HP Serviceguard Enterprise Cluster Master Toolkit User Guide

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1 Introduction

The Enterprise Cluster Master Toolkit (ECMT) is a set of templates and scripts that allow the configuration of Serviceguard packages for internet servers as well as for third-party Database Management Systems. This unified set of high availability tools is being released on HP-UX 11i v2 and 11i v3.

Each Toolkit is a set of scripts specifically for individual application to start, stop, and monitor the application.

This set also helps to integrate popular applications into a Serviceguard cluster.

Overview

The ECMT is a collection of toolkits for popular applications to integrate them with the Serviceguard environment. ECMT consists of the following toolkits:

Toolkits for database applications:

- Oracle Toolkit
- Sybase Toolkit
- DB2 Toolkit
- MySQL Toolkit

Toolkits for internet applications:

- Apache Toolkit
- Tomcat Toolkit
- CIFS (Samba) Toolkit

For more information on the application versions supported by toolkit, see the compatibility matrix at *HP Serviceguard Toolkit Compatibility Matrix (published April 2011 or later)*. See www.hp.com/go/hpux-serviceguard-docs -> *HP Serviceguard Enterprise Cluster Master Toolkit.*

All ECMT Toolkits, except the Sybase toolkit, support both the modular style and the legacy style of packaging. The Sybase toolkit supports only Modular style of packaging. It is recommended that modular style of packaging is used because it has multiple advantages over the legacy style of packaging.

Users can use either the CLI or the SGMgr GUI interface to create the packages using Toolkits. See the http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard Manager*.

The following toolkit supports deploying of applications over cluster file systems (CFS) storage.

- Oracle
- Apache
- Samba

These toolkit deployment over the CFS storage can reduce failover time for single instance applications.

Packages created using ECMT toolkit log messages to the package log file and also has the feature to send alert mails, whenever there is a major issue with the package. The location of the log and mail id is configurable for each package.

Apart from the ECMT Toolkit, there are set of other toolkits and application extensions which can be used to integrate other applications in Serviceguard. Table 1 (page 7) below shows the Toolkit name and applications supported by the toolkits.

Table 1 Toolkit Name/Application Extension and Application Name

Toolkit Name/ Application Extension	Application Name
Serviceguard Extension for RAC (SGeRAC)	Oracle Real application clusters
Serviceguard Extension for SAP (SGeSAP)	SAP
Serviceguard Extension for E-Business Suite (SGeEBS)	Oracle E-Business Suite
Serviceguard toolkit for Oracle Data Guard (ODG)	Oracle Data Guard
HA NFS Toolkit	Network File System (NFS)
HP VM Toolkit	HP VM Guest

To package applications that are not covered by the Serviceguard Toolkits, users can use the Serviceguard Developers toolbox. Using this framework, users can create their own toolkits. This framework can be downloaded for free available at: http://software.hp.com -> *HP-UX 11i software -> High availability -> Serviceguard Developer's ToolBox*.

2 Using the Oracle Toolkit in an HP Serviceguard Cluster

This chapter describes the High Availability Oracle Toolkit designed for use in a HP Serviceguard environment. This chapter covers the basic steps for configuring an Oracle instance in a HP-UX cluster, and is intended for users who want to integrate an Oracle Database Server with Serviceguard.

It is assumed that its readers are already familiar with Serviceguard configuration, as well as with Oracle Database Server concepts, including installation and configuration procedures.

This toolkit can be used to configure only single instance Oracle database and if the user wants to configure Oracle RAC, then user's must use SGeRAC. For more information, see www.hp.com/go/hpux-serviceguard-docs -> *HP Serviceguard Extension for RAC*.

Overview

The Oracle Toolkit for Serviceguard consists of a set of shell scripts that are used to start, stop, and monitor an Oracle database instance, Automatic Storage Management (ASM) instance and the configured listener(s).

The Oracle toolkit is designed to work in either of two modes:

- As a database instance failover package.
- As an ASM Multi-Node Package (MNP).

There can be only one ASM MNP package configured per cluster, while there can be multiple database instance packages per cluster.

To use this toolkit in legacy style, the toolkit scripts must be integrated into the Serviceguard package control script. See the sections "Support For Oracle Database without ASM" (page 9) and "Supporting Oracle ASM instance and Oracle database with ASM" (page 26) for examples to create a legacy package.

For more information on creating modular packages, see "Support For Oracle Database without ASM" (page 9) "Supporting Oracle ASM instance and Oracle database with ASM" (page 26) and the whitepaper *Modular package support in Serviceguard for Linux and ECM Toolkits* available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard Enterprise Cluster Master Toolkit*.

Supported versions

It is assumed that the user has already installed the supported and compatible versions of Serviceguard, Oracle, and the Enterprise Cluster Master Toolkit (ECMT), which contains the Oracle toolkit.

Unless otherwise stated, this toolkit supports all storage and volume managers that Serviceguard supports.

To find the latest supported versions of these products on Serviceguard, Oracle, Cluster File System (CFS) and HP-UX versions, check the compatibility matrix available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* .

To use CFS, you must install the appropriate version of HP Serviceguard Storage Management Suite.

For more details, see the Serviceguard Release Notes at http://www.hp.com/go/hpux-serviceguard-docs ->*HP Enterprise Cluster Master Toolkit*.

In a Serviceguard cluster, packages created using the ECMT Oracle toolkit can co-exist with packages created using the SGeRAC toolkit. In such cases, the single-instance database failover packages must be made dependent on the SGeRAC clusterware multi-node package (OC MNP

package). For more information, see the section "Configuring and packaging Oracle single-instance database to co-exist with SGeRAC packages" (page 52).

Support For Oracle Database without ASM

Setting Up The Application

To set up the application, it is assumed that the Oracle should be installed in `/home/Oracle` on all the cluster nodes by 'Oracle' as the database administrator, and that shared storage must be configured.

1. Make sure all database instances in the cluster have unique names (as identified by the user-defined variable `SID_NAME` in the `haoracle.conf` configuration file).
2. Make sure that the 'Oracle' user has the same user id and group id on all nodes in the cluster.
3. Some of the possible configurations are as follows:

   - **Configuring shared file system using LVM**

     Create a volume group, logical volume, and file system to hold the necessary configuration information and symbolic links to the Oracle executables. This file system will be defined as ORACLE_HOME in the package control scripts. Since the volume group and file system must be uniquely named within the cluster, use the name of the database instance (SID_NAME) in the names:

     Assuming that the name of the database is 'ORACLE_TEST0', create the following:

     ```
     A volume group:          /dev/vg0_ORACLE_TEST0
     A logical volume:        /dev/vg0_ORACLE_TEST0/lvol1
     A file system:           /dev/vg0_ORACLE_TEST0/lvol1 mounted at
                              /ORACLE_TEST0
     ```

     After the volume group, logical volume and file system have been created on one node, it must be imported to the other nodes that will run this database. Create the directory /ORACLE_TEST0 on all nodes so that `/dev/vg0_ORACLE_TEST0/lvol1` can be mounted on that node if the package is to be run on the node.

   - **Configuring shared file system using VxVM**

     Create a disk group, logical volume, and file system to hold the necessary configuration information and symbolic links to the Oracle executables. This file system will be defined as ORACLE_HOME in the package control scripts. Since the disk group and file system must be uniquely named within the cluster, use the name of the database instance (`SID_NAME`) in the names:

     Assuming ORACLE_TEST0 the name of the database create the following:

     - A disk group `/dev/vx/dsk/DG0_ORACLE_TEST0`
     - A logical volume `/dev/vx/dsk/DG0_ORACLE_TEST0/lvol1`
     - A file system `/dev/vx/dsk/DG0_ORACLE_TEST0/lvol1` mounted at /ORACLE_TEST0

     After the disk group, logical volume and file system have been created on one node, it must be deported.

     Execute the following command on all cluster nodes to allow them to access the disk groups:

     ```
     $ vxdctl enable
     ```

     Create the directory /ORACLE_TEST0 on all nodes so that `/dev/vx/dsk/DG0_ORACLE_TEST0/lvol1` can be mounted on that node if the package is to be run on the node.

If you need help creating, importing, or managing the volume group or disk group and filesystem, see *Building an HA Cluster Configuration* in the Serviceguard user manual available at http://www.hp.com/go/hpux-serviceguard-docs-> *HP Serviceguard*.

- **Configuring shared file system using CFS**

  The shared file system can be a CFS mounted file system.

  To configure an Oracle package in a CFS environment, the Serviceguard CFS packages need to be running in order for the Oracle package to access CFS mounted file systems. Create a directory /ORACLE_TEST0 on all cluster nodes. Mount the CFS file system on /ORACLE_TEST0 using the Serviceguard CFS packages. Use /ORACLE_TEST0 to hold the necessary configuration information and symbolic links to the Oracle executables.

  NOTE: For information on other Volume Managers, see the *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* manual.

4. The control files, table spaces, and redo-log files must be located in the file system /ORACLE_TEST0 during the initial creation of the database. It is also recommended to configure trace files and alert logs in /ORACLE_TEST0 for ease of manageability. See Oracle documentation for information on setting up trace files and alert logs.
5. ORACLE_HOME=/ORACLE_TEST0 needs to be set in the toolkit configuration file haoracle.conf.
6. /ORACLE_TEST0/dbs is the configuration directory for the 'ORACLE_TEST0' database. This directory contains the Oracle parameter file (pfile/spfile) and the password file for ORACLE_TEST0.

   Symbolic links need to be created for all subdirectories in `/home/Oracle` other than dbs, like "/ORACLE_TEST0/bin -> /home/Oracle/bin" and so on.

NOTE: If you opted to store the configuration information on a local disk and propagate the information to all nodes, ensure that pfile/spfile, the password file, and all control files and data files are on shared storage. For this set up, you will need to set up symbolic links to the pfile and the password file from `/home/Oracle/dbs` as follows:

ln -s /ORACLE_TEST0/dbs/initORACLE_TEST0.ora \
${ORACLE_HOME}/dbs/initORACLE_TEST0.ora

ln -s /ORACLE_TEST0/dbs/orapwORACLE_TEST0.ora \
${ORACLE_HOME}/dbs/orapwORACLE_TEST0.ora)

- **Multiple Instance Configuration**

  If multiple instances will be run in the same cluster, repeat the preceding steps for each instance. For example, if a second instance (ORACLE_TEST1) is to be included in the configuration you would:

  - **For LVM**

    Create a second volume group (for example, `/dev/vg0_ORACLE_TEST1`), logical volume and filesystem with mount point (/ORACLE_TEST1) for the second instance. All configuration information for ORACLE_TEST1 will reside in /ORACLE_TEST1/dbs. Similar to ORACLE_TEST0, symbolic links need to be created for all subdirectories (other than /ORACLE_TEST1/dbs/), to link /ORACLE_TEST1 to /home/Oracle.

  - **For VxVM**

    Create a second disk group (example, /dev/vx/dsk/DG0_ORACLE_TEST1), logical volume and filesystem with mount point (/ORACLE_TEST1) for the second instance. All configuration information for ORACLE_TEST1 will reside in /ORACLE_TEST1/dbs. Similar to ORACLE_TEST0, symbolic links need to be created for all subdirectories (other than /ORACLE_TEST1/dbs/), to link /ORACLE_TEST1 to /home/Oracle.

  - **For CFS**

    Create another directory /ORACLE_TEST1. Another CFS file system would then be mounted on /ORACLE_TEST1 by the Serviceguard CFS packages. All configuration information for ORACLE_TEST1 will reside in /ORACLE_TEST1/dbs. Similar to ORACLE_TEST0, symbolic links need to be created for all subdirectories (other than /ORACLE_TEST1/dbs/), to link /ORACLE_TEST1 to /home/Oracle.

    This configuration makes it possible to run several Oracle instances on one node, facilitating failover or failback of Oracle packages between nodes in the cluster.

- **Here is an alternate setup for Oracle 10g/11g single-instance database:**

  - **If you are using LVM or VxVM (supported on Oracle 10gR2 and 11g only):**

    For nodes that will run only one database instance, the configuration described above could be simplified by installing Oracle entirely on the shared volume/file system (/ORACLE_TEST0, in our example). The installation is simplified, since no symbolic links are required. In this case, all Oracle binaries and configuration is migrated to the standby node on failover.

NOTE: This setup is not supported if Oracle 10g Release 1 is configured with LVM or VxVM. If Oracle 10g Release 1 is configured with LVM or VxVM then local configuration is recommended. The above configuration is supported in Oracle 10g Release 2 and Oracle 11g, but subject to a condition that Oracle's Automatic Storage Management (ASM) is not configured on that node.

- **If you are using CFS:**

  In this setup, Oracle can be optionally installed on a CFS mounted file system (/ORACLE_TEST0, in our example) with all Oracle binaries and configuration files in a CFS mounted file system.

  NOTE: An Oracle license must be installed on every node that might potentially run Oracle in the cluster.

- **Set up additional database logical volumes, with LVM**

  It is possible to have the database reside on the same volume group or logical volume as $ORACLE_HOME/dbs, but more commonly, the database will probably reside on several volume groups and logical volumes, which all need to be shared among the nodes that are able to run the Oracle instances. Again, using a naming convention for the volume group(s) that includes the instance name (${SID_NAME}) could be used to associate a volume group with a unique instance.

  For example:

  Raw disk access for Oracle data:

```
/dev/vg01_ORACLE_TEST0/rlvol1       # Raw logical volume Oracle data
/dev/vg02_ORACLE_TEST0/rlvol1       # Raw logical volume Oracle data
/dev/vg02_ORACLE_TEST0/rlvol2       # Raw logical volume Oracle data
```

  or for use with Asynchronous disk access and file systems:

```
/dev/vg01_ORACLE_TEST0/lvol1        # Logical volume Oracle data
/dev/vg02_ORACLE_TEST0/lvol1        # Logical volume Oracle data
/dev/vg02_ORACLE_TEST0/lvol2        # Logical volume Oracle data
```

  See the Oracle documentation to determine which format is more appropriate for your environment.

  All data belonging to the database must reside on shared logical volumes (raw or file system), space needs to be allocated and shared for the following data:

  - Oracle tablespaces
  - Oracle rollback segments
  - Oracle logfiles

  After defining the shared volume groups/`logical volumes/file systems` for these entities, see the Oracle documentation for creating the database.

NOTE: If you are using VxVM, create appropriate disk groups as required.

If you are using CFS mounted file systems, you can have ${ORACLE_HOME}/dbs and database reside in the same CFS file system. You can also have multiple Oracle databases corresponding to multiple Oracle packages residing in the same CFS file system. However, it is recommended to have different CFS file systems for different Oracle packages.

Setting Up the Toolkit

Toolkit Overview

It is assumed that users have used swinstall to properly install both Serviceguard and the Enterprise Cluster Master Toolkit (referred to as the ECMT), which includes the scripts for Oracle.

After installing the toolkit, six scripts and a README file will be in the `/opt/cmcluster/toolkit/Oracle` directory. Two more scripts and one file will be installed which will be used only for modular packages. The two scripts will be in the `/etc/cmcluster/scripts/ecmt/Oracle` directory and the third file will be installed in the `/etc/cmcluster/modules/ecmt/Oracle` directory.

For legacy packages, there will be one toolkit configuration script (`haOracle.conf`) and nine functional scripts (`toolkit.sh` , `haoracle.sh`, `haoracle_sql.sh`, `haoracle.mon`, `halistener.mon`, `hadbhang.mon`, `hagetdbstatus.sh`, `hatimeoutdbhang.sh` and `SGAlert.sh`)that work with each other to integrate Oracle database with the Serviceguard package control script.

Table 2 Legacy Package Scripts

Script Name	Description
haoracle.conf (toolkit configuration file)	This script contains a list of pre-defined variables that the user must customize for use with a particular database instance. This is a configuration file which is read by the toolkit script, `haoracle.sh`. Table 3 (page 14) shows a list of variables in `haoracle.conf` which need to be set for the database package.
Main Script (`haoracle.sh`)	This script contains a list of internally used variables and functions that support the starting and stopping of an Oracle database or ASM instance. This script will be called by `toolkit.sh` to perform the following: • On package startup, it starts the database or ASM instance, a listener process in case of a database instance as well as launches monitor processes. • On package halt, it stops the database or ASM instance, the listener process in case of a database instance, and monitor process. • Oracle instance start/stop script (haoracle_sql.sh) This script contains functions for starting and stopping Oracle instances and the listeners. This script is invoked by the main script (`haoracle.sh`) to start up and shut down Oracle.
Monitor Script (haoracle.mon)	This script contains a list of internally used variables and functions for monitoring an Oracle server instance. This script will be called by `haoracle.sh`. By default, the following processes are monitored: ora_pmon_$SID_NAME, ora_smon__$SID_NAME, ora_lgwr_$SID_NAME, ora_dbwr_$SID_NAME, ora_ckpt_$SID_NAME, and ora_reco_$SID_NAME ($SID_NAME is the session id name of the Oracle instance). These process names are contained in the variable `MONITOR_PROCESSES`. To include other processes to be monitored, the user needs to add the names of the processes to `MONITOR_PROCESSES` array in the toolkit configuration file (`haOracle.conf`). For example, if Oracle archiver is enabled, then archiver process name can be added to the`MONITOR_PROCESSES` array (ora_arc0_${SID_NAME}).

Table 2 Legacy Package Scripts *(continued)*

Script Name	Description
Listener Monitor Script (halistener.mon)	This script will be called by `haoracle.sh` to monitor the configured listeners. The script makes use of a command supplied by Oracle to check the status of the listener.
Database Hang Monitor Scripts (hadbhang.mon, hagetdbstatus.sh, hatimeoutdbhang.sh)	The hadbhang.mon script will be called by `haOracle.sh` to monitor the Oracle instance for possible 'hung' state. hadbhang.mon script inturn uses `hagetdbstatus`.sh and hatimeoutdb `hang.sh` to check the database status.
Alert Notification Scriptv(SGAlert.sh)	This script is used to send an e-mail to the e-mail address specified by the value of the `ALERT_MAIL_ID` package attribute, whenever there are critical problems with the package.
Interface Script (toolkit.sh)	This script is the interface between the Serviceguard package control script and the Oracle toolkit.

Table 3 Variable or Parameter Name in haoracle.conf file

Variable/Parameter Name	Description
`INSTANCE_TYPE`	This parameter determines whether the instance is an ASM instance or a database instance. Set this parameter to "database".
`ORACLE_HOME`	The home directory of Oracle.
`ORACLE_ADMIN`	User name of the Oracle database administrator. This will be used for starting and stopping of the database.
`SID_NAME`	The Oracle session name. This is sometimes called the session ID (SID). (for example, ORACLE_TEST0) and uniquely identifies an Oracle database instance.
`START_MODE`	This parameter defines the Oracle database startup mode. Valid options are "no mount", "mount" and "open". Default mode is "open".
`LISTENER`	Set to "yes" if you want this toolkit to start and stop the Oracle Listener.
`LISTENER_NAME`	The name(s) of the listener process(es) (typically the `SID_NAME`)
`LISTENER_PASS`	The password(s) of the listener process(es).
`LISTENER_RESTART`	This parameter defines the number of attempts to be made to restart the listener. If the listener does not restart after "LISTENER_RESTART" number of consecutive attempts, the package will be failed over. If the listener restart is successful, then the next time listener fails, the toolkit again tries "LISTENER_RESTART" number of times to restart the listener.
`PFILE`	Oracle database parameter file. If not specified, Oracle picks this up from the Oracle configuration directory $ORACLE_HOME/dbs. This parameter when configured overrides the default file/location. If both pfile and spfile are present and this parameter left unspecified, then ECM Oracle Toolkit will make use of pfile as the parameter file. To make use of spfile in the toolkit do not configure this parameter and remove the default pfile from its default location.
`MONITOR_PROCESSES`	The names of all processes that should be executing.

Table 3 Variable or Parameter Name in haoracle.conf file *(continued)*

MAINTENANCE_FLAG	This variable will enable or disable maintenance mode for the Oracle database package. By default this is set to "yes". In order to disable this feature MAINTENANCE_FLAG should be set to "no". When Oracle Database or ASM needs to be maintained, then a "<package directory>/Oracle.debug" file needs to be touched. During this maintenance period Oracle database or ASM instance's process monitoring is paused. Even if an Oracle instance is brought down, its package will not be failed over to the standby node. To continue monitoring and come back from the maintenance mode, remove the Oracle.debug file. It is the user's responsibility to ensure that Oracle instance is properly running after the maintenance phase. **NOTE:** Setting MAINTENANCE_FLAG to "yes" and touching the Oracle.debug file in the package directory will put the package in toolkit maintenance mode. Serviceguard A.11.19 release has a new feature which allows individual components of the package to be maintained while the package is still up. This feature is called Package Maintenance mode and is available only for modular packages. For more information using Package Maintenance mode, see *Modular package support in Serviceguard for Linux and ECM Toolkits* available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard Enterprise Cluster Master Toolkit*. If the Oracle database package is dependent on the SGeRAC clusterware package (OC MNP), then the Oracle database package will automatically go into toolkit maintenance mode if the SGeRAC OC MNP is put into toolkit maintenance mode. To put the SGeRAC OC MNP into toolkit maintenance mode, its MAINTENANCE_FLAG attribute must be set to 'yes' and a file oc.debug must be created manually in the OC MNP working directory on that node. More details about how to put the SGeRAC OC MNP package in toolkit maintenance mode can be found in the SGeRAC toolkit user guide. If the MAINTENANCE_FLAG attribute of the SGeRAC OC MNP is set to 'yes', this parameter must also be set to 'yes' in the single-instance Oracle database package.
ORA_CRS_HOME	This parameter must be set only in case where Oracle database packages created using ECMT Oracle toolkit and SGeRAC packages run in the same cluster. This parameter must be set to the Oracle Clusterware home directory.
MONITOR_INTERVAL	The time interval script (in seconds) will wait between checks to ensure that the Oracle instance is running. Default value is 30 seconds.
TIME_OUT	The amount of time, in seconds, to wait for the Oracle abort to complete before killing the Oracle processes defined in MONITOR_PROCESSES. The TIME_OUT variable is used as protection against a worst-case scenario where a hung instance prevents the package halt script from completing, therefore preventing the standby node from starting the instance. The value of TIME_OUT must be less than the HALT_SCRIPT_TIMEOUT value set in the package configuration file. If HALT_SCRIPT_TIMEOUT is not defined then, it is the sum of all the SERVICE_HALT_TIMEOUT defined in the package. This variable has no effect on the package failover times.
PARENT_ENVIRONMENT	This is used to mention if the Oracle user's shell should be invoked as a new shell or as a subshell that inherits the variables set in the parent shell. This can be set to only yes or no. Set to 'yes' if the Oracle user's shell should be invoked as a subshell. Set to 'no' if the Oracle user's shell should be invoked as a new shell. If set to no, the Oracle user's profile file is executed and the variables set in this profile file are available to the new shell.
CLEANUP_BEFORE_STARTUP	This parameter indicates whether 'shutdown abort' needs to be executed before the startup of the Oracle or ASM instance. 'shutdown abort' ensures the cleanup of uncleared shared memory or semaphores. This parameter can be set to only 'yes' or 'no'. Default value is no.
USER_SHUTDOWN_MODE	This parameter is used to specify the database shutdown mode only when a shutdown is initiated by the user and not due to a failure of a service. This parameter can take values "abort" or "immediate" only. If "abort" is specified, the database is shutdown using the abort option. If "immediate" is specified, the database is shutdown using the immediate option.
ALERT_MAIL_ID	This parameter is used to specify the e-mail address for sending alerts.

Table 3 Variable or Parameter Name in haoracle.conf file *(continued)*

OC_TKIT_DIR	This parameter must be populated only in case of Oracle database packages being created using ECMT Oracle toolkit provided that SGeRAC packages are also running in the same cluster and Oracle database packages being dependent on SGeRAC OC MNP package. This parameter must point to the working directory of the SGeRAC OC MNP. In case of modular packages, the value for this parameter is automatically populated when the package is created using the `cmapplyconf`command. In case of legacy packages, this attribute must be populated manually in the `haoracle.conf` file. This parameter can be set only using the CLI and cannot be set using the Serviceguard Manager.
`TIME_OUT`	The amount of time, in seconds, to wait for the Oracle abort to complete before killing the Oracle processes defined in `MONITOR_PROCESSES`. The `TIME_OUT` variable is used as protection against a worst-case scenario where a hung instance prevents the package halt script from completing, therefore preventing the standby node from starting the instance. The value of `TIME_OUT` must be less than the `HALT_SCRIPT_TIMEOUT` value set in the package configuration file. If`HALT_SCRIPT_TIMEOUT` is not defined then, it is the sum of all the SERVICE_HALT_TIMEOUT's defined in the package. This variable has no effect on the package failover times.
`PARENT_ENVIRONMENT`	This is used to mention if the Oracle user's shell should be invoked as a new shell or as a subshell that inherits the variables set in the parent shell. This can be set to only yes or no. Set to 'yes' if the Oracle user's shell should be invoked as a subshell. Set to no if the Oracle user's shell should be invoked as a new shell. If set to 'no', the Oracle user's profile file is executed and the variables set in this .profile file are available to the new shell.
CLEANUP_BEFORE_STARTUP	This parameter indicates whether 'shutdown abort' needs to be executed before the startup of the Oracle/ASM instance. 'shutdown abort' ensures the cleanup of uncleared shared memory or semaphores. This parameter can be set to only yes or no. Default value is 'no'.
USER_SHUTDOWN_MODE	This parameter is used to specify the database shutdown mode only when a shutdown is initiated by the user and not due to a failure of a service. This parameter can take values "abort" or "immediate" only. If "abort" is specified, the database is shutdown using the abort option. If "immediate" is specified, the database is shutdown using the immediate option.
ALERT_MAIL_ID	This parameter is used to specify the e-mail address for sending alerts.
OC_TKIT_DIR	This parameter must be populated only in case of Oracle database packages being created using ECMT Oracle toolkit provided that SGeRAC packages are also running in the same cluster and Oracle database packages being dependent on SGeRAC OC MNP package. This parameter must point to the working directory of the SGeRAC OC MNP. In case of modular packages, the value for this parameter is automatically populated when the package is created using the cmapplyconf command. In case of legacy packages, this attribute must be populated manually in the haoracle.conf file.

For modular packages, there is an Attribute Definition File (ADF) - oracle.1, a Toolkit Module Script (tkit_module.sh) and a Toolkit Configuration File Generator Script (`tkit_gen.sh`) that work with the six scripts mentioned above for legacy packages, to integrate Oracle with the Serviceguard Master Control Script.

NOTE: The following three scripts are used only during the modular method of packaging.

Table 4 Modular Package Scripts

Script Name	Description
Attribute Definition File (oracle.1)	For every parameter in the legacy toolkit user configuration file, there is an attribute in the ADF. It also has an additional attribute `TKIT_DIR` which is analogous to the package directory in the legacy method of packaging. The ADF is used to generate a package ASCII template file.
Module Script (tkit_module.sh)	This script is called by the Master Control Script and acts as an interface between the Master Control Script and the Toolkit interface script (`toolkit.sh`). It is also responsible for calling the Toolkit Configuration File Generator Script (described below).
Toolkit Configuration File Generator Script (tkit_gen.sh)	This script is called by the Module Script when the package configuration is applied using `cmapplyconf` to generate the user configuration file in the package directory (`TKIT_DIR`).

Support for multiple listeners

This feature provides support for multiple listeners with the ECM Oracle Toolkit. It enables the user to configure:

1. Single service to monitor all the listeners together. This is the default behavior. To enable single service to monitor all listeners, the listener name must not be passed to the service command. The service_cmd in the package configuration file would appear as service_name Oracle_listener_monitor service_cmd "$SGCONF/scripts/ecmt/Oracle/tkit_module.sh Oracle_monitor_listener" service_restart none service_fail_fast_enabled no service_halt_timeout 300.
2. A separate service to monitor each listener. In this case, the default service_cmd in the package configuration file has to be changed to include the listener name.

   For example: service_name Oracle_listener_monitor_1 service_cmd "$SGCONF/scripts/ecmt/Oracle/tkit_module.sh Oracle_monitor_listener <listener_name1>" service_restart none service_fail_fast_enabled no service_halt_timeout 300 The above lines have to be repeated for each listener. The user should ensure that the listener name passed to this service_cmd, must match to one of those specified in the `LISTENER_NAME` array.

NOTE: It is not recommended to combine these two configurations together, that is, it is not allowed to configure some listeners in a single service and the others in a separate service. The user should either configure all the listeners in a single service or in a separate service for each of them but not both together.

The user should ensure that the elements in LISTENER_RESTART array and LISTENER_PASS array correspond to those in LISTENER_NAME array in the package configuration file. When some listeners do not require a restart value and some do not require a password, ordering the elements in the arrays becomes difficult. In such cases, to avoid confusion, it is recommended that LISTENER_RESTART is set to '0' and LISTENER_PASS to 'empty quotes'(""), if they are not required.

Support for database hang detection

This feature enables the user to configure a separate service which will detect the database hang and then take appropriate action if a hang is detected. Database hang is detected by connecting to the database and checking its status. If this process takes an unusually long time or if toolkit is unable to retrieve the database status, then it is assumed that the database is hung. The user has the option to configure two attributes when configuring this service:

1. TIMEOUT: This attribute defines how long the script should wait for the database hang check to return success. If the database health cannot be determined within this time after connecting

to the database, then it is assumed that the database is hung. It can have any positive integer as value. The default value for TIMEOUT is 30 (seconds). This should not be confused with the TIME_OUT package attribute or the service_halt_timeout attribute.

2. ACTION: This attribute defines the action that must be taken if a database hang is detected. Currently, this attribute can take one of the following values:
   - log - Log a message. A message is logged to the package log everytime a hang is detected. If the MONITOR_INTERVAL attribute is set to 30 seconds, then a message is logged to the package log file every 30 seconds.
   - alert - Send an alert mail. An alert mail is sent to the email address specified with the ALERT_MAIL_ID attribute. The mail is sent only the first time a database hang is detected.
   - failover - Failover the package to adoptive node.

The default value for ACTION is 'failover'.

The syntax of the service command is as follows: service_cmd "$SGCONF/scripts/ecmt/Oracle/tkit_module.sh Oracle_hang_monitor <TIMEOUT> <ACTION>"

Following is an example in which the TIMEOUT is set to 40 seconds and the ACTION is set to 'alert':

```
service_name db_hang_check
service_cmd "$SGCONF/scripts/ecmt/Oracle/tkit_module.sh Oracle_hang_monitor 40 alert"
service_restart none
service_fail_fast_enabled no
service_halt_timeout 300
```

Cluster Verification for ECMT - Oracle Toolkit

Cluster verification is proactive identification of cluster inconsistency that will adversely affect toolkit package failover to a node. It is a check for Serviceguard, Toolkit and Oracle database versions on all package nodes of the cluster. Cluster verification is supported in Serviceguard A.11.20.00 and ECMT B.06.00 Patch A or later. It will not fail `cmcheckconf` command if there is any inconsistency but appropriate warning messages will be logged. It facilitates future addition of new checks in an incremental fashion, transparent to Serviceguard.

Sample Demonstration:

Consider a two-node cluster, both nodes having Serviceguard A.11.20.00 and ECMT B.06.00 but different Oracle database versions. Use cmcheckconf command to check package configuration.

```
node1# cmcheckconf -P pkg.conf
On node2, validation of package Oracle_pkg succeeded with:
```

The toolkit configuration file in the toolkit configuration directory will be backed up and a new file will be created when the package configuration is applied.

```
On node1, validation of package Oracle_pkg succeeded with:
```

⚠ **WARNING!** Oracle database version on all package nodes does not match. Check syslog for more details.

```
cmcheckconf Verification completed with no errors found.
Use the cmapplyconf command to apply the configuration.
```

Oracle Package Configuration Example

Package Setup and Configuration

Assuming Oracle is already installed in its default home directory (for example, **/home/Oracle**), perform the following steps to make necessary directories shareable by all clustered nodes:

If you are using LVM or VxVM

Follow the instructions in the chapter *Building an HA Cluster Configuration* in the manual *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* to create a logical volume infrastructure on a shared disk. The disk must be available to all clustered nodes that will be configured to run this database instance. Create a file system to hold the necessary configuration information and symbolic links to the Oracle executables. This file system will be used as ORACLE_HOME in the package control scripts. Since the volume group and file system have to be uniquely named within the cluster, use the name of the database instance ($SID_NAME) in the name. Assuming the name of the database is 'ORACLE_TEST0', follow the instructions in the manual *Building an HA Cluster Configuration* in the manual *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* to create the following:

```
LVM
      ----
      /dev/vg0_ORACLE_TEST0                  (the volume group)
      /dev/vg0_ORACLE_TEST0/lvol1            (the logical volume)
      /dev/vg0_ORACLE_TEST0/lvol1            (the filesystem)
      mounted at /ORACLE_TEST0


VxVM
      -----
      /dev/vx/dsk/DG0_ORACLE_TEST0                  (the disk group)
      /dev/vx/dsk/DG0_ORACLE_TEST0/lvol1            (the logical volume)
      /dev/vx/dsk/DG0_ORACLE_TEST0/lvol1            (the filesystem)
      mounted at /ORACLE_TEST0
```

If you are using CFS

Make sure that the Serviceguard CFS packages are running in order for the Oracle package to access CFS mounted file systems. See Serviceguard Manual for information on how to configure Servicegaurd CFS packages. Create a directory /ORACLE_TEST0 on all cluster nodes. Mount the CFS file system on /ORACLE_TEST0 using the Servicegurad CFS packages. Use /ORACLE_TEST0 to hold the necessary configuration information and symbolic links to the Oracle executables.

- Assuming Oracle is installed in `/home/Oracle`, create symbolic links to all subdirectories under `/home/Oracle` with the exception of the dbs directory (dbs contains important instance configuration files, and should reside in the shared storage in ${SID_NAME}, example, /ORACLE_TEST0/dbs).
- Test the setup to ensure Oracle can be properly brought up. Log on as 'Oracle'. Set environment variables ORACLE_HOME to /home/Oracle and ORACLE_SID to ORACLE_TEST0. Test Oracle to ensure that it can be properly started.

  ```
  $ sqlplus '/ as sysdba'
  SQL> startup
  SQL> exit
  ```

  After few minutes, check for the existence of Oracle processes (there should be several, identified by "ora_")

  ```
  $ ps -fu Oracle
  ```

  Bring the database down,

  ```
  $ sqlplus '/ as sysdba'
  SQL> shutdown immediate
  SQL> exit
  ```

  If you are using LVM - unmount and deactivate the volume group,

  ```
  $ umount /ORACLE_TEST0
  $ vgchange -a n /dev/vg0_ORACLE_TEST0
  ```

If you are using VxVM - unmount and deport the disk group,

```
$ umount /ORACLE_TEST0
$ vxdg deport /dev/vx/dsk/DG0_ORACLE_TEST0
```

Repeat this step on all other cluster nodes to be configured to run the package to ensure Oracle can be brought up and down successfully.

- Create the Serviceguard package using legacy method.

  The following steps in this section describes the method for creating the Serviceguard package using the legacy method. For information on creating the Serviceguard package using the modular method, see *Modular package support in Serviceguard for Linux and ECM Toolkits* available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard Enterprise Cluster Master Toolkit*.

```
$ mkdir /etc/cmcluster/pkg/ORACLE_TEST0
Copy the toolkit files from Oracletoolkit
$ cd /etc/cmcluster/pkg/ORACLE_TEST0/
$ cp /opt/cmcluster/toolkit/oracle/*
```

  Create a package configuration file (ORACLE_TEST0.conf) and package control script (ORACLE_TEST0.cntl) as follows:

```
$ cmmakepkg -p ORACLE_TEST0.conf
$ cmmakepkg -s ORACLE_TEST0.cntl
```

  There should be one set of configuration and control script files for each Oracle instance.

  The Serviceguard package control script (ORACLE_TEST0.cntl). Below are some examples of modifications to the Serviceguard package control script you need to make to customize to your environment.

If you are using LVM

VOLUME GROUPS

Define the volume groups that are used by the Oracle instance. File systems associated with these volume groups are defined as follows:

```
VG[0]=/dev/vg00_${SID_NAME}
```

For example:

```
VG[0]=/dev/vg00_ORACLE_TEST0
```

Define the file systems which are used by the Oracle instance.

NOTE: One of these file systems must be the shared file system/logical volume containing the Oracle Home configuration information ($ORACLE_HOME). The name of the instance is used to name the volume groups, logical volumes and file systems.

```
LV[0]=/dev/vg00_${SID_NAME}/lvol1
FS[0]=/${SID_NAME}
```

For example:

```
LV[0]=/dev/vg00_ORACLE_TEST0/lvol1
FS[0]=/ORACLE_TEST0
```

If you are using VxVM

- **DISK GROUPS**

  Define the disk groups that are used by the Oracle instance. File systems associated with these disk groups are defined as follows:

  ```
  VXVM_DG[0]=/dev/vx/dsk/DG00_${SID_NAME}
  ```

  For example:

  ```
  VXVM_DG[0]=/dev/vx/dsk/DG00_ORACLE_TEST0
  ```

  Define the file systems which are used by the Oracle instance.

  NOTE: One of these file systems must be the shared file system/logical volume containing the Oracle Home configuration information ($ORACLE_HOME). The name of the instance is used to name the disk groups, logical volumes and file systems.

  ```
  LV[0]=/dev/vx/dsk/DG00_${SID_NAME}
  FS[0]=/${SID_NAME}
  ```

  For example:

  ```
  LV[0]=/dev/vx/dsk/DG00_ORACLE_TEST0/lvol1
  FS[0]=/ORACLE_TEST0
  ```

  NOTE: If you are using CFS mounted file systems, you must NOT configure volume groups, logical volumes, and file systems in the package control script, but configure dependency on Serviceguard CFS packages.

  The service name must be the same as defined in the package configuration file. Always call the Oracle executable script with "start" for the SERVICE_CMD definitions.

  ```
  SERVICE_NAME[0]=ORACLE_${SID_NAME}
  SERVICE_CMD[0]="/etc/cmcluster/pkg/${SID_NAME}/tookit.sh monitor"
  SERVICE_RESTART[0]="-r 2"
  ```

  For example:

  ```
  SERVICE_NAME[0]=ORACLE_TEST0
  SERVICE_CMD[0]="/etc/cmcluster/pkg/ORACLE_TEST0/toolkit.sh monitor"
  SERVICE_RESTART[0]="-r 2"
  ```

  If Listener is also chosen to be monitored, then another service for listener has to be added as shown below:

  ```
  SERVICE_NAME[1]=LSNR_0
  SERVICE_CMD[1]="/etc/cmcluster/pkg/ORACLE_TEST0/toolkit.sh monitor_listener"
  SERVICE_RESTART[1]="-r 2"
  ```

If the database must be monitored for a 'hang' condition, then another service has to be added as shown below:

```
SERVICE_NAME[2]=DB_HANG_0
SERVICE_CMD[2]="/etc/cmcluster/pkg/ORACLE_TEST0/toolkit.sh hang_monitor 30 failure"
SERVICE_RESTART[2]="-r 2"
```

The service restart counter can be reset to zero for this service by using Serviceguard command `cmmodpkg`. The service restart counter is incremented each time the service fails. It is used to determine when a package has exceeded its restart limit as defined by the SERVICE_RESTART parameter in the package control script.

To reset the restart counter execute the following command:

```
cmmodpkg [-v] [-n node_name] -R -s service_name package_name
```

NOTE: If listener monitoring is not required, then do NOT configure a new service for listener.

Edit the customer_defined_run_cmds function to execute the toolkit.sh script with the start option. In the example below, the line `/etc/cmcluster/pkg/ORACLE_TEST0/toolkit.sh start` was added, and the ":" null command line deleted.

For example:

```
function customer_defined_run_cmds
     {
     #  Start the Oracle database.

       /etc/cmcluster/pkg/ORACLE_TEST0/toolkit.sh start

       test_return 51
     }
```

Edit the customer_defined_halt_cmds function as shown below to include the check to get the reason for package halt, that is, whether the package halt is due to a failure of a service or a user initiated shutdown. Also, execute the toolkit.sh script with the stop option.

For example:

```
function customer_defined_halt_cmds
     {

      #  Stops the  database  with a "shutdown  abort" or a
      #  "shutdown immediate" command.

     if [ $SG_HALT_REASON = "user_halt" ]; then
          reason="user"
     else
          reason="auto"
     fi

     /etc/cmcluster/pkg/ORACLE_TEST0/toolkit.sh stop $reason

        test_return 52
     }
```

- The Serviceguard package configuration file (ORACLE_TEST0.conf).

  The package configuration file is created with "cmmakepkg -p", and should be put in the following location:

  ```
  '/etc/cmcluster/pkg/${SID_NAME}/${SID_NAME}.conf'
  ```

  For example:

  ```
  /etc/cmcluster/pkg/ORACLE_TEST0/ORACLE_TEST0.conf
  ```

The configuration file should be edited as indicated by the comments in that file. The package name must be unique within the cluster. For clarity, use the $SID_NAME to name the package.

```
PACKAGE_NAME <SID_NAME>
PACKAGE_NAME          ORACLE_TEST0
```

List the names of the clustered nodes to be configured to run the package, using the *NODE_NAME* parameter:

```
NODE_NAME                        node1
                    NODE_NAME                          node2
```

The service name must match the service name used in the package control script. The service name should include the Oracle instance name (that is, ${SID_NAME}). In the following example, since there is only one service for this package, the ${SID_NAME} (that is, ORACLE_TEST0) is assigned to the *SERVICE_NAME* parameter.

For example:

```
SERVICE_NAME                    ORACLE_TEST0
SERVICE_FAIL_FAST_ENABLED       NO
SERVICE_HALT_TIMEOUT            300
```

If the listener should also be monitored, another service must be added.

```
SERVICE_NAME                    LSNR_0
SERVICE_FAIL_FAST_ENABLED       NO
SERVICE_HALT_TIMEOUT            300
```

NOTE: If listener monitoring is not intended, do not create a new service.

The run and halt scripts are (typically) identified as the control script, as follows: RUN_SCRIPT /etc/cmcluster/pkg/ORACLE_TEST0/ORACLE_TEST0.cntl HALT_SCRIPT /etc/cmcluster/pkg/ORACLE_TEST0/ORACLE_TEST0.cntl .

If you are using a CFS mounted file system for the Oracle package, you need to configure dependency of the Oracle package on a Serviceguard CFS package(for example,. SG-CFS-MP-1, CFS mount point package).

If the Oracle package is configured to depend on a Serviceguard CFS package, the Oracle package will run as long as the dependee package is running. If the dependee package fails, then the dependent Oracle package will also fail.

To configure dependency of the Oracle package, you must set the following configurable parameters in the package configuration file:

```
DEPENDENCY_NAME
DEPENDENCY_CONDITION
DEPENDENCY_LOCATION
```

For example:

```
DEPENDENCY_NAME Oracle_dependency
DEPENDENCY_CONDITION SG-CFS-MP-1 = up
DEPENDENCY_LOCATION SAME_NODE
```

NOTE: If the Oracle database is running in a cluster where SGeRAC packages are also running, then the ECMT Oracle single-instance database package must be made dependent on the SGeRAC Oracle clusterware multi-node package (OC MNP). The dependency type should be 'SAME_NODE=up'. This is because, when the Oracle clusterware is halted, it halts the Oracle single-instance database. By putting this dependency, we ensure that the database package is always halted first and then the SGeRAC OC MNP is halted. Also, the Oracle database must be disabled from being started automatically by the Oracle Clusterware. This can be done by following the below steps:

1. Log in as the Oracle administrator and run the following command to set the database management policy to manual:

```
For Oracle 10g:
       # $ORACLE_HOME/bin/srvctl modify database -d <dbname> –y manual

For Oracle 11g:
       # $ORACLE_HOME/bin/srvctl modify database -d <dbname> –y MANUAL
```

- The Oracle toolkit user configuration file.

  In the package directory, modify the `haoracle.conf` configuration file for this Oracle instance.

NOTE: In case of a modular package, the user need not specify the parameter values in the`haoracle.conf` file. The toolkit populates `haoracle.conf` on its own.

For example:

Edit the `haoracle.conf` script as indicated by the comments in that script. You will have to set the variables as shown in the example below:

```
INSTANCE_TYPE=database
ORACLE_HOME=/ORACLE_TEST0
ORACLE_ADMIN=Oracle
SID_NAME=ORACLE_TEST0
START_MODE=open
ASM=no
LISTENER=yes
LISTENER_NAME=LISTENER_ORACLE_TEST0
LISTENER_PASS=
LISTENER_RESTART=
PFILE=${ORACLE_HOME}/dbs/init${SID_NAME}.ora
MONITOR_PROCESSES[0]=ora_pmon_${SID_NAME}
MONITOR_PROCESSES[1]=ora_dbw0_${SID_NAME}
MONITOR_PROCESSES[2]=ora_ckpt_${SID_NAME}
MONITOR_PROCESSES[3]=ora_smon_${SID_NAME}
MONITOR_PROCESSES[4]=ora_lgwr_${SID_NAME}
MONITOR_PROCESSES[5]=ora_reco_${SID_NAME}
MAINTENANCE_FLAG=yes
MONITOR_INTERVAL=30
TIME_OUT=30
PARENT_ENVIRONMENT=no
CLEANUP_BEFORE_STARTUP=no
USER_SHUTDOWN_MODE=abort
ALERT_MAIL_ID=
```

The parameters *ASM_DISKGROUP*, *ASM_VOLUME_GROUP*, *ASM_HOME*, *ASM_USER*, *ASM_SID*, and *KILL_ASM_FOREGROUNDS* need to be set only for a database package using ASM. For more information on ASM, see "Supporting Oracle ASM instance and Oracle database with ASM" (page 26).

After setting up the Serviceguard environment, each clustered Oracle instance should have the following files in the related package directory. For example, the ORACLE_TEST0 package, located at /etc/cmcluster/pkg/ORACLE_TEST0, would contain the following files:

Table 5 Files in ORACLE_TEST0

File Name	Description
`${SID_NAME}.conf`	Serviceguard package configuration file
`${SID_NAME}.cntl`	Serviceguard package control script
`toolkit.sh`	Toolkit Interface Script
`haoracle.conf`	Toolkit user configuration file
`haoracle.sh`	Toolkit main script
`haoracle_sql.sh`	Oracle start/stop script
`halistener.mon`	Toolkit Monitor Script
`halistener.mon`	Listener Monitor Script

Another example to create the Serviceguard package using modular method:

1. Create the modular package configuration file "pkg.conf" by including the ECMT Oraclt toolkit module.

   ```
   # cmmakepkg -m ecmt/Oracle/Oracle pkg.conf
   ```

   where,

   'ecmt/Oracle/Oracle' is the ECMT Oracle toolkit module name.

   `pkg.conf` is the name of the package configuration file.

2. Configure the following Serviceguard parameters in the `pkg.conf` file:

   package_name — Set to any name desired.

   package_type — Set to failover.

   Edit the service parameters if necessary. The service parameters are preset to:

   ```
   service_name                    Oracle_service
   service_cmd                     "$SGCONF/scripts/ecmt/Oracle/tkit_module.sh Oracle_monitor"
   service_restart                 none
   service_fail_fast_enabled       no
   service_halt_timeout            300
   service_name                    Oracle_listener_service
   service_cmd                     "$SGCONF/scripts/ecmt/Oracle/tkit_module.sh Oracle_monitor_listener"
   service_restart                 none
   service_fail_fast_enabled       no
   service_halt_timeout            300
   service_name oracle_hang_service
   service_cmd "$SGCONF/scripts/ecmt/oracle/tkit_module.sh oracle_hang_monitor 30 failover"
   service_halt_timeout 300
   ```

   If the listener is not configured, comment the second set of service parameters which are used to monitor the listener.

3. Configure the toolkit parameter *`TKIT_DIR`*. This parameter is synonymous to the package directory. On a `cmapplyconf`, *`TKIT_DIR`* will contain the toolkit configuration file `haoracle.conf` on all configured nodes. Configure the other toolkit parameters for the database package .

4. Apply the package configuration using the following command:

   ```
   # cmapplyconf -P pkg2.conf
   ```

   This command creates the package using the values specified in the package configuration file. It also creates the toolkit configuration directory defined by *`TKIT_DIR`* parameter on all target nodes, if not already present and then creates the toolkit configuration file in it with the values specified in the`pkg.conf` file.

For more information on modular packages, see the whitepaper *Modular package support in Serviceguard for Linux and ECM Toolkits* available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard Enterprise Cluster Master Toolkit*.

Also, refer the whitepaper "Migrating Packages from Legacy to Modular Style, October 2007" for more information. You can find this whitepaper at http://www.hp.com/go/hpux-serviceguard-docs -> HP Enterprise Cluster Master Toolkit .

5. For a running database package, if the value of any of the package attribute needs to be modified, then the package needs to be restarted. The following steps should be followed to update the attribute values of a running database package:
   a. Edit the package configuration file and populate the new values.
   b. Halt the package.
   c. Apply the package configuration file.
   d. Start the package.

Supporting Oracle ASM instance and Oracle database with ASM

This section discusses the use of the Oracle database server feature called Automatic Storage Management (ASM) in HP Serviceguard for single database instance failover. Serviceguard Extension for RAC (SGeRAC) supports ASM with Oracle RAC on both ASM over raw devices and ASM over SLVM. For Oracle single-instance failover, Serviceguard support is for ASM over LVM where the members of the ASM disk groups are raw logical volumes managed by LVM. LVM provides the necessary I/O fencing mechanism and also the multipathing capability not present in HP-UX 11i v2. When using ASM with Oracle single-instance database versions earlier to 11gR2, the ASM file descriptors were kept open on ASM disk group members even after the disk groups had been dismounted. Oracle has released patches which address the ASM descriptor issue and meets the Serviceguard requirement for supporting ASM. Note that these patches are not required for Oracle 11gR2 or later versions. This whitepaper describes how Oracle failover packages can now use Oracle ASM with the interim patches provided by Oracle. The framework for ASM integration with Serviceguard makes use of a Multi-Node Package (MNP) to encapsulate the ASM instance and to have the ASM instance running on all nodes, with one or more Oracle single-instance failover packages dependent on this MNP. Customers wishing to use the proposed framework for ASM integration with Serviceguard should use this whitepaper in conjunction with a bundle of Oracle Enterprise Cluster Master Toolkit (ECMT) scripts, provided by HP.

What is Automatic Storage Management (ASM)?

Automatic Storage Management is a feature provided in Oracle 10g or later to simplify the database files management. It provides the database administrator with a simple storage management interface that is consistent across all server and storage platforms. ASM provides file system and volume management capabilities directly inside the Oracle database kernel, allowing volumes and disk management with familiar SQL statements in Oracle. This is an alternative to platform file systems and volume managers for the management of most file types used to store the Oracle database, including Oracle datafiles, control files, and online and archived redo log files. File types not supported by ASM include Oracle database server binaries, trace files, audit files, alert logs, backup files, export files, tar files, and core files. Storage for application binaries and data cannot be managed by ASM. ASM uses disk groups to store datafiles; an ASM disk group is a collection of disks that ASM manages as a unit. Within a disk group, ASM exposes a file system interface for Oracle database files. The contents of files that are stored in a disk group are evenly distributed, or striped to eliminate hot spots and to provide uniform performance across the disks.

This section describes the High Availability Scripts for Oracle ASM support with Serviceguard. Support is for Automatic Storage Management (ASM) over LVM where the ASM disk group members are raw logical volumes managed by LVM.

Following are the supported versions of HP Serviceguard:

- A.11.19
- A.11.20

Oracle versions supported with ASM are 10.2.0.4, 11.1.0.6, and 11.1.0.7 with interim patches 7330611 and 7225720 installed. Before these patches were released by Oracle, ASM kept descriptors open on ASM disk group member volumes even after the ASM disk group had been dismounted. This prevented the deactivation of the LVM volume groups. These two patches address the ASM descriptor issue and meets the Serviceguard requirement for supporting ASM. Oracle version 11gR2 is also supported but does not require interim patches to be installed.

NOTE: For information on the proposed framework for ASM integration with Serviceguard, please refer to the whitepaper *High Availability Support for Oracle ASM with Serviceguard* available at: www.hp.com/go/hpux-serviceguard-docs —> *HP Enterprise Cluster Master Toolkit* .

The Oracle toolkit uses Multi-Node Package (MNP) and the package dependency feature to integrate Oracle ASM with HP Serviceguard. An MNP is used to encapsulate the per-node ASM instances with one or more Oracle single-instance failover packages that are dependent on this MNP. This configuration enables database instance to start up in the right order in relation to the ASM instance, and in the event of a failover, to relocate to a node where an ASM instance is available.

The Oracle toolkit scripts for ASM support with Serviceguard consists of a set of shell scripts that are used to start, stop, and monitor an Oracle ASM and database instance and the configured listeners. To use these scripts, the scripts must be integrated into the Serviceguard package control script in case of legacy packages. In the case of modular packages, the scripts must be integrated with the Serviceguard master control script. Subsequent sections provide guidelines for integrating these scripts with the Serviceguard package control script and the master control script.

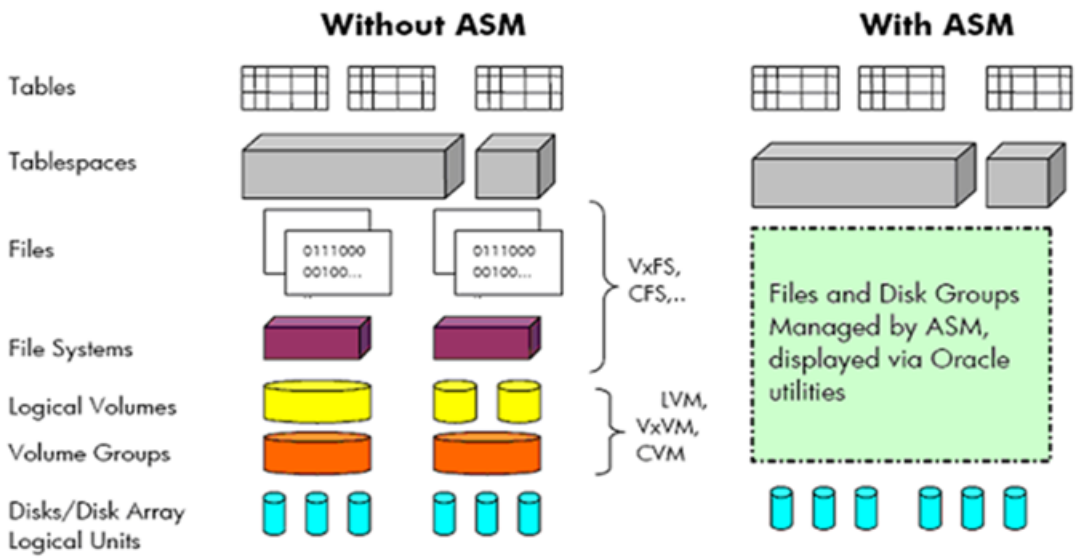
In a Serviceguard cluster, packages created using the Oracle toolkit can co-exist with packages created using the SGeRAC toolkit. In such an environment where the Oracle toolkit and the SGeRAC toolkit coexist, the ASM MNP package need not be created using the Oracle toolkit. The single-instance database failover packages must be made dependent on the SGeRAC Clusterware multi-node package (OC MNP package). Also, the package should be created using the command line interface and Serviceguard Manager must not be used to create the packages.

A major advantage of ASM is the ease of management it provides for database files:

- The system administrator has only to specify the set of raw devices to be used in an ASM disk group; the tasks of configuring and administering volume/disk groups and file systems are eliminated. Oracle ASM makes use of the Oracle feature called Oracle-Managed Files and performs the tasks of creating, deleting, and extending files on behalf of database instances; additionally, it manages their mirroring and striping.
- If a device is added to, or deleted from, an ASM disk group, ASM automatically rebalances database file striping based on the new disk layout.

Figure 1, contrasts the Oracle storage hierarchy as it appears when platform or 3rd party volume managers and file systems are used for Oracle data files, compared to when ASM is used. The layers corresponding to file systems and volume managers are absorbed into ASM. The files and directories in the storage hierarchy are not visible using standard operating system commands; to display them the customer must use Oracle utilities.

Figure 1 Oracle database storage hierarchy without and with ASM



Why ASM over LVM?

As mentioned above, we require ASM disk group members in Serviceguard configurations to be raw logical volumes managed by LVM. We leverage existing HP-UX capabilities to provide multipathing for LVM logical volumes, using either the PV Links feature, or separate products such as HP StorageWorks Secure Path that provide multipathing for specific types of disk arrays. Another reason for using LVM is that, it is the responsibility of Serviceguard to provide the necessary I/O fencing when it provides failover for a single-instance Oracle database instance. Serviceguard ensures I/O fencing for a failover package via a feature in the volume manager - exclusive activation of volume groups. Other advantages of the "ASM-over-LVM" configuration are as follows:

- ASM-over-LVM ensures that the HP-UX devices used for disk group members will have the same names (the names of logical volumes in LVM volume groups) on all nodes, easing ASM configuration.
- ASM-over-LVM protects ASM data against inadvertent overwrites from nodes inside/outside the cluster. If the ASM disk group members are raw disks, there is no protection currently preventing these disks from being incorporated into LVM or VxVM volume/disk groups.

The disadvantages of the ASM-over-LVM configuration are as follows:

- Additional configuration and management tasks are imposed by the extra layer of volume management (administration of volume groups, logical volumes, physical volumes).
- There is a small performance impact from the extra layer of volume management.

Configuring LVM Volume Groups for ASM Disk Groups

We require ASM disk group members in Serviceguard configurations to be raw logical volumes managed by LVM. But these logical volumes presented to ASM should resemble raw disks, as far as possible. Hence, each LVM logical volume (LV) used as a member of an ASM disk group is required to be laid out to occupy the usable space, in contiguous fashion, of exactly one single physical volume (PV). This implies that the LV:

- should be contiguous,
- should not be striped or mirrored,

- should not span multiple PVs
- and should not share a PV with other LVs.

The idea is that ASM provides the mirroring, striping, slicing, and dicing functionality as needed and LVM supplies the multipathing functionality not provided by ASM. Figure 2 indicates this one-to-one mapping between LVM PVs and LVs used as ASM disk group members.

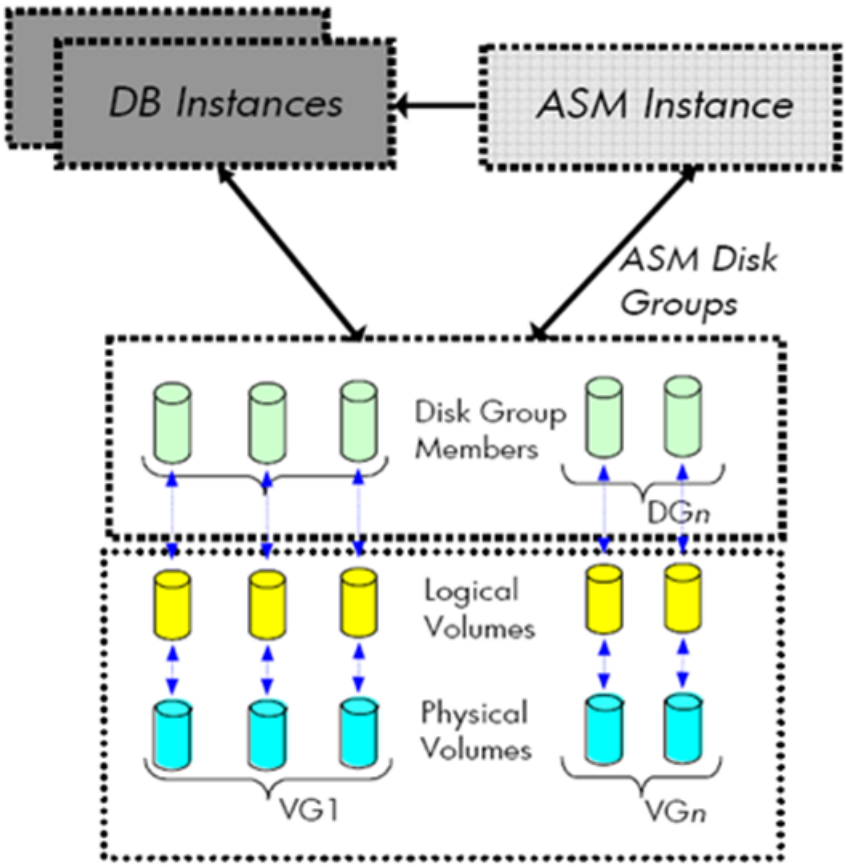
Further, the default retry behavior of LVM could result in an I/O operation on an LVM LV taking an indefinitely long period of time. This behavior could impede ASM retry and rebalance capabilities; hence a finite timeout must be configured for each LVM LV.

For example, the timeout could be configured to the value (total number of physical paths to the PV * PV timeout), providing enough time for LVM to try all available paths, if needed.

The PVs used in an ASM disk group can be organized into LVM volume groups as desired by the customer. In the example shown in Figure 2, for each ASM disk group, the PVs corresponding to its members are organized into a separate LVM volume group.

The LVM volume groups are marked as exclusive volume groups and exported across the Serviceguard cluster using standard Serviceguard procedures. As noted above, multiple physical paths to each physical volume should be configured using the LVM PV Links feature or a separate multipathing product such as HP StorageWorks Secure Path.

Figure 2 Oracle database storage hierarchy without and with ASM



Sample Command Sequence for Configuring LVM Volume Groups

Here is an example of a command sequence that can be used to prepare LVM Logical Volumes for use by ASM to meet the requirements specified above. The scenario for the example is that we are preparing a new volume group named vgora_asm with two PVs, each with two physical paths. The physical paths for the first PV are `/dev/dsk/c9t0d1` and `/dev/dsk/c10t0d1` and those for the second PV are `/dev/dsk/c9t0d2` and `/dev/dsk/c10t0d2`.

1. Create the volume group with the two PVs, incorporating the two physical paths for each (choosing hh to be the next hexadecimal number that is available on the system, after the volume groups that are already configured).

```
# pvcreate -f /dev/rdsk/c9t0d1
# pvcreate -f /dev/rdsk/c9t0d2
# mkdir /dev/vgora_asm
# mknod /dev/vgora_asm/group c 64 0xhh0000
# vgcreate /dev/vgora_asm /dev/dsk/c9t0d1
# vgextend /dev/vgora_asm /dev/dsk/c9t0d2
# vgextend /dev/vgora_asm /dev/dsk/c10t0d1
# vgextend /dev/vgora_asm /dev/dsk/c10t0d2
```

2. For each of the two PVs, create a corresponding LV.
   - Create an LV of zero length.
   - Mark the LV as contiguous.
   - Extend each LV to the maximum size possible on that PV (the number of extents available in a PV can be determined via vgdisplay -v <vgname>)
   - Configure LV timeouts, based on the PV timeout and number of physical paths, as described in the previous section. If a PV timeout has been explicitly set, its value can be displayed via pvdisplay -v. If not, pvdisplay will show a value of default, indicating that the timeout is determined by the underlying disk driver. For SCSI devices, in HP-UX 11i v2, the default timeout is 30 seconds.
   - Null out the initial part of each LV user data area to ensure ASM accepts the LV as an ASM disk group member. Note that we are zeroing out the LV data area, not its metadata. It is the ASM metadata that is being cleared.

```
# lvcreate -n lvol1 vgora_asm
# lvcreate -n lvol2 vgora_asm

# lvchange -C y /dev/vgora_asm/lvol1
# lvchange -C y /dev/vgora_asm/lvol2

# Assume vgdisplay shows each PV has 2900 extents in our example
# lvextend -l 2900 /dev/vgora_asm/lvol1 /dev/dsk/c9t0d1
# lvextend -l 2900 /dev/vgora_asm/lvol2 /dev/dsk/c9t0d2

# Assume a PV timeout of 30 seconds.
# There are 2 paths to each PV, so the LV timeout value is 60 seconds
# lvchange -t 60 /dev/vgora_asm/lvol1
# lvchange -t 60 /dev/vgora_asm/lvol2

# dd if=/dev/zero of=/dev/vgora_asm/rlvol1 bs=8192 count=12800
# dd if=/dev/zero of=/dev/vgora_asm/rlvol2 bs=8192 count=12800
```

3. Export the volume group across the Serviceguard cluster and mark it as exclusive, as specified by Serviceguard documentation. Assign the right set of ownerships and access rights to the raw logical volumes on each node as required by Oracle (oracle:dba and 0660, respectively).

   We can now use the raw logical volume device names as disk group members when configuring ASM disk groups using the Oracle database management utilities. There are a few ways to configure the ASM disk groups, for example, the dbca database creation wizard and sqlplus.

   The same command sequence can be used for adding new disks to an existing volume group that is being used by ASM to store one or more database instances.

Serviceguard support for ASM on HP-UX 11i v3 onwards

This document describes how to configure Oracle ASM database with Serviceguard for high availability using the ECMT Oracle toolkit. Look at the ECMT support matrix available at http://www.hp.com/go/hpux-serviceguard-docs -> HP Enterprise Cluster Master Toolkit for the supported versions of ECMT, Oracle, and Serviceguard.

Note that for a database failover, each database should store its data in its own disk group. Refer to Oracle documentation for limitation imposed by ASM on the number of disk groups. The disk group members must be logical volumes managed by HP Logical Volume Manager (LVM). Initial release of HP-UX 11i v3 did not support LVM version 2. With HP-UX 11i v3 0803, LVM version 2 logical volumes are also supported as members of the ASM disk groups.

A new I/O infrastructure that enables the native built-in multipathing functionality is introduced in HPUX 11i v3. This feature offers users a continuous I/O access to a LUN or disk if any of the paths fails. This feature is enabled in the operating system by default. In addition, new DSF (device special file) format is introduced in this operating system known as persistent DSF. An example of persistent DSF is /dev/disk/disk1, compared to the legacy DSF, /dev/rdsk/cxtydz.

A new cluster wide DSF format is introduced in HP-UX 11i v3 known as cDSF. Serviceguard A.11.20 requires the Serviceguard patch PHSS_41225 to support this feature. An example of cDSF is `/dev/cdisk/disk1`, compared to the persistent DSF, `/dev/disk/disk1`. ASM cannot detect cDSF format and hence this format cannot be used to create the ASM disk groups.

It is the responsibility of Serviceguard to provide the necessary I/O fencing when failover is provided for a single-instance Oracle database instance. Serviceguard ensures I/O fencing for a failover package via a feature in the volume manager - exclusive activation of volume groups. Hence it is required that the ASM disk group members be LVM logical volumes.

Framework for ASM support with Serviceguard

The framework for ASM integration with Serviceguard makes use of a Multi-Node Package (MNP) to encapsulate the per-node ASM instances, with one or more Oracle single-instance failover packages dependent on this MNP. This configuration enables the database instance to start up in the right order in relation to the ASM instance, and in the event of failover, to relocate to a node where an ASM instance is available. The benefits of this package framework for single-instance Oracle database using ASM-based storage are:

- Avoid failing over ASM instance. This reduces the failover time due to ASM instance restart.
- Many database instances can share one ASM instance per node.
- Sequencing between Oracle database instance and ASM instance during startup/shutdown/failover.
- Flexibility of the database instances to fail over independently.

HP provides a set of scripts known as the Enterprise Cluster Master Toolkit (ECMT) scripts which provides for the integration of ASM with Serviceguard. The operation of the Toolkit is described below.

The start function switches to the ASM software owner user id by executing the `su` command. It starts the ASM instance specified by the user using the sqlplus commands. The mounting of the ASM disk groups associated with a database instance will be done before database instance startup after volume group activation during the database package startup.

The stop function executes su to the ASM software owner user id. It stops the ASM instance using sqlplus commands.

The monitor function contains a continuous loop to check if the ASM instance processes specified are healthy. If the monitor function finds any process to have died, it means that the ASM instance has either failed or been inappropriately shut down, that is, without using `cmhaltpkg`. The service

that invokes the function fails at this point and the Serviceguard package manager fails the corresponding ASM MNP instance.

On ASM instance failure, all dependent database instances will be brought down and will be started on the adoptive node.

How Toolkit Starts, Stops and Monitors the Database instance

The Toolkit failover package for the database instance provides start and stop functions for the database instance and has a service for checking the status of the database instance.

There will be a separate package for each database instance. Each database package has a simple dependency on the ASM package. The package activates the volume groups in exclusive mode. The start function executes su to the Oracle software owner user id. This function mounts the ASM disk groups associated with the instance and starts the database instance specified by the user using the sqlplus commands.

The stop function executes su to the Oracle software owner user id. The database instance is shutdown using the sqlplus commands and the disk groups associated with the instance are dismounted. After dismounting the disk groups, the logical volumes are checked to see if ASM has closed its file descriptors. If file descriptors are still open, necessary steps are taken to ensure that file descriptors are closed. The package then deactivates the volume groups.

The monitor function contains a continuous loop to check if the database instance processes specified are healthy. If the monitor function finds any process to have died, it means that the database instance has either failed or been inappropriately shut down, that is, without using `cmhaltpkg`. The service that invokes the function fails at this point and the Serviceguard package manager fails the corresponding database failover package.

Consider two database instances DB0 and DB1. Each database instance uses its own disk group with the disk group members on its own volume group. Figure 3, depicts the scenario when the ASM instance and the database instances DB0 and DB1 start on nodes 1 and 2 respectively.

Figure 3 Serviceguard ASM environment

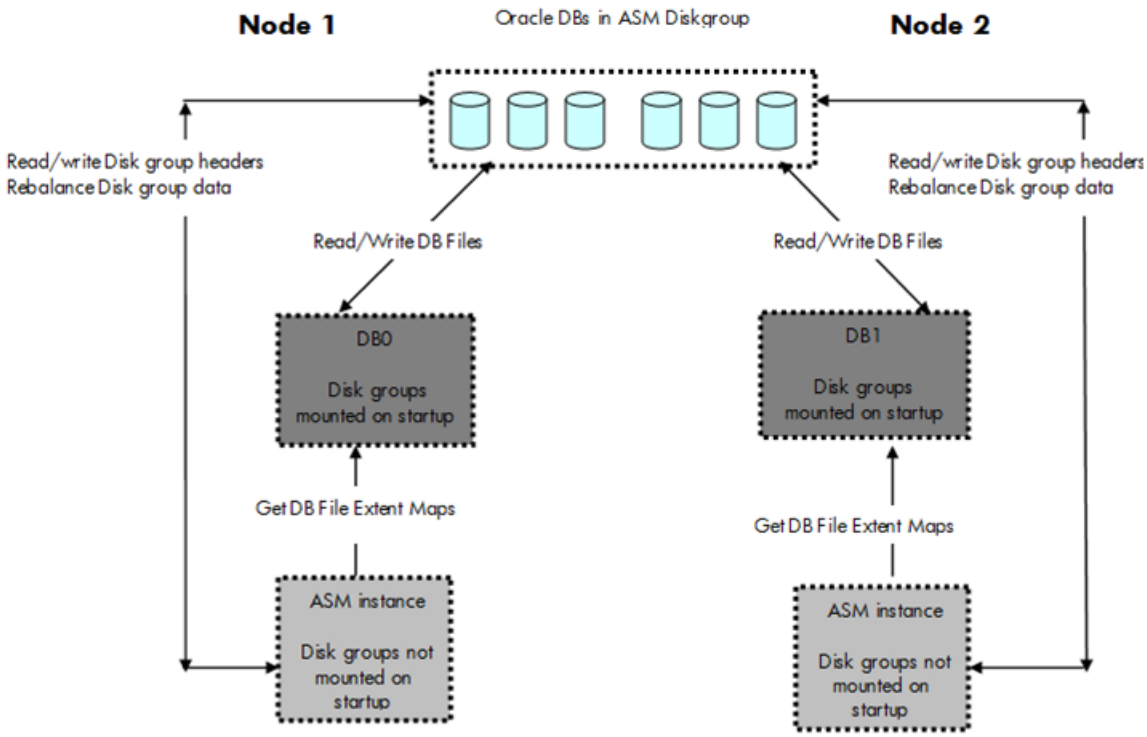
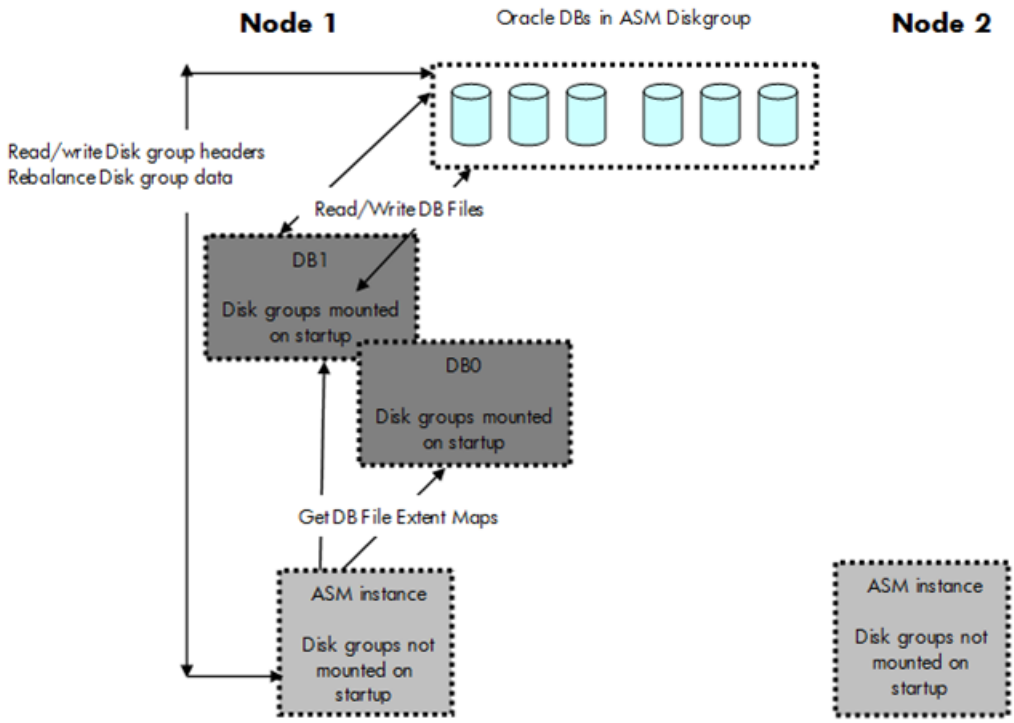


Figure 4, shows the scenario when DB1 fails on node 2.

Figure 4 ASM environment when DB1 fails on node 2

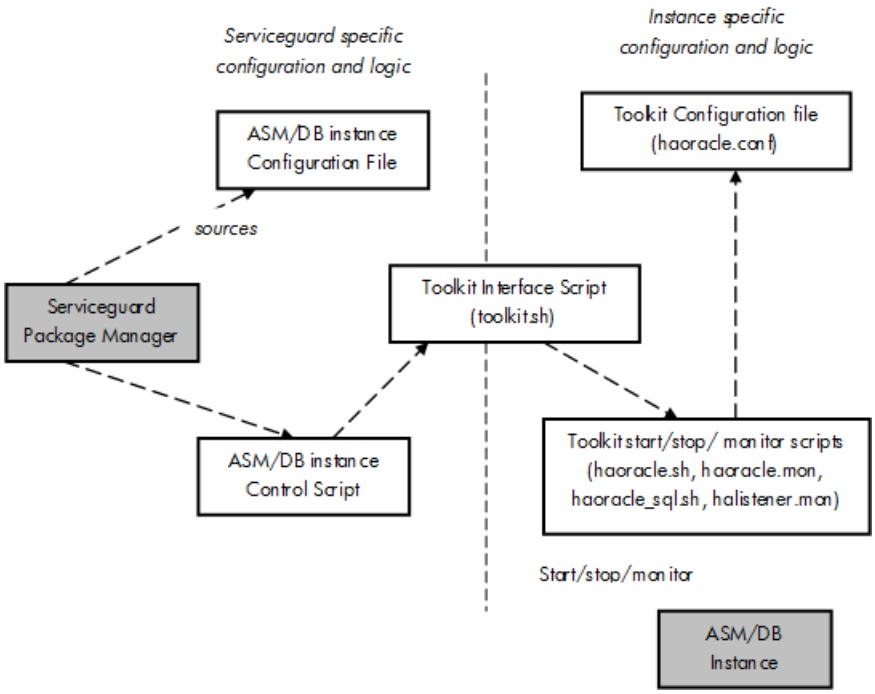


Serviceguard Toolkit Internal File Structure

HP provides a set of scripts for the framework proposed for ASM integration with Serviceguard. The ECMT Oracle scripts contain the instance specific logic to start/stop/monitor both the ASM and the database instance. These scripts support both legacy and the modular method of packaging. Even though, Legacy method of packaging is supported, it is deprecated now and will not be supported in future. Hence, it is recommended to use modular style of packaging. For more information on creating a modular package, look at the Serviceguard manual *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* latest edition at http://www.hp.com/go/hpux-serviceguard-docs -> HP Serviceguard. Serviceguard provides tools to migrate existing legacy packages to modular packages. For more information, look at the whitepaper "Migrating Packages from Legacy to Modular Style" available at http://www.hp.com/go/hpux-serviceguard-docs -> HP Serviceguard.

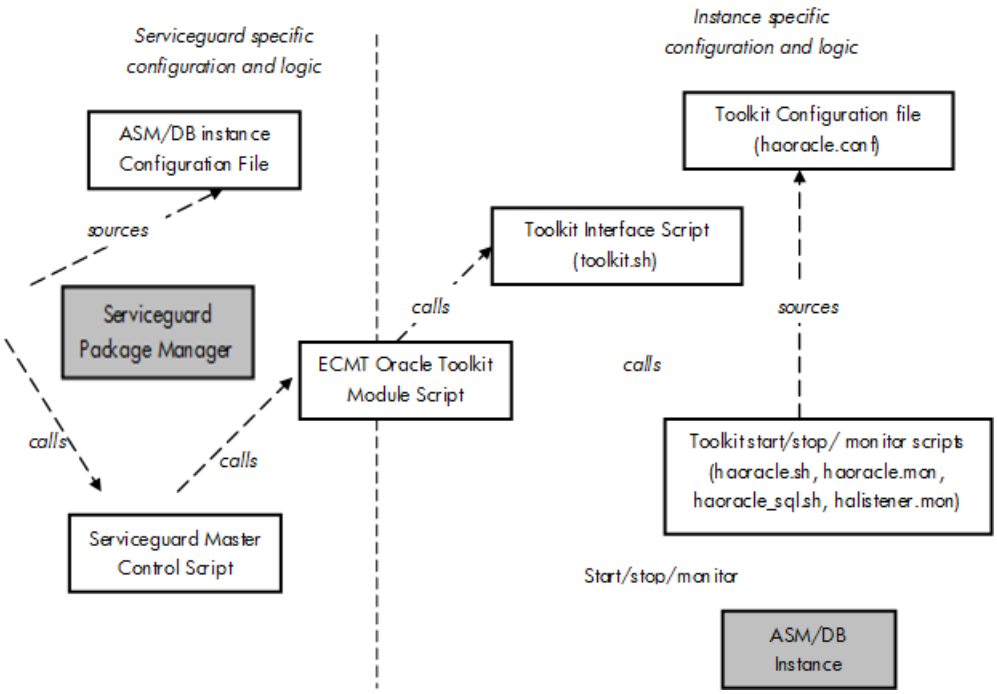
Legacy packages use the package configuration file and the package control script for the ASM or database instance on the Serviceguard specific side. The package configuration file parameters are stored in the Serviceguard configuration database (CDB) at `cmapplyconf` time, and are used by the package manager in its actions on behalf of this package. The control script invokes the ASM or the database instance specific functions for start/stop/monitor through the toolkit interface script (toolkit.sh). On the instance specific side, there is a toolkit configuration file (haoracle.conf) which is sourced by the start/stop/monitor (`haoracle.sh`,`haoracle_sql.sh`, `haoracle.mon`, and `halistener.mon`) script files. The toolkit interface script allows the start/stop/monitor calls to remain unaffected by changes in the instance specific scripts. Figure 5, shows the internal file structure for legacy packages.

Figure 5 Internal file structure for legacy packages



Modular packages use the package configuration file for the ASM or database instance on the Serviceguard specific side. The package configuration parameters are stored in the Serviceguard configuration database at cmapplyconf time, and are used by the package manager in its actions on behalf of this package. The Serviceguard master control script invokes the ASM or the database instance specific functions for start, stop and monitor through the Oracle toolkit module script. The toolkit module script in turn calls the legacy scripts toolkit.sh, `haoracle.sh`, haoracle_sql.sh, haoracle.mon, haoracle.conf, and halistener.mon to start, stop and monitor the ASM or database instance.Figure 6, shows the internal file structure for modular packages.

Figure 6 Internal file structure for modular packages



ASM File Descriptor Release

When an ASM disk group is dismounted on a node in the Serviceguard cluster, it is expected that the ASM instance closes the related descriptors of files opened on the raw volumes underlying the members of that ASM disk group. However, there may be a possibility that processes of the ASM instance and client processes to the ASM instance may not close the descriptors.

Consider a configuration in which there are multiple databases using ASM to manage their storage in a Serviceguard cluster. Assume each database stores its data in its own exclusive set of ASM disk groups. If the database instance is shutdown on a node and then its ASM disk groups are dismounted on that node, some ASM background and client processes may still hold open file descriptors to the underlying raw logical volumes. Hence an attempt at this point to deactivate the corresponding LVM volume group(s) on the node may fail.

Oracle has provided interim patches with which the ASM background processes close the file descriptors on the dismounted disk group volumes.

However, any client connections into the ASM instance using sqlplus or Oracle Enterprise Manager (OEM) results in ASM foreground processes opening file descriptors on all the disk group volumes of all the database instances. These descriptors may not close on dismount of the disk group. Oracle allows for terminating these foreground processes.

The toolkit package parameter `KILL_ASM_FOREGROUNDS` determines whether the scripts should kill the ASM foregrounds if the file descriptors are open on the dismounted disk group volumes. The ASM PMON process will recover any foreground processes that were killed. This parameter can be set either to yes or no only. The default value is “yes”.

The scripts will check to see if any ASM foreground processes of the form oracle <ASM_SID> have file descriptors open on the dismounted disk group volumes of the database instance. If this parameter is set to “yes”, and the ASM foregrounds have file descriptors open after dismount of the disk group, they will be removed using a SIGTERM signal by the scripts. Before removing the ASM foreground processes, the scripts will check every 3 seconds for a maximum of 12 seconds to see if the foreground processes have closed the file descriptors. If the file descriptors are closed within this 12 second timeout, then volume groups will be deactivated without waiting for the completion of this timeout. If this parameter is set to “no”, the ASM foregrounds will not be killed. However, when this parameter is set to “no”, and if ASM foregrounds have file descriptors open, volume group deactivation and hence the database instance package halt will fail.

Installing, Configuring, and Troubleshooting

Oracle ASM is part of the Oracle database server installation and does not require additional software from HP to operate in the Serviceguard environment.

Oracle 11gR2 onwards, the Oracle Clusterware software must be installed to use Oracle ASM.

Oracle ASM and ASM disk groups may be configured at the time of creating a database or before creating the database. Ensure that the LVM volume groups and raw disks have been prepared and activated prior to ASM disk group configuration or reconfiguration, as discussed in this document. Use the names of raw LVs contained in the LVM volume groups when configuring ASM disk groups. Ensure that each database instance uses different disk groups.

It is important to note that Oracle 11gR2 onwards, by default, the spfile of the ASM instance is stored on the ASM diskgroup. This is true only for the ASM instance and not for the database instance that uses the ASM diskgroup. For an ASM instance, the ECM Toolkit cannot verify the existence of the spfile on the ASM diskgroup. So, it is mandatory that a pfile is created from the spfile on the local disk, at a location that ECMT can access. The value of the PFILE attribute of the ASM instance package must point to the pfile that is created on the local disk.

Assume that the Serviceguard cluster, ASM instance and one or more database instances are already installed and configured.

- Halt the ASM and database instances.
- Configure the ASM MNP using the ECMT Oracle scripts provided by HP following the instructions in the README file in the scripts bundle.
- Start the ASM instance on all the configured nodes by invoking cmrunpkg on the ASM MNP.
- Next, configure the database failover package using the ECMT Oracle scripts provided by HP following the instructions in the README file in the scripts bundle.
- Start the database instance on the node by invoking cmrunpkg on the database package. For troubleshooting, it may be useful to look at subdirectories for database and ASM instances under $ORACLE_BASE/admin/, where log and trace files for these instances are deposited. Also look at HP-UX syslog and Serviceguard package logs.

Setting up DB instance and ASM instance

This section describes the sequence of steps to be followed to set up an ASM instance or a database instance using ASM storage.

Configuring ASM in a Serviceguard environment and creating the ASM instance

1. Configure the raw logical volumes to be used in the ASM disk groups as mentioned in the whitepaper "High Availability Support for Oracle ASM with Serviceguard" present at: http://www.hp.com/go/hpux-serviceguard-docs -> HP Enterprise Cluster Master Toolkit

   Assign the right set of ownership and permissions to the raw logical volumes (Oracle:dba and 0660 respectively).
2. Install the ASM binaries on local storage in ASM_HOME on all the nodes. ASM can have its own home to keep the database and ASM homes separate and to have a simpler configuration. Install interim patches 7330611 and 7225720 on all the nodes (these patches are not required for 11gR2). Verify that the patch has been installed correctly on all the nodes. Set your current directory to where the patch is located. Issue command `opatch lsinventory` to check that the Oracle inventory has been set up properly on all the nodes.
3. Create the ASM instance on one node. Create disk groups and specify the raw logical volumes configured to be members of the disk groups on that node.
4. Create the ASM instance on the other nodes and specify the ASM_DISKSTRING on each node. There is no need to create the disk groups on these nodes.

   ASM_DISKSTRING is an initialization parameter that specifies a comma-separated list of strings that limits the set of disks that ASM discovers.

Creating an Oracle database on an ASM disk group in a Serviceguard environment.

1. Install the Oracle binaries on local storage in ORACLE_HOME on all the nodes configured in the cluster.
2. Create the database instance on one node. Specify the storage type as Automatic Storage Management and provide the disk groups that the database instance is going to use.
3. Configure a listener (if required).
4. Since the Oracle binaries are installed on local storage on all the nodes, copy the parameter file or server parameter file of the database instance to all the nodes. Also, distribute the listener.ora file which is the listener configuration file from $ORACLE_HOME/network/admin, if a listener is configured.
5. Copy the directories from $ORACLE_BASE/admin to all the nodes. Halt the database instance and listener and ASM instance, (if configured) on all the nodes.

NOTE: If the Oracle database is running in a cluster where SGeRAC packages are also running, then the Oracle database must be disabled from being started automatically by the Oracle Clusterware. This can be done by following the below steps:

Log in as the Oracle administrator and run the following command to set the database management policy to manual:

```
For Oracle 10g:
          : $ORACLE_HOME/bin/srvctl modify database -d <dbname> –y manual
For Oracle 11g:
          : $ORACLE_HOME/bin/srvctl modify database -d <dbname> –y MANUAL
```

Setting Up the Toolkit

The internal structure of the Oracle Toolkit Scripts is the same for ASM Support as well. See to "Support For Oracle Database without ASM" (page 9) for information about the various Oracle toolkit scripts.

There are new variables introduced for ASM support, namely, *INSTANCE_TYPE, ASM, ASM_HOME, ASM_USER, ASM_SID, ASM_DISKGROUP, ASM_VOLUME_GROUP* ,and *KILL_ASM_FOREGROUNDS*. The following variables contained in `haoracle.conf` will help understanding these parameters better:

Table 6 Variables or Parameters in haoracle.conf file

Parameter Name	Description
ORA_CRS_HOME	This parameter must be set only in case where Oracle database packages created using ECMT Oracle toolkit and SGeRAC packages run in the same cluster. This parameter must be set to the Oracle Clusterware home directory. This parameter can be set only using the CLI and cannot be set using the Serviceguard Manager.
INSTANCE_TYPE	This parameter determines whether the instance is an ASM instance or a database instance. This can be set either to "database" or "ASM" only. This parameter must be set accordingly for both the database and ASM instance packages.
ORACLE_HOME	The home directory of Oracle. This parameter must be set only for the database instance package.
ORACLE_ADMIN	User name of the Oracle database administrator. Will be used for starting and stopping of the database. This parameter must be set only for the database instance package.
SID_NAME	The Oracle session name. This is called the session ID (SID). This parameter must be set only for the database instance package. This parameter is set to "Oracle" by default.
ASM	This option determines whether Automatic Storage Management (ASM) must be used to manage the storage for the database instance. This parameter can be set to either "yes" or "no". Set it to "yes" if an ASM database is being used. In all other cases, set it to no. By default, this parameter is set to no.

Table 6 Variables or Parameters in haoracle.conf file *(continued)*

Parameter Name	Description
ASM_DISKGROUP	This parameter gives the list of all ASM disk groups used by the database instance. This parameter must be set only for the ASM database instance package. **NOTE:** For ASM instance package, no value must be set for this parameter.
ASM_VOLUME_GROUP	This parameter gives the list of volume groups used in the disk groups for the ASM database instance. This parameter must be set only for the ASM database instance package. **NOTE:** For ASM instance package, no value must be set for this parameter.
ASM_HOME	The home directory where ASM is installed. This parameter must be set for both the ASM and the ASM database instance packages.
ASM_USER	The user name of the Oracle ASM administrator. This parameter must be set for both ASM instance and ASM database instance packages.
ASM_SID	The ASM session name. This uniquely identifies an ASM instance. If the database instance package depends on the ASM MNP package, then this parameter needs to be set for both the ASM and the database instance packages. This parameter need not be set in case the database instance package depends on the SGeRAC clusterware package (OC MNP). This parameter is set to "+ASM" by default.
PFILE	Oracle database /ASM parameter file. If not specified, Oracle picks this up from the Oracle configuration directory $ORACLE_HOME/dbs or $ASM_HOME/dbs depending on the INSTANCE_TYPE.
SPFILE	This parameter, when configured, overrides the default file or location. If both PFILE and SPFILE are present and this parameter is not specified, then the Oracle scripts will make use of PFILE as the parameter file. To make use of SPFILE in the scripts, do not configure this parameter and remove the default PFILE from its default location. This parameter must be set for both the ASM and the database instance packages. **NOTE:** For Oracle 11gR2, by default, the spfile of the ASM instance is stored on the ASM diskgroup. This is true only for the ASM instance and not for the database instance that uses the ASM diskgroup.For an ASM instance, the ECM Toolkit cannot verify the existence of the spfile on the ASM diskgroup. So, it is mandatory that a pfile is created from the spfile on the local disk, at a location that ECMT can access. For 11gR2 ASM instance, the value of the PFILE attribute must point to the pfile that is created on the local disk.
LISTENER	Set to "yes" if you want the scripts to start and stop the Oracle Listener. This parameter must be set only in the database instance package.
LISTENER_NAME	The name of the listener process. This parameter must be set only in the database instance package.
LISTENER_PASS	The password of the listener process. This parameter must be set only in the database instance package.
MONITOR_PROCESSES	The names of all processes that should be executing. This parameter must be set for the ASM and the database instance packages. The description of this attribute in the package configuration file has a sample of processes that must be monitored for ASM and database instances.

Table 6 Variables or Parameters in haoracle.conf file *(continued)*

Parameter Name	Description
MAINTENANCE_FLAG	This variable will enable or disable toolkit maintenance mode for the Oracle database package and ASM MNP. By default, this is set to "yes". To disable this feature, MAINTENANCE_FLAG must be set to "no". When Oracle Database or ASM must be maintained, then a file "<package directory >/Oracle.debug" must be created. During this maintenance period, the Database or ASM instance's process monitoring is paused. Even if the instance is brought down, its package will not be failed over to the standby node. To continue monitoring and to exit from the maintenance mode, you must remove the Oracle.debug file. It is user's responsibility to ensure that the instance is properly running after the maintenance phase. This parameter can be set in the ASM and database instance package. **NOTE:** If the Oracle database package is dependent on the SGeRAC clusterware multi-node package (OC MNP), then the Oracle database package will automatically go into toolkit maintenance mode if the SGeRAC OC MNP is put into toolkit maintenance mode. To put the SGeRAC OC MNP into toolkit maintenance mode, its MAINTENANCE_FLAG attribute must be set to 'yes' and a file oc.debug must be created manually in the OC MNP working directory on that node. More details about how to put the SGeRAC OC MNP package in toolkit maintenance mode can be found in the SGeRAC toolkit README file. If the MAINTENANCE_FLAG attribute of the SGeRAC OC MNP is set to 'yes', then this parameter must also be set to 'yes' in the Oracle database package.
MONITOR_INTERVAL	The time interval (in seconds) the script waits between checks to ensure that the Oracle instance is running. Default is 30 seconds. This parameter must be set in the ASM and database instance packages.
TIME_OUT	The amount of time, in seconds, the script waits during package halt for the Oracle database shutdown to complete before removing the Oracle processes defined in MONITOR_PROCESSES. The TIME_OUT variable is used to protect against a worst-case scenario where a hung instance prevents the package halt script from completing, therefore preventing the standby node from starting the instance. This parameter must be set for the ASM and database instance packages.
PARENT_ENVIRONMENT	This is used to mention if the Oracle or ASM administrator's shell should be invoked as a new shell or as a sub-shell that inherits the variables set in the parent shell. This can be set to either 'yes' or 'no' only. Set to 'yes' if the Oracle or ASM administrator's shell should be invoked as a sub-shell. Set to 'no' if the Oracle or ASM administrator's shell should be invoked as a new shell. If set to 'no', the Oracle or ASM administrator's .profile file is executed and the variables set in this .profile file are available to the new shell. This parameter can be set in the ASM and database instance package.
CLEANUP_BEFORE_STARTUP	This parameter indicates whether 'shutdown abort' must be executed before the startup of the Oracle or ASM instance. 'shutdown abort' ensures the cleanup of uncleared shared memory or semaphores. This parameter can be set to only yes or no. Default value is no. This parameter can be set in the ASM and database instance package.
USER_SHUTDOWN_MODE	This parameter is used to specify the instance shutdown mode only when a shutdown is initiated by the user and not due to a failure of a service. this parameter can take values "abort" or "immediate" only. If "abort" is specified, the instance is shutdown using the abort option. If "immediate" is specified, the instance is shutdown using the immediate option. The default value is "abort". This parameter can be set in the ASM and database instance package.

Table 6 Variables or Parameters in haoracle.conf file *(continued)*

Parameter Name	Description
KILL_ASM_FOREGROUNDS	When ASM is being used, this parameter is used to specify if the ASM foreground processes of the form Oracle <ASM_SID> having file descriptors open on the dismounted disk group volumes should be killed during database package halt. The Oracle scripts will wait for a timeout of 12 seconds before terminating the foreground processes that continue to have file descriptors open on the dismounted disk group volumes. This parameter can be set to either "yes" or "no". The default value is 'yes'. This parameter must be set only in the case of an ASM database instance package.
OC_TKIT_DIR	This parameter should be populated only in case the Oracle database package is dependent on the SGeRAC OC MNP package. This parameter should point to the working directory of the SGeRAC OC MNP. In case of modular packages, the value for this parameter is automatically populated when the package is created using the cmapplyconf command. In case of legacy packages, this attribute must be populated manually in the haoracle.conf file. This parameter can be set only using the CLI and cannot be set using the Serviceguard Manager.

ASM Package Configuration Example

Oracle Legacy Package Configuration Example

1. ASM Multi-Node Package Setup and Configuration

NOTE: This package must not be created if SGeRAC packages are created in the same cluster.

Create your own ASM package directory under /etc/cmcluster and copy over the scripts in the bundle.

Log in as root:

mkdir /etc/cmcluster/asm_package_mnp

cd /etc/cmcluster/asm_package_mnp

Then copy the framework scripts provided to this location : cp /opt/cmcluster/toolkit/Oracle/* .

Edit the configuration file haoracle.conf for the ASM MNP to fit your specific Oracle environment as indicated by the comments in that script. You will have to set the variables as shown in the example below:

```
INSTANCE_TYPE=ASM
ASM_HOME=/ASM_TEST0
ASM_USER=Oracle
ASM_SID=+ASM
PFILE=${ASM_HOME}/dbs/init${ASM_SID}.ora
LISTENER=no (Change from default value "yes" to "no")
MONITOR_PROCESSES[0]=asm_pmon_${ASM_SID}
MONITOR_PROCESSES[1]=asm_dbw0_${ASM_SID}
MONITOR_PROCESSES[2]=asm_ckpt_${ASM_SID}
MONITOR_PROCESSES[3]=asm_smon_${ASM_SID}
MONITOR_PROCESSES[4]=asm_lgwr_${ASM_SID}
MONITOR_PROCESSES[5]=asm_rbal_${ASM_SID}
MONITOR_PROCESSES[6]=asm_gmon_${ASM_SID}
MAINTENANCE_FLAG=yes
MONITOR_INTERVAL=30
TIME_OUT=30
PARENT_ENVIRONMENT=yes
CLEANUP_BEFORE_STARTUP=no
USER_SHUTDOWN_MODE=abort
```

Generate the ASM MNP package configuration file, control script and edit the parameters in these files for the ASM MNP in the package directory.

```
#  cmmakepkg -p asmpkg.conf
#  cmmakepkg -s asmpkg.cntl
```

In the package configuration file asmpkg.conf, edit the following parameters:

```
PACKAGE_NAME - Set to any name desired.
PACKAGE_TYPE - Set to MULTI_NODE.
FAILOVER_POLICY, FAILBACK_POLICY - Should be commented out.
RUN_SCRIPT  /etc/cmcluster/asm_package_mnp/asmpkg.cntl
HALT_SCRIPT /etc/cmcluster/asm_package_mnp/asmpkg.cntl
SERVICE_NAME                    ORACLE_ASM_SRV
SERVICE_FAIL_FAST_ENABLED       NO
SERVICE_HALT_TIMEOUT            300
```

In the package control script asmpkg.cntl, edit the following parameters:

Configure the package service:

```
SERVICE_NAME[0]="ORACLE_ASM_SRV"
SERVICE_CMD[0]="/etc/cmcluster/asm_package_mnp/toolkit.sh monitor"
SERVICE_RESTART[0]="-r 2"
```

Add in the customer_defined_run_cmds function:

```
/etc/cmcluster/asm_package_mnp/toolkit.sh start
```

Add in the customer_defined_halt_cmds function:

```
if [ $SG_HALT_REASON = "user_halt" ]; then
            reason="user"
       else
            reason="auto"
       fi
       /etc/cmcluster/asm_package_mnp/toolkit.sh stop $reason
```

Here, "user" indicates that the package halt is a user initiated halt and "auto" indicates that the package is being failed over automatically due to package dependencies, failure of a service, or due to dependent package failures.

Distribute the package configuration file, package control script, and the framework scripts to all nodes, and then apply the package configuration.

cmapplyconf -P asmpkg.conf

Run the ASM package.

cmrunpkg asmpkg_name

Check the package status using `cmviewcl`. Verify that the ASM instance is running on all the nodes.

2. Database Failover Package Setup and Configuration

Create your own database package directory under /etc/cmcluster and copy over the files shipped in the bundle.

Log in as root:

```
#  mkdir /etc/cmcluster/db1_package
#  cd /etc/cmcluster/db1_package
```

Copy the framework scripts provided to this location:

cp /opt/cmcluster/toolkit/Oracle/* .

Edit the configuration file haoracle.conf for the database failover package to fit your Oracle environment. Set the following parameters in the configuration file:

ORA_CRS_HOME=/app/Oracle/crs # . This attribute is needed only when this toolkit is used in an SGeRAC cluster.

```
INSTANCE_TYPE=database
ORACLE_HOME=/ORACLE_TEST0
ORACLE_ADMIN=Oracle
SID_NAME=ORACLE_TEST0
ASM=yes
ASM_DISKGROUP[0]=asm_dg1
ASM_DISKGROUP[1]=asm_dg2
ASM_VOLUME_GROUP[0]=vgora_asm1
ASM_VOLUME_GROUP[1]=vgora_asm2
ASM_HOME=/ASM_TEST0
ASM_USER=Oracle
ASM_SID=+ASM
LISTENER=yes
LISTENER_NAME=LSNR_TEST0
LISTENER_PASS=
PFILE=${ORACLE_HOME}/dbs/init${SID_NAME}.ora
MONITOR_PROCESSES[0]=ora_pmon_${SID_NAME}
MONITOR_PROCESSES[1]=ora_dbw0_${SID_NAME}
MONITOR_PROCESSES[2]=ora_ckpt_${SID_NAME}
MONITOR_PROCESSES[3]=ora_smon_${SID_NAME}
MONITOR_PROCESSES[4]=ora_lgwr_${SID_NAME}
MONITOR_PROCESSES[5]=ora_reco_${SID_NAME}
MONITOR_PROCESSES[6]=ora_rbal_${SID_NAME}
MONITOR_PROCESSES[7]=ora_asmb_${SID_NAME}
MAINTENANCE_FLAG=yes
MONITOR_INTERVAL=30
TIME_OUT=30
KILL_ASM_FOREGROUNDS=yes
PARENT_ENVIRONMENT=yes
CLEANUP_BEFORE_STARTUP=no
USER_SHUTDOWN_MODE=abort
```

OC_TKIT_DIR=/etc/cmcluster/crs # This attribute is needed only when this toolkit is used in an SGeRAC cluster.

Generate the database package configuration file and the control script in the database package directory. Then edit the parameters of these files as mentioned for the database package.

cmmakepkg -p db1pkg.conf

cmmakepkg -s db1pkg.cntl

Edit the package configuration file db1pkg.conf as shown below:

PACKAGE_NAME - Set to any name desired.

PACKAGE_TYPE - Set to FAILOVER.

```
RUN_SCRIPT /etc/cmcluster/db1_package/db1pkg.cntl
HALT_SCRIPT /etc/cmcluster/db1_package/db1pkg.cntl
DEPENDENCY_NAME asm_dependency
DEPENDENDY_CONDITION <ASM MNP PACKAGE_NAME>=UP
DEPENDENCY_LOCATION SAME_NODE
```

If SGeRAC packages are configured in the same cluster, then the ASM MNP package should not be created and the Oracle database package should depend on the SGeRAC Clusterware package instead of the ASM MNP. In this case, use the definition below instead of the one above this paragraph:

```
DEPENDENCY_NAME asm_dependency
DEPENDENDY_CONDITION <SGeRAC OC MNP PACKAGE_NAME>=UP
DEPENDENCY_LOCATION SAME_NODE
```

Configure the service parameters:

```
SERVICE_NAME ORACLE_DB1_SRV
SERVICE_FAIL_FAST_ENABLED NO
SERVICE_HALT_TIMEOUT 300
```

If listener is configured and needs to be monitored, configure another set of service parameters:

```
SERVICE_NAME ORACLE_LSNR_SRV
SERVICE_FAIL_FAST_ENABLED NO
SERVICE_HALT_TIMEOUT 300
```

Edit the package control script `db1pkg.cntl` as shown below:

Since LVM logical volumes are used in disk groups, Set VGCHANGE to "vgchange -a e" and specify the name(s) of the volume groups in VG[0], VG[1].

Configure the package service:

```
 SERVICE_NAME[0]="ORACLE_DB1_SRV"
 SERVICE_CMD[0]="/etc/cmcluster/db1_package/toolkit.sh monitor"
 SERVICE_RESTART[0]="-r 2"
```

If a listener service is configured in the package configuration file, set the following parameters:

```
 SERVICE_NAME[1]="ORACLE_LSNR_SRV"
 SERVICE_CMD[1]="/etc/cmcluster/db1_package/toolkit.sh monitor_listener"
 SERVICE_RESTART[1]="-r 2"
```

Configure the Package IP and the SUBNET.

Add in the customer_defined_run_cmds function:

/etc/cmcluster/db1_package/toolkit.sh start

Add in the customer_defined_halt_cmds function:

```
if [ $SG_HALT_REASON = "user_halt" ]; then
 reason="user"

 else
 reason="auto"
 fi
 /etc/cmcluster/db1_package/toolkit.sh stop $reason
```

"user" indicates that the package halt is a user initiated halt and "auto" indicates that the package is being failed over automatically due to package dependencies, failure of a service or due to dependent package failures.

Distribute the package configuration file, package control script and the framework scripts to all nodes, and then apply the package configuration:

cmapplyconf -P db1pkg.conf

Run the database package:

cmrunpkg dbpkg_name

Check the package status using `cmviewcl`. Verify that the database instance is running.

Repeat the above steps for each database instance:

Oracle Modular Package Configuration Example

Install and Configuration directory operations:

With modular packages, there are two modes of operation available. By default, the toolkit scripts that were previously used in legacy packages will be installed in the `/opt/cmcluster/toolkit/Oracle` directory. This directory is called the Installation directory. The user can copy these scripts to a configuration directory and define this location in the parameter

"TKIT_DIR" in the modular package configuration file. Serviceguard uses the toolkit scripts in the configuration directory by default. If the scripts are not found in the configuration directory, Serviceguard takes them from the installation directory.

This feature is useful for customers wanting to use modified versions of the toolkit.

1. **ASM Multi-Node Package Setup and Configuration**

NOTE: This package must not be created if SGeRAC packages are created in the same cluster.

Create the modular package configuration file `asmpkg.conf` in any location, (for example, `/etc/cmcluster/asm_package_mnp`). This includes all the toolkit attributes which need to be configured later by the user.

cmmakepkg -m ecmt/Oracle/Oracle `asmpkg.conf`

Configure the Serviceguard parameters as mentioned below:

package_name - Set to any name desired.

package_type - Set to "multi_node".

Edit the service parameters if necessary. The service parameters are preset to:

```
service_name Oracle_service
service_cmd "$SGCONF/scripts/ecmt/Oracle/tkit_module.sh Oracle_monitor"
service_restart none
service_fail_fast_enabled no
service_halt_timeout 300
service_name Oracle_listener_service
service_cmd "$SGCONF/scripts/ecmt/Oracle/tkit_module.sh Oracle_monitor_listener"
service_restart none
service_fail_fast_enabled no
service_halt_timeout 300
```

Uncomment the second set of service parameters in the package configuration file which are used to monitor the listener.

Configure the toolkit parameter *`TKIT_DIR`*. This parameter is synonymous to the legacy package directory (for example, `/etc/cmcluster/asm_package_mnp`). On a `cmapplyconf`, *`TKIT_DIR`* will contain the toolkit configuration file `haoracle.conf` on all configured nodes.

Configure the other toolkit parameters for the ASM package.

Apply the package configuration using:

cmapplyconf -P asmpkg.conf

This command applies the package configuration to the Serviceguard Configuration Database (CDB). It also creates a toolkit configuration directory defined by *`TKIT_DIR`* on all target nodes, if not already present and then creates the toolkit configuration file in it with the values specified in the `asmpkg.conf` file.

2. Database Failover Package Setup and Configuration

Create the modular package configuration file `db1pkg.conf` by including the toolkit attributes that need to be configured later.

cmmakepkg -m ecmt/Oracle/Oracle db1pkg.conf

Configure the following Serviceguard parameters:

```
package_name - Set to any name desired.
package_type - Set to "failover".
```

Edit the service parameters if necessary. The service parameters are preset to:

```
service_name Oracle_service
service_cmd "$SGCONF/scripts/ecmt/Oracle/tkit_module.sh Oracle_monitor"
```

```
service_restart none
service_fail_fast_enabled no
service_halt_timeout 300
service_name Oracle_listener_service
service_cmd "$SGCONF/scripts/ecmt/Oracle/tkit_module.sh Oracle_monitor_listener"
service_restart none
service_fail_fast_enabled no
service_halt_timeout 300
```

If the listener is not configured, comment the second set of service parameters which are used to monitor the listener.

Edit the dependency parameters as shown:

```
dependency_name asm_dependency
dependency_condition <ASM MNP package_name>=up
dependency_location same_node
```

If SGeRAC packages are configured in the same cluster, then the ASM MNP package should not be created and the Oracle database package should depend on the SGeRAC Clusterware package instead of the ASM MNP. In this case, use the definition below instead of the one above this paragraph:

```
DEPENDENCY_NAME asm_dependency
DEPENDENDY_CONDITION <SGeRAC OC MNP PACKAGE_NAME>=UP
DEPENDENCY_LOCATION SAME_NODE
```

Since LVM logical volumes are used in disk groups, specify the name(s) of the volume groups on which the ASM diskgroups reside on, for the attribute "vg".

Configure the ip_subnet and ip_address parameters.

Configure the toolkit parameter *TKIT_DIR*. This parameter is synonymous to the legacy package directory (for example, /etc/cmcluster/dg1_package). On a `cmapplyconf`, *TKIT_DIR* will contain the toolkit configuration file `haoracle.conf` on all configured nodes. Note that the *TKIT_DIR* for this package should be different from the *TKIT_DIR* configured for the ASM MNP.

Configure the other toolkit parameters for the database package as mentioned in "Support For Oracle Database without ASM" (page 9) for the database failover legacy package.

Apply the package configuration using:

cmapplyconf -P db1pkg.conf

This command "applies" the package configuration to the CDB (Serviceguard Configuration Database). It also creates toolkit configuration directory defined by TKIT_DIR on all target nodes, if not already present and then creates the toolkit configuration file in it with the values specified in the `db1pkg.conf` file.

For more information on modular packages, see whitepaper *Modular package support in Serviceguard for Linux and ECM Toolkits* available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard Enterprise Cluster Master Toolkit*.

Also refer the whitepaper *Migrating Packages from Legacy to Modular Style, October 2007* for more information. You can find this whitepaper at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard Enterprise Cluster Master Toolkit*

3. **To configure a ECMT modular failover package for an Oracle database using ASM in a Serviceguard cluster where SGeRAC packages are also running.**

NOTE: When configuring a Oracle package in a SGeRAC cluster, command line interface should be used to create the package and the Serviceguard Manager interface should not be used.

a. Disable the Oracle database instance from being managed automatically by the Oracle Clusterware.

Log in as the Oracle administrator and run the following command to set the database management policy to manual:

For Oracle 10g:

$ORACLE_HOME/bin/srvctl modify database -d <dbname> -y manual

For Oracle 11g:

$ORACLE_HOME/bin/srvctl modify database -d <dbname> -y MANUAL

b. Log in as root and create the database package directory:

mkdir /etc/cmcluster/db1_package

c. Create the modular package configuration file `db1pkg.conf` by including the toolkit attributes that need to be configured later by the user.

cmmakepkg -m ecmt/Oracle/Oracle db1pkg.conf

Edit the package configuration file pkg.conf and configure the Serviceguard parameters as mentioned below:

package_name - Set to any name desired.

package_type - Set to "failover".

Edit the service parameters if necessary. The service parameters are preset to:

```
service_name  Oracle_service
service_cmd "$SGCONF/scripts/ecmt/Oracle/tkit_module.sh Oracle_monitor"
service_restart none
service_fail_fast_enabled no
service_halt_timeout 300
service_name Oracle_listener_service
service_cmd "$SGCONF/scripts/ecmt/Oracle/tkit_module.sh Oracle_monitor_listener"
service_restart none
service_fail_fast_enabled no
service_halt_timeout 300
```

If the listener is configured, uncomment the second set of service parameters which are used to monitor the listener.

Edit the dependency parameters as shown:

dependency_name oc_dependency

dependency_condition <SGeRAC OC MNP Package name>=up

dependency_location same_node

If the Oracle database is created on LVM logical volumes, specify the name(s) of the volume groups for the parameter "vg".

Configure the ip_subnet and ip_address parameters.

d. Configure the toolkit parameter *`TKIT_DIR`*. This parameter is synonymous to the legacy package directory. On a `cmapplyconf`, *`TKIT_DIR`* will contain the toolkit configuration file `haoracle.conf` on all configured nodes. For example, `TKIT_DIR /etc/cmcluster/db1_package`.

Configure the other toolkit parameters for the database package for the database failover legacy package.

e. Configure the ASM Disk Group using the following attributes:

1) Set attribute ASM to yes.

   ASM = yes

2) Specify all the ASM Disk Groups used by the database using the ASM_DISKGROUP attribute.

```
ASM_DISKGROUP[0]=asm_dg1
ASM_DISKGROUP[1]=asm_dg2
```

3) Specify all the LVM Volume Groups used by the ASM Disk Groups using the ASM_VOLUME_GROUP attribute.

```
ASM_VOLUME_GROUP[0]=vgora_asm1
ASM_VOLUME_GROUP[1]=vgora_asm2
```

4) For the ASM_HOME attribute, specify the ASM Home directory. In case of Oracle 11g R2 this is same as Oracle clusterware home directory.

   ASM_HOME=/ASM_TEST0

5) For the ASM_USER attribute, specify the UNIX user account for administering ASM Instances

   ASM_USER=Oracle

6) For the ASM_SID attribute, specify "+ASM". ECMT will automatically discover the ASM SID on a node.

   ASM_SID=+ASM

7) Apply the package configuration.

   # cmapplyconf -P db1pkg.conf

   This command applies the package configuration to the cluster It also creates the toolkit configuration directory defined by the package attribute TKIT_DIR on all target nodes, if it is not already present, and then creates the toolkit configuration file in it with the values specified in the `db1pkg.conf` file.

8) Open the `haoracle.conf` file generated in the package directory (`TKIT_DIR`) . Ensure the attribute ORA_CRS_HOME is set to the Oracle Clusterware Home directory and the attribute OC_TKIT_DIR is set to the SGeRAC OC MNP package directory.

9) For a running database package, if the value of any of the package attributes need to be modified, then the package needs to be restarted. The given below steps should be followed to update the attribute values of a running database packages :

   a) Edit the package configuration file and populate the new values.
   b) Halt the package
   c) Apply the package configuration file.
   d) Start the package

Modifying a legacy database package using an older version of Oracle ECMT scripts to use the scripts provided for ASM support

A customer can migrate from an older ECMT version database package to use the Oracle ECMT scripts provided for ASM support. The new legacy or modular database package may or may not use ASM.

1. Migration to a legacy database package not using ASM:
   - Halt the database package.
   - Copy the framework scripts provided in the bundle to the package directory on one node.

- Edit the configuration file haoracle.conf in the package directory. Leave the INSTANCE_TYPE to the default value "database". Configure values for all parameters that were present in the older toolkit configuration file, that is, *ORACLE_HOME, ORACLE_ADMIN, SID_NAME, LISTENER, LISTENER_NAME, LISTENER_PASSWORD, PFILE, MONITORED_PROCESSES, MAINTENANCE_FLAG, MONITOR_INTERVAL, TIME_OUT*. Leave the value of ASM to the default value "no". The new parameters can be left as they are by default.
- Copy all the scripts from the package directory from this node to all the configured nodes.
- Start the database package. There is no need to re-apply the package configuration since no changes are being made to the package ASCII file.

2. Migration to a legacy database package using ASM:
   - Halt the database package.
   - Configure ASM on all the configured nodes as mentioned in this document. Create ASM disk groups, configure the raw logical volumes and make the database instance use the ASM storage. Steps to migrate a database to ASM can be found in Oracle manuals.
   - Configure an ASM MNP as mentioned in this document.
   - Apply the ASM MNP configuration.
   - Run the ASM MNP.
   - Copy the framework scripts provided in the bundle to the database instance package directory.
   - Configure the configuration file haoracle.conf file as mentioned in this document for the database package.
   - Create a new package ASCII file and control script or edit the existing package ASCII and control scripts in the database package directory. Configure the parameters as mentioned for the database package.
   - Copy the scripts from the package directory to all the configured nodes.
   - Remove the older database package configuration if a new package for the database instance is being configured.
   - Apply the database package configuration.
   - Run the database package.
3. Migration to a modular database package not using ASM:
   - Halt the database package.
   - In case of configuration directory mode of operation to be used, copy the new Oracle scripts to another package directory.
   - Migrate the older legacy package to a modular package containing Serviceguard parameters.

     # cmmigratepkg -p <legacy_pkg_name> -s -o <modular_pkg_name>

     Refer to the Whitepaper "Migrating Packages from Legacy to Modular Style, October 2007" and also the Whitepaper *Modular package support in Serviceguard for Linux and ECM Toolkits* available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard Enterprise Cluster Master Toolkit*
   - To add the values to this modular package configuration file, from the older toolkit configuration file, issue the following command:

     # cmmakepkg -i modular.ascii -m ecmt/Oracle/Oracle -t <older toolkit configuration file> modular1.ascii

"modular1.ascii" now has values for certain attributes that were present in the older toolkit configuration file. Edit the value for `TKIT_DIR` (where the new toolkit configuration file should be generated or where the toolkit scripts are copied to in case of a configuration directory mode of operation). Leave the INSTANCE_TYPE to the default value database. Leave the value of ASM to the default value “no". The new toolkit parameters can be left as they are by default.

- Apply the new modular package configuration using `cmapplyconf`.
- Start the database package.

4. Migration to a modular database package using ASM:
   - Halt the database package.
   - Configure ASM on all configured nodes as mentioned in this document. Create ASM disk groups, configure the raw logical volumes and make the database instance use the ASM storage. Steps to migrate a database to ASM can be found in Oracle manuals.
   - Configure a modular ASM MNP as mentioned in this document.
   - Apply the ASM MNP configuration.
   - Run the ASM MNP.
   - For the database package, in case of configuration directory mode of operation to be used, copy the new Oracle scripts to another package directory.
   - Migrate the older legacy package to a modular package containing Serviceguard parameters.

     # cmmigratepkg -p <legacy_pkg_name> -s -o <modular_pkg_name>

     Refer to the Whitepaper *Migrating Packages from Legacy to Modular Style,October 2007* and also the Whitepaper on modular package support in Serviceguard at http://www.hp.com/go/hpux-serviceguard-docs -> *HP Enterprise Cluster Master Toolkit*
   - To add the values to this modular package configuration file, from the older toolkit configuration file, issue the following command:

     # cmmakepkg -i modular.ascii -m ecmt/Oracle/Oracle -t <older toolkit configuration file> modular1.ascii
   - "modular1.ascii" now has values for certain attributes which were present in the older toolkit configuration file. Parameters like *`ORACLE_HOME, ORACLE_ADMIN, SID_NAME, PFILE, LISTENER, LISTENER_NAME, LISTENER_PASS, MONITOR_PROCESSES, MAINTENANCE_FLAG, MONITOR_INTERVAL`* , and *`TIME_OUT`* will have values from the old toolkit configuration file. They can be edited if needed for the new environment. Edit the value for `TKIT_DIR` (where the new toolkit configuration file should be generated or where the toolkit scripts are copied to in case of a configuration directory mode of operation). Leave the INSTANCE_TYPE to the default value "database". Edit the parameters *`ASM, ASM_DISKGROUP, ASM_VOLUME_GROUP, ASM_HOME, ASM_USER, ASM_SID, KILL_ASM_FOREGROUNDS, CLEANUP_BEFORE_STARTUP, and USER_SHUTDOWN_MODE`* as mentioned for the database package.
   - Apply the new modular package configuration using `cmapplyconf`.
   - Start the database package.

Adding the Package to the Cluster

After the setup is complete, add the package to the Serviceguard cluster and start it.

```
$ cmapplyconf -P ORACLE_TEST0
```

```
$ cmmodpkg -e -n <node1> -n <node2> ORACLE_TEST0
$ cmmodpkg -e ORACLE_TEST0
```

If necessary, consult the manual *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* for information on managing packages.

Node-specific Configuration

On many clusters, the standby nodes might be lower end systems than the primary node. An SMP machine might be backed up by a uniprocessor, or a machine with a large main memory may be backed up by a node with less memory.

From Oracle's point of view, we must make sure that any packaged instance can run on any specified node in the corresponding package configuration. The Oracle shell script handles this situation in the following way:

If node-specific tuning is required, set up a node-specific 'init.ora' file for each node in ${ORACLE_HOME}/dbs. This file should be named 'init${SID_NAME}.ora', and there should be one such file for each host.

For Example:

```
/ORACLE_TEST0/dbs/initORACLE_TEST0.ora.host1
/ORACLE_TEST0/dbs/initORACLE_TEST0.ora.host2
```

When the Oracle shell script executes the Oracle commands, they will check for the existence of such a file before starting the Oracle database. If no host specific init file exists, a 'global' init${SID_NAME}.ora file is assumed.

NOTE: If using this configuration, the 'PFILE' parameter in the haoracle.conf configuration file should be set to the specific pfile on a given host. For example, the PFILE in haoracle.conf on node1 should be set to /ORACLE_TEST0/dbs/initORACLE_TEST0.ora.node1.

Error Handling

On startup, the Oracle shell script will check for the existence of the init${SID_NAME}.ora or spfile${SID_NAME}.ora file in the shared ${ORACLE_HOME}/dbs directory. If this file does not exist, the database cannot be started on any node until the situation is corrected. The action by the Oracle shell script is to halt the package on that node and try it on the standby node.

Network Configuration

This document does not cover detailed instructions on how to configure the Oracle network products for a Serviceguard cluster. This section contains a few basic suggestions on how to configure a TCP/IP listener for a clustered environment. Consult Oracle documentation for a detailed description on how to set up the networking products.

/etc/hosts

If you want to access your Oracle instance through a 'hostname', you need to add entries for the relocatable IP-addresses to your /etc/hosts file (or nameserver). This will allow you to connect to your database using a logical name with a telnet or rlogin. Thus, /etc/hosts would contain names of services (database servers) in addition to real physical hostnames. From Serviceguard's point of view, these are relocatable hostnames:

EXAMPLE:

Assume a Serviceguard package for the Oracle instance ORACLE_TEST0, is assigned the IP address 192.10.10.1

Add the following entry to your hosts files:

192.10.10.1 ORACLE_TEST0

The 'ORACLE_TEST0' instance should now be reachable using the name 'ORACLE_TEST0' regardless of the node on which it is running.

Listener:

Set up a listener process for each Oracle instance that executes on a Serviceguard cluster, making sure that the listener can move with the instance to another node. Effectively, ensure the listener configured to a specific Oracle instance is assigned to a unique port.

In the current release you can configure ONE listener to be monitored by the toolkit.

However you can configure multiple listeners for the Oracle instance outside the Serviceguard environment to provide more HA to the listener.

NOTE: It is recommended to use encrypted passwords for password protected listeners.

The password specified for a listener in the parameter *PASSWORDS_<listener_name>* in the file LISTENER.ORA, must be copied to the LISTENER_PASS parameter in the `haoracle.conf` file. If there are multiple passwords configured for a single listener, you can use any one of them for the *LISTENER_PASS* parameter in the haoracle.conf.

In particular, for Oracle 10g and 11g, there is a new listener feature called "Local OS Authentication" activated by default, which permits the user who started it to administer the listener without requiring password authentication. To disable this feature, you need to specify "LOCAL_OS_AUTHENTICATION_listener_name = OFF" in LISTENER.ORA. Please note, in this situation, due to a change in Oracle 10g, you will have to specify the plain text password for the *LISTENER_PASS* parameter in `haoracle.conf` (and not the encrypted password found in LISTENER.ORA).

By default Local OS Authentication is enabled for Oracle 10g and 11g with default value of "LOCAL_OS_AUTHENTICATION_listener_name = ON". The absence of this parameter in LISTENER.ORA file implies the feature is enabled. In case if it has been disabled, it can be re-enabled by commenting or removing "LOCAL_OS_AUTHENTICATION_listener_name = OFF" from LISTENER.ORA or by setting it to "LOCAL_OS_AUTHENTICATION_listener_name = ON".

NOTE: Plain text listener passwords cannot contain white spaces (" ") when used with Oracle toolkit.

Database Maintenance

There might be situations, when the Oracle database has to be taken down for maintenance purposes like changing configuration, without having the instance to migrate to standby node. The following procedure should be followed:

NOTE: This feature is enabled only when the package attribute `MAINTENANCE_FLAG` is set to "yes".

The example assumes that the package name is ORACLE_TEST0, package directory is /etc/cmcluster/pkg/ORACLE_TEST0 and the ORACLE_HOME is configured as /ORACLE_TEST0.

- Disable the failover of the package through `cmmodpkg` command:

  $ cmmodpkg -d ORACLE_TEST0

- Pause the monitor script.

  Create an empty file /etc/cmcluster/pkg/ORACLE_TEST0/Oracle.debug as shown below:

  $ touch /etc/cmcluster/pkg/ORACLE_TEST0/Oracle.debug

  Toolkit monitor scripts (both database instance and listener monitoring scripts) which continuously monitor Oracle process daemons' processes and the listener process, would now stop monitoring these daemon processes. Two messages, "Oracle toolkit pausing monitoring and entering maintenance mode" and "Oracle toolkit pausing Listener <Listener_Name>

monitoring and entering maintenance mode" appears in the Serviceguard Package Control script log.

- If required, stop the Oracle database instance as shown below:

```
$ cd /etc/cmcluster/pkg/ORACLE_TEST0/
$ $PWD/toolkit.sh stop
```

- Perform maintenance actions (for example, changing the configuration parameters in the parameter file of the Oracle instance. If this file is changed, please remember to distribute the new file to all cluster nodes).
- Re-start the Oracle database instance again if you manually stopped it prior to maintenance

```
$ cd /etc/cmcluster/pkg/ORACLE_TEST0/
$ $PWD/toolkit.sh start
```

- Allow monitoring scripts to continue normally as shown below:

  $ rm -f /etc/cmcluster/pkg/ORACLE_TEST0/Oracle.debug

  Two messages "Starting Oracle toolkit monitoring again after maintenance" and "Starting Oracle Listener monitoring again after maintenance" appear in the Serviceguard Package Control script log.

- Enable the package failover

  $ cmmodpkg -e ORACLE_TEST0

NOTE: If the package fails during maintenance (example, the node crashes), the package will not automatically fail over to an adoptive node. It is the responsibility of the user to start the package up on an adoptive node. See the manual *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* for more details.

If the Oracle database package is dependent on the SGeRAC OC MNP, then the Oracle database package will automatically go to toolkit maintenance mode when the SGeRAC OC MNP is put into toolkit maintenance mode. To put the SGeRAC OC MNP into toolkit maintenance mode, its `MAINTENANCE_FLAG` attribute must be set to 'yes' and a file 'oc.debug' must exist in its package directory. See the SGeRAC toolkit README file for information details on how to put the SGeRAC OC MNP in toolkit maintenance mode. If the `MAINTENANCE_FLAG` attribute of the SGeRAC OC MNP is set to 'yes', then this parameter must also be set to 'yes'.

Configuring and packaging Oracle single-instance database to co-exist with SGeRAC packages

This section describes the way in which ECMT Oracle toolkit package must be configured for single-instance Oracle databases to work in a Serviceguard cluster, along with RAC database packages configured using SGeRAC Toolkit.

NOTE: The environment in which both ECMT Oracle packages and SGeRAC packages are running together will be referred to as 'coexistence environment' in this document.

Configuring Oracle single-instance database that uses ASM in a Coexistence Environment

single-instance Oracle databases using ASM are supported in SGeRAC/Serviceguard clusters only when ASM Disk Groups are configured using LVM Logical Volumes. In a coexistence environment, the following additional conditions also apply:

1. The Oracle Clusterware must be configured in a MNP package using SGeRAC Toolkit. See the *Using Serviceguard Extension for RAC" User Guide (published March 2011 or later)* available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard Extension for RAC/opt/cmcluster/SGeRAC/toolkit/README file* for configuring Oracle Clusterware (SGeRAC OC MNP package) as a package.
2. The ASM Multi-node package (MNP) must not be created using the ECMT toolkit. The ASM instances will be managed by the SGeRAC Oracle Clusterware package.
3. single-instance databases must be disabled for automatic startup by Oracle Cluster Ready Service (CRS).

The ECMT failover package for single-instance Oracle database must have the following additional configuration:

1. The ASM Disk Groups and underlying LVM volume groups used by the single-instance Oracle database must be configured as part of the database's ECMT failover package.
2. A SAME_NODE UP package dependency on SGeRAC Oracle Clusterware package must be configured in the ECMT failover package for the Oracle single-instance database.
3. The attributes: ORA_CRS_HOME and OC_TKIT_DIR must be specified with appropriate values as specified in section "Attributes newly added to ECMT".

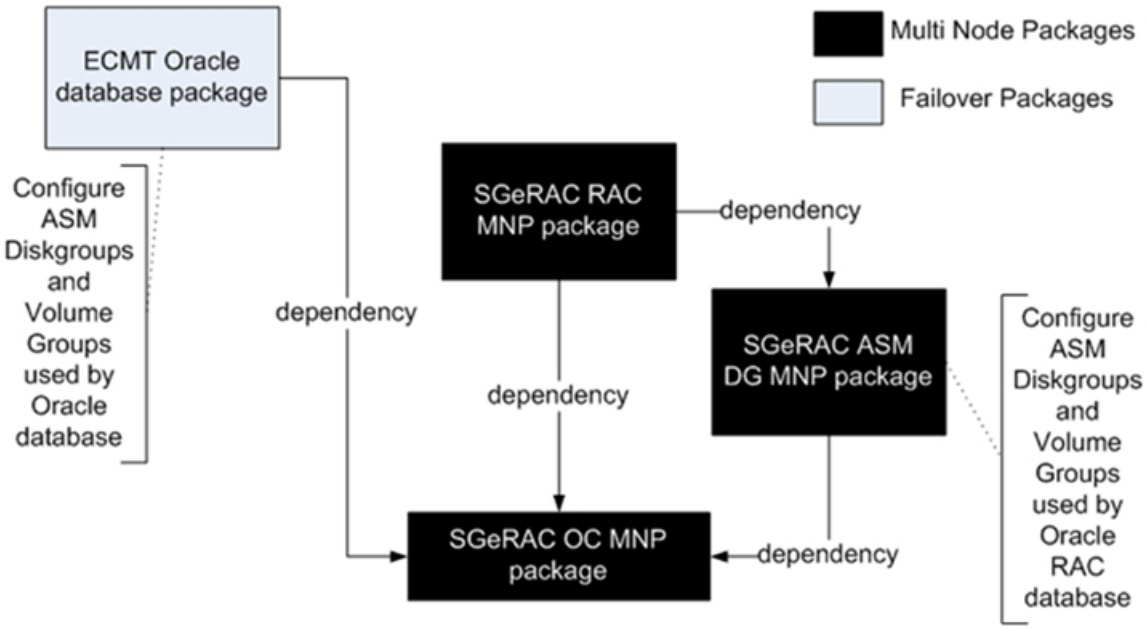
Attributes newly added to ECMT Oracle toolkit

The following attributes are added to ECMT oracle toolkit. These attributes are required to be populated only for coexistence in a SGeRAC cluster. When there are no SGeRAC packages configured in the same cluster, these attributes must be left empty.

1. ORA_CRS_HOME: When using ECMT oracle toolkit in a coexistence environment, this attribute must be set to Oracle CRS HOME.
2. OC_TKIT_DIR: When using ECMT Oracle in a coexistence environment, this attribute must be set to the SGeRAC Toolkit's Oracle Clusterware (OC) package directory.

Figure 7 describes the various package dependencies between the single-instance Oracle database package created using ECMT and the Oracle RAC packages created using SGeRAC.

Figure 7 Packages in a coexistence environment



Configuring a modular failover package for an Oracle database using ASM in a Coexistence Environment

To configure an ECMT modular failover package for an Oracle database:

1. Log in as the Oracle administrator and run the following command to set the database management policy to manual:

   ```
   $ORACLE_HOME/bin/srvctl modify database -d <dbname> -y MANUAL
   ```

2. Create a database package directory under /etc/cmcluster

   Log in as root:

   ```
   # mkdir /etc/cmcluster/db1_package
   ```

3. Create the modular package configuration file "pkg2.conf":

   ```
   #cmmakepkg -m ecmt/oracle/oracle pkg2.conf
   ```

4. Configure the package attributes as mentioned below:

   ```
   package_name - Set to any name desired.
        package_type - Set to "failover".
   ```

   Edit the service parameters if necessary. The service parameters are preset to:

   ```
        service_name                    oracle_service
        service_cmd    "$SGCONF/scripts/ecmt/oracle/tkit_module.sh oracle_monitor"
        service_restart                 none
        service_fail_fast_enabled       no
        service_halt_timeout            300
        service_name                    oracle_listener_service
        service_cmd   "$SGCONF/scripts/ecmt/oracle/tkit_module.sh oracle_monitor_listener"
        service_restart                 none
        service_fail_fast_enabled       no
        service_halt_timeout            300
        service_name                    oracle_hang_service
        service_cmd                     "$SGCONF/scripts/ecmt/oracle/tkit_module.sh oracle_hang_monitor 30
   failover"
        service_restart                 none
        service_fail_fast_enabled                       no
        service_halt_timeout                    300
   ```

   If the listener is configured, uncomment the second set of service parameters which are used to monitor the listener.

   Edit the dependency parameters as shown:

   ```
   dependency_name         oc_dependency
   dependency_condition    <SGeRAC OC MNP Package name>=up
   dependency_location     same_node
   ```

   Since LVM logical volumes are used in disk groups, specify the name(s) of the volume groups on which the ASM diskgroups reside, for the parameter "vg".

   Configure the ip_subnet and ip_address parameters.

5. Configure the toolkit package attribute TKIT_DIR. This parameter is synonymous to the legacy package directory. On a cmapplyconf, TKIT_DIR will contain the toolkit configuration file haoracle.conf on all configured nodes.

   Configure the other toolkit parameters for the database package as mentioned in this README for the database failover legacy package under "Supporting Oracle ASM instance and Oracle database with ASM" (page 26).

6. Configure the ASM Disk Group using the following attributes:

   - Set attribute ASM to yes:

     ASM yes

   - Specify all the ASM Disk Groups used by the database using the ASM_DISKGROUP attribute:

     ASM_DISKGROUP[0] asm_dg1

ASM_DISKGROUP[1] asm_dg2

- Specify all the LVM Volume Groups used by the ASM Disk Groups using the ASM_VOLUME_GROUP attribute:

  ASM_VOLUME_GROUP[0] vgora_asm1

  ASM_VOLUME_GROUP[1] vgora_asm2

- For the ASM_HOME attribute, specify the ASM Home directory. In case of Oracle 11g R2 this is same as CRS Home:

  ASM_HOME /ASM_TEST0

- For the ASM_USER attribute, specify the UNIX user account for administering ASM Instances:

  ASM_USER oracle

- For the ASM_SID attribute, Specify "+ASM" in a coexistence environment, ECMT will automatically discover the ASM SID on a node:

  ASM_SID +ASM

- Apply the package configuration file:

  ```
  # cmapplyconf -P pkg2.conf
  ```

  This command "applies" the package configuration to the CDB (Serviceguard Configuration Database). It also creates toolkit configuration directory defined by TKIT_DIR on all target nodes, if not already present and then creates the toolkit configuration file in it with the values specified in the pkg2.conf file.

- Open the `haoracle.conf` file generated in the package directory (TKIT_DIR).

Configuring a legacy failover package for an Oracle database using ASM in a Coexistence Environment

To configure an ECMT legacy package for an Oracle database:

1. Log in as the Oracle administrator and run the following command to set the database management policy to manual:

   ```
   $ORACLE_HOME/bin/srvctl modify database -d <dbname> -y MANUAL
   ```

2. Create your own database package directory under /etc/cmcluster and copy over the files shipped in the bundle.

   Log in as root:

   ```
   # mkdir /etc/cmcluster/db1_package
   # cd /etc/cmcluster/db1_package
   ```

   Copy the framework scripts provided to this location.

3. Edit the configuration file haoracle.conf for the database failover package to fit your Oracle environment. Set the following parameters in the configuration file:

   ```
   INSTANCE_TYPE=database
   ORACLE_HOME=/ORACLE_TEST0
   ORACLE_ADMIN=oracle
   SID_NAME=ORACLE_TEST0
   ASM=yes
   ASM_DISKGROUP[0]=asm_dg1
   ASM_DISKGROUP[1]=asm_dg2
   ASM_VOLUME_GROUP[0]=vgora_asm1
   ASM_VOLUME_GROUP[1]=vgora_asm2
   ```

```
ASM_HOME=/ASM_TEST0
ASM_USER=oracle
ASM_SID=+ASM
LISTENER=yes
LISTENER_NAME=LSNR_TEST0
LISTENER_PASS=LSNR_TEST0_PASS
PFILE=${ORACLE_HOME}/dbs/init${SID_NAME}.ora
MONITOR_PROCESSES[0]=ora_pmon_${SID_NAME}
MONITOR_PROCESSES[1]=ora_dbw0_${SID_NAME}
MONITOR_PROCESSES[2]=ora_ckpt_${SID_NAME}
MONITOR_PROCESSES[3]=ora_smon_${SID_NAME}
MONITOR_PROCESSES[4]=ora_lgwr_${SID_NAME}
MONITOR_PROCESSES[5]=ora_reco_${SID_NAME}
MONITOR_PROCESSES[6]=ora_rbal_${SID_NAME}
MONITOR_PROCESSES[7]=ora_asmb_${SID_NAME}
MAINTENANCE_FLAG=yes
MONITOR_INTERVAL=30
TIME_OUT=30
KILL_ASM_FOREGROUNDS=yes
PARENT_ENVIRONMENT=yes
CLEANUP_BEFORE_STARTUP=no
USER_SHUTDOWN_MODE=abort
ORA_CRS_HOME=/opt/oracle/crs
OC_TKIT_DIR=/etc/cmcluster/oc
```

4. Generate the database package configuration file and the control script in the database package directory and edit the parameters of these files as mentioned for the database package.

```
# cmmakepkg -p db1pkg.conf
# cmmakepkg -s db1pkg.cntl
```

Edit the package configuration file db1pkg.conf as shown below:

```
PACKAGE_NAME - Set to any name desired.
PACKAGE_TYPE - Set to FAILOVER.
RUN_SCRIPT /etc/cmcluster/db1_package/db1pkg.cntl
HALT_SCRIPT /etc/cmcluster/db1_package/db1pkg.cntl
DEPENDENCY_NAME                 oc_dependency
DEPENDENDY_CONDITION <SGeRAC OC MNP Package>=UP
DEPENDENCY_LOCATION             SAME_NODE
```

Configure the service parameters:

```
SERVICE_NAME                ORACLE_DB1_SRV
SERVICE_FAIL_FAST_ENABLED   NO
SERVICE_HALT_TIMEOUT        300
```

If listener is configured and needs to be monitored, configure another set of service parameters:

```
SERVICE_NAME                  ORACLE_LSNR_SRV
SERVICE_FAIL_FAST_ENABLED     NO
SERVICE_HALT_TIMEOUT          300
```

Edit the package control script db1pkg.cntl as shown below:

Since LVM logical volumes are used in disk groups, set VGCHANGE to "vgchange -a e" and specify the name(s) of the volume groups in VG[0], VG[1].

Configure the package service:

```
SERVICE_NAME[0]="ORACLE_DB1_SRV"
SERVICE_CMD[0]="/etc/cmcluster/db1_package/toolkit.sh monitor"
SERVICE_RESTART[0]="-r 2"
```

If listener service is configured in the package configuration file, set the following parameters:

```
SERVICE_NAME[1]="ORACLE_LSNR_SRV"
SERVICE_CMD[1]="/etc/cmcluster/db1_package/toolkit.sh monitor_listener"
SERVICE_RESTART[1]="-r 2"
```

Configure the Package IP and the SUBNET.

Add in the customer_defined_run_cmds function:

```
/etc/cmcluster/db1_package/toolkit.sh start
```

Add in the customer_defined_halt_cmds function:

```
if [ $SG_HALT_REASON = "user_halt" ]; then
             reason="user"
        else
             reason="auto"
        fi
        /etc/cmcluster/db1_package/toolkit.sh stop $reason
```

"user" indicates that the package halt is a user initiated halt and "auto" indicates that the package is being failed over automatically due to package dependencies, failure of a service or due to dependent package failures.

5. Distribute the package configuration file, package control script, and the framework scripts to all nodes in the cluster on which the package is configured to run, and then apply the package configuration.

   ```
   # cmapplyconf -P db1pkg.conf
   ```

6. Run the database package:

   ```
   # cmrunpkg <dbpkg_name>
   ```

   Check the package status using cmviewcl. Verify that the database instance is running. Repeat these steps for each database instance.

ECMT Oracle Toolkit Maintenance Mode

To put the single-instance ECMT Oracle toolkit package in maintenance mode, the package attribute `MAINTENANCE_FLAG` must be set to 'yes' and a file named 'oracle.debug' must exist in the package directory.

In a coexistence environment, the single-instance database will go into toolkit maintenance mode if any of the following condition is met:

1. If the `MAINTENANCE_FLAG` is set to 'yes' in the ECMT package configuration for single-instance Oracle and if oracle.debug file exists in the package directory.
2. If the SGeRAC OC MNP package is put in toolkit maintenance mode by creating an oc.debug file in the SGeRAC OC MNP package directory.

Supporting EBS database Tier

ECMT Oracle toolkit has been enhanced to support the packaging of EBS DB Tier. High availability for the EBS database tier is achieved using the very same technique that many standalone Oracle database implementations with Serviceguard have used in production for a considerable time.

NOTE: ECMT Oracle Toolkit can be used only to configure the EBS Database Tier and to configure the EBS APPs Tier, user needs to purchase SGeEBS.

Using re-locatable storage devices and a special "floating" IP network address, the database can failover from one physical server to another within the Serviceguard cluster while retaining the same outward appearance to applications.

From a network communications point of view, the Oracle database is not configured to bind to the network address associated with the actual physical server but rather to a specially-reserved

"floating" IP address. This floating IP address is called as package IP in Serviceguard terms. The floating IP address is one that is defined for exclusive use by the database as its networking end point and is normally included in the Domain Name Service so that the database can be located by its applications. The symbolic name that is associated with the floating IP address is the "virtual hostname" and it is this name that will be used as the database's hostname within the EBS topology configuration.

From the EBS APPS Tier point of view, the database failover from one machine to the other does not alter the single network end point at which it connect for service. As there is no change in the networking end point, no special reconfiguration of applications is required to handle the database failover sequence.

Much of the process of setting up the virtual hostname environment for the EBS database tier is automated during the installation process by using the `-servername` flag with the `RapidInstall` EBS Installer command. Details on this command option can be found in the Oracle Applications Release 12 installation guide.

As an example, to install the database tier with the virtual hostname ebs database, the RapidInstall command used to install the database tier needs to be started with the –servername ebsdatabase command line option. This will install the database product components, build the appropriate configuration files and file system directory layout automatically and use the virtual hostname ebsdatabase in place of the actual server hostname on which the install was run.

Oracle ASM Support for EBS DB Tier

Automatic Storage Management (ASM) simplifies administration of Oracle EBS DB Tier related files by allowing administrator to reference disk groups rather than individual disks and files. It provides functionalities like managing disk groups, disk redundancies, and allows management of database objects without specifying mount points and filenames.

Currently Oracle EBS DB Tier Rapid installation allows user to house the database in either shared file system or local file system. Automatic Storage Management is currently not supported using EBS DB Tier Rapid Install.

To support ASM for EBS DB Tier, Migrate from non-ASM storage to ASM storage. The following steps are for migrating EBS DB from Non-ASM storage to ASM storage:

NOTE: While performing the migration procedure, a scheduled downtime is needed for the application.

1. Halt the SGeEBS APPS Tier Packages on all nodes which are currently using DB Tier package whose database storage needs to be migrated.
2. Ensure that approximately 200GB free disk space is needed to create the ASM disk groups for EBS database.
3. Perform the migration procedure as per the Oracle document. "Steps To Migrate/Move a Database From Non-ASM to ASM [ID 252219.1]".

   NOTE: Refer to the latest Oracle document available in Oracle support website.

4. Set up the ASM and EBS DB packages with ASM. For details, see the section "Supporting Oracle ASM instance and Oracle database with ASM" (page 26) in this user guide.

3 Using the Sybase ASE Toolkit in a Serviceguard Cluster on HP-UX

This chapter describes the High Availability Sybase Adaptive Server Enterprise (ASE) Toolkit designed for use in a Serviceguard environment. This document covers the basic steps to configure a Sybase ASE instance in Serviceguard Cluster, and is intended for users who want to integrate a Sybase ASE Server with Serviceguard in HP-UX environments.

It is assumed that its readers are already familiar with the Serviceguard configuration, as well as with Sybase ASE concepts, including installation and configuration procedures.

NOTE: This toolkit supports:

- HP Serviceguard versions
  - A.11.19
  - A.11.20
- Sybase ASE version 15.0.2 or later
- HP-UX 11i v2 and HP-UX 11i v3

Unless otherwise stated, this toolkit runs on all distributions and all hardware supported by Serviceguard.

It is recommended to set appropriate roles for users managing the cluster and packages so that unauthorized users are restricted from viewing sensitive package attribute values like the Sybase administrator password. See section configuring Role Based Access (RBA) for more details.

Overview

The Sybase ASE Toolkit for Serviceguard consists of a shell script that is used to start, stop, and monitor a single-instance of Sybase ASE.

Note that this toolkit supports only modular packages.

NOTE: This toolkit does NOT support the Sybase ASE HA Failover feature.

To use this toolkit, the toolkit script must be integrated with the Serviceguard master control script. Subsequent sections "Setting up the Application" (page 60), "Setting up the Toolkit" (page 62) and "Sybase Package Configuration Example" (page 64)of this document provide guidelines for integration of this toolkit with Serviceguard master control script.

NOTE: It is assumed that the user has already installed Serviceguard, Sybase ASE and the Sybase ASE Toolkit on all the nodes in the cluster.

Sybase Information

Sybase ASE should be accessible from the same location on all nodes in the cluster that will run the package.

The ASE instance can be configured in different ways:

- Shared Config - where all Sybase ASE installed binaries and the database files are on a shared file system on LVM.
- Local Config -where the Sybase ASE instance is installed and configured on single node and the files are replicated on all the other nodes in the cluster. The application datafiles should be on shared file system on LVM.

Local Configuration

If the choice is to store the configuration files on a local disk, the configuration must be replicated to local disks on all nodes configured to run the package. Here the Sybase ASE binaries reside on the local storage. If any change is made to the configuration files, the file must be copied to all nodes. The user is responsible to ensure the systems remain synchronized.

Shared Configuration

This is the recommended configuration. Here, the configuration and database files are kept on shared disks (but the Sybase ASE binaries can be on the local storage). Since the configuration files and data files reside on a shared location, there is no additional work to ensure all nodes have the same configuration at any point in time. Another alternative setup is to put the Sybase ASE binaries too on the shared location along with the configuration and database files.

Sybase supports multiple ASE instances running on the same node simultaneously. This allows the system administrator the ability to move one instance from its own node while leaving another instance up. Each node can potentially run several instances. Each Sybase ASE Package corresponds to a separate Sybase ASE instance with its own ASE_SERVER instance name, unique volume groups, logical volume and file system for storing ASE binaries, configuration files, data files, system databases, log files and so on. This means the configuration information for each instance must be identical for each node that will be configured to run that instance. See *Building an HA Cluster Configuration* in the Serviceguard user manual available at:http://www.hp.com/go/hpux-serviceguard-docs-> *HP Serviceguard* for information on volume group creation and logical volume management.

NOTE: As previously stated, shared configuration can be stored on a local disk. If the choice is to do this, it is the user's responsibility to ensure the data is propagated to all the nodes, and is consistently maintained across the nodes. A disadvantage of storing the configuration on local disks is that this can increase the chance of the configuration for a database instance becoming inconsistent if changes are made to the configuration in one node. This configuration data is not distributed to all nodes that can run that database instance.

It is therefore recommended that the master database and other ASE system database files - like`master.dat` , `sysprocs.dat`and `sybsysdb.dat` be on shared disk.

The user is adviced to get the appropriate license for this type of setup. In case of a license that is server specific, each node will require a license to be generated with the corresponding MAC of that node. In case of local configuration, the license for each node can be separately put on the corresponding node under the $SYBASE/$SYBASE_SYSAM2/licenses directory. In case of a shared configuration, ensure that both nodes can access the corresponding license in the same path.

However, in case of a local configuration, note that the Sybase ASE instance specific files MUST be identical on all nodes; and in a shared configuration, all files must be on shared storage and be accessible from any one node at any given time.)

Setting up the Application

NOTE: This chapter assumes that Sybase ASE has already been installed in /home/Sybase ASE on all nodes in the cluster, and that shared storage has been configured.

1. Make sure all database instances in the cluster have unique names (as identified by the user-defined variable 'ASE_SERVER' in the package configuration file). This can be done at the time of configuring the ASE server processes, with entries made in the `<ASE_SERVER.cfg>` file while configuring with the default configuration tool, or in the $SYBASE/$SYBASE_ASE/init/sample_resource_files/srvbuild.adaptive_server.rs and similarly for the other servers.

NOTE: The dataserver and the monitor server, both need to be installed on the same disk as monitor server is dependent on the presence of the dataserver for its working.

2. Make sure that the 'sybase' user has the same user id and group id on all nodes in the cluster. Create the user or group with the following commands and ensure the uid/gid by editing the `/etc/passwd` file:

```
# groupadd sybase
# useradd -g sybase -d <installpath> -p <Passwd> sybase
```

3. Create a volume group, logical volume, and file system to hold the necessary configuration information and symbolic links to the Sybase ASE executables. This file system will be defined as SYBASE in the package configuration file and master control script. Since the volume group and file system must be uniquely named within the cluster, use the name of the database instance (ASE_SERVER) in the names:

   Assuming that the name of the ASE instance is 'SYBASE0', create the following:

```
A volume group: /dev/vg0_SYBASE0
A logical volume: /dev/vg0_SYBASE0/lvol1
A file system: /dev/vg0_SYBASE0/lvol1 mounted at /SYBASE0
```

   After the volume group, logical volume, and file system have been created on one node, it must be imported to the other nodes that will run this database. Create the directory /SYBASE0 on all nodes so that /dev/vg0_SYBASE0/lvol1 can be mounted on that node, if the package is to be run on the node.

   For more information on creating, importing, or managing the VG and file system, refer to the chapter entitled *Building an HA Cluster* in the *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* manual for explicit instructions.

4. The ASE system files, data tablespaces and files must be located in the file system /SYBASE0 during the initial creation of database. See Sybase ASE documentation for information on setting up these files.

Multiple Instance Configuration

If multiple instances will be run in the same cluster, repeat the preceding steps for each instance. For example, if a second instance (SYBASE_TEST1) is to be included in the configuration, create a second volume group (for example, /dev/vg0_SYBASE_TEST1), logical volume and file system with mount point (/SYBASE_TEST1) for the second instance. All configuration information for SYBASE_TEST1 will reside in /SYBASE_TEST1/dbs. Similar to SYBASE0, symbolic links need to be created for all subdirectories (other than /SYBASE_TEST1/dbs/), to link /SYBASE_TEST1 to $SYBASE for that instance.

This configuration makes it possible to run several Sybase ASE instances on one node, facilitating failover/failback of Sybase ASE packages between nodes in the cluster.

Set up additional database logical volumes.

It is possible to have the database reside on the same VG/LVOL as $Sybase ASE_HOME/dbs, but more commonly, the database will probably reside on several volume groups and logical volumes, all of which need to be shared among the nodes that are able to run the Sybase ASE instance. Again, using a naming convention for the VG(s) that includes the instance name (${ASE_SERVER}) could be used to associate a VG with a unique instance.

For Example:

Use with Asynchronous disk access and file systems:

```
/dev/vg01_SYBASE0/lvol1 #Logical volume Sybase ASE data
```

```
/dev/vg02_SYBASE0/lvol1 #Logical volume Sybase ASE data
/dev/vg02_SYBASE0/lvol2 #Logical volume Sybase ASE data
```

See the Sybase ASE documentation to determine which format is more appropriate for the setup environment that user prefers.

File system for Sybase ASE data files:

```
/SYBASE0 - mount point for /dev/vg03_SYBASE0/lvol1
```

All data belonging to the database must reside on shared logical volumes (file system), space needs to be allocated and shared for the following:

- Sybase ASE system data tables
- Sybase ASE indexes
- Sybase ASE stored procedures
- Sybase ASE transaction log files

After defining the shared volume groups/logical volumes/file systems for these entities, see Sybase ASE documentation for creating the database.

Setting up the Toolkit

- Toolkit Setup

  After installing the toolkit, this README and `SGAlert.sh` file will be in the /opt/cmcluster/toolkit/sybase directory. One script will be present in the /etc/cmcluster/scripts/ecmt/sybase directory. The other file for package attribute definition file will be present in the /etc/cmcluster/modules/ecmt/sybase directory. Copy the `SGAlert.sh` file to the TKIT_DIR directory.

  For modular packages, there is an Attribute Definition File (ADF) and a Toolkit Module Script (tkit_module.sh)

- Attribute Definition File (sybase.1)

  The ADF is used to generate a package ASCII template file. This file contains a list of pre-defined variables that will be added to the package configuration file during cmmakepkg, which the user must customize for use with a particular Sybase ASE instance. It has an attribute `TKIT_DIR` which will have the path of the package directory. For every parameter which requires user input in the package configuration file, there is an attribute in the ADF. The Sybase ASE attributes are discussed in Table 7 (page 62)

Table 7 Sybase ASE attributes

Sybase ASE Attributes	Description
SYBASE	The location where the Sybase products are installed. **NOTE:** This is also a SYBASE ENV variable and has to be set for Sybase ASE instance to start. Install different instances of Sybase ASE on different paths/LUNs.
SYBASE_ASE	The directory name under $SYBASE where the ASE products are installed. Note: This is also a SYBASE ENV variable and has to be set for Sybase ASE instance to start
SYBASE_OCS	The directory name under $SYBASE where the OCS products are installed. This directory bin should contain the binary file `isql`. **NOTE:** This is also a SYBASE ENV variable and has to be set for Sybase ASE instance to start.
SYBASE_ASE_HOME	The base directory of Sybase ASE where sybase is installed
SYBASE_ASE_ADMIN	System login name of the Sybase ASE administrator. User will be logged in using this account for starting and stopping of the database

Table 7 Sybase ASE attributes *(continued)*

Sybase ASE Attributes	Description
ASE_SERVER	Name of the Sybase ASE instance set during installation or configuration of the ASE. This uniquely identifies an ASE instance
ALERT_MAIL ID	Sends an e-mail message to the specified e-mail address when packages fail. This e-mail is generated only when packages fail, and not when a package is halted by the operator. To send this e-mail message to multiple recipients, a group e-mail ID must be created and specified for this parameter. When an e-mail ID is not specified for this parameter, the script does not send out this e-mail
SALOGIN	ASE Login with system administrator capability
SAPASSWD	ASE Password for Login with system administrator capability. **NOTE:** Along with other package attributes, the ASE password is also stored in the Cluster Database. If users are not restricted access based on their roles, this password can be viewed by unauthorized users using the cmviewcl command. It is highly recommended to grant access to users based only on their roles in managing the cluster and packages. See "Configuring Access Roles" (page 67) in this chapter for more details on configuring Role Based Access (RBA).
ASE_RUNSCRIPT	Path of the script to start ASE instance.
USER_SHUTDOWN_MODE	This parameter is used to specify the instance shutdown mode only when a shutdown is initiated by the user and not due to a failure of a service. This parameter can take values "wait" or "nowait". If "wait" is specified, the instance is shutdown using the wait option, which will be a clean shutdown. If "nowait" is specified, the instance is shutdown using the nowait option. The default value is "wait".
MONITOR_INTERVAL	The interval of time, in seconds, which this script should wait between checks to ensure of the Sybase database running. Default value is 30 seconds.
TIME_OUT	The interval of time, in seconds, to wait for Sybase abort to complete before killing the Sybase processes defined in MONITOR_PROCESSES. The TIME_OUT variable is used to protect against a worst case scenario where a hung database prevents the halt script from completing, therefore preventing the standby node from starting the database. The value of TIME_OUT must be less than the time-out set in the package configuration file. TIME_OUT variable has no effect on package failover times. Default value is 30 seconds.
RECOVERY_TIMEOUT	The maximum amount of time in seconds to wait for an ASE to complete recovery before determining that the server has failed to start up. This value must be set to allow enough time for all the databases to recover and come online.
MONITOR_PROCESSES	The names of all processes that must be executing to ensure this instance is up and running.
MAINTENANCE_FLAG	Maintenance flag will enable or disable the maintenance mode for the Sybase package. By default this is set to "yes". In order to disable this feature, `MAINTENANCE_FLAG` should be set to "no". If the Sybase ASE instance needs to be maintained, a file `$TKIT_DIR/sybase.debug` needs to be touched. During this maintenance period the Sybase ASE instance's monitoring is paused. Even if the ASE instance is brought down, the package will not be failed over to the standby node. To continue monitoring and come back from the maintenance mode, the `sybase.debug` file should be removed. It is the user's responsibility to ensure that the ASE instance is running properly after the maintenance phase.

- Module Script (tkit_module.sh)

  This script contains a list of internally used variables and functions that support the starting and stopping of an Sybase ASE database instance. This script is called by the Master Control Script to perform the following:

1. On package start-up, it starts the Sybase ASE instance and launches the monitor process.
2. On package halt, it stops the Sybase ASE instance and monitor process.

   This script also contains the functions for monitoring the Sybase ASE instance. By default, only the "€˜dataserver€" process of ASE is monitored. This process is contained in the variable MONITOR_PROCESSES.

Sybase Package Configuration Example

- Package Setup and Configuration

  1. Assuming Sybase ASE is already installed in its default home directory (for example, /home/sybase), perform the following steps to make necessary directories shareable by all clustered nodes.

     Follow the instructions in the chapter *Building an HA Cluster Configuration* in the *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* manual to create a logical volume infrastructure on a shared disk. The disk must be available to all clustered nodes that will be configured to run this database instance. Create a file system to hold the necessary configuration information and symbolic links to the Sybase ASE executables. This file system will be used as SYBASE_HOME in the package control scripts. Since the volume group and file system have to be uniquely named within the cluster, use the name of the database instance ($ASE_SERVER) in the name. Assuming the name of the database is 'SYBASE0', follow the instructions in the "Managing Serviceguard" manual ("Building an HA Cluster Configuration") to create the following:

     ```
     /dev/vg0_SYBASE0 (the volume group)
     /dev/vg0_SYBASE0/lvol1 (the logical volume)
     /dev/vg0_SYBASE0/lvol1 (the filesystem) mounted at /SYBASE0
     ```

  2. Assuming Sybase ASE is installed in /home/sybase; create symbolic links to all subdirectories under /home/sybase with the exception of the dbs directory (dbs contains important instance configuration files, and should reside in the shared storage in ${ASE_SERVER}, for example, /SYBASE0/dbs).
  3. Test the set up to ensure Sybase ASE can be properly brought up.

     Repeat this step on all other clustered nodes to be configured to run the package to ensure Sybase ASE can be brought up and down successfully.
  4. Create the Serviceguard package using modular package method

     Create a package configuration file (SYBASE0.conf) as follows:

     ```
     cmmakepkg -m ecmt/sybase/sybase -p SYBASE0.conf
     ```

     The configuration file should be edited as indicated by the comments in that file. The package name needs to be unique within the cluster. For clarity, use the $ASE_SERVER to name the package "package_name <ASE_SERVER>"

- The Serviceguard package configuration file (`SYBASE0.conf`)

  Described below are some examples of modifications to the Serviceguard package configuration file, which need to made to customize your environment.

  For example:

  ```
  package_name SYBASE0
  ```

  List the names of the clustered nodes to be configured to run the package, using the node_name parameter:

  ```
  node_name node1
  node_name node2
  ```

The following is an example of specifying Sybase ASE specific variables:

```
ecmt/sybase/sybase/TKIT_DIR /tmp/SYBASE0
ecmt/sybase/sybase/SYBASE /home/sybase
ecmt/sybase/sybase/SYBASE_ASE ASE-15_0
ecmt/sybase/sybase/SYBASE_OCS OCS-15_0
ecmt/sybase/sybase/SYBASE_ASE_ADMIN sybase
ecmt/sybase/sybase/SALOGIN sa
ecmt/sybase/sybase/SAPASSWD somepasswd
```

NOTE: Keep this commented if the password for the administrator is not set. Along with other package attributes, this password is also stored in the Cluster Database. If users are not restricted access based on their roles, this password can be viewed by unauthorized users using the `cmviewcl` command. It is highly recommended to grant access to users based only on their roles in managing the cluster and packages. See "Configuring Access Roles" (page 67) in this chapter for more details on configuring Role Based Access (RBA).

```
ecmt/sybase/sybase/ASE_SERVER SYBASE0
ecmt/sybase/sybase/ASE_RUNSCRIPT /home/sybase/ASE-15_0/install/RUN_SYBASE0
ecmt/sybase/sybase/USER_SHUTDOWN_MODE wait
```

The default is "wait". If the user requires that the ASE instance should abort immediately and do an unclean shutdown, this should be specified as "nowait".

```
ecmt/sybase/sybase/MONITOR_INTERVAL 5

ecmt/sybase/sybase/TIME_OUT 30

ecmt/sybase/sybase/RECOVERY_TIMEOUT 30

ecmt/sybase/sybase/MONITOR_PROCESSES dataserver

ecmt/sybase/sybase/MAINTENANCE_FLAG yes
```

Define the volume groups that are used by the Sybase ASE instance. File systems associated with these volume groups are defined as follows:

```
vg /dev/vg00_SYBASE0
vg /dev/vg01_SYBASE0
```

Define the file systems which are used by the Sybase ASE instance. Note that one of these file systems must be the shared file system/logical volume containing the Sybase ASE home configuration information ($SYBASE_HOME). The name of the instance is used to name the volume groups, logical volumes and file systems.

```
fs_name /dev/vg00_SYBASE0/lvol1
 fs_directory /SYBASE0
 fs_type "ext3"
 fs_mount_opt "-o rw"
```

Define the service related parameters. The service name should include the Sybase ASE instance name (that is ${ASE_SERVER}). In the following example, since there is only one service for this package, the ${ASE_SERVER} (that is SYBASE0) is assigned to the 'service_name' parameter.

```
service_name SYBASE_${ASE_SERVER}
service_cmd
"/opt/cmcluster/conf/scripts/ecmt/sybase/tkit_module.sh
sybase_monitor"
service_restart "-r 3"
```

The service restart counter can be reset to zero for this service by using Serviceguard command :`cmmodpkg`. The service restart counter is incremented each time the service fails. It is used

to determine when a package has exceeded its restart limit as defined by the "service_restart" parameter in the package control script.

To reset the restart counter execute the following command `cmmodpkg [-v] [-n node_name] -R -s service_name package_name`

After setting up the Serviceguard environment, each clustered Sybase ASE Instance should have the following files in the toolkit specific directories:

```
/etc/cmcluster/scripts/ecmt/sybase/tkit_module.sh
/etc/cmcluster/modules/ecmt/sybase/sybase (this is a
symbolic link)
/etc/cmcluster/modules/ecmt/sybase/sybase.1
/opt/cmcluster/toolkit/sybase/README
/opt/cmcluster/toolkit/sybase/SGAlert.sh
```

Creating the Serviceguard package using Modular method

Follow the steps below to create Serviceguard package using Modular method:

1. Create a directory for the package.

   ```
   #mkdir /etc/cmcluster/pkg/sybase_pkg/
   ```

2. Copy the toolkit template and script files from sybase directory.

   ```
   #cd /etc/cmcluster/pkg/sybase_pkg/
   #cp /opt/cmcluster/toolkit/sybase/*./
   ```

3. Create a configuration file (pkg.conf) as follows.

   ```
   #cmmakepkg -m ecmt/sybase/sybase pkg.conf
   ```

4. Edit the package configuration file.

   NOTE: Sybase toolkit configuration parameters in the package configuration file have been prefixed by `ecmt/sybase/sybase` when used in Serviceguard A.11.19.00.

   For Example:

   ```
   /etc/cmcluster/pkg/sybase_pkg/pkg.conf
   ```

   The configuration file should be edited as indicated by the comments in that file. The package name needs to be unique within the cluster.

   For Example:

   ```
   PACKAGE_NAME sybase
   NODE_NAME node1
   NODE_NAME node2
   ```

   Set the `TKIT_DIR` variable as the path of <package_directory>. For example, `TKIT_DIR /etc/cmcluster/pkg/pkg01.`

5. Use `cmcheckconf` command to check for the validity of the configuration specified.

   For Example:

   ```
   #cmcheckconf -P pkg.conf
   ```

6. If the `cmcheckconf` command does not report any errors, use the `cmapplyconf` command to add the package into Serviceguard environment.

   For Example:

   ```
   #cmapplyconf -P pkg.conf
   ```

Adding the Package to the Cluster

After the setup is complete, add the package to the Serviceguard cluster and start it up.

```
cmapplyconf -P SYBASE0
cmmodpkg -e -n <node1> -n <node2> SYBASE0
cmmodpkg -e SYBASE0
```

If necessary, consult the *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* manual for information on managing packages.

Configuring Access Roles

To restrict unauthorized users from viewing the values of package attributes, set appropriate roles for users who manage the cluster and packages. Set the Sybase administrator password using the SAPASSWD package attribute. Along with other package attributes, password set for the SAPASSWD package attribute is also stored in the Cluster Database.

If you do not restrict access of users for the SAPASSWD package attribute, then unauthorized users can use the `cmviewcl` command to view the Sybase administrator password. HP recommends to granting access to users based only on their roles in managing the cluster and packages. Configure Role Based Access (RBA) using the following configuration parameters in the cluster:

- USER_NAME
- USER_HOST
- USER_ROLE

Specify one of the following values for the USER_ROLE parameter:

Table 8 Parameters in USER_ROLE

User Role	Description
MONITOR	Allowed to perform cluster and package view operations.
PACKAGE_ADMIN	Allowed to perform package administration, and use cluster and package view commands.
FULL_ADMIN	Allowed to perform cluster administration, package administration, and cluster and package view operations.

Assign any of these roles to users who are not configured as root users. Root users are usually given complete control on the cluster using the FULL_ADMIN value.

When any of these values are specified for users who are not root users, they can view the Sybase administrator password using the `cmviewcl`command. Only those users who are not configured with any of these values cannot view the Sybase administrator password using the `cmviewcl` command.

For more information on configuring security for a Serviceguard cluster, see the *Securing Serviceguard, March 2009* whitepaper available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* .

Serviceguard allows the Role Based Access feature to be switched off, in which case only the root user will be able to view the package attributes.

As the Sybase administrator password is also entered in the package configuration ASCII file, it is recommended that this file is secured either by using file permissions feature provided by the operating system or by deleting the file after the package is applied.

Node-specific Configuration

Ensure that all files that are required by Sybase ASE to start up cleanly are updated and present on each node in the cluster or accessible through shared storage. It is the user's responsibility to replicate all files across all nodes, when using local configuration.

Error-Handling

During start up, the ASE server would require the IP/hostname that is mentioned in the interfaces file to be associated with a node name that it is configured to run on. If the IP is not configured, or ping-able, the ASE instance may fail to come up. Correct this using the guidelines specified in the next section.

Ensure that the setup has been done for all nodes in the cluster (or on shared storage) as specified by Sybase. Contact Sybase support for any issues.

Network Configuration

It is beyond the scope of this document to give detailed instructions on how to configure the Sybase ASE for a Serviceguard cluster. This section contains a few basic steps that user would require to

do for setting up a single-instance of ASE for failover in a Serviceguard cluster. Consult Sybase ASE documentation for a detailed description on how to setup ASE in a cluster.

- Sybase ASE interfaces file

  For setting up a single-instance of ASE in a Serviceguard cluster, the ASE instance should be available at the same IP address across all nodes in the cluster. To achieve this, the interfaces file of the ASE instance, available at the $SYBASE directory of that instance, should be edited. For example, a default setup of ASE would have an interface entry for the dataserver as:

```
MIG29
master tcp ether mig29 5000
query tcp ether mig29 5000
```

  This needs to be edited to have the re-locatable IP-address, as follows:

```
MIG29
master tcp ether 192.168.10.1 5000
query tcp ether 192.168.10.1 5000
```

  If user requires a re-locatable hostname to be associated with this re-locatable IP-address, there are two important things to be taken care of:

  1. Use the re-locatable hostname in the srvbuild.adaptive_server.rs and similar files for all the other 'server' processes and use srvbuildres utility to configure the servers.
  2. Make the (relocatable_,P relocatable_hostname) pairs entry in the /etc/hosts (and also in the nameserver, if necessary). The /etc/hosts, should then contain the <IP-address, hostname> associated with each ASE instance along with the physical IP-address and corresponding physical hostname entries.

     - /etc/hosts

     Ensure that the entries mentioned above are present in the `/etc/hosts` file before an attempt is made to bring up the ASE processes.

     For example, assume that the IP 192.168.10.1 is the associated IP and sybase0 is the associated hostname with the ASE instance SYBASE0. The entry required in /etc/hosts is:

     192.168.10.1 sybase0

     And in the adaptive server configuration file, the re-locatable hostname sybase0 should be put in place of the hostname:

```
sqlsrv.network_hostname_list: PUT_YOUR_HOSTNAME_HERE

as -

sqlsrv.network_hostname_list: sybase0
```

     NOTE: If user does not wish to use a re-locatable hostname with the ASE instance, the `/etc/hosts` file on each node should contain the re-locatable IP-address associated with the physical hostname of that node. For example, if node1_hostname and node2_hostname are the physical hostnames of two nodes in the cluster, and if 192.168.10.1 is the re-locatable IP-address for the ASE instance, then the /etc/hosts of node1 should have an entry like: 192.168.10.1 node1_hostname

     And the /etc/hosts file of node2 should have an entry like: 192.168.10.1 node2_hostname.

Database Maintenance

There might be situations, when the Sybase ASE database has to be taken down for maintenance purposes like changing configuration, without having the instance to migrate to standby node. The

following procedure should be used:

NOTE: The example assumes that the package name is SYBASE0, the package directory is `/opt/cmcluster/pkg/SYBASE0`, and the SYBASE_HOME is configured as /SYBASE0.

- Disable the failover of the package through `cmmodpkg` command:

  ```
  $ cmmodpkg -d SYBASE0
  ```

- Pause the monitor script.

  Create an empty file `<TKIT_DIR>/sybase.debug` as shown below:

  ```
  $ touch <TKIT_DIR>/sybase.debug
  ```

  The toolkit monitors script, that continuously checks the Sybase ASE process, would now stop monitoring this process. A message, "Sybase ASE toolkit pausing monitoring and entering maintenance mode" appears in the Serviceguard Package Control script log.

- If required, stop the Sybase ASE database instance as shown below:

  ```
  $ export SG_PACKAGE=SYBASE0
  $ $SGCONF/scripts/ecmt/sybase/tkit_module.sh stop
  ```

- Perform maintenance actions (for example, changing the configuration parameters in the parameter file of the Sybase ASE instance. If this file is changed, remember to distribute the new file to all cluster nodes).
- Start the Sybase ASE database instance again if it has been stopped:

  ```
  $ export SG_PACKAGE=SYBASE0
  $ SGCONF/scripts/ecmt/sybase/tkit_module.sh start
  ```

- Allow monitoring scripts to continue normally as shown below:

  ```
  $ rm -f /opt/cmcluster/pkg/SYBASE0/sybase.debug
  ```

  A message "Starting Sybase ASE toolkit monitoring again after maintenance" appears in the Serviceguard Package Control script log.

- Enable the package failover:

  ```
  $ cmmodpkg -e SYBASE0
  ```

  NOTE: If the package fails during maintenance (for example, the node crashes), the package will not automatically fail over to an adoptive node. It is the responsibility of the user to start the package up on an adoptive node. See the manual *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* for more details.

  This feature is enabled only when the configuration variable `MAINTENANCE_FLAG` is set to "yes" in the package configuration file.

4 Using the DB2 database Toolkit in a Serviceguard Cluster in HP-UX

DB2 is a RDBMS product from IBM. This chapter describes the High Availability toolkit for DB2 V9.1, V9.5 and V9.7 designed to be used in a Serviceguard environment. This chapter covers the basic steps to configure DB2 instances in a Serviceguard cluster. For more information on support matrix, see compatibility matrix available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* .

This chapter assumes that the readers are already familiar with Serviceguard configuration, as well as with DB2 database server concepts, including installation and configuration procedures.

NOTE: This toolkit runs on 11i v2 and 11i v3 HP-UX distributions. This toolkit is not supported on 11i v1 HP-UX distribution and it is supported in all hardware supported by the Serviceguard. Database Partitioning Feature (DPF) is supported only with the following versions:

- DB2 V9.1.
- DB2 V9.7 with Fix Pack 2.

The DB2 Database Toolkit for Serviceguard consists of a set of shell scripts that are used to start, stop, and monitor the DB2 database instances. This toolkit can be used with the legacy and modular style Serviceguard packages. It is strongly recommended to use the modular style of packaging as the legacy style of packaging will be obsolete in future. Subsequent sections of this chapter provide guidelines for integrating this toolkit with the Serviceguard package control script (for legacy packages), or with the master control script (for modular packages). The DB2 Database Toolkit for Serviceguard can also be configured using the Serviceguard manager graphical user interface.

NOTE: This chapter assumes that the user has already installed Serviceguard, a DB2 Database, and the Enterprise Cluster Master toolkit version B.06.00 on all cluster nodes.

DB2 Information

Each cluster member requires a local copy of DB2 server. DB2 instances are configured as packages under Serviceguard. Clients connect to the DB2 database using an IP address that is assigned to the Serviceguard package. Serviceguard monitors the health of the DB2 Database Server using the DB2 Database utility tool "db2gcf". In case of a failure of DB2 system on one node, Serviceguard fails over all the necessary resources and starts up an identical DB2 instance on one of the standby nodes.

Setting Up the Application

The steps below outline the installation procedures and the necessary checks required to provide high availability for DB2 UDB Enterprise Server Edition V9.5 /V9.7 in Serviceguard. For additional details see *Quick Beginning for DB2 Servers* available at ftp://ftp.software.ibm.com/ps/products/db2/info/vr95/pdf/en_US/db2ise952.pdf.

1. Create a volume group, a logical volume, and a file system to hold the database. The volume group, logical volume and file system parameters have to be defined in the Serviceguard package configuration file. Since the volume group and file system must be uniquely named within the cluster, include the identity of the database instance in their names. For step-by-step instructions on creating a volume group, see chapter *Building an HA Cluster Configuration* in

the Serviceguard user manual available at http://www.hp.com/go/hpux-serviceguard-docs -> *HP Serviceguard*.

2. Make sure that the minimum hardware and the software prerequisites are met before the product installation is initiated. The latest installation requirements are listed on IBM web site: http://www-306.ibm.com/software/data/db2/9/sysreqs.html.
3. Use the DB2 Setup Wizard or `db2install` script to install the database server deferring the instance creation. The destination directory for DB2 server must be the same on all cluster nodes. DB2 installation must be done by a root user.
4. IBM provides a utility called `/opt/IBM/DB2/V9.5/bin/db2osconf` in determining the minimum recommended kernel values for DB2 server. As root, run `/opt/IBM/DB2/V9.5/bin/db2osconf` or `/opt/IBM/DB2/V9.7/bin/db2osconf` utility to aid administrators in determining the minimum recommended kernel values for the DB2 server. Login as root, modify the kernel parameters using `kctune` command or kcweb (graphical browser) based utility. For example, to modify the value of `maxuprc` execute as root the following:

   ```
   root@hp46t191:/home/root>kctune maxuprc=256.
   ```

   For more information regarding the recommended kernel values for DB2 server, see IBM DB2 Information center.

   https://publib.boulder.ibm.com/infocenter/db2luw/v9r5/index.jsp

   https://publib.boulder.ibm.com/infocenter/db2luw/v9r7/index.jsp
5. Create required users and groups on all cluster members.

   To create required groups using command line utilities, execute as root:

   ```
   root@node1/]> groupadd -g 400 db2iadm1
   [root@node1/]> groupadd -g 500 db2fadm1
   [root@node1/]> groupadd -g 600 dasadm1
   ```

   To create required users using command line utilities, execute as root:

   ```
   [root@node1/]> useradd -u 400 -g db2iadm1 -m -d /home/payroll_inst payrollinst
   [root@node1/]> useradd -u 500 -g db2fadm1 -m -d /home/db2fenc1 db2fenc1
   [root@node1/]> useradd -u 600 -g dasadm1 -m -d /home/dasusr1 dasusr1
   ```

   see useradd (1M) and groupadd (1M) man pages for additional details.

   NOTE: The user names, user ID and groups shown here are for illustration purposes only.
6. Create a DB2 instance using db2icrt. The DB2 instances should be created on shared volume group.

   ```
   [root@node1 /]><DB2_installation_dir>/instance/db2icrt -a client -u db2fenc1 payroll_inst
   ```
7. In case of logical multi-partitioned database installation, edit DB2 node configuration file `db2nodes.cfg` in the exported instance owner home directory to define the database partitions that participate in a DB2 instance.

   For example:

   ```
   [payroll_inst@node1 ~]> vi /home/payroll_inst/sqllib/db2nodes.cfg
   0 node1 0 node1
   1 node1 1 node1
   ```
8. In case of physical multi-partitioned database installation, edit the DB2 node configuration file `db2nodes.cfg` in the exported instance owner home directory to define the physical and logical database partitions that participate in a DB2 instance.

   For example:

   ```
   [payroll_inst@node1 ~]> vi /home/payroll_inst/sqllib/db2nodes.cfg
   0 node1 0 node1
   1 node1 1 node1
   ```

```
2 node2 0 node2
3 node2 1 node2
```

9. To enable the communication between the partitions, edit the `/etc/services`, `/etc/hosts`, `.rhosts` file with the required entries.

   Edit the`/etc/hosts` file by adding the IP address and hostname of the DB2 server.

   For example:

   ```
   [payroll_inst@node1 ~]> vi /etc/hosts
   10.0.0.1 DBNODE.domainname.com DBNODE
   ```

   Edit the ~/.rhosts file for the instance owner:

   For example:

   ```
   [payroll_inst@node1 ~]> vi home/payroll_inst/.rhosts
   node1 payroll_inst
   node2 payroll_inst
   ```

10. As root, edit the `/etc/services` file to ensure that enough ports are reserved for Fast Communication Manager (FCM) to allow inter-partition communications. Add the following entries in the `/etc/services` file. The number of ports reserved depends upon the requirement.

    ```
    [root@node1/]>vi /etc/services
    db2c_payroll_inst  50000/tcp # DB2 connection service port
    DB2_payroll_inst    60000/tcp
    DB2_payroll_inst_1  60001/tcp
    DB2_payroll_inst_2  60002/tcp
    DB2_payroll_inst_3  60003/tcp
    DB2_payroll_inst_4  60004/tcp
    DB2_payroll_inst_5  60005/tcp
    DB2_payroll_inst_6  60006/tcp
    DB2_payroll_inst_7  60007/tcp
    DB2_payroll_inst_8  60008/tcp
    DB2_payroll_inst_END 60009/tcp
    ```

NOTE: In case of multiple physical and logical partition configuration of DB2, the number of ports added in the services file has to be sufficient for the number of partitions created in the current node as well as the number of partitions created on the other nodes. This is to ensure that enough ports are available for all partitions to startup on a single node if all packages managing different partitions are started on that node.

In case of multiple physical and logical partition configuration of DB2, number of ports added in services file has to be sufficient for the number of partitions created in the current node as well as the number of partitions created on the other nodes. This is to ensure that enough ports are available for all partitions to startup on a single node if all packages managing different partitions are started on that node.

As an instance owner execute the following:

```
[payroll_inst@node1/]> db2set DB2COMM=tcpip
[payroll_inst@node1/]> update database manager configuration using svcename db2c_payroll_inst
[payroll_inst@node1/]> db2stop
[payroll_inst@node1/]> db2start
```

NOTE: For multi-partitioned database using DB2 V9.7, a parameter called *DB2_PMODEL_SETTINGS* needs to be set to SERIAL_RESTART:TRUE. This parameter along with the respective Fix Pack installation, provides fix for Database Partitioning Feature (DPF) issue reported by IC66748:DB2START RESTART NEEDS SERIAL FAILOVER CODE RE-USE FROM V91 IN V97 case.

For example:

```
[payroll_inst@node1/]> db2set DB2_PMODEL_SETTINGS=SERIAL_RESTART:TRUE
```

11. Start the database manager and examine the database log for any errors.

```
[payroll_inst@node1 ~]> db2start
07/15/2008 18:10:32   1   0   SQL1063N  DB2START processing was successful.
04/15/2008 18:10:32   0   0   SQL1063N  DB2START processing was successful.
SQL1063N  DB2START processing was successful.
```

12. Define the `DBNAME` and `MNTPOINT` variables. Create the database on the mount point defined, connect to it locally, and terminate the connection.

    As an instance owner, execute,

```
payroll_inst@node1 ~]> db2 create database $DBNAME on $MNTPOINT
payroll_inst@node1 ~]> db2 connect to $DBNAME (as instance owner)
Check the DB2 log for errors in
$HOME/sqllib/db2dump/db2diag.log
```

    On other cluster nodes catalog the already created database:

```
payroll_inst@node1 ~]> db2 catalog database $DBNAME  on $MNTPOINT \
authentication client
```

13. Terminate the connection and release the logical volume.

```
[payroll_inst@node1 ~]> db2 terminate (as instance owner)
[payroll_inst@node1 ~]> db2stop (as instance user)
[root@node1 /]> umount $MNTPOINT (as root user)
[root@node1 /]> vgchange -a n $VG (as root user)
```

14. Stop database manager and correct errors (if any).

```
[payroll_inst@node1 ~]> db2stop
```

NOTE: In a Serviceguard cluster environment, the fault monitor facility provided by DB2 must be turned off. Fault monitor facility is a sequence of processes that work together to ensure that DB2 instance is running. Fault monitor facility is specifically designed for non-clustered environments and has the flexibility to be turned off if the DB2 instance is running in a cluster environment. In Serviceguard environment, DB2 instance start/stop is controlled by Serviceguard and hence the fault monitor facility should be turned off.

For more information on this, please look at the IBM DB2 documentation available at https://publib.boulder.ibm.com/infocenter/db2luw/v9r5/index.jsp and https://publib.boulder.ibm.com/infocenter/db2luw/v9r7/index.jsp .

The above steps from 1 to 12 have to be repeated on all nodes in the cluster. Steps 5-12 mentioned above are applicable for multi-partition database setup. Single partition users need not defer the instance creation while installing as mentioned in step 4. After the installation users can continue from step 11 onwards.

Multiple Instance Configurations

If multiple instances run in the same cluster, repeat the preceding steps for each instance. For example, if a second instance (employee) is to be included in the configuration, you would create a second volume group (for example, `/dev/vg_employee`), logical volume, and filesystem with mount point (`/mnt/employee`) for the second instance. This configuration makes it possible to run several DB2 instances on one node, facilitating failover/failback of DB2 packages between nodes in the cluster.

Set up additional database logical volumes

The database will reside on several volume groups and logical volumes, which need to be shared among the nodes that are able to run the DB2 instances. Again, using a naming convention for the VG(s) that includes the instance name could be used to associate a VG with a unique instance.

NOTE: Refer Step1 above, for creating logical volumes.

For example:

Raw disk access for DB2 data:

```
/dev/vg01_payroll/rlvol1        #Raw logical volume DB2 data
/dev/vg02_payroll/rlvol1        #Raw logical volume DB2 data
/dev/vg03_payroll/rlvol2        #Raw logical volume DB2 data
```

or for use with Asynchronous disk access and file systems:

```
/dev/vg01_payroll/lvol1         #Logical volume DB2 data
/dev/vg02_payroll/lvol1         #Logical volume DB2 data
/dev/vg03_payroll/lvol2         #Logical volume DB2 data
```

Setting Up the Toolkit

Toolkit Overview

After installing this toolkit, three scripts and the README file will be present in the `/opt/cmcluster/toolkit/db2/` directory. Two more scripts and one Attribute Definition File will be present which will be used only by modular packages. These scripts will be in the `/etc/cmcluster/scripts/ecmt/db2/` directory. The Attribute Definition file for modular packages

will be predefined, include the identity of the database instance as per the name set in the `/etc/cmcluster/modules/ecmt/db2/` directory.

For legacy packages, there will be one user configuration script `(hadb2.conf)` and three functional scripts `(toolkit.sh)`, `hadb2.sh` and `hadb2.mon`) which work with each other to integrate DB2 with the Serviceguard package control scripts.

For modular packages, there is an Attribute Definition File (ADF), a Toolkit Module Script (`tkit_module.sh`), and a Toolkit Configuration File Generator Script (`tkit_gen.sh`) which work with the three scripts mentioned above for legacy packages to integrate DB2 with the Serviceguard Master Control Script.

Table 9 (page 76) lists these scripts:

Table 9 Legacy Package Scripts

Script Name	Description
hadb2.conf (user configuration file)	This script contains a list of pre-defined variables that the user must customize for use with a particular database instance. This is a configuration file which is read by the toolkit script, `hadb2.sh`. The table Table 10 (page 76) shows variables that are contained in hadb2.conf.
Main Script (hadb2.sh)	This script contains a list of internally used variables and functions that support starting and stopping of a DB2 database instance. This script will be called by **toolkit.sh** to perform the following: • On package startup, it starts the DB2 instance and monitor process. • On package halt, it stops the DB2 instance and monitor process.
Monitor Script (hadb2.mon)	This script contains a list of internally used variables and functions for monitoring a DB2 server instance. This script will be called by **hadb2.sh** . It uses a tool called "db2gcf" to monitor the database.
Interface Script (toolkit.sh)	This script is the interface between the Serviceguard package control script and the DB2 toolkit.

Table 10 Variables in hadb2.conf File

Variable Name	Description
`INSTANCE_NAME`	The DB2 instance name.
`PARTITION_NUMBER`	The list of the logical database partitions that participate in a DB2 instance and are intended to run on single server. Physical partitions should be packaged separately.

Table 10 Variables in hadb2.conf File *(continued)*

Variable Name	Description
MONITOR_PROCESSES	This is the list of critical processes of a DB2 instance. **NOTE:** These processes must not be running after DB2 is shutdown. If the processes are still running they will be killed by sending a SIGKILL.
MAINTENANCE_FLAG	This variable will enable or disable maintenance mode for DB2 package. By default, this is set to "yes". In order to disable this feature MAINTENANCE_FLAG should be set to "no". When DB2 Database needs to be maintained then a file "<package directory>/db2.debug" needs to be touched. During this maintenance period DB2 database instance's process monitoring is paused. Even if DB2 instance is brought down, package will not be failed over to the standby node. To continue monitoring and come out of the maintenance mode, you should remove the file "db2.debug" from the package configuration directory. It is user's responsibility to ensure that db2 instance is properly running after the maintenance phase. **NOTE:** Setting MAINTENANCE_FLAG to "yes" and touching the db2.debug file in the package directory will put the package in toolkit maintenance mode. Serviceguard A.11.19 release has a new feature which allows individual components of the package to be maintained while the package is still up. This feature is called Package Maintenance mode and is available only for modular packages. For more information on using Package Maintenance mode, see the whitepaper "Modular package support in Serviceguard for Linux and ECM Toolkits" available at http://www.hp.com/go/hpux-SG-ECMT-docs.
MONITOR_INTERVAL	The time interval in seconds between the checks to ensure that the DB2 database is running. Default value is 30 seconds.
TIME_OUT	The amount of time, in seconds, to wait for the DB2 shutdown to complete before killing the DB2 processes defined in MONITOR_PROCESSES. The TIME_OUT variable is used to protect against a worst case scenario where a hung database prevents the package halt script from completing, thereby preventing the standby node from starting the database. The value of TIME_OUT must be less than the HALT_SCRIPT_TIMEOUT value set in the package configuration file. This variable has no effect on the package failover times.

The following ADF file and scripts are used only during the modular method of packaging.

Table 11 Modular Package Scripts

Script Name	Description
Attribute Definition File (db2)	For every parameter, in the legacy toolkit user configuration file, there is an attribute in the ADF. It also has an additional attribute TKIT_DIR which is analogous to the package directory in the legacy method of packaging. The ADF is used to generate the package ASCII template file.
Module Script (tkit_module.sh)	This script is called by the Master Control Script and acts as an interface between the Master Control Script and the Toolkit interface script (toolkit.sh). It is responsible for calling the Toolkit Configuration File Generator Script.
Toolkit Configuration File Generator Script (tkit_gen.sh)	This script is called by the Module Script when the package configuration is applied using cmapplyconf command to generate the toolkit user configuration file in the package directory (TKIT_DIR).

DB2 Package Configuration Example

Assuming DB2 is already installed.

1. To create a logical volume infrastructure on a shared disk, see *Building an HA Cluster Configuration* chapter of *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* . The disk must be exposed to all clustered

nodes that will be configured to run this database instance. Since the volume group and file system have to be uniquely named within the cluster, use the name of the database instance in the name. Assuming, the name of the database instance is 'payroll_inst', follow the instructions in the see *Building an HA Cluster Configuration* chapter of *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* to create the following:

```
/dev/vg0_payroll                (the volume group)
/dev/vg0_payroll/lvol1          (the logical volume)
/dev/vg0_payroll/lvol1          (the filesystem)  mounted at /mnt/payroll
```

2. Test the set up to ensure that DB2 can be properly brought up. Tert st DB2 to ensure that it can be properly started by executing the script toolkit.sh.

   For example,

```
cd  /tmp/db2
cp  /opt/cmcluster/toolkit/db2/*  .
Edit the DB2 toolkit configuration file hadb2.conf
./toolkit.sh start
```

   After waiting for a few minutes, check for the existence of DB2 processes (there should be several, identified by "db2") ps -ef | grep db2. Bring the database down, unmount, and deactivate the volume group.

```
./toolkit.sh stop
umount /mnt/payroll
vgchange -a n /dev/vg0_payroll
```

   Repeat this step on all other clustered nodes to be configured to run the package to ensure DB2 can be brought up and down successfully.

NOTE: Following section below describe the methods for creating Serviceguard package using the modular and legacy method. For more information on creating Serviceguard package using modular method, see white paper *Modular package support in Serviceguard for Linux and ECM Toolkits* available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard Enterprise Cluster Master Toolkit*.

Creating Serviceguard package using Modular method.

- Create the Serviceguard package using Modular method.

  Follow these steps to create Serviceguard package using Modular method:

  1. Create a directory for the package:

     ```
     #mkdir /etc/cmcluster/pkg/db2_pkg/
     ```

  2. Copy the toolkit template and script files from db2 directory:

     ```
     #cd /etc/cmcluster/pkg/db2_pkg/
               #cp /opt/cmcluster/toolkit/db2/* ./
     ```

  3. Create a configuration file (pkg.conf) as follows:

     ```
     #cmmakepkg -m ecmt/db2/db2  pkg.conf
     ```

  4. Edit the package configuration file.

     NOTE: DB2 toolkit configuration parameters in the package configuration file have been prefixed by `ecmt/db2/db2` when used in Serviceguard A.11.19.00. For example,

     ```
     /etc/cmcluster/pkg/db2_pkg/pkg.conf
     ```

     The configuration file should be edited as indicated by the comments in that file. The package name needs to be unique within the cluster. For clarity, use the name of the database instance to name the package. For example,

     ```
     PACKAGE_NAME                    db2_payroll
     ```

     List the names of the clustered nodes to be configured to run the package, using the *NODE_NAME* parameter.

     ```
     NODE_NAME                       node1
                        NODE_NAME                          node2
     ```

     Set the `script_log_file` variable. For example,

     ```
     script_log_file                 /etc/cmcluster/pkg/<pkg_dir>/log
     ```

     Set the `TKIT_DIR` variable as the path of <package_directory>. For example,

     ```
      TKIT_DIR                        /etc/cmcluster/pkg/pkg01
     ```

     Set the `INSTANCE_NAME` variable as the DB2 instance name. For example,

     ```
     INSTANCE_NAME                db2_payroll_inst
     ```

     Set the `PARTITION_NUMBER` variable to the partition numbers of the database which need to be started, stopped and monitored using this package. By default it is set to 0. Repeat the above variable to add additional partitions. For example,

     ```
      PARTITION_NUMBER                0
      PARTITION_NUMBER                1
     ```

     NOTE: Logical partitions of a database can be grouped to run in a single package while physical partitions need separate packages for each.

     Set the `MONITOR_PROCESSES` variable to process names, which must be monitored and cleaned up to ensure fail safe shutdown of the DB2 Instance or Partition. The actual monitoring is done by a command called `db2gcf`. The `MONITOR_PROCESSES` is only used to kill the processes that remain alive after the shutdown of the database. By default, .db2sysc. is configured in this variable. Repeat the variable to additional processes if required. For example,

     ```
     MONITOR_PROCESSES          db2sysc
     ```

     Set the `MAINTENANCE_FLAG` variable to “yes” or “no”, to “enable” or “disable” the maintenance mode feature for the package. For example,

     ```
     MAINTENANCE_FLAG                yes
     ```

Set the MONITOR_INTERVAL in seconds to specify how often the partition or instance is monitored. For example,

```
MONITOR_INTERVAL                30
```

Set the TIME_OUT variable to the time that the toolkit must wait for completion of a normal shut down, before initiating a forceful halt of the application. For example,

```
TIME_OUT                        30
```

Set the monitored_subnet variables to the subnet that is monitored for the package. Set the monitored_subnet_access variable to full if the subnet is available on all nodes, else set it to partial.

```
monitored_subnet_access         full
```

Set the variables for adding the package relocatable IP address. For example,

```
ip_subnet          x.x.x.x
```

Set the ip_subnet_node to the node names where the subnet is valid. For example,

```
ip_subnet_node                  node1
               ip_subnet_node                   node2
```

Set theip_address to a valid package IP. For example,

```
ip_address                      x.x.x.x
```

Create a separate vg variable for each volume group. For example,

```
vg          vg_dd0
```

Create a separate fs_name, fs_directory, fs_type, and fs_mount_opt variables for each database partition. For example,

```
fs_name                         /dev/vg_dd0/lvol1
fs_directory                    /dbpath/db2_payroll_inst/NODE0000
fs_type                         "ext3"
fs_mount_opt                    "-o rw"
fs_umount_opt                   ""
fs_fsck_opt                     ""
fs_name                         /dev/vg_dd0/lvol2
fs_directory                    /dbpath/db2_payroll_inst2/NODE0001
fs_type                         "ext3"
fs_mount_opt                    "-o rw"
fs_umount_opt                   ""
fs_fsck_opt                     ""
```

The example above defines the variable for two database partitions that is, partition 0 and partition 1, NODE0000 and NODE0001. The variables are named NODE0000 in accordance with DB2 directory structure.

5. Use `cmcheckconf` command to check for the validity of the configuration specified. For example,

   ```
   #cmcheckconf -P pkg.conf
   ```

6. If the `cmcheckconf` command does not report any errors, use the `cmapplyconf` command to add the package into Serviceguard environment. For example,

   ```
   #cmapplyconf -P pkg.conf
   ```

Creating Serviceguard package using legacy method.

- Create the Serviceguard package using legacy method.

  Follow these steps to create Serviceguard package using legacy method.

```
mkdir  /etc/cmcluster/pkg/db2_pkg/
Copy the toolkit files from db2
cd /etc/cmcluster/pkg/db2_pkg/
cp /opt/cmcluster/toolkit/db2/* ./
```

  Create a configuration file (pkg.conf) and package control script pkg.cntl) as follows:

```
cmmakepkg -p pkg.conf
cmmakepkg -s pkg.cntl
```

  NOTE: There should be one set of configuration and control script files for each DB2 instance.

  The Serviceguard package control script (pkg.cntl).

  Below are some examples of modifications to the Serviceguard package control script you need to make to customize to your environment.

  - **VOLUME GROUPS**

    Define the volume groups that are used by the DB2 instance. File systems associated with these volume groups are defined as follows:

```
VG[0]=/dev/vg0_payroll
```

    For example:

```
VG[0]=/dev/vg0_payroll
```

    Define the file systems which are used by the DB2 instance.

    NOTE: One of these file systems must be the shared file system/logical volume containing the DB2 home configuration information ($DB2_HOME). The name of the instance is used to name the volume groups, logical volumes and file systems. For example,

```
LV[0]=/dev/vg0_payroll/lvol1
FS[0]=/mnt/payroll
```

    The service name must be the same as defined in the package configuration file. Always call the toolkit.sh script with "monitor" for the SERVICE_CMD definitions. For example,

```
SERVICE_NAME[0]=payroll_inst_service
SERVICE_CMD[0]="/etc/cmcluster/pkg/db2_pkg/tookit.sh monitor"
SERVICE_RESTART[0]="-r 3
```

    Edit the `customer_defined_run_cmds` function to execute the toolkit.sh script with the start option. For example,

```
function customer_defined_run_cmds
     {
     # Start the DB2 database.

       /etc/cmcluster/pkg/db2_pkg/toolkit.sh start

       test_return 51
     }
```

    Edit the `customer_defined_halt_cmds` function to execute the toolkit.sh script with the stop option. For example,

```
     function customer_defined_halt_cmds
     {
```

```
        /etc/cmcluster/pkg/db2_pkg/toolkit.sh stop

        test_return 52
    }
```

The Serviceguard package configuration file (pkg.conf).

The package configuration file is created with `cmmakepkg -p`, and should be put in the following location:

`/etc/cmcluster/pkg/db2_pkg/`

For example:

`/etc/cmcluster/pkg/db2_pkg/pkg.conf`

The configuration file should be edited as indicated by the comments in that file. The package name needs to be unique within the cluster. For clarity, use the name of the database instance to name the package.

```
PACKAGE_NAME  db2_payroll
```

For example:

```
PACKAGE_NAME                    db2_payroll
```

List the names of the clustered nodes to be configured to run the package, using the *NODE_NAME* parameter:

```
NODE_NAME                       node1
NODE_NAME                       node2
```

The service name must match the service name used in the package control script. The service name can include the DB2 instance name (that is, $DB2_INSTANCE). In the following example, since there is only one service for this package, the ${DB2_INSTANCE} (that is,payroll_inst) is assigned to the *SERVICE_NAME* parameter. For example,

```
SERVICE_NAME                    payroll_inst_service
SERVICE_FAIL_FAST_ENABLED       NO
SERVICE_HALT_TIMEOUT            300
```

The run and halt scripts are (typically) identified as the control script, as follows:

```
RUN_SCRIPT  /etc/cmcluster/pkg/db2_pkg/pkg.cntl
HALT_SCRIPT /etc/cmcluster/pkg/db2_pkg/pkg.cntl
```

The DB2 Configuration file, in the package directory, modify the `hadb2.conf` configuration file for this DB2 instance. Edit the `hadb2.conf` as indicated by the comments in that script. For example,

```
INSTANCE_NAME=db2_payroll_inst
PARTITION_NUMBER[0]=0
PARTITION_NUMBER[1]=1
MONITOR_PROCESSES[0]=db2sysc
MONITOR_PROCESSES[1]=db2acd
MAINTENANCE_FLAG=YES
MONITOR_INTERVAL=30
TIME_OUT=30
```

After setting up the Serviceguard environment, each clustered DB2 instance should have the following files in the related package directory. For example, the DB2 package, located at `/etc/cmcluster/pkg/db2_pkg`, would contain the following files:

Table 12 DB2 Package Files

File Name	Description
`$PKG.cntl`	Serviceguard package control script for legacy packaging style.
`$PKG.conf`	Serviceguard package configuration file.
`hadb2.sh`	Main shell script of the toolkit.
`hadb2.mon`	Monitor the health of the application.
`hadb2.conf`	Toolkit DB2 configuration file.
`toolkit.sh`	Interface between pkg.cntl and hadb2.sh.

Adding the Package to the Cluster

After the setup is complete, add the package to the SG cluster and start it up.

```
cmapplyconf -P pkg.conf
cmmodpkg -e -n <node1> –n <node2> db2_payroll
cmmodpkg –e db2_payroll
```

For more information, see *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* .

Database Maintenance

Sometimes, when the DB2 database has to be taken down for maintenance purposes like changing configuration, without having the instance to migrate to standby node. The following procedure should be used:

NOTE: The example assumes that the package name is db2_payroll, package directory is `/etc/cmcluster/pkg/db2_pkg`.

- Disable the failover of the package through the `cmmodpkg` command:

  ```
  $ cmmodpkg -d db2_payroll
  ```

- Pause the monitor script.

  Create an empty file `/etc/cmcluster/pkg/db2_pkg/db2.debug`, as shown below:

  ```
  $ touch /etc/cmcluster/pkg/db2_pkg/db2.debug
  ```

  The toolkit monitor script (database instances) that continuously monitosr DB2 partitions would now stop monitoring these partitions.

  The message, "DB2 toolkit pausing, monitoring, and entering maintenance mode", appears in the Serviceguard Package Control script log in case of legacy packages and package configuration log file in case of modular style of packaging.

- If required, stop the DB2 database instance as shown below:

  ```
  $ cd /etc/cmcluster/pkg/db2_pkg/
  $ $PWD/toolkit.sh stop
  ```

- Perform maintenance actions (For example, changing the configuration parameters in the parameter file of the DB2 instance. If this file is changed, remember to distribute the new file to all cluster nodes).
- Start the DB2 database instance again if you have stopped it:

```
$ cd /etc/cmcluster/pkg/db2_pkg/
$ $PWD/toolkit.sh start
```

- Enable monitoring scripts to continue monitoring by removing `db2.debug` file:

  ```
  $ rm -f /etc/cmcluster/pkg/db2_pkg/db2.debug
  ```

  The message "Starting DB2 toolkit monitoring again after maintenance" appears in the Serviceguard Package Control script log.

- Enable the package failover:

  ```
  $ cmmodpkg -e db2_payroll
  ```

If the package fails during maintenance (for example, the node crashes) the package will not automatically fail over to an adoptive node. It is the responsibility of the user to start the package up on an adoptive node. For more information, see *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* .

This feature is enabled only when the configuration variable `MAINTENANCE_FLAG` is set to "yes" in the DB2 toolkit configuration file.

5 Using MySQL Toolkit in a HP Serviceguard Cluster

This chapter describes the MySQL Toolkit for use in the HP Serviceguard environment. The ideal audience is of those who want to configure the MySQL Database Server application toolkit under HP Serviceguard cluster environment using MySQL Toolkit. This toolkit supports the Enterpise MySQL Database Server Application 5.0.56 and later.

It is assumed that readers are already familiar with the HP Serviceguard cluster configuration as well as MySQL Database server concepts and their installation and configuration procedures.

NOTE: This toolkit supports:

- HP Serviceguard versions
  - A.11.19
  - A.11.20
- HP-UX 11i v2 and HP-UX 11i v3

At the time of publication, this version supports the above mentioned SG, application, and HP-UX versions. More recent versions of these products may be certified with B.06.00. For the latest information, see the compatibility matrix available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* .

NOTE: This version of the toolkit supports both, legacy and modular style packages, but this version of the toolkit is not supported with VxVM and CFS.

This toolkit consists of a set of shell scripts used by a Package Control Script to start, stop, and monitor the MySQL Database Server. The toolkit works with the Serviceguard package control script, managed by Serviceguard in case of legacy packages and Serviceguard master control script in case of modular packages. Each MySQL Database server instance is configured in its own Serviceguard package. This chapter assumes that users have used swinstall to properly install both Serviceguard and the Enterprise Cluster Master Toolkit (ECMT), which includes the scripts for MySQL.

For legacy packages, there will be one user configuration script (`hamysql.conf`) and three functional scripts (`toolkit.sh, hamysql.sh, hamysql.mon`) which work with each other to integrate MySQL with the Serviceguard package control scripts.

For modular packages, there is an Attribute Definition File (ADF), a Toolkit Module Script (`tkit_module.sh`) and a Toolkit Configuration File Generator Script (`tkit_gen.sh`) which work with the four scripts mentioned above for legacy packages to integrate MySQL with the Serviceguard Master Control Script.

During ECMT installation, you can use the files listed in Table 13 (page 87). The following files are located in: `/opt/cmcluster/toolkit/mysql`.

Table 13 Files in Legacy Packages in MySQL

File Name	Description
`README`	The contents of the README file have been moved to this user guide.
`hamysql.conf`	User defined variables for configuring MySQL in a specific environment.
`hamysql.sh`	The main shell script.
`hamysql.mon`	Script to monitor MySQL to ensure it is running.
`toolkit.sh`	Interface between the Serviceguard package control script and hamysql.sh in case of legacy packages and interface between the Serviceguard master control script and hamysql.sh in case of modular packages.

The following three files are also installed and they are used only for the modular method of packaging.

The following Attribute Definition File (ADF) is installed in `/etc/cmcluster/modules/ecmt/mysql`.

Table 14 ADF File in Modular Package in MySQL

File Name	Description
`mysql.1`	For every parameter in the legacy toolkit user configuration file, there is an attribute in the ADF. It also has an additional attribute TKIT_DIR which is analogous to the package directory in the legacy method of packaging. The ADF is used to generate a modular package ASCII template file.

For the alert mail notification feature, an additional parameter called *`ALERT_MAIL_ID`* is introduced in the ADF. *`ALERT_MAIL_ID`* sends an e-mail message to the specified e-mail address when packages fail. This e-mail is generated only when packages fail, and not when a package is halted by the operator. To send this e-mail message to multiple recipients, a group e-mail ID must be created and specified for this parameter. When an e-mail ID is not specified for this parameter, the script does not send out this e-mail.

The following files are located in `/etc/cmcluster/scripts/ecmt/mysql` after installation:

Table 15 Script Files

File Name	Description
`tkit_module.sh`	This script is called by the Master Control Script and acts as an interface between the Master Control Script and the Toolkit interface script (toolkit.sh). It is responsible for calling the Toolkit Configuration File Generator Script .
`tkit_gen.sh`	This script is called by the Module Script when the package configuration is applied using `cmapplyconf` to generate the toolkit user configuration file in the package directory (TKIT_DIR).

The MySQL database server must be installed on all nodes that will run the MySQL Packages in the HP Serviceguard Cluster. The node where this runs is termed as PRIMARY node. The other nodes that are ready to take up the service in case of failure are termed as STANDBY nodes. The MySQL Database Server application runs on the primary node servicing MySQL Database requests from clients. In an event of a failure on the primary node, the package will fail over to the standby node. This means that all necessary configuration information on all nodes must be identical and the resources must be available to all supporting nodes. The data must be stored on shared disks and these disks must be accessible by the same pathnames on each node.

MySQL database server supports multiple DB instances running on the same node. This toolkit helps in creating multiple MySQL packages. Each package corresponds to a separate DB server instance with its own database, toolkit files, and configuration.

MySQL Package Configuration Overview

The database server can be configured in two different ways:

- Local Configuration— by putting the configuration files on a single node, then replicating the files to all other nodes in the cluster.
- Shared Configuration —by putting the configuration files in a shared filesystem.

Local Configuration

If you decide to store the configuration files on a local disk, the configuration must be replicated to local disks on all nodes configured to run the package. If any change is made to the configuration, the file must be copied to all nodes. As it is up to the user to ensure the systems remain synchronized, the recommendation is to put all configuration and data files on shared storage.

Shared Configuration

This is the recommended configuration. Here, the configuration and database files are on shared disks, visible to all nodes. Since the storage is shared, there is no additional work to ensure all nodes have the same configuration at any point in time.

To run MySQL in a HP Serviceguard environment:

- Each node must have the same version of the MySQL Database Server software installed.
- Each node that will be configured to run the package must have access to the configuration files. The most efficient way to ensure all nodes have access to the configuration files is to put the configuration files on shared storage that is accessible to all nodes.
- Multiple databases configured in the same cluster will require unique configuration per database. Each DB instance will require its own volume group, set of configuration files, and copy of the toolkit customized for the unique instance.
- All data files must be accessible to all nodes configured to run the package. This means that all data files will need to reside on shared storage that is accessible to all nodes.
- Each package is assigned an IP address called the relocatable (or package) IP address.

When the package fails over from one node to another, the following actions occur:

- Primary Node
  1. The package is halted on the node where it is currently running. As a result, all (package) resources are halted.
  2. The relocatable IP address is removed from this node.
  3. File systems are unmounted and all volume groups assigned to this package are deactivated.
- Standby Node
  1. Volume groups are activated and file systems are mounted.
  2. The relocatable IP address is moved over to the new node.
  3. All resources are started up, and the database is brought up.
  4. Clients will (continue to) connect through the same (relocatable) IP address.

Multiple Database Instances

MySQL database server supports multiple DB instances running on the same node. Using the toolkit, multiple MySQL packages can be easily configured to run on the same node. One copy of the toolkit can serve exactly one package. So, to configure multiple packages, you must create separate directories, that is, one directory per package and configure each package to run a unique database instance.

Setting Up The Database Server Application

Before creating the packages, you must configure the shared storage and create the database.

1. For the volume group (VG) and file system creation, see *Building an HA Cluster Configuration* chapter of *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard*. Create a unique VG and filesystem on shared storage for each instance of the DB to be included in the configuration.
2. On each node, create a mount point for each filesystem. The mount point for a specified instance/package must be the same for all nodes.

The following example shows a configuration of MySQL for a filesystem named "/MySQL_1" on /dev/vg01.

1. Assuming that LVM has been set up on the shared storage, create a filesystem (for example, /MySQL_1) on the LV and mount point (for example,., /MySQL_1) on each of the nodes to mount the filesystem. For more information in creating the VG and filesystem, see to *Building*

an HA Cluster Configuration chapter of *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* .

2. Following the instructions in the documentation for MySQL, create a database on the lvol in /MySQL_1. This information may be viewed online at the following link http://www.mysql.com/documentation/mysql/bychapter/manual_Tutorial.html#Creating_database.
3. Copy the configuration file `/etc/my.cnf to /MySQL_1/my.cnf.`
4. Modify `/MySQL_1/my.cnf` to configure the DB for your unique environment. Changes may include specific assignments to the following parameters:

```
[mysqld]
* datadir=/MySQL_1/mysql
* socket=/MySQL_1/mysql/mysql.sock
* port=<UNIQUE PORT NUMBER>
 mysqld_safe]
* err-log=/MySQL_1/mysql/mysqld.err
* pid-file=/etc/cmcluster/pkg/mysql1/mysqld.pid
```

Since each database instance resides in its own filesystem, multiple database instances can be configured in the environment using this method.

Setting Up MySQL with the Toolkit

Toolkit Overview

The following files, in Table 16 (page 90), are included in the toolkit for MySQL:

Table 16 Files in MySQL toolkit

File Name	Description
`README`	The contents of the README file have been moved to this user guide.
`toolkit.sh`	Toolkit Interface Script. This script interfaces between the Package Control Script and the toolkit main script (hamysql.sh).
`hamysql.conf`	Toolkit Configuration File. This file contains a list of pre-defined variables that may be changed for your unique environment.
`hamysql.sh`	Toolkit Main Script. Contains the internal functions that support start/stop of a MySQL instance.
`hamysql.mon`	Toolkit Monitor Script. Contains the internal functions for monitoring a DB server instance.

The following scripts, in Table 17 (page 90) , are used only during the modular method of packaging.

Table 17 Scripts used in Modular Method of Packaging

File Name	Description
`Attribute Definition File (mysql)`	For every parameter in the legacy toolkit user configuration file, there is an attribute in the ADF. It also has an additional attribute TKIT_DIR which is analogous to the package directory in the legacy method of packaging. The ADF is used to generate a package ASCII template file.
`Module Script (tkit_module.sh)`	This script is called by the Master Control Script and acts as an interface between the Master Control Script and the Toolkit interface script (toolkit.sh). It is also responsible for calling the Toolkit Configuration File Generator Script (see description below).
`Toolkit Configuration File Generator Script (tkit_gen.sh)`	Toolkit Configuration File. This file contains a list of pre-defined variables that may be changed for your unique environment.

MySQL Configuration File (my.cnf)

The following parameters are contained in the configuration file `/etc/my.cnf`. This file must be copied to the file system on the shared storage (in our for example, `/etc/my.cnf` would be copied to `/MySQL_1/my.conf`). Then parameters need to be manually set with unique values for each DB instance configured.

Table 18 Parameters in MySQL Configuration File (my.cnf)

File/Directory name	Description
`[mysqld]`	
`datadir=/MySQL_1/mysql`	# Data Directory for MySQL DB
`socket=/MySQL_1/mysql/mysql.sock`	# Socket file for Client # Communication
`port=3310`	# Port Number for Client # Communication
`[mysqld_safe]`	
`err-log=/MySQL_1/mysql/mysqld.`	# Safe-mysqld's # Error Log file
`pid-file=/etc/cmcluster/pkg/MySQL1/mysqld.pid`	# pid file Path

NOTE: `mysqld_safe` was previously known as `safe_mysqld`. For an older version of MySQL, the user needs to modify suitable sections in the `my.cnf` file.

To run MySQL toolkit with the older versions of the MySQL follow the steps below:

1. Create a soft link named “mysqld_safe" in the MySQL, installation directory (typically `/usr/bin` for RH to point to "safe_mysqld".

   ```
   CMD> ln -s /usr/bin/mysqld_safe /usr/bin/safe_mysqld
   ```

2. Grant the execute permission to the newly created link:

   ```
   CMD> chmod 755 mysqld_safe
   ```

The following sections in this chapter describe the legacy mode of Serviceguard packages. For information on creating the Serviceguard package using the modular method, see the whitepaper *Modular package support in Serviceguard for Linux and ECM Toolkits* available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard Enterprise Cluster Master Toolkit*.

Toolkit Configuration File (hamysql.conf)

All the toolkit user configuration variables are stored in a single file - hamysql.conf, in Shell script format. User variables and sample values are included below, in Table 19 (page 92).

Table 19 User Variables in hamysql.conf file

File name	Description
CONFIGURATION_FILE_PATH="/MySQL_1/mysql/my.cnf" or DATA_DIRECTORY="/MySQL_1/mysql"	Only one of the two variables (either CONFIGURATION_FILE_PATH or DATA_DIRECTORY) should be defined. If both are defined, CONFIGURATION_FILE_PATH is used and DATA_DIRECTORY is ignored. **NOTE:** If DATA_DIRECTORY is used, my.cnf MUST reside in the DATA_DIRECTORY location. This directory is also used as the data directory for this instance of the database server.
PID_FILE="/var/run/mysql/mysqld.pid"	This is the path where PID file for the MySQL daemon is created for the Parent PID. If this variable is defined, it overrides the "pid-file" defined in the MySQL configuration file my.cnf. The PID identified in this file is monitored by the toolkit monitor, "hamysql.mon".
MAINTENANCE_FLAG (for example, MAINTENANCE_FLAG="yes")	This variable will enable or disable maintenance mode for the MySQL package. By default this is set to "yes". In order to disable this feature MAINTENANCE_FLAG should be set to "no". When MySQL needs to be maintained, the file <package directory>/mysql.debug needs to be touched. During this maintenance period, the MySQL process monitoring is paused. Even if the MySQL instance is brought down the package will not be failed over to the adoptive node. To continue monitoring and turn off maintenance mode, you should remove the mysql.debugfile. The user should ensure that the MySQL instance is running properly before exiting the maintenance phase, since monitoring of the instance will resume once out of the maintenance phase.
RETRY_TIMES=0	This variable is recommended to be set to "0". This will multiply the SERVICE_RESTART of the MySQL package service (monitor). For example, If the package service is set to SERVICE_RESTART = 2 & RETRY_TIMES=2 then actual retries = (SERVICE_RESTART + 1) * RETRY_TIMES.
MONITOR_INTERVAL=5 # Seconds.	This is the interval at which hamysql.mon will monitor the process with PID in the PID_FILE (mysqld parent process).

The time unit granularity is seconds. So, setting MONITOR_INTERVAL=5 means the parent process is monitored every 5 seconds.

Package Configuration File and Control Script

The following steps identify the changes needed to the Serviceguard package configuration file and control script templates to customize them for your specific configuration. This information was extracted from the chapter entitled "Configuring Packages and Their Services" of the *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* manual. For detailed information on configuring and managing a package, please refer to the "Managing Serviceguard" manual.

The following parameters are either in the configuration file or control script as identified below, and must be manually edited for your unique environment. In the followingTable 20 (page 92), values are assigned for a package named "mysql_1".

Table 20 Package Configuration File Parameters

Parameter Name [configuration file parameters]	Configuration file	Description
PACKAGE_NAME	mysql_1	# Package Name
NODE_NAME NODE_NAME	node1, node2	# nodes that can run the package
RUN_SCRIPT	<control script>	Script to start up the service

Table 20 Package Configuration File Parameters *(continued)*

Parameter Name [configuration file parameters]	Configuration file	Description
HALT_SCRIPT	<control script>	# Script to halt the service
SERVICE_NAME	"mysql_monitor"	# Service Name

Table 21 Package Control Script Parameters

Parameter Name [control script parameters]	Control script	Description
VG	vgMySQL	# VG created for this package
LV	/dev/vgMySQL/lvol1	# Logical vol created in VT
FS	/MySQL_1	# File system for DB
FS_TYPE	"ext2"	# FS type is "Extended 2"
FS_MOUNT_OPT	"-o rw"	# mount with read/write options
SUBNET	"192.70.183.0"	# Package Subnet
IP	"192.70.183.171"	# Relocatable IP

#The service name must be the same as defined in the package.

#configuration file.

SERVICE_NAME="mysql1_monitor"

SERVICE_CMD="/etc/cmcluster/pkg/MYSQL1/toolkit.sh monitor"

SERVICE_RESTART="-r 0"

In addition to the variables, modify the following functions in the package control script:

Table 22 Functions in Package Control Script

Functions in Package Control Script	Change
customer_defined_run_cmds	Replace the "empty" line (": #do nothing...") with `/etc/cmcluster/pkg/MySQL1/toolkit.sh start.`
customer_defined_halt_cmds	Replace the "empty" line (": #do nothing...") with `/etc/cmcluster/pkg/MySQL1/toolkit.sh stop.`
customer_defined_halt_cmds	Replace the "empty" line (": #do nothing...") with `/etc/cmcluster/pkg/MySQL1/toolkit.sh stop.`

Assuming the cluster has already been configured, edit the cluster configuration file to update the "MAX_CONFIGURED_PACKAGES" (for example, increase MAX_CONFIGURED_PACKAGES by the number of packages you are adding to the cluster). After editing the configuration file apply the change via the `cmapplyconf -C <cluster_config_file>` command.

Distribute the cluster configuration file to all the nodes of the cluster using rcp (this is optional but recommended).

The cluster has been updated so that you can add packages. To actually bring the cluster up, issue the command `cmruncl`, then `cmviewcl` to see the cluster up and running.

For more information on cluster configuration, management, and maintenance, see *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* manual.

Creating Serviceguard package using Modular method.

Follow the steps below to create Serviceguard package using Modular method:

1. Create a directory for the package.

   ```
   #mkdir /etc/cmcluster/pkg/mysql_pkg/
   ```

2. Copy the toolkit template and script files from mysql directory.

   ```
   #cd /etc/cmcluster/pkg/mysql_pkg/
   #cp /opt/cmcluster/toolkit/mysql/* ./
   ```

3. Create a configuration file (pkg.conf) as follows.

   ```
   #cmmakepkg -m ecmt/mysql/mysql pkg.conf
   ```

4. Edit the package configuration file.

   NOTE: Mysql toolkit configuration parameters in the package configuration file have been prefixed by `ecmt/mysql/mysql` when used in Serviceguard A.11.19.00.

   For Example:

   ```
   /etc/cmcluster/pkg/mysql_pkg/pkg.conf
   ```

   The configuration file should be edited as indicated by the comments in that file. The package name needs to be unique within the cluster.

   For Example:

   ```
   PACKAGE_NAME mysql
   NODE_NAME node1
   NODE_NAME node2
   ```

   Set the `TKIT_DIR` variable as the path of <package_directory>. For example, `TKIT_DIR /etc/cmcluster/pkg/pkg01`.

5. Use `cmcheckconf` command to check for the validity of the configuration specified.

   For Example:

   ```
   #cmcheckconf -P pkg.conf
   ```

6. If the `cmcheckconf` command does not report any errors, use the `cmapplyconf` command to add the package into Serviceguard environment.

   For Example:

   ```
   #cmapplyconf -P pkg.conf
   ```

Applying the Configuration and Running the Package

After the database is set upon the shared storage, configure the toolkit and package.

1. Create a directory in the cmcluster directory for each package (for example, `/etc/cmcluster/pkg/MySQL1`).
2. Copy the toolkit files from `/opt/cmcluster/toolkit/mysql` to the package directory (`/etc/cmcluster/pkg/MySQL1`), and change directory to the package directory.
3. Configure `hamysql.conf` for your unique configuration as described in the section entitled "Toolkit Configuration File (hamysql.conf)" (page 91) of this document.
4. In the package directory, generate the package configuration and control templates with `cmmakepkg` command.

   For example:

   ```
   cmmakepkg -p MySQL1.conf (configuration template)
   ```

   For example:

```
cmmakepkg -s MySQL1.cntl (control template)
```

5. Using any editor modify the package templates with your specific information, as described in the preceding section"Package Configuration File and Control Script" (page 92) of this chapter.
6. Change the owner and group of the package directory to the "mysql" user.

   For Example:

   chown mysql:mysql /etc/cmcluster/pkg/MySQL1
7. Ensure both root and mysql users have read, write, and execute permissions for the package directory.
8. Distribute the package directory to all nodes in the cluster.
9. Apply the Serviceguard package configuration using the command `cmapplyconf -P MySQL1.conf`
10. Enable package switching for MySQL package using:

```
cmmodpkg -e -n node1 -n node2 mysql_1
         cmmodpkg -e mysql_1
```

11. The package should now be running. If it is not, start the package by issuing the `cmrunpkg` command.

    cmrunpkg mysql_1

    Repeat these procedures to create multiple MySQL instances running in the Serviceguard environment.

Database Maintenance

There might be situations, when the MySQL database has to be taken down for maintenance purposes like changing configuration, without having the instance to migrate to standby node. The following procedure should be followed during maintenance:

NOTE: The example assumes that the package name is mysql_1, package directory is `/etc/cmcluster/pkg/MySQL1` and the MySQL DATADIR is configured as`/MySQL_1/mysql`.

- Disable the failover of the package through the `cmmodpkg` command.

  $ cmmodpkg -d mysql_1
- Pause the monitor script.

  Create an empty file `/etc/cmcluster/pkg/MySQL1/mysql.debug` as shown below:

  $ touch /etc/cmcluster/pkg/MySQL1/mysql.debug

  Toolkit monitor script which continuously monitors MySQL process, would now stop monitoring this daemon process. A message "MySQL toolkit pausing monitoring and entering maintenance mode" appears in the Serviceguard Package Control script log.
- If required, stop the MySQL database instance as shown below:

  `$ /etc/cmcluster/pkg/MySQL1/toolkit.sh stop`
- Perform maintenance actions (For example, changing the configuration parameters in the parameter file of the MySQL instance. If this file is changed, remember to distribute the new file to all cluster nodes).
- Start the MySQL database instance again if you stopped it:

  `$ /etc/cmcluster/pkg/MySQL1/toolkit.sh start`
- Allow monitoring scripts to continue normally as shown below:

  `$ rm -f /etc/cmcluster/pkg/MySQL1/mysql.debug`

A message "Starting MySQL toolkit monitoring again after maintenance" appears in the Serviceguard Package Control script log.

- Enable the package failover.

```
$ cmmodpkg -e mysql_1
```

NOTE: If the package fails during maintenance (for example, the node crashes), the package will not automatically fail over to an adoptive node. It is the responsibility of the user to start the package up on an adoptive node. Please refer to the manual *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* for more details.

This feature is enabled only when the configuration variable `MAINTENANCE_FLAG` is set to "yes" in the MySQL toolkit configuration file.

Do's and Don't with MySQL Toolkit

Each of the Toolkits are designed with few assumptions that integrate with the respective application and with HP Serviceguard. It is recommended to follow the below mentioned guidelines for setting up the Package using MySQL Toolkit:

Do's

1. Name the package name, and the package configuration file name, Package control script name in a consistent and self-explanatory protocol.

   For example, PACKAGE NAME mysql1

   Package configuration file `mysql1.ascii`

   Package control script mysql1.cntl
2. Keep the package configuration file, package control file, and toolkit files in separate directories for each of the packages.
3. Add <Package directory path> /toolkit.sh start | stop in the customer_defined_run_cmds | customer_defined_halt_cmds functions respectively for the MySQL toolkit.
4. Ensure that the `toolkit.sh, hamysql.sh, hamysql.mon` and package control script have execute permission.

Don'ts

Do not enable "HA_APP_SERVER" in package control script for each of the MySQL packages.

For example, #HA_APP_SERVER="pre-IP"

#HA_APP_SERVER="post-IP"

6 Using an Apache Toolkit in a HP Serviceguard Cluster

This chapter describes the toolkit that integrates and runs HP Apache in the HP Serviceguard environment. This chapter is intended for users who want to install, configure, and execute the Apache web server application in a Serviceguard clustered environment. It is assumed that users of this document are familiar with Serviceguard and the Apache web server, including installation, configuration, and execution.

NOTE: This toolkit supports:

- HP Serviceguard versions
  - A.11.19
  - A.11.20
- Apache version that is available with HP Web Server Suite(WSS) 2.X and 3.X and,
- HP-UX 11i v2 and HP-UX 11i v3

At the time of publication, this version supports the above mentioned SG, application, and HPUX versions. More recent versions of these products may be certified with B.06.00. For the latest information, see the compatibility matrix available at: http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard*

NOTE: This version of the toolkit supports both, legacy and modular style packages.

Unless otherwise stated, this toolkit supports all filesystems, storage and volume managers that Serviceguard supports.

This toolkit includes support for the following:

- HP Serviceguard A.11.19 with VERITAS Cluster File System (CFS) 5.0 on HP-UX 11i v2, and HP-UX 11i v3.
- HP Serviceguard A.11.19 with CFS 5.0.1 on HP-UX 11i v3.
- HP Serviceguard A.11.20 with CFS 5.1 SP1 on HP-UX 11i v3

To use CFS, install the appropriate version of HP Serviceguard Storage Management Suite. For more details see the Serviceguard Release Notes at: http://www.hp.com/go/hpux-serviceguard-docs ->*Serviceguard and the Storage Management Suite Release Notes* .

This toolkit consists of a set of shell scripts for configuring, starting, monitoring, and stopping the Apache web server application. The toolkit works with the Serviceguard package control script, managed by Serviceguard in case of legacy packages and Serviceguard master control script in case of modular packages. Each Apache instance is configured in its own Serviceguard package. This chapter assumes that users have used swinstall to properly install both Serviceguard and the Enterprise Cluster Master Toolkit (referred to as the ECMT), which includes the scripts for Apache. Table 23 (page 97) lists the files needed during installation, that are in `/opt/cmcluster/toolkit/apache`.

Table 23 Files in Apache Toolkit

File Name	Description
`README`	The content of this README has been moved to this user guide.
`hahttp.conf`	User defined variables for customizing this toolkit for your environment.
`hahttp.sh`	The main shell script.
`hahttp.mon`	Script that monitors the health of the Server application.

Table 23 Files in Apache Toolkit *(continued)*

File Name	Description
`toolkit.sh`	Interface between the package control script and the Apache Toolkit main shell script.
`SGAlert.sh`	This generates the Alert mail based on package failure

The following three files, listed in Table 24 (page 98) are also installed and they are used only for the modular method of packaging. The following Attribute Definition File (ADF) is installed in /etc/cmcluster/modules/ecmt/apache.

Table 24 Files in Modular Method Packaging

File Name	Description
tkit_module.sh	This script is called by the Master Control Script and acts as an interface between the Master Control Script and the Toolkit interface script (toolkit.sh). It is responsible for calling the Toolkit Configuration File Generator Script (described below).
tkit_gen.sh	The `tkit_gen.sh` file is located in `/etc/cmcluster/scripts/ecmt/apache` after installation. This script is called by the Module Script when the package configuration is applied using 'cmapplyconf' to generate the toolkit user configuration file in the package directory (TKIT_DIR).
`apache.1`	The `apache.1` file is located in `/etc/cmcluster/scripts/ecmt/apache` after installation. For every parameter in the legacy toolkit user configuration file, there is an attribute in the ADF. It also has an additional attribute TKIT_DIR which is analogous to the package directory in the legacy method of packaging. The ADF is used to generate a modular package ASCII template file.

The HP-UX Web Server suite, which includes the Apache application, has to be installed on all nodes that will be configured to run the package. A typical clustered configuration for an Apache Web Server application is configuring one node as a primary node and the other nodes as standby nodes. The application runs on the primary node accepting HTTP/HTTPS requests, sending responses to the clients. In the event of a failure on the primary node, a standby node will take over the application. This means that all necessary configuration information on each node must be identical and the resources must be available to all supporting nodes. The dynamic web pages and shared data must be stored on shared disks and these disks must be accessible to each node.

Apache Web Server supports multiple instances of the server daemons running on a node simultaneously. Each Apache package corresponds to a separate Apache server instance with its own SERVER_ROOT directory. SERVER_ROOT is a user configurable variable present in the toolkit user configuration file `hahttp.conf`. Each instance may support one or more web sites, depending on whether or not it has been configured to use "virtual hosts".

After Apache has been installed, the SERVER_ROOT directory defines an Apache server instance. This directory will contain the appropriate configuration file directory named "conf" that specifies how an Apache server instance is configured. The Apache configuration directives within this file will determine locations of log files, web documents, and domain name address for a specific Apache server instance.

NOTE: In an HP-UX 11.x environment, the Apache server is usually installed in the location `/opt/hpws22/apache` and the configuration file `httpd.conf` resides in the "conf" sub-directory under the "SERVER ROOT" directory.

Apache Package Configuration Overview

Apache starts up by reading the `httpd.conf` file from the "conf" sub-directory of the SERVER_ROOT directory which is configured in the toolkit user configuration file `hahttp.conf`. Configuration rules include the following:

- Each node must have the same version of the HP-UX based Apache Web Server.
- Each node must have the same SERVER_ROOT directory where identical copies of the configuration file for each instance are placed.
- Each node must have the same document root directory where identical copies of the web document for each instance are placed.

Apache Web Server can be configured in two different ways:

- (local config) by putting the configuration and other web-site files on a single node, then replicating the files to all other nodes in the cluster
- (shared config) with document root files (and optionally, configuration file) in a shared file system

Local Configuration

In a typical local configuration, nothing is shared between the nodes. Identical copies of the Apache server configuration file and web documents reside in exactly the same locations on each node. The user is responsible for maintaining identical copies of the apache components on the different nodes. This is useful when the information on the web-page is static.

If the user chooses to do this, it is the user's responsibility to ensure the data is propagated to all nodes, and is consistently maintained. A disadvantage of storing the configuration on local disks is that this can increase the chance of the configuration for an Apache instance becoming inconsistent if changes are made, but not distributed to all nodes that can run that Apache instance.

Shared Configuration

In a typical shared configuration, the document root directories are all on the shared file system. (Placing the SERVER_ROOT directory in the shared file system is optional.) Since the web documents (along with the apache configuration file) are on shared storage - accessible to all nodes in the cluster - there is no need to maintain local identical copies of the files on each node. The mount point of the shared file system should be identical across all the Apache package nodes. Hence this is the recommended Apache package configuration.

Each web site is assigned IP addresses (or domain addresses that maps to particular IP addresses) through the configuration file. These relocatable IP addresses are created for each Apache package and added to its Package Control Script in case of legacy packages or the Package ASCII file in case of modular packages. When the Apache package is switched over from one node to another, this particular instance is stopped and IP addresses are removed on the primary node, then the IP addresses are reallocated and the instance is started on the adoptive node. Clients will then be automatically connected through these IP addresses to the web site on the adoptive node.

Multiple Apache Instances Configuration

Apache Web Server is a multi-instance application, which means more than one instance of the Apache Web Server can run on a single node at the same time. For example, if two nodes are each running an instance of Apache and one node fails, the Apache instance on the failed node can be successfully failed over to the healthy node. In addition, the healthy node can continue to

run its own instance as well. Multiple Apache instance configuration can either be done as a local configuration or shared configuration or a combination of both.

Configuring the Apache Web Server with Serviceguard

To manage an Apache Web Server by Serviceguard, the default Apache configuration needs to be modified. Before creating and configuring Serviceguard packages, make sure that the following configurations have been completed for the Apache Web Server application for all cluster nodes:

When the Apache Server is installed, the default instance may be automatically configured to be started during system startup via the runlevel (rc) script "hpws22_apacheconf" in the /etc/rc.config.d/ directory by setting "HPWS22_APACHE_START=1". You should make sure this is disabled by setting "HPWS22_APACHE_START=0".

The `httpd.conf` file associated with the default Apache instance has a Listen directive "Listen 80", which is equivalent to listening for all IP addresses at port 80. If an Apache instance needs to be configured so that it listens to specific IP Addresses, this has to be changed to "Listen <IP Address> <Port>".

NOTE: The default configuration file is available at: `/opt/hpws22/apache/conf/httpd.conf`

You should disable the automatic start of the standard Apache default installation if Apache is run from Serviceguard so that nothing is running on the server at the system startup time.

You must create a separate, distinct SERVER_ROOT directory for each Apache Serviceguard package.

You must configure all Apache instances to listen to package re-locatable IP addresses using BindAddress or Listen directives. (Refer to the Apache Web Server documentation for detailed information on configuring virtual hosts.) For example, the configuration file for an Apache instance that combines IP-based and name-based virtual hosts would include following directive:

```
Listen 192.168.0.1:80
Listen 192.168.0.2:80
NameVirtualHost 192.168.0.2:80

<VirtualHost web.site1.url:80>
ServerName web.site1.url
DocumentRoot /shared/httpd/www-site1
</VirtualHost>

<VirtualHost web.site2.url:80>
ServerName web.site2.url
DocumentRoot /shared/httpd/www-site2
</VirtualHost>
```

Local Configuration

For a local configuration, install and configure Apache in the same location on the primary and all backup nodes and set up identical (or equivalent) configuration files in the same server root directory on all nodes. Also, all document root directories must exist on all nodes and should contain identical files.

For a shared configuration, typically configure document root directory on shared file system. Note that one or more shared file systems may be used. Ensure that all required components which are on shared storage will be available at the same time. (It is not mandatory to place the SERVER_ROOT directory on a shared file system in order to make use of shared storage. Choose a local SERVER_ROOT directory for configuration files and place only the document root directories on a shared file system. However, configure identical SERVER_ROOT directories and identical configuration files on all nodes.)

Shared Configuration

To configure a shared file system which is managed by LVM, create volume group(s) and logical volume(s) on the shared disks and construct a new file system for each logical volume for the Apache Web Server document root (and server root).

Static web data such as web pages with no data update features may reside on local disk. However, all web data that needs to be shared must reside on shared storage. This data may contain dynamic data generated and updated by a client's HTTP POST request.

The following is an example of configuring an Apache instance that uses shared storage for all Apache instance data. The procedures below assume that all Apache instance files are configured on a shared file system `/shared/apache_1` directory, which resides on a logical volume "lvol1" from a shared volume group "/dev/vg01":

1. Create a Volume Group "vg01" for a shared storage.
2. Create a Logical Volume "lvol1" on the volume group "vg01".
3. Construct a new file system on the Logical Volume "lvol1".
4. Create a directory named `/shared/apache_1` on a local disk. Repeat this step on all nodes configured to run the package.
5. Mount device `/dev/vg01/lvol1` to the `/shared/apache_1`.
6. Copy all files from `/opt/hpws22/apache/conf` to `/shared/apache_1/conf`.
7. Create a directory "logs" under the `/shared/apache_1/`.
8. Create a symbolic link between `/shared/apache_1/modules` and `/opt/hpws22/apache/modules`.
9. Update the Apache configuration files present in `/shared/apache_1/conf` directory and change the Apache instance configurations to suit your requirement.

To configure a shared file system which is managed by VxVM, create disk group(s) and logical volume(s) on the shared disks and construct a new file system for each logical volume for the Apache Web Server document root (and server root).

The following is an example of configuring the above steps using VxVM:

1. Create a Disk Group "DG_00" on the shared storage.
2. Create Logical volume "LV_00" on the Disk Group "DG_00".
3. Construct a new file system on the Logical Volume "LV_00".
4. Create a directory named /shared/apache_1 on a local disk. Repeat this step on all nodes configured to run the package.
5. Mount device "/dev/vx/dsk/DG_00/LV_00" on "/shared/apache_1"

Follow steps 6 to 9 described above.

Multiple Apache instances can be configured in the cluster using the same method. See *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* for more detailed instruction on creating volumes and logical volumes.

To configure an Apache Web Server package in a CFS environment, the SG CFS packages need to be running in order for the Apache package to access CFS mounted file systems. See *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* for information on how to configure SG CFS packages. Create a directory /shared/apache on all cluster nodes. Mount the CFS filesystem on /shared/apache to hold necessary files and configuration information.

In a Veritas Cluster File System environment Apache Web Server can be configured in the following two ways:

Active - Active

In an active-active configuration, multiple nodes can run an Apache instance concurrently serving the same document root. To coordinate the startup and shutdown of Apache instances with cluster

node startup and shutdown, create a one-node package for each node that runs an Apache instance.

Active - Passive

In an active-passive configuration, an instance of Apache Web Server can run on only one node at any time. A package of this configuration is a typical failover package. The active - passive support on CFS comes with a caution or limitation that, when an Apache instance is up on one node, no attempts should be made to start the same instance of Apache on any another node.

NOTE: In both active-active and active-passive Apache configurations the Apache installation on all nodes reside on the single shared CFS mount point. For complete details on how to setup Apache Web server on CFS, please refer the Apache whitepaper on CFS or CVM support referenced from the ECMT Release Notes of this version.

Under shared configuration, choose to put Apache binaries as well in shared file system. This can be configured by 2 methods:

To create a shared configuration for the Apache Web Server on the shared file system mounted at /mnt/apache:

Method #1

1. Create the shared storage that will be used to store the apache files for all nodes configured to run the Apache package. Once that storage has been configured, create the mount point for that shared storage on these nodes. For this example, the mount point is `/mnt/apache`.
2. Copy all files from `/opt/hpws22/apache` to `/mnt/apache` on any one node.
3. Remove or rename `/opt/hpws22/apache` on all nodes configured to run the apache package.
4. Create a symbolic link between `/opt/hpws22/apache` and `/mnt/apache` on all nodes configured to run the package.

Method #2

1. Create the shared storage that will be used to store the apache files for all nodes configured to run the Apache package. Once that storage has been configured, create the mount point for that shared storage on these nodes. For this example, the mount point is `/mnt/apache`.
2. On any one node in the cluster that is configured to run the package, activate the shared storage and mount it at the mount point `/mnt/apache`. Copy the Apache files to the shared storage using the altroot.sh utility:$ /opt/hpws22/util/altroot.sh -apache /mnt/apache Besides moving the files in the /opt/hpws22/apache directory to the new directory /mnt/apache, one additional apache file will need to be copied to all the other nodes in the cluster that are configured to run the package. The next step explains which file needs to be moved.
3. On the same node as above, copy the following file to the other nodes in the cluster that are configured to run the package: `/etc/rc.config.d/hpws22_apacheconf`.
4. On the other nodes in the cluster remove or rename the /opt/hpws22/apache directory if desired.
5. Now configure the `hahttp.conf` file as required for the Apache Server package on all nodes in case of legacy packages and the Apache toolkit parameters in the package ASCII file in case of modular packages.

NOTE: The following sections describe the method for creating the Serviceguard package using the legacy method. For information on creating the Serviceguard package using the modular method, see the white paper *Modular package support in Serviceguard for Linux and ECM Toolkits* available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard Enterprise Cluster Master Toolkit*

Setting up the package

The following procedures include the steps to configure a Serviceguard package running the Apache instance, which includes customizing the Serviceguard package configuration file and package control script. (See *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* " for more detailed instructions on cluster configuration.

The procedures below assume that the user is configuring a Serviceguard Apache package named "http_pkg1", consisting of one service named "http1_monitor". The Apache instance is listening to a relocatable IP address "192.168.0.201" and all of its configuration and document files are on a file system "/shared/apache_1" directory, which resides on a logical volume "lvol1" in a shared volume group "/dev/vg01". Here, it is assumed that the user has already determined the Serviceguard cluster configuration, including cluster name, node names, heartbeat IP addresses, and so on. See the *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* for more detail.

NOTE: To increase the number of packages that may be added to this cluster, modify the cluster configuration file and set the variable MAX_CONFIGURED_PACKAGES to reflect the number of packages to be added to the cluster. After the edit, apply the change to the cluster via `cmapplyconf -C` cluster_config_file

Before working on the package configuration, create a directory (for example, `/etc/cmcluster/pkg/http_pkg1`) for this package to run. This directory should belong to a single Apache package. Copy all Apache toolkit scripts from the directory `/opt/cmcluster/toolkit/apache` to the package directory.

For example:

```
$ mkdir /etc/cmcluster/pkg/http_pkg1
$ cd/etc/cmcluster/pkg/http_pkg1
$ cp/opt/cmcluster/toolkit/apache/*.
```

To create both the package configuration (`http_pkg.conf`) and package control (`http_pkg.cntl`) files, cd to the package directory (example, cd /etc/cmcluster/pkg/http_pkg1).

1. Create a Serviceguard package control file with command `cmmakepkg -s http_pkg.cntl`. The package control file must be edited as indicated by the comments in that file. The package control file must be customized to your environment.

   For Example:

   ```
   PACKAGE_NAME     http_pkg1
   NODE_NAME        node1
   NODE_NAME        node2
   ```

NOTE: When configuring an Active - Active configuration the package configuration file should hold the name of that single node only on which the instance will run. For example, on node1, NODE_NAME parameter in the package configuration file would be edited as NODE NAME node1 and in node2 as, NODE NAME node2

```
RUN_SCRIPT    /etc/cmcluster/pkg/http_pkg1/http_pkg.cntl
RUN_SCRIPT    /etc/cmcluster/pkg/http_pkg1/http_pkg.cntl
HALT_SCRIPT   /etc/cmcluster/pkg/http_pkg1/http_pkg.cntl
SERVICE_NAME http1_monitor
```

If CFS mounted file system is used configure dependency of this Apache package on SG CFS package. If the Apache package is configured to depend on a SG CFS package, the Apache package will run as long as the dependee package is running. If the dependee package fails, then the dependent Apache package will also fail.

To configure the dependency of the Apache package, set the following configurable parameters in the package configuration file:

```
DEPENDENCY_NAME
http1_dependency
DEPENDENCY_CONDITION    SG-CFS-MP-1 = up
DEPENDENCY_LOCATION     SAME_NODE
```

2. Create a Serviceguard package control file with command `cmmakepkg -s http_pkg.cntl`. The package control file must be edited as indicated by the comments in that file. The package control file must be customized to your environment.

   #The service name must be the same as defined in the package #configuration file.

   For example:

```
 LVM  |       VxVM
        -----  |      ------
    |
    VG[0]="vg01"   | VXVM_DG[0]="DG_00"
    |
    LV[0]="/dev/vg01/lvol1"     | LV[0]="/dev/vx/dsk/DG_00/LV_00
    FS[0]="/shared/apache1"    | FS[0]="/shared/apache1"
    FS_TYPE[0]="vxfs"   | FS_TYPE[0]="vxfs"
    FS_MOUNT_OPT[0]="-o rw" | FS_MOUNT_OPT[0]="-o rw"


    IP[0]="192.168.1"
    SUBNET[0]="192.168.0.0"

SERVICE_NAME="http1_monitor"
SERVICE_CMD="/etc/cmcluster/pkg/http_pkg1/toolkit.sh  monitor"
SERVICE_RESTART="-r 0"
```

   Edit the `customer_defined_run_cmds` function to execute the toolkit.sh script with the start option. In the example below, the line `/etc/cmcluster/pkg/http_pkg1/toolkit.sh start` was added, and the ":" null command line deleted.

   Edit the customer_defined_halt_cmds function to execute the toolkit.sh script with the stop option. In the example below, the line `/etc/cmcluster/pkg/http_pkg1/toolkit.sh stop` was added, and the ":" null command line deleted.

   For example:

```
function customer_defined_run_cmds
     {
     # Start the Apache Web Server.
```

```
        /etc/cmcluster/pkg/http_pkg1/toolkit.sh start

        test_return 51
      }
```

For example:

```
function customer_defined_halt_cmds
      {
        # Stop the Apache Web Server.

        /etc/cmcluster/pkg/http_pkg1/toolkit.sh stop

        test_return 51
      }
```

NOTE: If CFS mounted file systems are used then volume groups, logical volumes and file systems must not be configured in the package control script but dependency on SG CFS packages must be configured.

3. Configure the Apache user configuration file `hahttp.conf` as explained in the next section.
4. Copy this package configuration directory to all other package nodes.

Use the same procedure to create multiple Apache packages (multiple Apache instances) that will be running on the cluster.

Setting up The Toolkit

Toolkit Overview

After installing the toolkit, four scripts and one README file will be installed in the location `/opt/cmcluster/toolkit/apache`. Two more scripts and one file will be installed which will be used only for modular packages. The two scripts will be in the `/etc/cmcluster/scripts/ecmt/apache` directory. The third file will be in the `/etc/cmcluster/modules/ecmt/apache` directory.

For legacy packages, one user configuration script (`hahttp.conf`) and three functional scripts (toolkit.sh, hahttp.sh and hahttp.mon) will work together to integrate Apache web server with the Serviceguard package control script.

Table 25 (page 105) lists the scripts used in legacy packages are:

Table 25 Scripts in Legacy Packages

Script Name	Description
User Configuration file (hahttp.conf)	This script contains a list of pre-defined variables that may be customized for the user's environment. This script provides the user a simple format of the user configuration data. This file will be included (that is, sourced) by the toolkit main script hahttp.sh.
Main Script (hahttp.sh)	This script contains a list of internal-use variables and functions that support the start and stop of an Apache instance. This script will be called by the Toolkit Interface Script to do the following: • On package start, it starts the Apache server instance. • On package stop, it stops the Apache server instance.
Monitor Script (hahttp.mon)	Monitoring functionality will be initiated by calling the toolkit with the "monitor" parameter as "toolkit.sh monitor".
Interface Script (toolkit.sh)	This script is an interface between the Serviceguard package control script and the toolkit main script (hahttp.sh).

Toolkit User Configuration

All the user configuration variables are kept in a single file `hahttp.conf` in shell script format. The variable names and their sample values are listed in Table 26 (page 106):

Table 26 Configuration Variables

Configuration Variables	Description
`HP_APACHE_HOME` (for example, HP_APACHE_HOME="/opt/hpws22/apache")	This is the base directory where HP Apache web server is installed. By default HP Apache is installed in the directory `/opt/hpws22/apache` and hence this is also the default value.
`SERVER_ROOT` (for example, SERVER_ROOT="/opt/hpws22/apache")	This variable holds the root directory of an Apache server instance. Each Apache instance must have its own root directory that contains its own server configuration file (`httpd.conf`). The Apache's system default server root directory is `/opt/hpws22/apache`. However, to have multiple instances running in a cluster, set a value for this variable.
`PID_FILE` (for example, PID_FILE="/var/run/httpd_s1.pid")	This variable holds the Process ID file path of the Apache server instance. Each Apache instance must have its own PID file that keeps the main process ID of the running Apache server instance. If this variable is not set then the PID file is assumed to be <package_directory>/httpd.pid.
`SSL` (for example: SSL="no")	When this variable is set to "yes" the Apache web server runs in secured mode where the Apache web server can listen to HTTPS requests otherwise. When set to "no" Apache web server is started in non secure mode and Apache can only listen to HTTP requests.
`MAINTENANCE_FLAG` (for example, MAINTENANCE_FLAG ="yes")	This variable will enable or disable maintenance mode for the Apache package. By default this is set to "yes". In order to disable this feature `MAINTENANCE_FLAG` should be set to "no". When Apache needs to be maintained the file "<package directory apache.debug" needs to be touched. During this maintenance period apache process monitoring is paused. Even if the apache instance is brought down the package will not be failed over to the adoptive node. To continue monitoring and turn off maintenance mode, remove the `apache.debug` file. It is the user's responsibility to ensure that the Apache instance is running properly after the maintenance phase. **NOTE:** Setting `MAINTENANCE_FLAG` to "yes" and touching the `apache.debug` file in the package directory will put the package in toolkit maintenance mode. Serviceguard A.11.19 release has a new feature which allows individual components of the package to be maintained while the package is still up. This feature is called Package Maintenance mode and is available only for modular packages. For more information using Package Maintenance mode, see the*Modular package support in Serviceguard for Linux and ECM Toolkits* available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard Enterprise Cluster Master Toolkit*
`MONITOR_INTERVAL` (for example, MONITOR_INTERVAL=5)	This is the tomcat server listening port. This should be same as the port configured in the Tomcat configuration file `$CATALINA_BASE/conf/server.xml`. The toolkit checks the existence of the Tomcat process by periodically checking whether this port is listening. If multiple instances of tomcat are configured, this port needs be unique for each instance. The default value is 8081.
`MONITOR_INTERVAL` (for example, MONITOR_INTERVAL=5)	This variable holds a time interval (in seconds) for monitoring the Apache instance. That is, the monitor process checks the running of httpd daemons every 'interval' seconds. If not defined, its default value will be 5 seconds.
`RETRY_TIMES` (for example, RETRY_TIMES=2)	This variable holds the number of times to attempt to check the 'httpd' daemon processes before giving up and exiting to fail state. If not defined, its default value will be 2.

For the alert mail notification feature, an additional parameter called *`ALERT_MAIL_ID`* is introduced in the ADF. *`ALERT_MAIL_ID`* sends an e-mail message to the specified e-mail address when

packages fail. This e-mail is generated only when packages fail, and not when a package is halted by the operator. To send this e-mail message to multiple recipients, a groupe-maill ID must be created and specified for this parameter. When e-mail ID is not specified for this parameter, the script does not send out this e-mail.

The following information provides the steps for configuring the toolkit and running the package. This includes configuring the Apache toolkit user configuration file.

NOTE: Before working on the toolkit configuration, the package directory (for example, `/etc/cmcluster/pkg/http_pkg1`) must be created and all toolkit scripts copied to the package directory.

1. Edit the Apache Toolkit user configuration file.

   In the package directory, edit the user configuration file (`hahttp.conf`) as indicated by the comments in that file.

   For example:

```
SERVER_ROOT="/shared/apache1/httpd"
PID_FILE="/var/run/httpd1.pid"
SSL="yes"
MAINTENANCE_FLAG="yes"
```

2. Copy the entire package directory at the same path on all nodes configured for the package.

   For this example, each package node must have the following files in the package directory:

```
http_pkg.conf        #Package configuration file
http_pkg.cntl        #Package control file
hahttp.conf          #Apache toolkit user configuration file
hahttp.mon           #Apache toolkit monitor program
hahttp.sh            #Apache toolkit main script
toolkit.sh           #Interface file between the package
                     #control file and the toolkit
```

3. Apply the Serviceguard package configuration using the command `cmapplyconf -P http_pkg.conf`.

   Use the same procedures to create multiple Apache instances for Serviceguard packages that will be running on the cluster.

Creating Serviceguard package using Modular method.

Follow the steps below to create Serviceguard package using Modular method:

1. Create a directory for the package.

```
#mkdir /etc/cmcluster/pkg/apache_pkg/
```

2. Copy the toolkit template and script files from apache directory.

```
#cd /etc/cmcluster/pkg/apache_pkg/
#cp /opt/cmcluster/toolkit/apache/* ./
```

3. Create a configuration file (pkg.conf) as follows.

```
#cmmakepkg -m ecmt/apache/apache pkg.conf
```

4. Edit the package configuration file.

   NOTE: Apache toolkit configuration parameters in the package configuration file have been prefixed by `ecmt/apache/apache` when used in Serviceguard A.11.19.00 or later.

   For Example:

```
/etc/cmcluster/pkg/apache_pkg/pkg.conf
```

The configuration file should be edited as indicated by the comments in that file. The package name needs to be unique within the cluster.

For Example:

```
PACKAGE_NAME apache
NODE_NAME node1
NODE_NAME node2
```

Set the `TKIT_DIR` variable as the path of <package_directory>. For example, `TKIT_DIR /etc/cmcluster/pkg/apache_pkg`.

5. Use `cmcheckconf` command to check for the validity of the configuration specified.

   For Example:

   ```
   #cmcheckconf -P pkg.conf
   ```

6. If the `cmcheckconf` command does not report any errors, use the `cmapplyconf` command to add the package into Serviceguard environment.

   For Example:

   ```
   #cmapplyconf -P pkg.conf
   ```

Error Handling

On startup, the Apache server application will check for the existence of the `httpd.conf` file in the directory `<SERVER ROOT>/conf/httpd.conf`. If the configuration file does not exist in this location or Apache does not start for some other reason the action by the Apache toolkit script is to halt the package on that node and try it on another node. In order to troubleshoot why Apache has not been started correctly one has to look at the Apache error log files. The Apache log files can be located by the value set for the ErrorLog directive in the Apache instance configuration file `httpd.conf`. Usually this value is <SERVER ROOT>/logs/error_log.

Apache Web Server Maintenance

There might be situations, when the Apache Web Server has to be taken down for maintenance purposes like changing the configuration, without having the instance to migrate to another node. This procedure should be followed:

NOTE: The example assumes that the package name is http_pkg1, package directory is `/etc/cmcluster/pkg/http_pkg1` and the Apache SERVER ROOT is configured as `/shared/apache1/httpd`.

- Disable the failover of the package through `cmmodpkg` command `cmmodpkg -d http_pkg1`
- Pause the monitor script. Create an empty file, `/etc/cmcluster/pkg/http_pkg1/apache.debug`, as shown below:

  `touch/etc/cmcluster/pkg/http_pkg1/apache.debug`.

  The toolkit monitor script which continuously monitored the Apache daemons, would now stop monitoring these daemons. A message "Apache toolkit pausing monitoring and entering maintenance mode" is logged in the package control script log.

  - If required, stop the apache application as shown below:

    `cd /etc/cmcluster/pkg/http_pkg1/ $PWD/toolkit.sh stop`

  - Perform maintenance actions (for example, changing the configuration of the Apache instance, or making changes to the toolkit configuration file, `hahttp.conf` for starting up Apache web server application in secured mode. If this file is changed, remember to distribute the new file to all cluster nodes).

- Start the apache instance again if stopped, `cd /etc/cmcluster/pkg/http_pkg1/$PWD/toolkit.sh start`
- Allow monitoring scripts to continue normally as shown below:

  `rm -f /etc/cmcluster/pkg/http_pkg1/apache.debug`

  A message "Starting Apache toolkit monitoring again after maintenance" appears in the Serviceguard Package Control script log.
- Enable the package failover

  `cmmodpkg -e http_pkg1`

NOTE: If the package fails during maintenance (for example, the node crashes), it will not automatically fail over to an adoptive node. It is the responsibility of the user to start the package up on an adoptive node. See *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* for more details

This feature is enabled only when the configuration variable, `MAINTENANCE_FLAG`, is set to "yes" in the apache toolkit configuration file: `/etc/cmcluster/pkg/http_pkg1/hahttp.conf`

---

7 Using Tomcat Toolkit in a HP Serviceguard Cluster

This chapter describes the toolkit that integrates and runs HP Tomcat in the HP Serviceguard environment. It is intended for users who want to install, configure, and execute the Tomcat servlet engine application in a Serviceguard clustered environment. It is assumed that users of this document are familiar with Serviceguard and the Tomcat Servlet engine, including installation, configuration, and execution.

This toolkit supports:

HP Serviceguard versions:

- A.11.19
- A.11.20

Tomcat version that is available with HP Web Server Suite (WSS)

- 2.X and 3.X

HP-UX 11i v2 and HP-UX 11i v3

At time of publication, this version supports the above mentioned SG, application and HPUX versions. More recent versions of these products may be certified with B.06.00. For the latest information, see the compatibility matrix available at: http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* .

NOTE: This version of the toolkit supports both, legacy and modular style packages.

NOTE: Unless otherwise stated, this toolkit supports all filesystems, storage and volume managers that Serviceguard supports other than CFS.

This toolkit consists of a set of shell scripts for configuring, starting, monitoring, and stopping the Tomcat Servlet engine application. The toolkit works with the Serviceguard package control script, managed by Serviceguard in case of legacy packages or the Serviceguard master control script in case of modular packages. Each Tomcat instance is configured in its own Serviceguard package. This chapter assumes that users have used swinstall to properly install both Serviceguard and the Enterprise Cluster Master Toolkit (referred to as the ECMT), which includes the scripts for Tomcat.

During installation, you can use these files, listed in Table 27 (page 110). They are located in: `/opt/cmcluster/toolkit/tomcat`

Table 27 Files in Tomcat Toolkit

File Name	Description
`hatomcat.conf`	User defined variables for customizing this toolkit for your environment.
`hatomcat.mon`	The script that monitors the health of the Server application.
`toolkit.sh`	The interface between the package control script and the Tomcat Toolkit main shell script.
`SGAlert.sh`	This script generates Alert mails in case of package failure.

The following three files in Table 28 (page 111) and Table 29 (page 111) are also installed and they are used only for the modular method of packaging.

The following Attribute Definition File (ADF) is installed in `/etc/cmcluster/modules/ecmt/tomcat`.

Table 28 ADF File for Modular Method of Packaging

File Name	Description
`tomcat.1`	For every parameter in the legacy toolkit user configuration file, there is an attribute in the ADF. It also has an additional attribute TKIT_DIR which is analogous to the package directory in the legacy method of packaging. The ADF is used to generate a modular package ASCII template file.

The following files are located in `/etc/cmcluster/scripts/ecmt/tomcat` after installation.

Table 29 Files For Modular Method of Packaging

File Name	Description
`tkit_module.sh`	This script is called by the Master Control Script and acts as an interface between the Master Control Script and the Toolkit interface script (toolkit.sh). It is responsible for calling the Toolkit Configuration File Generator Script (described below).
`tkit_gen.sh`	This script is called by the Module Script when the package configuration is applied using `cmapplyconf` to generate the toolkit user configuration file in the package directory (TKIT_DIR).

The HP-UX Web Server suite, which includes the Tomcat application, has to be installed on all nodes that will be configured to run the package. A typical clustered configuration for a Tomcat Servlet engine application is configuring one node as a primary node and the other nodes as standby nodes. The application runs on the primary node accepting client requests and sending responses to the clients. In the event of a failure on the primary node, a standby node will take over the application. This means that all necessary configuration information on each node must be identical and the resources must be available to all supporting nodes. The dynamic web pages and shared data must be stored on shared disks and these disks must be accessible to each node.

The Tomcat Servlet engine supports multiple instances of the server daemons running on a node simultaneously. Each Tomcat package corresponds to a separate Tomcat server instance with its own CATALINA_BASE directory. CATALINA_BASE is a user configurable variable present in the toolkit user configuration file `hatomcat.conf`. After Tomcat has been installed, the CATALINA_BASE directory defines a Tomcat server instance. This directory will contain the appropriate configuration files directory named "conf" that specifies how a Tomcat server instance is configured. The Tomcat configuration directives, within this file, will determine locations of log files, web documents, and the domain name address for a specific Tomcat server instance.

Tomcat will calculate all relative references for files in the following directories based on the value for CATALINA_BASE instead of CATALINA_HOME:

- **conf** - Server configuration files (including server.xml).
- **logs** - Log and output files.
- **webapps** - Automatically loaded web applications.
- **work** - Temporary working directories for web applications.
- **temp** - Directory used by the JVM for temporary files (java.io.tmpdir)

If you do not set CATALINA_BASE to an explicit value, it will be initialized to the same value as is set for CATALINA_HOME (which means that the same directory is used for all relative path resolutions).

NOTE: In an HP-UX 11.x environment, the Tomcat server is usually installed in the location `/opt/hpws22/tomcat` and the default configuration file `server.xml` resides in the `conf` sub-directory under this directory. If HP-UX WSS 2.X is installed, then the Tomcat server will be installed in the location `/opt/hpws/tomcat`.

Tomcat Package Configuration Overview

Tomcat starts up by reading the `server.xml` file from the `conf` sub-directory of the `CATALINA_BASE` directory which is configured in the toolkit user configuration file `hatomcat.conf`.

The configuration rules include the following:

- Each node must have the same version of the HP-UX based Tomcat Servlet Engine.
- Each node must have the same CATALINA_BASE directory where identical copies of the configuration file for each instance are placed.
- Each node must have the same document root directory where identical copies of the web document for each instance are placed.

Tomcat servlet engine can be configured in two different ways:

- **Local Config**: Putting the configuration and other web-site files on a single node, and then replicating the files to all other nodes in the cluster
- **Shared config**: with configuration files and document root files in a shared file system

NOTE: Under a shared configuration, you can choose to put tomcat binaries as well in a shared file system. The steps to configure this is covered in this document later.

Local Configuration

In a typical local configuration, nothing is shared between the nodes. Identical copies of the Tomcat server configuration file and web documents reside in exactly the same locations on each node. The user is responsible for maintaining identical copies of the tomcat components on the different nodes. This is useful when the information on the web-page is static.

If the user chooses to use this configuration, it is the user's responsibility to ensure the data is propagated to all nodes, and is consistently maintained. A disadvantage of storing the configuration on local disks is that this can increase the chance of the configuration for a Tomcat instance becoming inconsistent if changes are made, but not distributed to all nodes that can run that Tomcat instance.

Shared Configuration

In a typical shared configuration, the web application directories are all on the shared file system. (Placing the CATALINA_BASE directory in the shared file system is optional.) Since the web applications (along with the tomcat configuration directory) are on shared storage - accessible to all nodes in the cluster - there is no need to maintain local identical copies of the files on each node. The mount point of the shared file system should be identical across all the tomcat package nodes. Hence this is the recommended Tomcat package configuration.

Each web site is assigned IP addresses (or domain addresses that maps to particular IP addresses) through the configuration file. These relocatable IP addresses are created for each Tomcat package. They are added to the Package Control Script in case of legacy packages or the Package ASCII file in case of modular packages. When the Tomcat package is switched over from one node to another, this particular instance is stopped and IP addresses are removed on the primary node, then the IP addresses are reallocated and the instance is started on the adoptive node. Clients will then be automatically connected through these IP addresses to the web site on the adoptive node.

Multiple Tomcat Instances Configuration

Tomcat servlet engine is a multi-instance application. More than one instance of the Tomcat can run on a single node simultaneously. For example, if two nodes are each running an instance of Tomcat and one node fails, the Tomcat instance on the failed node can be successfully failed over to the healthy node. In addition, the healthy node can continue to run its own instance as well. Multiple Tomcat instance configuration can either be done as a local configuration or shared configuration or a combination of both. CATALINA_BASE needs to be unique for each Tomcat instance.

Configuring the Tomcat server with Serviceguard

To manage a Tomcat Server with Serviceguard, the default Tomcat configuration needs to be modified. Before creating and configuring Serviceguard packages, make sure that the following configurations have been completed for the Tomcat Server application for all cluster nodes:

When the Tomcat Server is installed, the default instance may be automatically configured to be started during system startup via the runlevel (rc) script "hpws22_tomcatconf" in the /etc/rc.config.d/ directory by setting "HPWS22_TOMCAT_START=1". Make sure this is disabled by setting "HPWS22_TOMCAT_START=0".

The connector component to be used is defined as an element in the Tomcat server configuration file `server.xml`. The connector component has a port attribute that needs to be unique for each Tomcat instance.

NOTE: The default server configuration file is available at `/opt/hpws22/tomcat/conf/server.xml`. If WSS 2.x is installed it will be installed at `/opt/hpws22/tomcat/conf/server.xml`.

The default installation for Tomcat is set to automatic start, when configuring Tomcat with Serviceguard this should be disabled.

Create a separate, distinct CATALINA_BASE directory for each Tomcat Serviceguard package.

Configure all Tomcat instances to listen to package relocatable IP addresses. (Refer to the Tomcat Server documentation for detailed information on configuring virtual hosts.)

For a local configuration, install and configure the Tomcat in the same location on the primary and all backup nodes and set up identical (or equivalent) configuration files in the same server root directory on all nodes. Also, all web application directories must exist on all nodes and should contain identical files.

Shared Configuration

For a shared configuration, typically configure web application directories on a shared file system. Note that one or more shared file systems may be used. Ensure all required components that are on shared storage will be available at the same time. (It is not mandatory to place the CATALINA_BASE directory on a shared file system in order to make use of shared storage. Choose a local CATALINA_BASE directory for configuration files and place only the web application directories on a shared file system. However, configure identical CATALINA_BASE directories and identical configuration files on all nodes.)

1. **Using LVM**

   To configure a shared file system which is managed by LVM, create volume group(s) and logical volume(s) on the shared disks and construct a new file system for each logical volume for the Tomcat Server web applications (and CATALINA_BASE).

   Static web data such as web pages with no data update features, may reside on a local disk. However, all web data that needs to be shared must reside on shared storage. This data may contain dynamic data generated and updated by a client's HTTP POST request.

The following is an example of configuring a Tomcat instance that uses shared storage for all Tomcat instance data.

NOTE: The procedures below assume that configuring all Tomcat instance files on a shared file system "/shared/tomcat_1" directory, that resides on a logical volume "lvol1" from a shared volume group "/dev/vg01":

a. Create a Volume Group "vg01" for a shared storage.
b. Create a Logical Volume "lvol1" on the volume group "vg01".
c. Construct a new file system on the Logical Volume "lvol1".
d. Create a directory named "/shared/tomcat_1" on a local disk. Repeat this step on all nodes configured to run the package.
e. Mount device "/dev/vg01/lvol1" to the "/shared/tomcat_1".
f. Copy all files from "/opt/hpws22/tomcat/conf" to "/shared/tomcat_1/conf"
g. Create a directory "logs" under the "/shared/tomcat_1/".
h. Update the Tomcat configuration files present in "/shared/tomcat_1/conf" directory and change the Tomcat instance configurations to suit your requirement.

2. **Using VxVM**

To configure a shared file system which is managed by VxVM, create disk group(s) and logical volume(s) on the shared disks and construct a new file system for each logical volume for the Tomcat Web applications (and CATALINA_BASE).

The following is an example of configuring the above steps using VxVM:

a. Create a Disk Group "DG_00" on the shared storage.
b. Create Logical volume "LV_00" on the Disk Group "DG_00".
c. Construct a new file system on the Logical Volume "LV_00".
d. Create a directory "/shared/tomcat_1" on a local disk. Repeat this step on all nodes configured to run the package.
e. Mount device "/dev/vx/dsk/DG_00/LV_00" on "/shared/tomcat_1".

Configure multiple Tomcat instances in the cluster using the same method. See *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* " for more detailed instruction on creating volumes and logical volumes.

NOTE: As mentioned before, under shared configuration, you can choose to put the Tomcat binaries as well in a shared file system. This can be configured by 2 methods:

To create a shared configuration for the Tomcat Server on the shared file system mounted at /mnt/tomcat:

a. Method 1

1) Create the shared storage that will be used to store the Tomcat files for all nodes configured to run the Tomcat package. Once that storage has been configured, create the mount point for that shared storage on these nodes. For this example, the mount point is "/mnt/tomcat".

2) Copy all files from `/opt/hpws22/tomcat` to `/mnt/tomcat` on any one node.

3) Remove or rename `/opt/hpws22/tomcat` on all nodes configured to run the Tomcat package.

4) Create a symbolic link between `/opt/hpws22/tomcat` and `/mnt/tomcat` on all nodes configured to run the package.

b. Method 2

1) Create the shared storage that will be used to store the Tomcat files for all nodes configured to run the Tomcat package. Once that storage has been configured, create the mount point for that shared storage on these nodes. For this example, the mount point is "/mnt/tomcat".

2) On any one node in the cluster that is configured to run the package, activate the shared storage and mount it at the mount point "/mnt/tomcat". Copy the Tomcat files to the shared storage using the altroot.sh utility: `$ /opt/hpws22/util/altroot.sh --tomcat /mnt/tomcat`

Besides moving the files in the /opt/hpws22/tomcat directory to the new directory /mnt/tomcat, one additional Tomcat file will need to be copied to all the other nodes in the cluster that are configured to run the package. Step 3 explains which file needs to be moved.

3) On the same node as above, copy the following file to the other nodes in the cluster that are configured to run the package:`/etc/rc.config.d/hpws22_tomcatconf` .

4) On the other nodes in the cluster remove or rename the /opt/hpws22/tomcat directory if desired.

5) Now configure the `hatomcat.conf` file as required for the Tomcat Server package on all nodes in case of legacy packages and the Tomcat toolkit parameters in the package ASCII file in case of modular packages.

NOTE: The following sections describe the method for creating the Serviceguard package using the legacy method. For information on creating the Serviceguard package using the modular method, see the white paper *Modular package support in Serviceguard for Linux and ECM Toolkits* available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard Enterprise Cluster Master Toolkit*.

Setting Up The Package

The following procedures here show how to configure a Serviceguard package running the Tomcat instance, which includes customizing the Serviceguard package configuration file and package control script. See *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* for more detailed instructions on cluster configuration.

The procedures below assume that the user is configuring a Serviceguard Tomcat package named "tomcat_pkg1", consisting of one service named "tomcat1_monitor". The Tomcat instance is listening to a relocatable IP address "192.168.0.201" and all of its configuration and document files are

on a file system "/shared/tomcat_1" directory, that resides on a logical volume "lvol1" in a shared volume group "/dev/vg01". Here, it is assumed that the user has already determined the Serviceguard cluster configuration, including cluster name, node names, heartbeat IP addresses, and so on. See the *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* for more detail.

NOTE: To increase the number of packages that may be added to this cluster, modify the cluster configuration file and set the variable MAX_CONFIGURED_PACKAGES to reflect the number of packages to be added to the cluster. After the edit, apply the change to the cluster via `cmapplyconf -C cluster_config_file`.

Before working on the package configuration, create a directory (for example, `/etc/cmcluster/pkg/tomcat_pkg1`) for this package to run. This directory should belong to a single Tomcat package. Copy all Tomcat toolkit scripts from the directory `/opt/cmcluster/toolkit/tomcat` to the package directory.

To create both the package configuration (`tomcat_pkg.conf`) and package control (`tomcat_pkg.cntl`) files, cd to the package directory (example, cd /etc/cmcluster/pkg/tomcat_pkg1).

For Example:

$ mkdir /etc/cmcluster/pkg/tomcat_pkg1

$ cd /etc/cmcluster/pkg/tomcat_pkg1

$ cp /opt/cmcluster/toolkit/tomcat/*.

1. Create a Serviceguard package configuration file with the command `cmmakepkg -p tomcat_pkg1.conf`. The package configuration file `tomcat_pkg1.conf` must be edited as indicated by the comments in that file. The package name must be unique within the cluster.

   For Example:

```
PACKAGE_NAME    tomcat_pkg1
NODE_NAME    node1
NODE_NAME    node2
RUN_SCRIPT    /etc/cmcluster/pkg/tomcat_pkg1/http_pkg.cntl
HALT_SCRIPT   /etc/cmcluster/pkg/tomcat_pkg1/http_pkg.cntl
SERVICE_NAME tomcat1_monitor
```

2. Create a Serviceguard package control file with command `cmmakepkg -s tomcat_pkg.cntl`. The package control file must be edited as indicated by the comments in that file. The package control file must be customized to your environment.

Example 1 For example:

```
              LVM                |              VxVM
             -----               |             ------
                                 |
VG[0]="vg01"                     |       VXVM_DG[0]="DG_00"
                                 |
LV[0]="/dev/vg01/lvol1"          |       LV[0]="/dev/vx/dsk/DG_00/LV_00
FS[0]="/shared/tomcat_1"         |       FS[0]="/shared/tomcat_1"
FS_TYPE[0]="vxfs"                |       FS_TYPE[0]="vxfs"
FS_MOUNT_OPT[0]="-o rw"          |       FS_MOUNT_OPT[0]="-o rw"


IP[0]="192.168.0.1"
SUBNET[0]="192.168.0.0"
#The  service name must be the same as defined in the package
#configuration file.

SERVICE_NAME[0]="tomcat1_monitor"
SERVICE_CMD=[0]"/etc/cmcluster/pkg/tomcat_pkg1/toolkit.sh  monitor"
SERVICE_RESTART[0]="-r 0"

 Edit  the   customer_defined_run_cmds   function  to  execute   the
 toolkit.sh script with the start option.  In the example below, the
 line  "/etc/cmcluster/pkg/tomcat_pkg1/toolkit.sh  start" was added,
 and the ":"  null command line deleted.

 For example:

 function customer_defined_run_cmds
 {
 # Start the Tomcat Web Server.

   /etc/cmcluster/pkg/tomcat_pkg1/toolkit.sh start

   test_return 51
 }

 Edit  the   customer_defined_halt_cmds   function  to  execute  the
 toolkit.sh  script with the stop option.  In the example below, the
 line  "/etc/cmcluster/pkg/tomcat_pkg1/toolkit.sh  stop" was  added,
 and the ":"  null command line deleted.

 For example:

 function customer_defined_halt_cmds
 {
   # Stop the Tomcat Web Server.

   /etc/cmcluster/pkg/tomcat_pkg1/toolkit.sh stop

   test_return 51
 }
```

3. Configure the Tomcat user configuration file `hatomcat.conf` as explained in the next section.
4. Copy this package configuration directory to all other package nodes.

Use the same procedure to create multiple Tomcat packages (multiple Tomcat instances) that will be running on the cluster.

Creating Serviceguard package using Modular method.

Follow the steps below to create Serviceguard package using Modular method:

1. Create a directory for the package.

```
#mkdir /etc/cmcluster/pkg/tomcat_pkg/
```

2. Copy the toolkit template and script files from tomcat directory.

```
#cd /etc/cmcluster/pkg/tomcat_pkg/
#cp /opt/cmcluster/toolkit/tomcat/* ./
```

3. Create a configuration file (pkg.conf) as follows.

```
#cmmakepkg -m ecmt/tomcat/tomcat pkg.conf
```

4. Edit the package configuration file.

NOTE: Tomcat toolkit configuration parameters in the package configuration file have been prefixed by `ecmt/tomcat/tomcat` when used in Serviceguard A.11.19.00 or later.

For Example:

```
/etc/cmcluster/pkg/tomcat_pkg/pkg.conf
```

The configuration file should be edited as indicated by the comments in that file. The package name needs to be unique within the cluster.

For Example:

```
PACKAGE_NAME tomcat
NODE_NAME node1
NODE_NAME node2
```

Set the `TKIT_DIR` variable as the path of <package_directory>. For example, `TKIT_DIR /etc/cmcluster/pkg/tomcat_pkg`.

5. Use `cmcheckconf` command to check for the validity of the configuration specified.

For Example:

```
#cmcheckconf -P pkg.conf
```

6. If the `cmcheckconf` command does not report any errors, use the `cmapplyconf` command to add the package into Serviceguard environment.

For Example:

```
#cmapplyconf -P pkg.conf
```

Setting up The Toolkit

Toolkit Overview

After installing the toolkit, four scripts and one README file will be installed in the location `/opt/cmcluster/toolkit/tomcat`. Two more scripts and one file will be installed which will be used only for modular packages. The two scripts will be in the `/etc/cmcluster/scripts/ecmt/tomcat` directory. The third file will be in the `/etc/cmcluster/modules/ecmt/tomcat` the directory.

Table 30 (page 119) shows the scripts used in legacy packages are:

Table 30 Legal Package Scripts

Script Name	Description
User Configuration file (hatomcat.conf)	This script contains a list of pre-defined variables that may be customized for the user's environment. This script provides the user a simple format of the user configuration data. This file will be included (that is, sourced) by the toolkit main script hatomcat.sh.
Main Script (hatomcat.sh)	This script contains a list of internal-use variables and functions that support the start and stop of a Tomcat instance. This script will be called by the Toolkit Interface Script to do the following: • On package start; it starts the Tomcat server instance. • On package stop; it stops the Tomcat server instance.
Monitor Script (hatomcat.mon)	This script contains a list of internal variables and functions that supports monitoring of a Tomcat instance. Monitoring functionality will be initiated by calling the toolkit interface script with the "monitor" parameter.
Interface Script (toolkit.sh)	This script is an interface between the Serviceguard package control script and the toolkit main script (hatomcat.sh).

Toolkit User Configuration

All the user configuration variables are kept in a single file `hatomcat.conf` in shell script format. The variable names and their sample values are given below in Table 31 (page 119):

Table 31 User Configuration Variables

User Configuration Variables	Description
`CATALINA_HOME` (for example, CATALINA_HOME="/opt/hpws22/tomcat")	This is the base directory where HP Tomcat web server is installed. By default HP Tomcat is installed in the directory /opt/hpws22/tomcat and hence this is also the default value.
`CATALINA_BASE` (for example, CATALINA_BASE="/opt/hpws22/tomcat")	This variable holds the specific configuration file path of a Tomcat server instance. Each Tomcat instance must have its own configuration directory that contains its own server configuration file (`server.xml`). The Tomcat server default server root directory is "/opt/hpws22/tomcat". However, to have multiple instances running in a cluster, set a value for this variable.
`JAVA_HOME` (for example, JAVA_HOME=/opt/java1.5)	This is the base directory of Java Development kit. This software is a prerequisite for running Tomcat.

Table 31 User Configuration Variables *(continued)*

User Configuration Variables	Description
MAINTENANCE_FLAG (for example, MAINTENANCE_FLAG ="yes")	This variable will enable or disable maintenance mode for the Tomcat package. By default, this is set to "yes". In order to disable this feature, MAINTENANCE_FLAG should be set to "no". When Tomcat needs to be maintained the file, <package directory>/tomcat.debug needs to be touched. During this maintenance period, the tomcat process monitoring is paused. Even if the tomcat instance is brought down, the package will not be failed over to the adoptive node. To continue monitoring and turning off maintenance mode, remove the tomcat.debug file. It is the user's responsibility to ensure that the tomcat instance is running properly after the maintenance phase. **NOTE:** Setting MAINTENANCE_FLAG to "yes" and touching the tomcat.debug file in the package directory will put the package in toolkit maintenance mode. Serviceguard A.11.19 release has a new feature which allows individual components of the package to be maintained while the package is still up. This feature is called Package Maintenance mode and is available only for modular packages. For more information using Package Maintenance mode, see *Modular package support in Serviceguard for Linux and ECM Toolkits* available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard Enterprise Cluster Master Toolkit*.
MONITOR_PORT (for example: MONITOR_PORT=8081)	This is the tomcat server listening port. This should be as same as the port configured in the Tomcat configuration file $CATALINA_BASE/conf/server.xml. The toolkit checks the existence of the Tomcat process by periodically checking whether this port is listening. If multiple instances of tomcat are configured, this port needs be unique for each instance. The default value is 8081.
MONITOR_INTERVAL (for example, MONITOR_INTERVAL=5)	Specify a time interval in seconds for monitoring the Tomcat instance. The monitor process checks the Tomcat daemons at this interval to validate they are running. The default value will be 5 seconds.
RETRY_TIMES (for example, RETRY_TIMES=2)	This variable holds the number of times to attempt to check the 'tomcat' daemon processes before giving up and exiting to fail state. If not defined, its default value will be 2.

For the alert mail notification feature, an additional parameter called *ALERT_MAIL_ID* is introduced in the ADF. It sends an e-mail message to the specified e-mail address when packages fail. This e-mail is generated only when packages fail, and not when a package is halted by the operator. To send this e-mail message to multiple recipients, a group e-mail ID must be created and specified for this parameter. When an e-mail ID is not specified for this parameter, the script does not send out this e-mail.

The following information provides the steps for configuring the toolkit and running the package. This includes configuring the Tomcat toolkit user configuration file:

NOTE: Before working on the toolkit configuration, the package directory (for example, /etc/cmcluster/pkg/tomcat_pkg1) must be created and all toolkit scripts copied to the package directory.

1. Edit the Tomcat Toolkit user configuration file.

   In the package directory, edit the user configuration file (hatomcat.conf) as indicated by the comments in that file.

   For Example:

```
CATALINA_HOME="/opt/hpws22/tomcat"
CATALINA_BASE="/shared/tomcat_1"
```

```
MAINTENANCE_FLAG="yes"
MONITOR_PORT=8081
```

2. Distribute all package files in the package directory to the other package nodes. All nodes should have an identical file path for these files. For this example, each package node must have the following files in the package directory:

   For Example:

```
tomcat_pkg.conf          #Package configuration file
tomcat_pkg.cntl          #Package control file
hatomcat.conf            #Tomcat toolkit user configuration file
hatomcat.mon             #Tomcat toolkit monitor program
hatomcat.sh              #Tomcat toolkit main script
toolkit.sh               #Interface file between the package
                         #control file and the toolkit
```

3. Apply the Serviceguard package configuration using the command `cmapplyconf -P tomcat_pkg.conf`.

Use the same procedures to create multiple Tomcat instances for Serviceguard packages that will be running on the cluster.

Error Handling

On startup, the Tomcat server application will check for the existence of the `server.xml` file in the directory <CATALINA_BASE/conf>. If the configuration file does not exist in this location or if the Tomcat does not start for some other reason the action by the Tomcat toolkit script is to halt the package on that node and try it on another node. In order to troubleshoot why Tomcat has not been started correctly, one has to look at the Tomcat error log files. The Tomcat log files can be available at $CATALINA_BASE/logs directory.

Tomcat Server Maintenance

There might be situations, when the Tomcat Server has to be taken down for maintenance. For example, when a user wants to change configuration of Tomcat but does not want to migrate to another node. See the example that follows:

NOTE: The example assumes that the package name is tomcat_pkg1, package directory is `/etc/cmcluster/pkg/tomcat_pkg1` and the Tomcat CATALINA_BASE is configured as /shared/tomcat_1

1. Disable the failover of the package through the `cmmodpkg` command `cmmodpkg -d tomcat_pkg1`.
2. Pause the monitor script .
   - Create an empty file, `/etc/cmcluster/pkg/tomcat_pkg1/tomcat.debug` as, shown below:

     touch`/etc/cmcluster/pkg/tomcat_pkg1/tomcat.debug`

     The toolkit monitor script, which continuously monitored the Tomcat daemons, would now stop monitoring these daemons. A message "Tomcat toolkit pausing monitoring and entering maintenance mode" is logged in the package control script log.
3. If required stop the tomcat application as shown below:-

```
cd /etc/cmcluster/pkg/tomcat_pkg1/
$PWD/toolkit.sh stop
```

4. Perform maintenance actions (for example, changing the configuration of the Tomcat instance, or making changes to the toolkit configuration file, `hatomcat.conf`. If this file is changed, remember to distribute the new file to all cluster nodes).
5. Start the tomcat instance again if it is stopped using cd `/etc/cmcluster/pkg/tomcat_pkg1/ $PWD/toolkit.sh start`.
6. Allow monitoring scripts to continue normally as shown below:

   ```
   rm -f /etc/cmcluster/pkg/tomcat_pkg1/tomcat.debug
   ```

   A message "Starting Tomcat toolkit monitoring again after maintenance" appears in the Serviceguard Package Control script log.
7. Enable the package failover:

   ```
   cmmodpkg -e tomcat_pkg1
   ```

NOTE: If the package fails during maintenance (for example, the node crashes), the package will not automatically fail over to an adoptive node. It is the responsibility of the user to start the package up on an adoptive node. See *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* " for more details.

NOTE: This feature is enabled only when the configuration variable `MAINTENANCE_FLAG` is set to "yes" in the tomcat toolkit configuration file `/etc/cmcluster/pkg/tomcat_pkg1/hatomcat.conf`.

Configuring Apache web server with Tomcat in a single package

NOTE: This section contains details on configuring Apache web server with Tomcat in a single package only for the legacy method of packaging. For configuring Apache and Tomcat in a single package using the modular method of packaging, see whitepaper *Modular package support in Serviceguard for Linux and ECM Toolkits* available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard Enterprise Cluster Master Toolkit*.

Tomcat can be setup in a stand alone configuration that allows web browsers to be connected directly to the tomcat servlet or through web server such as Apache. To integrate Tomcat with Apache, the JK Connector is used. The mod_jk component needs to be configured in Apache in order to make Apache work with Tomcat. When the user chooses this type of configuration and it needs to be deployed in a highly available Serviceguard environment then both the Apache and Tomcat toolkit need to be configured in a single package. The example below gives the steps for configuring such a package. This example assumes that both Apache and Tomcat server are configured on a single Volume group vg01 (in case of LVM) and a single mount point /share/pkg_1.

1. mkdir -p /etc/cmcluster/pkg/http_pkg1 /etc/cmcluster.
2. Copy the Apache and Tomcat toolkits files into the respective directories.
3. Edit the user configuration files of both Apache and Tomcat and make suitable changes. See "Using an Apache Toolkit in a HP Serviceguard Cluster" (page 97) and "Using Tomcat Toolkit in a HP Serviceguard Cluster" (page 110)
4. cd /etc/cmcluster/pkg/tomcat_pkg1
5. Create the Serviceguard Package configuration and Package control scripts

   ```
   cmmakepkg -p pkg1.ascii (Serviceguard Package configuration script)
   cmmakepkg -s pkg1.cntl (Serviceguard Package control script).
   ```
6. Edit the Package Configuration script "pkg1.ascii" and configure it. Also configure two services "http_pkg1.monitor" and "tomcat_pkg1.monitor" as shown below:

   ```
   SERVICE_NAME                    tomcat_pkg1.monitor
   SERVICE_FAIL_FAST_ENABLED       NO
   SERVICE_HALT_TIMEOUT            300
   ```

```
SERVICE_NAME                    http_pkg1.monitor
SERVICE_FAIL_FAST_ENABLED       NO
SERVICE_HALT_TIMEOUT            300
```

7. Edit the Package Control script "pkg1.cntl" and configure the two toolkits as show below:-

Example 2 For example:

```
VG[0]="vg01"
LV[0]="/dev/vg01/lvol1"
FS[0]="/share/pkg_1"
FS_MOUNT_OPT[0]="-o rw"
FS_UMOUNT_OPT[0]=""
FS_FSCK_OPT[0]=""
FS_TYPE[0]="vxfs"

 Configure the two services one for Tomcat and Apache instances
 respectively

SERVICE_NAME[0]="tomcat_pkg1.monitor"
SERVICE_CMD[0]="/etc/cmcluster/pkg/tomcat_pkg1/toolkit.sh monitor"
SERVICE_RESTART[0]=""
SERVICE_NAME[1]="http_pkg1.monitor"
SERVICE_CMD[1]="/etc/cmcluster/pkg/http_pkg1/toolkit.sh monitor"
SERVICE_RESTART[1]=""

       Edit the customer_defined_run and customer_defined_halt function
       as shown below:-

       function customer_defined_run_cmds
       {
         # ADD customer defined run commands.
          /etc/cmcluster/pkg/tomcat_pkg1/toolkit.sh start
          /etc/cmcluster/pkg/http_pkg1/toolkit.sh start
          test_return 51
       }

       function customer_defined_halt_cmds
       {
         # ADD customer defined run commands.
          /etc/cmcluster/pkg/tomcat_pkg1/toolkit.sh stop
          /etc/cmcluster/pkg/http_pkg1/toolkit.sh stop
          test_return 51
       }
```

See *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* and, see "Using an Apache Toolkit in a HP Serviceguard Cluster" (page 97) for more details.

NOTE: While bringing down Apache or Tomcat application for maintenance, touch the files `tomcat.debug` and `apache.debug` in Tomcat and Apache package directories `/etc/cmcluster/pkg/tomcat_pkg1/` and `/etc/cmcluster/pkg/http_pkg1/` respectively. This will ensure that monitoring services of both Apache and Tomcat is paused during the maintenance period.

Both Tomcat and Apache applications, are configured in a single package. For troubleshooting and debugging, the user needs to look at Serviceguard package logs in the directory where the package control file resides. For application related logs the user needs to look for error and logs directory in $SERVER_ROOT and $CATALINA_BASE for Apache and Tomcat applications respectively

8 Using SAMBA Toolkit in a Serviceguard Cluster

This chapter describes the High Availability SAMBA Toolkit for use in the Serviceguard environment. The chapter is intended for users who want to install and configure the SAMBA toolkit in a Serviceguard cluster. Readers should be familiar with Serviceguard configuration as well as HP CIFS Server application concepts and installation/configuration procedures.

NOTE: This toolkit supports:

- HP Serviceguard versions:
  - A.11.19
  - A.11.20
- The version of HP CIFS Server included with HP-UX.
- HP-UX 11i v2 and HP-UX 11i v3.

At the time of publication, this version supports the above mentioned SG, application and HPUX versions. More recent versions of these products may be certified with B.06.00. For the latest information, see the compatibility matrix available at : http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* .

NOTE: This version of the toolkit supports both, legacy and modular style packages.

Unless otherwise stated, this toolkit supports all filesystems, storage and volume managers that Serviceguard supports.

This toolkit includes support for the following:

- HP Serviceguard A.11.19 with VERITAS Cluster File System (CFS) 5.0 on HP-UX 11i v2, and HP-UX 11i v3.
- HP Serviceguard A.11.19 with CFS 5.0.1 on HP-UX 11i v3.
- HP Serviceguard A.11.20 with CFS 5.1 SP1 on HP-UX 11i v3

To use CFS, you must install the appropriate version of HP Serviceguard Storage Management Suite.

For more details please refer to the Serviceguard Release Notes at:http://www.hp.com/go/hpux-serviceguard-docs ->*HP Enterprise Cluster Master Toolkit*

The SAMBA Toolkit for Serviceguard consists of a set of shell scripts for configuring, starting, halting, and monitoring the HP CIFS Server application. These scripts work together with a Serviceguard Package Control Script. This chapter assumes that users have installed Serviceguard and the Enterprise Cluster Master Toolkit (ECMT) containing the SAMBA toolkit on all cluster nodes.

As delivered, this toolkit contains the following files in the `/opt/cmcluster/toolkit/samba` directory:

Table 32 Scripts in SAMBA Directory

File Name	Description
`README`	The contents of the README file have been moved to this user guide.
`hasmb.conf`	User defined variables required for customization of the toolkit for your environment.
`hasmb.sh`	The main shell script.
`hasmb.mon`	The script provided to monitor the health of the running HP CIFS Server application.
`toolkit.sh`	Interface between the package control script and the toolkit main shell script (hasmb.sh).

The following three files are also installed and they are used only for the modular method of packaging.

Attribute Definition File (ADF) is installed in `/etc/cmcluster/modules/ecmt/samba` .

Table 33 Attribute Definition File (ADF)

File Name	Description
samba.1	For every parameter in the legacy toolkit user configuration file, there is an attribute in the ADF. It also has an additional attribute TKIT_DIR which is analogous to the package directory in the legacy method of packaging. The ADF is used to generate a modular package ASCII template file.

For the alert mail notification feature, an additional parameter called *ALERT_MAIL_ID* is introduced in the ADF. *ALERT_MAIL_ID* sends an e-mail message to the specified e-mail address when packages fail. This e-mail is generated only when packages fail, and not when a package is halted by the operator. To send this e-mail message to multiple recipients, a group e-mail ID must be created and specified for this parameter. When an e-mail ID is not specified for this parameter, the script does not send out this e-mail.

The following files are located in `/etc/cmcluster/scripts/ecmt/samba` after installation:

Table 34 Scripts name

File Name	Description
`tkit_module.sh`	This script is called by the Master Control Script and acts as an interface between the Master Control Script and the Toolkit interface script (toolkit.sh). It is responsible for calling the Toolkit Configuration File Generator Script (described below).
`tkit_gen.sh`	This script is called by the Module Script when the package configuration is applied using `cmapplyconf` to generate the toolkit user configuration file in the package directory (`TKIT_DIR`).

The HP CIFS Server application must be installed on all nodes that will run the HP CIFS Server packages in the Serviceguard cluster. A typical clustered configuration is configuring one node as a primary node and the other nodes as standby nodes. The HP CIFS Server runs on the primary node serving HP CIFS Server requests from the clients. In the event of a failure on the primary node, the package will fail over to the standby node. This means that all necessary configuration information on all nodes must be identical and the resources must be available to all supporting nodes. The file systems providing access to clients must be stored on shared disks and these disks must be accessible by the same path names on each node.

HP CIFS Server Package Configuration Overview

Configuration rules include the following:

- Each node has the same version of the HP CIFS Server application. All nodes configured to run the package must contain the HP CIFS Server file system and configuration files.
- A file system containing HP CIFS Server data must reside on shared storage. Configuration files (as well as executables) may either reside on shared or local storage. However, for ease of maintenance, it is recommended to place configuration files on shared storage.
- Each node has the same configuration directory, where identical copies of the configuration files for each instance are placed on a local or shared hard disk.
- Each node has the same HP CIFS Server file system directories to access the shared storage.

The following information discusses configuration options of either using a combination of shared and local storage, or using shared storage only. The choice of local or shared storage is left to the user's discretion. However, shared storage is recommended, as it is easier to maintain.

Local Configuration

In a typical local configuration, identical copies of the HP CIFS Server configuration files reside in exactly the same locations on the local file system on each node. All HP CIFS Server file systems are shared between the nodes. It is the responsibility of the toolkit administrator to maintain identical copies of the HP CIFS Server components on all nodes. If the shared file system allows only read operations, then local configuration is easy to maintain. But if the file system allows write operations also, it is the administrator's responsibility to propagate updates to all the package nodes.

Shared Configuration

In a typical shared configuration, the HP CIFS Server file systems and configuration files are all on the shared storage. The same HP CIFS Server file systems and configuration files are shared between the cluster nodes, so there is no need to maintain identical copies of configuration files on each node.

In a cluster environment each HP CIFS Server instance should have unique IP addresses. One or more relocatable IP addresses are created for each HP CIFS Server when the package is created. When the HP CIFS Server package is switched over from one node to another, this particular instance is stopped, IP addresses are removed from the primary node, IP addresses are reallocated to a standby node, and the instance is started on that node. Clients will then be automatically connected or manually reconnected through these IP addresses to the identical HP CIFS Server file systems on the standby node.

Multiple HP CIFS Server Instances Configuration

The HP CIFS Server permits multiple instances of its NetBIOS and SMB master daemons.

Each HP CIFS Server has its own `smb.conf` file to define its configuration. The NetBIOS name and IP address that the client connects to will determine which smb.conf file is used to serve that connection. This multiple HP CIFS Server master daemon configuration allows CIFS Server to run multiple Serviceguard packages simultaneously.

Setting Up the Application

Before configuring the Serviceguard package, the following configuration tasks must be performed for the application:

1. When the CIFS Server is installed, the default HP CIFS Server may be automatically configured to start during system startup. If the Server is already installed and configured, simply stop it with the `/opt/samba/bin/stopsmb` command.
2. Ensure the RUN_SAMBA parameter in the `/etc/rc.config.d/samba` file is set to 0 on all nodes. This disables Automatic Startup when the machine boots.

Here is a simple example of a multiple-instance configuration.

"<netbios_name>" used in the following steps needs to be replaced with the appropriate name of the CIFS server.

1. Create directories:

```
/var/opt/samba/<netbios_name>
/var/opt/samba/<netbios_name>/locks
/var/opt/samba/<netbios_name>/logs
```

   For example,

```
$mkdir /var/opt/samba/smb1
$mkdir /var/opt/samba/smb1/locks
$mkdir /var/opt/samba/smb1/logs
```

2. Create a file `/etc/opt/samba/smb.conf.<netbios_name>` (For example, `/etc/opt/samba/smb.conf.smb1`) with the following lines:

```
[global]
workgroup = ha_domain
```

```
netbios name = smb1
interfaces = XXX.XXX.XXX.XXX/xxx.xxx.xxx.xxx
bind interfaces only = yes
log file = /var/opt/samba/smb1/logs/log.%m
lock directory = /var/opt/samba/smb1/locks
pid directory = /var/opt/samba/smb1/locks
```

Replace the "XXX.XXX.XXX.XXX/xxx.xxx.xxx.xxx" with one (space separated) relocatable IP address and subnet mask for the Serviceguard package.

Copy the workgroup line from the `/etc/opt/samba/smb.conf` file.

Copy the NetBIOS name line from the same file, or, if there is no NetBIOS name line, enter the UNIX host name for the server on the NetBIOS name line.

Add in the rest of desired configuration items.

Include all HP CIFS Server users and their passwords of all instances in all nodes using the command `smbpasswd <username>`, where the username must be a name that already exists in the standard UNIX passwd file.

To use a shared file system, the file system must reside on shared storage.

Shared Configuration

1. Using LVM

   To configure a shared file system managed by LVM, you need to create volume group(s) and logical volume(s) on the shared disks, then construct a new file system for each logical volume for the HP CIFS Server file system (and HP CIFS Server configuration files). See the *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* for information on configuring LVM and creating a file system. (For a local configuration, you must install and configure the HP CIFS Server in the same location on both the primary and all backup nodes and set up identical (or equivalent) configuration files in the same directory on all nodes.)

   The following is an example of configuring shared storage for a CIFS Server package. The procedures below assumes that `/shared/smb1` is a shared file system directory, which resides on a logical volume "lvol1" in a shared volume group "/dev/vg01".

   a. Create a Volume Group "vg01" for a shared storage.
   b. Create a Logical Volume "lvol1" for the "vg01".
   c. Construct a new file system on the Logical Volume "lvol1".
   d. Create a directory "/shared/smb1" on a local disk.
   e. Mount device "/dev/vg01/lvol1" to the "/shared/smb1" .
   f. Copy all the necessary files depending on the configuration.
   g. Unmount "/shared/smb1".

2. Using VxVM

   To configure a shared file system which is managed by VxVM, you need to create disk group(s) and logical volume(s) on the shared disks and construct a new file system for each logical volume for the HP CIFS Server file system and HP CIFS Server configuration files.

   The following is an example of configuring the above steps using VxVM:

   a. Create a Disk Group "DG_00" on the shared storage.
   b. Create Logical volume "LV_00" on the Disk Group "DG_00".
   c. Construct a new file system on the Logical Volume "LV_00".
   d. Create a directory "/shared/smb1" on a local disk.
   e. Mount device "/dev/vx/dsk/DG_00/LV_00" on "/shared/smb1".

f. Copy all the necessary files depending on the configuration.

g. Unmount "/shared/smb1".

3. Using CFS

To configure a Samba package in a CFS environment, the SG CFS packages need to be running in order for the Samba package to access CFS mounted file systems. Please see your Serviceguard Manual for information on how to configure SG CFS packages. Create a directory `/shared/smb1` on all cluster nodes. Mount the CFS filesystem on `/shared/smb1` using the CFS packages. Use `/shared/smb1` to hold the necessary files and configuration information.

NOTE: CIFS supports CFS with a limitation. A running package will fail if another cluster node tries to start samba using the configuration used by this package. Do NOT attempt to start another samba instance on a different cluster node using the shared configuration that is being used by any samba package.

If you need help creating, importing or managing the volume group or disk group and filesystem, see chapter titled *Building an HA Cluster Configuration* in the Serviceguard user manual available at:http://www.hp.com/go/hpux-serviceguard-docs-> *HP Serviceguard*

You can configure more shared storage for additional HP CIFS Server instances using the same method.

NOTE: Under shared configuration, you can choose to put samba binaries as well in shared file system. You may have to create soft links on the local file system, to these binaries residing in shared file system.

The following sections describe the method for creating the Serviceguard package using the legacy method. For more information on creating the Serviceguard package using the modular method, see *Modular package support in Serviceguard for Linux and ECM Toolkits* available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard Enterprise Cluster Master Toolkit*

Setting Up the Package

The following procedures include the steps to configure a package running the HP CIFS Server instance, which includes customizing the package configuration file and package control script.

The procedures below assume that the user is configuring an HP CIFS Server package named "smb1", consisting of one service named "smb1_monitor". The HP CIFS Server instance is listening to a relocatable IP address "192.168.0.1" and all of its configuration and document files are in a file system `/shared/smb1` directory. Here, it is assumed that the user has already determined the cluster configuration, including cluster name, node names, heartbeat IP addresses, and so on. See the *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* for specific details on cluster configuration.

NOTE: To increase the number of packages that may be added to this cluster, please modify the cluster configuration file and set the variable `MAX_CONFIGURED_PACKAGES` to reflect the number of packages to be added to the cluster. After the edit, apply the change to the cluster via `cmapplyconf -C cluster_config_file`.

Before working on the package configuration, create a directory (example, `/etc/cmcluster/smb1`) for this package. This directory should belong to a single HP CIFS Server package (that is, each package will have its own directory). Copy all SAMBA toolkit scripts from the directory `/opt/cmcluster/toolkit/samba` to the package directory.

For example:

```
$ mkdir /etc/cmcluster/smb1
```

```
$ cd /etc/cmcluster/smb1
$ cp /opt/cmcluster/toolkit/samba/* . #copy to $PWD
```

To create both the package configuration (`smb_pkg.conf`) and package control (`smb_pkg.cntl`) files, cd to the package directory (for example, cd `/etc/cmcluster/smb1`)

1. Create a package configuration file with the command `cmmakepkg -p`. The package configuration file must be edited as indicated by the comments in that file. The package name must be unique within the cluster.

   For example:

   ```
   PACKAGE_NAME smb1
   NODE_NAME node1
   NODE_NAME node2
   RUN_SCRIPT /etc/cmcluster/smb1/smb_pkg.cntl
   HALT_SCRIPT /etc/cmcluster/smb1/smb_pkg.cntl
   SERVICE_NAME smb1_monitor
   ```

   If you are using CFS mounted file system you need to configure dependency of this Samba package on SG CFS package. If the Samba package is configured to depend on a SG CFS package, the Samba package will run as long as the dependee package is running. If the package fails, then the dependent Samba package will also fail.

   To configure dependency of the Samba package, you must set the following configurable parameters in the package configuration file:

   ```
   DEPENDENCY_NAME  smb1_dependency
   DEPENDENCY_CONDITION  SG-CFS-MP-1 = up
   DEPENDENCY_LOCATION  SAME_NODE
   ```

2. Create a package control file with command `cmmakepkg -s`. The package control file must be edited as indicated by the comments in that file. The package control file must be customized to your environment.

   Example:

   ```
     LVM | VxVM
    ----- | ------
     VG[0]="vg01" | VXVM_DG[0]="DG_00"
      |
     LV[0]="/dev/vg01/lvol1" | LV[0]="/dev/vx/dsk/DG_00/LV_00
     FS[0]="/shared/smb1" | FS[0]="/shared/smb1"
     FS_TYPE[0]="vxfs" | FS_TYPE[0]="vxfs"
     FS_MOUNT_OPT[0]="-o rw" | FS_MOUNT_OPT[0]="-o rw"
   IP[0]="192.168.0.1" SUBNET="192.168.0.0"

    SERVICE_NAME[0]="smb1_monitor"
    SERVICE_CMD[0]="/etc/cmcluster/smb1/toolkit.sh monitor"
    SERVICE_RESTART[0]="-r 2"
   ```

   NOTE: If you are using CFS mounted file systems you must NOT configure volume groups, logical volumes and file systems in the package control script but configure dependency on SG CFS packages.

3. Edit the customer_defined_run_cmds function in the package control script to execute the `toolkit.sh` script with the start option. In the example below, the line `/etc/cmcluster/smb1/toolkit.sh start` was added, and the ":" null command line deleted.

   For example:

   ```
   function customer_defined_run_cmds
    {
    # Start the HP CIFS Server.
   ```

```
/etc/cmcluster/smb1/toolkit.sh start

test_return 51
}
```

4. Edit the customer_defined_halt_cmds function in the package control script to execute the toolkit.sh script with the stop option. In the example below, the line `/etc/cmcluster/smb1/toolkit.sh stop` was added, and the ":" null command line deleted.

   EXAMPLE:

```
function customer_defined_halt_cmds
 {
 # Stop the HP CIFS Server.

 /etc/cmcluster/smb1/toolkit.sh stop

 test_return 51
 }
```

5. Configure the user configuration file `hasmb.conf` as explained in the next section and customize it for your environment.
6. Copy this package configuration directory to all other package nodes.

   You can use the same procedure to create multiple HP CIFS Server packages (multiple HP CIFS Server instances) that will be managed by Serviceguard.

Setting Up the Toolkit

Toolkit Overview

After installing the toolkit, four scripts and one README file will be installed in the location `/opt/cmcluster/toolkit/samba`. Two more scripts and one file will be installed which will be used only for modular packages. The two scripts will be in the `/etc/cmcluster/scripts/ecmt/samba` directory. The third file will be in the `/etc/cmcluster/modules/ecmt/samba` directory.

For legacy packages, one user configuration script (`hasmb.conf`) and three functional scripts (`toolkit.sh, hasmb.sh and hasmb.mon`) will work together to integrate the HP CIFS server with the Serviceguard package control script.

The scripts used in legacy packages are:

Table 35 Legacy Package Scripts

Script Name	Description
`User Configuration file User (hasmb.conf)`	This script contains a list of pre-defined variables that may be customized for your environment. This script provides you with a simple format for (user) configuration data. This file will be included (that is, sourced) by the toolkit main script (`hasmb.sh`).
`Main Script (hasmb.sh)`	This script contains a list of internal-use variables and functions that support start or stop of an HP CIFS Server instance. This script will called by the toolkit interface script (toolkit.sh) to do the following: • On package start, it starts an HP CIFS Server instance and launches a monitor process by calling `hasmb.mon`. • On package stop, it stops the HP CIFS Server server instance and halts `hasmb.mon`.

Table 35 Legacy Package Scripts *(continued)*

Script Name	Description
`Monitor Script (hasmb.mon)`	This script contains a list of internal-use variables and functions for monitoring an HP CIFS Server server instance. This script will be called by the toolkit main script (`hasmb.sh`) and will constantly monitor two HP CIFS Server daemons, smbd and nmbd.
`Interface Script (toolkit.sh)`	This script is an interface between a package control script and the toolkit main script (`hasmb.sh`).

Creating Serviceguard package using Modular method.

Follow the steps below to create Serviceguard package using Modular method:

1. Create a directory for the package.

   ```
   #mkdir /etc/cmcluster/pkg/samba_pkg/
   ```

2. Copy the toolkit template and script files from samba directory.

   ```
   #cd /etc/cmcluster/pkg/samba_pkg/
   #cp /opt/cmcluster/toolkit/samba/* ./
   ```

3. Create a configuration file (pkg.conf) as follows.

   ```
   #cmmakepkg -m ecmt/samba/samba pkg.conf
   ```

4. Edit the package configuration file.

   NOTE: Samba toolkit configuration parameters in the package configuration file have been prefixed by `ecmt/samba/samba` when used in Serviceguard A.11.19.00.

   For Example:

   `/etc/cmcluster/pkg/samba_pkg/pkg.conf`

   The configuration file should be edited as indicated by the comments in that file. The package name needs to be unique within the cluster.

   For Example:

   ```
   PACKAGE_NAME samba
   NODE_NAME node1
   NODE_NAME node2
   ```

   Set the `TKIT_DIR` variable as the path of <package_directory>. For example, `TKIT_DIR /etc/cmcluster/pkg/pkg01`.

   SERVICE_NAME smb1_monitor

   If you are using CFS mounted file system you need to configure dependency of this Samba package on SG CFS package. If the Samba package is configured to depend on a SG CFS package, the Samba package will run as long as the dependee package is running. If the package fails, then the dependent Samba package will also fail.

   To configure dependency of the Samba package, you must set the following configurable parameters in the package configuration file:

   ```
   DEPENDENCY_NAME smb1_dependency
   DEPENDENCY_CONDITION SG-CFS-MP-1 = up
   DEPENDENCY_LOCATION SAME_NODE
   ```

5. Use `cmcheckconf` command to check for the validity of the configuration specified.

   For Example:

```
#cmcheckconf -P pkg.conf
```

6. If the `cmcheckconf` command does not report any errors, use the `cmapplyconf` command to add the package into Serviceguard environment.

   For Example:

   ```
   #cmapplyconf -P pkg.conf
   ```

Toolkit User Configuration

All the user configuration variables are kept in a single file in shell script format. The variable names and their sample values are in Table 36 (page 133):

Table 36 User Configuration Variables

Configuration Variables	Description
`NETBIOS_NAME` (for example, NETBIOS_NAME=smb1)	This variable holds the NetBIOS Name of the server. If the configuration of HP CIFS Server is done using `/opt/samba/bin/samba_setup` command, the NetBIOS ame can be found in `/etc/opt/samba/smb.conf`. If you are configuring multiple HP CIFS Server packages, ensure the NetBIOS name is unique for each of the packages.
`CONF_FILE` (for example, CONF_FILE=/etc/opt/samba/smb.conf.${NETBIOS_NAME})	This variable holds the path of the "smb.conf.<netbios_name>". By default, the path is `/etc/opt/samba/smb.conf.${NETBIOS_NAME}`. If the path is different, modify the variable.
`LOG_DIRECTORY` (for example, LOG_DIRECTORY=/var/opt/samba/${NETBIOS_NAME}/logs)	This variable holds the log directory path of the CIFS Server instance of the particular package. By default, the path is `/var/opt/samba/${NETBIOS_NAME}/logs`. If the path is different, modify the variable.
`SMBD_PID_FILE` (for example, SMBD_PID_FILE=/var/opt/samba/${NETBIOS_NAME}/locks/smbd.pid)	This variable holds the PID File path of smbd process of the particular package. By default, the path is `/var/opt/samba/${NETBIOS_NAME}/locks/smbd.pid`. If the path is different, modify the variable.
`NMBD_PID_FILE` (for example, NMBD_PID_FILE=/var/opt/samba/${NETBIOS_NAME}/locks/nmbd.pid)	This variable holds the PID File path of nmbd process of the particular package. By default, the path is `/var/opt/samba/${NETBIOS_NAME}/locks/nmbd.pid`. If the path is different, modify the variable.

Table 36 User Configuration Variables *(continued)*

Configuration Variables	Description
MAINTENANCE_FLAG (for example, (MAINTENANCE_FLAG=yes)	This variable will enable or disable maintenance mode for the Samba package. By default, this is set to "yes". In order to disable this feature MAINTENANCE_FLAG should be set to "no". When Samba needs to be maintained then a file <package directory>/samba.debug needs to be touched. During this maintenance period Samba process monitoring is paused. Even if Samba is brought down, its package will not be failed over to the standby node. To continue monitoring and come back from the maintenance mode, remove the samba.debug file. It is the user's responsibility to ensure that Samba is properly running after the maintenance phase. **NOTE:** Setting MAINTENANCE_FLAG to "yes" and touching the samba.debug file in the package directory will put the package in toolkit maintenance mode. Serviceguard A.11.19 release has a new feature which allows individual components of the package to be maintained while the package is still up. This feature is called Package Maintenance mode and is available only for modular packages. For more information using Package Maintenance mode, see white paper *Modular package support in Serviceguard for Linux and ECM Toolkits* available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard Enterprise Cluster Master Toolkit*.
MONITOR_INTERVAL (for example, MONITOR_INTERVAL=5)	This variable holds a time interval (in seconds) for monitoring the CIFS Server instance. The monitor process checks to ensure the smbd and nmbd daemons are running every MONITOR_INTERVAL seconds. If not defined, its default value will be 5 seconds.
RETRY_TIMES (for example, RETRY_TIMES=0)	This variable holds the number of times to attempt to check the CIFS Server daemons before giving up and exiting to fail state. If not defined, its default value will be 0 times. It is preferred to keep this as 0. SERVICE_RESTART * RETRY_TIMES = total restart count.

The following information provides the steps for configuring the toolkit and running the package. This includes configuring the SAMBA toolkit user configuration file.

NOTE: Before working on the toolkit configuration, the package directory (example, /etc/cmcluster/smb1) must be created and all toolkit scripts copied to the package directory.

1. Edit the SAMBA Toolkit user configuration file.

   In the package directory, edit the user configuration file (hasmb.conf) as indicated by the comments in that file.

   For example:

```
NETBIOS_NAME=smb1
CONF_FILE=/etc/opt/samba/smb.conf.${NETBIOS_NAME}
LOG_DIRECTORY=/var/opt/samba/${NETBIOS_NAME}/logs
SMBD_PID_FILE=/var/opt/samba/${NETBIOS_NAME}/locks/smbd.pid
NMBD_PID_FILE=/var/opt/samba/${NETBIOS_NAME}/locks/nmbd.pid
```

2. Copy the entire package directory at the same path on all nodes configured for the package.

   For this example, each package node must have the following files in the package directory:

```
smb_pkg.conf #Package configuration file
smb_pkg.cntl #Package control file
hasmb.conf #SAMBA toolkit user config file
hasmb.mon #SAMBA toolkit monitor program
hasmb.sh #SAMBA toolkit main script
toolkit.sh #Interface file between the package
#control file and the toolkit
```

3. Apply the package configuration using the command `cmapplyconf -P smb_pkg.conf`. Repeat the preceding procedures to create multiple HP CIFS Server packages.

CIFS Server Maintenance Mode

There might be situations, when a CIFS Server instance has to be taken down for maintenance purposes like changing configuration, without having the instance to migrate to standby node. The following procedure should be implemented:

NOTE: The example assumes that the package name is SMB_1, package directory is `/etc/cmcluster/pkg/SMB_1`.

- Disable the failover of the package through `cmmodpkg` command.

  $ cmmodpkg -d SMB_1

- Pause the monitor script.

  Create an empty file `/etc/cmcluster/pkg/SMB_1/samba.debug` as shown below:

  $ touch `/etc/cmcluster/pkg/SMB_1/samba.debug`

  Toolkit monitor scripts which continuously monitors Samba daemon processes, would now stop monitoring these daemon processes. A message, "Samba toolkit pausing, monitoring and entering maintenance mode" appears in the Serviceguard Package Control script log.

- If required stop the CIFS Server instance and as shown below:

```
$ cd /etc/cmcluster/pkg/SMB_1/
$ $PWD/toolkit.sh stop
```

- Perform maintenance actions (for example, changing the configuration parameters. If files are changed, remember to distribute the new file to all cluster nodes as needed).
- Start the CIFS Server instance again, if you stopped it as below:

```
$ cd /etc/cmcluster/pkg/SMB_1/
$ $PWD/toolkit.sh start
```

- Allow monitoring scripts to continue normally as shown below:

  `$ rm -f /etc/cmcluster/pkg/SMB_1/samba.debug`

  A message "Starting Samba toolkit monitoring again after maintenance" appears in the Serviceguard Package Control script log.

- Enable the package failover.

  `$ cmmodpkg -e SMB_1`

NOTE: If the package fails during maintenance (for example, the node crashes), the package will not automatically fail over to an adoptive node. It is the responsibility of the user to start the package up on an adoptive node. See the manual *Managing ServiceGuard* manual available at http://www.hp.com/go/hpux-serviceguard-docs —>*HP Serviceguard* for more details.

This feature is enabled only when the configuration variable, `MAINTENANCE_FLAG`, is set to "yes" in the Samba toolkit configuration file.

Special Notes

Please consider the following areas when implementing HP CIFS Server in the Serviceguard HA framework.

- Client Applications

  HA CIFS Server cannot guarantee that client applications with open files on a CIFS Server share or applications launched from CIFS Server share, will recover from a switchover. In these instances there may be cases where the application will need to be restarted and the files reopened, as a switchover is a logical shutdown and restart of the CIFS Server.

- File Locks

  File locks are not preserved during failover, and applications are not advised about any lost file locks.

- Print Jobs

  If a failover occurs when a print job is in process, the job may be printed twice or not at all, depending on the job state at the time of the failover.

- Symbolic Links

  Symbolic links in the shared directory trees may point to files outside of any shared directory. If symbolic links point to files that are not on shared file systems, after a failover occurs, the symbolic links may point to different files or to no file. Keeping the targets of all shared symbolic links, synchronized with all nodes at all times, could be difficult in this situation.

  Alternatives would either be to set wide links to "no", or to be sure that every file or directory pointed to is on a shared file system.

- Security Files and Encrypted Passwords

  Authentication is dependent on several entries in different security files. An important security file is the user password file, smbpasswd. If your CIFS Server is configured with encrypted passwords set to "yes", use an `smbpasswd` file. By default, this file is located in the path `/var/opt/samba/private` but a different path may be specified via the `smb passwd` file parameter.

  Another important security file is `secrets.tdb`. Machine account information is among the important contents of this file. Since this file will be updated periodically (as defined in `smb.conf` by 'machine password timeout', 604800 seconds by default), HP recommends that you locate secrets.tdb on a shared storage. As with the `smbpasswd` file, discussed above, the location of this file is defined by the `smb.conf` parameter `smb passwd` file. For example, `smb passwd file = /var/opt/samba/shared_vol_1/private/smbpasswd` will result in the file`/var/opt/samba/shared_vol_1/private/secrets.tdb` .

  To summarize, both the machine account file (`secrets.tdb`) and the password file (`smbpasswd`) should be put on shared storage.

- Username Mapping File

  If the HP CIFS Server configuration is set to use a username mapping file, it should be located on a shared file system. This way, if changes are made, all the nodes will always be up-to-date. The username mapping file location is defined in `smb.conf` by the parameter 'username map', example, 'username map = /var/opt/samba/shared_vol_1/username.map'. There is no username map file by default.

- HP CIFS Server as a WINS Server

  If HP CIFS Server is configured as a WINS server (that is, the WINS support parameter is set to "yes"), the database /var/opt/samba/locks/browse.tdb will be stored.

  If this file is not on a shared file system, when a failover occurs, there will be a short period of time when all the WINS clients update the CIFS WINS server with their address. However, if this short period of time to restore the WINS database is not acceptable, you can reduce the period of time to restore the full WINS service.

  To do so, configure `/var/opt/samba/locks/browse.tdb` to be a symbolic link to a `browse.tdb` file on a shared file system. It is not recommended to put the entire /var/opt/samba/locks directory on a shared file system, because the locking data may not be correctly interpreted after a failover.

- HP CIFS Server as a Master Browser

  If HP CIFS Server is configured as the domain master browser (that is, the domain master support parameter is set to "yes"), the database will be stored in the `/var/opt/samba/locks/browse.tdb` file. HP does not recommend doing this in an HA configuration.

  However, if the CIFS Server is configured as the domain master browser, `/var/opt/samba/locks/browse.tdb` should be set as a symbolic link to `browse.tdb` on the shared file system. HP does not recommend putting the entire directory (/var/opt/samba/locks) on the shared file system, as the locking data may not be correctly interpreted after a failover.

- Automatic Printer Sharing

  If network/shared printers are configured, ensure all nodes configured to run the HP CIFS Server also have access to the printers. Otherwise, when a failover occurs, the list of shared printers will differ across clustered nodes, resulting in problems for clients accessing those printers.

- HP CIFS Server's LMHOSTS File

  If the file `LMNHOSTS` is used to store static addresses of netbios names, put this file in the shared file system. When invoking nmbd, specify the path for LMNHOSTS with the -H option. Ensure all package and tookit scripts include the -H option where nmbd is invoked. Also edit the script `/opt/samba/bin/startsmb` to add the -H option where nmbd is invoked.

  Example:

  Assuming that the `LMHOSTS` file is in the `/etc/cmcluster/smb1` directory, the following lines need to be changed in `hasmb.sh`:

  In the start_samba_server function, change as follows:

  ```
  (old) /opt/samba/bin/nmbd -D -1${LOG_DIRECTORY} -s ${CONF_FILE}
   (new) /opt/samba/bin/nmbd -D -1${LOG_DIRECTORY} -s ${CONF_FILE} \
   -H /etc/cmcluster/smb1/lmhosts
  ```

  For more information see `lmhosts (1M)` manpage.

9 Support and other resources

Information to collect before contacting HP

Be sure to have the following information available before you contact HP:

- Software product name
- Hardware product model number
- Operating system type and version
- Applicable error message
- Third-party hardware or software
- Technical support registration number (if applicable)

How to contact HP

Use the following methods to contact HP technical support:

- In the United States, see the Customer Service / Contact HP United States website for contact options:

  http://welcome.hp.com/country/us/en/contact_us.html

- In the United States, call 1-800-HP-INVENT (1-800-474-6836) to contact HP by telephone. This service is available 24 hours a day, 7 days a week. For continuous quality improvement, conversations might be recorded or monitored.
- In other locations, see the Contact HP Worldwide website for contact options:

  http://welcome.hp.com/country/us/en/wwcontact.html

Registering for software technical support and update service

HP Insight software includes one year of 24 x 7 HP Software Technical Support and Update Service. This service provides access to HP technical resources for assistance in resolving software implementation or operations problems.

The service also provides access to software updates and reference manuals in electronic form as they are made available from HP. Customers who purchase an electronic license are eligible for electronic updates.

With this service, Insight software customers benefit from expedited problem resolution as well as proactive notification and delivery of software updates. For more information about this service, see the following website:

http://www.hp.com/services/insight

Registration for this service takes place following online redemption of the license certificate.

How to use your software technical support and update service

After you have registered, you will receive a service contract in the mail containing the Customer Service phone number and your Service Agreement Identifier (SAID). You need your SAID when you contact technical support. Using your SAID, you can also go to the Software Update Manager (SUM) web page at http://www.itrc.hp.com to view your contract online.

Warranty information

HP will replace defective delivery media for a period of 90 days from the date of purchase. This warranty applies to all Insight software products.

HP authorized resellers

For the name of the nearest HP authorized reseller, see the following sources:

- In the United States, see the HP U.S. service locator web site:
  http://www.hp.com/service_locator
- In other locations, see the Contact HP worldwide web site:
  http://welcome.hp.com/country/us/en/wwcontact.html

Documentation feedback

HP welcomes your feedback. To make comments and suggestions about product documentation, send a message to:

docsfeedback@hp.com

Include the document title and manufacturing part number in your message. All submissions become the property of HP.

Related information

- HP ProLiant servers:
  - ProLiant BL BladeSystem servers:
    http://www.hp.com/go/blades
  - ProLiant DL series rack mount servers:
    http://www.hp.com/servers/dl
  - ProLiant ML series tower servers:
    http://www.hp.com/servers/ml
  - ProLiant SL series scalable system servers:
    http://h10010.www1.hp.com/wwpc/us/en/sm/WF02a/15351-15351-3896136.html
- HP Integrity servers: http://www.hp.com/go/integrity
- HP NonStop servers: http://www.hp.com/go/nonstop

Typographic conventions

This document uses the following typographical conventions:

Book title	The title of a book. On the web, this can be a hyperlink to the book itself.
`Command`	A command name or command phrase, For example `ls -a`.
`Computer output`	Information displayed by the computer.
Ctrl+x or **Ctrl-x**	A key sequence that indicates you must hold down the keyboard key labeled **Ctrl** while you press the letter `x`.
`ENVIRONMENT VARIABLE`	The name of an environment variable, For example, `PATH`.
Key	The name of a keyboard key. **Return** and **Enter** both refer to the same key.
Term	A term or phrase that is defined in the body text of the document, not in a glossary.
`User input`	Indicates commands and text that you type exactly as shown.

Replaceable	The name of a placeholder that you replace with an actual value.
[ ]	In command syntax statements, these characters enclose optional content.
{ }	In command syntax statements, these characters enclose required content.
|	The character that separates items in a linear list of choices.
...	Indicates that the preceding element can be repeated one or more times.
WARNING	An alert that calls attention to important information that, if not understood or followed, results in personal injury.
CAUTION	An alert that calls attention to important information that, if not understood or followed, results in data loss, data corruption, or damage to hardware or software.
IMPORTANT	An alert that calls attention to essential information.
NOTE	An alert that contains additional or supplementary information.
TIP	An alert that provides helpful information.