

# Ignite-UX and SAS Devices



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## Introduction

The following white paper is intended to explain how to use SAS disks with Ignite-UX to allow you to install and recover your systems without having to worry about Ignite-UX restrictions with SAS.

## Agility and what Ignite-UX knows about SAS

SAS disks are identified to a system with a unique World-Wide Name (WWN) also known as a SAS address.

The I/O stack on HP-UX 11i v2 internally associates that WWN to a hardware path. The hardware path is not a typical hardware path since the hardware path can change if you reinstall or recover the system and the SAS configuration has changed.

On HP-UX 11i v3, legacy device special files (DSFs) for SAS devices are handled similarly to 11i v2. Therefore, if the SAS configuration changes, the legacy DSFs for SAS devices can change during an installation or recovery session.

With persistent DSFs on 11i v3 there is reliable mapping between a SAS device and the persistent DSF. Since the system knows about the correlation between the WWN and the persistent DSF<sup>1</sup>, Ignite-UX is able to keep the mapping between a persistent DSF and WWN when performing a recovery. The information presented later in this white paper is not applicable to persistent DSFs, it is aimed at HP-UX 11i v2 and legacy DSFs on HP-UX 11i v3.

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**Note:**

You will have actions to perform when replacing a SAS device on HP-UX 11i v3 since a persistent DSF is tied to a WWN. See the `io_redirect_dsf(1m)` manual page on any HP-UX 11i v3 system for more information. If you use legacy DSFs you may also need to use the `sasmgr(1m)` command's `replace_tgt` option.

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## Improvements Made in Recent Ignite-UX Versions

Ignite-UX continues to make improvements in managing SAS devices.

Release C.7.5 improved the identification of devices during recovery by saving WWN (or WWID) information in the config files (in addition to the hardware path). This improvement allowed SAS devices to be added, removed, or moved; and still be correctly chosen for installation during a recovery. However, the hardware path and legacy device file names were different after a recovery in this situation, resulting in the failure to import LVM data volumes due to the device file names changing. Importing data volumes had to be done manually (the `vgscan` command could be used in this case).

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<sup>1</sup> Requires you to use Ignite-UX version C.7.2 or later to reliably recover persistent DSFs for SAS devices when you have more than 7 mass storage devices connected to a system.

Release C.7.10 of Ignite-UX improved recovery by preserving hardware paths and legacy device file names under the `sasd` driver if hardware paths are available for swapping at installation time. As a result, you do not have to import LVM data volumes manually.

## SAS RAID LUNs

You should be aware of the following information when you configure RAID LUNs.<sup>2</sup>

Ignite-UX fully supports a configuration where only RAID LUNs are presented to a system. (This includes having a hot spare configured.) Note that the HP PCI/PCI-X SAS MPT Adapter supports a maximum of two RAID LUNs and a hot spare. SAS RAID LUNs must be configured from EFI before installing HP-UX. Please consult the hardware documentation of your system and Core I/O card for information on how to configure a SAS RAID LUN.

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**Important:**

After initial system configuration you cannot add or remove SAS RAID LUNs. Creating or deleting SAS RAID LUNs post-installation may cause the hardware paths of SAS RAID LUNs to change during a cold-install or recovery session.

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If you have a system containing a mixture of RAID LUNs and individual SAS devices, the devices used for the RAID LUNs and the global spare should be configured from Bay 8 working downwards, and the individual SAS drives populated from Bay 1 upwards. Do not change the configuration after system installation; until agile recovery is implemented, you risk encountering the recovery issues discussed elsewhere in this white paper.

## Recovery and cold installation

For Ignite-UX releases prior to C.7.5, use the hardware path of a device as the unique identifier for a device. As mentioned above, if you change your SAS configuration, the hardware path for SAS devices on HP-UX 11i v2 and for legacy DSFs on HP-UX 11i v3 can change when you reinstall or recover a system. This effectively breaks Ignite-UX's ability to automatically use the correct devices when the SAS configuration changes. However, only some changes break the association of hardware path to SAS device.

The following configuration changes<sup>3</sup> might cause the hardware path associated with a SAS device to change if the system is reinstalled or recovered:

- Placing a SAS device into an empty lower Bay
- Creating a SAS RAID device post-installation

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<sup>2</sup> The restrictions discussed by this white paper regarding individual SAS devices do not apply to the P400 Core I/O card. The P400 Core I/O card presents only RAID LUNs to the system; it is not possible to present individual SAS drives to a system.

<sup>3</sup> It is important to understand that making these changes at any time – while a system is running, or down, or recovering, will cause the issues discussed here about hardware path changes.

- Swapping two or more SAS devices
- Permanently removing<sup>4</sup> a SAS device when there are still devices in higher numbered bays
- Moving a SAS device from one SAS HBA to another.
- Creating or deleting SAS RAID volumes post-installation<sup>5</sup>

Once installed, if a SAS device must be replaced, you **must** use the `sasmgr(1m)` option `replace_tgt` to re-associate a SAS device with the hardware path of the device it replaces (it will be assigned a new hardware path since it has a different WWN).

As of release C.7.5 of Ignite-UX, the WWN (or WWID) is also used to identify a device during a recovery. This allows Ignite-UX to restore the system to the same SAS disks as before. However, the hardware paths and legacy device file names will still change when configuration changes are made.

As of release C.7.10, Ignite-UX attempts to remap legacy hardware paths so it can restore legacy device file names for SAS devices under the `sasd` driver. For this to work correctly, a recovery archive must be made after each hardware configuration change.

In the next few sections we will discuss exactly what happens when you place a SAS device in a lower bay number or remove a SAS device when there are some in higher bay numbers, and then cold-install or recover a system.

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<sup>4</sup> This does not include replacing a SAS device as long as the replacement is performed before doing a cold-install or recovery using Ignite-UX.

<sup>5</sup> Performing either of these actions may change the hardware path of other RAID volumes. These actions will not affect the hardware paths of SAS devices. See the previous section for more information.

## rx6600 and rx3600 SAS bay numbers

The following diagram shows the SAS bay numbers from highest to lowest on a HP Integrity rx6600 system.



The following diagram shows the SAS bay numbers from highest to lowest on a HP Integrity rx3600 system.



This white paper will not present SAS numbering information for external SAS enclosures or future systems that contain SAS devices, please consult the hardware documentation for those products to determine how SAS bays are numbered.

## Placing a SAS device into a lower bay number

When rx3600 and rx6600 systems are shipped to you from HP, unfortunately the SAS bays are populated from 8 working downwards. Placing a new SAS device into a lower bay number will cause the hardware paths to change after a new cold-install or recovery session.

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**Note:**

If you have never changed your SAS configuration before, you can safely move SAS devices downwards as a block<sup>6</sup>. That is, if you have bays 6, 7, and 8 occupied you can move them to bays 1, 2, and 3 without having the hardware paths change during a cold-install or recovery session while the system is shut down. Note that you must move the disks in order and you can not rearrange them. For example, you can move bay 6 to 1, 7 to 2, and 8 to 3. After doing this you can safely populate the SAS enclosure from bay 4 onwards.

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**Important:**

Never move devices from Bays 9-16 to Bays 1-8 as they are controlled by different SAS HBAs (Host Bus Adapters). On HP-UX 11i v2 and with legacy DSFs on 11i v3 the device file for the SAS device will change. On HP-UX 11i v3 persistent DSFs will not change.

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The following example illustrates the behavior of SAS devices that can cause problems.

Take this example configuration:

SAS Enclosure Bay #	Hardware Path
5	0/4/1/0.0.0.0.0
6	0/4/1/0.0.0.1.0
7	0/4/1/0.0.0.2.0
8	0/4/1/0.0.0.3.0

The hardware paths have been given in ascending order of bay number<sup>7</sup>. So, why will adding a new SAS device into Bay 4 cause problems?

The answer is: nothing at the time that you do it. The new configuration will look like:

SAS Enclosure Bay #	Hardware Path
4	0/4/1/0.0.0.4.0
5	0/4/1/0.0.0.0.0
6	0/4/1/0.0.0.1.0
7	0/4/1/0.0.0.2.0
8	0/4/1/0.0.0.3.0

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<sup>6</sup> If you move a boot device you do not need to change the boot manager menu options for boot devices that have changed Bays within Enclosure. EFI keeps track of SAS devices by WWID not Bay number.

<sup>7</sup> You should be able to rely on devices receiving hardware paths from the lowest bay number upwards.

A problem happens if you were to re-install or recover this system<sup>8</sup>, as the hardware paths would change to become:

SAS Enclosure Bay #	Old Hardware Path	New Hardware Path
4	0/4/1/0.0.0.4.0	0/4/1/0.0.0.0.0
5	0/4/1/0.0.0.0.0	0/4/1/0.0.0.1.0
6	0/4/1/0.0.0.1.0	0/4/1/0.0.0.2.0
7	0/4/1/0.0.0.2.0	0/4/1/0.0.0.3.0
8	0/4/1/0.0.0.3.0	0/4/1/0.0.0.4.0

Since Ignite-UX (prior to version C.7.5) is driven by hardware path and device files are driven by hardware paths, during a non-interactive recovery if the old hardware path was 0/4/1/0.0.0.3.0 (Bay 8), it now would attempt to use the device in Bay 7 instead since that bay is now associated with the old hardware path.

As of C.7.10, devices under the `sasd` driver will have their hardware paths correctly mapped:

SAS Enclosure Bay #	Old Hardware Path	New Hardware Path
4	0/4/1/0.0.0.4.0	0/4/1/0.0.0.4.0
5	0/4/1/0.0.0.0.0	0/4/1/0.0.0.0.0
6	0/4/1/0.0.0.1.0	0/4/1/0.0.0.1.0
7	0/4/1/0.0.0.2.0	0/4/1/0.0.0.2.0
8	0/4/1/0.0.0.3.0	0/4/1/0.0.0.3.0

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**Important:**

An unattended recovery or a reinstallation of a system (using Ignite-UX releases prior to C.7.5) might overwrite the wrong device causing data loss unless you take care to use the SAS device in the appropriate bay.

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<sup>8</sup> Using a version of Ignite-UX prior to C.7.10.

## Removing a SAS device when there are still devices in higher numbered bays

In this section we will look at removing SAS devices from a system. We will start with the following configuration:

SAS Enclosure Bay #	Hardware Path
1	0/4/1/0.0.0.0.0
2	0/4/1/0.0.0.1.0
3	0/4/1/0.0.0.2.0
4	0/4/1/0.0.0.3.0
5	0/4/1/0.0.0.4.0

If we remove the device in Bay 3 we will be left with the following configuration:

SAS Enclosure Bay #	Hardware Path
1	0/4/1/0.0.0.0.0
2	0/4/1/0.0.0.1.0
Not Present	
4	0/4/1/0.0.0.3.0
5	0/4/1/0.0.0.4.0

If you recover the system you will end up with the following configuration:

SAS Enclosure Bay #	Hardware Path	New Hardware Path
1	0/4/1/0.0.0.0.0	0/4/1/0.0.0.0.0
2	0/4/1/0.0.0.1.0	0/4/1/0.0.0.1.0
Not Present		
4	0/4/1/0.0.0.3.0	0/4/1/0.0.0.2.0
5	0/4/1/0.0.0.4.0	0/4/1/0.0.0.3.0

This would cause problems the next time you were to ever cold-install or recover the system. The new hardware paths cannot be correctly assigned to the disks in bays 4 and 5 because, as of C.7.10, there is no way for Ignite-UX to arbitrarily move a hardware path. The only method Ignite-UX can use to correct legacy hardware path assignments is swapping between two disks. So, in the above example, there is no way to assign the disk in Bay 4 the correct hardware path of 0/4/1/0.0.0.3.0 or the disk in Bay 5 the correct hardware path of 0/4/1/0.0.0.4.0.

Continuing with our scenario, you would probably like to fix the hardware path assignments that were confused by recovering without an expected device in Bay 3. Starting with our misassigned hardware paths, place a SAS device into Bay 3 and then recover the system; Ignite-UX will then swap legacy hardware path assignments until each device has the correct path.

SAS Enclosure Bay #	Hardware Path	New Hardware Path
1	0/4/1/0.0.0.0.0	0/4/1/0.0.0.0.0
2	0/4/1/0.0.0.1.0	0/4/1/0.0.0.1.0
3	0/4/1/0.0.0.4.0	0/4/1/0.0.0.2.0
4	0/4/1/0.0.0.2.0	0/4/1/0.0.0.3.0
5	0/4/1/0.0.0.3.0	0/4/1/0.0.0.4.0

## What you can do with SAS devices

You can replace SAS devices that have failed. You should, however, consult the SAS documentation and documentation for the revision of HP-UX you are running for the correct procedure for replacing SAS devices. Simply replacing a device while the system is up will create a new hardware path for the device (since it does not have the same WWN as the original device).

To complete the replacement of a SAS device while the system is running you must use the `sasmgr(1m)` command's `replace_tgt` option. On 11i v3 you will need to run `io_redirect_dsf(1m)` to have the new device use the persistent DSF of the device it has replaced. Failing to do this can lead to recovery problems because of hardware path changes.

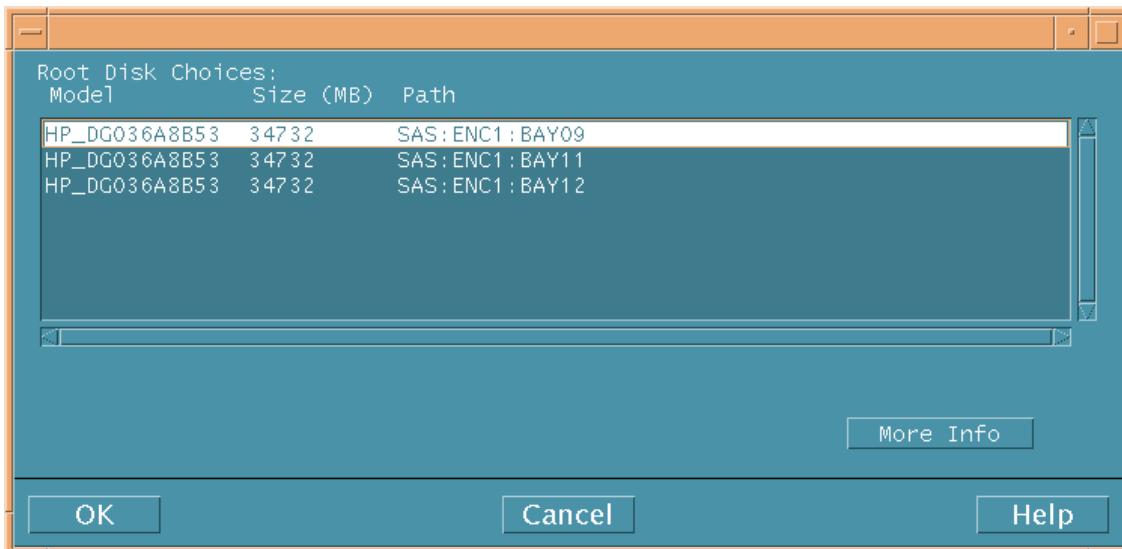
Replacing the device while performing a recovery or cold install will work as expected since any mapping between WWN and hardware path is preserved with the Device Specifier (see the `instl_adm(4)` section Device Specifier for more details).

You can remove SAS devices in order of highest bay downwards without affecting how your system will be recovered. Note that importing any LVM volume group that was on the SAS devices that have been removed will fail for recovery archives created before the devices were removed. If you subsequently add new SAS devices back, you should consult the SAS documentation and documentation for the release of HP-UX you are running to determine if any additional configuration steps are required.

You can add new SAS devices but you should not leave any empty bays between new SAS devices. You might need to perform the steps required for replacing a device; consult the SAS documentation and documentation the release of HP-UX you are running for more information. If you are unsure of the numbering of SAS bays, always consult hardware documentation before adding a SAS device into an enclosure to determine the next available SAS bay. On an rx6600 if you have the bays loaded from Bay 8 downwards, you can add SAS devices into Bay 9 onwards if they are not already occupied.

## Information Ignite-UX can tell you to help during a recovery

To help you identify SAS devices during installation and recovery, Ignite-UX uses a device attribute called physical location. The physical location indicates the enclosure and bay where the device is located. For example, a physical location may be "SAS:ENC01:BAY01". You can find this information in `itool` during an interactive installation or recovery by navigating to a screen that shows lists of disks - it will show the physical location of the SAS device instead of a hardware path, for example:



## Conclusion

This white paper presents information on the limitations of using Ignite-UX with SAS devices by illustrating the issues you may face during a recovery. An update to Ignite-UX release C.7.10 addresses the device selection issues discussed here, however you should still be aware of the hardware path and device special file name changes that still occur when configuration changes are made.

## For More Information

The following relevant documents are available online at <http://www.hp.com/go/hpux-core-docs>

*Ignite-UX Administration Guide*

*HP-UX 11i v[1|2|3] Installation and Update Guide*

*HP-UX 11i v[1|2|3] Release Notes*

*Managing Systems and Workgroups: A Guide for HP-UX System Administrators*

*HP-UX System Administrator's Guide*

Product information regarding Ignite-UX is available at:

- <http://www.hp.com/go/ignite-ux>
- <http://www.hp.com/go/ignite-ux-docs>

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