavior, you might not have correctly performed [Step 2](#) and [Step 3](#) in “[How to Register and Configure HA for SAP liveCache](#)” on page 25.

2. Log on to SAP APO by using your SAP GUI with user DDIC, and verify that liveCache starts correctly by using transaction LC10.

3. As user root, switch the liveCache resource group to another node.

```
# clresourcegroup switch -n node2 livecache-resource-group
```

4. Repeat [Step 1](#) through [Step 3](#) for each potential node on which the liveCache resource can run.
5. Log on to the nodes that host the SAP xserver resource, and verify that the fault monitor functionality works correctly.

Terminate SAP xserver abnormally by stopping all SAP xserver processes.

```
# ps -ef|grep xserver
# kill -9 xserver-process
```

Verify that the SAP xserver agent restarts the SAP xserver.

Tuning HA for SAP liveCache Fault Monitors

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

- The SAP liveCache fault monitor
- The SAP xserver fault monitor

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

TABLE 3 Resource Types for HA for SAP liveCache Fault Monitors

Fault Monitor	Resource Type
SAP liveCache	SUNW.sap_livecache
SAP xserver	SUNW.sap_xserver

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

Tuning the HA for SAP liveCache fault monitors involves the following tasks:

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

For more information, see [“Tuning Fault Monitors for Oracle Solaris Cluster Data Services” in Oracle Solaris Cluster 4.3 Data Services Planning and Administration Guide](#) . Information about the HA for SAP liveCache fault monitors that you need to perform these tasks is provided in the subsections that follow.

Tune the HA for SAP liveCache fault monitors when you register and configure HA for SAP liveCache. For more information, see [“Registering and Configuring the HA for SAP liveCache” on page 25](#).

Factors That Affect the Interval Between Fault Monitor Probes

To determine whether SAP xserver and SAP liveCache are operating correctly, the HA for SAP liveCache fault monitors probe these resources periodically. The optimum interval between fault monitor probes depends on the time that is required to respond to a fault in a resource. This time depends on how the complexity of the resource affects the time that is required for operations such as restarting the resource.

Operations by the HA for SAP liveCache Fault Monitors During a Probe

The optimum timeout for fault monitor probes depends on the operations that a fault monitor performs to probe the resource.

Operations by the SAP liveCache Fault Monitor During a Probe

During a probe, the SAP liveCache fault monitor performs the following operations:

1. The SAP liveCache fault monitor determines whether SAP liveCache is online.
2. If liveCache is online, the SAP liveCache fault monitor determines whether the liveCache parent process is running.
3. If liveCache is not online, the SAP liveCache fault monitor determines whether a user stopped liveCache outside the control of Oracle Solaris Cluster.

A user can stop liveCache by using the `Stop liveCache` button in LC10 or the `lcinit` command.

4. If a user did not stop liveCache outside the control of Oracle Solaris Cluster, the SAP liveCache fault monitor determines whether SAP xserver is available.

Operations by the SAP xserver Fault Monitor During a Probe

During a probe, the SAP xserver fault monitor determines whether SAP xserver is available.

Faults Detected by the HA for SAP liveCache Fault Monitors

Faults that each HA for SAP liveCache fault monitor detects are described in the subsections that follow.

Faults Detected by the SAP liveCache Fault Monitor

The SAP liveCache fault monitor detects the following faults in SAP liveCache:

- Unexpected termination of liveCache

Note - The liveCache fault monitor also detects the expected termination of liveCache, which is not a fault. For more information, see [“Monitoring the Termination of liveCache by a User” on page 33](#).

- Unexpected termination of the liveCache parent process
- System failures

SAP liveCache can be stopped or restarted only if SAP xserver is available. Therefore, the SAP liveCache fault monitor also detects the unavailability of SAP xserver. This fault monitoring supplements the fault monitoring that the SAP xserver fault monitor provides. This additional fault monitoring enforces the cross-resource group resource dependency between SAP xserver and SAP liveCache.

Faults Detected by the SAP xserver Fault Monitor

The SAP xserver fault monitor detects following faults:

- **Unavailability of SAP xserver.** Unavailability of SAP xserver is also detected by the SAP liveCache fault monitor.
- **System errors.** The SAP xserver fault monitor treats a system error as a partial failure.
- **Persistent system errors.** A persistent system error is a system error that occurs four times within the retry interval. If a persistent system error occurs, the fault monitor restarts SAP xserver.

Recovery Actions in Response to Detected Faults

To minimize the disruption that transient faults in a resource cause, a fault monitor restarts the resource in response to such faults. For persistent faults, more disruptive action than restarting the resource is required:

- For the SAP liveCache resource, the fault monitor fails over the resource to another node. The SAP liveCache resource is a failover resource.
- For the SAP xserver resource, the fault monitor takes the resource offline. The SAP xserver is a multiple master data resource.

Monitoring the Termination of liveCache by a User

The SAP liveCache fault monitor detects when a user stops liveCache outside the control of Oracle Solaris Cluster. A user can stop liveCache by using the Stop liveCache button in LC10 or the `lcinit` command.

In this situation, the liveCache fault monitor updates the status of the liveCache resource to indicate that liveCache is stopped. However, the liveCache fault monitor performs no recovery action.

If a user restarts liveCache, the liveCache fault monitor updates the status of the liveCache resource to indicate that liveCache is running again.

HA for SAP liveCache Extension Properties

Extension properties for HA for SAP liveCache resource types are described in the following sections.

- “[SUNW.sap_livecache Extension Properties](#)” on page 35
- “[SUNW.sap_xserver Extension Properties](#)” on page 36

For details about system-defined properties, see the [r_properties\(5\)](#) man page and the [rg_properties\(5\)](#) man page.

SUNW.sap_livecache Extension Properties

The `SUNW.sap_livecache` resource type represents the SAP liveCache application in a Oracle Solaris Cluster configuration. The extension properties of this resource type are as follows:

`Confdir_list` (optional)

The directory for liveCache software and the instance directory.

Data type	String
Default	/sapdb
Range	Not applicable
Tunable	At creation

`Livecache_name` (required)

Name of liveCache database instance.

Data type	String
Default	None

Range Not applicable

Tunable At creation

Monitor_retry_count

Number of PMF restarts that are allowed for the fault monitor.

Data type Integer

Default 4

Range No range defined

Tunable Any time

Monitor_retry_interval

Time interval in minutes for fault monitor restarts.

Data type Integer

Default 2

Range No range defined

Tunable Any time

Probe_timeout

Timeout value in seconds for the probes.

Data type Integer

Default 90

Range No range defined

Tunable Any time

SUNW.sap_xserver Extension Properties

The SUNW.sap_xserver resource type represents SAP xserver in a Oracle Solaris Cluster configuration. The extension properties of this resource type are as follows:

Confdir_List

The full path to the directory that contains the SAP liveCache software and SAP liveCache database instance.

Data type	String
Default	/sapdb
Range	Not applicable
Tunable	At creation

Independent_Program_Path

The full path to the directory that contains the following programs and libraries for SAP xserver:

- Programs that are independent of the database software version
- Libraries for the client runtime environment

HA for SAP liveCache determines the path to the `x_server` command from the value of this property. The `x_server` command resides in the `bin` subdirectory of the directory that this property specifies.

Data type	String
Default	No default defined
Range	Not applicable
Tunable	When disabled
Introduced in release	3.1 4/04

Monitor_retry_count

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

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

Monitor_retry_interval

The period of time in minutes during which the PMF counts restarts of the fault monitor.

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

Probe_timeout

The timeout value in seconds for fault monitor probes.

Data type	Integer
Default	120
Range	No range defined
Tunable	Any time

Soft_Stop_Pct

The percentage of the Stop method timeout that is used to stop SAP xserver by using the SAP utility `x_server stop`. If this timeout is exceeded, the SIGKILL signal is used to stop all SAP xserver processes.

Data type	Integer
Default	50
Range	1–100
Tunable	When disabled

Xserver_User

The UNIX user identity of the OS user who administers SAP xserver.

Data type	String
Default	root
Range	Not applicable

Tunable

At creation

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