

HP-UX 11i v3 Persistent DSF Migration Guide

Next Generation Mass Storage Stack



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Introduction

In HP-UX 11i v3 HP has architected a new mass storage stack and subsystems to significantly enhance scalability, performance, availability, manageability, and serviceability. Maximum configuration limits have been increased to address very large SAN configurations while delivering performance with automatic load balancing, parallel I/O scan, optimized I/O forwarding and CPU locality.

To enhance availability, the mass storage stack monitors paths to devices, reroutes traffic and recovers from path failures when they occur. The stack has a built-in intelligent retry algorithm on path failures and also implements path authentication to avoid data corruption. The introduction of native multi-pathing and path-independent persistent Device Special Files (DSFs) and the auto discovery of devices greatly enhance the overall manageability. New commands and libraries further enhance the manageability and serviceability of mass storage devices.

This re-architecture introduces a new representation of mass storage hardware and subsystems called the agile view. The central idea of the agile view is that disk and tape devices are identified via their World Wide Identifier (WWID) and not by a path to the device. Therefore in the agile representation, multiple paths to a single device can be transparently treated as a single virtualized path, with I/O distributed across many paths. A persistent DSF is not affected by changes in the paths to the device. To take full advantage of this agile view, HP recommends the migration to persistent DSFs.

This white paper provides a step by step guide to ease the process of migrating applications from using legacy DSFs to persistent DSFs. The key areas addressed in this white paper are:

- ❖ Comprehensive set of links in [“Read before Migrating” to HP-UX 11i v3](#) documents
- ❖ New commands and command line options to operate in the agile view
- ❖ Step by Step guide on what needs to be done prior to migration
- ❖ Detailed instructions on how to migrate
- ❖ Possible recovery actions in case backing out is needed

For a complete overview of the mass storage changes in HP-UX 11i v3, see the white paper [“The Next Generation Mass Storage Stack”](#) in the Network and Systems Management section of <http://docs.hp.com>, under “Storage Area Management”.

Formats of DSFs and Hardware Paths for Mass Storage Devices

Legacy View

The legacy DSF format for disks is:

```
/dev/[r]dsk/cxydz[sn]
```

Where *x* is the HBA instance

y is the SCSI-2 target number

z is the SCSI-2 LUN number

n is the partition number

Example: `/dev/dsk/c5t0d1` or `/dev/rdsk/c6t0d1s2`

Note that the legacy DSF contains path related information. Associated with each legacy DSF is a specific legacy hardware path, and a multi-pathed device will have multiple legacy DSFs.

Agile View

The persistent DSF format for disks introduced with the agile view in HP-UX 11i v3 is:

/dev/[r]disk/diskx[_py]

Where *x* is the device instance
y is the partition number

Example: /dev/disk/disk2, /dev/rdisk/disk5_p2

The persistent DSF is associated with a LUN, not with a path to a LUN. A LUN has a virtualized hardware path known as the LUN hardware path. Each physical path to the LUN is a lunpath hardware path, which is the agile equivalent of the legacy hardware path. It is important to understand that there is no path related information encoded within a persistent DSF.

For more information on the agile naming model, refer to the “[HP-UX 11i v3 Mass Storage Device Naming](http://docs.hp.com)” White Paper available at <http://docs.hp.com>.

Agile and Legacy Views in ioscan

By default in HP-UX 11i v3 `ioscan` shows the legacy view. This view is compatible with previous releases of HP-UX. To enable the agile view in output of the `ioscan` command you must use the new `-N` option.

Mapping Commands

In HP-UX 11i v3, the `ioscan` command offers two new options to map configuration information from the legacy view to agile view:

<code>-m dsf [dsf_name]</code>	To map legacy DSFs to persistent DSFs
<code>-m hwpath [-H hw_path]</code>	To map legacy hardware paths to lunpath hardware paths and LUN hardware paths

Legacy DSF to Persistent DSF mapping:

The “`ioscan -m dsf [dsf_name]`” command shows the mapping between character legacy DSFs and character persistent DSFs if no `dsf_name` is specified. As a rule, the block DSFs are mapped similarly. If a `dsf_name` is specified, it shows the mapping for this DSF name only.

Sample “`ioscan -m dsf`” output:

Persistent DSF	Legacy DSF(s)
/dev/rdisk/disk17	/dev/rdisk/c9t0d0
/dev/rdisk/disk24	/dev/rdisk/c4t0d0
/dev/rdisk/disk37	/dev/rdisk/c5t0d0
	/dev/rdisk/c8t0d0
/dev/rdisk/disk38	/dev/rdisk/c5t1d0
	/dev/rdisk/c8t1d0

In the example above the persistent DSF `/dev/rdisk/disk17` maps to the legacy DSF `/dev/rdisk/c9t0d0`. The persistent DSF `/dev/rdisk/disk37` maps to the legacy DSFs `/dev/rdisk/c5t0d0` and `/dev/rdisk/c8t0d0`. This also implies that block persistent DSF `/dev/disk/disk17` (not shown) maps to block legacy DSF `/dev/dsk/c9t0d0`.

Legacy Hardware Path to Lunpath Hardware Path mapping:

The “`ioscan -m hwpath [-H hw_path]`” command shows the mapping between legacy hardware paths, lunpath hardware paths, and LUN hardware paths. If a `hw_path` is specified with option `-H`, it shows the mapping for that `hw_path` only.

Sample “`ioscan -m hwpath`” output:

Lun H/W Path	Lunpath H/W Path	Legacy H/W Path
--------------	------------------	-----------------

```

=====
64000/0xfa00/0x10
    0/2/1/0.0x0.0x0
    0/2/1/0.0.0
64000/0xfa00/0x8
    0/5/1/1.0x0.0x0
    0/5/1/1.0.0
64000/0xfa00/0x1a
    0/2/1/1.0x0.0x0
    0/2/1/1.0.0
    0/5/1/0.0x0.0x0
    0/5/1/0.0.0
64000/0xfa00/0x1b
    0/2/1/1.0x1.0x0
    0/2/1/1.1.0
    0/5/1/0.0x1.0x0
    0/5/1/0.1.0

```

The Legacy H/W path is the hardware path for the legacy DSF. The Lun H/W path is the virtualized hardware path representing the LUN. The Lunpath H/W Path is the physical hardware path to the LUN. The LUN under Lun H/W Path 64000/0xfa00/0x1a shows that it has two lunpaths leading to it. Note that the last two elements of a LUN H/W path and a Lunpath H/W path use the hexadecimal notation instead of the decimal notation.

Benefits of Migrating to the Persistent DSF Naming Model

Enhanced Features

The HP-UX 11i v3 mass storage stack provides major enhancements for performance, management, scalability, availability, and serviceability. A major component of the new architecture is the new persistent DSF naming model. Using persistent DSFs simplifies I/O management and diagnostics and allows users to take full advantage of the rich set of new functionality.

Unlike legacy DSFs, persistent DSFs are path independent. Because of this a LUN can be moved around to different paths with its persistent DSF name remaining the same. An example of this would be moving a Fibre Channel connection into a new HBA, legacy DSFs would change but persistent DSFs would see the new path and keep the same DSF. This feature eliminates the need for applications to change their configuration information.

The path-independent nature of a persistent DSF offers the benefit of simplified management. Each persistent DSF represents a LUN, unlike a legacy DSF which is really a path to a LUN. In a multi-path environment, the number of persistent DSFs is smaller than the number of legacy DSFs. Applications do not have to be aware of multi-pathing, simply using a persistent DSF provides multi-pathing support.

Persistent DSFs offer significant scalability over legacy DSFs. The architectural limit is 16 million LUNs in the persistent view, versus 32,768 in the legacy view.

Note: To enable a smooth migration from legacy to persistent DSFs, HP-UX 11i v3 supports coexistence of both types of DSFs, and commands can display their output in either view or show the mapping, allowing users to learn about management in the agile view while still having access to management in the legacy view. Note also that legacy DSFs are deprecated in HP-UX 11i v3 and will be obsoleted in a future release of HP-UX.

New I/O Management Commands in HP-UX 11i v3

scsimgr

A new utility, *scsimgr*, is provided for management and diagnostics of SCSI objects (such as a single LUN, LUN path, target path, host bus adapter (HBA), or a group of these) and subsystems (SCSI services module, a SCSI class driver, or a SCSI interface, also known as interface driver). Most of the options to this utility are used in the agile view (requiring persistent DSFs as input).

Migration to the persistent DSFs offers an enhanced experience in I/O management and diagnosis of the mass storage stack.

See the `scsimgr(1M)` manpage and the “[scsimgr SCSI Management And Diagnostics Utility on HP-UX 11i v3](http://docs.hp.com)” White Paper at <http://docs.hp.com> for more details.

io_redirect_dsf

Another new command, `io_redirect_dsf`, allows users to change the association of a persistent DSF from device A to device B without a reboot and without the need to change any application configuration information. After the operation, applications using the DSF of device A can transparently access device B. This command only accepts persistent DSFs or LUN hardware paths.

Example:

Disk A with DSF `/dev/disk/disk1` becomes non-operational. Users may want to direct any further I/O access from disk A to disk B (with DSF `/dev/disk/disk5`, which is already in the system) without rebooting and/or changing application configuration.

See the `io_redirect_dsf(1M)` manpage for more details.

iobind

Another new HP-UX 11i v3 command is `iobind`. It performs online binding of a driver to a device. The driver must however support online binding. One of the arguments to this new command is a LUN hardware path. Since a persistent DSF is mapped to a LUN hardware path, users can easily find out the required hardware path from the persistent DSF by using the “`ioscan -m lun [dsf_name]`” command.

See the `iobind(1M)` manpage for more details.

Enhanced Commands

New command line options have been added to some I/O commands to allow users to manage their system in the agile view.

- ioscan** The `ioscan` command has been enhanced to work with the agile view of the I/O system. Certain options will only be applicable to this view:
- o `ioscan -N [other options]`: Display output in the agile view.
 - o `ioscan -b -M driver_name -H hw_path`: The `-b` option specifies deferred binding of a driver to the given hardware path. The input parameter `hw_path` must be the LUN hardware path in the agile view.
 - o `ioscan -m keyword [parameters]`: This option shows mapping information between paths and/or devices. The `-m` option takes one of these keywords: `lun`, `dsf`, or `hwpath`. Parameters to the `lun` keyword must be in the agile view; parameters to the `dsf` and `hwpath` keywords can be either from the legacy or agile view.
 - o `ioscan -P keyword [-H hw_path]`: This option displays the properties of system hardware. The `-P` option takes one of the keywords (such as `health`, `instance`, and so on); for a complete list, see the `-P` option in the `ioscan(1M)` manpage. The `hw_path` parameter is from the agile view and the display uses the agile view as well.
 - o `ioscan -r -H hw_path`: The `-r` option removes a deferred driver binding. Input parameter must be in the agile view.

See the `ioscan(1M)` manpage for more details.

- rmsf** This command accepts either legacy or persistent DSF. It has a new option, `-L`, to disable the legacy naming model and remove legacy DSFs on the system.
- insf** This command creates both legacy and persistent DSFs. It also has a new option, `-L`, to re-enable the legacy naming model and recreate legacy DSFs on the system. The combination of the `-Lv` options report whether the legacy naming model is enabled on the system or not.
- lssf** This command accepts both legacy and persistent DSFs.
- mksf** This command creates either legacy or persistent DSFs.

“Read before Migrating” to HP-UX 11i v3

Before migrating to HP-UX 11i v3, HP recommends users to become familiar with the following documentation:

- ✚ For an overall view of the HP-UX 11i v3 release, refer to the HP-UX 11i v3 release page at <http://docs.hp.com/en/oshpux11iv3.html>
- ✚ For an overview of the mass storage changes and a list of enhanced I/O commands available in HP-UX 11i v3, refer to the “[The Next Generation Mass Storage Stack](http://docs.hp.com/en/netsys.html#Storage%20Area%20Management) HP-UX 11i v3” White Paper at <http://docs.hp.com/en/netsys.html#Storage%20Area%20Management>
- ✚ For an overview of the migration from HP-UX 11iv2 to 11iv3 with emphasis on mass storage, refer to the “Mass Storage Stack Update Guide” White Paper at <http://docs.hp.com/en/netsys.html#Storage%20Area%20Management>
- ✚ For an overview of LVM migration from legacy to agile naming model, refer to the “LVM Migration from legacy to agile naming model HP-UX 11i v3” White Paper at <http://docs.hp.com/en/hpux11iv3.html#LVM%20Volume%20Manager>
See also at the same location:
“LVM New Features in HP-UX 11i v3” White Paper
“HP-UX System Administrator’s Guide: Logical Volume Management”
- ✚ Other useful links:
For information in HP-UX subsystems, check the HP web site at <http://docs.hp.com>
For information on storage devices, check the following HP web sites:
<http://h18006.www1.hp.com/storage/oshpux.html> or
<http://www.hp.com/products1/serverconnectivity/index.html>

Agile Naming Support

This section discusses limitations to agile naming support (that is, the use of persistent DSFs) at the introduction of HP-UX 11i v3, as well as backward compatibility and backward compatibility exceptions.

Subsystems with No Persistent DSF Support at HP-UX 11i v3 Introduction

The subsystems listed below do not currently support the use of persistent DSFs. Use of persistent DSFs may require, as detailed below, that users replace an existing subsystem with a different one, or that they use a later version of that subsystem, which may not be available at HP-UX 11i v3 introduction. HP recommends that users check the web sites provided below and/or in the “[Read before Migrating” to HP-UX 11i v3](#)” section for the latest information on possible replacement products and on newer subsystems versions that would support the use of persistent DSFs.

The following subsystems/applications do not support persistent DSFs at the first release of HP-UX 11i v3:

HP Openview Storage Data Protector 6.0: Support of persistent DSFs will be provided via a patch. Please check the [HP OpenView Storage Data Protector V6.0 Software](#) for the latest information.

HP Openview Storage Data Protector 5.5: Openview Storage Data Protector 5.5 servers are not supported in HP-UX 11i v3. Openview Storage Data Protector 5.5 clients support legacy DSFs only. Users must migrate to DP 6.0 in order to get support for persistent DSFs with the HP Openview Storage Data Protector software.

HP Storage Works Command View SDM supports legacy DSFs only.

Library & Tape Tools version 4.2 SR1 is required for support in HP-UX 11i v3 with both legacy and persistent DSFs.

Storage System Scripting Utility (SSU): Version 6.0 and lower does not support persistent DSFs. Version 6.0.2 or later is required for persistent DSF support.

dvd+rw tools (commands like growisofs or dvd+rw-format) operate properly with legacy DSFs only.

vPars does not support creation/modification of virtual partitions using the agile view. But persistent DSFs can be used on the partition after the partition has been created. For more information on vPars, refer to <http://docs.hp.com/en/vse.html#vPars>.

VERITAS Volume Manager (VxVM) 4.1 supports legacy DSFs only. Persistent DSFs will be supported in a future VxVM release. For more information, refer to: <http://docs.hp.com/en/oshpux11iv3.html#VxVM>.

Third-party applications related to mass storage: Users should check with the vendors whether the applications are impacted by the persistent DSFs and if they are, whether it is possible to use them with persistent DSFs.

NOTE: If you use any applications that do not support agile naming, be aware that a full migration (removing the legacy view with the `rmsf -L` command) may not be possible. See the [“Disable Legacy DSFs”](#) section.

Backward Compatibility

Legacy DSF support is maintained in HP-UX 11i v3 to retain backward compatibility. HP-UX commands and utilities have been enhanced to manage subsystems in both legacy and agile views. By default those commands behave the same way in HP-UX 11i v3 as on prior HP-UX releases. For instance, the output of most commands is the same in HP-UX 11i v2 and in HP-UX 11i v3 (for options supported on both releases). See the [“Backward Compatibility Exceptions”](#) section below for the list of exceptions.

Note that some commands display either agile view or legacy view depending on which view was used during their configuration. For these commands, if the agile view was used to configure some devices, the commands will display these devices in the agile view. For example, the LVM commands may display persistent DSFs, legacy DSFs, or a mix of both, depending on which DSFs were used when the LVM configuration was created.

Fully Backward Compatible Commands and Utilities

Most commands are fully backward compatible, meaning that in the legacy view, they behave the same way as they did on releases prior to HP-UX 11i v3. Here are examples of such commands:

- o `ioscan(1M)` - Specify the `-N` option as necessary to manage the agile view. Without the `-N` option, output appears the same as in HP-UX 11i v2 if using options supported on both releases (for example, `ioscan -kfn` will still show legacy hardware paths and legacy DSFs).

- `rmsf(1M)`, `insf(1M)`, `lssf(1M)`, `mksf(1M)` – Accept legacy and persistent DSFs and hardware paths as input.
- `savecrash(1M)` - Accepts both legacy and persistent DSFs as input.
- `swapon(1M)` - Accepts both legacy and persistent DSFs as input.
- `swapinfo(1M)` - Displays either persistent or legacy DSF, depending on what was configured.
- STM - Provides a menu option to display in legacy or agile view.
- System Management Homepage (SMH) - Provides a toggle to allow users to display in legacy or agile view.
- LVM commands - Accept both legacy and persistent DSFs as input. New options have been introduced to allow a choice between legacy DSFs and persistent DSFs. For example, the `-N` option has been added to the `vgscan` command to perform `/etc/lvmtab` recovery using persistent DSFs. Without the `-N` option, `vgscan` behaves as in HP-UX 11i v2, using legacy DSFs. Refer to the LVM documentation mentioned in [“Read before Migrating” to HP-UX 11i v3](#).

Backward Compatibility Exceptions

The following commands and utilities behave differently in HP-UX 11i v3 than in previous HP-UX releases:

- The `crashconf` command accepts persistent DSFs as input. For backward compatibility, it accepts legacy DSFs, but it converts them to persistent DSFs, and its output is displayed in the agile view only (persistent DSFs are displayed with option `-v` and lunpath hardware paths are displayed with the option `-l`). See the `crashconf(1m)` manpage for details.
- The `setboot` command accepts persistent DSFs as input as well as lunpath hardware paths, or legacy hardware paths, but it selects and stores in stable storage the lunpath hardware path to the device, and subsequently it only displays output in the agile view (persistent DSFs and lunpath hardware paths), regardless of whether a legacy hardware path was passed as input. See the `setboot(1m)` manpage for details.
- Ignite-UX operates in the agile view. It displays lunpath hardware paths for the location of the target install media in the root disk selection screen. The mapping of lunpath hardware paths to legacy hardware paths is provided via a “More Info” screen. Also, when Ignite-UX is used to cold-install a system, HP-UX 11i v3 configures the boot, swap, and dump devices to use persistent DSFs.

Migrating to the Agile Naming Model

When HP-UX 11i v3 is installed, both legacy and persistent DSFs are created on the system. Both types of DSFs can coexist and may be used simultaneously to access mass storage devices. However, only the use of persistent DSFs allows the users to get the full benefits of the agile naming model. Therefore, HP recommends users to migrate applications using legacy DSFs and hardware paths to the agile naming model.

This section defines the steps to migrate from using legacy DSFs to using persistent DSFs. In most cases, user applications perform I/O through DSFs. In rare cases, they may reference hardware paths. Hardware paths apply to various types of elements, such as cell, HBA, and device. If users have applications referencing such hardware paths for devices beyond a mass storage HBA (legacy hardware paths), these hardware paths must be migrated to the lunpath hardware paths as well.

Migrating legacy DSFs to persistent DSFs involves both preparation steps and migration steps.

Preparation

Preparation steps include identifying the applications and files that need to be migrated and saving original copies of those files in case you need to back out the migration. To help with the identification, here are the main changes that could affect an application:

- New DSF names and hardware path formats (see [Formats of DSFs and Hardware Paths for Mass Storage Devices](#))
- New DSF location (for instance, moved from `/dev/[r]dsk` to `/dev/[r]disk`)
- New command options to retrieve DSF names and hardware paths (for instance, add `-N` option to `ioscan`)
- Decoding of DSF names and `dev_ts` is different as they no longer encode HBA/target/lun information

If you have written your own applications, look for the impacts above in the code.

Migration

Migration steps include making the actual modifications to the applications and files, testing the modified applications, and finally disabling legacy naming model which removes the legacy DSFs. If the modified applications run into issues, it may be necessary to back out the migration (return to using legacy DSFs) (see [“Backing Out From Migration”](#) section below). The steps for migrating legacy DSFs to persistent DSFs are as follows:

Make an IUX Recovery Tape

Objective: Ensure the system can be recovered to the current state

Back up the system to a recovery tape. See the section “Backing Up Your System” in the Ignite-UX Administration Guide available at <http://docs.hp.com>.

Identify System Configuration Files That Use Legacy DSFs/Hardware Paths

This section discusses HP-UX subsystems that may be configured in a user’s system. A system can be configured with LVM, VxVM, or whole disk (neither LVM nor VxVM).

- o LVM is configured

The LVM configuration is maintained in the binary file `/etc/lvmtab` and optionally the ASCII file `/etc/lvmpvg`, which may contain legacy DSFs, persistent DSFs, or a mix of both. LVM provides the `/usr/contrib/bin/vgdsf` tool for migrating the LVM configuration from legacy DSFs to persistent DSFs. For activated volume groups, the `vgdisplay` command with the `-v` option displays which DSFs a volume group is using. However users must migrate all LVM volume groups, not only the activated ones. See “LVM Migration from legacy to agile naming model HP-UX 11i v3” White Paper at <http://docs.hp.com/en/hpux11iv3.html#LVM%20Volume%20Manager> for LVM migration details.

Note: Make sure to migrate the ASCII file `/etc/lvmpvg` using the `vgdsf` tool and not using the `iofind` tool described below as `vgdsf` takes other actions required for proper LVM migration.

For LVM boot disk, run the `lvlnboot` command with the `-v` option to see if LVM is using legacy DSFs or persistent DSFs for boot, swap, or dump. If LVM is using legacy DSFs for boot, swap, or dump, users must

- run the `"/usr/contrib/bin/vgdsf -c vg_name"` command to migrate the LVM configuration for the root volume group `vg_name` from legacy DSFs to persistent DSFs
- run the `lvlnboot -R /dev/vg_name` to migrate the LVM on-disk boot information to match `/etc/lvmtab`.

See the LVM documentation in the ["Read before Migrating" to HP-UX 11i v3](#) section for more details.

o VxVM is configured

Agile view is not supported with VxVM 4.1. Therefore users cannot migrate to persistent DSFs if they use VxVM 4.1.

o Whole disk configuration is used (neither LVM nor VxVM)

For whole disk configurations, typically a single boot disk has been configured for boot, swap, and dump using either a legacy DSF or a persistent DSF. If a system is updated from HP-UX 11i v2 to HP-UX 11i v3, the update process migrates the legacy configuration to the agile view.

Users can verify the configuration by using the `bdf` command to check the file system configuration, the `setboot` command to check the boot path, the `crashconf` command to check the dump device, and the `swapinfo` command to check the swap device. The `setboot` and `crashconf` commands automatically convert the configured DSFs into agile view. If `swapinfo` displays any configured legacy DSFs, use the `swapon` command to perform the migration.

The `/etc/fstab` and `/stand/system` files contain information about the file system and other system configuration. Swap and dump devices may be configured in `/etc/fstab` and `/stand/system`. If these two files contain legacy DSFs or legacy hardware paths, migrate them to persistent DSFs or lunpath hardware paths either manually or by using the `iofind` tool described below. Make sure to backup the files first before making any changes. Note that modifications to the `/etc/fstab` and `/stand/system` files may require a reboot to take effect. See the `bdf(1M)`, `crashconf(1M)`, `setboot(1M)`, `swapinfo(1M)`, `swapon(1M)`, and `fstab(4)` manpages for more details.

Execute the iofind command

Objective: Find instances of legacy DSFs and hardware paths in ASCII files on the system and help the user to convert them to the agile view.

The `iofind` command scans ASCII files in the system to identify those containing legacy DSFs and legacy hardware paths. The `-d` option specifies the directories in which to search. The `-i` option specifies the files to scan. To look for specific legacy information (DSFs or hardware paths), specify them in a file using the `-f` option. The default is to search all files and subdirectories under the current directory (where `iofind` is run) for all legacy DSFs and hardware paths configured. To speed up performance, some directories are excluded from the search using an exclusion list. Users can modify this exclusion list. If the search starts from the root directory and the file system is large, redirect the output to a file as the tool may take a long time to execute.

Other command options give users the flexibility to display the legacy information found in the files, replace them interactively with persistent DSFs and hardware paths from the agile view (`-R` option), replace them without user interaction (`-F` option), or only simulate the replacement (`-p` option). Before replacing the legacy information, the original files are backed up in the `/var/adm/iofind/logs/mmddyymmss/backup/` directory. HP recommends users to make notes of the names of the modified files and the backup directory.

To search every ASCII file in the system for all legacy DSFs and hardware paths known by the system (based on the `ioscan -kfn` output), run the `iofind` command from the root directory with only the `-Hn` options. If some files are found that contain legacy information, determine

- o whether these files need to be modified, and
- o whether additional migration steps are required by the applications referencing these files.

If there are additional migration steps required by the applications, follow their instructions. To migrate the files identified by `iofind`, run the `iofind` command again with the `-R` option.

If you think there might be unconfigured mass storage devices in the system, run `ioscan -fn` before executing `iofind`. This step ensures that all legacy DSFs and hardware paths have been configured and subsequently all legacy references to these devices will be found by the `iofind` command.

See the `iofind(1M)` manpage for more details.

If the modified ASCII files are executable (such as shell scripts), test them to make sure that they still perform as expected. If the ASCII file is an input to an application, test the application as well.

See examples of using `iofind` in the [Appendix](#).

Recompile User Applications

There are two cases where legacy information may be referred to by a binary program:

- o A binary program file reads an ASCII file as an input during run time.
- o A source file has embedded legacy DSFs and/or hardware paths and it is compiled into binary application.

The `iofind` command will have replaced the legacy information for the first case. For case 2, if the source file is in the system where `iofind` is run, the (ASCII) source will have been updated with persistent data and the source must be recompiled. If the source file is not on the system where `iofind` executes, then the source file must be modified manually with the information from `ioscan` outputs as described above (see [Mapping Commands](#)), then recompiled. Backup the source files and binary before making the modifications and recompiling. Make notes of what changes are made to the source files. Test the modified applications to ensure successful execution.

Identify User Applications That Require DSFs or Hardware Paths as Input

There may be applications that need DSFs and/or hardware paths for mass storage devices as input. For example, a database application may require a user to type in a DSF. Identify such applications and map the legacy DSFs and hardware paths to persistent DSFs and lunpath hardware paths using the `ioscan` outputs as described above (see [Mapping Commands](#)). Test the applications. Make notes of what changes are needed and record the changes.

Save Other Configuration Files

In addition to saving the original files (found by `iofind` and other user applications) before migrating them, there is other information that needs to be saved for diagnostic purposes in case there are issues with migration. Save the following output to files before performing the last step in migration ([Disable Legacy DSFs](#) below):

Outputs of:

```
ioscan -kfnN
ioscan -kfn
ioscan -m dsf
ioscan -m hwpath
ll /dev/dsk
ll /dev/rdisk
ll /dev/rmt
```

NOTE: Worksheets at the end of this document give examples on what information to save.

Disable Legacy DSFs

After users have made all the changes described in the steps above and checked that the migrated applications work using agile view, there are two ways to complete the migration:

1. Full migration

- Disable legacy naming model (will remove the legacy DSFs)
- Test applications with legacy naming model disabled

If all the migrated applications work as expected, the migration is complete.

2. Partial migration

If there are applications with limited support for persistent DSFs (such as the ones discussed above), there are two approaches that can be taken:

- Disable legacy naming model and test the applications that support running in the agile view to make sure that they are operating successfully with legacy naming model disabled. Then re-enable legacy naming model to be able to use those applications that need legacy naming model. This testing ensures that the applications that were migrated to agile view have been migrated successfully.

or

- If disabling the legacy naming model is not possible due to the application limitations, simply continue to operate with the legacy naming model enabled. However, since the legacy naming model is still enabled, it is not certain that applications have been migrated successfully to agile view.

Full Migration Details

To disable legacy DSFs, a new option (-L) has been added to `rmsf` to disable (remove) the legacy naming model. See the [Appendix](#) for an example of `rmsf -L`. After execution, all the legacy information (in the kernel and legacy DSFs under `/dev` directories) is removed. To reverse this step, see the "[Backing Out From Migration](#)" section below.

Perform the following steps to do a full migration:

- Run "`rmsf -L`". This command will first perform a critical resource analysis. If some legacy DSFs are still open, the command will fail. The command "`insf -Lv`" will display whether the legacy naming model is enabled or not.

NOTE: Automatic migration of dump devices occurs using Event Management (EVM) events when `rmsf -L` completes successfully.

- After this command has been successfully executed, access to mass storage devices via their legacy DSFs and paths will fail. Note also that `ioscan` will no longer display mass storage device information in the legacy view.
- Test the applications to make sure that they are running successfully. If everything works, migration is complete.

TIP: If there is any failure, the reason can be that an application is still trying to access a legacy DSF; check the syslog file for error messages related to opening of DSFs.

If there are any issues that users cannot correct, see the "[Backing Out From Migration](#)" section below.

NOTE: On a system with multiple boot disks containing different OS versions, if an HP-UX 11i v3 system crashes with legacy naming model disabled and the next boot is on a pre-HP-UX 11i v3 (for instance, HP-UX 11i v2) system, `savecrash` will not be able to save the dump.

In this case the boot will otherwise succeed, and the dump can still be saved manually, using the `-D` option to `savecrash` and specifying the appropriate device files.

Note: See the [Appendix](#) for examples of `rmsf -L` and `insf -L`.

Partial Migration Details

If some applications were modified to run in the agile view but a full migration is not possible because other applications with limitations (such as the ones discussed in the prior section) require the legacy naming model to be enabled, users can still validate the changes for the applications that were modified by disabling the legacy naming model using the steps below:

- Run the "`rmsf -L`" command to disable the legacy naming model and test the modified applications to ensure their successful execution as discussed previously under the "[Full Migration Details](#)" section.
- Run the "`insf -L`" command to re-enable the legacy naming model so that other applications that require legacy naming model can also operate properly. This command re-installs the legacy naming model and recreates the legacy DSFs as they were before. The `ioscan` command displays the legacy view again after this command is executed. Users can check whether legacy naming model is re-enabled by running "`insf -Lv`".

Note: See the [Appendix](#) for examples of `rmsf -L` and `insf -L`.

Backing Out From Migration

This section discusses how to back out the changes made during the migration steps above in case there are any problems encountered during or after the migration. A new option (`-L`) to `insf` restores the legacy configuration back onto the system and recreates the legacy DSFs as they were before. The following are the steps to back out from a migration:

- Step 1: Run "`insf -L`". This command re-enables the legacy naming model and recreates the legacy DSFs as they were before.
- Step 2: Restore the ASCII files modified by `iofind` from the `/var/adm/iofind/logs/mmddyy_hhmmss/backup/` directory to their original directories.
- Step 3: Restore the backup binary applications (if any).
- Step 4: If LVM is used, refer to the "LVM Migration from legacy to agile naming model HP-UX 11i v3" White Paper at <http://docs.hp.com/en/hpux11iv3.html#LVM%20Volume%20Manager> for backing out LVM migration (the LVM commands are `vgextend` and `vgreduce`). If whole disk configuration is used and changes were made to `/etc/fstab` and `/stand/system`, restore the original `/etc/fstab` and `/stand/system`. A reboot may be required.
- Step 5: Retry the original applications to verify that they are operating properly again. The original applications should work as before if everything has been restored as it was before. If this is the case, then the back out is successful. Otherwise, do recovery in Step 6.
- Step 6: Restore the system from IUX Recovery Tape. (Perform this only if Step 5 fails)

Conclusion

To take advantage of the benefits of the agile naming model, HP recommends users to migrate their affected applications to use persistent DSFs. Users first need to understand the impact and define the changes to be made. Some restrictions may apply initially and may prevent a full migration, but the coexistence with the legacy naming model allows users to take a phased approach.

Planning Worksheets

This section lists sample worksheets (in table format) to identify, collect, document, and migrate legacy DSFs and hardware paths. If users have applications referencing legacy hardware paths, these paths need to be migrated as well. The lists document what needs to be changed and provide a record to recover from in case there are any problems with the migration.

These records are for illustration purposes only and the DSFs, hardware paths and file names listed are examples. Users would most likely save electronic copies of `ioscan` and other command output as well (per the migration steps above).

1. Mapping legacy to persistent DSF. The following table is derived from the output of "`ioscan -m dsf`". This table is needed if there are any applications referencing legacy DSFs.

Persistent DSF	Legacy DSF(s).
/dev/rdisk/disk14	/dev/rdisk/c7t0d0 /dev/rdisk/c4t0d0

2. Mapping legacy hardware path to lunpath hardware path. The following table is derived from the output of "`ioscan -m hwpath`". This table is only needed if there are any applications referencing legacy hardware paths.

LUN Hardware path	Lunpath Hardware path	Legacy hardware path
64000/0xfa00/0x6	0/1/1/0.0x0.0x0	0/1/1/0.0.0

3. List of ASCII files changed by the `iofind` command

Files changed by <code>iofind</code>	Original files saved at:	What changed?
/usr/adm/myconfig	/var/adm/ioscan/logs/mmddyy_hhmmss /backup/usr/adm/myconfig	Line 5: From /dev/dsk/c8t1d0 To /dev/disk/disk6
/usr/adm/myperl.pl	/var/adm/ioscan/logs/mmddyy_hhmmss /backup/usr/adm/myperl.pl	Line 20: From /dev/rdisk/c3t0d0 To /dev/rdisk/disk20
/etc/fstab	/var/adm/ioscan/logs/mmddyy_hhmmss /backup/etc/fstab	Line 6: From /dev/dsk/c2t0d0s2 To /dev/disk/disk22_p2

4. List of other files changed (recompiled/migrated)

This list is to record any applications that need recompilation/migration.

(Other) files changed	Original files saved at:	What was changed?
/usr/contrib/myprogramA.c	/tmp/mysave/myprogramA.c	Line 15: From /dev/rdisk/c1t0d2 To /dev/rdisk/disk28
/usr/contrib/myprogramB.c	/tmp/mysave/myprogramB.c	Line 20: From 0/4/1/0.1.0 To 0/4/1/0.0x1.0x0

5. List of other applications that require manual legacy DSF/hardware path input during execution. This list contains names of any applications that require users to input legacy parameters, such as a database application which needs a user to enter legacy information.

Name and directory of apps	Legacy information	Agile view information
/usr/admin/mydatabase	/dev/dsk/c5t1d0	/dev/disk/disk25

6. List of boot/swap/dump and other migration information.

Name of subsystem configuration	Legacy information	Agile view information
Dump	/dev/dsk/c9t2d0	/dev/disk/disk16

7. Location of other saved files

This list is for verification and recovery.

- The `ioscan` output will help to determine what has changed in the system configuration.
- The files in `/dev/dsk/`, `/dev/rdisk/`, and `/dev/rmt` directories represent the legacy DSFs.

IMPORTANT: Save these files before running `"rmsf -L"` because this command removes the legacy configuration from the system. The saved files will serve as a record.

Files	Saved at
Save the following before running "rmsf -L":	(For illustration purpose, the saved files are called *b4)
<code>ioscan -m dsf >/tmp/mysave/ioscan.dsf.b4</code>	<code>/tmp/mysave/ioscan.dsf.b4</code>
<code>ioscan -kfnN >/tmp/mysave/ioscan.kfnN.b4</code>	<code>/tmp/mysave/ioscan.kfnN.b4</code>
<code>ioscan -kfn >/tmp/mysave/ioscan.kfn.b4</code>	<code>/tmp/mysave/ioscan.kfn.b4</code>
<code>ioscan -m hwpath >/tmp/mysave/ioscan.hwpath.b4</code>	<code>/tmp/mysave/ioscan.hwpath.b4</code>
<code>ll /dev/dsk >/tmp/mysave/dsk.b4</code>	<code>/tmp/mysave/dsk.b4</code>
<code>ll /dev/rdisk >/tmp/mysave/rdisk.b4</code>	<code>/tmp/mysave/rdisk.b4</code>
<code>ll /dev/rmt >/tmp/mysave/rmt.b4</code>	<code>/tmp/mysave/rmt.b4</code>

Appendix

Examples of using iofind

Example 1 - Find files containing the DSF names (`/dev/dsk/c0t0d0` and `/dev/dsk/c2t0d0`) starting at the directory `/opt`, and preview the replacement with persistent DSFs. This example assumes that there is a user file, `/opt/myconfig`, containing DSF `/dev/dsk/c2t0d0`.

- A. Create a file `/var/adm/mydsf` containing two lines:
`/dev/dsk/c0t0d0`
`/dev/dsk/c2t0d0`
- B. Run: `iofind -n -f /var/adm/mydsf -d /opt -R -p`
- C. The utility displays files found and asks if you want to change the DSF name in all occurrences found. Since this is a preview, the changes are not done on the original file but put into a preview directory. The following is the output from the `iofind` command:

```
The following occurrences of /dev/dsk/c2t0d0 was found in file /opt/myconfig:
FileName:Line Number: Matching Pattern
```

```
/opt/myconfig:425:# my device name (e.g. /dev/dsk/c2t0d0)
```

```
Do you want iofind to replace /dev/dsk/c2t0d0 with /dev/disk/disk3 : (Y)Yes; (N)No; Q(Quit)
? Y
```

```
Replaced /dev/dsk/c2t0d0 with /dev/disk/disk3 in file
/var/adm/iofind/logs/013007_142244/preview/opt/myconfig
```

- D. Review the logging files under `/var/adm/iofind/logs/mmddyy_hhmmss` (the exact location is provided by the tool). You can view all the files with matching instances found.

When the tool is run the first time, the `iofind` command creates an exclusion list at `/var/adm/iofind/cfg/iofind_exclude.cfg`. This file includes directories that do not likely contain ASCII configuration files with legacy information. Searching files in these directories may slow down the tool execution.

Review the contents of this exclusion file to make sure that there is no file or directory that should be searched. If there is any, remove the file or directory name from the exclusion file and run `iofind` again.

Example 2 – Run the same command as above, but without the preview option. If you are satisfied with the preview results, you may run the tool again and go ahead with the real changes (do not specify `-p` for preview):

```
# iofind -n -f /var/adm/mydsf -d /opt -R
```

The following are output from the `iofind` command:

Matching instances will be displayed as follows:

```
The following occurrences of /dev/dsk/c2t0d0 was found in file /opt/myconfig:
FileName:Line Number: Matching Pattern
```

```
/opt/myconfig:425:# my device name (e.g. /dev/dsk/c2t0d0)
```

```
Do you want iofind to replace /dev/dsk/c2t0d0 with /dev/disk/disk3 : (Y)Yes; (N)No; Q(Quit)
? Y
```

```
Replaced /dev/dsk/c2t0d0 with /dev/disk/disk3 in file /opt/myconfig
```

This time, the “Y” answer makes the modification in the file. A backup is saved under `/var/adm/iofind/logs/mmddyy_hhmmss/backup`.

Example 3 – Search for all possible DSFs and hardware paths across all files on the system. For this, run the following command:

```
# iofind -n -H -d /
```

Note: As this command may take a long time to execute, users may want to redirect the output to a file `myoutput`, execute the command in background, and monitor the progress by looking at the increasing size of the `myoutput` file. The command syntax is as follows:

```
# iofind -n -H -d / > myoutput &
```

This command generates a list of known DSFs and hardware paths from `ioscan -kfn` and searches all files under `/` and its subdirectories, except for the files and directories listed in the exclusion list. This command may take a long time to execute as it must check all the ASCII files on the system.

If users want to do an automatic replacement of DSF names and hardware paths found in any files, re-run the command adding the option `-R`; adding `-F` will execute the replacements without asking for permission:

```
# iofind -n -H -d / -R -F
```

Examples of using “`rmsf -L`”, “`insf -Lv`”, and “`insf -L`”

Example 1 – To disable legacy mode, run:

```
# rmsf -L
WARNING: This command may be disruptive to the system.
Before running this command, make sure you have first run
iofind(1M) and migrated all applications using legacy device
special files. Please refer to the man page of rmsf(1M) to
verify the possible side effects of the option '-L'.
Do you want to continue ?
(You must respond with 'y' or 'n'.): y
rmsf: Legacy mode has been successfully disabled
```

Example 2 – To verify whether legacy mode is disabled, run:

```
# insf -L -v
insf: Legacy mode is disabled
```

– To verify that all legacy DSFs are removed, run:

```
# ioscan -kfn
```

- o The `ioscan` output does not display any entries for mass storage devices.
- o The legacy DSF directories (`/dev/dsk`, `/dev/rdisk`, `/dev/rmt`) are empty.

Example 3 – To re-enable legacy mode, run:

```
# insf -L
This command will re-install all legacy I/O nodes and legacy DSFs.
Do you want to continue ?
(You must respond with 'y' or 'n'.): y
insf: Legacy mode has been successfully enabled
```

– To verify that the legacy mode has been re-enabled, run:

```
# ioscan -kfn
```

- o The `ioscan` output again shows the entries for the mass storage devices.
- o The DSFs have been recreated in the `/dev/dsk`, `/dev/rdsk`, and `/dev/rmt` directories.

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