

HP Dynamic Smart Array RAID Controller User Guide

Abstract

This document is for the person who installs, administers, and troubleshoots servers and storage systems. HP assumes you are qualified in the servicing of computer equipment and trained in recognizing hazards in products with hazardous energy levels.



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Overview

Features

Supported feature	B120i controller	B320i controller
Drive support		
Hot-plug SATA drives and SATA SSD	Yes	Yes
Hot-plug SAS drives and SAS SSD	No	Yes ¹
Direct Connect drives	Yes	Yes
Physical drives	6	8
Logical drives	8	8
Smart Carrier LED support	Yes ²	Yes ²
Online spares	Yes	Yes
Cache module support		
Optional 512 MB FBWC module	Yes ³	Yes
RAID support		
RAID 0, 1, and 1+0	Yes	Yes
RAID 5	Yes ⁴	Yes ⁴
Firmware and utility support		
SATA drive firmware flash	Yes	Yes
SAS drive firmware flash	No	Yes
ACU	Yes	Yes
HP SIM	Yes	Yes
Intelligent Provisioning	Yes	Yes

¹The HP Dynamic Smart Array B320i RAID controller supports SAS drives when the HP Smart Array SAS License Key is installed. For more information, see "Installing the HP Smart Array SAS License Key (on page 7)."

²For more information on Smart Carrier LED support, see "Drive LEDs (on page 19)."

³The 512 MB FBWC module is not supported on HP ProLiant ML310e, DL320e, and SL140s Gen8 Servers.

⁴HP Dynamic Smart Array RAID controllers support RAID 5 when an optional 512 MB FBWC module is installed. For more information, see "Upgrading to 512 MB FBWC (on page 7)."

For more information about product features, specifications, options, configurations, and compatibility, see the QuickSpecs on the HP website

(<http://h18000.www1.hp.com/products/quickspecs/ProductBulletin.html>). At the website, choose the geographic region, and then locate the product by name or product category.

Enabling and configuring the controller

Enabling the controller



IMPORTANT: For HP ProLiant DL160, SL230, and SL250 Gen8 Servers, be sure to update the BIOS to March 2012 or later.

For the HP ProLiant DL160 Gen8 Server, the HP Dynamic Smart Array B120i RAID controller must be enabled manually in RBSU.

For HP ProLiant SL230, SL250, and SL270 Gen8 Servers, the HP Dynamic Smart Array B320i RAID controller must be enabled manually in RBSU.

For all other supported servers, the controller (either the B120i or the B320i) is enabled automatically or by default.

For more information on supported servers, see the product QuickSpecs on the HP website (<http://h18000.www1.hp.com/products/quickspecs/ProductBulletin.html>).

For more information on RBSU, see the *HP ROM-Based Setup Utility User Guide* on the Documentation CD or the HP website (<http://www.hp.com/support/smartstart/documentation>).

To manually enable the controller:

1. At POST, press the **F9** key to enter RBSU.
2. For the B120i controller, do the following:
 - a. Select **System Options>Embedded SATA Configuration>Enable Dynamic HP Smart Array B120i RAID Support**.
 - b. Follow the onscreen prompts to enable the B120i controller.
3. For the B320i controller, do the following:
 - a. Select **System Options>HP Smart Array B320i RAID configuration**.
 - b. Follow the onscreen prompts to enable the B320i controller.

Setting the boot order

1. Confirm that the controller is enabled ("[Enabling the controller](#)" on page 6).
2. Do one of the following:
 - a. If the controller has just been enabled, reboot the server. Then, press the **F9** key at POST to enter RBSU.
 - b. If the controller is already enabled, proceed to the next step.
3. Select **Boot Controller Order**.
4. Select the Dynamic Smart Array Controller from the list, and move it to controller position 1.

Installing the HP Smart Array SAS License Key

When installed and activated on the B320i controller, the HP Smart Array SAS License Key provides support for SAS hard drives.

To enter the license key, use ACU ("[Array Configuration Utility](#)" on page 30).

After the license key is added, a Validating License Key screen appears, and you will receive confirmation that the license key has been successfully activated. SAS drives are now enabled. Use ACU to configure the drives.

Configuring an array

For the most efficient use of drive space, all drives within an array should have approximately the same capacity. Each configuration utility treats every physical drive in an array as if it has the same capacity as the smallest drive in the array. Any excess capacity of a particular drive cannot be used in the array. Therefore, the capacity is unavailable for data storage.

The more physical drives that are in an array, the greater the probability that the array will experience a drive failure during any given period. To reduce the risk of data loss that might occur when a drive fails, configure all logical drives in an array with a suitable fault-tolerance (RAID) method.

To configure an array, use Intelligent Provisioning (on page 31) to enter the Array Configuration Utility (on page 30). For more information about using ACU to configure an array, see the *Configuring Arrays on HP Smart Array Controllers Reference Guide* on the HP website (<http://www.hp.com/go/bizsupport>).

Setting the controller read cache

HP Dynamic Smart Array RAID controllers can use a configurable amount of main system memory for read caching. The default amount of memory used is 64 MB. However, this value can be set to 0, 64, or 128 MB.

Use ACU ("[Array Configuration Utility](#)" on page 30) in **offline mode** to configure the amount of read cache. For more information, see the *Configuring Arrays of HP Smart Array Controllers Reference Guide* on the HP website (<http://www.hp.com/go/bizsupport>).

Upgrading to 512 MB FBWC

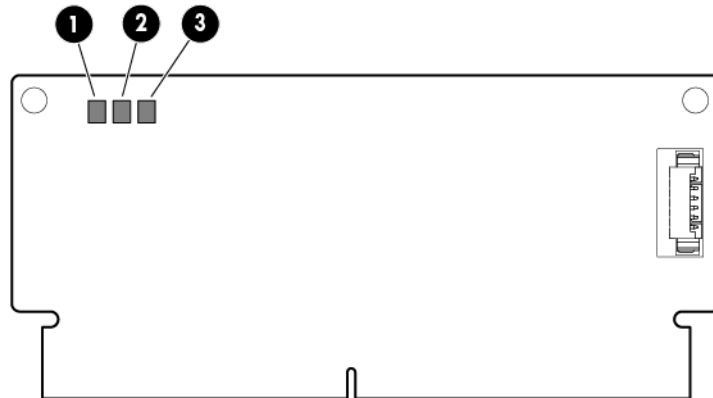
The 512 MB FBWC option provides RAID 5 capabilities for HP Dynamic Smart Array B120i and B320i RAID controllers.

For more information, see the server QuickSpecs on the HP website (<http://h18000.www1.hp.com/products/quickspecs/ProductBulletin.html>). To obtain the option, contact an HP authorized reseller.

After the option is installed, use ACU ("[Array Configuration Utility](#)" on page 30) to configure RAID 5. For more information, see the *HP Smart Array Controllers for HP ProLiant Servers User Guide* on the HP website (<http://www.hp.com/go/bizsupport>).

FBWC module LEDs (B120i, B320i)

The FBWC module has three single-color LEDs (one amber and two green).



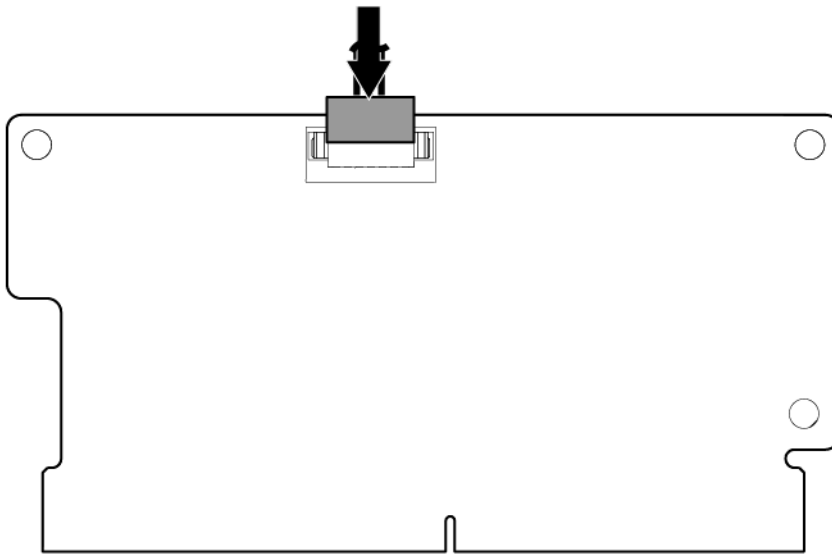
1 - Amber	2 - Green	3 - Green	Interpretation
Off	Off	Off	The cache module is not powered.
Off	Flashing 0.5 Hz	Flashing 0.5 Hz	The cache microcontroller is executing from within its boot loader and receiving new flash code from the host controller.
Off	Flashing 1 Hz	Flashing 1 Hz	The cache module is powering up, and the capacitor pack is charging.
Off	Off	Flashing 1 Hz	The cache module is idle, and the capacitor pack is charging.
Off	Off	On	The cache module is idle, and the capacitor pack is charged.
Off	On	On	The cache module is idle, the capacitor pack is charged, and the cache contains data that has not yet been written to the drives.
Off	Flashing 1 Hz	Off	A backup is in progress.
Off	On	Off	The current backup is complete with no errors.
Flashing 1 Hz	Flashing 1 Hz	Off	The current backup failed, and data has been lost.
Flashing 1 Hz	Flashing 1 Hz	On	A power error occurred during the previous or current boot. Data may be corrupt.
Flashing 1 Hz	On	Off	An overtemperature condition exists.
Flashing 2 Hz	Flashing 2 Hz	Off	The capacitor pack is not attached.
Flashing 2 Hz	Flashing 2 Hz	On	The capacitor has been charging for 10 minutes, but has not reached sufficient charge to perform a full backup.
On	On	Off	The current backup is complete, but power fluctuations occurred during the backup.
On	On	On	The cache module microcontroller has failed.

Installing the FBWC module and capacitor pack

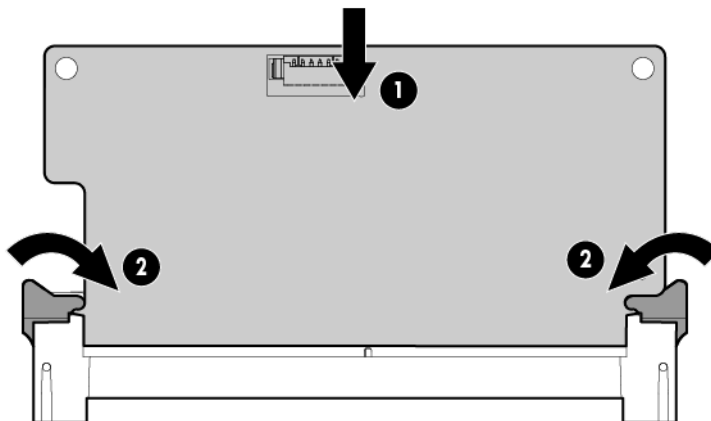
For detailed installation and cable routing information, see the server user guide.

1. Power down the server.
2. Remove all power:
 - a. Disconnect each power cord from the power source.
 - b. Disconnect each power cord from the server.
3. Remove the access panel.
4. Remove all components as needed to access the FBWC module and capacitor pack.
5. Connect the capacitor pack cable to the cache module.

CAUTION: When connecting or disconnecting the capacitor pack cable, the connectors on the cache module and cable are susceptible to damage. Avoid excessive force and use caution to avoid damage to these connectors.



6. Install the cache module in the cache module connector on the system board.
For more information on the location of the cache module connector, see the server user guide.



7. Install the FBWC capacitor pack.
8. Install all previously removed components.

9. Route the capacitor pack cable. For more information, see the server user guide.
10. Install or close the access panel.
11. Power up the server.

Installing device drivers and Management Agents

Installing device drivers



IMPORTANT: If necessary, enable the controller before installing device drivers. For more information, see "Enabling the controller (on page 6)."

A device driver is required for the operating system to communicate with the disk drive controller. For more information on supported operating systems, see the product page for the appropriate controller on the HP website (<http://www.hp.com/go/dynamicsa>).

The device drivers are provided with HP Service Pack for ProLiant (on page 30). Use Intelligent Provisioning (on page 31) to install the controller drivers.

Driver updates are posted to the HP website (<http://www.hp.com/support>). When prompted for product information, enter the appropriate server model name or controller model.

Windows operating systems



IMPORTANT: The Windows media DVD is required for all installation options.

The device driver for the B120i and B320i controllers is not included with the off-the-shelf Microsoft Windows operating system. Use one of the following methods to install the device drivers:

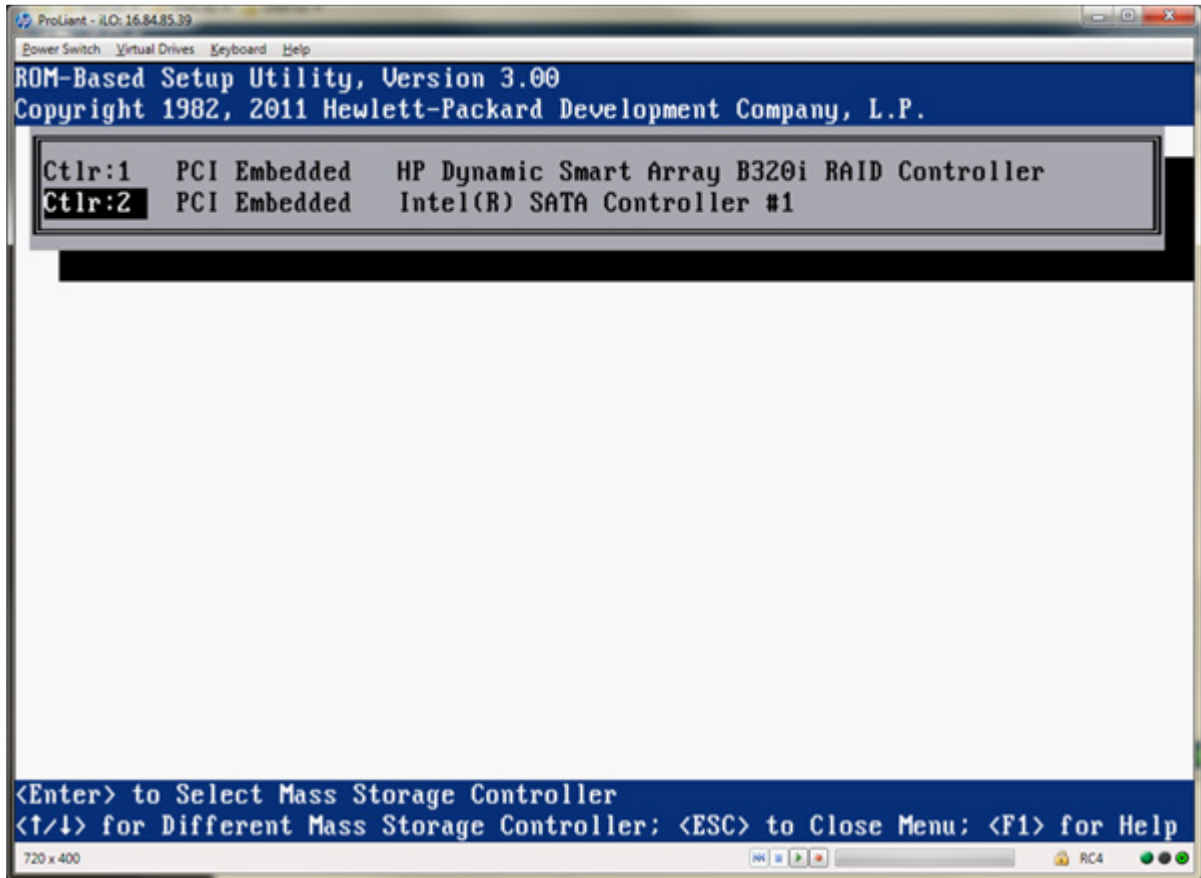
- Assisted Installation—When using the assisted installation option in the Intelligent Provisioning software ("Intelligent Provisioning" on page 31), the driver is added automatically during installation.
- Manual installation
 - With Virtual Install Disk enabled—The VID is a special partition that contains critical drivers. When VID is enabled, the driver is automatically added during installation. Windows automatically recognizes this partition and loads the driver for the Dynamic Smart Array Controller to expose the disk volumes for installation.
To enable VID in RBSU, select **Advanced Options>Advanced System ROM Options>Virtual Install Disk**, and then select **Enable**.
 - With VID disabled—When VID is disabled, you must install the driver manually from a USB drive during the operating system installation.

For more information, see "Manually installing the device driver (on page 11)."

Manually installing the device driver

1. If VID is disabled, obtain the driver using SPP ("HP Service Pack for ProLiant" on page 30) and extract the file to a USB drive.

2. Confirm the boot device in RBSU.

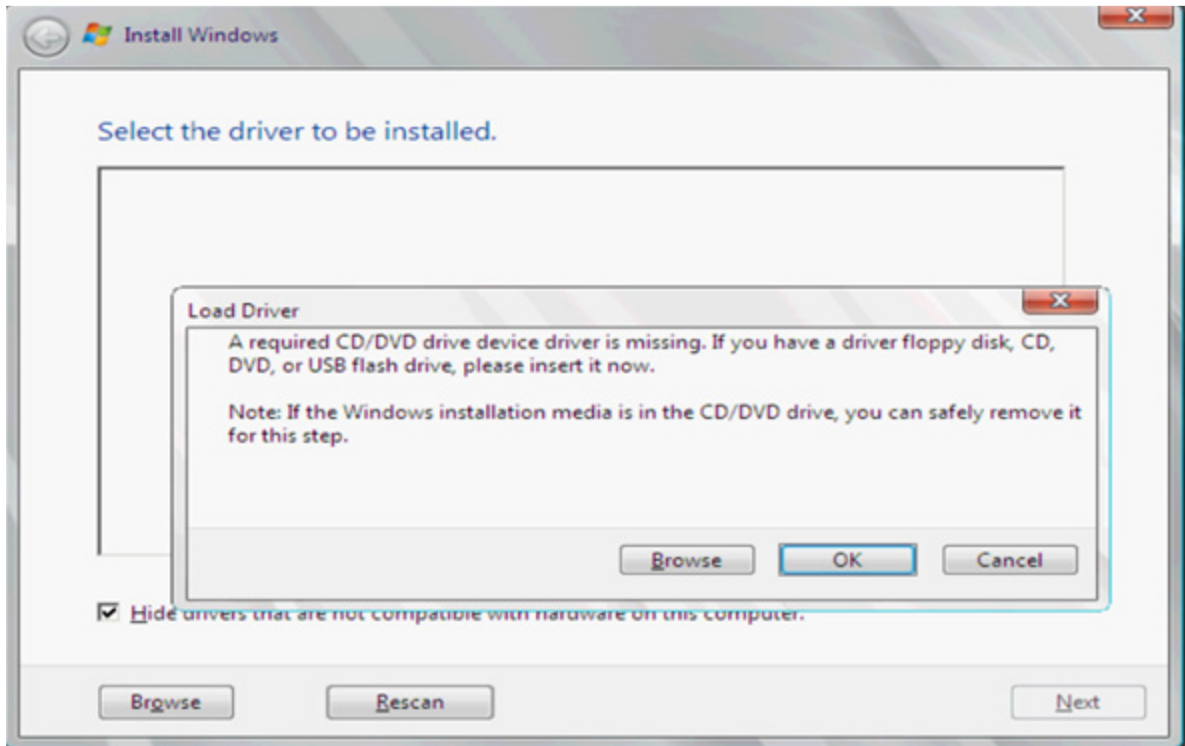


3. Insert the operating system DVD.
4. Confirm that the hard drive or logical volume on the boot device is configured and present.
5. Boot the server.
6. Do one of the following:



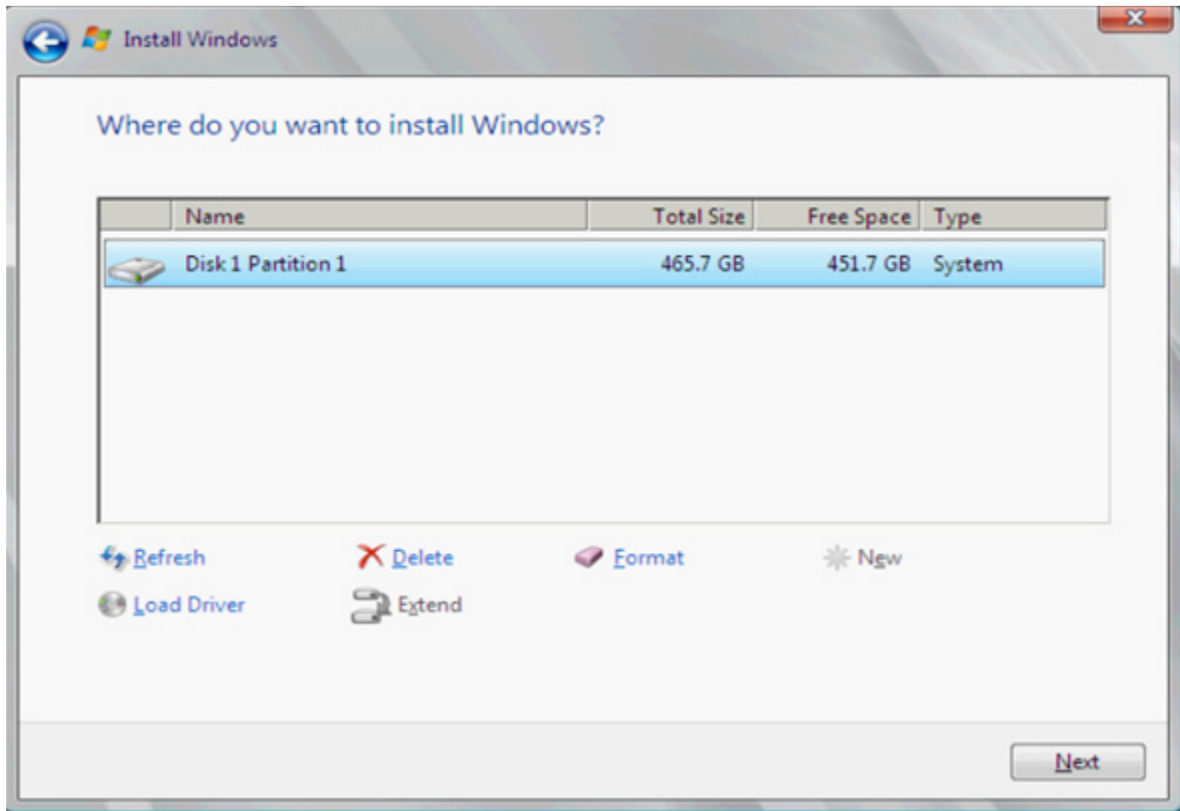
IMPORTANT: When you install the operating system from an optical device on a server that supports the B120i controller, you are prompted early in the installation process for the optical device driver. You must install the driver for the installation to continue.

- For servers that support the B120i controller and have a SATA optical drive, Windows prompts for the optical device driver. Insert the USB drive containing the driver, and then click **Browse**.



- For all other servers, continue to the next step.
7. Follow the prompts for installation.
 8. When **Where do you want to install Windows?** appears, confirm that the correct drive or logical volume is available.

If the drive or logical volume is not available, select **Load Driver**. Then, insert the USB drive containing the driver and follow the prompts for installation.



IMPORTANT: If the intended boot volume is not detected after installing the driver, you may need to load other drivers for it at this time. For drives that are behind a Smart Array controller, use ACU (**F5**) or Intelligent Provisioning (**F10**) to create the volume.

9. Continue installing the operating system as normal.

Linux operating systems

For Linux operating systems, use the driver update diskette (DUD) images located on the SPP DVD ("HP Service Pack for ProLiant" on page 30) or on the HP website (<http://www.hp.com/go/bizsupport>).

Before installing the device drivers, observe the following conditions:

- Be sure you have already created a logical volume using the Intelligent Provisioning software ("Intelligent Provisioning" on page 31) or ACU ("Array Configuration Utility" on page 30).
- Be sure you have a USB device containing the DUD image.
- If you are installing a 32-bit version of Linux, read cache is not supported.

The readme file provided on the DUD image provides detailed instructions for installing device drivers on specific versions of the Linux operating system. For general installation instructions, see the following:

- "Installing device drivers (Red Hat Enterprise Linux 5 or 6) (on page 15)"
- "Installing device drivers (SUSE Enterprise Linux 10 or 11) (on page 15)"

Installing device drivers (Red Hat Enterprise Linux 5 or 6)

1. Enable the controller ("Enabling the controller" on page 6), if necessary.
2. Reboot the server.
3. Press the **Tab** key.
4. Insert the USB device containing the DUD image.
5. Enter `linux dd`.
6. For a B120i controller, append `blacklist=ahci`. If you are installing a 32-bit kernel, append `vmalloc=384M` to the line.



IMPORTANT: The appended code `vmalloc=384M` is case sensitive.

7. Do one of the following:
 - o For Red Hat Enterprise Linux 5, press **Enter** to install or upgrade in graphical mode.
 - o For Red Hat Enterprise Linux 6, select **Install or upgrade an existing system**. Then, press **Enter**.
8. At the Driver disk prompt, select **Yes** and then press **Enter**.
9. At the Driver Disk Source prompt, select **SDA** and then press **Enter**.
10. At the Insert Driver Disk prompt, select **OK** and then press **Enter**.
11. At the More Driver Disks? prompt, remove the USB device. Then, select **No** and press **Enter**.
12. Proceed with operating system installation as normal.

Installing device drivers (SUSE Enterprise Linux 10 or 11)



IMPORTANT: Before installing SUSE Linux Enterprise 11 SP1, you must mount a kISO boot image and then insert the SUSE Linux Enterprise 11 SP1 DVD when prompted. For more information, see the HP website (<http://h20000.www2.hp.com/bizsupport/TechSupport/Document.jsp?objectID=c03237878>).

To install the device drivers on SUSE Enterprise Linux 10 or 11:

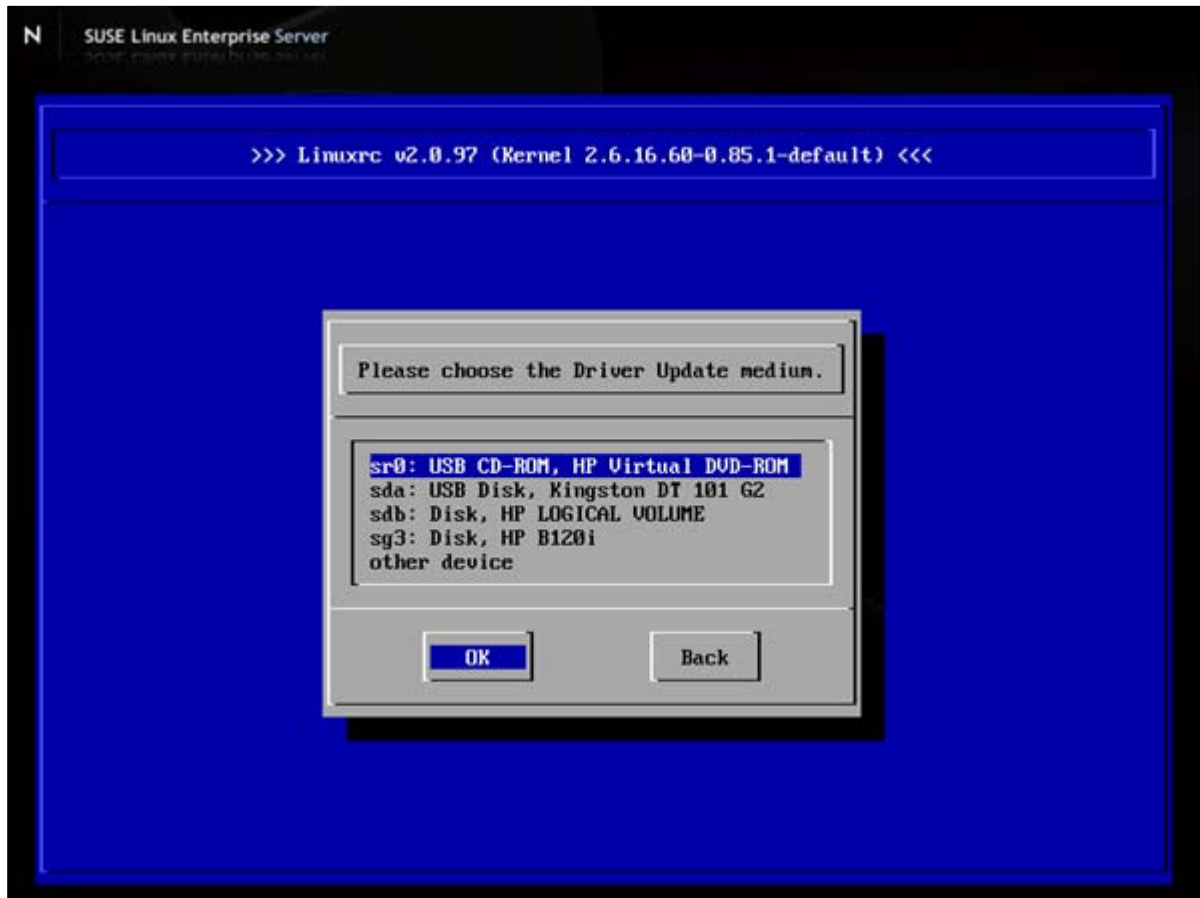
1. Enable the controller ("Enabling the controller" on page 6), if necessary.
2. Reboot the server.
3. Insert the USB device containing the DUD image.
4. Do one of the following:
 - o For SUSE Linux Enterprise 10, press the **F5** key and then select **Yes**.
 - o For SUSE Linux Enterprise 11, press the **F6** key and then select **Yes**.
5. For a B120i controller, append `broken_modules=ahci` to `linux dd`. If you are installing a 32-bit kernel, append `vmalloc=384M` to the line.



IMPORTANT: The appended code `vmalloc=384M` is case sensitive.

6. Be sure that **Installation** is selected, and then press **Enter**.

7. The following screen appears. If the correct controller appears on the list, the driver has been installed correctly.



8. After confirming that the driver is installed, remove the USB device.
9. Select **Back**, and then press **Enter**.
10. Proceed with operating system installation as normal.

VMware ESX operating systems

To obtain the device driver for VMware vSphere 5, you must obtain the HP custom image for VMware. To obtain the custom image, see the HP Software Depot website (<http://software.hp.com/>) and select the Virtualization Software/Server Virtualization category. For more information on supported servers, see the HP website (<http://h20195.www2.hp.com/V2/GetPDF.aspx/4AA3-4003ENW.pdf>).

You can obtain the device driver for VMware ESXi 5.0 and VMware ESX/ESXi 4 in one of the following ways:

- By purchasing a VMware license from HP. If you purchase a license from HP, the device driver will already be installed. The HP Dynamic Smart Array driver (hpvsa) is installed on HP ESXi 5.0 u1 and ESX/ESXi 4 u2 custom images by default. For more information and to obtain the images, see the HP website (<http://www.hp.com>).
- By installing the driver with one of the following methods:
 - For VMware ESX 4.1, install a device driver in one of the following ways:

- Install the driver during operating system installation ("[Installing the device driver during OS installation \(ESX 4.1\)](#)" on page 17).
- Install the driver as an update ("[Installing the device driver as an update \(ESX 4.1\)](#)" on page 17).
- For VMware ESXi 4.1, you must reinstall the operating system using a new install image that contains the updated device driver.
- For VMware ESX 5.0, install the device driver as an update ("[Installing the device driver as an update \(ESXi 5.0\)](#)" on page 18).

Installing the device driver during OS installation (ESX 4.1)

1. Enable the controller ("[Enabling the controller](#)" on page 6), if necessary.
2. Set the boot controller order ("[Setting the boot order](#)" on page 6).
3. Do one of the following:
 - Insert the OS installation media.
 - Mount the OS image via iLO virtual media.
4. Boot the installer process. The installer asks if there are custom drivers to install.
5. Select **yes**. The installer prompts you to remove the OS install media and insert the driver ISO image media.
6. After the driver ISO image is read, the ESX OS prompts you to remove the driver media and insert the OS install media.

The OS installation then proceeds as usual.

For more information on installing the operating system, see the documentation on the VMWare website (<http://www.vmware.com>).

Installing the device driver as an update (ESX 4.1)

1. Prepare the system for remote access and ssh/scp:
 - a. Log in to the ESX OS system console as root.
 - b. Enter `chkconfig firewall off`.
 - c. Enter `chkconfig iptables off`.
 - d. Enter `service firewall restart`.
 - e. Enter `esxcfg-firewall -allowIncoming -allowOutgoing`.
 - f. Enter `vi /etc/ssh/sshd_config`.
 - g. Find the line `PermitRootLogin`.
 - h. Change the value to **yes**.
 - i. Save the file and exit.
2. Enter `service sshd restart`.
3. To copy the new hpvsa driver, enter `<scp <VIB filename> IP Addr of ESX server>:/tmp`
 Example:


```
scp vmware-esx-drivers-scsi-hpvsa-400.4.1.0-4OEM.x86_64.vib
10.10.10.25:/tmp
```
4. To install the driver update:

- a. Log in to ESX system console as root.
- b. Enter `cd /tmp`.
- c. Enter `esxupdate -b <VIB> --nodeps --nosigcheck --maintenancemode update`.

Example:

```
esxupdate -b vmware-esx-drivers-scsi-hpvsa-400.4.1.0-4OEM.x86_64.vib
--nodeps --nosigcheck --maintenancemode update
```

5. Reboot the server.

Installing the device driver as an update (ESXi 5.0)

To update the driver from the system console:

1. Prepare the system for remote access and ssh/scp:
 - a. On ESXi 5.0 system console, Select **F2 Customize System**.
 - b. Log in as root.
 - c. Select **Troubleshooting Options**.
 - d. Enable ESXi Shell and SSH.
 - e. Log out.
2. To copy the new hpvsa driver, enter `scp <VIB filename> <IP Addr of ESX server>:/tmp`.

Example:

```
scp scsi-hpvsa-5.0.0-2OEM.500.0.0.406165.x86_64.vib 10.10.10.25:/tmp
```

3. To Install the driver update:
 - a. Press **Alt-F1** to log in to the ESX system console as root.
 - b. Enter `cd /tmp`.
 - c. Enter: `cp <VIB> /var/log/vmware`.

Example:

```
cp scsi-hpvsa-5.0.0-2OEM.500.0.0.406165.x86_64.vib /var/log/vmware
```

4. Enter `esxcli software vib install -v file:./<VIB> --force --no-sig-check --maintenance-mode`.

Example:

```
esxcli software vib install -v file:./
scsi-hpvsa-5.0.0-2OEM.500.0.0.406165.x86_64.vib --force --no-sig-check
--maintenance-mode
```

5. Reboot the server.

Installing Management Agents

If you use the Assisted Installation path feature of the Intelligent Provisioning software to install the operating system on a new server, the Management Agents are automatically installed at the same time.

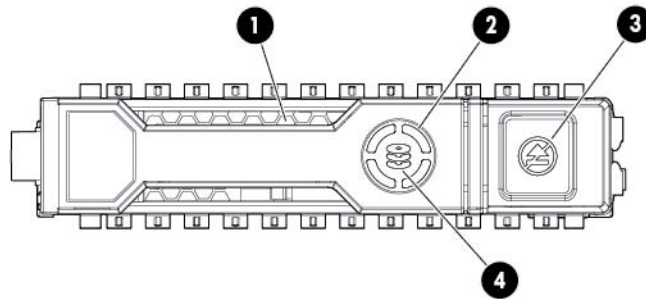
You can update the Management Agents by using the latest versions of the agents provided in the Intelligent Provisioning software ("[Intelligent Provisioning](#)" on page 31).

Replacing, moving, or adding hard drives

Drive LEDs

HP Dynamic Smart Array RAID controllers support drive LED illumination only on systems with backplane support for drive LEDs.

In addition, HP Dynamic Smart Array RAID controllers support HP Smart Carrier LED illumination. However, LED functionality is provided only if the drives are authenticated through HP Smart Carrier.



Item	LED	Status	Definition
1	Locate	Solid blue	The drive is being identified by a host application.
		Flashing blue	The drive carrier firmware is being updated or requires an update.
2	Activity ring	Rotating green	Drive activity
		Off	No drive activity
3	Do not remove	Solid white	Do not remove the drive. Removing the drive causes one or more of the logical drives to fail.
		Off	Removing the drive does not cause a logical drive to fail.
4	Drive status	Solid green	The drive is a member of one or more logical drives.
		Flashing green	The drive is rebuilding or is erasing.
		Flashing amber/green	The drive is a member of one or more logical drives and predicts the drive will fail.
		Flashing amber	The drive is not configured and predicts the drive will fail.
		Solid amber	The drive has failed.
		Off	The drive is not configured by a RAID controller.

Recognizing hard drive failure



CAUTION: Sometimes, a drive that has previously been failed by the controller may seem to be operational after the system is power-cycled or (for a hot-pluggable drive) after the drive has been removed and reinserted. However, continued use of such marginal drives may eventually result in data loss. Replace the marginal drive as soon as possible.

The following items indicate a hard drive failure:

- The following POST messages appear when the system is restarted, as long as the controller detects at least one functional drive:
 - 1784: Drive Array Failure
 - 1786: Drive Array Recovery Needed
- ACU represents failed drives with a distinctive icon.
- HP SIM can detect failed drives remotely across a network. For more information about HP SIM, see the documentation on the HP website (<http://www.hp.com/go/support>).
- The HP SMH indicates that a drive has failed.
- iLO/AMS indicates that a drive has failed.
- In Windows operating systems, the Event Notification Service posts an event to the Microsoft Windows system event log and the IML.
- In Linux operating systems, systems events are logged to `/var/log/messages`.
- ACU lists all failed drives (on systems supported by ACU v8.28.13.0 or later).

For more information about diagnosing hard drive problems, see *HP ProLiant Gen8 Troubleshooting Guide, Volume I: Troubleshooting* on the HP website (<http://www.hp.com/go/bizsupport>).

Effects of a hard drive failure

When a hard drive fails, all logical drives that are in the same array are affected. Each logical drive in an array might be using a different fault-tolerance method. Therefore, each logical drive can be affected differently.

- RAID 0 configurations cannot tolerate drive failure. If any physical drive in the array fails, all RAID 0 logical drives in the same array also fail.
- RAID 1 configurations can tolerate one drive failure. If one physical drive in a RAID 1 configuration fails, the RAID volume is still intact as a degraded RAID 1.
- RAID 1+0 configurations can tolerate up to two drive failures as long as no failed drives are mirrored to one another.

A RAID 1+0 configuration of four drives consists of two RAID 1 volumes of two drives each. One drive from each RAID 1 volume can fail for a total of two failed drives. If both drives in one RAID 1 volume fail, the entire RAID 1+0 volume fails.

- RAID 5 configurations can tolerate up to one drive failure. Data protection is provided by **parity data**. This parity data is calculated stripe by stripe from the user data that is written to all other blocks within that stripe. The blocks of parity data are distributed evenly over every physical drive within the logical drive.



IMPORTANT: RAID 5 is available only when the optional 512 MB FBWC module is installed. For more information, see "Upgrading to 512 MB FBWC (on page 7)."

Compromised fault tolerance



CAUTION: When fault tolerance is compromised, data loss can occur. However, it may be possible to recover the data. For more information, see "Recovering from compromised fault tolerance (on page 21)."

If more drives fail than the fault-tolerance method can manage, fault tolerance is compromised, and the logical drive fails. If this failure occurs, the operating system rejects all requests and indicates unrecoverable errors.

For example, fault tolerance may be compromised when a drive in an array fails while another drive in the array is being rebuilt.

Compromised fault tolerance can also be caused by problems unrelated to drives. In such cases, replacing the physical drives is not required.

Recovering from compromised fault tolerance

If fault tolerance is compromised, inserting replacement drives does not improve the condition of the logical volume. Instead, if the screen displays unrecoverable error messages, perform the following procedure to recover data:

1. Power down the entire system, and then power it back up. In some cases, a marginal drive will work again for long enough to enable you to make copies of important files.
If a 1779 POST message is displayed, press the **F2** key to re-enable the logical volumes. Remember that data loss has probably occurred and any data on the logical volume is suspect.
2. Make copies of important data, if possible.
3. Replace any failed drives.
4. After you have replaced the failed drives, fault tolerance may again be compromised. If so, cycle the power again. If the 1779 POST message is displayed:
 - a. Press the **F2** key to re-enable the logical drives.
 - b. Recreate the partitions.
 - c. Restore all data from backup.

To minimize the risk of data loss that is caused by compromised fault tolerance, make frequent backups of all logical volumes.

Replacing hard drives

If you are replacing a drive in a fault-tolerant configuration while the system is powered down, a POST message appears when the system is powered up. When this message appears, press the **F1** key to enable automatic data recovery. If you do not enable automatic data recovery, the logical volume remains in a ready-to-recover condition, and the same POST message appears when the system is restarted.

In RAID 1 configurations, you can replace one failed drive.

In RAID 1+0 configurations, drives are mirrored in pairs. If drives are not mirrored to removed or failed drives, you can replace them simultaneously.

In RAID 5 configurations, you can replace one failed drive. When a physical drive fails, data that was on the failed drive can be calculated from the remaining parity data and user data on the other drives in the array. This recovered data is usually written to an online spare in a process called a **rebuild**.

Guidelines

Before replacing hard drives, observe the following guidelines:

- Be sure that the array has a current, valid backup.
- Confirm that the replacement drive is one of the following:
 - For B120i controllers—SATA or SATA SSD drives
 - For B320i controllers—SATA, SATA SSD, or SAS drivesACU does not allow mixing SAS and SATA drives in the same array.
- Use replacement drives that have a capacity equal to or greater than the smallest drive in the array. The controller immediately fails drives that have insufficient capacity.
- After removing a drive, wait 3 seconds. After 3 seconds, the firmware generates an event indicating that the drive has been removed. You can now safely install a new drive.

To replace more drives in an array than the fault tolerance method can support, follow the previous guidelines for replacing several drives simultaneously. Wait until rebuild is complete, as indicated by ACU/ACU-CLI, before replacing additional drives.

If you need to replace more drives than the fault tolerance method can support because fault tolerance has been compromised, back up the data before replacing any drives. For more information, see "Recovering from compromised fault tolerance (on page 21)."

Data recovery (rebuild)

When you replace a hard drive in an array, the controller uses the fault-tolerance information on the remaining drives in the array to reconstruct the data from the original drive and write it to the replacement drive. This process is called automatic data recovery or rebuild. If fault tolerance is compromised, this data cannot be reconstructed and, likely, is lost permanently.

Rebuilding an array requires that you either be in offline ACU or booted into the operating system with the driver installed.

The operating system must be running for the rebuild to occur.

If another drive in the array fails while fault tolerance is unavailable during rebuild, a fatal system error can occur, and all data on the array is then lost. In exceptional cases, however, failure of another drive does not always cause a fatal system error. These exceptions include the following:

- Failure after activation of a spare drive
- Failure of a drive that is not mirrored to any other failed drives (in a RAID 1+0 configuration)

Time required for a rebuild

The time required for a rebuild varies, depending on several factors:

- The priority that the rebuild is given over normal I/O operations
Change the priority setting with ACU ("[Array Configuration Utility](#)" on page 30).

- The amount of I/O activity during the rebuild operation
- The rotational speed of the hard drives
- The brand, model, and age of the drives
- The amount of unused capacity on the drives
- In RAID 5 configurations, the time required for a rebuild may be affected by data parity initialization.



IMPORTANT: RAID 5 is available only when the optional 512 MB FBWC module is installed. For more information, see "Upgrading to 512 MB FBWC (on page 7)."

Allow approximately 15 minutes per gigabyte for the rebuild process to complete.

System performance is affected during the rebuild, and the system is unprotected against further drive failure until the rebuild has finished. Therefore, replace drives during periods of low activity, when possible.

When automatic data recovery has finished, the state of the logical volume is updated in ACU/ACU-CLI /agents, and an event is posted to the system event log indicating that the rebuild is complete.

If the ACU/ACU-CLI/agents or the posted event indicate that the rebuild has terminated abnormally, determine the appropriate course of action. See "Abnormal termination of a rebuild (on page 23)."

Abnormal termination of a rebuild

If the activity LED on the replacement drive permanently ceases to be illuminated even while other drives in the array are active, the rebuild process has terminated abnormally. The following table indicates the three possible causes of abnormal termination of a rebuild.

Observation	Cause of rebuild termination
None of the drives in the array have an illuminated amber LED.	One of the drives in the array has experienced an uncorrectable read error.
The replacement drive has an illuminated amber LED.	The replacement drive has failed.
One of the other drives in the array has an illuminated amber LED.	The drive with the illuminated amber LED has now failed.

Each of these situations requires a different remedial action.

Case 1: An uncorrectable read error has occurred.

1. Back up as much data as possible from the logical drive.



CAUTION: Do not remove the drive that has the media error. Doing so causes the logical drive to fail.

2. Restore data from backup. Writing data to the location of the unreadable sector often eliminates the error.
3. Remove and reinsert the replacement drive. This action restarts the rebuild process.

If the rebuild process still terminates abnormally:

1. Delete and recreate the logical drive.
2. Restore data from backup.

Case 2: The replacement drive has failed.

Verify that the replacement drive is of the correct capacity and is a supported model. If these factors are not the cause of the problem, use a different drive as the replacement.

Case 3: Another drive in the array has failed.

A drive that has recently failed can sometimes be made temporarily operational again by cycling the server power.

1. Power down the server.
2. Remove the replacement physical drive (the one undergoing a rebuild), and reinstall the drive that it is replacing.
3. Power up the server.

If the newly failed drive seems to be operational again:

1. Back up any unsaved data.
2. Remove the drive that was originally to be replaced, and reinsert the replacement physical drive. The rebuild process automatically restarts.
3. When the rebuild process has finished, replace the newly failed drive.


However, if the newly failed drive has not recovered:

1. Remove the drive that was originally to be replaced, and reinsert the replacement physical drive.
2. Replace the newly failed drive.
3. Restore data from backup.

Moving hard drives and arrays

When moving drives, observe the following guidelines:

- You can move drives to other ID positions on the same array controller.
- You can move drives from a B-series controller to a P-series controller.

 **CAUTION:** Back up all data before moving drives from a B-series controller to a host bus adapter. Otherwise, data will be lost.

- You can move drives from a B-series controller to a host bus adapter.
- You cannot move drives from a P-series controller to a B-series controller.
- You cannot move drives from a B120i controller to a B320i controller, or vice versa.

Observe the following conditions for moving drives:

- Power down the server.
- If moving the drives to a different server, confirm that the new server has empty bays to accommodate all the drives simultaneously.
- Confirm that the array has no failed or missing drives.
- Confirm that no spare drive in the array is acting as a replacement for a failed drive.
- If moving the drives to a different server, confirm that the new server has the latest system ROM and drivers. For more information, see the HP website (<http://www.hp.com/go/support>).

Observe the following conditions for moving an array to another controller:

- If the other controller is connected to one or more arrays of configured logical drives, the total number of logical drives on the controller after the drives have been moved must not exceed the number of logical drives that the controller supports. This number depends on the controller model and on the controller firmware version.
- If moving the logical volume to a hardware-based Smart Array controller that is connected to one or more logical drives, confirm that the total number of logical drives does not exceed the number of logical drives that the controller supports.
- If moving the logical volume to an controller in another server, remove all physical drives from the other server.

When all the conditions have been met, move the drives:

1. Back up all data before removing any drives or changing configuration. This step is **required** if you are moving data-containing drives from a controller that does not have a cache module.
2. Power down the system.
3. Move the drives.
4. Power up the system.
5. Observe the POST messages:
 - If a 1785 POST message appears, the drive array did not configure properly. Continue with step 6.
 - If a 1724 or 1727 POST message appears, drive positions were changed successfully and the configuration was updated. Continue with step 7.
6. If the array did not configure properly, do the following:
 - a. Power down the system immediately to prevent data loss.
 - b. Return the drives to their original locations.
 - c. Restore the data from backup, if necessary.
7. Verify the new drive configuration by running ACU ("[Array Configuration Utility](#)" on page 30).

After the drives have been moved, confirm that the total number of hard drives on the new controller does not exceed the maximum number of supported hard drives for that controller model and firmware version.

Adding drives

You can add hard drives to a system at any time if you do not exceed the maximum number of drives that the controller supports. You can then build a new array from the added drives.

If the hard drives that you intend to add to the system are configured into logical drives, you must meet certain conditions before adding the hard drives to the system. For more information, see "[Moving hard drives and arrays](#) (on page 24)."

Migrating hard drives to an optional Smart Array controller

1. Install the optional controller. To install an optional Smart Array controller, see the *HP Smart Array Controllers for HP ProLiant Servers User Guide* on the HP website (<http://www.hp.com/go/bizsupport>).
2. Do one of the following:

- Migrate the hard drives (Windows) ("[Migrating hard drives to an optional Smart Array controller—Microsoft Windows](#)" on page 26).
- Migrate the hard drives (Linux) ("[Migrating hard drives to an optional Smart Array controller—Linux](#)" on page 27).

Migrating hard drives to an optional Smart Array controller—Microsoft Windows

This section provides instructions to migrate hard drives from an embedded HP Dynamic Smart Array RAID controller to an optional Smart Array controller in a server with a Microsoft Windows operating system.

Installing the Smart Array driver—Microsoft Windows

To install the driver from the HP website (<http://www.hp.com/go/support>):

1. When prompted for product information, enter the Smart Array controller model number in the product field.
2. Select **Download drivers and software**.
3. Select the appropriate operating system.
4. Download the HP ProLiant Smart Array SAS/SATA Controller Driver package.
5. To install the driver, run the Smart Array Controller Driver package.

To install the driver using the Intelligent Provisioning software ("[Intelligent Provisioning](#)" on page 31):

1. From the System Support Software menu, select the current operating system.
2. Select **Driver – storage controller**.
3. Download the HP ProLiant Smart Array SAS/SATA Controller Driver package.
4. To install the driver, run the Smart Array Controller package.

When the driver is installed, complete the migration procedure ("[Completing the migration to an optional Smart Array controller—Microsoft® Windows®](#)" on page 26).

Completing the migration to an optional Smart Array controller—Microsoft® Windows®

To complete the migration to the Smart Array controller:

1. Back up all data.
2. Access the **Device Manager** menu:
 - a. Right-click **My Computer**.
 - b. Select **Manage**.
3. In the Storage Controller section, verify that the system recognizes the Smart Array controller.
4. Power down the server.
5. Remove the access panel.
6. Remove components and cables as needed.
7. Disconnect the existing data cable from the hard drive backplane.
8. Connect the SAS cable to the controller and hard drive backplane.

This action replaces the SATA connection.

9. Install components and cables removed previously.
10. Install the access panel.
11. Power up the server.

Migrating hard drives to an optional Smart Array controller—Linux

This section provides instructions to migrate hard drives from an embedded HP Dynamic Smart Array RAID controller to an optional Smart Array controller in a server with the Red Hat Enterprise Linux operating system or the SuSE Linux Enterprise Server operating system.

Before migrating hard drives, be sure that you have installed the operating system *by label*, using the latest driver from the HP website (<http://www.hp.com/go/support>) or by using SPP ("HP Service Pack for ProLiant" on page 30).

The following table indicates the Smart Array driver used by each supported Linux operating system.

Operating system	Driver
Red Hat Enterprise Linux 5	cciss
Red Hat Enterprise Linux 6	hpsa
SuSE Linux Enterprise Server 10 SP4	cciss
SuSE Linux Enterprise Server 11 SP1	hpsa
SuSE Linux Enterprise Server 11 SP2	hpsa



IMPORTANT: Migrating drives on a SLES system installed with the default method is not supported. By default, a SLES installation uses a device or controller ID to partition and format hard drives. In order to migrate drives to a Smart Array controller, you must manually change the installation configuration to install by label.

For more information about installing Red Hat Enterprise Linux by label, see the OS documentation for Red Hat Enterprise Linux.

For more information about installing SLES by label, see the OS documentation for SLES.

Installing the Smart Array driver (Linux)

SLES 10



IMPORTANT: Use this procedure if you installed SLES 10 with the default identify disk by ID option. If you installed the operating system by label, then use the procedure for SLES 11 ("RHEL 5, RHEL 6, SLES 11" on page 28).

1. Back up all data.
2. Edit `/etc/fstab` and change all `scsi-` prefixes to `cciss-`.
3. Edit `/boot/grub/menu.lst` and change all `scsi-` prefixes to `cciss-`.



IMPORTANT: Be sure to change only the prefixes.

4. Download and the latest Smart Array cciss driver from the HP website (<http://www.hp.com/go/support>) or by using SPP ("HP Service Pack for ProLiant" on page 30).
If downloading from the HP website, do the following:
 - a. When prompted for product information, enter the Smart Array controller model number in the product field.
 - b. Select **Download drivers and software**.
 - c. Select the appropriate operating system.
 - d. Download the Smart Array cciss driver rpm.
5. Install the cciss driver rpm.
6. Enter `grub-install`.
This updates the boot sector by indicating to grub that it will find the boot/root drive on the cciss drive.
7. Edit `/boot/grub/device.map` and change all `scsi-` prefixes to `cciss-`.

When the driver is installed and the system is configured, complete the migration procedure ("[Completing the migration to the Smart Array controller—Linux](#)" on page 28).

RHEL 5, RHEL 6, SLES 11

1. Back up all data.
2. Download the latest Smart Array hpsa driver from the HP website (<http://www.hp.com/go/support>) or by using SPP ("HP Service Pack for ProLiant" on page 30).
If downloading from the HP website, do the following:
 - a. When prompted for product information, enter the Smart Array controller model number in the product field.
 - b. Select **Download drivers and software**.
 - c. Select the appropriate operating system.
 - d. Download the Smart Array hpsa driver rpm.
3. Install the Smart Array hpsa driver rpm.
For more information, see the text file that is downloaded with the driver.

When the driver is installed and the system is configured, complete the migration procedure ("[Completing the migration to the Smart Array controller—Linux](#)" on page 28).

Completing the migration to the Smart Array controller—Linux

1. Power down the server.
2. Be sure the optional controller is installed. For more information, see the *HP Smart Array Controllers for HP ProLiant Servers User Guide*.
3. Remove the access panel.
4. Remove components and cables as needed.
5. Disconnect the SAS cables from the Dynamic Smart Array controller, and connect them to the optional Smart Array controller.
6. Install components and cables removed previously.


7. Install the access panel.
8. Reboot the server. At boot, press **F5** for ACU or **F10** for Intelligent Provisioning.
9. Select the newly installed card.
10. Set the preferred logical volume as the boot volume.
11. Exit ACU or Intelligent Provisioning, and then reboot the server.

The optional Smart Array controller should appear at boot. It should have the same number of logical volumes that were configured for the Dynamic Smart Array controller.

Migrating drives to an optional host bus adapter

For information on installing an optional host bus adapter and migrating the drives, see the *HP Host Bus Adapters for HP ProLiant Servers Installation Guide* on the HP website (<http://www.hp.com/go/bizsupport>).

Upgrading or migrating from a host bus adapter to a B320i controller

 **CAUTION:** Back up all data before moving drives from a B-series controller to a host bus adapter. Otherwise, data will be lost.

To upgrade or migrate from a host bus adapter to a B320i controller:

1. Back up all data.
2. Be sure the latest BIOS is installed. If it is not installed, use Intelligent Provisioning (on page 31) to install the latest BIOS.
3. If necessary, enable the controller ("Enabling the controller" on page 6).
4. Configure the array ("Configuring an array" on page 7).
5. Install the device drivers ("Installing device drivers" on page 11).
6. Restore the backed-up data to the drives.

Software and configuration utilities

Array Configuration Utility

ACU is a browser-based utility with the following features:

- Runs as a local application or remote service accessed through the HP System Management Homepage
- Suggests the optimum configuration for an unconfigured system
- Provides different operating modes, enabling faster configuration or greater control over the configuration options
- Remains available any time that the server is on
- Displays on-screen tips for individual steps of a configuration procedure
- Provides context-sensitive searchable help content
- Provides diagnostic and SmartSSD Wear Gauge functionality on the Diagnostics tab

ACU is now available as an embedded utility, starting with HP ProLiant Gen8 servers. To access ACU, use one of the following methods:

- If an optional controller is not installed, press **F10** during boot.
- If an optional controller is installed, when the system recognizes the controller during POST, press **F5**.

For optimum performance, the minimum display settings are 1024 × 768 resolution and 16-bit color. Servers running Microsoft® operating systems require one of the following supported browsers:

- Internet Explorer 6.0 or later
- Mozilla Firefox 2.0 or later

For Linux servers, see the README.TXT file for additional browser and support information.

For more information about the controller and its features, see the *HP Smart Array Controllers for HP ProLiant Servers User Guide* on the HP website

(<http://bizsupport2.austin.hp.com/bc/docs/support/SupportManual/c01608507/c01608507.pdf>). To configure arrays, see the *Configuring Arrays on HP Smart Array Controllers Reference Guide* on the HP website

(<http://bizsupport1.austin.hp.com/bc/docs/support/SupportManual/c00729544/c00729544.pdf>).

HP Service Pack for ProLiant

SPP is a release set that contains a comprehensive collection of firmware and system software components, all tested together as a single solution stack for HP ProLiant servers, their options, BladeSystem enclosures, and limited HP external storage.

SPP has several key features for updating HP ProLiant servers. Using HP SUM as the deployment tool, SPP can be used in an online mode on a Windows or Linux hosted operating system, or in an offline mode where the server is booted to the ISO so that the server can be updated automatically with no user interaction or updated in interactive mode.

For more information or to download SPP, see the HP website (<http://www.hp.com/go/spp>).

Intelligent Provisioning

Several packaging changes have taken place with HP ProLiant Gen8 servers: SmartStart CDs and the Smart Update Firmware DVD will no longer ship with these new servers. Instead, the deployment capability is embedded in the server as part of HP iLO Management Engine's Intelligent Provisioning.

Intelligent Provisioning is an essential single-server deployment tool embedded in HP ProLiant Gen8 servers that simplifies HP ProLiant server setup, providing a reliable and consistent way to deploy HP ProLiant server configurations.

- Intelligent Provisioning assists with the OS installation process by preparing the system for installing "off-the-shelf" versions of leading operating system software and automatically integrating optimized HP ProLiant server support software from SPP. SPP is the installation package for operating system-specific bundles of HP ProLiant optimized drivers, utilities, management agents, and system firmware.
- Intelligent Provisioning provides maintenance-related tasks through Perform Maintenance features.
- Intelligent Provisioning provides installation help for Microsoft Windows, Red Hat and SUSE Linux, and VMware. For specific OS support, see the *HP Intelligent Provisioning Release Notes*.

For more information on Intelligent Provisioning software, see the HP website (<http://www.hp.com/go/ilo>). For more information about Intelligent Provisioning drivers, firmware, and SPP, see the HP website (<http://www.hp.com/go/spp/download>).

Diagnostic tools

To troubleshoot array problems and generate feedback about arrays, use the following diagnostic tools:

- **ACU**

For more recent products, array diagnostics is available with ACU v8.28.13.0 and later. This utility is available on the HP website (<http://www.hp.com/support>). For ProLiant Gen8 servers, ACU is embedded in the system, available during boot with the F5 key. For more information about ACU, see the *Configuring Arrays on HP Smart Array Controllers Reference Guide* on the Documentation CD that ships with the controller. For more information about error messages, see the appropriate troubleshooting guide for your product.

- **Event Notification Service**

This utility reports array events to the Microsoft Windows system event log and IML. You can obtain the utility from the HP website (<http://www.hp.com/support>). When prompted for product information, enter the server model name.

- **HP Active Health System**

The HP Active Health System monitors and records changes in the server hardware and system configuration. The Active Health System assists in diagnosing problems and delivering rapid resolution when server failures occur.

- **HP Insight Diagnostics**

HP Insight Diagnostics is a tool that displays information about the system hardware configuration and performs tests on the system and its components, including drives if they are connected to Smart Array controllers. This utility is available on the HP website (<http://www.hp.com/servers/diags>).

- **POST messages**

Smart Array controllers produce diagnostic error messages (POST messages) at reboot. Many POST messages suggest corrective actions. For more information about POST messages, see the appropriate troubleshooting guide for your product.

Flashing firmware

To flash the firmware, use one of the following options:

- Smart Components ("Smart Components for ROM Flash" on page 32)
- SPP ("HP Service Pack for ProLiant" on page 30)

Smart Components for ROM Flash

To update the firmware on the server, controller, hard drives, or enclosure use Smart Components. These components are available on the Firmware Maintenance CD. A more recent version of a particular component might be available on the support page of the HP website (<http://www.hp.com/support>). Components for controller and hard drive firmware updates are also available from the support and drivers page for storage products (<http://www.hp.com/support>).

1. Find the most recent version of the component that you require. Components for controller firmware updates are available in offline and online formats.
2. Follow the instructions for installing the component on the server. These instructions are given with the CD and are provided on the same Web page as the component.

Follow the additional instructions that describe how to use the component to flash the ROM. These instructions are provided with each component.

Support and other resources

Support and training information

HP offers a number of additional software support services, many of which are provided to customers at no additional charge:

- **Software Technical Support and Update Service**—Insight Control and select Insight Management software products include one year of 24 x 7 HP Software Technical Support and Update Service. This service provides access to HP technical resources for assistance in resolving software implementation or operations problems. The service also provides access to software updates and reference manuals in electronic form as they are made available from HP. With this service, Insight Control and Insight Management customers will benefit from expedited problem resolution as well as proactive notification and delivery of software updates. For more information about this service, see the HP website (<http://www.hp.com/services/insight>).
- **Registration for Software and Technical Support and Update Services**—If you received a license entitlement certificate, registration for this service occurs following online redemption of the license certificate/key.
- **How to Use Your Software Technical Support and Update Service**—Once you are registered, you will receive a service contract in the mail containing the Customer Service phone number and your Service Agreement Identifier. You will need your SAID when calling for technical support. Using your SAID, you can also use your SAID to view your contract on the HP Support Center website (<http://www.hp.com/go/hpsc>).
- **Warranty**—HP will replace defective delivery media for a period of 90 days from the date of purchase. This warranty applies to all Insight Software, HP Systems Insight Manager, and Insight Management products.
- **Join the discussion**—The HP Support Center is a community-based, user-supported tool for HP customers to participate in discussions amongst the customer community about HP products. For discussions related to Insight Control and Insight Management software, see the "Management Software and System Tools" area of the HP Support Center website (<http://www.hp.com/go/hpsc>).
- **Contact Support**—HP Worldwide Customer Service contact numbers are available on the HP website (<http://www.hp.com/country/us/en/wwcontact.html>). For U.S. customers, say "Insight Manager" when prompted for the product name.

Electrostatic discharge

Preventing electrostatic discharge

To prevent damaging the system, be aware of the precautions you need to follow when setting up the system or handling parts. A discharge of static electricity from a finger or other conductor may damage system boards or other static-sensitive devices. This type of damage may reduce the life expectancy of the device.

To prevent electrostatic damage:

- Avoid hand contact by transporting and storing products in static-safe containers.
- Keep electrostatic-sensitive parts in their containers until they arrive at static-free workstations.
- Place parts on a grounded surface before removing them from their containers.
- Avoid touching pins, leads, or circuitry.
- Always be properly grounded when touching a static-sensitive component or assembly.

Grounding methods to prevent electrostatic discharge

Several methods are used for grounding. Use one or more of the following methods when handling or installing electrostatic-sensitive parts:

- Use a wrist strap connected by a ground cord to a grounded workstation or computer chassis. Wrist straps are flexible straps with a minimum of 1 megohm ± 10 percent resistance in the ground cords. To provide proper ground, wear the strap snug against the skin.
- Use heel straps, toe straps, or boot straps at standing workstations. Wear the straps on both feet when standing on conductive floors or dissipating floor mats.
- Use conductive field service tools.
- Use a portable field service kit with a folding static-dissipating work mat.

If you do not have any of the suggested equipment for proper grounding, have an authorized reseller install the part.

For more information on static electricity or assistance with product installation, contact an authorized reseller.

Acronyms and abbreviations

ACU

Array Configuration Utility

AMS

agentless management services

IML

Integrated Management Log

POST

Power-On Self Test

RBSU

ROM-Based Setup Utility

SAID

Service Agreement Identifier

SIM

Systems Insight Manager

SMH

System Management Homepage

SPP

HP Service Pack for ProLiant

VID

Virtual Install Disk

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