The HP Partner Technology Access Center – New Jersey (PTAC-NJ) has successfully integrated the SAS Metadata Server 5.01 application, one of the SAS 9.1.3 Foundation Servers, with Serviceguard A.11.16.00 under HP-UX 11i V2 (11.23) on the Itanium platform. The implementation and validation of the SAS Metadata Server followed the PTAC-NJ’s High Availability Implementation and Validation Process.

This application has been validated and found to work with Serviceguard using the information contained within this document. To ensure the highest level of customer satisfaction, customers requesting support for the scripts contained herein should first contact the SAS Institute, who will work with HP Support should assistance with Serviceguard be needed.

Information regarding the process followed for this validation, and how other ISVs may take advantage of this service, is available in these PTAC-NJ documents:

Appendix 19: HP’s Partner Technology Access Center High Availability Implementation and Validation Services Datasheet

Appendix 20: HP’s Partner Technology Access Center High Availability Implementation and Validation Services Process and Methodology
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Executive Overview

SAS Metadata Server

Source: SAS Metadata Server Fact Sheet

Metadata is commonly defined as “information about data sources, content, business rules and access authorizations”. The SAS Metadata Server, a central, shared application server for storing metadata, provides a central repository for all metadata that is created and required by an organization.

An enterprise may use one or many SAS Metadata Servers, depending upon the structure of the business environment. A SAS Metadata Server is used for one or many SAS Metadata Repositories. Repositories may be dependent on other repositories, and a foundation repository ensures that all dependent repositories are updated when the master is updated, keeping all information linked.

SAS Metadata Server is a multi-user software server that retrieves metadata from one or more repositories to requesting applications via the SAS Open Metadata Architecture. With the ability to import, export, reconcile and update metadata, and the ability to document those actions, the server manages technical, process and administrative metadata across all applications within an enterprise. It adheres to the Common Warehouse Metamodel standard, and supports interoperability with third-party products.

Unless an organization can operate with a single source of integrated metadata, that organization will be unable to deliver consistent information to its employees and customers. The SAS Metadata Server delivers the power to integrate, share, centrally manage and leverage metadata across entire organizations. Benefits achieved through use of the SAS Metadata Server include reduced complexity, fewer maintenance issues and increased interoperability between applications in an enterprise environment, resulting in lower cost of ownership and a single version of enterprise information.

Given the critical nature of data managed by the SAS Metadata Server, it is clear that the functionality of this application is of prime importance to a business that has implemented the SAS Metadata Server. To that end, the SAS Institute and Hewlett-Packard Company (HP) have worked to implement the SAS Metadata Server with HP’s Serviceguard high availability product suite. Following this implementation, HP and SAS worked to validate the compatibility of the SAS Metadata Server with HP’s Serviceguard in a mission-critical, clustered environment.

This document provides a detailed history of the steps that were taken to:

- Install and configure a Serviceguard cluster under the HP-UX Unix operating system running on HP Integrity servers.
- Configure the SAS Metadata Server to be started, stopped and monitored by HP’s Serviceguard.
- Test the response and functionality of the SAS Metadata Server following a series of failover scenarios in which the application was repeatedly moved between server nodes in a Serviceguard cluster.
**High Availability with HP Serviceguard**

HP Serviceguard is a specialized facility for protecting mission-critical applications from a wide variety of hardware and software failures. With Serviceguard, multiple—up to 16—nodes (systems) are organized into an enterprise cluster that delivers highly available application services to LAN-attached clients.

HP Serviceguard monitors the health of each node and quickly responds to failures in a way that minimizes or eliminates application downtime. Serviceguard is able to automatically detect and respond to failures in the following components:

- System processors
- System memory
- LAN media and adapters
- System processes
- Application processes

**Application Packages**

With HP Serviceguard, application services and all the resources needed to support the application are bundled into special entities called application packages. These application packages are the basic units that are managed and moved within an enterprise cluster. Packages simplify the creation and management of highly available services and provide outstanding levels of flexibility for workload balancing.

**Fast Detection of Failure, Fast Restoration of Applications**

Within an enterprise cluster, HP Serviceguard monitors hardware and software components, detects failures, and responds by promptly allocating new resources to support mission-critical applications. The process of detecting the failure and restoring the application service is completely automated—no operator intervention is needed.

Recovery times provided by HP Serviceguard for LAN adapter failures are extremely fast, typically within a few seconds. Recovery times for failures requiring the switch of an application to an alternate node will vary, depending on the software services being used by the application.

**Other Benefits of Serviceguard:**

- Availability during Hardware and Software Maintenance
- Online Reconfiguration Reduces Planned Downtime
- Workload Balancing
- Protecting Data Integrity
SAS Metadata Server 5.01 in a Highly-Available Environment

SAS Metadata Server with Serviceguard provides additional redundancy and high availability for SAS’ customers. This integration provides:

- Automatic failover and restart of the Metadata Server to a standby node in the event of a HP-UX server system failure, an application process or component failure, or a networking failure.
- Minimal Metadata Server downtime in the event of a system failure.
- Minimal delay before Metadata Server clients are able to connect, query data or modify data following an application or server failure.
- No network reconfiguration of Metadata Server clients necessary after an application failover; the Serviceguard movement of the application components within a Serviceguard cluster to another physical server node is transparent to any client. While the client must be restarted following an application failover, the client does not need to be reconfigured to connect to a different server node.
In the Serviceguard (SG) configuration tested, one cluster was configured using two server nodes.

- The first node, rx5670a, also referred to as the primary node, was used to run the following application package:
  - SAS Metadata Server package (saspkg)

- The second node, rx5670b, also referred to as the failover node, was used as a dedicated failover server.

The method employed for cluster arbitration in this HA Validation configuration was a cluster lock disk. Since both of the cluster nodes were connected to one ds2100 disk device, one of the disk mechanisms in the ds2100 disk device functioned as the cluster lock disk.

Additionally, the ds2100 disk device contained all shared executables and configuration files, and was shared between the primary node and the failover node.

The following configuration was tested and validated:

- SAS Metadata Server package
  - This Serviceguard package was the primary Metadata Server repository.
  - The package activated volume group /dev/vg01 and mounted one file system containing the binaries, configuration files, log files and repository for the Metadata Server.
  - Upon failover of the Metadata Server package, the package, now running on its failover server, successfully restarted all Metadata Server processes. Clients were then able to reconnect to the repository, and have the client requests (e.g. read data, write data) handled properly.

**One two-node rx5670 cluster, running one package:**

- a package named saspkg, which activated one shared volume group (vg01), mounted one shared file system and started the Metadata Server.
  - The package, named saspkg:
    - Mounted one shared volume group residing on the ds2100 disk device
      - vg01
    - mounted one logical volume:
      - /dev/vg01/lvo1 /sas
    - Took the following steps on startup:
      - MetadataServer.sh start
    - Took the following steps on shutdown:
      - MetadataServer.sh stop_no_error
  - One monitor script was used for this application:
    - `/etc/cmcluster/saspkg/monitor_sas.sh`
      - Loops at a selectable time interval, checking for the existence of all Metadata Server processes that were started.
• If any Metadata Server process is not found, the monitor script performs an “exit 1”, initiating a Serviceguard failover of this package. This behavior is configurable.

The SAS Metadata Server 5.01 application, one of the SAS 9.1.3 Foundation Servers, is validated by Hewlett-Packard as compatible with Hewlett-Packard’s Serviceguard high availability software on the HP-UX Itanium platform. All packages created for the Metadata Server can be monitored by Serviceguard, with the level of monitoring highly-configurable and subject to the implementation plans of the customer.

This document details a series of tests showing that the Metadata Server application is compatible with Serviceguard. The tests show that:

• If any Metadata Server process experiences a failure, the Metadata Server monitor process will recognize this failure, and initiate a package failover. Following the failover, any clients will then be able to re-establish their connection to the Metadata Server.

• If a node running any of the Metadata Server packages experiences a failure, the package running on that node can be restarted by Serviceguard on an alternate node in less than 10 seconds. Any clients will then be able to re-establish their connection to the Metadata Server.

Serviceguard packages are dependent on having automated application startup and shutdown scripts. SAS and HP engineers have developed package configuration and control scripts that are suitable for use (after minor system-specific modifications related to IP addresses and network subnets) in a SAS Metadata Server production environment.
SAS Metadata Server Implementation and Validation in a HP-UX Itanium Serviceguard Cluster

The process followed for the validation of the SAS Metadata Server in a HP-UX Itanium Serviceguard environment is detailed in:

Appendix 20: HP’s Partner Technology Access Center High Availability Implementation and Validation Services Process and Methodology

Implementation and Validation Onsite Process Participants:

Hewlett-Packard: Walt Saiko  
_Sr. Technical Consultant, Partner Technology Access Center, Solution Alliances Engineering, Technology Solutions Group_

SAS Institute: Steve Holzworth  
_Senior Systems Developer  
Host Systems R&D_

SAS APPLICATION IMPLEMENTATION NOTES:

Modified MetadataServer.sh script to add a command-line option: stop_no_error

This option is used in the saspkg.cntl script in the customer_defined_halt_cmds function to stop the Metadata Server without returning an error indicating a non-existent process (PID file). This will allow the Serviceguard package halt to complete successfully, and to failover to the secondary cluster node.
Serviceguard Configuration

Configuring the Cluster

Create the ASCII cluster template file

```bash
cmquerycl -v -C /etc/cmcluster/cluster1.ascii -n <node name> -n <node name>
```

Modify the template (cluster1.ascii) to reflect the environment and to verify the cluster configuration.

Check the correctness of the entries to the cluster configuration file.

```bash
cmcheckconf -v -C /etc/cmcluster/cluster1.ascii
```

Create the cluster by applying the configuration file. This will create the binary file “cmclconfig” and automatically distribute it among the nodes defined in the cluster.

```bash
cmapplyconf -v -C /etc/cmcluster/cluster1.ascii
```

Start the cluster and check the cluster status. Test the cluster halt also.

```bash
cmuncl -v       # Run the cluster
cmviecl -v      # View the cluster status
cmhaltcl -f -v  # Halt the cluster
cmuncl -v       # Run the cluster
```

Configuring Serviceguard Packages on the Primary Node

Create the package configuration files and tailor to the test environment. Do not include the failover node at this stage.

```bash
cd /etc/cmcluster
mkdir saspkg           # Metadata Server Package

cmmakepkg -p /etc/cmcluster/saspkg/saspkg.ascii # Edit the config file
```

Create package control script and tailor to the test environment. Do not include application startup/shutdown, service monitoring, or relocatable IP addresses at this stage.

```bash
cmmakepkg -s /etc/cmcluster/saspkg/saspkg.cntl # Edit the control file
```

Shut down cluster, verify and distribute the binary configuration files

```bash
cmhaltcl -f -v

cmcheckconf -v -C /etc/cmcluster/cluster1.ascii -P /etc/cmcluster/saspkg/saspkg.ascii

cmapplyconf -v -C /etc/cmcluster/cluster1.ascii -P /etc/cmcluster/saspkg/saspkg.ascii
```

```bash
cd /etc/cmcluster
rcp -r * rx5670b:/etc/cmcluster
```

Test cluster and package startup. First, unmount all logical volumes on shared volume groups and deactivate the volume groups. Then, ...

```bash
cmuncl -v       # Start cluster and package
cmviecl -v      # Check that package has started
```
Add knowledge of the Failover Node to the package (package is switchable in this configuration)

vi /etc/cmcluster/saspkg/saspkg.ascii

Shut down cluster, verify and distribute the binary configuration file

cmhaltcl –f –v

cmapplyconf –v –C /etc/cmcluster/cluster1.ascii –P /etc/cmcluster/saspkg/saspkg.ascii

Test cluster and package startup after having added knowledge of failover node

cmrunc1 –v # Start cluster and package

cmviecl –v # Check that package has started on proper node

Assign the dynamic IP address of the package.

Edit /etc/cmcluster/saspkg/saspkg.cntl file to include dynamic IP address, as desired

cmhaltpkg saspkg

cd /etc/cmcluster

rcp –r * rx5670b:/etc/cmcluster

cmrunpkg saspkg

cmviecl –v # Check package has started and dynamic IP address is ping-able

Enable the switchable package to switch to its failover node by editing the package control file

edit /etc/cmcluster/saspkg/saspkg.cntl file #add NODE_NAME rx5670b

cmhaltcl –f –v

cd /etc/cmcluster

rcp –r * rx5670b:/etc/cmcluster

cmrunc1 –v

Test package switching to alternate node

cmhaltpkg saspkg

cmmodpkg –e saspkg # Enable package switching

cmrunpkg –n rx5670b saspkg # Run Metadata Server on secondary node

Add application startup/shutdown details to package control script (saspkg.cntl) and check successful package activation.

    cmhaltpkg saspkg
    cd /etc/cmcluster
    rcp –r * rx5670b:/etc/cmcluster
    cmrunpkg saspkg
    cmviecl –v # Check package has started on node rx5670a and all binaries are running
**Serviceguard Failover Test Scenarios**

**Repository Connectivity Test Scenarios**

To adequately test the operation of an application following a failover, a series of acceptance tests must be performed before and after each failover. These tests should be sufficient to ensure a full and thorough exercising of the data flow through the application. Care must be taken to avoid instances where cached data is returned in response to an application request or query.

For the Metadata Server, these acceptance tests, performed before and after each failover test in this section of the document, consist of the following specific actions:

1. On a client PC running Windows XP Professional, run the Repository Query Application. This application is Java-based and sends a series of queries to the Metadata Server requesting a list of all available repository names. The Repository Query application will note loss of connection to the Metadata Server, and will retry a query every ten seconds until a connection to the Metadata Server is established.

2. Use the SAS Management Console to create a new project repository.

**Test 1**

Description:
- Metadata Server package UP on its Primary node (rx5670a)
- With the package running:
  - Shutdown the Metadata Server package using Serviceguard commands.
  - Test the response of the package
- Commands:
  - cmhaltpkg saspkg
- Results:
  - Metadata Server processes shutdown cleanly – all daemons stopped, all processes terminated, all sockets closed.
  - Metadata Server shutdown did not cause any errors within Serviceguard or on the rx5670 server. The HP server was still fully accessible (i.e. ssh, telnet, etc.) and functional.

**Test 2**

Description:
- These tests were performed immediately following Test 1.
- Metadata Server package down on its primary node (rx5670a).
- Attempt to query the repository
- Results:
  - The client request was unable to establish a connection with the Metadata Server
Test 3

Description:
- This test should be performed immediately following Test 2.
- Metadata Server package down on its primary node.

- Start Metadata Server package using Serviceguard commands, specifying that the package should start on its Failover node.
- Attempt to query the repository.

- Commands:
  - cmrunpkg –n rx5670b saspkg

- Results:
  - Metadata Server package started cleanly
  - A client query was able to be satisfied correctly, as the Metadata Server was now up and running
  - No package hang or inappropriate error message

Test 4

Description:
- Metadata Server package UP on its Secondary node (rx5670b)

- With the package running:
  - Shutdown the Metadata Server package using Serviceguard commands.
  - Test the response of the Metadata Server package

- Commands:
  - cmhaltpkg saspkg

- Results:
  - Metadata Server processes shutdown cleanly – all daemons stopped, all processes terminated, all sockets closed.
  - Metadata Server shutdown did not cause any errors within Serviceguard or on the rx5670b server. The server was still fully accessible and functional.

Test 5

Description:
- These tests were performed immediately following Test 4.

- Test package down on its secondary node (rx5670b).

- Attempt to query the repository.

- Results:
  - The client request was unable to establish a connection with the Metadata Server
  - No package hang or inappropriate error message
Test 6

Description:
- This test should be performed immediately following Test 5.
- Metadata Server package down.
- Start Metadata Server package using Serviceguard commands, specifying that the package should start on its primary node.
- Attempt to query the repository.
- Commands:
  - `cmrunpkg -n rx5670a saspkg`
- Results:
  - Metadata Server package started cleanly.
  - A client query was able to be satisfied correctly, as the Metadata Server was now up and running
  - No package hang or inappropriate error message

Test 7

Description:
- Test the monitoring and restart capabilities of the Metadata Server package.
- Metadata Server package running on its primary node.
- The Metadata Server monitor script is started as a service within the saspkg control script (saspkg.cntl). The following test was performed with the Metadata Server package running on both rx5670a and rx5670b, in sequence:
  - Locate any Metadata Server (e.g. sas, elssrv) process using the ps-ef command
  - Kill one Metadata Server process using the `kill -9` command
  - The Metadata Server monitor script saw the loss of the monitored process and performed an “exit 1”, to return to Serviceguard.
  - Serviceguard initiated a total shutdown of the Metadata Server on its current node.
  - Serviceguard then initiated a restart of the Metadata Server on its failover node
  - A client query was then able to be satisfied correctly.

Test 8

Description:
- Test local failure of LAN cards in each cluster node to verify that the package uses the standby LAN interface card when the Primary LAN interface card in the machine upon which it is running has failed. This test is used to verify the independence of the application from dependencies on MAC addresses. This test does not specifically exercise any functionality of Metadata Server or its component pieces, other than the aforementioned MAC address independence.
- Package UP on its primary node
- Commands:
  - Disconnect rx5670a primary data LAN cable from designated port on the network hub.
• Results:
  • Disconnected LAN cable of LAN0 on rx5670a from network hub.
  • No noticeable delay of the Metadata Server Repository Query application, as the LAN switch is virtually instantaneous.
  • LAN1 (Standby Data LAN) on rx5670a now active.
  • Repository Query application now accessing Metadata Server using original Package IP address on Standby Data LAN interface card.
  • Monitor status for Metadata Server package still responded correctly, and all Repository Query activity to the Metadata Server continued normally.

Test 9

Description:
• Restore LAN connectivity disconnected in Test 8, above; i.e. plug the LAN cable back into the network hub.

• Packages UP on its primary node.

• Commands:
  • Re-connect rx5670a primary data LAN cable to designated port on the network hub.

• Results:
  • Connected LAN cable of LAN0 on rx5670a to network hub.
  • No noticeable delay of the Metadata Server Repository Query application, as the LAN switch is virtually instantaneous.
  • LAN1 (Standby Data LAN) on rx5670a now active.
  • Repository Query application now accessing Metadata Server using original Package IP address on Standby Data LAN interface card.
  • Monitor status for Metadata Server package still responded correctly, and all Repository Query activity to the Metadata Server continued normally.

Test 10

Description:
• Package UP on its primary node.

• Power off primary node (rx5670a) using a <PC –OFF> request from the Management Processor interface.
  • Test rx5670b and Repository Query application responses.

• Commands:
  • Initiate a Power-Off from the Management Processor.

• Results:
  • System powered off, so the Metadata Server was shutdown abruptly, without any chance to clean-up any intermediate files, sockets, etc.
  • Repository Query operations to the Metadata Server could not complete.
  • Serviceguard recognized the loss of one cluster member, and reformed the cluster with the one remaining node.
  • Serviceguard started the Metadata Server package on that package’s secondary node.
Once the Metadata Server package had restarted, a new request was automatically submitted to the Metadata Server by the Repository Query application. The Metadata Server correctly received the query from the Repository Query application, and returned the appropriate response.

Note: After the primary node has recovered, use SG commands to add it back to the cluster and enable failover

Test 11

Description:

- Test the restart capability of all Serviceguard-monitored services.

- In the saspkg.cntl package control script, “monitor_sas.sh” is the service run by Serviceguard for this package.

- This service was set for no restarts.

Commands:

- Kill this script with the <kill –9> command.

Results:

- Serviceguard realized the loss of the monitored service.
- Since the service was coded for no restarts, Serviceguard halted the Metadata Server package and performed a package failover to the package’s failover node.
- The package started correctly on the failover node.
- The Repository Query application was able to connect to the Metadata Server and receive an appropriate response.

Test 12

Description:

- Test the performance of the Metadata Server package when the cluster heartbeat is lost between the cluster nodes.

Commands:

- Choose one of the cluster nodes and disconnect its primary cluster heartbeat cable from the network hub.
- Altogether, one cable has been disconnected.

Methodology:

- One of the two nodes will obtain control of the cluster lock disk
- The remaining node will perform a TOC (Transfer Of Control) in order to avoid a potential race condition.
- If the Metadata Server package was running on the TOC’d node, the Metadata Server will be restarted on the surviving node by Serviceguard.
- If the Metadata Server package was running on the node that was not TOC’d, it should continue normal operation while the cluster reforms.
Results:

- The heartbeat cable of rx5670b was disconnected from its network hub.
- rx5670a, the node running the Metadata Server package, took control of the cluster lock disk.
- rx5670b performed a TOC.
  - The Metadata Server package continued running on rx5670a. The Repository Query application continued to request and receive data from the Metadata Server package that was still running on rx5670a.
Appendix 1: Cluster Configuration File (cluster1.ascii)

# **************************************************************************
# ********* HIGH AVAILABILITY CLUSTER CONFIGURATION FILE ***************
# ***** For complete details about cluster parameters and how to ********
# ***** set them... consult the Serviceguard manual. ********************
# **************************************************************************

# Enter a name for this cluster.  This name will be used to identify the
# cluster when viewing or manipulating it.

CLUSTER_NAME cluster1

# Cluster Lock Parameters
# The cluster lock is used as a tie-breaker for situations
# in which a running cluster fails, and then two equal-sized
# sub-clusters are both trying to form a new cluster.  The
# cluster lock may be configured using only one of the
# following alternatives on a cluster:
#          the LVM lock disk
#          the quorom server

# Consider the following when configuring a cluster.
# For a two-node cluster, you must use a cluster lock.  For
# a cluster of three or four nodes, a cluster lock is strongly
# recommended.  For a cluster of more than four nodes, a
# cluster lock is recommended.  If you decide to configure
# a lock for a cluster of more than four nodes, it must be
# a quorum server.

# Lock Disk Parameters.  Use the FIRST_CLUSTER_LOCK_VG and
# FIRST_CLUSTER_LOCK_PV parameters to define a lock disk.
# The FIRST_CLUSTER_LOCK_VG is the LVM volume group that
# holds the cluster lock. This volume group should not be
# used by any other cluster as a cluster lock device.

# Quorum Server Parameters. Use the QS_HOST, QS_POLLING_INTERVAL,
# and QS_TIMEOUT_EXTENSION parameters to define a quorum server.
# The QS_HOST is the host name or IP address of the system
# that is running the quorum server process.  The
# QS_POLLING_INTERVAL (microseconds) is the interval at which
# Serviceguard checks to make sure the quorum server is running.
# The optional QS_TIMEOUT_EXTENSION (microseconds) is used to increase
# the time interval after which the quorum server is marked DOWN.

# The default quorum server timeout is calculated from the
# Serviceguard cluster parameters, including NODE_TIMEOUT and
# HEARTBEAT_INTERVAL.  If you are experiencing quorum server
# timeouts, you can adjust these parameters, or you can include
# the QS_TIMEOUT_EXTENSION parameter.

# The value of QS_TIMEOUT_EXTENSION will directly effect the amount
# of time it takes for cluster reformation in the event of failure.
# For example, if QS_TIMEOUT_EXTENSION is set to 10 seconds, the cluster
# reformation will take 10 seconds longer than if the QS_TIMEOUT_EXTENSION
# was set to 0. This delay applies even if there is no delay in
# contacting the Quorum Server.  The recommended value for
# QS_TIMEOUT_EXTENSION is 0, which is used as the default
# and the maximum supported value is 30000000 (5 minutes).

# For example, to configure a quorum server running on node
# "qshost" with 120 seconds for the QS_POLLING_INTERVAL and to
# add 2 seconds to the system assigned value for the quorum server
# timeout, enter:

QS_HOST qshost
QS_POLLING_INTERVAL 120000000
QS_TIMEOUT_EXTENSION 2000000

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FIRST_CLUSTER_LOCK_VG /dev/vg01

Definition of nodes in the cluster.
Repeat node definitions as necessary for additional nodes.
NODE_NAME is the specified nodename in the cluster.
It must match the hostname and both cannot contain full domain name.
Each NETWORK_INTERFACE, if configured with IPv4 address, must have ONLY one IPv4 address entry with it which could be either HEARTBEAT_IP or STATIONARY_IP.
Each NETWORK_INTERFACE, if configured with IPv6 address(es) can have multiple IPv6 address entries (up to a maximum of 2, only one IPv6 address entry belonging to site-local scope and only one belonging to global scope) which must be all STATIONARY_IP. They cannot be HEARTBEAT_IP.

NODE_NAME rx5670a
NETWORK_INTERFACE lan0
  STATIONARY_IP 192.6.174.10
  NETWORK_INTERFACE lan1
  HEARTBEAT_IP 10.10.10.10
  NETWORK_INTERFACE lan2
FIRST_CLUSTER_LOCK_PV /dev/dsk/c5t15d0
# List of serial device file names
# For example:
# SERIAL_DEVICE_FILE /dev/tty0p0
# Warning: There are no standby network interfaces for lan0.

NODE_NAME rx5670b
NETWORK_INTERFACE lan0
  STATIONARY_IP 192.6.174.12
  NETWORK_INTERFACE lan1
  HEARTBEAT_IP 10.10.10.12
  NETWORK_INTERFACE lan2
FIRST_CLUSTER_LOCK_PV /dev/dsk/c5t15d0
# List of serial device file names
# For example:
# SERIAL_DEVICE_FILE /dev/tty0p0
# Warning: There are no standby network interfaces for lan0.

Cluster Timing Parameters (microseconds).

The NODE_TIMEOUT parameter defaults to 2000000 (2 seconds).
This default setting yields the fastest cluster re-formations.
However, the use of the default value increases the potential for spurious re-formations due to momentary system hangs or network load spikes.
For a significant portion of installations, a setting of 5000000 to 8000000 (5 to 8 seconds) is more appropriate.
The maximum value recommended for NODE_TIMEOUT is 30000000 (30 seconds).
HEARTBEAT_INTERVAL 1000000
NODE_TIMEOUT 2000000

The FAILOVER_OPTIMIZATION parameter enables Failover Optimization, which reduces the time Serviceguard takes for failover. (Failover Optimization cannot, however, change the time an application needs to shut down or restart.)
There are four requirements:
* The Serviceguard Extension for Faster Failover product (SGeFF) must be installed on all cluster nodes.
* Only one or two node clusters are supported.
* A quorum server must be configured as the tie-breaker.
* The cluster must have more than one heartbeat subnet, and neither can be a serial line (RS232).

Other considerations are listed in the SGeFF Release Notes and the Serviceguard manual.

You must halt the cluster to change FAILOVER_OPTIMIZATION parameter.

To enable Failover Optimization, set FAILOVER_OPTIMIZATION to TWO_NODE.
The default is NONE.

FAILOVER_OPTIMIZATION <NONE/TWO_NODE>

FAILOVER_OPTIMIZATION NONE

Configuration/Reconfiguration Timing Parameters (microseconds).

AUTO_START_TIMEOUT 600000000
NETWORK_POLLING_INTERVAL 2000000

Network Monitor Configuration Parameters.
The NETWORK_FAILURE_DETECTION parameter determines how LAN card failures are detected.
If set to INONLY_OR_INOUT, a LAN card will be considered down when its inbound message count stops increasing or when both inbound and outbound message counts stop increasing.
If set to INOUT, both the inbound and outbound message counts must stop increasing before the card is considered down.

NETWORK_FAILURE_DETECTION INOUT

Package Configuration Parameters.
Enter the maximum number of packages which will be configured in the cluster.
You can not add packages beyond this limit.
This parameter is required.
MAX_CONFIGURED_PACKAGES 5

Access Control Policy Parameters.

Three entries set the access control policy for the cluster:
First line must be USER_NAME, second USER_HOST, and third USER_ROLE.
Enter a value after each.

1. USER_NAME can either be ANY_USER, or a maximum of 8 login names from the /etc/passwd file on user host.
2. USER_HOST is where the user can issue Serviceguard commands.
   If using Serviceguard Manager, it is the COM server.
   Choose one of these three values: ANY_SERVICEGUARD_NODE, or (any) CLUSTER_MEMBER_NODE, or a specific node. For node, use the official hostname from domain name server, and not an IP addresses or fully qualified name.
3. USER_ROLE must be one of these three values:
   * MONITOR: read-only capabilities for the cluster and packages
   * PACKAGE_ADMIN: MONITOR, plus administrative commands for packages in the cluster
   * FULL_ADMIN: MONITOR and PACKAGE_ADMIN plus the administrative commands for the cluster.

Access control policy does not set a role for configuration capability. To configure, a user must log on to one of the cluster's nodes as root (UID=0). Access control policy cannot limit root users' access.

MONITOR and FULL_ADMIN can only be set in the cluster configuration file, and they apply to the entire cluster. PACKAGE_ADMIN can be set in the cluster or a package configuration file. If set in the cluster configuration file, PACKAGE_ADMIN applies to all configured packages. If set in a package configuration file, PACKAGE_ADMIN applies to that package only.
# Conflicting or redundant policies will cause an error while applying the configuration, and stop the process. The maximum number of access policies that can be configured in the cluster is 200.

# Example: to configure a role for user john from node noir to administer a cluster and all its packages, enter:
# USER_NAME  john
# USER_HOST  noir
# USER_ROLE  FULL_ADMIN

# List of cluster aware LVM Volume Groups. These volume groups will be used by package applications via the vgchange -a e command.
# Neither CVM or VxVM Disk Groups should be used here.
# For example:
# VOLUME_GROUP /dev/vgdatabase
VOLUME_GROUP /dev/vg01

# List of OPS Volume Groups.
# Formerly known as DLM Volume Groups, these volume groups will be used by OPS or RAC cluster applications via the vgchange -a s command. (Note: the name DLM_VOLUME_GROUP is also still supported for compatibility with earlier versions.)
# For example:
# OPS_VOLUME_GROUP  /dev/vgdatabase
# OPS_VOLUME_GROUP  /dev/vg02
#OPS_VOLUME_GROUP   /dev/vg01
Appendix 2: Metadata Server Package Configuration File (saspkg.ascii)

# **********************************************************************
# ****** HIGH AVAILABILITY PACKAGE CONFIGURATION FILE (template) *******
# **********************************************************************
# ******* Note: This file MUST be edited before it can be used. *******
#  For complete details about package parameters and how to set them, *
#  consult the Serviceguard Extension for RAC manuals.
# **********************************************************************

# Enter a name for this package. This name will be used to identify the
# package when viewing or manipulating it. It must be different from
# the other configured package names.

PACKAGE_NAME  saspkg

# Enter the package type for this package. PACKAGE_TYPE indicates
# whether this package is to run as a FAILOVER or SYSTEM_MULTI_NODE
# package.

FAILOVER

# package runs on one node at a time and if a failure
# occurs it can switch to an alternate node.

SYSTEM_MULTI_NODE

package runs on multiple nodes at the same time.
It can not be started and halted on individual nodes.
Both NODE_FAIL_FAST_ENABLED and AUTO_RUN must be set
to YES for this type of package. All SERVICES must
have SERVICE_FAIL_FAST_ENABLED set to YES.

NOTE: Packages which have a PACKAGE_TYPE of SYSTEM_MULTI_NODE are
not failover packages and should only be used for applications
provided by Hewlett-Packard.

Since SYSTEM_MULTI_NODE packages run on multiple nodes at
one time, following parameters are ignored:

FAILOVER_POLICY
FAILBACK_POLICY

Since an IP address can not be assigned to more than node at a
time, relocatable IP addresses can not be assigned in the
package control script for multiple node packages. If
volume groups are assigned to multiple node packages they must
activated in a shared mode and data integrity is left to the
application. Shared access requires a shared volume manager.

Examples : PACKAGE_TYPE   FAILOVER (default)
            PACKAGE_TYPE   SYSTEM_MULTI_NODE

# Enter the failover policy for this package. This policy will be used
# to select an adoptive node whenever the package needs to be started.
# The default policy unless otherwise specified is CONFIGURED_NODE.
# This policy will select nodes in priority order from the list of
# NODE_NAME entries specified below.

FAILOVER_POLICY

# The alternative policy is MIN_PACKAGE_NODE. This policy will select
# the node, from the list of NODE_NAME entries below, which is
# running the least number of packages at the time this package needs
# to start.

FAILBACK_POLICY

# Enter the failback policy for this package. This policy will be used
to determine what action to take when a package is not running on
its primary node and its primary node is capable of running the
package. The default policy unless otherwise specified is MANUAL.
The MANUAL policy means no attempt will be made to move the package
back to its primary node when it is running on an adoptive node.
The alternative policy is AUTOMATIC. This policy will attempt to
move the package back to its primary node whenever the primary node
is capable of running the package.

FAILBACK_POLICY MANUAL

# Enter the names of the nodes configured for this package. Repeat
# this line as necessary for additional adoptive nodes.
# NOTE: The order is relevant.
# Put the second Adoptive Node after the first one.
# Example : NODE_NAME original_node
# NODE_NAME adoptive_node
# If all nodes in the cluster are to be specified and order is not
# important, "NODE_NAME *" may be specified.
# Example : NODE_NAME *

NODE_NAME rx5670a
NODE_NAME rx5670b

# Enter the value for AUTO_RUN. Possible values are YES and NO.
The default for AUTO_RUN is YES. When the cluster is started the
package will be automatically started. In the event of a failure the
package will be started on an adoptive node. Adjust as necessary.
AUTO_RUN YES

# Enter the value for LOCAL_LAN_FAILOVER_ALLOWED.
# Possible values are YES and NO.
# The default for LOCAL_LAN_FAILOVER_ALLOWED is YES. In the event of a
# failure, this permits the cluster software to switch LANs locally
# (transfer to a standby LAN card). Adjust as necessary.
# LOCAL_LAN_FAILOVER_ALLOWED replaces obsolete NET_SWITCHING_ENABLED.
LOCAL_LAN_FAILOVER_ALLOWED YES

# Enter the value for NODE_FAIL_FAST_ENABLED.
# Possible values are YES and NO.
# The default for NODE_FAIL_FAST_ENABLED is NO. If set to YES,
# in the event of a failure, the cluster software will halt the node
# on which the package is running. All SYSTEM_MULTI_NODE packages must have
# NODE_FAIL_FAST_ENABLED set to YES. Adjust as necessary.
NODE_FAIL_FAST_ENABLED NO

# Enter the complete path for the run and halt scripts. In most cases
# the run script and halt script specified here will be the same script,
# the package control script generated by the cmmakepkg command. This
# control script handles the run(ning) and halt(ing) of the package.
# Enter the timeout, specified in seconds, for the run and halt scripts.
# If the script has not completed by the specified timeout value,
# it will be terminated. The default for each script timeout is
# NO_TIMEOUT. Adjust the timeouts as necessary to permit full
# execution of each script.
RUN_SCRIPT /etc/cmcluster/saspkg/saspkg.cntl
RUN_SCRIPT_TIMEOUT NO_TIMEOUT
HALT_SCRIPT /etc/cmcluster/saspkg/saspkg.cntl
HALT_SCRIPT_TIMEOUT NO_TIMEOUT

Enter the names of the storage groups configured for this package.
Repeat this line as necessary for additional storage groups.

Storage groups are only used with CVM disk groups. Neither VxVM disk groups or LVM volume groups should be listed here.
By specifying a CVM disk group with the STORAGE_GROUP keyword this package will not run until the VxVM-CVM-pkg package is running and thus the CVM shared disk groups are ready for activation.

NOTE: Should only be used by applications provided by Hewlett-Packard.

Example: STORAGE_GROUP dg01
          STORAGE_GROUP dg02
          STORAGE_GROUP dg03
          STORAGE_GROUP dg04

Enter the SERVICE_NAME, the SERVICE_FAIL_FAST_ENABLED and the SERVICE_HALT_TIMEOUT values for this package. Repeat these three lines as necessary for additional service names. All service names MUST correspond to the SERVICE_NAME[] entries in the package control script.

The value for SERVICE_FAIL_FAST_ENABLED can be either YES or NO. If set to YES, in the event of a service failure, the cluster software will halt the node on which the service is running. If SERVICE_FAIL_FAST_ENABLED is not specified, the default will be NO.

SERVICE_HALT_TIMEOUT is represented as a number of seconds. This timeout is used to determine the length of time (in seconds) the cluster software will wait for the service to halt before a SIGKILL signal is sent to force the termination of the service. In the event of a service halt, the cluster software will first send a SIGTERM signal to terminate the service. If the service does not halt, after waiting for the specified SERVICE_HALT_TIMEOUT, the cluster software will send out the SIGKILL signal to the service to force its termination. This timeout value should be large enough to allow all cleanup processes associated with the service to complete. If the SERVICE_HALT_TIMEOUT is not specified, a zero timeout will be assumed, meaning the cluster software will not wait at all before sending the SIGKILL signal to halt the service.

Example: SERVICE_NAME DB_SERVICE
          SERVICE_FAIL_FAST_ENABLED NO
          SERVICE_HALT_TIMEOUT 300

To configure a service, uncomment the following lines and fill in the values for all of the keywords.

SERVICE_NAME monitor_sas
SERVICE_FAIL_FAST_ENABLED NO
SERVICE_HALT_TIMEOUT 300

Enter the network subnet name that is to be monitored for this package. Repeat this line as necessary for additional subnet names. If any of the subnets defined goes down, the package will be switched to another...
# node that is configured for this package and has all the defined subnets available.
The subnet names could be IPv4 or IPv6. The network subnet names that are to be monitored for this package could be a mix of IPv4 or IPv6 subnet names

SUBNET 192.6.174.0
SUBNET 10.0.0.0

The keywords RESOURCE_NAME, RESOURCE_POLLING_INTERVAL, RESOURCE_START, and RESOURCE_UP_VALUE are used to specify Package Resource Dependencies. To define a package Resource Dependency, a RESOURCE_NAME line with a fully qualified resource path name, and one or more RESOURCE_UP_VALUE lines are required. The RESOURCE_POLLING_INTERVAL and the RESOURCE_START are optional.

The RESOURCE_POLLING_INTERVAL indicates how often, in seconds, the resource is to be monitored. It will be defaulted to 60 seconds if RESOURCE_POLLING_INTERVAL is not specified.

The RESOURCE_START option can be set to either AUTOMATIC or DEFERRED. The default setting for RESOURCE_START is AUTOMATIC. If AUTOMATIC is specified, Serviceguard will start up resource monitoring for these AUTOMATIC resources automatically when the node starts up. If DEFERRED is selected, Serviceguard will not attempt to start resource monitoring for these resources during node start up. User should specify all the DEFERRED resources in the package run script so that these DEFERRED resources will be started up from the package run script during package run time.

RESOURCE_UP_VALUE requires an operator and a value. This defines the resource 'UP' condition. The operators are =, !=, >, <, >=, and <=, depending on the type of value. Values can be string or numeric. If the type is string, then only = and != are valid operators. If the string contains whitespace, it must be enclosed in quotes. String values are case sensitive. For example,

- RESOURCE_UP_VALUE = UP "UP"
- RESOURCE_UP_VALUE != DOWN Any value except "DOWN"
- RESOURCE_UP_VALUE = "On Course" "On Course"

If the type is numeric, then it can specify a threshold, or a range to define a resource up condition. If it is a threshold, then any operator may be used. If a range is to be specified, then only > or >= may be used for the first operator, and only < or <= may be used for the second operator. For example,

- RESOURCE_UP_VALUE = 5 5 (threshold)
- RESOURCE_UP_VALUE > 5.1 greater than 5.1 (threshold)
- RESOURCE_UP_VALUE > -5 and < 10 between -5 and 10 (range)

Note that "and" is required between the lower limit and upper limit when specifying a range. The upper limit must be greater than the lower limit. If RESOURCE_UP_VALUE is repeated within a RESOURCE_NAME block, then they are inclusively OR'd together. Package Resource Dependencies may be defined by repeating the entire RESOURCE_NAME block.

Example: RESOURCE_NAME /net/interfaces/lan/status/lan0
RESOURCES_POLLING_INTERVAL 120
RESOURCES_START AUTOMATIC
RESOURCES_UP_VALUE = RUNNING
RESOURCES_UP_VALUE = ONLINE

Means that the value of resource /net/interfaces/lan/status/lan0 will be checked every 120 seconds, and is considered to be 'up' when its value is "RUNNING" or "ONLINE".
# Uncomment the following lines to specify Package Resource Dependencies.
#
# RESOURCE_NAME   <Full_path_name>
# RESOURCE_POLLING_INTERVAL  <numeric_seconds>
# RESOURCE_START   <AUTOMATIC/DEFERRED>
# RESOURCE_UP_VALUE   <op> <string_or_numeric> [and <op> <numeric>]

# Access Control Policy Parameters.
# Three entries set the access control policy for the package:
# First line must be USER_NAME, second USER_HOST, and third USER_ROLE.
# Enter a value after each.

# 1. USER_NAME can either be ANY_USER, or a maximum of
# 8 login names from the /etc/passwd file on user host.
# 2. USER_HOST is where the user can issue Serviceguard commands.
#    If using Serviceguard Manager, it is the COM server.
#    Choose one of these three values: ANY_SERVICEGUARD_NODE, or
#    (any) CLUSTER_MEMBER_NODE, or a specific node. For node,
#    use the official hostname from domain name server, and not
#    an IP addresses or fully qualified name.
# 3. USER_ROLE must be PACKAGE_ADMIN. This role grants permission
#    to MONITOR, plus for administrative commands for the package.

# These policies do not effect root users. Access Policies here
# should not conflict with policies defined in the cluster configuration file.

# Example: to configure a role for user john from node noir to
# administer the package, enter:
# USER_NAME  john
# USER_HOST  noir
# USER_ROLE  PACKAGE_ADMIN
Appendix 3: Metadata Server Package Control Script (saspkg.cntl)

# A.11.16.00 $Date: 03/15/04 $
# ************************************************************************
# * HIGH AVAILABILITY PACKAGE CONTROL SCRIPT (template) *
# * Note: This file MUST be edited before it can be used. *
# *
# ************************************************************************

The PACKAGE and NODE environment variables are set by Serviceguard at the time the control script is executed. Do not set these environment variables yourself! The package may fail to start or halt if the values for these environment variables are altered.

`$(SGCONFFILE=-/etc/cmcluster.conf)`

UNCOMMENT the variables as you set them.

Set PATH to reference the appropriate directories.

`PATH=$SGSBIN:/usr/bin:/usr/sbin:/etc:/bin`

# VOLUME GROUP ACTIVATION:
# Specify the method of activation for volume groups.
# Leave the default ("VGCHANGE="vgchange -a e") if you want volume groups activated in exclusive mode. This assumes the volume groups have been initialized with 'vgchange -c y' at the time of creation.
# Uncomment the first line (VGCHANGE="vgchange -a e -q n"), and comment out the default, if your disks are mirrored on separate physical paths,
# Uncomment the second line (VGCHANGE="vgchange -a e -q n -s"), and comment out the default, if your disks are mirrored on separate physical paths, and you want the mirror resynchronization to occur in parallel with the package startup.
# Uncomment the third line (VGCHANGE="vgchange -a y") if you wish to use non-exclusive activation mode. Single node cluster configurations must use non-exclusive activation.

`VGCHANGE="vgchange -a e -q n"`
`VGCHANGE="vgchange -a e -q n -s"`
`VGCHANGE="vgchange -a y"`
`VGCHANGE="vgchange -a e"` # Default

# CVM DISK GROUP ACTIVATION:
# Specify the method of activation for CVM disk groups.
# Leave the default (CVM_ACTIVATION_CMD="vxdg -g \$DiskGroup set activation=exclusivewrite") if you want disk groups activated in the exclusive write mode.
# Uncomment the first line (CVM_ACTIVATION_CMD="vxdg -g \$DiskGroup set activation=readonly"), and comment out the default, if you want disk groups activated in the readonly mode.
# Uncomment the second line (CVM_ACTIVATION_CMD="vxdg -g \$DiskGroup set activation=sharedread"), and comment out the default, if you want disk groups activated in the shared read mode.
# Uncomment the third line (CVM_ACTIVATION_CMD="vxdg -g \$DiskGroup set activation=sharedwrite"), and comment out the default, if you want disk groups activated in the shared write mode.

`CVM_ACTIVATION_CMD="vxdg -g \$DiskGroup set activation=readonly"`
`CVM_ACTIVATION_CMD="vxdg -g \$DiskGroup set activation=sharedread"`
# CVM_ACTIVATION_CMD="vxdg -g /$DiskGroup set activation=sharedwrite"
CVM_ACTIVATION_CMD="vxdg -g /$DiskGroup set activation=exclusivewrite"

# VOLUME GROUPS
Specify which volume groups are used by this package. Uncomment VG[0]="" and fill in the name of your first volume group. You must begin with VG[0], and increment the list in sequence.

For example, if this package uses your volume groups vg01 and vg02, enter:
   VG[0]=vg01
   VG[1]=vg02

The volume group activation method is defined above. The filesystems associated with these volume groups are specified below.

VG[0]=vg01

# CVM DISK GROUPS
Specify which cvm disk groups are used by this package. Uncomment CVM_DG[0]="" and fill in the name of your first disk group. You must begin with CVM_DG[0], and increment the list in sequence.

For example, if this package uses your disk groups dg01 and dg02, enter:
   CVM_DG[0]=dg01
   CVM_DG[1]=dg02

The cvm disk group activation method is defined above. The filesystems associated with these volume groups are specified below in the CVM_* variables.

#CVM_DG[0]="

# VXVM DISK GROUPS
Specify which VxVM disk groups are used by this package. Uncomment VXVM_DG[0]="" and fill in the name of your first disk group. You must begin with VXVM_DG[0], and increment the list in sequence.

For example, if this package uses your disk groups dg01 and dg02, enter:
   VXVM_DG[0]=dg01
   VXVM_DG[1]=dg02

The cvm disk group activation method is defined above.

# VXVM_DG[0]="

# NOTE: A package could have LVM volume groups, CVM disk groups and VxVM disk groups.

# NOTE: When VxVM is initialized it will store the hostname of the local node in its volboot file in a variable called 'hostid'. The Serviceguard package control scripts use both the values of the hostname(1m) command and the VxVM hostid. As a result the VxVM hostid should always match the value of the hostname(1m) command.

If you modify the local host name after VxVM has been initialized and such that hostname(1m) does not equal uname -n, you need to use the vxctl(1m) command to set the VxVM hostid field to the value of hostname(1m). Failure to do so will result in the package failing to start.

# FILESYSTEMS
Filesystems are defined as entries specifying the logical volume, the mount point, the mount, umount and fsck options and type of the file system. Each filesystem will be fsck'd prior to being mounted. The filesystems will be mounted in the order specified during package startup and will be unmounted in reverse order during package shutdown. Ensure that volume groups referenced by the logical volume definitions below are included in volume group definitions above.
# Specify the filesystems which are used by this package. Uncomment
# LV[0]=""; FS[0]=""; FS_MOUNT_OPT[0]=""; FS_UMOUNT_OPT[0]=""; FS_FSCK_OPT[0]=""
# FS_TYPE[0]="" and fill in the name of your first logical volume,
# filesystem, mount, umount and fsck options and filesystem type
# for the file system. You must begin with LV[0], FS[0],
# FS_MOUNT_OPT[0], FS_UMOUNT_OPT[0], FS_FSCK_OPT[0], FS_TYPE[0]
# and increment the list in sequence.
#
# Note: The FS_TYPE parameter lets you specify the type of filesystem to be
# mounted. Specifying a particular FS_TYPE will improve package failover time.
# The FSCK_OPT and FS_UMOUNT_OPT parameters can be used to include the
# -s option with the fsck and umount commands to improve performance for
# environments that use a large number of filesystems. (An example of a
# large environment is given below following the description of the
# CONCURRENT_MOUNT_AND_UMOUNT_OPERATIONS parameter.)
# Example: If a package uses two JFS filesystems, pkg01a and pkg01b,
# which are mounted on LVM logical volumes lvoll and lvoll2 for read and
# write operation, you would enter the following:
# LV[0]=/dev/vg01/lvol1; FS[0]={pkg01a}; FS_MOUNT_OPT[0]="-o rw";
# FS_UMOUNT_OPT[0]=""; FS_FSCK_OPT[0]=""; FS_TYPE[0]="vxfs"
# LV[0]=/dev/vg01/lvol1; FS[0]=/sas; FS_MOUNT_OPT[0]="-o rw"; FS_UMOUNT_OPT[0]=""
# FS_FSCK_OPT[0]=""; FS_TYPE[0]="vxfs"
# VOLUME RECOVERY
#
# When mirrored VxVM volumes are started during the package control
# bring up, if recovery is required the default behavior is for
# the package control script to wait until recovery has been
# completed.
# To allow mirror resynchronization to occur in parallel with
# the package startup, uncomment the line
# VXVOL="vxvol -g \$DiskGroup -o bg startall" and comment out the default.
# VXVOL="vxvol -g \$DiskGroup -o bg startall"
# VXVOL="vxvol -g \$DiskGroup startall"
# VXVOL="vxvol -g \$DiskGroup startall" # Default

# FILESYSTEM UNMOUNT COUNT
# Specify the number of unmount attempts for each filesystem during package
# shutdown. The default is set to 1.
FS_UMOUNT_COUNT=5

# FILESYSTEM MOUNT RETRY COUNT.
# Specify the number of mount retries for each filesystem.
# The default is 0. During startup, if a mount point is busy
# and FS_MOUNT_RETRY_COUNT is 0, package startup will fail and
# the script will exit with 1. If a mount point is busy and
# FS_MOUNT_RETRY_COUNT is greater than 0, the script will attempt
# to kill the user responsible for the busy mount point
# and then mount the file system. It will attempt to kill user and
# retry mount, for the number of times specified in FS_MOUNT_RETRY_COUNT.
# If the mount still fails after this number of attempts, the script
# will exit with 1.
# NOTE: If the FS_MOUNT_RETRY_COUNT > 0, the script will execute
# "fuser -ku" to freeup busy mount point.
# FS_MOUNT_RETRY_COUNT=0

# Configuring the concurrent operations below can be used to improve the
# performance for starting up or halting a package. The maximum value for
# each concurrent operation parameter is 1024. Set these values carefully.
# The performance could actually decrease if the values are set too high
# for the system resources available on your cluster nodes. Some examples
# of system resources that can affect the optimum number of concurrent
# operations are: number of CPUs, amount of available memory, the kernel
configuration for nfile and nproc. In some cases, if you set the number
of concurrent operations too high, the package may not be able to start
or to halt. For example, if you set CONCURRENT_VGCHANGE_OPERATIONS=5
and the node where the package is started has only one processor, then
running concurrent volume group activations will not be beneficial.
It is suggested that the number of concurrent operations be tuned
carefully, increasing the values a little at a time and observing the
effect on the performance, and the values should never be set to a value
where the performance levels off or declines. Additionally, the values
used should take into account the node with the least resources in the
cluster, and how many other packages may be running on the node.
For instance, if you tune the concurrent operations for a package so
that it provides optimum performance for the package on a node while
no other packages are running on that node, the package performance
may be significantly reduced, or may even fail when other packages are
already running on that node.

CONCURRENT VCHANGE OPERATIONS
Specify the number of concurrent volume group activations or
deactivations to allow during package startup or shutdown.
Setting this value to an appropriate number may improve the performance
while activating or deactivating a large number of volume groups in the
package. If the specified value is less than 1, the script defaults it
to 1 and proceeds with a warning message in the package control script
logfile.
CONCURRENT_VCHANGE_OPERATIONS=1

CONCURRENT FSCK OPERATIONS
Specify the number of concurrent fsck to allow during package startup.
Setting this value to an appropriate number may improve the performance
while checking a large number of file systems in the package. If the
specified value is less than 1, the script defaults it to 1 and proceeds
with a warning message in the package control script logfile.
CONCURRENT_FSCK_OPERATIONS=1

CONCURRENT MOUNT AND UMOUNT OPERATIONS
Specify the number of concurrent mounts and umounts to allow during
package startup or shutdown.
Setting this value to an appropriate number may improve the performance
while mounting or un-mounting a large number of file systems in the package.
If the specified value is less than 1, the script defaults it to 1 and
proceeds with a warning message in the package control script logfile.
CONCURRENT_MOUNT_AND_UMOUNT_OPERATIONS=1

Example: If a package uses 50 JFS filesystems, pkg01aa through pkg01bx,
which are mounted on the 50 logical volumes lvol1..lvol150 for read and write
operation, you may enter the following:

     CONCURRENT_FSCK_OPERATIONS=50
     CONCURRENT_MOUNT_AND_UMOUNT_OPERATIONS=50

     LV[0]=/dev/vg01/lvol1; FS[0]=/pkg01aa; FS_MOUNT_OPT[0]="-o rw";
     FS_MOUNT_OPT[1]="-s"; FS_FSCK_OPT[0]="-s"; FS_TYPE[0]="vxfs"


     :               :
     :               :
     :               :

     FS_MOUNT_OPT[49]="-s"; FS_FSCK_OPT[49]="-s"; FS_TYPE[0]="vxfs"

IP ADDRESSES
Specify the IP and Subnet address pairs which are used by this package.
You could specify IPv4 or IPv6 IP and subnet address pairs.
 Uncomment IP[0]="" and SUBNET[0]="" and fill in the name of your first
IP and subnet address. You must begin with IP[0] and SUBNET[0] and
increment the list in sequence.
For example, if this package uses an IP of 192.10.25.12 and a subnet of
192.10.25.0 enter:
#          IP[0]=192.10.25.12
SUBNET[0]=192.10.25.0
(netmask=255.255.255.0)

Hint: Run "netstat -l" to see the available subnets in the Network field.

For example, if this package uses an IPv6 IP of 2001::1/64
The address prefix identifies the subnet as 2001::/64 which is an available
subnet.

enter:
IP[0]=2001::1
SUBNET[0]=2001::/64
(netmask=ffff:ffff:ffff:ffff::)

Alternatively the IPv6 IP/Subnet pair can be specified without the prefix
for the IPv6 subnet.
IP[0]=2001::1
SUBNET[0]=2001::
(netmask=ffff:ffff:ffff:ffff::)

Hint: Run "netstat -l" to see the available IPv6 subnets by looking
at the address prefixes
IP/Subnet address pairs for each IP address you want to add to a subnet
interface card. Must be set in pairs, even for IP addresses on the same
subnet.

IP[0]=192.6.174.11
SUBNET[0]=192.6.174.0

# SERVICE NAMES AND COMMANDS.
# Specify the service name, command, and restart parameters which are
# used by this package. Uncomment SERVICE_NAME[0]="", SERVICE_CMD[0]="",
# SERVICE_RESTART[0]="" and fill in the name of the first service, command,
# and restart parameters. You must begin with SERVICE_NAME[0], SERVICE_CMD[0],
# and SERVICE_RESTART[0] and increment the list in sequence.
#
# For example:
# SERVICE_NAME[0]=pkgl
SERVICE_CMD[0]="/usr/bin/X11/xclock -display 192.10.25.54:0"
SERVICE_RESTART[0]=""  # Will not restart the service.

# SERVICE_NAME[1]=pkglb
SERVICE_CMD[1]="/usr/bin/X11/xload -display 192.10.25.54:0"
SERVICE_RESTART[1]="-r 2"  # Will restart the service twice.

# SERVICE_NAME[2]=pkglc
SERVICE_CMD[2]="/usr/sbin/ping"
SERVICE_RESTART[2]="-R"  # Will restart the service an infinite
#                       number of times.

Note: No environmental variables will be passed to the command, this
includes the PATH variable. Absolute path names are required for the
service command definition. Default shell is /usr/bin/sh.

SERVICE_NAME[0]=monitor_sas
SERVICE_CMD[0]="/etc/cmcluster/saspkg/monitor_sas.sh"
SERVICE_RESTART[0]="

# DEFERRED_RESOURCE NAME
# Specify the full path name of the 'DEFERRED' resources configured for
# this package. Uncomment DEFERRED_RESOURCE_NAME[0]="" and fill in the
# full path name of the resource.
DEFERRED_RESOURCE_NAME[0]="

# DTC manager information for each DTC.
# Example: DTC[0]=dtc_20
DTC_NAME[0]=

# HA_NFS_SCRIPT_EXTENSION
# If the package uses HA NFS, this variable can be used to alter the
# name of the HA NFS script. If not set, the name of this script is
# assumed to be "ha_nfs.sh". If set, the "sh" portion of the default
# script name is replaced by the value of this variable. So if
# HA_NFS_SCRIPT_EXTENSION is set to "package1.sh", for example, the name
# of the HA NFS script becomes "ha_nfs.package1.sh". In any case,
# the HA NFS script must be placed in the same directory as the package
# control script. This allows multiple packages to be run out of the
# same directory, as needed by SGeSAP.
#HA_NFS_SCRIPT_EXTENSION=""

# START OF CUSTOMER DEFINED FUNCTIONS

# This function is a place holder for customer define functions.
# You should define all actions you want to happen here, before the service is
# started. You can create as many functions as you need.

function customer_defined_run_cmds
{
  # ADD customer defined run commands.
  # do nothing instruction, because a function must contain some command.
   /sas/MetadataServer/Lev1/SASMain/MetadataServer/MetadataServer.sh start
   test_return 51
}

# This function is a place holder for customer define functions.
# You should define all actions you want to happen here, before the service is
# halted.

function customer_defined_halt_cmds
{
  # ADD customer defined halt commands.
  : do nothing instruction, because a function must contain some command.
   /sas/MetadataServer/Lev1/SASMain/MetadataServer/MetadataServer.sh stop_no_error
   test_return 52
}

# END OF CUSTOMER DEFINED FUNCTIONS

# START OF RUN FUNCTIONS

/* For the sake of brevity, this script has been abbreviated,
   as the remainder of the script was unmodified from the
   standard. */
Appendix 4: Metadata Server Monitor Script (monitor_sas.sh)

#!/bin/sh

sleep 30

CHECKFOR="elssrv sas MetadataServer.sh"

trap "exit" 15

while true
    do
        print 
        print "Checked for SAS MetadataServer processes....."
        for i in $CHECKFOR
            do
                print "monitored process = ${i}"
                ps -efx | grep -i $i | grep -v grep > /dev/null 2>&1
                if [ $? -eq 1 ]
                    then
                        print "\n"
                        print "Process not found: ${i}"
                        exit 1
                fi
            done
        print "All MetadataServer processes found."
        sleep 15
    done

exit $EXIT

Appendix 5: Output of <bdf> on node rx5670a

<table>
<thead>
<tr>
<th>Filesystem</th>
<th>kbytes</th>
<th>used</th>
<th>avail</th>
<th>%used</th>
<th>Mounted on</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/vg00/lvol13</td>
<td>524288</td>
<td>218624</td>
<td>303288</td>
<td>42%</td>
<td>/</td>
</tr>
<tr>
<td>/dev/vg00/lvol11</td>
<td>524288</td>
<td>68816</td>
<td>451968</td>
<td>13%</td>
<td>/stand</td>
</tr>
<tr>
<td>/dev/vg00/lvol18</td>
<td>632424</td>
<td>1130896</td>
<td>5154320</td>
<td>18%</td>
<td>/var</td>
</tr>
<tr>
<td>/dev/vg00/lvol17</td>
<td>5242880</td>
<td>2620088</td>
<td>5224520</td>
<td>50%</td>
<td>/usr</td>
</tr>
<tr>
<td>/dev/vg00/lvol16</td>
<td>8388608</td>
<td>124816</td>
<td>8200000</td>
<td>1%</td>
<td>/tmp</td>
</tr>
<tr>
<td>/dev/vg00/lvol15</td>
<td>5242880</td>
<td>3458344</td>
<td>1770616</td>
<td>66%</td>
<td>/opt</td>
</tr>
<tr>
<td>/dev/vg00/lvol14</td>
<td>4194304</td>
<td>92072</td>
<td>4070216</td>
<td>2%</td>
<td>/home</td>
</tr>
<tr>
<td>/dev/vg01/lvol11</td>
<td>15360000</td>
<td>3510177</td>
<td>11109242</td>
<td>24%</td>
<td>/sas</td>
</tr>
</tbody>
</table>
Appendix 6: Output of `<cmviewcl -v>`

<table>
<thead>
<tr>
<th>CLUSTER</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>cluster1</td>
<td>up</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NODE</th>
<th>STATUS</th>
<th>STATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>rx5670a</td>
<td>up</td>
<td>running</td>
</tr>
</tbody>
</table>

Network_Parameters:

<table>
<thead>
<tr>
<th>INTERFACE</th>
<th>STATUS</th>
<th>PATH</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRIMARY</td>
<td>up</td>
<td>0/1/1/0/4/0</td>
<td>lan0</td>
</tr>
<tr>
<td>PRIMARY</td>
<td>up</td>
<td>0/2/1/0</td>
<td>lan1</td>
</tr>
<tr>
<td>STANDBY</td>
<td>up</td>
<td>0/3/1/0</td>
<td>lan2</td>
</tr>
</tbody>
</table>

PACKAGE STATUS STATE AUTO_RUN NODE

<table>
<thead>
<tr>
<th>PACKAGE</th>
<th>STATUS</th>
<th>STATE</th>
<th>AUTO_RUN</th>
<th>NODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>saspkg</td>
<td>up</td>
<td>running</td>
<td>enabled</td>
<td>rx5670a</td>
</tr>
</tbody>
</table>

Policy_Parameters:

<table>
<thead>
<tr>
<th>POLICY_NAME</th>
<th>CONFIGURED_VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failover</td>
<td>configured_node</td>
</tr>
<tr>
<td>Failback</td>
<td>manual</td>
</tr>
</tbody>
</table>

Script_Parameters:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>STATUS</th>
<th>MAX_RESTARTS</th>
<th>RESTARTS</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
<td>up</td>
<td>0</td>
<td>0</td>
<td>monitor_sas</td>
</tr>
<tr>
<td>Subnet</td>
<td>up</td>
<td></td>
<td></td>
<td>192.6.174.0</td>
</tr>
<tr>
<td>Subnet</td>
<td>up</td>
<td></td>
<td></td>
<td>10.0.0.0</td>
</tr>
</tbody>
</table>

Node_Switching_Parameters:

<table>
<thead>
<tr>
<th>NODE_TYPE</th>
<th>STATUS</th>
<th>SWITCHING</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>up</td>
<td>enabled</td>
<td>rx5670a (current)</td>
</tr>
<tr>
<td>Alternate</td>
<td>up</td>
<td>enabled</td>
<td>rx5670b</td>
</tr>
</tbody>
</table>

Appendix 7: Contents of `/etc/fstab` (same on both cluster nodes)

```
# System /etc/fstab file. Static information about the file systems
# See fstab(4) and sam(1M) for further details on configuring devices.
/dev/vg00/lvol3 / vxfs delaylog 0 1
/dev/vg00/lvol1 /stand vxfs tranflush 0 1
/dev/vg00/lvol4 /home vxfs delaylog 0 2
/dev/vg00/lvol5 /opt vxfs delaylog 0 2
/dev/vg00/lvol6 /tmp vxfs delaylog 0 2
/dev/vg00/lvol7 /usr vxfs delaylog 0 2
/dev/vg00/lvol8 /var vxfs delaylog 0 2
```
Appendix 8: Contents of /etc/hosts

## Configured using SAM by root on Tue Feb  8 09:15:38 2005
# @(#)B11.23_LRhosts $Revision: 1.9.214.1 $ $Date: 96/10/08 13:20:01 $
#
# The form for each entry is:
#   <internet address>   <official hostname> <aliases>
# For example:
#   192.1.2.34             hpfcrm    loghost
# See the hosts(4) manual page for more information.
# Note: The entries cannot be preceded by a space.
# The format described in this file is the correct format.
# The original Berkeley manual page contains an error in
# the format description.
#
192.6.174.10    rx5670a
10.10.10.10     rx5670a-hb
192.6.175.97    ptacws5
192.6.175.100   ptacws4
192.6.174.11    saspkg
192.6.174.12    rx5670b
127.0.0.1      localhost  loopback
### Appendix 9: Output of `<ioscan -f>` on node rx5670a

<table>
<thead>
<tr>
<th>Class</th>
<th>I</th>
<th>H/W Path</th>
<th>Driver</th>
<th>S/W State</th>
<th>H/W Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>root</td>
<td>0</td>
<td>root</td>
<td>CLAIMED</td>
<td>BUS_NEXUS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>lioa</td>
<td>0</td>
<td>0</td>
<td>sba</td>
<td>CLAIMED</td>
<td>BUS_NEXUS</td>
<td>System Bus Adapter (1229)</td>
</tr>
<tr>
<td>ba</td>
<td>0</td>
<td>0/0</td>
<td>lba</td>
<td>CLAIMED</td>
<td>BUS_NEXUS</td>
<td>Local PCI-X Bus Adapter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(122e)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tty</td>
<td>0</td>
<td>0/0/1/0</td>
<td>asio0</td>
<td>CLAIMED</td>
<td>INTERFACE</td>
<td>PCI SimpleComm (103c1290)</td>
</tr>
<tr>
<td>tty</td>
<td>1</td>
<td>0/0/1/1</td>
<td>asio0</td>
<td>CLAIMED</td>
<td>INTERFACE</td>
<td>PCI Serial (103c1048)</td>
</tr>
<tr>
<td>ext_bus</td>
<td>0</td>
<td>0/0/2/0</td>
<td>c8xx</td>
<td>CLAIMED</td>
<td>INTERFACE</td>
<td>SCSI C896 Ultra Wide Single-Ended</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(122e)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>disk</td>
<td>0</td>
<td>0/0/2/0/0</td>
<td>tgt</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td></td>
</tr>
<tr>
<td>target</td>
<td>1</td>
<td>0/0/2/0/2</td>
<td>tgt</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td></td>
</tr>
<tr>
<td>disk</td>
<td>1</td>
<td>0/0/2/0/2</td>
<td>sdisk</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td>HP 36.4GMAM3367MC</td>
</tr>
<tr>
<td>target</td>
<td>6</td>
<td>0/0/2/0/7</td>
<td>tgt</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td></td>
</tr>
<tr>
<td>ctrl</td>
<td>0</td>
<td>0/0/2/0/7</td>
<td>sctl</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td>Initiator</td>
</tr>
<tr>
<td>ext_bus</td>
<td>1</td>
<td>0/0/2/1</td>
<td>c8xx</td>
<td>CLAIMED</td>
<td>INTERFACE</td>
<td>SCSI C896 Ultra Wide Single-Ended</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(122e)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tty</td>
<td>4</td>
<td>0/0/2/1/3</td>
<td>tgt</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td></td>
</tr>
<tr>
<td>disk</td>
<td>4</td>
<td>0/0/2/1/3</td>
<td>sdisk</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td>HP DVD-ROM 305</td>
</tr>
<tr>
<td>target</td>
<td>7</td>
<td>0/0/2/1/7</td>
<td>tgt</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td></td>
</tr>
<tr>
<td>ctrl</td>
<td>2</td>
<td>0/0/2/1/7</td>
<td>sctl</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td>Initiator</td>
</tr>
<tr>
<td>ba</td>
<td>1</td>
<td>0/1</td>
<td>lba</td>
<td>CLAIMED</td>
<td>BUS_NEXUS</td>
<td>Local PCI-X Bus Adapter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(122e)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tty</td>
<td>5</td>
<td>0/1/0/1/0/3</td>
<td>tgt</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td></td>
</tr>
<tr>
<td>tape</td>
<td>0</td>
<td>0/1/0/1/0/3</td>
<td>stape</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td>HP C1537A</td>
</tr>
<tr>
<td>target</td>
<td>9</td>
<td>0/1/0/1/0/7</td>
<td>tgt</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td></td>
</tr>
<tr>
<td>ctrl</td>
<td>3</td>
<td>0/1/0/1/0/7</td>
<td>sctl</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td>Initiator</td>
</tr>
<tr>
<td>ext_bus</td>
<td>3</td>
<td>0/1/0/1/1</td>
<td>c8xx</td>
<td>CLAIMED</td>
<td>INTERFACE</td>
<td>SCSI C1010 Ultra Wide Single-Ended</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(122e)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>target</td>
<td>2</td>
<td>0/1/0/1/1/0</td>
<td>tgt</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td></td>
</tr>
<tr>
<td>disk</td>
<td>2</td>
<td>0/1/0/1/1/0</td>
<td>sdisk</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td>HP 36.4GMAM3367MC</td>
</tr>
<tr>
<td>target</td>
<td>3</td>
<td>0/1/0/1/1/2</td>
<td>tgt</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td></td>
</tr>
<tr>
<td>disk</td>
<td>3</td>
<td>0/1/0/1/1/2</td>
<td>sdisk</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td>HP 36.4GMAM3367MC</td>
</tr>
<tr>
<td>target</td>
<td>8</td>
<td>0/1/0/1/1/7</td>
<td>tgt</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td></td>
</tr>
<tr>
<td>ctrl</td>
<td>1</td>
<td>0/1/0/1/1/7</td>
<td>sctl</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td>Initiator</td>
</tr>
<tr>
<td>lan</td>
<td>0</td>
<td>0/1/0/4/0</td>
<td>igelan</td>
<td>CLAIMED</td>
<td>INTERFACE</td>
<td>HP A6794-60001 PCI 1000Base-T</td>
</tr>
<tr>
<td>ba</td>
<td>3</td>
<td>0/2</td>
<td>lba</td>
<td>CLAIMED</td>
<td>BUS_NEXUS</td>
<td>Local PCI-X Bus Adapter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(122e)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lan</td>
<td>1</td>
<td>0/2/1/0</td>
<td>igelan</td>
<td>CLAIMED</td>
<td>INTERFACE</td>
<td>HP A6825-60101 PCI 1000Base-T</td>
</tr>
<tr>
<td>ba</td>
<td>4</td>
<td>0/3</td>
<td>lba</td>
<td>CLAIMED</td>
<td>BUS_NEXUS</td>
<td>Local PCI-X Bus Adapter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(122e)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lan</td>
<td>2</td>
<td>0/3/1/0</td>
<td>igelan</td>
<td>CLAIMED</td>
<td>INTERFACE</td>
<td>HP A6825-60101 PCI 1000Base-T</td>
</tr>
<tr>
<td>ba</td>
<td>5</td>
<td>0/4</td>
<td>lba</td>
<td>CLAIMED</td>
<td>BUS_NEXUS</td>
<td>Local PCI-X Bus Adapter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(122e)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ba</td>
<td>6</td>
<td>0/5</td>
<td>lba</td>
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<td>BUS_NEXUS</td>
<td>Local PCI-X Bus Adapter</td>
</tr>
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<tr>
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<td>INTERFACE</td>
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<td>BUS_NEXUS</td>
<td>Local PCI-X Bus Adapter</td>
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<td>INTERFACE</td>
<td>HP Tachyon XL2 Fibre Channel Mass Storage Adapter</td>
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<td>Local PCI-X Bus Adapter</td>
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<td>c8xx</td>
<td>CLAIMED</td>
<td>INTERFACE</td>
<td>SCSI C1010 Ultra160 Wide LVD</td>
</tr>
<tr>
<td>target</td>
<td>10</td>
<td>0/7/1/0/6</td>
<td>tgt</td>
<td>CLAIMED</td>
<td>DEVICE</td>
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<td>ctrl</td>
<td>6</td>
<td>0/7/1/0/6</td>
<td>sctl</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td>Initiator</td>
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<tr>
<td>ext_bus</td>
<td>5</td>
<td>0/7/1/1</td>
<td>c8xx</td>
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<td>INTERFACE</td>
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<tr>
<td>target</td>
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<td>0/7/1/1/6</td>
<td>tgt</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td></td>
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<tr>
<td>ctrl</td>
<td>7</td>
<td>0/7/1/1/6</td>
<td>sctl</td>
<td>CLAIMED</td>
<td>DEVICE</td>
<td>Initiator</td>
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<tr>
<td>target</td>
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<td>0/7/1/1/9</td>
<td>tgt</td>
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Appendix 10: Output of <lanscan> on node rx5670a

<table>
<thead>
<tr>
<th>Hardware Station</th>
<th>Crd Hdw</th>
<th>Net-Interface</th>
<th>NM</th>
<th>MAC</th>
<th>HP-DLPI</th>
<th>DLPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Path Address</td>
<td>In#</td>
<td>NamePPA</td>
<td>ID</td>
<td>Type</td>
<td>Support</td>
<td>Mjr#</td>
</tr>
<tr>
<td>0/1/0/4/0</td>
<td>0</td>
<td>lan0 snap0</td>
<td>1</td>
<td>ETHER</td>
<td>Yes</td>
<td>119</td>
</tr>
<tr>
<td>0/2/1/0</td>
<td>1</td>
<td>lan1 snap1</td>
<td>2</td>
<td>ETHER</td>
<td>Yes</td>
<td>119</td>
</tr>
<tr>
<td>0/3/1/0</td>
<td>2</td>
<td>lan2 snap2</td>
<td>3</td>
<td>ETHER</td>
<td>Yes</td>
<td>119</td>
</tr>
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</table>

Appendix 11: Output of <etc/mount> on node rx5670a

```
/on /dev/vg00/lvol3 ioerror=nodisable,log,dev=40000003 on Tue Feb  8 10:10:33 2005
/stand on /dev/vg00/lvol1 ioerror=mwdisable,log,tranflush,dev=40000001 on Tue Feb  8 10:10:35 2005
/var on /dev/vg00/lvol8 ioerror=mwdisable,delaylog,dev=40000008 on Tue Feb  8 10:10:50 2005
/usr on /dev/vg00/lvol7 ioerror=mwdisable,delaylog,dev=40000007 on Tue Feb  8 10:10:50 2005
/net on -hosts ignore,indirect,nsuid,soft,nobrowse,dev=4c000000 on Tue Feb  8 10:11:59 2005
/sas on /dev/vg01/lvol1 ioerror=mwdisable,delaylog,dev=40010001 on Tue Feb  8 15:09:09 2005
```
Appendix 12: Contents of `/etc/rc.config.d/netconf` on node rx5670a

```
HOSTNAME="rx5670a"
OPERATING_SYSTEM=HP-UX
LOOPBACK_ADDRESS=127.0.0.1

INTERFACE_NAME[0]="lan0"
IP_ADDRESS[0]="192.6.174.10"
SUBNET_MASK[0]="255.255.255.0"
BROADCAST_ADDRESS[0]=""
INTERFACE_STATE[0]=""
DHCP_ENABLE[0]=0
INTERFACE_MODULES[0]=""

ROUTE_DESTINATION[0]="default"
ROUTE_MASK[0]=""
ROUTE_GATEWAY[0]="192.6.174.1"
ROUTE_COUNT[0]="1"
ROUTE_ARGS[0]=""

# Dynamic routing daemon configuration. See gated(1m)
#
# GATED: Set to 1 to start gated daemon.
# GATED_ARGS: Arguments to the gated daemon.

GATED=0
GATED_ARGS=""

# Router Discover Protocol daemon configuration. See rdpd(1m)
#
# RDPD: Set to 1 to start rdpd daemon
#
RDPD=0

# Reverse ARP daemon configuration. See rarpd(1m)
#
# RARP: Set to 1 to start rarpd daemon
#
RARP=0

DEFAULT_INTERFACE_MODULES=""
IP_ADDRESS[1]="10.10.10.10"
SUBNET_MASK[1]="255.0.0.0"
INTERFACE_NAME[1]="lan1"
BROADCAST_ADDRESS[1]="10.255.255.255"
INTERFACE_STATE[1]="up"
```
Appendix 13: Output of <netstat -nr> on node rx5670a

IPv4 Routing tables:
<table>
<thead>
<tr>
<th>Dest/Netmask</th>
<th>Gateway</th>
<th>Flags</th>
<th>Refs</th>
<th>Interface</th>
<th>Pmtu</th>
</tr>
</thead>
<tbody>
<tr>
<td>127.0.0.1/255.255.255.255</td>
<td>127.0.0.1</td>
<td>UH</td>
<td>0</td>
<td>lo0</td>
<td>4136</td>
</tr>
<tr>
<td>10.10.10.10/255.255.255.255</td>
<td>10.10.10.10</td>
<td>UH</td>
<td>0</td>
<td>lan1</td>
<td>4136</td>
</tr>
<tr>
<td>192.6.174.10/255.255.255.255</td>
<td>192.6.174.10</td>
<td>UH</td>
<td>0</td>
<td>lan0</td>
<td>4136</td>
</tr>
<tr>
<td>192.6.174.11/255.255.255.255</td>
<td>192.6.174.11</td>
<td>UH</td>
<td>0</td>
<td>lan0:1</td>
<td>4136</td>
</tr>
<tr>
<td>192.6.174.0/255.255.255.0</td>
<td>192.6.174.10</td>
<td>U</td>
<td>3</td>
<td>lan0</td>
<td>1500</td>
</tr>
<tr>
<td>192.6.174.0/255.255.255.0</td>
<td>192.6.174.11</td>
<td>U</td>
<td>3</td>
<td>lan0:1</td>
<td>1500</td>
</tr>
<tr>
<td>10.0.0.0/255.0.0.0</td>
<td>10.10.10.10</td>
<td>U</td>
<td>2</td>
<td>lan1</td>
<td>1500</td>
</tr>
<tr>
<td>127.0.0.0/255.0.0.0</td>
<td>127.0.0.1</td>
<td>U</td>
<td>0</td>
<td>lo0</td>
<td>0</td>
</tr>
<tr>
<td>default/0.0.0.0</td>
<td>192.6.174.1</td>
<td>UG</td>
<td>0</td>
<td>lan0</td>
<td>0</td>
</tr>
</tbody>
</table>

IPv6 Routing tables:
<table>
<thead>
<tr>
<th>Destination/Prefix</th>
<th>Gateway</th>
<th>Flags</th>
<th>Refs</th>
<th>Interface</th>
<th>Pmtu</th>
</tr>
</thead>
<tbody>
<tr>
<td>::1/128</td>
<td>::1</td>
<td>UH</td>
<td>0</td>
<td>lo0</td>
<td>4136</td>
</tr>
</tbody>
</table>

Appendix 14: Contents of /etc/passwd on node rx5670a

root:a3xF1EeqHE..Uk:0:3::/roothome:/sbin/sh
daemon:*1:5:::/sbin/sh
bin:*2:2:::/usr/bin:/sbin/sh
sys:*3:::
adm:*4:4:::/var/adm:/sbin/sh
ucp:*5:5:/var/spool/uucppublic:/usr/sbin/uucico
lp:*9:7:/var/spool/lp:/sbin/sh
nuucp:*11:11:/var/spool/uucppublic:/usr/sbin/uucico
hpdb:*27:1:ALLBASE:/sbin/sh
nobody:*-2:-2::
www:*-30:1::
smbnull:*-101:101:DO NOT USE OR DELETE - needed by Samba:/home/smbnull:/sbin/sh
sshd:*-102:ssh privsep:/var/empty:/bin/false
iwww:*-103:/home/iwww:/sbin/sh
owww:*-104:/home/owww:/sbin/sh
mysql:*-105:103:/home/mysql:/sbin/sh
sas:x2n3y1kH5SXXY:106:110::,/:home/sas:/usr/bin/sh
sasadm:A3W0q2AWDDL:N:107:110::,:/home/sasadm:/usr/bin/sh
sasdemo:x3JWn:FsGbwr:108:110::,:/home/sasdemo:/usr/bin/sh
sasrvn:3tnBtp4KV4rM:109:110::,:/home/sasrvn:/usr/bin/sh
sasguest:44ftBz0ZDl9R6:110:110::,:/home/sasguest:/usr/bin/sh
sastrust:L4Duis5qh/fKY:111:110::,:/home/sastrust:/usr/bin/sh
Appendix 15: Contents of /etc/services

# @(#)B11.23_LRservices $Revision: 1.32.214.7 $ $Date: 97/09/10 14:50:42 $
#
# This file associates official service names and aliases with
# the port number and protocol the services use.
#
# Some of the services represented below are not supported on HP-UX.
# They are provided solely as a reference.
#
# The form for each entry is:
# <official service name>  <port number/protocol name>  <aliases>
#
# See the services(4) manual page for more information.
# Note: The entries cannot be preceded by a blank space.
#
tcpmux         1/tcp                 # TCP port multiplexer (RFC 1078)
    echo           7/tcp                 # Echo
    echo           7/udp                 #
discard        9/tcp  sink null      # Discard
    discard        9/udp  sink null      #
systat        11/tcp  users          # Active Users
    daytime        13/tcp                 # Daytime
    daytime        13/udp                 #
qotd          17/tcp  quote           # Quote of the Day
    chargen       19/tcp  ttytst source # Character Generator
    chargen       19/udp  ttytst source  #
ftp-data      20/tcp                 # File Transfer Protocol (Data)
    ftp           21/tcp                 # File Transfer Protocol (Control)
    telnet        23/tcp                 # Virtual Terminal Protocol
    smtp          25/tcp                 # Simple Mail Transfer Protocol
    time          37/tcp  timeserver     # Time
    time          37/udp  timeserver     #
artisan       39/tcp  nicname        # Who Is
    pop           109/tcp postoffice pop2 # Post Office Protocol - Version 2
    pop3         110/tcp  pop-3         # Post Office Protocol - Version 3
    portmap       111/tcp  sunrpc        # SUN Remote Procedure Call
    portmap       111/udp  sunrpc        #
    auth         113/tcp  authentication # Authentication Service
    sftp         115/tcp                 # Simple File Transfer Protocol
    uucp-path     117/tcp                 # UUCP Path Service
    nntp         119/tcp  readnews untp  # Network News Transfer Protocol
    ntp          123/udp                 # Network Time Protocol
    netbios_ns   137/tcp                 # NetBIOS Name Service
    netbios_ns   137/udp                 #
    netbios_dgm  138/tcp                 # NetBIOS Datagram Service
    netbios_dgm  138/udp                 #
    netbios_ssn  139/tcp                 # NetBIOS Session Service
    netbios_ssn  139/udp                 #
    bftp        152/tcp                 # Background File Transfer Protocol
    snmp         161/udp snmpd          # Simple Network Management Protocol Agent
    snmp-trap    162/udp trapd          # Simple Network Management Protocol Traps
    xdmcp        177/tcp                 # X Display Manager Control Protocol
    xdmcp        177/udp                 # X Display Manager Control Protocol
    bgp          179/tcp                 # Border Gateway Protocol
# FV performance tool services entries
pvserver     382/tcp  # PV server
pvalarm     383/tcp  # PV alarm management
svrloc       427/tcp  # Server Location
svrloc       427/udp # Server Location
# Ports for IPSec
isakmp       500/tcp isakmp  # IPSec Key Management (ISAKMP)
isakmp       500/udp isakmp  # IPSec Key Management (ISARMP)
# UNIX services
# biff         512/udp comsat  # mail notification
exec         512/tcp                 # remote execution, passwd required
login        513/tcp                 # remote login
who          513/udp whod          # remote who and uptime
shell        514/tcp cmd           # remote command, no passwd used
syslog       514/udp                 # remote system logging
printer      515/tcp spooler       # remote print spooling
talk         517/udp                 # conversation
talk         518/udp                 # new talk, conversation
route        520/udp router routed # routing information protocol
efs          520/tcp                 # extended file name server
timed        525/udp timeserver     # remote clock synchronization
tempo        526/tcp newdate       #
courier      530/tcp rpc          #
conference    531/tcp chat        #
netnews      532/tcp readnews     #
etwall       533/udp                 # Emergency broadcasting
uucp         540/tcp uucpd         # uucp daemon
remotefs     556/tcp rfs_server rfs # Brunhoff remote filesystem
ingreslock   1524/tcp             #
# Other HP-UX services
# lansrm       570/udp              # SRM/UX Server
DAServer      987/tcp              # SQL distributed access
install_boot  1067/udp             # installation bootstrap protocol server
install_bootc 1068/udp             # installation bootstrap protocol client
nfstakepalive 1110/udp             # Client status info
nfstatus       1110/tcp             # Cluster status info
mysql         1111/tcp              # Mini SQL database server
rdb           1260/tcp              # remote loopback diagnostic
cvm-config    1476/tcp              # HA LVM configuration
diagmond      1508/tcp              # Diagnostic System Manager
ntf           1536/tcp              # NS network file transfer
sna-cs        1553/tcp              # SNAplus client/server
sna-cs        1553/udp              # SNAplus client/server
ncpm-policy   1591/udp              # NCPM Policy Manager
ncpm-hostinfo 1594/udp              # NCPM Host Information Provider
cvmv supervised 1686/udp             # Clusterview cvmmond-cvmmap communication
registrar     1712/tcp              # resource monitoring service
registrar     1712/udp              # resource monitoring service
ncpm-ft       1744/udp              # NCPM File Transfer
psmon         1788/tcp              # Predictive Monitor
psmon         1788/udp              # Hardware Predictive Monitor
pmlockd       1889/tcp              # SynerVision locking daemon
pmlockd       1889/udp              #
nfsd          2049/udp              # NFS remote file system
nfsd          2049/tcp              # NFS remote file system
netdist       2106/tcp              # update(1m) network distribution service
cvmmon        2300/tcp              # ClusterView Management cluster support
hpidadmin     2984/tcp              # HP-UX Host Intrusion Detection System admin
hpidadmin     2984/udp              # HP-UX Host Intrusion Detection System admin
hpidagent     2985/tcp              # HP-UX Host Intrusion Detection System agent
hpidagent     2985/udp              # HP-UX Host Intrusion Detection System agent
hp-clic       3384/tcp              # Cluster Management Services
hp-clic       3384/udp              # Hardware Management
rfac          4672/tcp              # NS remote file access
veesm         4789/tcp              # HP VEE service manager
hac1-hb        5300/tcp             # High Availability (HA) Cluster heartbeat
hac1-gs        5301/tcp             # HA Cluster General Services
hac1-cfg       5302/tcp             # HA Cluster TCP configuration
hacl-cfg         5302/udp         # HA Cluster UDP configuration
hacl-probe       5303/tcp        # HA Cluster TCP probe
hacl-probe       5303/udp        # HA Cluster UDP probe
hacl-local       5304/tcp        # HA Cluster Commands
hacl-test        5305/tcp        # HA Cluster Test
hacl-dlm         5408/tcp        # HA Cluster distributed lock manager
omni             5555/tcp        # HP OpenView OmniBack
lanmgrx.osB      5696/tcp        # LAN Manager/X for B.00.00 OfficeShare
hcserver         5710/tcp        # HP Cooperative Services
wbem-http        5988/tcp        # Web-Based Enterprise Management HTTP
wbem-http        5988/udp        # Web-Based Enterprise Management HTTP
wbem-https       5989/tcp        # Web-Based Enterprise Management HTTPS
wbem-https       5989/udp        # Web-Based Enterprise Management HTTPS
gcmd             5999/tcp        # graphics resource manager
spc               6111/tcp        # sub-process control
desmevt          6868/tcp        # DE/ Services Monitor, Event Service
pdcclientd       6874/tcp        # Palladium print client daemon
pdeventd         6875/tcp        # Palladium print event daemon
iasqlsvr         7489/tcp        # Information Access
reccsvr           7815/tcp       # SharedX Receiver Service
p7_c33upd        8545/tcp        # TSD acceSS7 configuration update RPC server
p7_c33           8545/udp        # TSD acceSS7 configuration RPC server
p7_c32           8547/tcp        # TSD acceSS7 communications status RPC server
p7_c35           8548/tcp        # TSD acceSS7 communications configuration RPC server
p7_g06           8549/tcp        # TSD acceSS7 application version registration RPC server
p7_e30           8550/tcp        # TSD acceSS7 event manager RPC server
comms_normal     8551/tcp        # acceSS7 normal priority messages
comms_high       8552/tcp        # acceSS7 high priority messages
c34_main         8553/udp        # acceSS7 Inter-Server messages
ftp-ftam          8868/tcp       # FTP->FTAM Gateway
mcsemon           9999/tcp       # MC/System Environment monitor
console           10000/tcp       # MC/System Environment console multiplexor
actcp             31766/tcp      # ACT Call Processing Server
SrpSiteDaemon    6178/tcp        # acceSS7 Statistics Remote Site query daemon
SrpCentralDaemon 6179/tcp        # acceSS7 Statistics Central Server query daemon
erdb_svr         35100/tcp       # acceSS7 Statistics Central Database
erdb_bck         35101/tcp       # acceSS7 Statistics Database Backup
hp-sco            19410/tcp       # HP SCO port number
hp-sco            19410/udp       # HP SCO port number
hp-sca            19411/tcp       # HP SCA port number
hp-sca            19411/udp       # HP SCA port number

# Kerberos (Project Athena/MIT) services
# Kerberos5         88/udp       kdc           # Kerberos 5 kdc
klogin            543/tcp       krcmd         # Kerberos rlogin -kfall
kshell            544/tcp       krcmd         # Kerberos remote shell -kfall
ekshell           545/tcp       krcmd         # Kerberos encrypted remote shell -kfall
kerberos          750/udp       kdc           # Kerberos (server) udp -kfall
kerberos          750/tcp       kdc           # Kerberos (server) tcp -kfall
kerberos_master   751/tcp       kadmin       # Kerberos kadmin
krbupdate          760/tcp       kreg          # Kerberos registration -kfall
kpassword          761/tcp       kpwd          # Kerberos "password" -kfall
eklogin           2105/tcp      # Kerberos encrypted rlogin -kfall
# The X10_LI server for each display listens on ports 5800 + display number.
# The X10_MI server for each display listens on ports 5900 + display number.
# The X11 server for each display listens on ports 6000 + display number.
# The X11 font server listens on port 7000.
# Do NOT associate other services with these ports.
# Refer to the X documentation for details.

hpoms-ci-lstdn   5403/tcp    # SAP spooler support
hpoms-dps-lstdn  5404/tcp    # SAP spooler support
samd             3275/tcp    # sam daemon
dtspc            6112/tcp    # subprocess control
swat              901/tcp    # SAMBA Web-based Admin Tool
### Appendix 16: Output of `swlist -l product`

```
# Initializing...
# Contacting target "rx5670a"...
# Target: rx5670a:

<table>
<thead>
<tr>
<th>Product</th>
<th>Version</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACXX</td>
<td>C.05.55</td>
<td>HP aC++</td>
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<tr>
<td>Accounting</td>
<td>B.11.23</td>
<td>Accounting</td>
</tr>
<tr>
<td>Asian-Core</td>
<td>B.11.23</td>
<td>Asian Core</td>
</tr>
<tr>
<td>Asian-PRINTER</td>
<td>B.11.23</td>
<td>Asian Printer Support</td>
</tr>
<tr>
<td>Asian-TERM</td>
<td>B.11.23</td>
<td>Asian Terminal Support</td>
</tr>
<tr>
<td>Asian-UTILITY</td>
<td>B.11.23</td>
<td>Asian Utility</td>
</tr>
<tr>
<td>AudioSubsystem</td>
<td>B.11.23</td>
<td>HP-UX Audio Subsystem</td>
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<tr>
<td>Auxiliary-Opt</td>
<td>B.11.23</td>
<td>Auxiliary Optimizer for HP Languages.</td>
</tr>
<tr>
<td>Bastille</td>
<td>B.02.01.02</td>
<td>HP-UX Security Hardening Tool</td>
</tr>
<tr>
<td>C-ANSI-C</td>
<td>C.05.55</td>
<td>HP C/ANSI C Compiler</td>
</tr>
<tr>
<td>C-Dev-Tools</td>
<td>B.11.23.03</td>
<td>C Language Development Tools</td>
</tr>
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<td>CDE</td>
<td>B.11.23</td>
<td>HP-UX CDE User Interface</td>
</tr>
<tr>
<td>CIFS-Client</td>
<td>A.01.09.02</td>
<td>CIFS Client</td>
</tr>
<tr>
<td>CIFS-Development</td>
<td>A.01.11.02</td>
<td>HP CIFS Server Source Code Files</td>
</tr>
<tr>
<td>CIFS-Server</td>
<td>A.01.11.02</td>
<td>HP CIFS Server (Samba) File and Print Services</td>
</tr>
<tr>
<td>CM-Provider-MOF</td>
<td>B.03.00.01</td>
<td>CM Provider and MOF</td>
</tr>
<tr>
<td>COMPLIBS</td>
<td>B.11.23</td>
<td>Compiler Support Libraries</td>
</tr>
<tr>
<td>Caliper</td>
<td>B.11.23.05</td>
<td>HP Itanium Performance Measurement Tools</td>
</tr>
<tr>
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<td>rc(1M) cumulative patch</td>
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PHKL_31517 1.0 Cumulative asyncdsk driver patch
PHNE_31725 1.0 Mail agents/utilities cumulative patch
PHNE_31726 1.0 Bind 9.2.0 components
PHNE_31727 1.0 gated (1M) patch
PHNE_31728 1.0 int1100 driver cumulative patch
PHNE_31731 1.0 r-commands cumulative mega-patch
PHNE_31732 1.0 ftpd(1M) and ftp(1) patch
PHNE_31733 1.0 telnet kernel, telnetd(1M), telnet(1) patch
PHNE_31734 1.0 sendmail(1M) 8.11.1 patch
PHNE_31735 1.0 nettl(1M), netfmt(1M) and netntladm(1M) patch
PHNE_31736 1.0 DHCPv6 patch
PHNE_31737 1.0 inetd(1M) cumulative patch
PHNE_31738 1.0 cumulative PPP patch
PHNE_31739 1.0 NTP timeservices upgrade plus utilities
PHSS_29679 1.0 assembler patch
PHSS_30414 1.0 aC++ Runtime (IA: A.05.56, PA: A.03.50)
PHSS_30480 1.0 X11 Font Library Patch
PHSS_30505 B.11.23.10 Xserver cumulative patch
PHSS_30601 1.0 KWDB 3.0
PHSS_30713 1.0 FORTRAN Intrinsics [libF90 B.11.23.17]
PHSS_30714 1.0 FORTRAN I/O Library [libIO77]
PHSS_30715 1.0 FORTRAN90 +UT77 support library [LibUT77]
PHSS_30716 1.0 libcbs and libomp [ia64/IA32: Release 6.1.2]
PHSS_30719 1.0 Math Library Cumulative Patch
PHSS_30771 1.0 HP DCE 1.9 client cumulative patch
PHSS_30795 1.0 HP DCE/9000 1.9 Integrated Login patch
PHSS_30820 1.0 WDB and PXDB Patch
PHSS_31086 1.0 Integrity Unwind Library
PHSS_31087 1.0 linker + fdp cumulative patch
PHSS_31181 1.0 X Font Server Patch
PHSS_31242 1.0 Internationalization for ar catalog
PHSS_31755 1.0 KRB5-Client Version 1.0 Cumulative patch
PHSS_31756 1.0 GSS-API Version 1.0 Cumulative patch
PHSS_31816 1.0 Aries cumulative patch
PHSS_31817 1.0 ObAM Patch
PHSS_31819 1.0 Asian PRINTER/UTILITY patch
PHSS_31831 1.0 CDE Base Patch
PHSS_31832 1.0 CDE Applications Patch
PHSS_31833 1.0 XClients Patch
PHSS_31834 1.0 X/Motif Runtime Patch
PHSS_31840 1.0 AudioSubsystem Patch
PRM-Sw-Krn C.01.02 Process Resource Manager PRM-Sw-Krn product
PRM-Sw-Lib C.02.03.03 Process Resource Manager PRM-Sw-Lib product
Package-Manager A.11.16.00 HP Package-Manager
PartitionManager B.11.23.02.00.03.04 Partition Manager for HP-UX
PeriphDevWeb B.11.23.02 HP-UX Peripheral Device Tool
Perl15-32 D.5.8.0.D The 32 Bit Perl Programming Language with Extensions
Perl16-64 D.5.8.0.D The 64 Bit Perl Programming Language with Extensions
PrinterMgmt B.11.23 PrinterMgmt
Proc-Resrc-Mgr C.02.03.03 Process Resource Manager Proc-Resrc-Mgr product
ProgSupport B.11.23 ProgSupport
RAIDSA B.11.23.02 RAID SA; Suppted HW=A7143A/A9890A/A9891A
SG-Apache-Tool B.02.11 Serviceguard Apache Script Templates
SG-FF A.01.00.00 HP Serviceguard Extension for Faster Failover
SG-Manager A.04.00 ServiceGuard Java GUI
SG-Manager-Addn A.04.00 ServiceGuard Manager/OpenView Integration Add-on
SG-Manager-Cnt1 A.04.00 ServiceGuard Manager
SG-NFS-Tool A.11.23.02 MC/ServiceGuard NFS Script Templates
SG-NMAPI A.11.16.00 SG-NMAPI ServiceGuard Extension for RAC SD product
SG-Oracle-Tool B.02.11 Serviceguard Oracle Script Templates
SG-Samba-Tool B.02.11 Serviceguard Samba Script Templates
SG-Tomcat-Tool B.02.11 Serviceguard Tomcat Script Templates
SOE B.11.23 SOE
SW-DIST B.11.23.0409 HP-UX Software Distributor
SecPatchChk B.02.02 HP-UX Security Check Tool
Secure_Shell A.03.71.007 HP-UX Secure Shell
SecurityMon B.11.23 SecurityMon
SecurityTools B.01.02.00 The security tools that Bastille can Configure
ServiceGuard A.11.16.00 ServiceGuard
SourceControl B.11.23 SourceControl
Spelling B.11.23 Spelling
Streams B.11.23        HP-UX Streams Product
Streams-TIO B.11.23        HP-UX_Streams-TIO_Product
Sup-Tool-Mgr B.11.23.03.16 HP-UX Support Tools Manager for HP-UX systems
SysMgmtAgent B.03.00.09        servicecontrol manager Agent Product
SysMgmtBase B.00.00        HP-UX Common System Management Enablers
SysMgmtServer B.03.00.09        servicecontrol manager Server Product
SystemAdmin B.11.23        HP-UX System Administration Tools
SystemComm B.11.23        System Communication utilities -
tct,cu,ptydaemon,vt,kermit
TechPrintServ B.11.23        HP-UX Technical Image Printing Service
TerminalMngr B.11.23        TerminalMngr
TextEditors B.11.23        TextEditors
TextFormatters B.11.23        TextFormatters
USB00 B.11.23.02 HP Object Oriented USB Driver
UUCP B.11.23 Unix to Unix CoPy
Update-UX B.11.23.0409        HP-UX Update-UX
Upgrade B.11.23 Upgrade
UserLicense B.11.23        HP-UX User License
VRTSfspro 3.5_2_ga08.006 VERITAS File System Management Services Provider
VRTSob 3.2.532.0.001 VERITAS Enterprise Administrator Service
VRTSobgui 3.2.532.0.001 VERITAS Enterprise Administrator
VRTSvlic 3.01.IA.002.010 VERITAS License Utilities
VRTSvmdoc 3.5-IA.014        VERITAS Volume Manager Documentation
VRTSvmspro 3.5-IA.014 VERITAS Volume Manager Management Services Provider
VRTSvxml 3.5-IA.014 Base VERITAS Volume Manager 3.5 for HP-UX
WBEMP-LAN B.11.23.01 LAN Provider: CIM/WBEM Provider for Ethernet interfaces.
WBEMServices A.02.00.04 WBEM Services CORE Product
WDB B.11.23.05 HP Wildebeest (HP WDB) Debugger
WDB-GUI B.11.23.05 GUI for the HP WDB Debugger
WLM-Monitor A.02.03.03 HP-UX Workload Manager Utilities
WLM-Toolkits A.01.07.03 HP-UX Workload Manager Toolkits
Workload-Mgr A.02.03.03 HP-UX Workload Manager
X11 B.11.23 HP-UX X Window Software
X11MotifDevKit B.11.23.07 HP-UX Developer's Toolkit - X11, Motif, and Imake
Xserver B.11.23 HP-UX Xserver
hpuxwsAPACHE B.2.0.90.01 HP-UX Apache-based Web Server
hpuxwsTOMCAT B.4.1.29.03 HP-UX Tomcat-based Servlet Engine
hpuxwsWEBMIN A.1.070.01 HP-UX Webmin-based Admin
hpuxwsXML A.2.00 HP-UX XML Web Server Tools
iCOD B.11.23.06.03 Instant Capacity On Demand
mysql 3.23.54a.01 MySQL open-source database
openssl A.00.09.07 Secure Network Communications Protocol
openssl A.00.09.07-0.011 Secure Network Communications Protocol
scsiU320 B.11.23.01 PCI-X SCSI U320; Supptd HW=A7173A/AB290A
Appendix 17: Contents of /stand/system

*  Created on Tue Feb  8 10:20:06 2005
*  version 1
configuration nextboot "created during initial installation" [4208d6c7]
*
* Module entries
*
module root best [41F8EB4F]
module sba best [41F8EB87]
module lba best [41F8EB50]
module asio0 best [41F8EB4F]
module tgt best [41F8EB89]
module sdiak best [41F8EB89]
module sc1 best [41F8EB89]
module PCItoPCI best [41F8EB50]
module stape best [41F8EB89]
module azusa_psm best [41F8EB4F]
module pty0 best [41F8EB52]
module pty1 best [41F8EB52]
module LCentIf best [41F8EB4F]
module acpi_node best [41F8EB4F]
module sac best [41F8EB4F]
module wxb_hp best [41F8EB4F]
module ia64_psm best [41F8EB4F]
module lion_psm best [41F8EB4F]
module pdh best [41F8EB4F]
module c8xx best [41F8EB89]
module diag2 best [41F8EB89]
module dmem best [41F8EB51]
module dev_config best [41F8EB87]
module cdfs best 0.1.0
module rng loaded 0.1.0
module inet best [41F8EB60]
module uipc best [41F8EB52]
module tun best [4133B744]
module telm best [412EBD79]
module tels best [412EBD79]
module netdiag1 best [41F8EB8E]
module btlan best [412E8A46]
module int1100 best [412E8A84]
module dipi best [412E9113]
module token_arp best [412E9113]
module nms best [41F8EB69]
module hpstreams best [412E9162]
module clone best [412E9162]
module strlog best [412E9162]
module sad best [412E9162]
module echo best [412E9162]
module sc best [412E9162]
module timod best [412E9162]
module tirdwr best [412E9162]
module pipedev best [412E9162]
module pipemod best [412E9162]
module ffs best [412E9162]
module ldterm best [41F8EB6D]
module ptem best [41F8EB6D]
module pts best [41F8EB6D]
module pm best [41F8EB6D]
module nfs_core best [412E8CC1]
module nfs_server best [412E8CC4]
module nfs_client best [412E8CC1]
module nfs best [412E8CC4]
module rpcmod best [412E8C55]
module autofs best [412E92E1]
module cachefs best [412E936B]
module clfs best [410AC7FA]
module td best [412342AF]
module lv best [41F8EB5E]
module lv best [41F8EB5E]
module vxfs best [41F8EB74]
module vxportal best [41F8EB74]
module ipmi best [41F8EB4F]
module ipmi_psm best [41F8EB4F]
module mip6mod best [412E9271]
module fcd best [4134EEB7]
module fcd_fcp best [4134EEB7]
module fcd_vbus best [4134EEB7]
module fddi4 best [41237311]
module gelan best [4122D39E]
module iether best [4122D3DB]
module igelan best [4122D3BD]
module pfll auto 0.1.0
module asyncdsk best [41F8EB8B]
module ciss best [4122361B]
module vxvm best [41258D12]
module vxdmp best [4121E998]
module vol best [41258D12]
module vols best [41258D12]
module mpt best [41223F81]
module prn best [41F8EB51]
 *
* Swap entries
*
*
* Dump entries
*
dump lvol
*
* Driver binding entries
*
*
* Tunables entries
*
tunable cmc_plat_poll 15
tunable nstrpty 60
tunable streampipes 1
### Appendix 18: Output of <vgdisplay -v vg01> on node rx5670a

--- Volume groups ---

<table>
<thead>
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<th>Item</th>
<th>Value</th>
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<td>/dev/vg01</td>
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<tr>
<td>VG Write Access</td>
<td>read/write</td>
</tr>
<tr>
<td>VG Status</td>
<td>available, exclusive</td>
</tr>
<tr>
<td>Max LV</td>
<td>255</td>
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<tr>
<td>Cur LV</td>
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<td>Open LV</td>
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<td>Max PV</td>
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<tr>
<td>Cur PV</td>
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</tr>
<tr>
<td>Act PV</td>
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</tr>
<tr>
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</tr>
<tr>
<td>VGDA</td>
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<tr>
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</tr>
<tr>
<td>Total PE</td>
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</tr>
<tr>
<td>Alloc PE</td>
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</tr>
<tr>
<td>Free PE</td>
<td>4931</td>
</tr>
<tr>
<td>Total PVG</td>
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</tr>
<tr>
<td>Total Spare PVs</td>
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</tr>
<tr>
<td>Total Spare PVs in use</td>
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--- Logical volumes ---

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<td>LV Status</td>
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<tr>
<td>Allocated PE</td>
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<tr>
<td>Used PV</td>
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--- Physical volumes ---

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</tr>
<tr>
<td>PV Status</td>
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</tr>
<tr>
<td>Total PE</td>
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</tr>
<tr>
<td>Free PE</td>
<td>4931</td>
</tr>
<tr>
<td>Autoswitch</td>
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</table>
HP’s Partner Technology Access Center - NJ
High Availability Implementation and Validation Services

At a Glance

Hewlett-Packard Company has a wide range of powerful high availability tools and services to assist ISVs in the validation of their applications in a highly available, mission-critical Hewlett-Packard environment.

HP’s High Availability software tool suite, including Serviceguard, is a specialized facility for protecting mission-critical applications from hardware and software failures.

With Serviceguard, multiple nodes (systems) are organized into an enterprise cluster that is capable of delivering highly available application services to LAN attached clients.

For ease of management and outstanding flexibility, Serviceguard allows all of the resources needed by an application to be organized into entities called “application packages”. Application packages consist of any resource needed to support a specific application service, such as disks, network resources, and application or system processes. Packages are the entities that are managed and moved within the enterprise cluster.

When an ISV delivers an application that will be run in a mission critical environment, it is important to validate that the application has been configured and tested in a Serviceguard environment.

To aid ISVs in validating their applications in a highly available environment, the HP Partner Technology Access Center – New Jersey (PTAC-NJ) provides hardware and consulting services. The following are the types of services provided:

- Analysis of Application Environment:
  - system resources used by the application
  - application design and number of packages
  - use of raw, HFS or JFS volumes
  - application recovery methods
  - data loss specifications
  - checkpointing or buffer flushing frequency
  - shared versus replicated file systems for code and/or data
  - capacity requirements
  - issues affecting failover time

- Cluster configuration of PTAC-East hardware to match your application needs

- Define application packages and resources required

Solution Alliances

- Create application package control scripts:
  - application startup & shutdown
  - application monitoring
  - application error handling
  - application restart options
  - application IP addresses
  - volume group handling
  - data recovery procedures

- Create, verify and execute a test plan which will exercise defined failure scenarios

- Demonstrate the functionality of the highly available cluster

Hardware for High Availability Implementation and Validation is maintained at the HP PTAC-NJ in Paramus, NJ.

Contact your HP Sales Representative for more information about these and additional services.
Appendix 20: HP’s Partner Technology Access Center-NJ High Availability Implementation and Validation Services Process and Methodology

HP’s Partner Technology Access Center - NJ
High Availability Implementation And Validation Services Process and Methodology

At a Glance

To aid Independent Software Vendors (ISVs) in validating their applications in a highly available environment, the Hewlett-Packard (HP) Partner Technology Access Center – NJ (PTAC-NJ) provides hardware, HA training, and consulting services. The following are the types of services provided:

- Analysis of Application Environment
- Cluster configuration of PTAC-NJ hardware to match application needs
- Define application packages and resources required
- Create application package control scripts
- Create, verify and execute a test plan which will exercise defined failure scenarios
- Demonstrate the functionality of the highly available cluster

To perform this service, and to offer it as a repeatable deliverable, the PTAC-NJ has defined a process and methodology. The completion of this process will result in an ISV’s application being validated by HP as being able to perform in a highly available environment.

An ISV’s customer either:
- View the ISV’s application as mission-critical
- Mandates that the application must be run in a highly available state

However, a typical ISV has limited experience with architecting and testing HA solutions. Additionally, hardware for failover testing is often unavailable.

Initial Activities
- Contact your PTAC-NJ representative and request the HA Validation Services Package.
- Read and share the package with your ISV.
- A knowledgeable engineer from the ISV must be present at the PTAC-NJ lab during the entire HA validation.
- If the ISV has assigned HP TC, that TC may optionally be present for the HA validation.
- Call PTAC-NJ administration and schedule PTAC-NJ HA Lab time.

Homework
The HA Validation Services Package contains:
- Serviceguard (SG) manual
- Designing Highly Available Cluster Applications white paper
- Serviceguard product brief
- Example HA Validation write-up
- Example cluster and package configuration scripts.

The goal of this step is that the ISV should understand HP’s HA product family and understand how to architect his application for HA validation.

Planning
- What should the cluster look like during normal operations?
- What is the standard configuration of most customers?
- Can application modules be spread across multiple systems?
- Is this normal?
- Do all pieces of the application failover together to the failover machine?
- Can applications running on different machines failover to a shared failover machine?
- Is there any HA mechanism already built in to the app?
- What are the customers’ expectations of HP’s HA product suite?

Technical Evaluation
- Evaluate the application per HA design rules
- Review each node with the application engineers
- What does the application do today to handle a system panic or reboot?
- Does the app use any system specific calls (e.g. uname, gethostname, SPU_ID, etc.)?

The deliverable of this step is a write-up of any issues.
App Setup Without SG
- Setup the system without Serviceguard
- Install the app on the primary system
- Install all shared data on separate external volume groups
- Use JFS file systems as appropriate
- Test the app on the primary system
- Perform a “standard” ISV-provided test to ensure that the app is running correctly
- If possible, connect to the app through a client
- Crash the primary system, reboot it, and test how the app starts
- Document any manual procedures
- Can everything start from init.d scripts?
- Write a script which brings up the app and all required services

The goal of this step is to ensure that the app can automatically be started and shutdown.

The deliverable of this step is the tasks or scripts which start the app automatically.

No SG, 2 Systems
Try to failover the app to the failover system by hand:
- Connect the volume group to the second system, vgimport, create mount points, etc.
- Document what has to be created on the failover system for the certification whitepaper
- With the app NOT running on the primary system, try to bring it up on the failover system
- Repeat this process until the app will run on the failover system

The goal of this step is to ensure that the failover can occur manually.

Hands On with SG
Configure the SG Cluster:
- Cluster configuration
- Create package(s)
- Create package script
- Compile package configuration scripts and distribute
- Use these scripts as the “customer defined” functions in the package control scripts

The deliverable of this step is the cluster and package scripts.

Testing
Testing should be performed with a client connected and under system load. This is to test how well and how quickly the application recovers from a failover when a large amount of “work” is queued.
- Halt the package on the primary system and move it to the failover system.
- Move the package back to the primary system.
- Fail one of the systems (e.g. power off, kill monitored process, LAN disconnected)
- Ensure that the package starts on the failover system
- Repeat failover from the failover system back to the primary
- Be sure to test all combinations of application load during testing
- Repeat the failover process under different application states (i.e. heavy user load, no user load, batch jobs, online transactions)
- Keep timing records of how long it takes to completely failover the app

The customer of the ISV will want to know the failover timing as part of the validation process.

Application Monitoring
- SG can monitor the health of processes which are critical to the correct running of the application
- Or, a custom monitor script can be written to monitor specific ISV processes
- Monitor script can be written now (during the HA Validation), or be written at each customer site

Support and write-up
- The ISV will own the SG scripts, but the PTAC-NJ will keep copies for our records
- Determine whether the ISV will want to come back to test new application releases
- HP supports SG, and the ISV supports the concept of failover with its application

The PTAC-NJ HA engineer will work with the ISV to produce the following deliverables. A copy of these will be placed on the HP Advanced Technology Center (ATC) High Availability web page:
- Whitepaper with technical details of the failover, known issues and recommended configurations
- Package control script
- Package configuration file (ASCII)
- Press release on the integration
Example Timetable
To understand the progression of the HA certification process, here is a typical ISV certification scenario:

- Day 1: ISV's HP contact calls PTAC-NJ Information line
- Day 2: HA Validation Services information package is e-mailed to HP contact
- Day 3: HP contact reviews documentation, and provides to ISV
- Day 4: ISV reviews documentation to understand what must be done prior to coming to the PTAC-NJ HA Lab
- Day 5: ISV reports to HP contact when they will be ready to begin certification process
- Day 5: HP contact schedules PTAC-NJ HA Lab and engineering time
- Day 6-10: ISV performs necessary homework in preparation for certification process. ISV gathers all materials that will be needed for the certification. If so desired, ISV prepares a client machine for delivery to the PTAC-NJ HA Lab.
- Day 11: ISV travels to PTAC-NJ HA Lab in Paramus, NJ
- Day 12: ISV is given a half day of informal training on HP's HA product suite
- Day 12: ISV and PTAC-NJ engineer begin installation of ISV application on PTAC-NJ hardware
- Day 13-17: ISV and PTAC-NJ engineer follow the HA validation process noted earlier in this document

Notes:
- This is an example scenario. Timing and process progression will be different for each ISV.
- If the ISV wishes to test a client connection to his application, the ISV must supply the client software. The PTAC-NJ lab will provide Windows 2000/XP workstations, PC display monitors and PC keyboards.
- The ISV must provide all non-HP software material on 4mm DAT tape, CD-ROM or DVD-ROM.

For More Information...
To receive the PTAC-NJ HA Validation Services Package, contact your PTAC-NJ representative.

Once you have received and examined the PTAC-NJ HA Validation Services Package, you will want to schedule the PTAC-NJ Lab, as well as a PTAC-NJ High Availability engineer. To do so, please contact your PTAC-NJ representative.

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2/24/2005