



LifeKeeper[®] for Linux

SAP Recovery Kit v6.2 Administration
Guide

February 2011

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SAP Recovery Kit Administration Guide

Introduction

The LifeKeeper® for Linux SAP Recovery Kit provides a mechanism to recover SAP R/3 and NetWeaver from a failed primary server onto a backup server in a LifeKeeper environment. The SAP Recovery Kit works in conjunction with other LifeKeeper Recovery Kits (the IP Recovery Kit, NFS Server Recovery Kit, NAS Recovery Kit, and a Database Recovery Kit) to provide comprehensive failover protection.

This guide provides information critical for configuring and administering your SAP resources. You should follow the configuration instructions carefully to ensure a successful LifeKeeper implementation. You should also refer to the Administration Guides for the related recovery kits.

Document Contents

This guide explains the following topics:

- [LifeKeeper Documentation](#). Provides a list of the LifeKeeper for Linux documentation and where the information is available.
- [Abbreviations](#). Contains a list of abbreviations that are used throughout this document along with their meaning.
- [Requirements](#). Lists the hardware and software requirements that you must meet before installing and setting up the recovery software.
- [SAP Recovery Kit Overview](#). Describes the general functions of the recovery kit and provides a sample hierarchy as it appears in the LifeKeeper GUI.
- [SAP Configuration Considerations](#). Provides a general description of configuration issues followed by a step by step procedure for configuring SAP with LifeKeeper protection.
- [Resource Configuration Tasks](#). Provides a detailed description of SAP administration tasks through LifeKeeper.
- [Administration Tips](#). Provides suggestions and information related to the routine administration of SAP in a LifeKeeper environment.
- [Troubleshooting](#). Provides a list of informational and error messages with recommended solutions.

LifeKeeper Documentation

The following is a list of LifeKeeper related information available from SIOS Technology Corp.:

- *LifeKeeper for Linux Release Notes*
- *LifeKeeper for Linux Online Product Manual* (available from the Help menu within the LifeKeeper GUI)
- *LifeKeeper for Linux Planning and Installation Guide*

This documentation, along with documentation associated with other LifeKeeper recovery kits, is available online at:

<http://us.sios.com/support>

In particular, refer to the following guides for SAP-related recovery kits:

- *LifeKeeper for Linux IP Recovery Kit Administration Guide*
- *LifeKeeper for Linux NFS Server Recovery Kit Administration Guide*
- *LifeKeeper for Linux Network Attached Storage Recovery Kit Administration Guide*
- *LifeKeeper for Linux Oracle Recovery Kit Administration Guide*
- *LifeKeeper for Linux SAP DB / MaxDB Recovery Kit Administration Guide*
- *LifeKeeper for Linux DB2 Recovery Kit Administration Guide*

Reference Documents

The following are documents associated with SAP that are referenced throughout this guide:

- *SAP R/3 in Switchover Environments (SAP document 50020596)*
- *R/3 Installation on UNIX: (Database specific)*
- *SAP Web Application Server in Switchover Environments*
- *Component Installation Guide SAP Web Application Server (Database Specific)*
- SAP Notes 7316, 14838, 201144, 27517, 31238, 34998 and 63748

Abbreviations

The following abbreviations are used throughout this document:

Abbreviation	Meaning
HA	Highly Available, High Availability.
SPOF	Single Point of Failure.
CI	Central Instance - the SAP instance that contains the Message and Enqueue services. This instance is a single point of failure and must be protected by LifeKeeper. CI is also used to denote the Primary CI Server.
(CI)	The backup SAP CI server. This is the server that hosts the CI when the primary CI server fails.
ASCS	ABAP SAP Central Services Instance - the SAP instance that contains the Message and Enqueue services for the NetWeaver ABAP environment. This instance is a single point of failure and must be protected by LifeKeeper.
(ASCS)	The backup ASCS server. This is the server that hosts the ASCS when the primary ASCS server fails.
SCS	SAP Central Services Instance - the SAP instance that contains the Message and Enqueue services for the NetWeaver Java environment. This instance is a single point of failure and must be protected by LifeKeeper.
(SCS)	The backup SCS server. This is the server that hosts the SCS when the primary SCS server fails.
DB	The SAP Database instance. This database may be Oracle, DB2, SAP DB or any other database supported by SAP. This instance is a single point of failure and must be protected by LifeKeeper. Note that the CI and DB may be located on the same server or different servers. DB is also used to denote the Primary DB Server.
(DB)	The backup DB server. This is the server that hosts the DB when the primary DB server fails. Note that a single server might be a backup for both the DB and CI.
AS	SAP Application Server. Although AS typically refers to any application server, within the context of this document it is intended to mean a non-CI, redundant application server. Thus, the application server is not protected by LifeKeeper.
[AS]	A redundant AS that LifeKeeper controls, but does not protect. This redundant AS is typically running on the CI Backup Server. LifeKeeper will shut down this AS when the SAP hierarchy is coming in-service on the server where it is running and restart it when the SAP hierarchy comes in-service on another server.

SID or <SID>	Uppercase three character identifier for the SAP system.
sid or <sid>	Lower case version of SID.
ID or <ID>	Two digit numerical identifier for an SAP instance.
<sapmnt>	SAP home directory, which is <i>/sapmnt</i> by default, but may be changed by the user during installation.
<INST> or <AS-INST>	Directory for a SAP instance, whose name is derived from the services included in the instance and the instance number, for example a CI <INST> might be DVEBMGS00. The designation <AS-INST> is used to distinguish a redundant application server instance from a CI instance.

Requirements

Before attempting to install or remove the LifeKeeper SAP Recovery Kit, you must understand the hardware and software requirements and the installation and removal procedures.

Hardware and Software Requirements

Before installing and configuring the LifeKeeper SAP Recovery Kit, be sure that your configuration meets the following requirements:

- **Servers.** This recovery kit requires two or more computers configured in accordance with the requirements described in the *LifeKeeper for Linux Release Notes* and the *LifeKeeper for Linux Planning and Installation Guide*, which are shipped with the product media.
- **Shared Storage.** SAP CI, ASCS Instance, SCS Instance, and program files must reside on shared disk(s) in a LifeKeeper environment.
- **IP network interface.** Each server requires at least one Ethernet TCP/IP-supported network interface. In order for IP switchover to work properly, user systems connected to the local network should conform to standard TCP/IP specifications.
Note: Even though each server requires only a single network interface, multiple interfaces should be used for a number of reasons: heterogeneous media requirements, throughput requirements, elimination of single points of failure, network segmentation, and so forth.
- **Operating System.** Linux operating system. (See the *LifeKeeper for Linux Release Notes* for a list of supported distributions and kernel versions).
- **TCP/IP software.** Each server requires the TCP/IP software.
- **SAP Software.** Each server must have the SAP software installed and configured before configuring LifeKeeper and the LifeKeeper SAP Recovery Kit. The same version should be installed on each server. Consult the *LifeKeeper for Linux Release Notes* or your sales representative for the latest release compatibility and ordering information.
- **LifeKeeper software.** You must install the same version of LifeKeeper software and any patches on each server. Please refer to the *LifeKeeper for Linux Release Notes* for specific LifeKeeper requirements.
- **LifeKeeper IP Recovery Kit.** This recovery kit is required if remote clients will be accessing the SAP CI, ASCS, or SCS instance. You must use the same version of this recovery kit on *each* server.
- **LifeKeeper for Linux NFS Server Recovery Kit.** This recovery kit is required for most configurations. You must use the same version of this recovery kit on *each* server.
- **LifeKeeper for Linux Network Attached Storage Recovery Kit.** This recovery kit is required for some configurations. You must use the same version of this recovery kit on *each* server.
- **LifeKeeper for Linux Database Recovery Kit.** The LifeKeeper recovery kit for the database being used with SAP must be installed on each database server. Please refer to the *LifeKeeper for Linux Release Notes* for information on supported databases. A LifeKeeper database hierarchy must be created for the SAP CI, ASCS, or SCS Instance prior to configuring SAP.

Important Notes:

- Refer to the *LifeKeeper for Linux Planning and Installation Guide* for instructions on how to install or remove the LifeKeeper Core software and the SAP Recovery Kit.
- For details on configuring each of the required LifeKeeper Recovery Kits, you should refer to the Administration Guide for each kit (IP, NFS Server, NAS, and **Database** Recovery Kits).

SAP Recovery Kit Overview

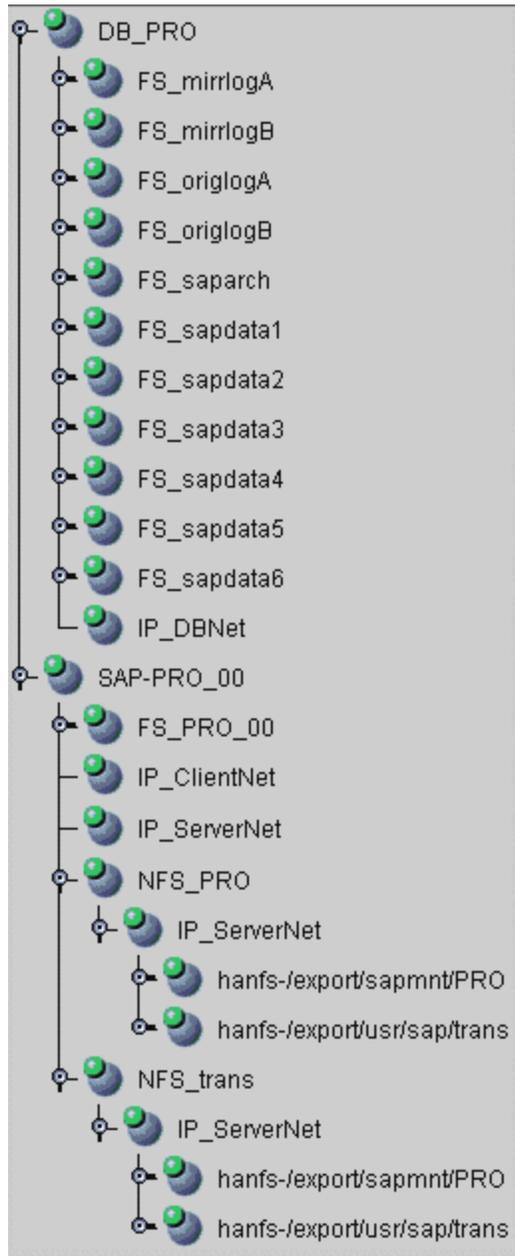
The SAP Recovery Kit provides monitoring and switchover for the SAP Central Instance (CI), ABAP SAP Central Service (ASCS), or the SAP Central Services (SCS) Instance (NetWeaver environments). The enqueue and message server are protected. In ABAP+Java AddIn environments, a single LifeKeeper SAP hierarchy protects the Java SCS in addition to the ABAP Instance. The SAP Recovery Kit works with the recovery kit for the appropriate database to protect the database and with the NFS Server Recovery Kit to protect the NFS mounts. The IP Recovery Kit is also used to provide a virtual IP address that can be moved between network cards in the cluster as needed. The Network Attached Storage Recovery Kit is used to protect the local NFS mounts. The various recovery kits are used to build the SAP resource hierarchy which provides protection for all of the components of the application environment.

Each recovery kit monitors the health of the application under protection and is able to stop and restart the application both locally and on another cluster server.

A typical SAP resource hierarchy as it appears in the LifeKeeper GUI is shown on the following page. This particular example shows a separate hierarchy for SAP and the database. As explained later, some configurations require a single hierarchy where the database hierarchy is a dependent child of the SAP hierarchy. In this example, the database resource with tag DB_PRO is the highest level resource in the hierarchy and is therefore used to perform operations such as starting and stopping the application and performing manual failovers. Below the DB_PRO resource are child filesys and IP resources responsible for protecting the database file systems and virtual IP addresses.

Likewise, the SAP resource with tag SAP-PRO_00 is the highest level resource in the SAP hierarchy. Below this resource are file system, NFS and IP resources responsible for protecting the required NFS shares, file systems and SAP's virtual IP addresses.

SAP Resource Hierarchy



Note: The directory /usr/sap/trans is optional in SAP environments. The directory does not exist in the SAP NetWeaver Java only environments.

SAP Configuration Considerations

This section contains information you should consider before you start to configure SAP and examples of typical SAP configurations. It also includes a step by step process for configuring and protecting SAP with LifeKeeper.

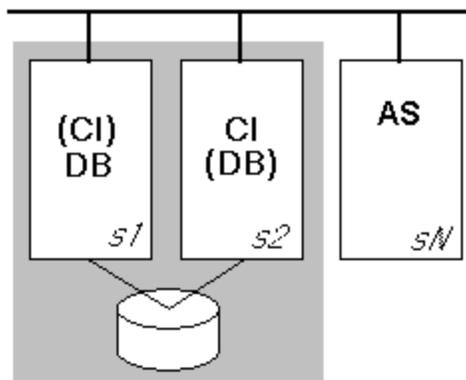
For instructions on installing SAP on Linux distributions supported by LifeKeeper using the 2.4 or 2.6 kernel, please see the database-specific SAP installation guide available from SAP.

Also, refer to your *LifeKeeper Online Product Manual* for instructions on configuring your LifeKeeper Core resources (for example, file system resources).

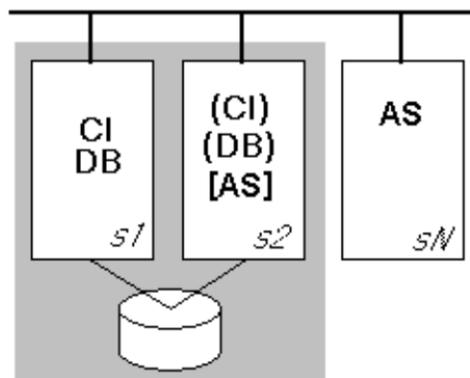
Supported Configurations

There are many possible configurations of database and application servers in a SAP Highly Available (HA) environment. The specific steps involved in setting up SAP for LifeKeeper protection are different for each configuration, so it is important to recognize the configuration that most closely fits your requirements. The supported configurations are shown below.

ABAP Configurations



Config. #1



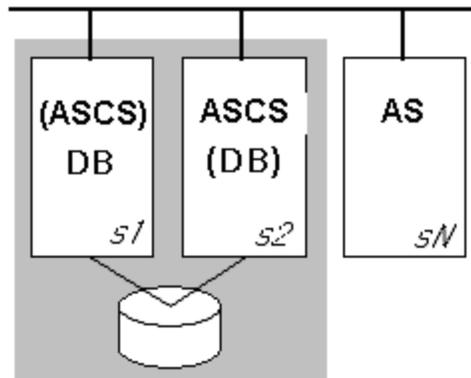
Config. #2

Please note that in the figures above CI represents the CI in SAP R/3 environments or the CI in NetWeaver environments. Both configurations consist of two servers hosting the CI and DB (*s1*, *s2*) and zero or more additional redundant AS servers (*sN*). Although it is possible to configure SAP with no redundant AS's, this would require users to log into the CI, which is not recommended by SAP. In both configurations, the CI and DB servers have access to shared file storage for database and application files.

There are two primary differences between the two configurations. In Configuration #1, the DB and CI are protected through two distinct LifeKeeper hierarchies and allowed to run on separate servers or on the same server. In Configuration #2, the DB and CI are protected by a single LifeKeeper hierarchy and are forced to run on the same server.

Additionally, Configuration #2 shows a redundant AS running on the backup server (*s2*). This application server is allowed to run on *s2* so long as the CI/DB is running on the primary server (*s1*). If the CI/DB is moved to the backup server (*s2*) due to a manual switchover operation or failure of *s1*, the redundant AS on *s2* is shut down by LifeKeeper prior to the startup of the CI. This prevents overloading of system resources on *s2*. Likewise, if the CI/DB is returned to *s1* after running for a period of time on *s2*, LifeKeeper will restart the AS on *s2*.

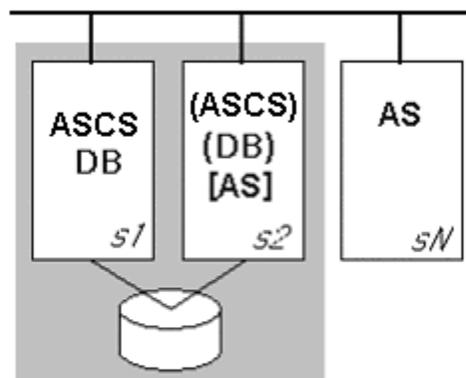
ABAP SCS Configurations



Config. #1

Configuration #1

- Server2 is the primary server for the ASCS and the backup for the DB, while Server1 is the primary for the DB and the backup server for the ASCS.
- SAP is installed on shared storage and the database software is installed on local storage of Server1, then on Server2 using identical installation parameters. The database data files are located on shared storage.



Config. #2

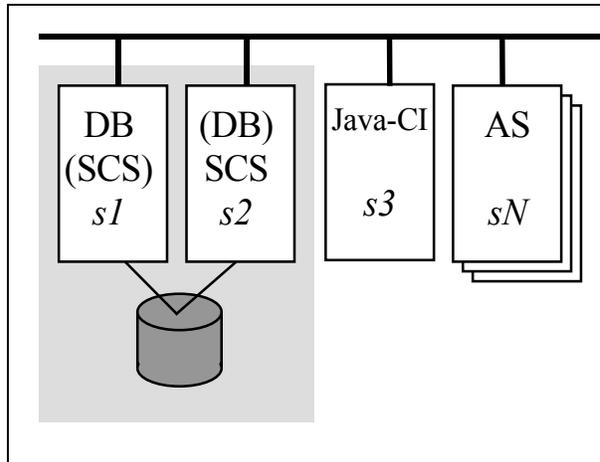
Configuration #2

- Server1 is the primary server for the ASCS and for the DB, while Server2 is the backup server for the ASCS and DB. An SAP Application Server (AS) runs on Server2 when SAP and the DB are running on Server1.
- A LifeKeeper dependency is created manually between the SAP and DB hierarchies.
- SAP is installed on shared storage and the database software is installed on local storage of Server1, then on Server2 using identical installation parameters. The database data files are located on shared storage.

Java SCS Configurations

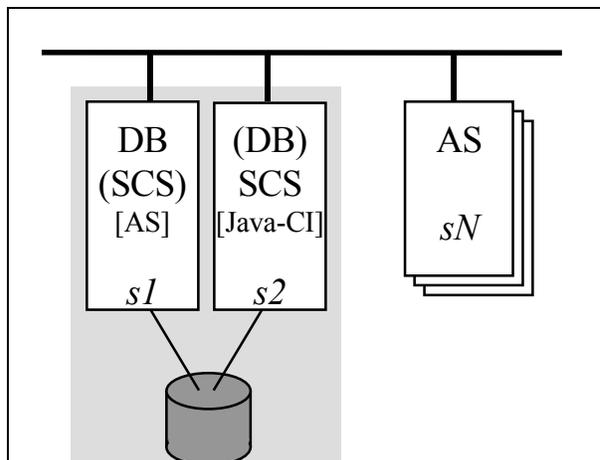
In ABAP+Java Add In configurations, the LifeKeeper SAP Recovery Kit protects the ABAP Central Instance (CI) and the Java SAP Central Services (SCS) Instance. The Java CI is not protected and monitored as it is not a single point of failure.

In Java Only configurations the LifeKeeper SAP Recovery Kit protects the Java SCS.



Configuration #1

- Server2 is the primary server for the SAP SCS and the backup for the DB, while Server1 is the primary for the DB and the backup server for the SAP SCS.
- The Java CI is installed outside of the cluster.
- SAP is installed on shared storage and the database software is installed on local storage of Server1, then on Server2 using identical installation parameters. The database data files are located on shared storage.



Configuration #2

- Server2 is the primary server for the SAP SCS and the backup for the DB, while Server1 is the primary for the DB and the backup server for the SAP SCS.
- The Java CI and an application server (AS) are installed on the cluster system but are not LifeKeeper protected.
- SAP is installed on shared storage and the database software is installed on local storage of Server1, then on Server2 using identical installation parameters. The database data files are located on shared storage.

Configuration Notes

The following are technical notes related to configuring SAP to run in a HA environment. Please see subsequent sections for step by step instructions on protecting SAP with LifeKeeper.

Directory Structure

The directory structure for the database will be different for each database management system that is used with the SAP system. Please consult the SAP installation guide specific to the database management system for details on the directory structure for the database. All database files must be located on shared disks to be protected by the LifeKeeper Recovery Kit for the database. Consult the database specific LifeKeeper Recovery Kit Administration Guide for additional information on protecting the database.

See [Directory Structure Diagrams](#) for graphical depictions of the SAP directories described in this section.

SAP recommends the following file systems for the CI installation.

File System Name	Description	Notes	NFS Shared
<i><sapmnt>/<SID></i>	Software and data for one SAP System	<i><sapmnt></i> directory name is configurable during installation	Yes
<i>/usr/sap/<SID></i>	Instance-specific data, symbolic links to the data for one system		No
<i>/usr/sap/trans</i>	Global transport directory for all SAP Systems	Can be located anywhere within the SAP System. If it is mounted on the CI server, it will be protected by LifeKeeper.	Yes

Additionally, during SAP software installation, a user named *<sid>adm* is created and given a home directory where SAP **start** and **stop** scripts are installed. In newer version the SAP **start**

and **stop** scripts are located in `/usr/sap/<SID>/SYS/exe`. LifeKeeper uses these scripts to start and stop SAP.

In order for LifeKeeper to protect the SAP CI, ASCS, and SCS, the files and data located under most of these paths must be located on a shared file system. The required directory structure depends on the chosen configuration. There are several issues that dictate the required directory structure.

NFS Mount Points and Inodes

LifeKeeper maintains NFS share information using inodes; therefore, every NFS share is required to have a unique inode. Since every file system root directory has the same inode, NFS shares must be at least one directory level down from root in order to be protected by LifeKeeper. For example, referring to the table above, if the `/usr/sap/trans` directory is NFS shared on the SAP server, the `/trans` directory is created on the shared storage device, which would require mounting the shared storage device as `/usr/sap`. It is not necessarily desirable, however to place all files under `/usr/sap` on shared storage which would be required with this arrangement. To circumvent this problem, it is recommended that you create an `/export` directory tree for mounting all shared file systems containing directories that are NFS shared, and then create a soft link between the SAP directories and the `/export` directories, or alternately, locally NFS mount the NFS shared directory. (Note: The name of the directory that we refer to as `/export` can vary according to user preference; however, for simplicity we will refer to this directory as `/export` throughout this document.) For example, the following directories and links/mounts for Configuration #2 on the SAP Primary Server would be:

For the <code>/usr/sap/trans</code> share	
Directory	Notes
<code>/trans</code>	created on shared file system and shared through NFS
<code>/export/usr/sap</code>	mounted to <code>/</code> (on shared file system)
<code>/usr/sap/trans</code>	soft linked to <code>/export/usr/sap/trans</code>

Likewise, the following directories and links for the `<sapmnt>/<SID>` share would be:

For the <code><sapmnt>/<SID></code> share	
Directory	Notes
<code>/<SID></code>	created on shared file system and shared through NFS
<code>/export/sapmnt</code>	mounted to <code>/</code> (on shared file system)
<code><sapmnt>/<SID></code>	NFS mounted to <code><virtual SAP server>:/export/sapmnt/<SID></code>

Detailed instructions are given for creating all directory structures and links in the configuration steps later in this guide. See the *NFS Server Recovery Kit Administration Guide* for additional information on inode conflicts.

Local NFS Mounts

The recommended directory structure for SAP in a LifeKeeper environment requires a locally mounted NFS share for one or more SAP system directories. If the NFS export point for any of the locally mounted NFS shares becomes unavailable, the system may hang while waiting for the export point to become available again. Many system operations will not work correctly, including a system reboot. You should be aware that the NFS server for the SAP cluster should be protected by LifeKeeper and should not be manually taken out of service while local mount points exist.

To avoid accidentally causing your cluster to hang by inadvertently stopping the NFS server, please follow the recommendations listed in the [Server/LifeKeeper Shutdown](#) section of this document. It is additionally helpful to mount all NFS shares using the 'intr' mount option so that hung processes resulting from inaccessible NFS shares can be killed.

NFS Mounts and su

LifeKeeper accomplishes many database and SAP tasks by executing database and SAP operations using the `su - <admin name> -c <command>` command syntax. The `su` command, when called in this way causes the login scripts in the administrator's home directory to be executed. These login scripts set environment variables to various SAP paths, some of which may reside on NFS mounted shares. If these NFS shares are not available for some reason, the `su` calls will hang, waiting for the NFS shares to become available again.

Since hung scripts can prevent LifeKeeper from functioning properly, it is desirable to configure your servers to account for this potential problem. The LifeKeeper scripts that handle SAP resource remove, restore and monitoring operations have a built in timer that prevent these scripts from hanging indefinitely. No configuration actions are therefore required to handle NFS hangs for the SAP Application Recovery Kit.

The database recovery kit, however, may not have a method of handling server hangs due to unavailable NFS shares. Specific instructions are contained in section [2.5 Modifying Database administrator's .cshrc file](#) section of this guide for database modifications that will prevent NFS hangs.

Note that there are many manual operations that unavailable NFS shares will still affect. You should always ensure that all NFS shares are available prior to executing manual LifeKeeper operations.

Location of <INST> directories

Since the `/usr/sap/<SID>` path is not NFS shared, it can be mounted to the root directory of the file system. The `/usr/sap/<SID>` path contains the SYS subdirectory and a `<INST>` subdirectory for each SAP instance that can run on the server. For Configuration #1, there is only one `<INST>` directory, so it is acceptable for it to be located under `/usr/sap/<SID>` on the shared file system. For Configuration #2, however, the backup server also contains a local AS instance whose `<INST>` directory should not be on a shared file system since it will not always be available. To solve this problem, it is recommended that for Configuration #2, the CI's, ASCS, or SCS's `/usr/sap/<SID>/<INST>`, `/usr/sap/<SID>/<ASCS-INST>`, or `/usr/sap/<SID>/<SCS-INST>` directory should be mounted to the shared file system instead of `/usr/sap/<SID>` and the `/usr/sap/<SID>/SYS` and `/usr/sap/<SID>/<AS-INST>` for the AS should be located on the local server.

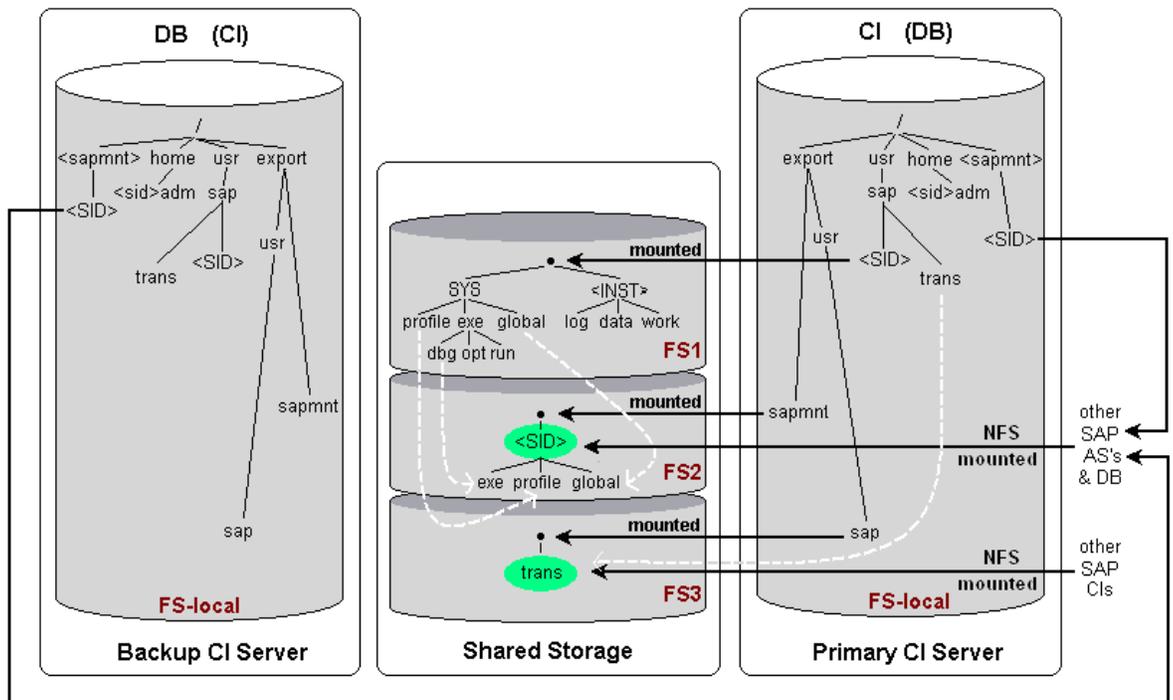
For example, the following directories and mount points should be created for Configuration #2:

Directory	Notes
<i>/usr/sap/<SID>/<CI-INST></i>	mounted to / (on shared file system)
<i>/usr/sap/<SID>/<SCS-INST></i>	mounted to / (on shared file system) - Present in NetWeaver 2004s ABAP+Java and ABAP environments only.
<i>/usr/sap/<SID>/<SCS-INST></i>	mounted to / (on shared file system) - Present in NetWeaver ABAP+Java and Java environments only.
<i>/usr/sap/<SID>/<AS-INST></i>	created for AS on backup server

Directory Structure Diagrams

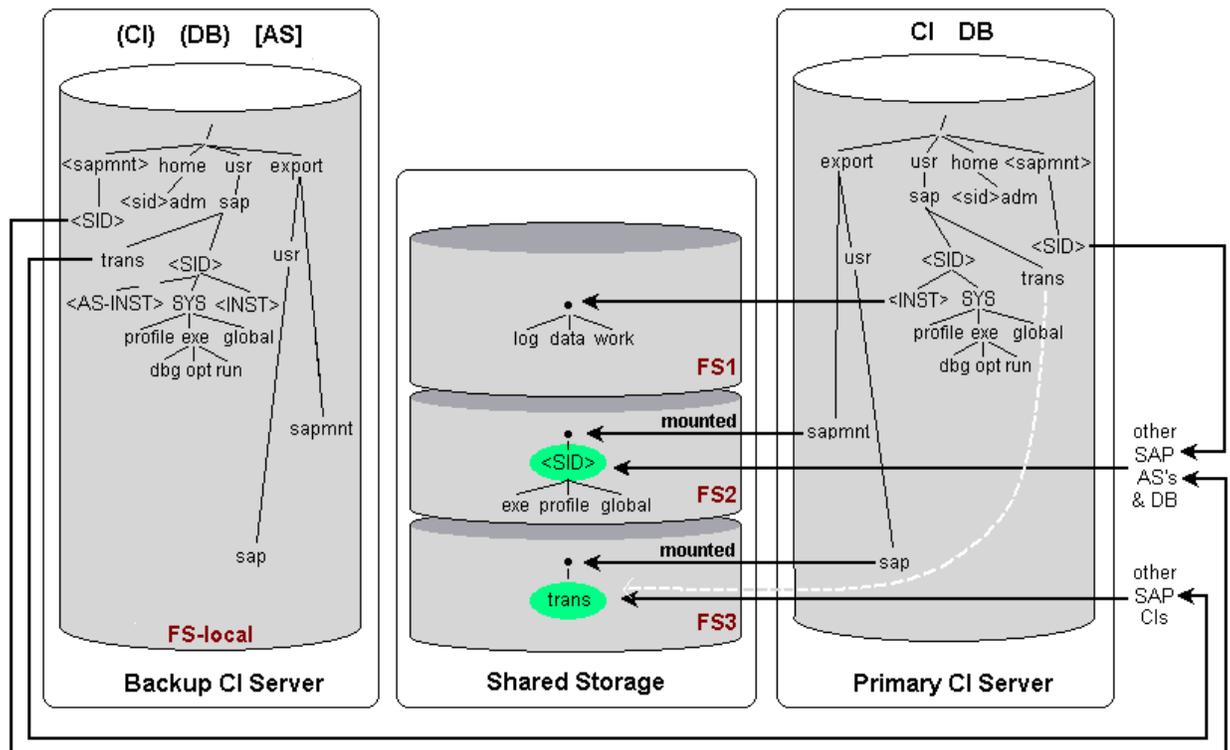
For NetWeaver 2004 ABAP+Java and Java environments please see the directory structure diagrams in the SAP document *SAP Web Application Server in Switchover Environments*. For NetWeaver 2004s environments the directory structure diagrams are included in the SAP installation documentation. The directory structure required for LifeKeeper protection of ABAP only environments is shown graphically in the figures below. See the [Abbreviations](#) section at the beginning of the guide for a description of the abbreviations used in the figures.

Directory Structure for Configuration #1



- LEGEND**
-  exe soft link
 -  mount point
 -  <SID> NFS shared file system
 - CI** Primary CI Server
 - (CI)** Backup CI Server
 - AS** SAP Application Server
 - DB** Primary DB Server
 - (DB)** Backup DB Server
 - FSn** File System on shared storage
 - FS-local** File System on local disk

Directory Structure for Configuration #2



LEGEND	
	soft link
	mount point
	NFS shared file system
CI	Primary CI Server
(CI)	Backup CI Server
AS	SAP Application Server
DB	Primary DB Server
(DB)	Backup DB Server
FSn	File System on shared storage
FS-local	File System on local disk
[AS]	Redundant AS (to be shut down on failover)

Directory Structure Options

The configuration steps presented in this guide are based on the directory structure and diagrams described above. This is the recommended directory structure as tested and certified by SIOS Technology Corp.

There are other directory structure variations that should also work with the SAP Recovery Kit, although not all of them have been tested. For configurations with directory structure variations, you should follow the guidelines below.

- The `/usr/sap/trans` directory can be hosted on any server accessible on the network and does not have to be the CI server. If you locate the `/usr/sap/trans` directory remotely from the CI, you will need to decide whether access to this directory is mission critical. If it is, then you

may want to protect it with LifeKeeper. This will require that it be hosted on a shared or replicated file system and protected by the LifeKeeper NFS Recovery Kit. If you have other methods of making the `/usr/sap/trans` directory available to all of the SAP instances without NFS, this is also acceptable.

- The `/usr/sap/trans` directory does not have to be NFS shared regardless of whether it is located on the CI server.
- The `/usr/sap/trans` directory does not have to be on a shared file system if it is not NFS shared or protected by LifeKeeper.
- The directory structure and path names used to export NFS file systems shown in the diagrams are examples only. The path `/export/usr/sap` could also be `/export/sap` or just `/sap`.
- The `/usr/sap/<SID>/<INST>` path needs to be on a shared file system at some level. It does not matter which part of this path is the mount point for the file system. It could be `/usr`, `/usr/sap`, `/usr/sap/<SID>` or `/usr/sap/<SID>/<INST>`.
- The `/sapmnt/<SID>` path needs to be on a shared file system at some level. The configuration diagrams show this path as NFS mounted, although this is a SAP requirement and not a LifeKeeper requirement.

Virtual Server Name

SAP Application Servers and SAP clients communicate with the SAP CI using the name of the server where the CI is running. Likewise, the SAP CI communicates with the DB using the name of the DB server. In a HA environment, the CI may be running on either the Primary Server or Backup Server at any given time. In order for other servers and clients to maintain a seamless connection to the CI regardless of which server it is active on, a virtual server name is used for all communication with the CI. This virtual server name is also mapped to a switchable IP address that can be active on whichever server the CI is running.

The switchable IP address is created and handled by LifeKeeper using the IP Recovery Kit. The virtual server name is configured manually by adding a virtual server name/switchable IP address mapping in DNS and/or in all of the servers' and clients' host files. See the *IP Recovery Kit Administration Guide* for additional information on how this works.

Additionally, SAP configuration files must be modified so that the virtual server name is substituted for the physical server name. This is covered in detail in a later section where step-by-step instructions are given for configuring SAP with LifeKeeper.

SAP (ABAP Environment) Health Monitoring

LifeKeeper monitors the health of the CI and initiates a recovery operation if it determines that SAP is not functioning correctly. In order to do this, LifeKeeper requires a utility called **sapinfo** that is installed with the SAP RFCSDK. The RFCSDK is included on the SAP Presentation CD and must be manually installed. The utility is described in *SAP Note 34998* and the installation of RFCSDK is described in *SAP Note 27517*.

The SAP Recovery Kit scripts expect the RFCSDK package to be installed under the path `/usr/sap`. If you wish to install it in an alternate location, you will need to add a line to the `/etc/default/LifeKeeper` file as follows, with the actual path substituted for `<path to RFCSDK>`:

```
SAP_RFC_PATH=<path to RFCSDK>    # /usr/sap/rfcsdk by default
```

LifeKeeper uses the SAP utility **lgtst** to monitor the SAP message server. This utility is installed during the normal SAP installation.

SAP License

In a HA environment, SAP is configured to run on both a Primary and a Backup Server. Since the SAP licensing scheme is hardware dependent, a separate license is required for each server where SAP is configured to run. You will therefore need to obtain and install a SAP license for both the Primary and Backup Servers.

Profile File Maintenance

Note: This section does not apply for later versions of SAP where the profile file name includes the virtual server name instead of the actual server name.

As described later in this document, there may be two sets of configuration and startup files in a HA environment: one set for the Primary CI or SCS Server and one for the Backup CI or SCS Server. The Primary Server and Backup Server configuration and startup files can be identical, or they can be different, depending on which services you want the CI or SCS to run on each server.

It is important to remember that any changes to configuration information that are to be applied to the CI or SCS running on both the Primary and Backup Servers must be made to both sets of files. If both files are identical, it may be helpful to maintain only a single copy of the file and create a link to it from the other one. It is not recommended that you use the built-in mechanism (transaction RZ10) for profile file maintenance. Instead, the files should be maintained manually.

Automatic Switchback

For Configuration #1, the SAP CI, ASCS, or SCS and DB hierarchies are separate and are in-service on different servers during normal operation. There are times, however, when both hierarchies will be in-service on the same server, such as when one of the servers is being taken down for maintenance. If both hierarchies are in-service on one of the servers and both servers go down, then when the servers come back up, it is important that the database hierarchy come in-service before the SAP hierarchy in-service operation times out. Since LifeKeeper brings hierarchies in-service during startup serially, if it chooses to bring SAP up first, the database in-service operation will wait on the SAP in-service operation to complete and the SAP in-service operation will wait on the database to become available, which will never happen because the DB restore operation can only begin after the CI, ASCS, or SCS restore completes. This deadlock condition will exist until the CI, ASCS, or SCS restore operation times out.

To prevent this deadlock scenario, it is important for this configuration to set the switchback flag for both hierarchies to Automatic Switchback. This will force LifeKeeper to restore each hierarchy on its highest priority server during LifeKeeper startup, which in this case is two different servers. Since LifeKeeper restore operations on different servers can occur in parallel, the deadlock condition is prevented.

SAP Start and Stop Scripts

LifeKeeper uses the SAP **start** and **stop** scripts in the <sid>adm's home directory. These scripts are installed with the names **startsap_<server name>_<instance id>** and **stopsap_<server name>_<instance id>**. In a HA environment, SAP recommends that these scripts be renamed to **startsap_<virtual server name>_<instance id>** and **stopsap_<virtual server name>_<instance id>** prior to doing any system upgrades.

To facilitate this, LifeKeeper automatically renames these scripts using the virtual server name during the SAP hierarchy creation operation. Likewise, when the SAP hierarchy is deleted, the

scripts are changed back to their original names. This only applies to earlier versions of SAP. For Web Application Server installations this is no longer an issue.

Other Notes

The following items require special configuration steps in a HA environment. Please consult the document *SAPR/3 in Switchover Environments or SAP Web Application Server in Switchover Environments* for additional information on configuration requirements for each:

- Login Groups
- SAP Spoolers
- Batch Jobs
- SAP Router
- SAP System Upgrades

Configuration Tasks

Before you can use LifeKeeper to create a SAP resource hierarchy, you must perform the following tasks in the order recommended below. Note that there are additional non-HA specific configuration tasks that must be performed that are not listed below. Consult the appropriate SAP installation guide for additional details.

The following tasks refer to the “SAP Primary Server” and “SAP Backup Server.” The SAP Primary Server is the server on which the CI and/or will run during normal operation, and the SAP Backup Server is the server on which the CI and/or will run if the SAP Primary Server fails.

In the previous configuration diagrams (see [Supported Configurations](#)), *s2* is the CI Primary Server for Configuration #1 and *s1* is the SAP Primary Server for Configuration #2. Likewise, “DB Primary Server” and “DB Backup Server” are used to denote the primary and backup servers for the database. In the previous configuration diagrams, *s1* is the DB Primary Server for both configurations #1 and #2.

Although it is not necessarily required, the steps below include the recommended procedure of protecting all shared file systems with LifeKeeper prior to using them. Prior to LifeKeeper protection, a shared file system is accessible from both servers and is susceptible to data corruption. Using LifeKeeper to protect the file systems preserves single server access to the data.

Task Overview

The tasks for configuring SAP with LifeKeeper fall into four major steps. Each of these four steps links to detailed tasks that follow.

1. Before Installing SAP
2. Installing SAP Software
3. Protecting SAP
4. Testing the SAP Resource Hierarchy

1. Before Installing SAP

These tasks are required before installing your SAP software. Perform the tasks below in the order given. Details for each task are presented in the sections that follow. Please also refer to the SAP document *SAP Web Application Server in Switchover Environments* when planning your installation in NetWeaver Environments.

- 1.1 [Plan your configuration](#)
- 1.2 [Install LifeKeeper](#)
- 1.3 [Create file systems and directory structure](#)
- 1.4 [Protect dependent resources with LifeKeeper](#)

1.1 Plan Your Configuration

1. Determine which configuration you wish to use. The required tasks vary depending on the configuration.
2. Determine whether the SAP system-wide `/usr/sap/trans` directory will be hosted on the SAP CI or somewhere else on the network. It can be hosted anywhere as long as it is NFS shared and accessible to all CIs in your SAP landscape. If it is hosted on the SAP CI and located on a shared file system, it should be protected by LifeKeeper and included in the SAP hierarchy.
3. Consider the storage requirements for SAP and DB as listed in the *SAP Installation Guide*. Most of the SAP files will have to be installed on shared storage. Consult the LifeKeeper Administration Guide for the database-specific recovery kit for information on which database files are installed on shared storage and which are installed locally. Note that in a SAP environment, SAP requires local access to the database binaries, so they will have to be installed locally. Determine how to best use your shared storage to meet these requirements.

Also note that when shared storage resources are under LifeKeeper protection, they can only be accessed by one server at a time. If the shared device is a disk array, an entire LUN is protected. If a shared device is a disk, then the entire disk is protected. All file systems located on a single volume will therefore be controlled by LifeKeeper together. This means that you must have at least two logical volumes (LUNs), one for Oracle and one for SAP. Refer to the *SAP R/3 Installation Guide* for the specific recommended number of volumes.

4. Select a non-used switchable IP address for each network requiring communication with the SAP. Select a non-used virtual server name for SAP. Make a mapping entry in DNS and/or all `/etc/hosts` files on all systems that need to communicate with the SAP in order to associate the switchable IP addresses with the virtual server name. For example, if you have a network for SAP server communication and a different network for SAP client connection, you will need to establish a switchable IP address for each network and map both IP addresses to the virtual server name. After SAP is protected by LifeKeeper, all connections to the SAP CI, ASCS, or SCS will be made using the virtual server name.
5. Select a non-used switchable IP address for the network used for communication between the SAP CI and DB. Select a non-used virtual server name for the DB. Make a mapping entry in DNS and/or all `/etc/hosts` files on all systems needing to communicate with the DB to map the switchable IP addresses with the virtual server name. For example, you will probably have a single network for communication between the SAP CI and DB; thus you will need to establish a switchable IP address for that network and map this IP address to the virtual server name. After SAP is protected by LifeKeeper, the SAP CI connection to the DB will be made using the virtual server name.

Note: This step is optional for Configuration #2 because the CI and DB are always running on the same server, and communication between them is always local. But it is advisable to have separate switchable IP addresses and virtual server names for CI and DB in case you ever want to run them on different servers.

6. Determine the SID and ID for the SAP CI.

1.2 Install LifeKeeper

1. If you have not done so already, install LifeKeeper software now on both CI Primary and CI Backup servers, including the following recovery kits:
 - SAP

- appropriate database (i.e. Oracle, SAP DB)
- IP
- NFS
- NAS (recommended but optional – Refer to the [Using the LifeKeeper NAS Kit to Avoid NFS Issues](#) section in this document)

Refer to each of the Recovery Kit Administration Guides for additional information about installing the recovery kit and configuring the server for protecting resources.

2. After installing LifeKeeper on both servers, create comm paths between the servers.

1.3 Create File Systems and Directory Structure

1. Create all file systems required for the DB. Add an entry in the */etc/fstab* file on the DB Primary Server for each mount point and mount the file systems on the DB Primary Server using these mount points. The DB binaries (i.e. */oracle/<SID>/920_<32 or 64> path, SAP DB Independent Data Path (IndepDataPath) and Independent Program Path (IndepProgPath) , etc.*) should be installed on a local file system on each server, so do not put the Oracle home directory on a shared file system. SAP needs access to these binaries locally from both servers.

Consult the LifeKeeper Administration Guide for the database-specific recovery kit and the *SAP R/3 Installation Guide or Component Installation Guide SAP Web Application Server* for additional information on which file systems need to be created and protected by LifeKeeper.

2. Create file systems on shared storage for the SAP CI, ASCS, or SCS. When working with the Oracle Database, if you decide to locate the Oracle staging directory */oracle/stage/920_<32 or 64>* on a shared file system, it should be twice as large as recommended, if possible. Then create the local mount points shown below on both the CI, ASCS, or SCS Primary and CI, ASCS, or SCS Backup servers. Add an entry in the */etc/fstab* file on the CI, ASCS, or SCS Primary Server for each mount point and mount the file systems on the CI, ASCS, or SCS Primary Server using these mount points. Note that these mount points might be different from those described in the *SAP R/3 Installation Guide or Component Installation Guide SAP Web Application Server*. Also note that all soft links shown in the table below will be created in a later step. The following file systems need to be created and mounted on the CI Primary Server:

Configuration #1

Description	Mount Point
SAP System software & data	<i>/export/sapmnt</i>
Instance specific data	<i>/usr/sap/<SID></i>
Transport directory	<i>/export/usr/sap</i>

Configuration #2

Description	Mount Point
SAP System software & data	<i>/export/sapmnt</i>
Instance specific data	<i>/usr/sap/<SID>/<INST> , /usr/sap/<SID>/<ASCS-INST> , and /usr/sap/<SID>/<SCS-INST> (Java environments)</i>
Transport data	<i>/export/usr/sap</i>

Note that for Configuration #2, you will have to create the */usr/sap/<SID>/<INST>* , */usr/sap/<SID>/<ASCS-INST>* , or */usr/sap/<SID>/<SCS-INST>* directory before installing SAP. This will require knowing what *<INST>*, *<ASCS-INST>*, or *<SCS-INST>* is for the SAP environment. The *<INST>* is composed of an abbreviation for each service running on the CI plus the instance ID. For example, *<INST>* for the default installation with *<ID>=00*, which includes dialog (D), update (V), enqueue (E), batch (B), message (M), gateway (G), and spool(S) services is DVEBMGS00.

- After the file systems are created and mounted on the SAP Primary Server, create the following subdirectories in the mounted file systems:

Configuration #1 and #2

Description	Mount Point	Subdirectory
SAP System software & data	<i>/export/sapmnt</i>	<i>/export/sapmnt/<SID></i>
Transport directory	<i>/export/usr/sap</i>	<i>/export/usr/sap/trans</i>

- Please skip this step for NetWeaver installations. Create the following soft links on the CI Primary server. You will create the soft links on the Backup server in a subsequent step.

Configuration #1 and #2

Server(s)	Local Directory	Linked to:
Primary & Backup	<i>/usr/sap/trans</i>	<i>/export/usr/sap/trans</i>

- Make sure all directories created have 777 permissions. If necessary, use the command **chmod -R 777 <dir>** to change permissions.
- NFS share the following directories on the CI Primary Server. Refer to the *LifeKeeper for Linux NFS Server Recovery Kit Administration Guide* for additional information on how to configure NFS shares for LifeKeeper protection. Note that neither of these directories is the root directory on the shared file system due to the inode conflict concerns discussed earlier in this guide and in the *NFS Server Recovery Kit Administration Guide*.

Configuration #1 and #2

Description	Directory to NFS share
SAP System software & data	<i>/export/sapmnt/<SID></i>
Transport directory	<i>/export/usr/sap/trans</i>

1.4 Protect Dependent Resources with LifeKeeper

1. For SAP, create the following hierarchies in LifeKeeper on the SAP Primary Server, in the order listed, and extend them to the SAP Backup Server. An example LifeKeeper tag name is given for each hierarchy that is used for the remainder of this document to reference that hierarchy. Your tag names may be different. Also, be sure to select the IP resource you created for the Server-to-Server Communication when creating the NFS hierarchies.

Step	Type	Example Tag Name	Resource being protected	Comments
1	IP	IP_ServerNet	Switchable IP address for server-to-server communication	Used in the NFS hierarchy creation
2	IP	IP_ClientNet	Switchable IP address for client-to-server communication	Not needed if there is only one network
3	NFS	NFS_SID	<i>/export/sapmnt/<SID></i>	
4	NFS	NFS_trans	<i>/export/usr/sap/trans</i>	Not needed if <i>/usr/sap/trans</i> is hosted on another server.
5	File System	FS_SID_00	<i>/usr/sap/<SID></i> (config. #1) <i>/usr/sap/<SID>/<INST></i> (config. #2)	

2. Create the required IP and file system hierarchies in LifeKeeper for the database on the DB Primary Server. For Configuration #1, this is the SAP Backup Server. For Configuration #2, this is the same server as the SAP Primary Server. Refer to the database-specific recovery kit administration guide for details.
3. For Configuration #1, after creating the database IP and file system hierarchies in LifeKeeper on the SAP Backup Server (DB Primary Server), bring them in-service on the SAP Primary Server using the LifeKeeper GUI. This will allow the SAP and DB to be installed together on the SAP Primary Server for both configurations.
4. After all of the hierarchies created so far are in-service on the SAP Primary Server, test them as follows. Note that these are tests only and are not part of the required configuration procedure.

2.3 [Install SAP software on CI backup server](#)

2.4 [Install RFCSDK](#)

2.1 Install SAP Software on SAP Primary Server

1. Before installing software, make sure that the date/time is synchronized on all servers. This is important for both LifeKeeper and SAP.
2. Install the SAP software on the SAP Primary Server as per the instructions in the *SAP R/3 Installation Guide* for a Central System installation. You should use the <SID> and <ID> that were used when creating the directory structure.

For SAP Kernel 4.6D: You should enter the actual SAP Primary Server name during the install and not the virtual SAP Server name. Enter the actual CI Primary Server name for the DB Server as well, regardless of which configuration you are installing in.

For SAP Web Application Server 6.x and higher: You should call the SAP install utility 'sapinst' with the "ha" product catalog option. Please see the document *SAP Web Application Server in Switchover Environments* for instructions on installing SAP using Virtual Server Names. You should enter the SAP Virtual Server name during the install and not the SAP Physical Server name. Enter the DB Virtual Server name for the DB Server.

For SAP Web Application Server 7.x and higher: The HA installation instructions from the SAP installation document should be followed when installing the system.

Hint: It may be quicker to create a shared partition on which to copy the SAP install CDs which can be mounted on either server.

Note: If using SAP DB please see "Update Version in DATABASE.R3S" in Appendix B.

3. For Configuration #2 only, verify that the <INST> directory you created was correct. The <INST> directory you created should be the only instance directory under /usr/sap/<SID> after the installation. There should also be a SYS directory.
4. Install a SAPGUI somewhere on the client network.
5. Make a backup copy of the <sapmnt>/<SID>/profile directory. The *DEFAULT.PFL* file will be overwritten in a subsequent step and it is a good idea to have the original copy.
6. Start SAP if it is not already started and verify that it is functioning correctly. It was probably left running after the installation. Log in from the SAPGUI and execute several transactions. Refer to the SAP documentation regarding how to start SAP and which checks to perform.
7. If the database used is Oracle, see the section "Validate the Oracle Database Configuration" in Appendix A.8. Obtain a license key from SAP for the Primary Server and install it using the **saplicense** tool provided by SAP. (See SAP Notes 14838, 31238 and 63748 for more information on **saplicense**). The SAP CI must be running when you install the license key on the server.
9. Stop SAP, including the DB.

2.2 Complete Directory Structure on Backup Server

1. Again, using the LifeKeeper GUI, bring all hierarchies in-service on the CI Backup Server.
2. Please skip this step for NetWeaver when installing in a NetWeaver environment. For earlier versions, complete the creation of the directory structure on the CI Backup Server as shown

in the following table. Make an entry in the `/etc/fstab` file for each NFS mount point and include 'intr' as a mount option. You should use the Virtual CI Server Name when creating the entries and not the Virtual IP Address. ***Please note that for Active/Standby configurations where only the SAP CI and the database is running in the cluster, it is acceptable to use symbolic links to avoid potential issues with using local NFS mount issues.***

Configuration #1

Local Directory	Linked to:	NFS Mounted to:
<code>/usr/sap/trans</code>	<code>/export/usr/sap/trans</code>	N/A

Configuration #2

Local Directory	Linked to:	NFS Mounted to:
<code>/usr/sap/trans</code>	N/A	<code><virtual SAP server>:/export/usr/sap/trans</code>

3. Make sure all directories have 777 permissions.

2.3 Install SAP software on SAP Backup Server

Please refer to the SAP document *SAP Web Application Server in Switchover Environments* for instructions on installing in NetWeaver Environments.

1. As previously described, the SAP install process will fail when the `<sapmnt>/<SID>` path is mounted using NFS. To allow the installation to proceed on the SAP Backup Server, you must create a temporary soft link as follows:

Configuration #1 and #2

Local Directory	Linked to:
<code><sapmnt>/<SID></code>	<code>/export/sapmnt/<SID></code>

In a later step, this temporary link will be removed and replaced with a permanent NFS mount. ***Please note that for Active/Standby configurations where only the SAP CI and the database is running in the cluster, it is acceptable to use symbolic links to avoid potential issues with using local NFS mount issues. If you choose to do so, you can skip the later step that instructs you to remove the link.***

2. There are two options for installing the SAP software on the CI Backup Server:

Note: If using SAP DB please see [Update the Database Version in DATABASE.R3S](#) in Appendix B.

Option 1: The first option is to install it in the same way you did on the Primary Server, overwriting all files and reloading the database from scratch. This option can be time consuming due to the extensive time required to load the database.

Option 2: The second option involves modifying the SAP installation script so that the database load steps are skipped. See the section [Avoiding the Database Load on the Backup Server](#) in the Appendix for the appropriate database for specific instructions.

3. Start SAP and verify that it is functioning correctly on the CI Backup Server. Log in from the SAPGUI and execute several transactions. Refer to the SAP documentation regarding how to start SAP and which checks to perform.
4. If the database used is Oracle see the section [Validate the Oracle Database Configuration](#) in Appendix A.
5. Obtain a license key from SAP for the Backup Server and install it using the **saplicense** tool provided by SAP. (See SAP Notes 14838, 31238 and 63748 for more information on **saplicense**). The SAP CI must be running when you install the license key on the server.
6. Stop SAP, including the DB and CI.
7. Using the LifeKeeper GUI, bring all of the SAP CI related hierarchies in-service on the CI Primary Server, including those protecting the SAP file systems, NFS shares and SAP CI IP addresses.

For Configuration #1 only, leave the DB related hierarchies in-service on the CI Backup Server, including those protecting database file systems and IP addresses. The CI Backup Server for this configuration will be the DB Primary Server.

For Configuration #2, bring all DB related hierarchies in-service on the CI Primary Server so that all hierarchies are in-service on the CI Primary Server. For this configuration, the CI and DB share the same Primary Server.

2.4 Install RFCSDK in ABAP Environments

In order to monitor the SAP CI, LifeKeeper needs a utility that is included with the SAP RFCSDK. The RFCSDK package is not installed automatically, so it must be installed in a separate step.

1. Mount the SAP Presentation CD on the CI Primary Server and locate the RFCSDK package in the path `<cddir>/SDK/UNIX/LINUX_32/RFC.SAR`. From a command prompt, make `/usr/sap` the current directory. If you want to install the RFCSDK in a directory other than `/usr/sap`, see [SAP Health Monitoring](#) for more information.
2. Use the SAPCAR tool to unpack the RFC.SAR file as follows:


```
<cd dir>/SDK/UNIX/LINUX_32/SAPCAR -xvf
<cd dir>/ SDK/UNIX/LINUX_32/RFC.SAR
```

This should unpack the RFCSDK into the desired path. Verify that the file, `/usr/sap/rfcsdk/bin/sapinfo` exists.
3. Repeat steps 1 and 2 on the CI Backup Server.

2.5 Modifying Database administrator's .cshrc file

In order to prevent potential database script hangs due to unavailable NFS shares, it is recommended that you manually edit the `.cshrc` file in the database administrator's home directory on both servers. See the section [NFS Mounts and su](#) for a description of why this is desirable.

On each server, log in as the database user and manually edit the `.cshrc` file by adding the lines shown in bold below:

```
# SAP environment
if ( $?prompt ) then
    if ( -e $HOME/.sapenv_`hostname`.csh ) then
        source $HOME/.sapenv_`hostname`.csh
    else if ( -e $HOME/.sapenv.csh ) then
        source $HOME/.sapenv.csh
    endif
endif
```

This will leave the administrator's environment unaltered for manual logins, but will omit the SAP specific settings for `su` logins, thereby preventing the database scripts from hanging if the SAP NFS shares are not available.

3. Protecting SAP

These tasks are required before establishing LifeKeeper protection for your SAP software. Perform the tasks below in the order given. Details for each task are presented in the sections that follow.

- 3.1 [Create permanent mount points for <sapmnt>/<SID>](#)
- 3.2 [Protect the database with LifeKeeper](#)
- 3.3 [Modify the SAPDBHOST value in DEFAULT.PFS](#)
- 3.4 [Make additional modifications to the Startup and Profile files](#)
- 3.5 [Install redundant AS](#)
- 3.6 [Create LifeKeeper SAP hierarchy](#)

3.1 Create Permanent Mount Points for <sapmnt>/<SID>

If this is a NetWeaver installation, please skip this step.

In previous steps, temporary soft links were created to facilitate an error free SAP software installation. These links should now be removed and replaced with permanent NFS mounts as shown below. Note that you will actually be NFS mounting the `/export/sapmnt/<SID>` share locally. There are issues with locally mounting an NFS share in a LifeKeeper environment that are addressed in this document under [Configuration Notes](#). If SAP is running, stop it prior to removing the temporary links. Make an entry in the `/etc/fstab` file for each NFS mount point and include 'intr' as a mount option. You should use the Virtual CI Server Name when creating the entries and not the Virtual IP Address. ***Please note that for Active/Standby configurations where only the SAP CI and the database are running in the***

cluster, it is acceptable to use symbolic links to avoid potential issues with using local NFS mounts.

Configuration #1 and #2

Local Directory	Remove Soft Link:	Create NFS Mount to
<sapmnt>/<SID>	/export/sapmnt/<SID>	<virtual SAPserver>:/export/sapmnt/<SID>

3.2 Protect the Database with LifeKeeper

1. Using the LifeKeeper database specific Administration Guide, configure the Primary DB and Backup DB servers for LifeKeeper protection. Refer to the section [Protecting the Database with LifeKeeper](#) in the Appendix for the specific database used.
2. Using the LifeKeeper GUI, create a database hierarchy for the database on the DB Primary Server, and extend the hierarchy to the DB Backup Server. Due to the large number of file systems, this could take a while. Be sure to create a dependency between the database resource and the IP address resource you created.
3. Verify that the database can be accessed using the virtual DB server name from both the DB Primary and DB Backup server. Debug and correct any connection problems before proceeding.

3.3 Modify the SAP Database HOST Value(s) in DEFAULT.PFL

Note: This step is not necessary for NW2004s or later environments.

1. Restore the copy of the *DEFAULT.PFL* file that was installed on the SAP Primary server. This file should have been saved in a backup directory during a previous step. It also still exists in the profile directory where the SAP installation program on the SAP Backup Server renamed it with a .0 extension.
2. Change the SAPDBHOST value in the *DEFAULT.PFL* file as shown below:

```
SAPDBHOST=<virtual DB server name>
```

For NetWeaver environments that includes a Java installation it may also be necessary to change value for *j2ee/dbhost* and *j2ee/dbadminurl* to the virtual DB server name also.

3. Start SAP on the Primary Server and verify that it can successfully connect to the database using the virtual DB server name. To do this, log in through the SAP GUI, execute transaction RZ11, enter SAPDBHOST for the parameter name and verify that the value is the virtual DB server name. Debug and correct any problems at this point before proceeding.
4. Stop SAP on the Primary Server.

3.4 Make Additional Modifications to the Startup and Profile Files

Note: This step is not necessary for NetWeaver 2004s or later environments.

1. Find the profile and startup files in the path `<sapmnt>/<SID>/profile`. Modify the files as follows. You should have made a backup copy of these files in a previous step.

DEFAULT.PFL: only one default profile file will exist. It must be manually edited as follows:

The value of SAPDBHOST and the Java database parameters should already have been changed in a previous step to allow for a virtual DB location:

```
SAPDBHOST=<Virtual DB Server Name>
j2ee/dbhost=<Virtual DB Server Name>
j2ee/dbadminurl=<Virtual DB Server Name>
```

For NetWeaver environments, database reconnection is automatic. For earlier versions, add the following lines to enable database reconnect:

```
rsdb/reco_trials = 100
rsdb/reco_sleep_time = 10
rsdb/reco_sosw_for_db = ON
rsdb/reco_sync_all_server = ON
```

Change the physical server name to the virtual one in the following variables:

```
rdisp/mshost = <Virtual CI Server Name>
rdisp/sna_gateway = <Virtual CI Server Name>
rdisp/vbname = <Virtual CI Server Name>_<SID>_<ID>
rdisp/enqname = <Virtual CI Server Name>_<SID>_<ID>
rdisp/btcname = <Virtual CI Server Name>_<SID>_<ID>
```

<SID>_<INST>_<SERVERNAME>: one file was installed for each server. Both files must be manually edited as follows:

Add the following lines to enable the proper setting of SAP internal variables:

```
SAPLOCALHOSTFULL = <Virtual CI Server Name>
SAPLOCALHOST = <Virtual CI Server Name>
```

START_<INST>_<SERVERNAME>: no changes required to these files.

Please note: For NetWeaver installations the name of these files may include the virtual server name instead of the machine name. If this is the case you will need to create a link to the files for each server. The link should include that actual server name. This is necessary for SAP and LifeKeeper to work correctly.

3.5 Install Redundant AS

Install the redundant AS on the backup server (Configuration #2 only) or other server (Configuration #1 only).

1. The AS installation requires access to the `/usr/sap/trans` directory. On the server where you will be installing the AS, mount `/usr/sap/trans` from SAP Server as follows:

`/usr/sap/trans` — NFS mounted to \rightarrow `<virtual CI server>:/export/usr/sap/trans`

2. Install an additional SAP AS on the SAP Backup Server (Configuration #2 only) or other server (Configuration #1) in the way recommended by SAP. Note that this instance will have to have a different `<ID>` than the CI, ASCS, or SCS if it is installed on the SAP Backup

Server. When prompted for the CI host, ASCS host, SCS host, and DB host, enter the SAP Virtual Server Name and DB Virtual Server Name, respectively.

3. Find the profile and startup files for this AS in the path `<sapmnt>/<SID>/SYS/profile`. Note that this path is NFS mounted on the AS Server and is the same path being used by the CI, ASCS, or SCS. It therefore contains the profile and startup files for the CI, ASCS, or SCS that you previously modified. Modify the AS files as follows:

`<SID>_<AS-INST>_<SERVERNAME>`:

Add the following lines to enable the proper setting of SAP internal variables:

```
SAPGLOBALHOST = <Virtual CI Server Name>
SAPLOCALHOST = <Actual AS Server Name>
SAPLOCALHOSTFULL = <Actual AS Server Name>
```

3.6 Create LifeKeeper SAP Hierarchy

1. Referring to the [Resource Configuration Tasks](#) section of this guide, create a SAP hierarchy on the SAP Primary Server and extend it to the SAP Backup Server. Please note the following:
 - The previously created file system and NFS hierarchies will automatically be brought into the hierarchy as dependent resources.
 - For Java only installations when prompted choose “Yes” if you would like for the Java CI to be started in addition to the SCS Instance. Please note the Java CI is not monitored since it is not a SPOF.
 - When prompted, select all virtual IP addresses that were created for communicating with the SAP CI, ASCS, or SCS. All IP addresses that were included as a dependent resource in a NFS hierarchy will also be included in the SAP hierarchy by default.
 - When extending the hierarchy to the SAPBackup Server, select the `<SID>` and `<ID>` of the redundant AS that was installed on the Backup Server (Configuration #2 only).
 - The test steps described below assume that the hierarchies have been created with the Automatic Switchback setting turned off.
 - If SAP is not running, LifeKeeper will start it during the hierarchy creation process.
2. For Configuration #2 only, create a LifeKeeper dependency between the SAP hierarchy and the database hierarchy.

4. Test the SAP Resource Hierarchy

You should thoroughly test the SAP hierarchy after establishing LifeKeeper protection for your SAP software. Perform the tasks below in the order given.

4.1 Test Preparation

1. Set up a SAP GUI on a SAP client to log into SAP using the virtual SAP server name.
2. Set up a SAP GUI on a SAP client to log into the redundant AS.
3. If desired, install additional AS's on other servers in the cluster and set up a login group among all application servers, excluding the CI. For every AS installed, the profile file will have to be modified as previously described.

4.2 Perform Tests

Perform the following series of tests. The test steps are different for each configuration. Some steps call for verifying that SAP is running correctly, but do not call out specific tests to perform. For a list of possible tests to perform to verify that SAP is configured and running correctly, refer to the appendices of the SAP document, *SAP R/3 in Switchover Environments*.

Tests for Configuration #1:

1. When the SAP hierarchy is created, the SAP and DB will in-service on different servers. From a SAP GUI, log into SAP. Verify that you can successfully log in and that SAP is running correctly.
2. Log out and re-login through a redundant AS. Verify that you can successfully log in.
3. If you have set up a login group, verify that you can successfully log in through this group.
4. Using the LifeKeeper GUI, bring the SAP hierarchy in-service on the SAP Backup Server. Both the SAP and DB will now be in-service on the same server.
5. Again, verify that you can log into the SAP using the SAP virtual server name, a redundant AS and the login group. Verify that SAP is running correctly.
6. Using the LifeKeeper GUI, bring the DB hierarchy in-service on the DB Backup Server. Each hierarchy will now be in-service on its backup server.
7. Again, verify that you can log into SAP using all login methods and that SAP is running correctly. If you execute transaction SM21, you should be able to see in the logs where the CI lost, then regained communication with the DB.
8. While logged into SAP, shut down the SAP Backup server where SAP is currently in-service by pushing the power supply switch. Verify that the SAP hierarchy comes in-service on the SAP Primary Server, and that after the failover you can again log into the CI, and that it is running correctly.
9. Restore power to the failed server. Using the LifeKeeper GUI, bring the DB hierarchy back in-service on the DB Primary Server. Again, while logged into SAP, shut down the DB Primary server where the DB is currently in-service by pushing the power supply switch. Verify that the DB hierarchy comes in-service on the DB Backup Server and that after the failover you are still logged into SAP and can execute transactions successfully.

10. Restore power to the failed server. Using the LifeKeeper GUI, bring the DB hierarchy back in-service on the DB Primary Server.

Tests for Configuration #2

1. When the hierarchy is created, both the SAP and DB will be in-service on the Primary Server. The redundant AS will be started on the Backup Server. From a SAP GUI, log into SAP . Verify that you can successfully log in and that SAP is running correctly. Execute transaction SM51 to see the list of SAP servers. This list should include both the CI or ASCS and AS.
2. Log out and re-login through the redundant AS on the Backup Server. Verify that you can successfully log in.
3. If you have set up a login group, verify that you can successfully log in through this group.
4. Using the LifeKeeper GUI, bring the SAP/DB hierarchy in-service on the Backup Server.
5. Again, verify that you can log into SAP using the SAP virtual server name, a redundant AS and the login group. Verify that SAP is running correctly.
6. While logged into SAP, shut down the SAP/DB Backup server where the hierarchy is currently in-service by pushing the power supply switch. Verify that the SAP/DB hierarchy comes in-service on the Primary Server and after the failover, you can again log into the CI and that it is running correctly (you will lose your connection when the server goes down and will have to re-login).
7. Restore power to the failed server. Again, while logged into SAP, shut down the SAP/DB Primary server where the DB is currently in-service by pushing the power supply switch. Verify that the SAP/DB hierarchy comes in-service on the Backup Server, and that after the failover you can again log into SAP, and that it is running correctly.
8. Again, restore power to the failed server. Using the LifeKeeper GUI, bring the SAP/DB hierarchy in-service on the Primary Server.

Resource Configuration Tasks

You can perform the following configuration tasks from the LifeKeeper GUI. The following four tasks are described in this guide, as they are unique to an SAP resource instance, and different for each recovery kit.

- **[Create a Resource Hierarchy](#)**. Creates an application resource hierarchy in your LifeKeeper cluster.
- **[Delete a Resource Hierarchy](#)**. Deletes a resource hierarchy from all servers in your LifeKeeper cluster.
- **[Extend a Resource Hierarchy](#)**. Extends a resource hierarchy from the primary server to a backup server.
- **[Unextend a Resource Hierarchy](#)**. Unextends (removes) a resource hierarchy from a single server in the LifeKeeper cluster.

The following tasks are described in the GUI Administration section within the *LifeKeeper Online Product Manual*, because they are common tasks with steps that are identical across all recovery kits.

- **Create a Resource Dependency**. Creates a parent/child dependency between an existing resource hierarchy and another resource instance and propagates the dependency changes to all applicable servers in the cluster.
- **Delete a Resource Dependency**. Deletes a resource dependency and propagates the dependency changes to all applicable servers in the cluster.
- **In Service**. Brings a resource hierarchy into service on a specific server.
- **Out of Service**. Takes a resource hierarchy out of service on a specific server.
- **View/Edit Properties**. View or edit the properties of a resource hierarchy on a specific server.

Note: Throughout the rest of this section, we explain how to configure your recovery kit by selecting certain tasks from the **Edit** menu of the LifeKeeper GUI. You can also select each configuration task from the toolbar. You may also right click on a global resource in the Resource Hierarchy Tree (left-hand pane) of the status display window to display the same drop down menu choices as the **Edit** menu. This, of course, is only an option when a hierarchy already exists.

Alternatively, you can right click on a resource instance in the Resource Hierarchy Table (right-hand pane) of the status display window to perform all the configuration tasks, except creating a resource hierarchy, depending on the state of the server and the particular resource.

As an example, a complete SAP Hierarchy for Configuration #2 might look something like this:

Creating an SAP Resource Hierarchy

The previous [Configuration Tasks](#) section of this guide included steps involving the creation of a SAP Hierarchy to protect the SAP CI. To create this hierarchy in the LifeKeeper GUI, from the Primary Server, you should complete the following tasks:

1. From the LifeKeeper GUI menu, select **Edit**, then **Server**. From the drop down menu, select **Create Resource Hierarchy**.

A dialog box will appear with a drop down list box with all recognized recovery kits installed within the cluster. Select **SAP** from the drop down listing.



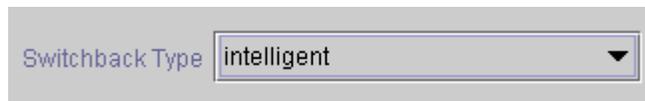
Click **Next**.

When the **Back** button is active in any of the dialog boxes, you can go back to the previous dialog box. This is especially helpful should you encounter an error that might require you to correct previously entered information.

If you click **Cancel** at any time during the sequence of creating your hierarchy, LifeKeeper will cancel the entire creation process.

2. Select the **Switchback Type**. This dictates how the SAP instance will be switched back to this server when it comes back into service after a failover to the backup server. You can choose either *intelligent* or *automatic*. Intelligent switchback requires administrative intervention to switch the instance back to the primary/original server. Automatic switchback means the switchback will occur as soon as the primary server comes back on line and reestablishes LifeKeeper communication paths.

Note: For configuration #1, the switchback type should be set to *automatic*. See [Automatic Switchback](#) under “Configuration Notes” for additional information.



The switchback type can be changed later, if desired, from the General tab of the Resource Properties dialog box.

Click **Next**.

3. Select the **Server** where you want to place the SAP CI, ASCS, or SCS (typically this is referred to as the primary or template server). All the servers in your cluster are included in the drop down list box.



Click **Next**.

4. Select the **SAP SID**. This is the system identifier of the SAP CI, ASCS, or SCS system being protected.



A screenshot of a configuration dialog showing a dropdown menu labeled 'SAP SID' with the value 'PRO' selected.

Click **Next**.

5. Select the **SAP Instance ID** for the SID being protected.



A screenshot of a configuration dialog showing a dropdown menu labeled 'SAP Instance' with the value '00' selected.

Click **Next**.

Note: In ABAP+Java AddIn environments, the Java Instance is automatically detected and protected in addition to the instance chosen in the dialog.

6. This screen only appears in a NetWeaver “ABAP Only” and “ABAP Add-In” environments. Select the Replicated Enqueue profile if running a Replicated Enqueue in the environment. Select “none” otherwise.



A screenshot of a configuration dialog showing a dropdown menu labeled 'ABAP Replicated Enqueue Profile' with the value 'none' selected.

Click **Next**.

7. This screen only appears in a NetWeaver “ABAP Add-In” and “Java Only” environments. Select the Replicated Enqueue profile if running a Replicated Enqueue in the environment. Select “none” otherwise.



A screenshot of a configuration dialog showing a dropdown menu labeled 'Java Replicated Enqueue Profile' with the value 'none' selected.

Click **Next**.

6. This screen only appears in a NetWeaver “Java Only” environment. Select “Yes” if you would like to start the Java Central Instance (CI) in addition to the SAP Central Services Instance (SCS). Select “No” otherwise. Please note the Java CI is not monitored since it is not a SPOF.



A screenshot of a configuration dialog showing a dropdown menu labeled 'Protect the Java Central Instance also?' with the value 'Yes' selected.

Click **Next**.

- Select all **IP** resources that will be used to communicate with the CI. Note that IP resources that are included in previously created NFS hierarchies are also listed here. If these are not selected, they will be included in the hierarchy by default anyway.

IP child resource

IP_ClientNet
IP_ServerNet

- Select or enter the **SAP Tag**. This is a tag name that LifeKeeper gives to the SAP hierarchy. You can select the default or enter your own tag name. The default tag is SAP-<SID>_<ID>.

Root Tag

SAP-PRO_00

When you click **Create**, the Create Resource Wizard will create your SAP resource.

- At this point, an information box appears and LifeKeeper will validate that you have provided valid data to create your SAP resource hierarchy. If LifeKeeper detects a problem, an **ERROR** will appear in the information box. If the validation is successful, your resource will be created. There may also be errors or messages output from the SAP startup scripts that are displayed in the information box.

```

Creating appsuite/sap resource...
05/23/2002 17:44:31 create: Begin creation of "SAP-PRO_00" on server "adam"
05/23/2002 17:44:31 create: END successful creation of "SAP-PRO_00" on
server "adam."
05/23/2002 17:44:44 restore: BEGIN restore of "SAP-PRO_00" on server "adam"
05/23/2002 17:44:44 restore: END successful restore of "SAP-PRO_00" on
server "adam"

```

Click **Next**.

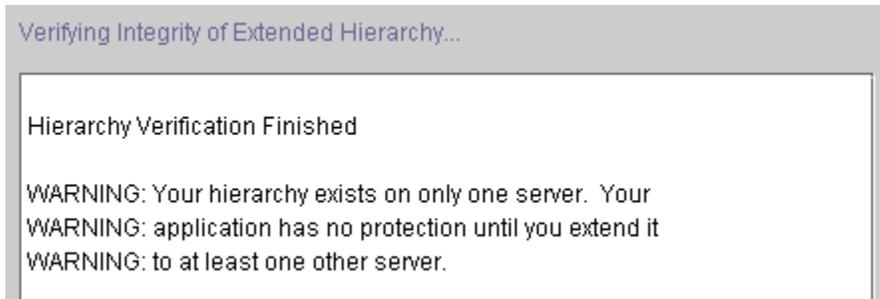
- Another information box will appear explaining that you have successfully created an SAP resource hierarchy, and you must **Extend** that hierarchy to another server in your cluster in order to place it under LifeKeeper protection.

You have successfully created a resource hierarchy on one server. You may select continue in order to extend this resource hierarchy to another server, or you may cancel at this point.

If you cancel, the resource hierarchy provides no protection for your applications until it is extended to at least one other server in the cluster.

When you click **Continue**, LifeKeeper will launch the Pre- Extend Wizard that is explained later in this section.

If you click **Cancel** now, a dialog box will appear warning you that you will need to come back and extend your SAP resource hierarchy to another server at some other time to put it under LifeKeeper protection.



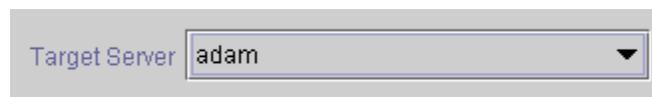
11. Click **Done** to exit the Create Resource Hierarchy menu selection.

Deleting a Resource Hierarchy

To delete a resource hierarchy from all the servers in your LifeKeeper environment, complete the following steps:

1. From the LifeKeeper GUI menu, select **Edit**, then **Resource**. From the drop down menu, select **Delete Resource Hierarchy**.
2. Select the name of the **Target Server** where you will be deleting your SAP resource hierarchy.

Note: If you selected the Delete Resource task by right clicking from the right pane on an individual resource instance, or from the left pane on a global resource where the resource is on only one server this dialog box will not appear.

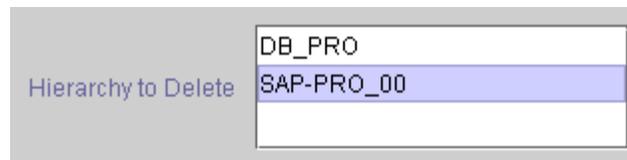


Target Server: adam

Click **Next**.

3. Select the **Hierarchy to Delete**. Identify the resource hierarchy you wish to delete, and highlight it.

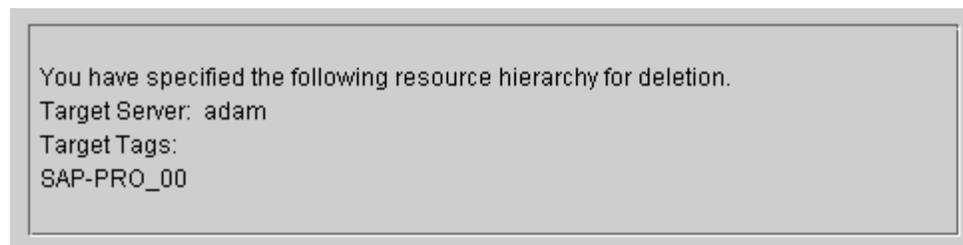
Note: If you selected the Delete Resource task by right clicking from either the left pane on a global resource or the right pane on an individual resource instance, this dialog will not appear.



Hierarchy to Delete: DB_PRO
SAP-PRO_00

Click **Next**.

4. An information box appears confirming your selection of the target server and the hierarchy you have selected to delete.



You have specified the following resource hierarchy for deletion.
Target Server: adam
Target Tags:
SAP-PRO_00

Click **Delete**.

5. Another information box appears confirming that the SAP resource was deleted successfully.

```
Deleting resource hierarchy...
Successfully removed
ins_remove[701,Iraci.C]Thu Jun 1 07:06:54 EDT 2000:
    fletch,priv_globact(1,delete): Running Post Global delete
    Machine cornfed
ins_remove[714,Iraci.C]Thu Jun 1 07:06:56 EDT 2000:
    fletch,priv_globact(1,delete): Post Global delete Scripts F
    Exiting 0 On Machine cornfed With Output Following:
Icdrecover[701,Iraci.C]Thu Jun 1 07:12:15 EDT 2000:
```

6. Click **Done** to exit.

Extending Your Hierarchy

After you have created a hierarchy, you will need to extend that hierarchy to another server in the cluster. There are three possible scenarios to extend your resource instance from the template server to a target server. The first scenario is when you “Continue” from creating the resource into extending that resource to another server. The second scenario is when you enter the Extend Resource Hierarchy task from the edit menu as shown below. The third scenario is when you right click on an unextended hierarchy in either the left or right hand pane. Each scenario takes you through the same dialog boxes (with a few exceptions, which are clearly detailed below).

1. If you are entering the Extend wizard from the LifeKeeper GUI menu, select **Edit**, then **Resource**. From the drop down menu, select **Extend Resource Hierarchy**. This will launch the Extend Resource Hierarchy wizard.
2. The first dialog box to appear will ask you to select the **Template Server where your SAP resource hierarchy is currently in service**. It is important to remember that the **Template Server** you select now and the **Tag to Extend** that you select in the next dialog box represent an *in service* resource hierarchy. An error message will appear if you select a resource tag that is not in service on the template server you selected. The drop down box in this dialog provides the names of all the servers in your cluster.

Note: If you are entering the Extend Resource Hierarchy task immediately following the creation of an SAP resource hierarchy, this dialog box will not appear, since the wizard has already identified the template server in the create stage. This is also the case when you right-click on either the SAP resource icon in the left hand pane or right-click on the SAP resource box in the right hand pane the of the GUI window and choose **Extend Resource Hierarchy**.



It should be noted that if you click the **Cancel** button at any time during the sequence of extending your hierarchy, LifeKeeper will cancel the extension process to that particular server. However, if you have already extended the resource to another server, that instance will continue to be in effect until you specifically unextend it.

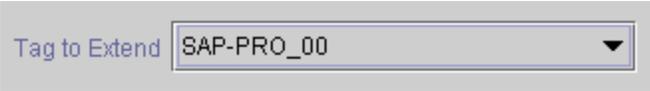
For example, let’s say you have created your resource on Server 1 and extended that resource to Server 2. In the middle of extending the same resource to Server 3, you change your mind and click on the **Cancel** button inside one of the dialog boxes. This will cancel only your

action to extend the resource to Server 3, not the extension you created to Server 2. If you want to remove Server 2 from this hierarchy, you must unextend the resource from Server 2.

Click **Next**.

3. Select the **Tag to Extend**. This is the name of the SAP instance you wish to extend from the template server to the target server. The wizard will list in the drop down list box all the resources that you have created on the template server, which you selected in the previous dialog box.

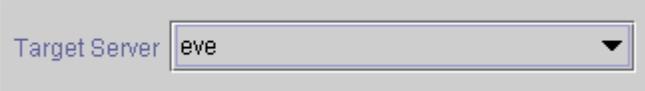
Note: Once again, if you are entering the Extend Resource Hierarchy task immediately following the creation of an SAP resource hierarchy, this dialog box will not appear, since the wizard has already identified the tag name of your SAP resource in the create stage. This is also the case when you right-click on either the SAP resource icon in the left hand pane or on the SAP resource box in the right hand pane the of the GUI window and choose **Extend Resource Hierarchy**.



A screenshot of a GUI dialog box. On the left, the text 'Tag to Extend' is displayed in a light blue font. To its right is a rectangular dropdown menu with a thin border. The menu is currently open, showing the text 'SAP-PRO_00' in black. A small downward-pointing triangle is visible on the right side of the menu box.

Click **Next**.

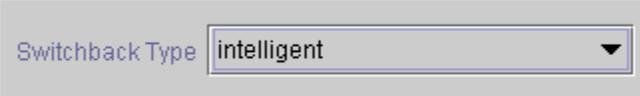
4. Select the **Target Server** where you are extending your SAP resource hierarchy. The drop down box provides the names of the servers in your cluster that are not already in the selected hierarchy.



A screenshot of a GUI dialog box. On the left, the text 'Target Server' is displayed in a light blue font. To its right is a rectangular dropdown menu with a thin border. The menu is currently open, showing the text 'eve' in black. A small downward-pointing triangle is visible on the right side of the menu box.

Click **Next**.

5. Select the **Switchback Type**. This dictates how the SAP instance will be switched back to this server when it comes back into service after a failover to the backup server. You can choose either *intelligent* or *automatic*. Intelligent switchback requires administrative intervention to switch the instance back to the primary/original server. Automatic switchback means the switchback will occur as soon as the primary server comes back on line and reestablishes LifeKeeper communication paths.



A screenshot of a GUI dialog box. On the left, the text 'Switchback Type' is displayed in a light blue font. To its right is a rectangular dropdown menu with a thin border. The menu is currently open, showing the text 'intelligent' in black. A small downward-pointing triangle is visible on the right side of the menu box.

The switchback type can be changed later, if desired, from the General tab of the Resource Properties dialog box.

Click **Next**.

6. The **Template Priority** is shown for informational purposes only.

Click **Next**.



A screenshot of a GUI dialog box. On the left, the text 'Template Priority' is displayed in a light blue font. To its right is a rectangular dropdown menu with a thin border. The menu is currently open, showing the text '1' in black. A small downward-pointing triangle is visible on the right side of the menu box.

7. Select or enter the **Target Priority** of your extended SAP resource. The priority is a number between 1 and 999 indicating a server's priority in the cascading failover sequence for the

resource. The hierarchy priorities are sorted numerically, where a lower number means a higher priority (the number 1 indicates the highest priority). Note that LifeKeeper automatically assigns the number “1” to the server that the hierarchy is created on. The priorities need not be consecutive, but no two servers can have the same priority for a given resource.

A screenshot of a user interface element. It consists of a label 'Target Priority' followed by a text input field containing the number '10'. To the right of the input field is a small downward-pointing arrow icon, indicating a dropdown menu.

Click **Next**.

8. An information box will appear explaining that LifeKeeper has successfully checked your environment and that all the requirements for extending this SAP resource have been met. If there were some requirements that had not been met, LifeKeeper would not allow you to select the **Next** button, and the **Back** button would be enabled.

A screenshot of a dialog box with a title bar that reads 'Executing the pre-extend script..'. The main area contains a list of status messages:

- Checking existence of extend and canextend scripts
- Building independent resource list
- Checking extendability for IP_ServerNet
- Checking extendability for IP_ClientNet
- Checking extendability for SAP-PRO_00
- IP_ServerNet is already extended to eve
- IP_ClientNet is already extended to eve

 At the bottom of the list, it says 'Pre Extend checks were successful'. The dialog box has a vertical scrollbar on the right side.

If you click **Back**, you can make changes to your resource extension according to any error messages that may appear in the information box.

If you click **Cancel** now, you will need to come back and extend your SAP resource hierarchy to another server at some other time to put it under LifeKeeper protection.

When you click **Next**, LifeKeeper will launch you into the Extend Resource Hierarchy configuration task.

9. If there is a SAP AS instance on the Target Server that should be running when the CI, ASCS, or SCS is in-service on the Template Server, but shut down when the CI, ASCS, or SCS is in-service on the Target Server, the SID for that instance should be selected from the list. For most cases this will be the same SID as the CI, ASCS, or SCS. If you do not wish LifeKeeper to control any other SAP instances on the target server, select none. If you wish LifeKeeper to control more than one instance, select the first one during the extend operation and add additional ones using the method described in the Administration Tips section at the end of this guide.

A screenshot of a user interface element. It shows a label 'SID of Addit. Instance on eve to control' followed by a dropdown menu. The dropdown menu is currently displaying the text 'PRO'.

Click **Next**.

10. The next dialog box is displayed only if a SID was selected in the previous dialog. Select the **SAP Instance for <SID> to control**. This is the instance corresponding to the SID selected

in the previous dialog that is started by LifeKeeper when the SAP hierarchy is in-service on the Template server, but shut down by LifeKeeper when the SAP hierarchy is in-service on the Target server.

Instance of PRO on eve to control 01

Click **Next**.

11. Select or enter the **SAP Tag**. The default tag is identical to the Template Server tag.

Root Tag SAP-PRO_00

Click **Extend**.

12. An information box will appear verifying that the extension is being performed.

Extending resource hierarchy...

```
Setting switchback type for hierarchy
Creating equivalencies
LifeKeeper Admin Lock (SAP-PRO_00) Released

Hierarchy successfully extended
05/24/2002 13:51:05 extend: BEGIN extend of "SAP-PRO_00" on server "eve"
05/24/2002 13:51:13 ASControl 109999: Starting Application Server with
SID="PRO" and ID="01" on server "eve."
05/24/2002 13:51:46 ASControl 109999: Successfully started Application Server
with SID="PRO" and ID="01" on server "eve."
05/24/2002 13:51:46 extend: END successful extend of "SAP-PRO_00" on server
"eve"
```

Click **Next Server** if you want to extend the same SAP resource instance to another server in your cluster. This will repeat the Extend Resource Hierarchy operation.

If you click **Finish**, another dialog box will appear confirming LifeKeeper has successfully extended your SAP resource.

Verifying Integrity of Extended Hierarchy...

```
Examining hierarchy on cornfed

Hierarchy Verification Finished
```

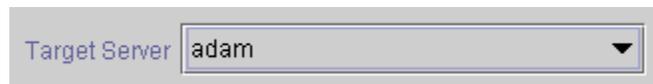
13. Click **Done** to exit.

Note: Be sure to test the functionality of the new instance on *both* servers.

Unextending Your Hierarchy

1. From the LifeKeeper GUI menu, select **Edit**, then **Resource**. From the drop down menu, select **Unextend Resource Hierarchy**.
2. Select the **Target Server** where you want to unextend the SAP resource. It cannot be the server where SAP is currently in service.

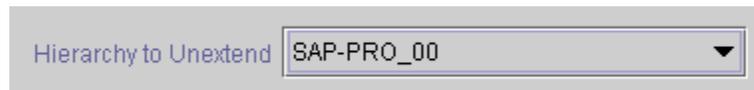
Note: If you selected the Unextend task by right clicking from the right pane on an individual resource instance this dialog box will not appear.



Target Server adam

Click **Next**.

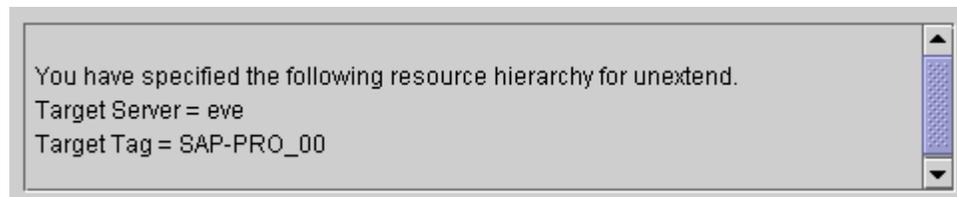
3. Select the SAP **Hierarchy to Unextend**.
Note: If you selected the Unextend task by right clicking from either the left pane on a global resource or the right pane on an individual resource instance, this dialog will not appear.



Hierarchy to Unextend SAP-PRO_00

Click **Next**.

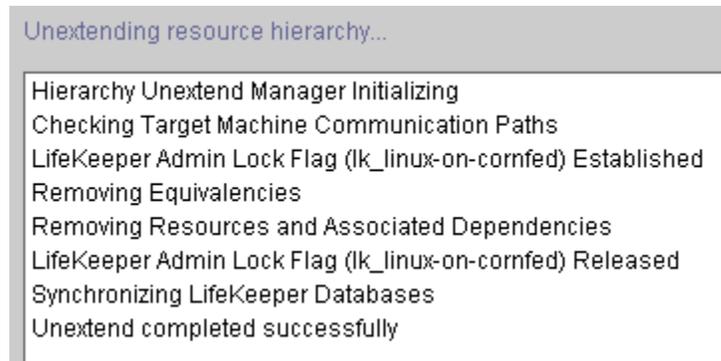
4. An information box appears confirming the target server and the SAP resource hierarchy you have chosen to unextend.



You have specified the following resource hierarchy for unextend.
Target Server = eve
Target Tag = SAP-PRO_00

Click **Unextend**.

5. Another information box appears confirming that the SAP resource was unextended successfully.



Unextending resource hierarchy...

Hierarchy Unextend Manager Initializing
Checking Target Machine Communication Paths
LifeKeeper Admin Lock Flag (lk_linux-on-cornfed) Established
Removing Equivalencies
Removing Resources and Associated Dependencies
LifeKeeper Admin Lock Flag (lk_linux-on-cornfed) Released
Synchronizing LifeKeeper Databases
Unextend completed successfully

6. Click **Done** to exit.

Administration Tips

This section provides tips and other information that may be helpful for administration and maintenance of certain configurations.

Server/LifeKeeper Shutdown

As previously described in the [Configuration Notes](#) section of this document, if you have configured the file system on either the CI Primary or Backup server to locally mount NFS shares, an NFS hierarchy out-of-service operation will hang the system and prevent a clean reboot. To avoid causing your cluster to hang by inadvertently stopping the NFS server, we make the following recommendations:

- Do not take your NFS hierarchy out of service on a server that contains local NFS mount points to the protected NFS share. You may take your SAP resource in and out of service freely so long as the NFS child resources stay in-service. You may also bring your NFS hierarchies in-service on a different server prior to shutting a server down.
- If you must stop LifeKeeper on a server where the NFS hierarchy protecting locally mounted NFS shares is in-service, always use the `-f` option. Stopping LifeKeeper using the command **lkstop -f** stops LifeKeeper without taking the hierarchies out of service, thereby preventing a server hang due to local NFS mounts. See the **lkstop** man page for additional information.
- If you must reboot a server where the NFS hierarchy protecting locally mounted NFS shares is in-service, you should first stop LifeKeeper using the `-f` option as described above. A server reboot will cause the system to stop LifeKeeper without the `-f` option, thereby taking the NFS hierarchies out-of-service and hanging the system.
- If you need to uninstall the SAP package, do not do so when there are SAP hierarchies containing NFS resources that are in-service protected (ISP) on the server. Delete the SAP hierarchy prior to uninstalling the package.
- If you are upgrading LifeKeeper, or if you need to run the LifeKeeper Installation Support setup scripts, it is recommended that you follow the upgrade instructions included in the *LifeKeeper for Linux Planning and Installation Guide*. This includes switching all applications away from the server to be upgraded before running the setup script on the LifeKeeper Installation Support CD and/or updating your LifeKeeper packages. Specifically, the setup script on the LifeKeeper Installation Support CD should not be run on a server where LifeKeeper is protecting active NFS shares, since upgrading the `nfsd` kernel module requires stopping NFS on that server which may cause the server to hang with locally mounted NFS file systems. For additional information, refer to the *NFS Server Recovery Kit Administration Guide*.

SAP Replicated Enqueue Protection

The LifeKeeper SAP Recovery Kit has the ability to start and monitor the SAP Replicated Enqueue on the backup server. To enable the protection of the Replicated Enqueue the user must select the name of Replicated Enqueue profile file when [creating the SAP resource hierarchy](#).

Alternately, the user can edit the file

`<LKROOT>/subsys/appsuite/resources/sap/REPENQ_<TAG>`, where `<LKROOT>` is the

LifeKeeper root path and `<TAG>` is the tag name of the SAP resource on the local server. Each line in this file contains information about one instance. There are two fields on each line, delimited by a colon. The fields are:

1. ID of the instance
2. The Replicated Enqueue profile file name.

Any changes made to these files take effect immediately. To add an instance for LifeKeeper to control on the SAP Backup Server, add a line at the end of the file on both servers. To remove an instance, simply delete the line on both servers.

For example, a file for controlling the Replicated Enqueue server for instance “01” for the protected SAP system might have the following line:

```
01:REPENQPF
```

Please refer to the SAP documentation for information on configuring the SAP Replicated Enqueue. The following parameter must be set in the profile file for the Replicated Enqueue server:

```
enque/enrep/inactive_action=shutdown
```

SAP Application Server Administration

For Configuration #2, it is possible to configure LifeKeeper to control one or more SAP instances on the SAP Backup Server. The recommendation is that a single AS instance be installed on the SAP Backup Server to be used as a Dialog Instance while the CI, ASCS, or SCS is running on the SAP Primary Server, and shut down by LifeKeeper when a failover occurs. This recommendation however does not preclude the possibility of installing multiple instances on the SAP Backup Server for LifeKeeper to control in a similar way. Likewise, the instances installed do not necessarily have to be redundant AS's. For example, it is possible to use a test server as a SAP Backup Server and configure LifeKeeper to control the CI, ASCS, or SCS on the test system.

During the Extend operation, you are allowed to select a single instance for LifeKeeper to control. If you want LifeKeeper to control more than one instance or if you want to add more instances after the initial hierarchy creation, you will have to manually edit a file used by LifeKeeper to maintain information about instances on the SAP Backup Server. The file exists on both servers, so any changes made to the file on one server will have to also be made on the other server.

The file is `<LKROOT>/subsys/appsuite/resources/sap/AS_<TAG>`, where `<LKROOT>` is the LifeKeeper root path and `<TAG>` is the tag name of the SAP resource on the local server. Each line in this file contains information about one instance. There are three fields on each line, delimited by `<Ctl-A>` characters. The fields are:

1. SID of the instance
2. ID of the instance
3. Name of the SAP Backup Server where this instance exists.

Any changes made to these files take effect immediately. To add an instance for LifeKeeper to control on the SAP Backup Server, add a line at the end of the file on both servers. To remove an instance, simply delete the line on both servers.

For example, a file for controlling the application server “00” for the “PRO” system on server “eve” might have the following line:

```
PRO<Ctl-A> 00<Ctl-A> eve
```

Client Reconnect

A SAP client can either be configured to log on to a specific SAP instance or a logon group. If configured to log on through a logon group, SAP determines which running instance the client actually connects to.

If the instance to which the client is connected goes down, the client connection is lost and the client must re-logon. If the database is temporarily lost, but the instance to which the client is connected stays up, the client will be temporarily unavailable until the database comes back up, but the client does not have to re-logon.

For performance reasons, clients should logon to redundant AS instances and not the CI, ASCS, or SCS. Administrators may wish, however, to be able to logon to the CI to view logs, etc. After protecting SAP with LifeKeeper a client login can be configured using the virtual SAP server name so the client can logon regardless of whether the SAP Instance is active on the SAP Primary or Backup server.

Script Timeout Values

Several of the SAP scripts have been written with a timeout feature to allow hung scripts to automatically kill themselves. This feature is required due to potential problems with unavailable NFS shares. This is explained in greater detail in the [NFS Mounts and su](#) section of this document under Configuration Notes.

Each script equipped with this feature has a default timeout value in seconds that can be overridden if necessary. The table below shows the script names, default value and variable name. To override a default value, simply add a line to the */etc/default/LifeKeeper* file with the desired value for that script. For example, to allow the remove script to run for a full minute before being killed, add the following line to */etc/default/LifeKeeper*:

```
SAP_REMOVE_TIMEOUT=60
```

Note that the script may actually run for slightly longer than the timeout value before being killed.

Script Name	Variable Name	Default Value (seconds)
ASControl	SAP_ASCONTROL_TIMEOUT	20
remove	SAP_REMOVE_TIMEOUT	90
restore	SAP_RESTORE_TIMEOUT	145 (for manual operations) 715 (for failovers)
recover	SAP_RECOVER_TIMEOUT	300

quickCheck	SAP_QUICKCHECK_TIMEOUT	30
------------	------------------------	----

Note: In a NetWeaver Java Only environment if you choose to start the Java CI in addition to the SCS Instance, you may need to increase the values for SAP_RESTORE_TIMEOUT and SAP_RECOVER_TIMEOUT.

Separation of SAP and NFS Hierarchies

Although the LifeKeeper SAP hierarchy described in this guide implements the SAP NFS hierarchies as child dependencies to the SAP resource, it is possible to detach and maintain the NFS hierarchies separately after the SAP hierarchy is created. You should consider the advantages and disadvantages of maintaining these as separate hierarchies as described below prior to removing the dependency. Note that this is only possible if the NFS shares being detached are hosted on a logical volume (LUN) that is separate from other SAP filesystems.

To maintain these two hierarchies separately, simply create the SAP hierarchy as described in this guide and then manually break the dependency between the SAP and NFS resources through the LifeKeeper GUI.

Advantage to maintaining SAP and NFS hierarchies separately: If there is a problem with NFS, the NFS hierarchy can failover separately from SAP. In this situation, so long as SAP handles the temporary loss of NFS mounted directories transparently, a SAP failover will not occur.

Disadvantage to maintaining SAP and NFS hierarchies separately: NFS shares are not guaranteed to be hosted on the same server where the CI, ASCS, or SCS is running. SAP does not recommend remotely hosting the <sapmnt>/<SID> share.

The diagram below shows the SAP and NFS hierarchies after the dependency has been deleted.

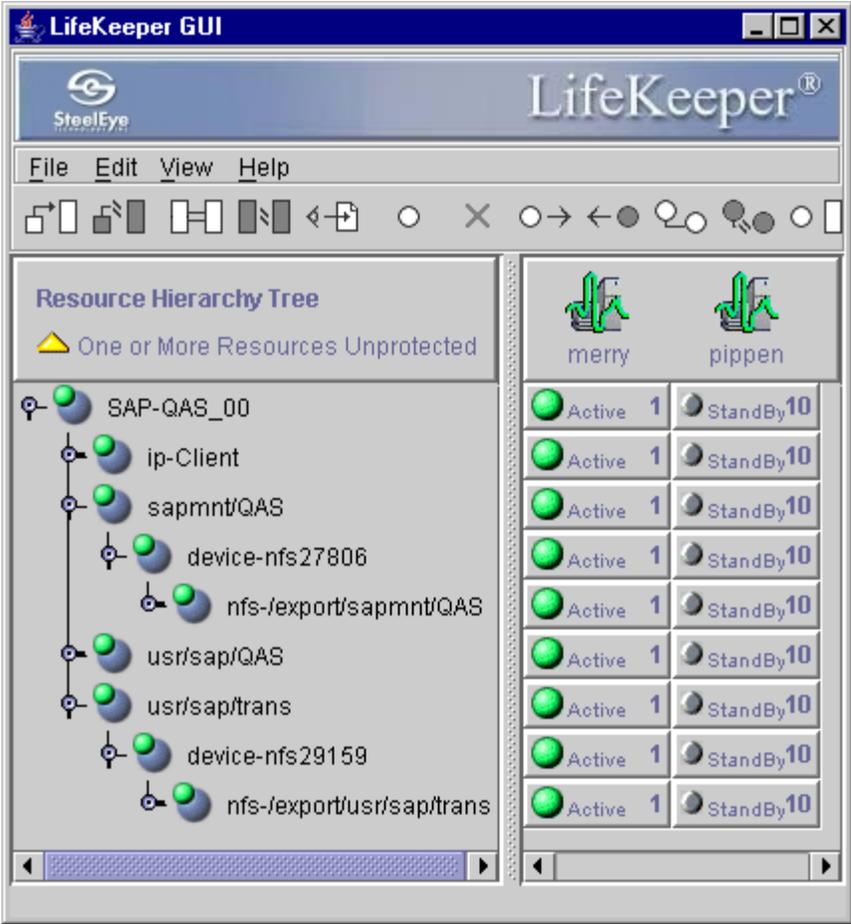
Using the LifeKeeper NAS Kit to Avoid NFS Issues

It is recommended that the LifeKeeper NAS Recovery Kit be used to avoid issues that can occur when the NFS children resources of the SAP hierarchy are taken out-of-service. Inserting the NAS resource at the appropriate place in the hierarchy ensures that the local NFS mount is unmounted before the NFS resource comes out of service. Of course, the use of the NAS resource is not necessary when it is specified that a link be created to the NFS export (ie., in Configuration #1 */usr/sap/trans* is a link to */export/usr/sap/trans*).

Inserting the NAS resource requires the following manual steps:

1. Create the SAP resource hierarchy.
2. Create the NAS resources. One for */sapmnt/<SID>* and one for */usr/sap/trans*.
3. For both NAS resources, create a dependency between the device child of the NAS hierarchy and the appropriate NFS resource. (The NFS resource for */export/sapmnt/<SID>* will become the child of the device child in the NAS hierarchy for */sapmnt/<SID>* and if necessary. The NFS resource for */export/usr/sap/trans* will become the child of the device child in the NAS hierarchy for */usr/sap/trans*.)
4. Make the NAS resource or resources a child or children of the SAP hierarchy.
5. Delete the dependency between the SAP resource and the NFS resource for */export/sapmnt/<SID>*.
6. For Configuration #2, delete the dependency between the SAP resource and the NFS resource for */export/usr/sap/trans*.

The diagram below shows the resulting SAP resource hierarchy for Configuration #2:



Troubleshooting

This section provides a list of messages that you may encounter during the process of creating and extending a LifeKeeper SAP resource hierarchy, removing and restoring a resource, and, where appropriate, provides additional explanation of the cause of the errors and necessary action to resolve the error condition. Other messages from other LifeKeeper scripts and utilities are also possible. In these cases, please refer to the documentation for the specific script or utility. Messages in this section fall under these topics:

- [Hierarchy Create and Extend Errors](#)
- [Hierarchy Delete Errors](#)
- [Hierarchy Restore and Remove Errors](#)
- [Resource Monitoring Errors](#)
- [SAP Error Messages During Failover or In-Service](#)
- [Other Errors](#)

Hierarchy Create and Extend Errors

The error messages that might be displayed during a hierarchy creation or extension are listed below, along with a suggested explanation for each.

Error Number	Error Message	Description
109001	Server name not specified.	An error occurred causing invalid arguments to be passed to the create script.
109002	Tag name not specified.	
109003	SAP SID not specified.	
109004	SAP Instance ID not specified.	
109005	Error getting SAP root directory using link from /usr/sap/SID/SYS/profile.	The create script finds the SAP root directory by looking for a link and it could not find the link specified.
109006	Error getting rdisp/mshost value from DEFAULT.PFL file in path <SAPRootDir>/<SID>/profile/DEFAULT.PFL on server <SysName.>.	The create script gets the virtual server name from the rdisp/mshost value in the <i>DEFAULT.PFL</i> file and it could not find this value.
109007	rdisp/mshost value in DEFAULT.PFL file is still set to the physical server name. It must be set to the virtual server name.	The create script found the rdisp/mshost value, but it has not been changed to the virtual server name. See Configuration Tasks for information on how to configure SAP to work with LifeKeeper.
109008	The /usr/sap/SID directory contains multiple instance directories for ID=ID	The chosen SID is only allowed to have a single instance directory for a given ID.

109010	.Could not find physical path for \$SAPRootDir/\$SID	The create script looks for the actual path to these three directories, parsing through each subpath and resolving mount points and links. For some reason, it was unable to find the actual path for one of the three directories. Consult the Configuration Notes for information on how to set up the SAP directory structure.
109012	The INST path does not exist.	For some reason the instance directory does not exist for the chosen SID and ID.
109013	The INST path must be on a shared file system.	The indicated path was found, but it does not appear to be located on a shared file system.
109014	The SAPMNT path must be on a shared file system.	This path is required to be on a shared file system.
109015	The TRANS directory is NFS shared on server SYS, but no NFS hierarchy could be found protecting it. You must create a NFS hierarchy to protect this share before creating the SAP hierarchy.	If the indicated directory is NFS hosted on the local server, a NFS LifeKeeper hierarchy must be created to protect it prior to entering the SAP creation wizard.
109016	The SAPMNT directory is NFS shared on server SYS, but no NFS hierarchy could be found protecting it. You must create a NFS hierarchy to protect this share before creating the SAP hierarchy.”	
109017	Error creating resource TAG on server SYS, err=ERR.	There was an error creating the SAP hierarchy.
109018	Error creating dependency between parent TAG and child TAG on server SERVER.	There was an error with the execution of dep_create.
109019	Could not successfully bring SAP hierarchy with tag TAG in-service on server SYS. The hierarchy will therefore be removed. Please attempt to correct the problem and retry the create operation.	There was a problem starting SAP on the server. Look in the start script log file in the SAP user's home directory for possible clues as to the source of the problem.
109051	Error creating instance TAG on SYS.	There was an error with the execution of ins_create.
109052	Error setting state for instance TAG to STATE.	There was an error with the execution of ins_setstate.
109053	Error setting switchback for instance TAG to SWTYPE.	There was an error with the execution of ins_setas.
109101	Usage: extend TemplateSysName TemplateTagName SwitchbackType AS_SID AS_ID TargetTagName	An error occurred causing invalid arguments to be passed to the extend script.
109102	END failed resource extension of TARGETTAG on server TARGETSYS with err=ERR - backing out changes made to server.	The extend operation was unsuccessful – look for other error messages for reason.

109103	Error getting Virtual Server Name, SID and INSTANCE_ID from resource TEMPLATETAG on server TEMPLATESYS.	There was an error getting necessary information from the LifeKeeper instance.
109104	Template resource CHILDTAG on server TEMPLATESYS does not exist.	For some reason, LifeKeeper cannot find the target resource.
190105	Cannot access extend script LKROOT/subsys/APP/TYP/bin/extend on server TARGETSYS.	The extend script for SAP cannot find an extend script for a child resource.
109106	Error copying file LKROOT/subsys/APP/resource/TYP/AS_TAG from TARGETSYS to TEMPLATESYS	LifeKeeper could not copy the file from the target to the template server using ldcrcp.
109150	Usage error - depstoextend TemplateSysName TemplateTagName.	An error occurred causing invalid arguments to be passed to the depstoextend script.
109160	Usage error - canextend TemplateSysName TemplateTagName	An error occurred causing invalid arguments to be passed to the canextend script.
109161	Cannot extend resource TEMPLATETAG to server TARGET.	Cannot proceed with the extend operation. Look for other error messages for the reason.
109162	Error getting SID and INSTANCE_ID from resource TEMPLATETAG on server TEMPLATE.	There was an error getting necessary information from the LifeKeeper instance.
109163	Group IDs or User IDs for SAP user SAPADMIN are different on TEMPLATE and TARGET. They must be identical on both servers."	The user or group IDs don't match between template and target servers.
109164	Can't find home directory for SAP user SAPADMIN. Verify that SAP is installed correctly on TARGET.	LifeKeeper looks for the home directory for the SAP admin user by looking in the password file. The admin home directory for the selected SID could not be determined in this way.
109165	Template resource CHILDTAG on server TEMPLATESYS does not exist.	For some reason, the resource on the template server could not be found.
109166	Cannot access canextend script LKROOT/lkadm/subsys/APP/TYP/bin/canextend on server TARGET.	The extend script for SAP cannot find a canextend script for a child resource.
109167	The SAP startup or stop files are missing for the SAP instance! Verify that SAP is installed correctly on "TargetSysName".	SAP does not appear to be installed correctly on the Target Server. You may need to re-install SAP on this server.
109250	Error renaming SAP startup file for TAG on server SYS.	An error occurred during extend or create and the subsequent cleanup operation could not complete successfully for the stipulated reason.
109251	Error deleting dependencies for TAG on server SYS.	
109252	Error removing SAP resource TAG on server SYS	
109253	Error removing SAP child resource for TAG on server SYS.	
109301	Error getting /etc/passwd file path from varlookup	LifeKeeper error getting path to <i>passwd</i> file.
109302	Can't find any SIDs in SAPDIR path	LifeKeeper can't find any subdirectories in <i>/usr/sap</i> that look like SIDs.
109902	Error renaming startup file startsap_LOCALSYS_ID in directory ADMINHOME to startsap_VIRTUALSYS_ID.	LifeKeeper renames start and stop files in the SAP admin home directory using the virtual server name. There was an error

109903	Error renaming stop file stopsap_LOCALSYS_ID in directory ADMINHOME to stopsap_VIRTUALSYS_ID.	renaming these files.
109904	Relative links not supported	A path to a SAP directory included relative links and these are not supported by LifeKeeper.
109905	Missing data in Application Server control file PATH/AS_TAG for entry LINE	There is a syntax error in the AS control file.
109906	SID or ID is incorrect length in Application Server control file PATH/AS_TAG for entry LINE.	Either the SID was not 3 characters long or the ID was not 2 characters long in the AS control file.
109907	Cannot start Application Server with SID=SID and ID=ID on Server SERVER because there are no LIVE comm. paths to that server.	The server where the AS is supposed to start is not available.

Hierarchy Delete Errors

The error messages that might be displayed during hierarchy delete operation are listed below, along with a suggested explanation for each.

Error Number	Error Message	Description
109601	Either tag or id name not specified	An error occurred causing invalid arguments to be passed to the delete script.
109602	END failed hierarchy delete of resource TAG on server SERVER with return value of ERR.	There was an error deleting the hierarchy. Look for other error messages to determine the reason.
109603	Error getting SID, Instance ID or Virtual server name from resource TAG on server SYS.	There was an error getting necessary information from the LifeKeeper instance. Ignore this error.
109900	Error renaming startup file startsap_VIRTUALSYS_ID in directory ADMINHOME to startsap_LOCALSYS_ID.	LifeKeeper renames start and stop files in the SAP admin home directory using the virtual server name. When a hierarchy is deleted, they are changed back to their original names using the physical server name. There was an error renaming these files.
109901	Error renaming stop file stopsap_VIRTUALSYS_ID in directory ADMINHOME to stopsap_LOCALSYS_ID.	

Hierarchy Restore and Remove Errors

The error messages that might be displayed during a hierarchy restore or remove operation are listed below, along with a suggested explanation for each.

Error Number	Error Message	Description
109200	Usage: ASControl Start Stop SID ID Server	An error occurred causing invalid arguments to be passed to the ASControl script.
109201	Error starting SAP Application Server with SID=SID and ID=ID on server SERVER. Startup script exited with return value VAL.	There was an error starting the SAP Application Server. VAL is the value returned from the SAP startup script.
109202	Error stopping SAP Application Server with SID=SID and ID=ID on server SERVER. Startup script exited with return value VAL.	There was an error stopping the SAP Application Server. VAL is the value returned from the SAP stop script.
109203	ASControl script has hung - attempting to kill it.	The script has reached its timeout value before completing – timeout value could be too small or script could be hung due to unavailable NFS.
109350	Usage: OSCoIStart SID	Script as called with incorrect arguments.
109351	OSCoIStart script has hung - attempting to kill it.	The script has reached its timeout value before completing – timeout value could be too small or script could be hung due to unavailable NFS.
109500	Either tag or id name not specified	An error occurred causing invalid arguments to be passed to the restore script.
109501	END failed restore of resource TAG on server SERVER with return value of ERR.	There was an error restoring the hierarchy. Look for other error messages to determine the reason.
109502	Error getting SID, Instance ID or Virtual server name from resource TAG on server SERVER.	There was an error getting necessary information from the LifeKeeper instance.
109503	Error stopping application server on SERVER - proceeding with restore procedure anyway.	LifeKeeper could not stop the SAP Application Server. Look for additional messages from ASControl script.

109504	Error starting saposcol on server REMOTESYS with return code VAL. Proceeding with CI startup for SID SID and ID ID on server SERVER anyway."	The restore script attempts to start the saposcol process on the remote server in case it was forced to shut down due to the failover of underlying file systems. There was an error starting this process. For some configurations, running saposcol on the backup server is not necessary or possible.
109505	Error starting SAP with SID SID and ID ID on server SERVER, with return code VAL. See startup log file in SAP home directory for possible cause of failure."	There was an error starting SAP.
109506	restore script has hung - attempting to kill it.	The script has reached its timeout value before completing – timeout value could be too small or script could be hung due to unavailable NFS.
109550	Either tag or id name not specified	An error occurred causing invalid arguments to be passed to the remove script.
109551	END failed remove of resource TAG on server SERVER with return value of VAL.	There was an error removing the hierarchy from service. Look for other error messages to determine the reason.
109552	Can't find resource with tag name TAG on server SERVER.	The remove script can't find the SAP resource tag.
109553	Error getting SID, Instance ID or Virtual server name from resource TAG on server SERVER.	There was an error getting necessary information from the LifeKeeper instance.
109554	Error stopping SAP with SID SID and ID ID on server VIRTUALSYS, with return code VAL.	There was an error stopping SAP.
109555	Error stopping SAP OS Collector on server SERVER. Proceeding with remove operation anyway. A running OS Collector during a LifeKeeper remove operation may cause server to hang, forcing a manual reboot.	The OS Collector could not be stopped while taking the hierarchy out of service. If the OS Collector is accessing a file system being taken out of service, the server may hang.
109556	remove script has hung - attempting to kill it.	The script has reached its timeout value before completing – timeout value could be too small or script could be hung due to unavailable NFS.
109655	quickCheck script called on resource TAG on server SERVER which has already begun a recover operation.	A local recovery operation is in progress, so the monitoring script exits without checking the resource.

Resource Monitoring Errors

The error messages that might be displayed during a hierarchy quickCheck operation are listed below, along with a suggested explanation for each.

Error Number	Error Message	Description
109557	Cannot stop SAP because the local server has SAP NFS shares mounted and the NFS server does not seem to be available.	Stopping SAP is not possible if the SAP NFS shares are not accessible. Correct the problem and retry the operation.
109650	quickCheck script for resource TAG on server SERVER is being killed due to a timeout error	The quickcheck script is taking too long and has timed out.
109651	Usage: quickCheck -t TAG -i ID	An error occurred causing invalid arguments to be passed to the quickCheck script.
109652	quickCheck script called on resource TAG on server SERVER which is out of service.	The quickCheck script script is not allowed to check a resource that is out of service.
109653	Error getting SID or INSTANCE_ID from resource TAG on server SERVER	There was an error getting necessary information from the LifeKeeper instance.
109654	Calling sendevent for resource TAG on server SERVER	The application does not seem to be operating correctly. Starting the recovery process.
109700	ID not specified	An error occurred causing invalid arguments to be passed to the recover script.
109701	END failed recovery of resource TAG on server SERVER with return value of ERR.	There was an error recovering the hierarchy on the local server. Look for other error messages to determine the reason.
109702	Error getting SID, Instance ID or Virtual server name from resource TAG on server SERVER.	There was an error getting necessary information from the LifeKeeper instance.
109703	Error stopping SAP with SID and ID on server SERVER with return code VAL.	LifeKeeper attempts to stop SAP prior to restarting it. There was an error trying to stop SAP.
109704	Error starting SAP with SID and ID on server SERVER with return code VAL.	There was an error starting SAP on the specified server.
109705	SAP with SID and ID on server SERVER started correctly, but doesn't seem to be running correctly.	The SAP startup script exited with success, but SAP still doesn't seem to be running correctly.
109706	recover script has hung – attempting to kill it.	The script has reached its timeout value before completing – timeout value could be too small or script could be hung due to unavailable NFS.
109707	Cannot recover SAP because the local server has SAP NFS shares mounted and the NFS server does not seem to be available.	Starting SAP is not possible if the SAP NFS shares are not accessible.

SAP Error Messages During Failover or In-Service

After a failover of a SAP , there will be error messages in the SAP logs. Many of these error messages are normal and can be ignored.

On Failure of the DB

BVx: Work Process is in reconnect status – This error message simply states that a work process has lost the connection to the database and is trying to reconnect.

BVx: Work Process has left reconnect status – This is not really an error, but states that the database is back up and the process has reconnected to it.

Other errors – There could be any number of other errors in the logs during the period of time that the database is down.

On Startup of the CI

E15: Buffer SCSA Already Exists – This error message is not really an error at all. It is simply telling you that a previously created shared memory area was found on the system which will be used by SAP.

E07: Error 00000 : 3No such process in Module rslgsmcc (071) – See *SAP Note 7316* – During the previous shutdown, a lock was not released properly. This error message can be ignored.

During a LifeKeeper In-Service Operation

The following messages may be displayed in the LifeKeeper In Service Dialog during an in-service operation:

```
error: permission denied on key 'net.unix.max_dgram_qlen'
error: permission denied on key 'kernel.cap-bound'
```

These errors occur when **saposc01** is started and can be ignored (see *SAP Note 201144*).

SAP Installation Errors

Incorrect Name in tnsnames.ora or listener.ora Files

When using the Oracle database, if the SAP installation program complains about the incorrect server name being in the *tnsnames.ora* or *listener.ora* file when you do the CI Backup Server installation, then you may not have installed the Oracle binaries on local file systems. The Oracle binaries in `/oracle/<SID>/920_<32 or 64>` must be installed on a local file system on each server for the configuration to work properly.

Other Errors

'tset' Errors Appear in the LifeKeeper Log File

The **su** commands used by the SAP and Database Recovery Kits cause a 'tset' error message to be output to the LK log that appears as follows:

```
tset: standard error: Invalid argument
```

This error comes from one of the profile files in the SAP administrator's and Database user's home directory and it is only in a non-interactive shell.

Suggested Action:

If using the c-shell for the Database user and SAP Administrator, add the following lines into the `.sapenv_<hostname>.csh` in the home directory for these users. This code should be added around the code that determines if 'tset' should be executed:

```
if (  $?prompt  ) then
    tty -s
    if (  $status == 0 ) then
        .
        .
        .
    endif
endif
```

Note: The code from "tty -s" to the inner "endif" already exists in the file.

If using the bash shell for the Database user and SAP Administrator, add the following lines into the `.sapenv_<hostname>.sh` in the home directory for the users.

Before the code that determines if 'tset' should be executed add:

```
case  $-  in
    *i*)  INTERACTIVE = "yes" ;;
    *)  INTERACTIVE = "no" ;;
esac
```

Around the code the that determines if 'tset' should be executed add:

```
if [  $INTERACTIVE == "yes"  ]; then
    tty -s
    if [  $? -eq 0  ]; then
        .
        .
        .
    fi
fi
```

Note: The code from "tty -s" to the inner "endif" already exists in the file.

Appendix A – Oracle Database

Validate the Oracle Database Configuration

Validate that the Oracle database is configured correctly by doing the following:

1. Verify that the entry for the SID in the *oratab* file is correct, including the *ORACLE* home directory, is correct. Be sure to disable automatic start-up of the instance.
2. Login as the ORACLE user and run the **sqlplus** utility. Execute **shutdown**, then **startup** in the utility to ensure that the SID stops and starts correctly.

Note: If any problems are detected please consult the Oracle documentation. Refer to the *LifeKeeper for Linux Oracle Recovery Kit Administration Guide* for information on configuring Oracle with LifeKeeper.

Avoiding the Database Load During Installation on the Backup Server

Note: For SAP Web Application Server 6.x, SAP recommends that you refer to the instructions in SAP Note 659509. Database loads can be avoided by following the steps in this SAP Note.

For SAP Kernel v4.6D, after creating the temporary installation directory and executing *INSTTOOL.SH* to copy installation files from the CD, make a backup copy of the *DATABASE.R3S* script and then modify the script as follows:

- 1) Locate the [EXE] section which sequentially lists the installation steps. Each step has a step number and step identifier.
- 2) Find the <XXX>=DBRESETDATABASE_IND_ORA step under [EXE]. This is the first database load step that you want to skip.
- 3) Find the <YYY>=DBCREATEROLLSEG_IND_ORA listed under [EXE]. You do not want to delete this step because it adds an entry in the local *init<SID>.ora* file.
- 4) Find the step before the last one listed under [EXE], which should be <ZZZ>=RFCRADDDBDIF_IND_IND.
- 5) Delete all steps under [EXE] from DBRESETDATABASE_IND_ORA to RFCRADDDBDIF_IND_IND, inclusive, except do not delete the DBCREATEROLLSEG_IND_ORA step. This should eliminate all of the steps related to database loading and setup. Do not worry about deleting anything else from this script. When you have finished deleting the unwanted steps, the end of the [EXE] section should include the following steps only:

(all steps before <XXX>)

```
<XXX>=BRBACKUPFILEPERMISSIONS_IND_ORA
```

```
<YYY>=DBCREATEROLLSEG_IND_ORA
```

```
<ZZZ>=QUERIESFINISHED_IND_IND
```

After modifying the script, proceed with SAP installation in the normal way. Make sure you enter the same group and user IDs on the CI Backup Server that were used on the CI Primary Server. When prompted, enter the CI Backup Server Name and not the Virtual CI Server Name. SAP should install correctly, skipping the database load steps.

If the installation fails because the Oracle staging area is too small, delete the directory */oracle/stage/920_<32 or 64>/Disk1* and retry the installation operation.

Protecting the Database with LifeKeeper

Make sure the *listener.ora* and *tnsnames.ora* files are set up correctly on both servers to use the database's virtual server name. Make sure a valid entry exists for <SID> in the */etc/oratab* file on both servers. The SAP installation tool creates a line for <SID> in */etc/oratab*, but lists '*' for the <SID>. Change the '*' to <SID>. Make sure the database is running on the DB Primary Server (use the **startdb** utility to start it).

Appendix B – MAXDB

Avoiding Database Load During Installation on Backup

Note: For SAP Web Application Server v6.x, there is currently not a defined method to avoid the database load on the backup system.

For SAP Kernel v4.6D, after creating the temporary installation directory and executing INSTTOOL.SH to copy installation files from the CD, make a backup copy of the DATABASE.R3S script and then modify the script as follows:

- 1) Locate the [EXE] section which sequentially lists the installation steps. Each step has a step number and step identifier.
- 2) Delete steps 300 – 620 under the [EXE] section

After modifying the script, proceed with SAP installation in the normal way. Make sure you enter the same group and user IDs on the CI Backup Server that were used on the CI Primary Server. When prompted, enter the CI Backup Server Name and not the Virtual CI Server Name. SAP should install correctly, skipping the database load steps.

Accessing the Database Using the Virtual IP Address

The MAXDB 'xuser' utility can be used to setup the .XUSER.62 file for the Database Administration User and the SAP Administration User to access the database using the virtual IP address for the database.

Protecting the Database with LifeKeeper

When creating the LifeKeeper hierarchy, enter the user "c" when prompted for the USER_KEY.

Appendix C – DB2

Supported Configuration with DB2

For details about the configurations refer to the section “[Supported Configurations](#)”.

Entering the Encryption Key During R3Setup

During the SAP system installation on the primary and backup servers using R3Setup, when prompted to “Enter/confirm the encryption key: **DB2DB6EKEY**” be sure to enter the same key. This ensures proper operation on both servers.

Avoiding the Database Load During Installation on the Backup Server

For SAP Kernel 4.6D, after creating the temporary installation directory and executing INSTTOOL.SH to copy installation files from the CD, make a backup copy of the CENTRDB.R3S script and then modify the script as follows:

1. Locate the [EXE] section which sequentially lists the installation steps. Each step has a step number and step identifier.
2. Delete steps 460, 470 and 500 – 750 under the [EXE] section

After modifying the script, proceed with SAP installation in the normal way. Make sure you enter the same group and user IDs on the CI Backup Server that were used on the CI Primary Server. When prompted, enter the CI Backup Server Name and not the Virtual CI Server Name. SAP should install correctly, skipping the database load steps.

Increased SAP Startup Time After Failover

After a failover it may take longer for SAP to start. This is due to recovery of the DB2 database. The recovery begins when the database is activated or when the first client connects. In the LifeKeeper solution the first client connection is made during SAP startup.