Application Migration from PA-RISC to HP Integrity Using HP 9000 Containers

(HP 9000 Containers A.01.02 on HP Integrity)

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1. Preamble

HP 9000 servers with PA-RISC processors were the primary platform for HP-UX and delivered exceptional performance. With the advancement in technology, demand for more performance, arise of complex mission-critical workloads and to improve business continuity HP developed the HP Integrity servers as the successor of HP 9000 systems enabling the latter to reach end of sale on December 31, 2008. The combination of HP Integrity servers with HP-UX 11i v3 created new benchmarks in the industry with robust performance re-defining reliability, availability and serviceability features. To leverage on the performance of balanced standard architecture and lower operating cost, organizations are now moving away from legacy systems. Migration with less disruption and reduced downtime is the key and HP has significantly simplified the transition with the introduction of, HP 9000 Containers'.

1.1 Document Overview

This document outlines the application migration process from PA-RISC to HP Integrity Servers to assist customers to modernize and migrate from their older platforms to the new architecture.

1.2 Intended Audience

This document is intended for Solution Architects, System Administrators, and all others involved in migrating applications from PA-RISC to HP Integrity servers using HP 9000 Containers, and involved in managing the migrated environment.

1.3 Purpose of the Document

This document describes the installation and configuration process of HP 9000 Containers A.01.02 on HP-UX 11i v3. It also describes how to migrate application environment from PA-RISC to HP Integrity servers.

1.4 Product Overview

HP 9000 Containers

HP 9000 Container is a set of tools that enable quick transition of application environment from a legacy HP Server to an HP-UX 11i v3 OS instance on an HP Integrity server. It provides a mechanism to re-host the complete HP 9000 user-space environment without the need to re-compile or re-install individual applications. The transition application will reside in a chroot environment (called the HP 9000 Container) along with the HP 9000 commands and libraries. The HP 9000 Container will have its own IP address that can be used to login, start/stop applications and network. The HP 9000 Container can be started, stopped, exported, imported and deleted.

The HP 9000 Containers does not support the creation of multiple HP 9000 Containers on the same HP-UX instance because a part of the file system will be shared between the HP 9000 Container and the HP-UX 11i v3 host system. However, HP 9000 Containers can be deployed on

HP-UX 11i v3 instance using HP VSE (HP-VM, vPar, nPar). This provides the means to consolidate multiple HP 9000 servers onto a single HP Integrity server. HP 9000 Containers is built using two key HP-UX technologies. They are

- The HP ARIES dynamic binary translator
- HP-UX Secure Resource Partition (SRP)

HP ARIES

The HP ARIES dynamic binary translator has proven to be a reliable tool for migrating HP 9000 applications without recompilation. ARIES transparently executes 32-bit and 64-bit HP 9000 HP-UX (all versions) applications on HP-UX 11i v2 and higher on HP Integrity servers. ARIES is ideal for legacy applications with no source codes, non-availability of third party dependencies or old ISV application version on HP Integrity servers.

Secure Resource Partitions (SRP)

The HP-UX Secure Resource Partitions (SRP) provides an environment for securely consolidating multiple applications

within a single image of the HP-UX 11i operating system. SRP is a component of the Partitioning Continuum for HP-UX and offers high efficiency in resource utilization. It also offers maximum flexibility and performance for customers seeking benefits of application consolidation.

2. HP 9000 Environment evaluation

Scan9000 is a free automated tool to assess the suitability of HP 9000 Containers to migrate from HP-UX PA-RISC environment to HP Integrity Servers. Scan9000 scans the application database of a HP-UX PA-RISC environment for compatibility with re-hosting to HP Integrity Servers using HP 9000 Containers. It provides a detailed report on the installed software, current utilization, sizing and issues (if any) when re-hosting the environment to HP-UX HP Integrity Servers with HP 9000 Containers. To get the usage of the tool, click on http://www.visolve.com/hp9000container.php?a=migration.

3. Installation and Configuration in HP Integrity Severs

3.1 Pre-requisites

- HP-UX 11i v3

  Configure every HP 9000 Container on a fresh HP-UX 11i v3 instance. This instance can also be a HP-VM guest HP-UX 11i operating system. No application should be available in the system when the HP 9000 Container is being setup. Security Containment Extensions

- HP recommends

  Security Containment Extensions version B.11.31.02, which includes the HP-UX Security Containment Compartment Login. The HP-UX Security Containment Plus features should be installed.

- HP ARIES patch PHSS_41099 or later

  Download and install the most recent HP ARIES patch for HP-UX 11i v3 from HP IT Resource Center.

- HP-UX Secure Resource Partitions(SRP) v2

  HP-UX Secure Resource Partitions (SRP) provides lifecycle management and isolation from the host system for HP 9000 Containers.

3.2 Installing HP-UX Secure Resource Partitions (SRP)

To install HP-UX SRP follow the steps:

Note: All the depots and patches will be stored under/tmp

1. Make sure the system meets the above pre-requisites for installing the SRP.
2. Verify the products included in the depot

   ```
   #swlist -l product -s <path>/HP-UX-SRP_A.02.02_HP-UX_B.11.31_IA_PA.depot
   ```

3. Login as root.
4. Install SRP with autoreboot option enabled.

   ```
   # swinstall -x autoreboot=true -s <path>/srpHP-UX-SRP_A.02.02_HP-UX_B.11.31_IA_PA.depot
   ```

If the installation fails the *swinstall* command displays an error message. Check the file /var/opt/adm/sw/swagent.log for more information.

5. Execute *swverify* command to verify the installed packages and depots.

```
# swverify HP-UX-SRP
```

6. Run *swlist* command to verify that the products are configured.

```
# swlist-a state -l fileset HP-UX-SR
```

If the product is configured correctly, each fileset will display as configured.

3.3 Configuring HP-UX Secure Resource Partitions (SRP)

- Login as root user and run

```
# srp_sys-setup
```

Note: Answer negative for the following question as PRM is not supported in SRP layer.

prm (Process Resource Management) [y] N

ipfilter (ipfilter host firewall rules) [y] N

Would you like to add the memory record? [y] N

Would you like to load and activate PRM configuration? [y] N

Would you like to enable PRM when the system is rebooted? [y] N ipsec (ipsec secure transport rules) [y] N Would you like to enable the IPfilter module? [y] N

3.4 Installing HP ARIES Patch (PHSS_41099)

- List HP-ARIES products

```
# swlist –l product –s <path>/PHSS_41099.depot
```

- Install HP-ARIES patch

```
# swinstall –s <path>/PHSS_41099.depot
```

3.5 Installing HP 9000 Containers

The HP 9000 Containers depot contain tools to configure and manage a HP 9000 Container on an HP Integrity HP-UX 11i v3 server. To install and verify the depot, run the following commands: 1. List HP 9000 Container products # swlist –s <path>/HP9000-Containers_A.01.02.depot 2. Install HP 9000 Container # swinstall –x autoreboot=true –s <path>/HP9000-Containers_A.01.02.depot

4. Migrating from PA-RISC to HP Integrity Servers

This section describes the essential steps to be followed in transitioning the entire application environment from an HP 9000 server running HP-UX 11i operating system to a HP 9000 Container on a HP-UX 11i v3 instance running on a HP Integrity server.

4.1 Overview

The transition process from an HP 9000 server to an HP 9000 Container typically involves the following sequence of activities:

- Migrate user accounts to the HP Integrity server
- Create the HP 9000 server file system image
- Recover HP 9000 files on the HP Integrity server

- Complete the HP Integrity system configuration
- Create and configure a SRP compartment
- Setup and configure the HP 9000 Container
- Start the HP 9000 Container and test applications

4.2 Migrating Users and Groups

Migrate non-default users, groups and namespaces from the HP 9000 server to the HP-UX 11i v3 instance on the HP Integrity server. This may include the following tasks:

1. Modify /etc/group to include and modify the group to replicate the unique entries in the source environment.
2. Modify /etc/passwd to include and modify the group to replicate the unique entries in the source environment.

4.3 Creating the HP 9000 Server Image

Image Creation process overview

Archive all required directories from the HP 9000 server. Some directories such as /tmp and /var/adm/crash may be excluded if they are known to contain no relevant files. However, make sure that all basic HP-UX directories are archived including /bin, /lib, /etc, /home, /opt, /sbin, /usr, and /var.

It is recommended that all applications on the server should be stopped before making an image. This is to prevent transient files from being copied over. These transient files can cause unexpected behavior when applications are re-started inside the HP 9000 Container.

Using fbackup for image creation of HP 9000 files

The following describes how to use *fbackup* for archiving all the required directories in a single session.

1. Prepare a graph file with the include exclude list. Example:

```
i /var
e /var/adm/crash
```

2. Compute the total space requirement for the archive.

```
# du -sk
```

3. Running fbackup

```
# /usr/sbin/fbackup -0 -f <output device or file path> -g <graph file path>
-I <index file> - V <volume file>2>&1 | tee <fbackup log file>
```

For Example, the paths can be as below:

```
<output device or file path>          - /tmp/backup/fbackup
<graph file path>                     - /tmp/graph
<index file>                          - /tmp/backup/index
<volume file>                         - /tmp/backup/volume
<fbackup log file>                    - fbackup.log
```

Here the "index file" and the "volume file" are output files that are created on the completion of *fbackup* session. Check *fbackup* log file for any errors. Some temporary files like those in /var/tmp or /var/spool/sockets/pwgr may not be allowed for archival and may appear in the error log, these can be ignored.

4.4 Recovering HP 9000 files

Recovery process overview

Recover HP 9000 files only after all the HP 9000 users have been migrated. This is necessary to ensure proper file ownership upon recovery. The exact recovery mechanism would depend on what archival method/utility was used. If *fbackup* was used, the recovery can be done using *frecover*.

Recover the directories under an "alternate root" on the HP Integrity server. Here the alternate root is referred as <container_root> in the sections to follow.

The path leading up to <container_root> must be owned by root:sys (owner=root, group=sys) and have 0755 permission, as this root cannot be created under any standard directory such as /opt and /var, which are owned by bin:bin. The recommendation is to create this directory under '/' and name it by an identifiable name such as "/<container server name>_root".

Ensure that there is enough space to store the recovered HP 9000 files under <container_root>. Provision an additional 8 GB for the HP 9000 Container. This will be used during HP 9000 Container setup to backup HP 9000 commands and other files that need to be moved out of their existing locations and for copying HP-UX 11i v3 PA-RISC system libraries, if needed.

Using frecover for recovering HP 9000 files

The following describes how to use *frecover* to get the archive extracted on the HP Integrity server under an alternate root.

NoteFor the purpose of this document, the <container root> is referred as /disk/PAapache

1. Create hp_9000 root directory.

```
# mkdir /<container_root>
```

2. Verify '*fbackup*' image using '*frecover*'

```
# /usr/sbin/frecover -N –f <backup device or file path> -I <recover index
file path>
# diff <recover index file> <corresponding backup index>
```

Here the paths mentioned above refer to the following:

```
<container_root>                - /disk/PAapache
<backup device or file path>    - /disk/backup/fbackup
<recover index file path>       - /tmp/recover.index
<recover index file>            - /disk/backup/index
<corresponding backup index>    - /tmp/recover.index
```

3. Run '*frecover*' on the image to extract the file

```
# cd /<container_root> #
/usr/sbin/frecover -x -X -f <backup device or file> > <log file>
```

Refer to the paths mentioned above as:

```
<container_root>                - /disk/PAapache
<backup device or file>         - /disk/backup/fbackup
<log file>                      - /tmp/extract.log
```

Post recovery steps

Once the recovery complete, create directories that were not copied and assign appropriate ownership and permissions.

```
# mkdir <container_root>/var/adm/crash
```

```
# chown root:root <container_root>/var/adm/crash
# chmod 0755 <container_root>/var/adm/crash
```

4.5 Configuring an HP-UX SRP Compartment

1. Create a HP-UX SRP compartment

Login as root to the HP-UX 11i v3 server and run the command

```
# srp -add <srp_name>
```

2. Ensure that the following parameters are configured

   IP address: compartment IP address (different from host system IP address but in the same subnet)
   Network interface name: LAN interface to be associated with the IP address
   Subnet mask: as configured in /etc/rc.config.d/netconf
   Gateway server IP address: as configured in /etc/rc.config.d/netconf

3. Verify the created SRP

```
# srp -list
<srp_name>      base    admin, cmpt, init, login, network
```

4. Add '*sshd*' template to create SRP compartment

```
# srp -add <srp_name> -t sshd -b
```
   Add compartment rules succeeded.
   Add provision rules succeeded.

5. Verify the newly added template to the compartment

```
# srp -list
<srp_name>      base    admin, cmpt, init, login, network
                Sshd    cmpt, provision
```

Testing SRP Compartment Start and Stop Operations

1. Start the compartment using

```
# srp -start <srp_name>
```

All startup messages should say OK.

2. Check the compartment specific *sshd* using

```
# ps -ef | grep sshd_config
```

Note: Make sure the process is started from
/opt/ssh/sbin/sshd –f /var/hpsrp/<srp_name>/opt/ssh/sshd_config

3. Stop the compartment

```
# srp -stop <srp_name>
```

All shutdown messages should say OK.

4.6 Configuring the HP 9000 Container

1. Add 'hp9000'template to the SRP

Run the command

```
# srp –add <srp_name> –t hp9000
```

Enter the requested values when prompted.
Services to add: [cmpt. provision] <enter>
Extracted root path for HP 9000 files [] <enter container_root path>
Example:
For the purpose of this document, the <container_root> path is referred as /disk/PAapache.
The process may take 5-10 minutes – do not interrupt. Wait until the configuration is complete and the following messages appear.

1. Add compartment rules succeeded

HP 9000 Container configuration completed
Log file <log file path>
Add provision service succeeded
Check the log file for any errors in HP 9000 Container configuration.

2. Verify the newly added template using

```
# srp –list
<srp_name>              base            admin, cmpt, init, login, network
                        Sshd            cmpt, provision
                                        hp9000 cmpt, provision
```

Reverting the configuration (if needed)

1. In case of any issues or errors during configuration, revoke the HP 9000 template

```
# srp –delete <srp_name> -t hp9000
```

Delete compartment rules succeeded
HP 9000 Container cleanup completed Log file
<log file path>
Delete provision service succeeded
Check log file for any errors in the HP 9000 Container cleanup.

4.7 Testing the HP 9000 Containers

1. To start the HP 9000 Container, run

```
# srp –start <srp_name>
```

2. Login to the HP 9000 Container using

```
# ssh –l root <compartment_IP_address>
```

Note: <Compartment_IP_address> – IP address for the compartment
Password – Use the same password as that of the host machine

3. Start the applications as normally done on an HP 9000 server and start testing.
4. Make sure the application is running using HP – ARIES

```
# /usr/sbin/fuser /usr/lib/hpux32/aries32.so /usr/lib/hpux64/aries64.so
```

5. Stop the application
6. Stop the Container

```
# srp –stop <srp_name>
```

5. Things to Lookout for

1. HP 9000 Containers A.01.02 does not support creation of multiple HP 9000 Containers on the same HP-UX instance.
2. Make sure all basic HP-UX directories are archived including /bin, /lib, /etc, /home, /opt, /sbin, /usr, and /var.
3. The path leading up to the <container_root> must be owned by root:sys (owner: root, group:sys) and have permission 0755.
4. Ensure there is enough space to store the HP 9000 files under <container_root>, with an additional 8 GB for the HP 9000 Containers.

6. Links to other tools

Scan9000 download: http://www.visolve.com/docs/Scan9000.pdf

Scan9000 Installation Guide: http://www.visolve.com/docs/HP9000_Container-proveIT.pdf

Container Service Datasheet: http://www.visolve.com/docs/Containers_DC.pdf

Cross Platform Database Migration: PA-RISC to Linux: http://www.visolve.com/docs/oracle_PARISC_to_x86-64_migration_v4.pdf

MySQL Performance Tuning on HP-UX: http://www.visolve.com/database/MySQL_HPUX_Perf.pdf

7. Links to key whitepapers and pages on hp.com

White Paper: http://h20195.www2.hp.com/v2/GetPDF.aspx/4AA3-2481ENW.pdf

For more information on HP 9000 Containers product, refer to: http://www.hp.com/go/hp9000-containers

For information about the products used for building HP 9000 Containers\

HP ARIES dynamic binary translator: http://www.hp.com/go/aries

HP-UX Secure Resource Partitions: http://www.hp.com/go/srp

For information about the HP OverEasy portfolio of products, visit: http://www.hp.com/go/overeasy

HP Serviceguard for HP-UX 11i: http://www.hp.com/go/serviceguard

For information on HP Integrity servers, HP-UX 11i v3 and VSE, visit

http://www.hp.com/go/integrity

http://www.hp.com/go/hpux11i

http://www.hp.com/go/vse