AHCI and RAID on HP Compaq Elite 8000, 8100, and 8200 Business PCs

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Introduction

This white paper covers the Advanced Host Controller Interface (AHCI) and Redundant Array of Independent Disks (RAID) drive technologies that are provided on the HP Compaq Elite 8000, 8100, and 8200 (hereafter referred to as the 8000-series) Business PC products. This white paper provides a basic overview of AHCI and RAID technology, supported factory configurations of HP Elite 8000-series Business PCs, other supported RAID configurations, and basic instructions on how to migrate non-RAID to RAID configurations in the field. HP also provides a Smart IV Hard Drive technical white paper for Smart IV Technology on HP Business Desktop Hard Drives on www.hp.com.

AHCI is a hardware mechanism that allows software to communicate with Serial ATA (SATA) devices. It is enumerated as a PCI device and it transfers data between system memory and SATA devices.

The HP Elite dc7900 Business PC was the first HP business PC to have AHCI as the default SATA emulation mode in BIOS. All previous HP business PCs that supported SATA were in IDE (legacy) SATA emulation mode by default.

HP Elite 8000-series Business PC products provide support for AHCI in single and multiple drive configurations.

RAID (Redundant Array of Independent Disks) is a category of hard drives that employs two or more drives in combination for fault tolerance and performance. Initially used with servers, desktop PCs are increasingly using RAID by adding a RAID controller and extra IDE or SCSI disks.

HP Elite 8000-series Business PCs take advantage of Serial Advanced Technology Attachment (SATA) technology and the integration of RAID support into select Intel chipsets. Table 1 lists the HP business PC platforms and associated Intel chipsets that provide native RAID support.

Table 1. HP Elite 8000-series Business PCs and Intel chipsets with RAID support

HP business PC	Intel chipset	Chipset components (#; type)
Elite 8000	Q45 Express	2; Q45 GMCH & 82801 ICH10
Elite 8100	Q57 Express/5 Series	1; Q57 PCH-DO
Elite 8200	Q67 Express/6 series	1; Q67 PCH-D0

This white paper provides a basic overview of RAID technology, supported factory configurations of HP Elite 8000-series Business PCs, other supported RAID configurations, and basic instructions on how to migrate non-RAID to RAID configurations in the field.

Basics of AHCI and RAID Technology

Definitions

Table 2. Basic AHCI and RAID Definitions

Acronym or term	Description
AHCI	Advanced Host Controller Interface, a specification for hardware and software, is a registered interface for SATA, intended to add higher speed, NCQ and other features.
ATA	Advanced Technology Attachment.
BIOS	Basic Input/Output System, also known as system ROM.
Chipset	Term used to define a collection of integrated components required to make a PC function.
HDD	Hard disk drive
ICH	The Input/Output Controller Hub. This component includes the mass storage controller. ICH is part of the Intel Q45 Chipset
IDE	Integrated Drive Electronics
INF	Information file (.inf) used by Microsoft® operating systems that support the Plug & Play feature. When installing a driver, this file provides the operating system needed information about driver filenames, driver components, and supported hardware.
Migration	Term used to describe the movement of data from one configuration or usage model to another.
NCQ	Native Command Queuing.
Option ROM	Piece or software module inside the System BIOS which provides extended support for a particular piece of hardware. The RAID Option ROM provides boot support for RAID volumes as well as a user interface for managing and configuring the system's RAID volumes.
PCH	Platform Controller Hub. This component includes the mass storage controller. PCH is part of the Intel Q57/Q67 chipset
PCI	Peripheral Components Interface.
PCIe	PCI express. A serial version of PCI.
PnP	Plug and Play
RAID	Redundant Array of Independent Disks.
ROM	Read Only Memory.
SATA	Serial ATA
Strip	Set of data on a single hard drive in a RAID 0 volume.
Stripe	Group of all strips going horizontally across all the hard drive members of a RAID volume.

Benefits of AHCI

AHCI provides several benefits:

- Elimination of master/slave handling
- Native Command Queuing (NCQ)
- Hot-plugging

AHCI mode eliminates the master/slave topology for cabling SATA hard drives. Hardware and software that emulate IDE still have some limitations with the master/slave topology that came from the Parallel ATA (PATA) mass storage implementation. With AHCI mode, there is no need to worry about cabling considerations, other than the boot drive should be on the lowest numbered SATA port (dark blue connector). SATA ports are independent of each other and are not tied together by master/slave relationship.

Native Command Queuing (NCQ) is technology that allows a SATA device to internally optimize the order of command execution for increased performance. Commands sent to a NCQ-capable SATA device are placed in an internal queue where they can be dynamically and intelligently re-ordered and tracked.

Hot-plugging is the ability to insert a SATA device into a running system and have the operating system recognize the device. AHCI is required for eSATA hot-plug functionality. Refer to the "Using eSATA on HP Compaq Business PCs" white paper for more information about eSATA hot-plugging.

BIOS / Software / Hardware Considerations

BIOS Interface

SATA Emulation Mode

SATA emulation mode can be set in F10 Setup by selecting **Storage** > **Storage Options** > **SATA Emulation** > **Default** - **AHCI**.

SATA emulation mode is set to AHCI by default. This is a change from previous HP Compaq dc7xxx Business PCs, which had a default SATA emulation mode of IDE (legacy).

RAID SATA emulation mode includes AHCI functionality. Customers purchasing a RAID system do not need to make any changes in F10 Setup.

BIOS Support for _GTF in ACPI Mode

The system BIOS supports the Get Task File (_GTF) ACPI control method while in AHCI mode. However, a Registry key is required to enable the port(s). See the _GTF Support section for more information.

Software Drivers

AHCI Driver

In addition to setting the SATA emulation mode of AHCI or RAID in F10 Setup (See BIOS Interface section for more information), an AHCI driver is required for AHCI support.

The Windows Vista™ or Windows 7 image that ships with the HP Elite 8000-series Business PC has the Intel AHCI driver (iastor.sys) pre-loaded. The system can be freely switched between IDE to AHCI.

Note

In order to reuse a hard drive from a RAID configuration in AHCI mode, it is necessary to remove RAID metadata from the drive. This can be accomplished using low level system format or Option ROM interface.

For customers who do not use the pre-installed HP image, there are several scenarios for using AHCI:

New operating system installation

A fresh installation of Windows XP, Vista or Windows 7, while in AHCI mode, is the most straightforward way of installing the AHCI driver.

Windows XP requires adding the Intel AHCI driver with the F6 option during installation. Windows Vista and Windows 7 has native AHCI support, so either the native AHCI driver will be used or the Intel AHCI driver can be added.

An existing Windows XP, Vista or Windows 7 image using the native AHCI driver can be updated to use the Intel AHCI driver (iastor.sys). The driver can be downloaded from www.hp.com.

Enhancing existing Vista or Windows 7 images from IDE mode or native AHCI mode

Vista and Windows 7 have a native AHCI driver. If Vista or Windows 7 was installed while in IDE mode, a registry change will allow users to gracefully switch to AHCI mode using the Microsoft driver. See the Microsoft Knowledge Base Article at http://support.micorsoft.com/kb/922976/en-us

Corporate IT may be able to update an existing Vista or Windows 7 image that was created in IDE mode to use the Intel AHCI driver. The process requires inserting the Intel AHCI drivers into the image in a pre-installation environment using the appropriate OS Tools.

Required software to insert the Intel AHCI driver:
- Windows Preinstallation Environment (WinPE) CD
- Windows OPK (OEM Preinstallation Kit) CD
- PKGMGR.EXE (Package Manager)

The OPK CD is not available for general download. It must be obtained through a Microsoft authorized distributor. PKGMGR.EXE is a tool that installs, uninstalls, configures, and updates features and packages for Vista and Windows 7.

For more information and instructions on OPK or PKGMGR.EXE, go to http://www.hp.com.

The process is as follows:

1. Boot into WinPE.

2. Run PKGMGR.EXE from OPK.

A sample command line is:

```
pkgmgr.exe /o:"C:\;C:\Windows" /n:"C:\AddAHCI\HP-AHCI.xml"
```

Where C:\AddAHCI\HP-AHCI.xml contains:

```
    <?xml version="1.0" ?>
<unattend xmlns="urn:schemas-microsoft-com:asm.v3"
xmlns:wcm="http://
   schemas.microsoft.com/WMIConfig/2002/State">
  <settings pass="offlineServicing">
   <component name="Microsoft-Windows-
PnpCustomizationsNonWinPE"
processorArchitecture="x86"
    publicKeyToken="31bf3856ad364e35" language="neutral"
versionScope="nonSxS">
     <DriverPaths>
      <PathAndCredentials wcm:keyValue="1">
 <Path>C:\AddAHCI</Path>
      </PathAndCredentials>
     </DriverPaths>
   </component>
  </settings>
</unattend>
```

3. Reboot the computer.

4. Enter F10 Setup and change SATA Emulation mode to AHCI.

5. Reboot the computer into the OS.

An existing Vista or Windows 7 image using the native AHCI driver can be updated to use the Intel AHCI driver (iastor.sys). The driver can be downloaded from www.hp.com.

Note

Be careful when moving an image to computer with a different chipset. The Device ID of the AHCI controller must match what is in the INF or the AHCI driver will fail and the computer will not boot.

Enhancing existing Windows XP images from IDE Mode

Corporate IT may be able to update an existing Windows XP image to be AHCI-compatible that was created in IDE mode. The process requires inserting the AHCI drivers into the image in a pre-installation environment. Once that is done, the system can be switched to AHCI mode safely.

Required software to insert the AHCI driver:

- Windows Preinstallation Environment (WinPE) CD
- Windows OPK (OEM Preinstallation Kit) CD
- MSDINST.EXE (Mass Storage Device Installer)

The OPK CD is not available for general download. It must be obtained through a Microsoft authorized distributor. MSDINST.EXE is a tool designed to insert mass storage drivers into an offline Microsoft Windows XP image.

For more information and instructions about OPK or MSDINST.EXE go to http://www.microsoft.com.

The process for updating an existing Windows XP image to be AHCI compatible is as follows:

1. Boot into WinPE.
2. Run MSDINST.EXE from OPK.
   MSDINST.EXE is executed from a command line where the location for the .inf file containing the PnP ID of the RAID/AHCI SATA controller of the target system and location of the Windows directory are specified.
   For example: Newmsd.inf has the PnP IDs and it is in the C:\AddAHCI directory. C:\Windows is the location of the Windows directory. The command line is:

```
msdinst.exe c:\AddAHCI\newmsd.inf c:\windows /force
```

   Newmsd.inf contents:
```
[SysprepMassStorage]
PCI\VEN_8086&DEV_2822&CC_0104 =
C:\Compaq\MSD\Intel\iaStor.inf
PCI\VEN_8086&DEV_3A02&CC_0106 =
c:\Compaq\MSD\Intel\iaahci.inf
PCI\VEN_8086&DEV_3A22&CC_0106 =
c:\Compaq\MSD\Intel\iaahci.inf
PCI\VEN_8086&DEV_3B22&CC_0106 =
c:\Compaq\MSD\Intel\iaahci.inf
PCI\VEN_8086&DEV_1C02&CC_0106 =
c:\Compaq\MSD\Intel\iaahci.inf
```
   …where:
   Dev 2822 is the device ID for Intel[(R)] ICH8R/ICH9R/ICH10R/DO/PCH SATA RAID Controller
   Dev 3A02 is the device ID for Intel[(R)] ICH10D/DO SATA AHCI Controller
   Dev 3A22 is the device ID for Intel[(R)] ICH10R SATA AHCI Controller
   Dev 2B22 is the device ID for Intel[(R)] PCH SATA AHCI Controller.
   Dev 1C02 is the device ID for Intel[(R)] Desktop/Workstation/Server Express Chipset SATA AHCI Controller.

3. Reboot the computer.
4. Enter F10 Setup and change SATA Emulation mode to AHCI.
5. Reboot the computer into Windows XP.

_GTF Support (HP 8000 and 8100 Business PCs only)

HP Elite 8000 and 8100 Business PCs support _GTF (Get Task File) AHCI control method when in AHCI mode. The Intel AHCI driver needs a registry key to enable _GTF for each port. This registry key has been added with the Windows XP, Vista or Windows 7 image that ships with HP Elite 8000 and 8100 Business PCs.

For customers using their own image, the following key is required:

```
HKLM\System\CCS\Services\iaStor\Parameters\Port[X]
name:GTF
value: 0=disabled 1=enabled
```

…where [X] represents the physical AHCI port of the connected drive to be _GTF enabled. To enable _GTF support for all ports, set this value under each port (Port0, Port1…PortN).

Hardware

The HP Elite 8000-series Business PCs uses Intel chipsets that support an AHCI capable Host Bus Adapter (HBA). This HBA supports ATA and ATAPI devices in both PIO and DMA modes with NCQ as long as the device supports NCQ.

All hard drives shipped with the HP Elite 8000-series Business PCs are NCQ capable.

Limitations

NCQ functionality requires both HBA and hard drive to support it. Non-NCQ capable hard drives will not see any performance benefits even though the HBA is NCQ capable.

Hot-plugging is not possible in an operating system without an AHCI driver that supports hot-plugging, such as DOS, Windows 9x, Windows NT4.0, and older versions of Linux.

Changing AHCI to IDE Mode through the HP Replicated Setup Utility

Multiple AHCI systems can be reverted back to IDE mode using the HP Replicated Setup Utility. This utility allows for system BIOS settings to be replicated and distributed throughout an enterprise. The procedures and information about how to obtain the Replicated Setup Utility are described in the HP white paper "Business Desktop UEFI BIOS Tools" available at www.hp.com.

Basic RAID Types

This section provides a brief explanation of the supported RAID configurations for HP Elite 8000-series Business PCs.

RAID 0 with two hard drives (Striped)

Even though HP supports RAID 0, it is not the recommended configuration for business PC users. Lack of redundancy causes less than half the reliability of a single hard drive system since the Mean Time Between Failure (MTBF) of RAID 0 is equal to the MTBF of an individual drive, divided by the number of drives.

Table 3. RAID 0 with two hard drives (Striped)

First Disk	Second Disk
Data Segment 1	Data Segment 2
Data Segment 3	Data Segment 4
Data Segment 5	Data Segment 6
Data Segment 7	Data Segment 8
Data Segment 9	Data Segment 10
Data Segment 11	Data Segment 12
Data Segment 13	Data Segment 14
Data Segment 15	Data Segment 16

In the previous table, each "Data Segment n" represents a group of data, known as a strip. In this case, each row represents a stripe. RAID 0 represented in the table above shows how information is segmented, made into chunks or strips, and stored across the stripes of the hard drive members of this RAID volume.

To better illustrate the concept of RAID 0 and striping, Figure 1 shows how a sequence of data "ABCD…" is stored in a RAID 0 mode. In this example, each letter represents a segment or strip. The graphic shows how the various pieces of the information go to different hard drives. If any segment of RAID 0 fails, all information from all members is lost.
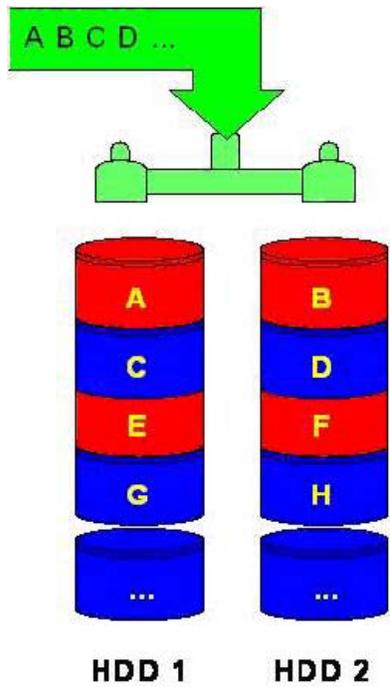
Figure 1. Performance - RAID 0 with two hard drives

At a higher reliability cost with faster performance, the HP Compaq Elite 8000-series Business PC Convertible Minitower also allows for RAID 0 with three hard drives. RAID 0 with two or three hard drives is a supported configuration.

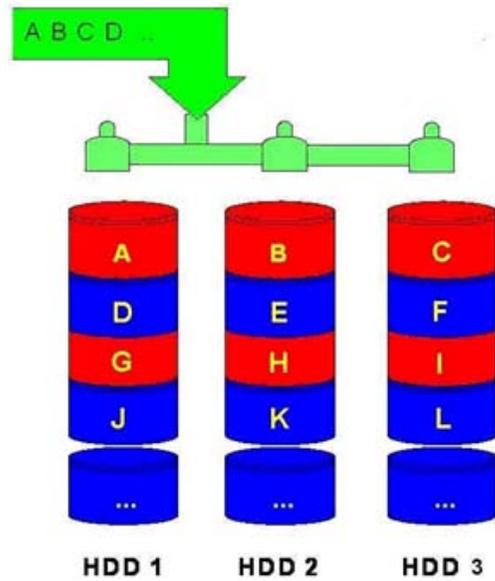RAID 0 with three hard drives is shown in Figure 2.

Figure 2. Performance - RAID 0 with three hard drives

RAID 1 with two hard drives (Mirror))

Because it is a very cost-effective way to increase system storage reliability and a great value proposition, RAID 1 is the only RAID configuration that HP pre-configures for HP Elite 8000-series Business PCs. RAID 1 provides high availability with minimal performance impact, as well as greater reliability compared to a single hard drive configuration.

RAID 1 has redundancy and hence is a true RAID. It more than doubles reliability because the MTBF of RAID 1 is equal to the MTBF of an individual drive multiplied by the number of drives (2). In other words, the probability of one hard drive failure on a given day is the square root of that same probability. Hypothetically, if the chance for a single hard drive failure is 1:2000, then the chance that both hard drives failing in RAID 1is 1:4,000,000.

Mirroring, segmentation, and striping have no real meaning in RAID 1. In the table and graphic, the data is arranged in rows for representation of different pieces of data.

Table 4. RAID 0 with two hard drives (Mirror)

First Disk	Second Disk
Data Segment 1	Data Segment 1
Data Segment 2	Data Segment 2
Data Segment 3	Data Segment 3
Data Segment 4	Data Segment 4
Data Segment 5	Data Segment 5
Data Segment 6	Data Segment 6
Data Segment 7	Data Segment 7
Data Segment 8	Data Segment 8

In the previous table, each "Data Segment n" represents a group of data, known as a strip. In this case, each rows represent a stripe. This table shows how information is duplicated in both hard drives. The size of the strips is mostly irrelevant and not a configurable option.

To better illustrate the concept of RAID 1 and mirroring, Figure 3 shows how a sequence of data "ABCD…" is stored in a RAID 1 volume. In this example, each letter represents a data segment. The graphic shows how the various pieces are replicated for both of the hard drives; hence, if any one member of the RAID 1 volume fails, the information is kept in the surviving members. After a hard drive failure, the user interface sends a notification so the failed hard drive can be replaced. No user information is lost in this scenario.
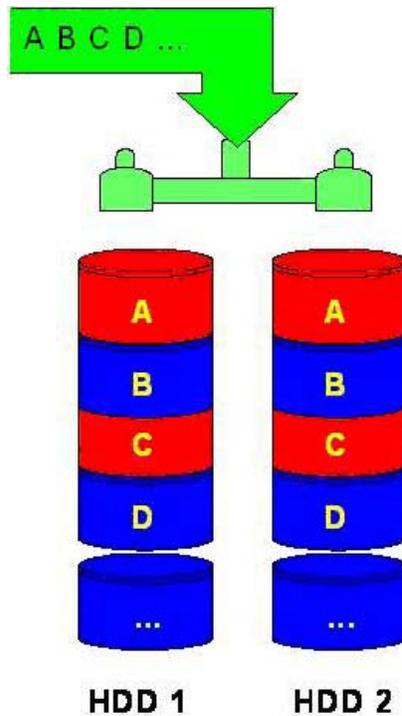
Figure 3. Reliability: RAID 1 - Mirroring

RAID 5 with three hard drives

RAID 5 has been used in servers for many years and is one of the most common types of RAID. RAID 5 uses striping with parity data in distributed blocks across all member disks. Therefore, the mass storage controller can simultaneously write new information to two hard drives and parity information to the third hard drive, so if one hard drive fails, the RAID controller can rebuild all the information after the volume degradation occurred. Hence, RAID 5 with three hard drives has similar performance to RAID 0 with two hard drives, and the reliability of RAID 1 with a minimum of three hard drives.

Table 5. RAID 5 with three hard drives (Parity)

First Disk	Second Disk	Third Drisk
Data Segment 1	Data Segment 2	Parity for 1 and 2
Data Segment 3	Parity for 3 and 4	Data Segment 4
Parity for 5 and 6	Data Segment 5	Data Segment 6
Data Segment 7	Data Segment 8	Parity for 7 and 8
Data Segment 9	Parity for 9 and 10	Data Segment 10
Parity for 11 and 12	Data Segment 11	Data Segment 12
Data Segment 13	Data Segment 14	Parity for 13 and 14
Data Segment 15	Parity for 15 and 16	Data Segment 16
Parity for 17 and 18	Data Segment 17	Data Segment 18

In the previous table, each "Data Segment x" represents a strip. A stripe is made with strip "Data Segment x", "Data Segment y" and strip "Parity for x and y." Notice that the strip "Parity for x and y" is used to store the required information to recreate the data if any one of the RAID volume members is compromised.

To better illustrate the concept of RAID 5 (parity-based RAID), Figure 4 shows how a sequence of data "ABCD…" is stored in a RAID 5. In this example, each letter represents a segment or strip. The various pieces of the information go to different hard drives, hence if any one member of the RAID 5 fails, the information from all members is not lost.
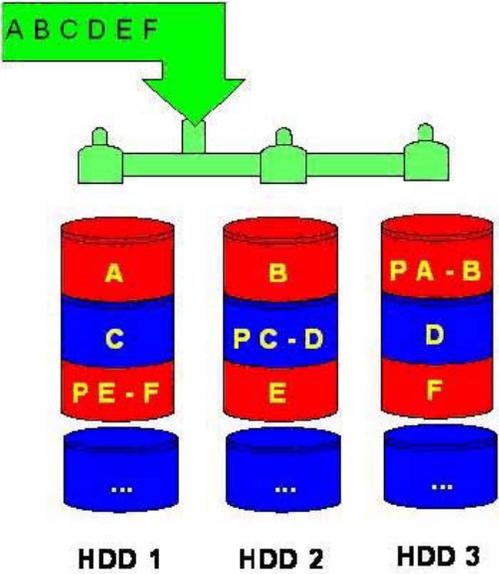

Figure 4. RAID 5 with three hard drives

Intel Matrix RAID Technology

This technology provides protection against data loss from a hard drive failure and faster access to digital photo, video, and music files by supporting NCQ as well as RAID 0, 1, 5, and 10. As shown in Figure 5, Matrix RAID enables two RAID levels to be combined for data loss protection plus performance.
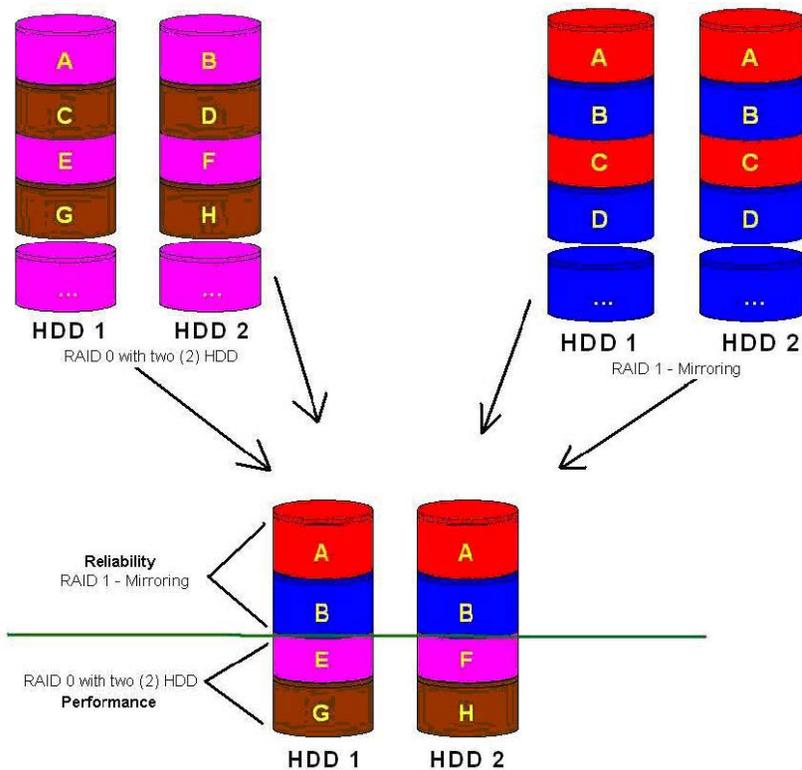

Figure 5. Matrix RAID combining reliability and performance with the same two hard drives

Using Intel Matrix RAID Technology, you can configure an HP Elite 8000-series Business PC Convertible Mini-tower with two RAID volumes using three hard drives (Figure 6) - a RAID 0 volume for ultimate performance, and a second volume as RAID 5 with reliability and performance improvements.
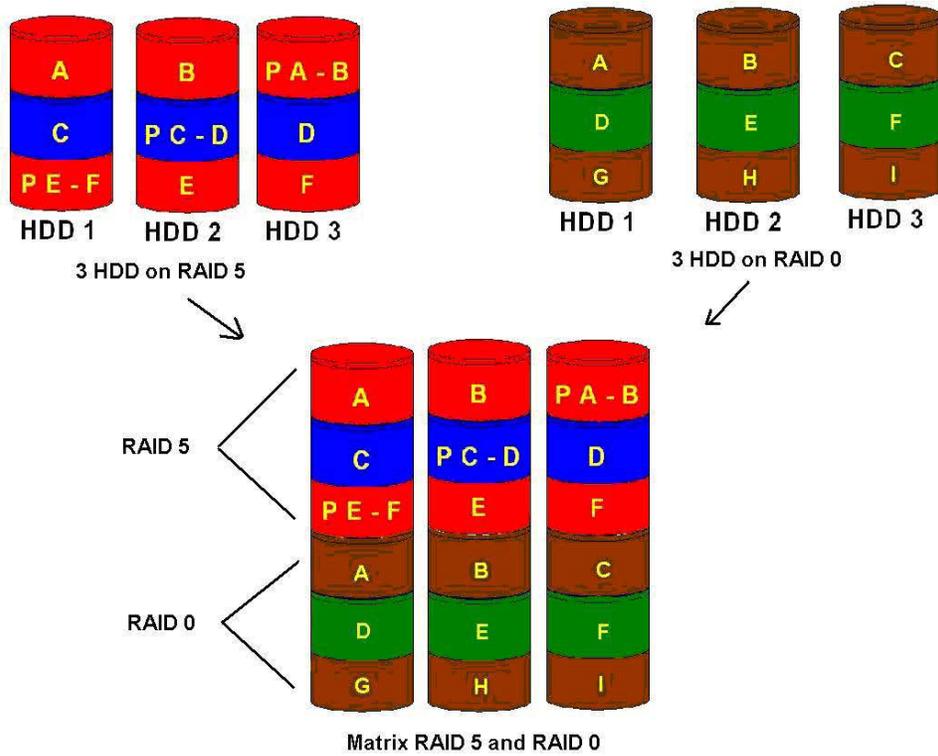
Figure 6. Matrix RAID combining reliability and performance with same three hard drives

Configurations

Recommended configurations

HP recommends factory configurations of the preinstalled RAID offerings for HP Elite 8000-series Business PCs. The preinstalled RAID offering is a RAID 1 volume of two identical SATA hard drives.

HP Elite 8000-series Business PCs are based on Intel chipsets that provide a combined hardware and software RAID solution. The Intel mass storage controller allows all drives to operate in IDE or RAID SATA modes. Each mode of the controller means a different PCI controller, with different device ID, class code, and driver support.

Note

HP recommends and only supports Microsoft's IDE driver stack based on the ATAPI.SYS driver for HP Compaq Business PC products including all supported RAID configurations.

Warning

The PCI Device ID of the mass storage controller changes after changing IDE mode. Changing the BIOS from IDE mode to RAID mode is the equivalent of connecting the hard drives to a new add-on RAID storage controller. The installed operating system on the hard drive is unaware of this new mass storage controller. If the operating system does not have the RAID drivers enumerated and PnP for the RAID controller, the operating system will fail to boot (blue screens) when Microsoft XP, Vista or Windows 7 attempts to boot.

Table 6. RAID Drives

Mode	Purpose	Minimum drives required
RAID 0	Striped for Performance.	2
RAID 1	Mirrored for Protection.	2
RAID 5	Parity for Accuracy.	3
RAID 0 + 1	Mirrored and Striped.	4*
Intel's Rapid Technology	4 logical drives on 2 physical disks, to emulate RAID 0 and 1	2

* Not supported on HP Elite 8000-series Business PCs

Important RAID configuration

The following notes are important for RAID configuration:

- RAID 1 is the only RAID configuration that HP Elite 8000-series Business PC products offer as a factory configuration option.
- All pre-configured systems:
  — Are complete RAID systems
  — Have both drives installed
  — Have the necessary Option ROM configuration
  — Are pre-loaded and pre-installed with all required Intel software
  — Include a preinstalled operating system that is mirrored mode out of the box
- HP also recommends keeping the default options in the RAID Option ROM and in the Windows RAID application. Options like "chunk" size for changing the "stripe" size have more history in their defaults settings

Other supported configurations

HP Elite 8000-series Business PC products support two other RAID configurations:

- Two-drive configuration:
  — Two equal size/type SATA hard drive RAID configurations in RAID 0 or RAID 1 or Matrix Mode of RAID 0 and RAID 1.
  — Maximum of two SATA optical drives (on HP Elite 8000-series Business PC Convertible Minitowers).
- Three-drive configuration (only on HP Elite 8000-series Business PC Convertible Minitowers):
  — Three equal size/type SATA hard drive RAID configurations in RAID 0 or RAID 5 or Matrix Mode of RAID and RAID 5.
  — Maximum of one SATA optical drives.

Unsupported configurations

HP Elite 8000-series Business Desktop PC products only support configurations offering the best user experience and highest possible reliability. As a result, HP does not support the following combinations of RAID hard drives:
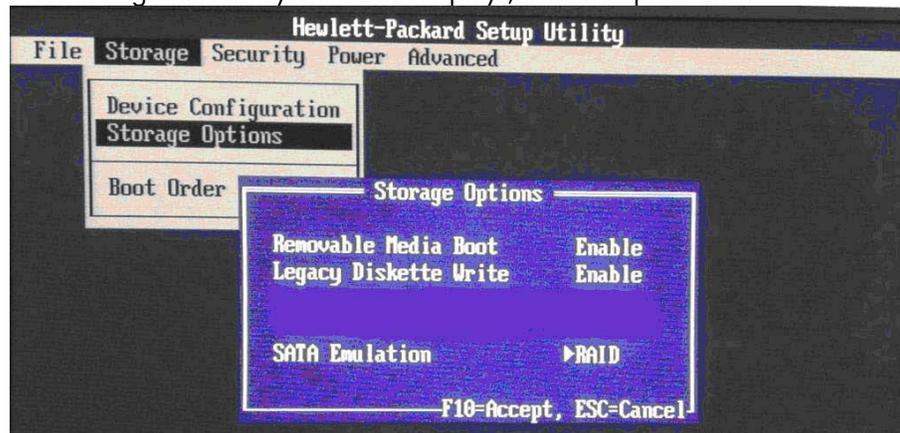
- Different sizes
- Different speeds (5400 rpm, 7200 rpm, etc)
- Old and new technologies (SATA 1.5 GB and SATA 3.0 GB)
- NCQ hard drives and non-NCQ drives
- Different cache size
- RAID combinations of hard drives with any operating system other than Windows XP Pro (SP2/SP3), Windows Vista SP1/SP2, and Windows 7 using Microsoft's IDE driver stack based on ATAPI.SYS

Configuring RAID on non-factory preinstalled configurations

The remaining sections of this white paper describe steps to set up supported RAID configurations where customers have not purchased factory preinstalled RAID configurations.

Enabling RAID through F10 System BIOS

1. Turn on or restart the computer by clicking **Start** > **Shut Down** > **Restart the Computer**.
2. Press **F10** as soon as the monitor light turns green.
   If you do not press **F10** at the appropriate time, you must restart the computer, and then press **F10** again to access the utility.
3. Select your language from the list, and then press **Enter**.
4. Use the arrow keys to select **Storage**.
5. Use the down arrow key to select **Storage Options**, and then press **Enter**.
6. On the **Storage Options** menu, use the down arrow key to select **SATA Emulation**.
7. Press the right arrow key until **RAID** displays, and then press **Enter**.

8. To apply and save changes, select **File** > **Save Changes** and **Exit**.
   — If you do not want to apply your changes, select **Ignore Changes and Exit**.
   — To reset to factory settings, select **Set Defaults and Exit**. This option restores the original factory defaults.

> **CAUTION**
>
> Do NOT turn the computer power off while the ROM is saving the F10 Computer Setup changes as the CMOS could become corrupted. Only turn the computer off after exiting the F10 Setup screen.

Accessing RAID Option ROM

You can only access Computer Setup at system startup. To access the Computer Setup Utilities menu and enable RAID:

1. Turn on or restart the computer by clicking **Start** > **Shut Down** > **Restart the Computer**.
   The following screen (RAID Option ROM) displays briefly during boot up. The RAID configuration utility is English only. To configure RAID in other languages, use the Windows-based RAID configuration utility.

2. Press **Ctrl + I** repeatedly as soon as the monitor light turns green to enter the RAID configuration utility. If you do not press **Ctrl + I** at the appropriate time, you must restart the computer, and then press **Ctrl + I** again to access the utility.

Configuring RAID Volume using the Option ROM

1. Use the up or down arrow key to select **Create RAID Volume**, and then press **Enter** to access the Create Volume screen.

2. Select or enter the desired **RAID Level**. Use the information on the bottom half of the screen if necessary.

3. Use the arrow keys to scroll to **Create Volume**, and press **Enter**. The following screen appears. **WARNING**: **All data on the selected disk will be deleted**.

4. Type **Y** to continue.

Notes for operating system installation

- After creating a RAID disk volume in the option ROM, you can install the operating system.
- HP provides a driver download for Windows XP, Vista and Windows 7 at www.hp.com.
- Customer-created images MUST account for the RAID controller.
- Failure to install and enumerate the RAID driver after enabling the RAID controller (with or without creating a volume) will result in a Windows boot failure (blue screen) for inaccessible boot device.

WARNING:

The PCI Device ID of the mass storage controller changes after changing IDE mode. Changing the BIOS from IDE mode to RAID mode is the equivalent of connecting the hard drives to a new add-on RAID storage controller. The installed operating system on the hard drive is unaware of this new mass storage controller. If the drivers are not available, enumerated, and PnP for this new controller, the operating system blue screens in Microsoft XP and Microsoft Vista/Windows 7.

Intel Rapid Storage Manager software installation

This section of the paper focuses on how to configure RAID using Intel Rapid Storage Manager software. The configuration steps are for application usage and supported RAID migrations.

1. Select **Start** > **All Programs** > **Intel** > **Intel(R) Rapid Storage Console**.

2. Click **Next**.
3. Read the driver agreement. If you agree, click **Next**.
4. Read the License Agreement. If you agree, click **Yes**.
5. Review the Readme for Intel Rapid Storage Technology, and then click **Next**.
6. Click **Next**, after the setup operations complete.
7. Click **Next** to finish the installation.
8. Select **Restart Now** or **Restart Later**, and then click **Finish** to close the setup.
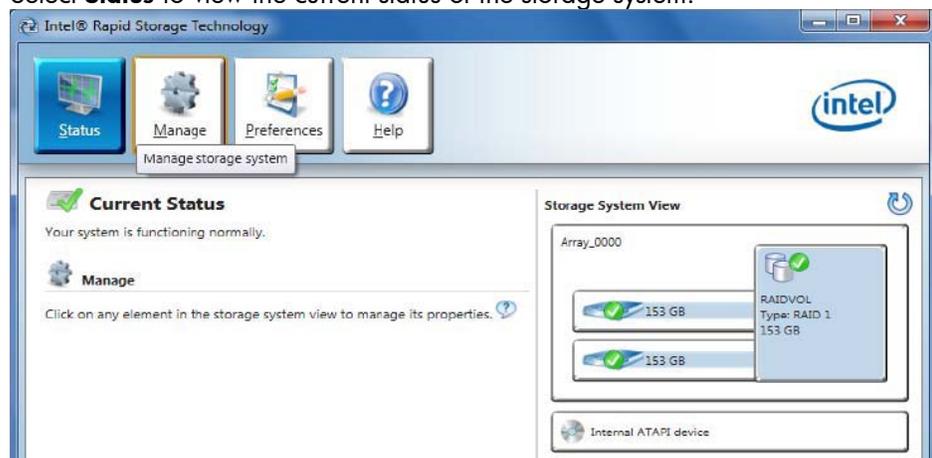9. Restart the computer.

Using the Intel Rapid Storage Console interface

1. Click **Start** > **All Programs** > **Intel** > **Intel Rapid Storage Console** to open the Intel Rapid Storage Console application. The Intel Rapid Storage Console starts in Status mode by default and has three main menus.

> **Note**
>
> The report the applications generate is very comprehensive. You can view the report at **View/System Report**. The report contains information about the driver, operating system, language, and hard drive.

2. Select **Status** to view the current status of the storage system.

3. For a more detailed view of the RAID controller, click **Manage**.

In Manage, the Intel Rapid Storage Console also includes the **Advanced** menu. Use this menu to access the advanced features of the RAID solution.

RAID migrations using Intel Rapid Storage Console

Migration to RAID 1 from two non-RAID hard drives

NOTE

HP Elite 8000-series Business PC products only support RAID based on two identical SATA hard drives in either RAID 0 or RAID 1 or Matrix RAID Mode of RAID 0 and RAID 1.

NOTE

At least 6 MB of free space at the end of the drive is required to migrate from a non-RAID to RAID configuration or an error will occur.

---

1. Open the Intel Rapid Storage Console and select **Create** in the top pane and select the **Volume Type** in the right pane. Select **Real-time data protection (RAID 1)**.

2. Click **Next** to configure the volume.
3. In the Configure window, name the volume, select the two disks, and specify if you want to keep data from one of the selected disks.

4. Click **Next** to begin the confirmation process and start the **Create Volume** action.

5. Click **Create Volume** to confirm you understand the Volume Creation warning and you want to continue the action.
6. Click **OK** after the action completes.

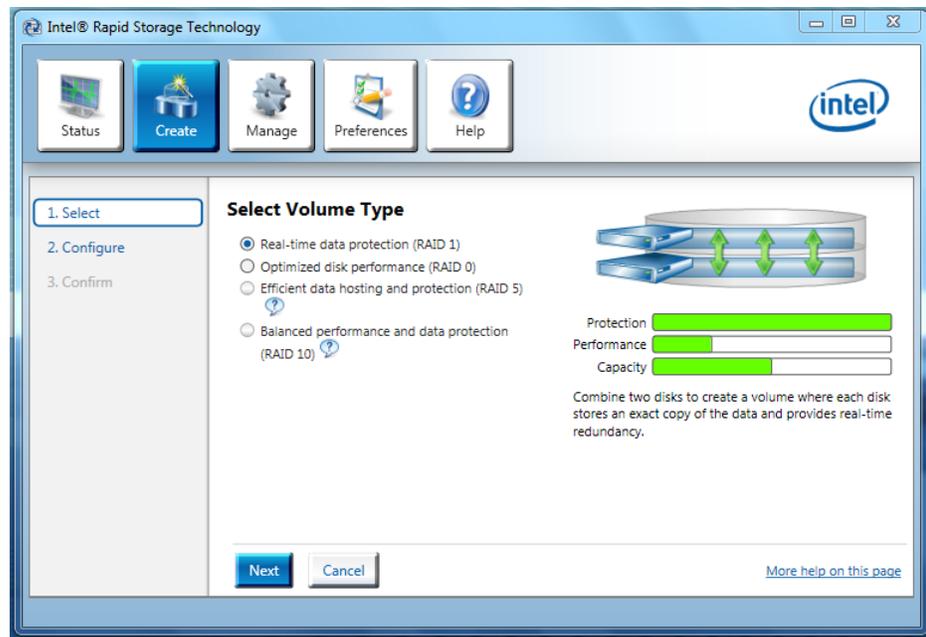**Migration to RAID 0 from two non-RAID hard drives**

> **NOTE**
>
> HP Elite 8000-series Business PC products only support RAID based on two identical SATA hard drives in either RAID 0 or RAID 1 or Matrix RAID Mode of RAID 0 and RAID 1.

To migrate two non-RAID hard drives to a RAID 0 configuration using Intel Rapid Storage Console perform the following steps:

1. Open the Intel Rapid Storage Console and select **Create** and select the volume type **Optimized disk performance (RAID 0)**.

2. Click **Next** to configure the volume.
3. In the Configure window, name the volume, select the two disks and specify if you want to keep data from one of the selected disks.
4. Click **Next** to begin the confirmation process and start the Create Volume action.
5. Click **Create Volume** to confirm you understand the Volume Creation warning and you want to continue the action.
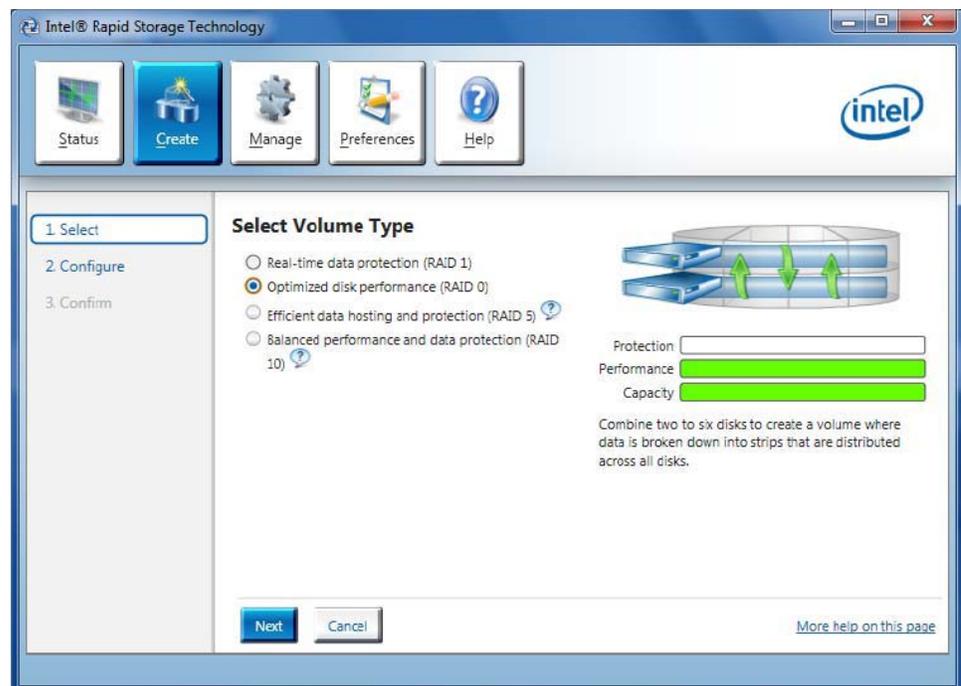6. Click **OK** after the action completes.

Migration to RAID 0 from three non-RAID hard drives

> **NOTE**
>
> Back up all data before proceeding.

> **NOTE**
>
> HP Elite 8000-series Business PC products only support RAID based on three identical SATA hard drives in either RAID 0 or RAID 5 or Matrix RAID Mode of RAID 0 and RAID 5.

1. Open the Intel Rapid Storage Console and select **Create** in the top pane and select the Volume Type in the right pane. Select Optimized disk performance (RAID 0).
2. Click **Next** to configure the volume.
3. In the Configure window, name the volume, select the three disks and specify if you want to keep data from one of the selected disks.
4. Click **Next** to begin the confirmation process and start the Create Volume action.

> **NOTE:**
>
> HP currently supports only the default Strip Size (in this case 128KB). There is a performance relation between the type of data and the strip sizes.

5. Click **Create Volume** to confirm you understand the Volume Creation warning and you want to continue the action.
6. Click **OK** after the action completes.

Migration to RAID 5 from three non-RAID hard drives

> **NOTE**
>
> Back up all data before proceeding.

> **NOTE**
>
> HP Elite 8000-series Business PC products only support RAID based on three identical SATA hard drives in either RAID 0 or RAID 5 or Matrix RAID Mode of RAID 0 and RAID 5.

1. Open the Intel Rapid Storage Console and select **Create** in the top pane and select the Volume Type in the right pane. Select Efficient data hosting and protection (RAID 5).
2. Click Next to configure the volume.
3. In the Configure window, name the volume, select the three disks and specify if you want to keep data from one of the selected disks.
4. Specify if you want to keep data from one of the selected disks?

5. Click **Next** to begin the confirmation process, review the selected configuration and click **Create Volume** to start the Create Volume action.

> **NOTE**
>
> HP currently supports only the default Strip Size (in this case 128KB). There is a performance relation between the type of data and the strip sizes.

6. Click **Create Volume** to confirm you understand the Volume Creation warning and you want to continue the action.

7. Click **OK** after the action completes.

> **NOTE:**
>
> If users consume all available storage for this RAID volume, there will be no space to create another RAID volume for this hard drive, thereby not allowing for Matrix RAID Mode. Note the size if you want to create a second RAID volume in this set of hard drives.

8. . Reboot the system after the migration finishes.

Migration to Matrix RAID 5 and RAID 0 from three non-RAID hard drives

> **NOTE**
>
> Back up all data before proceeding.

> **NOTE**
>
> HP Elite 8000-series Business PC products only support RAID based on three identical SATA hard drives in either RAID 0 or RAID 5 or Matrix RAID Mode of RAID 0 and RAID 5.

1. Open the Intel Rapid Storage Console and select **View** > **Advanced Mode**.

2. Click **Actions/Create RAID Volume from Existing Hard Drive** to open a verification window.

3. Click **Next**.

4. Type the RAID Volume Name, select the **RAID Level** (for three hard drive RAID 0 or RAID 5 only), and select the **Strip Size**.

> **NOTE**
>
> HP currently supports only the default Strip Size (in this case 128KB).

5. Click **Next** to see the selection of hard drives that will be part of this RAID volume.

6. Select the source hard drive (Port 0), and then click on the arrow to move them to the **Selected** box.

7. Click **Next**.

8. Select all hard drive members of the RAID volume, and then click the right arrow to place the (port 2 and port 3) hard drives in the selected box.

> **NOTE**
>
> If users consume all available storage for this RAID volume, there will be no space to create another RAID volume for this hard drive, thereby not allowing for Matrix RAID Mode. Note the size if you want to create a second RAID volume in this set of hard drives.

9. To create two volumes based on your space, reliability and performance needs, select the size of the first RAID volume by sliding the bar or entering the desired volume size. For example, divide in half the available hard drive storage in two RAID volumes by setting the **Percentage of Available Space** to 50%, so that 50% of drive capacity is used for RAID 0.

10. Click **Next**.

11. Click **Finish** to start the migration process, which can take a few hours.

12. Reboot the system after the migration finishes.

> **NOTE**
>
> Back up all data before proceeding.

13. After the first RAID volume has been created, create the second RAID volume by opening the Intel Rapid Storage Console, clicking **View** > **Advanced Mode**, and then clicking **Actions/Create RAID Volume from Existing Hard Drive**.

14. Click **Next**.

15. Use the same values you entered in the previous RAID volume confirmation and type the RAID **Volume Name**, select the **RAID Level** (for three hard drive RAID 0 or RAID 5 only), and select the **Strip Size**.

> **NOTE**
>
> HP currently supports only the default Strip Size (in this case 64KB).

16. Click **Next** to see the selection of hard drives that will be part of this RAID volume.

17. Because this is the second volume for this set of hard drives, select the existing name in the **Available** box (Array 0000), and then click the right arrow to move this array into the **Selected** box.

18. Click **Next**.

The Specify Volume Size screen is grayed out because the second volume of this Matrix RAID Mode takes the remaining space. After the selection of the all hard drive members of this RAID volume, follow the volume size selection screen.

NOTE

The first array volume creation is the place for adjusting the size; the second volume will take any remaining space.

19. While creating the second RAID volume, click **Next** to open the completion window.

20. Select **Finish** to start the migration process, which can take a few hours. The following screen appears.

You can see the state of the Matrix RAID Mode created by opening the Intel Rapid Storage Console and clicking **View** > **Advanced Mode**. The Matrix RAID Mode of three hard drives is illustrated in the following image.
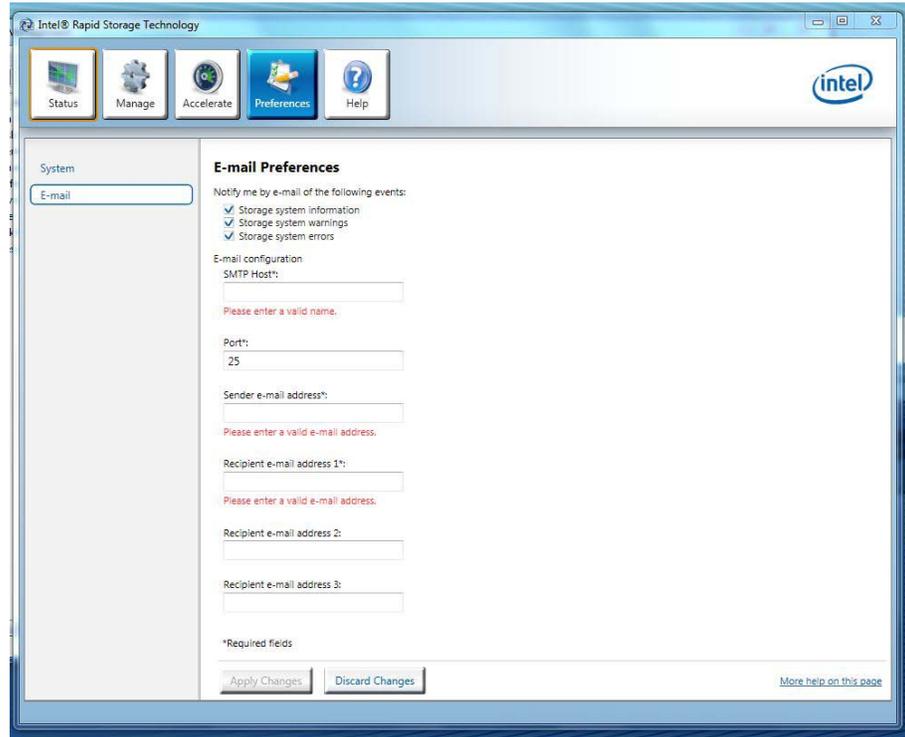
Migration to Matrix RAID 1 and RAID 0 from two non-RAID hard drives

The migration process for two hard drives to RAID Matrix Mode (0 + 1) is very similar to the process described in the section about migration of three hard drives to matrix mode RAID (0 + 5). The difference in the process is selecting two hard drives as part of the volume created and selecting RAID 5 instead of RAID 1.

Configuring Intel Rapid Storage Console for Email notifications (HP Elite 8200 Business PCs only)

To configure Intel Rapid Storage Console to send notifications of specified events to a designated email address, use the following steps:
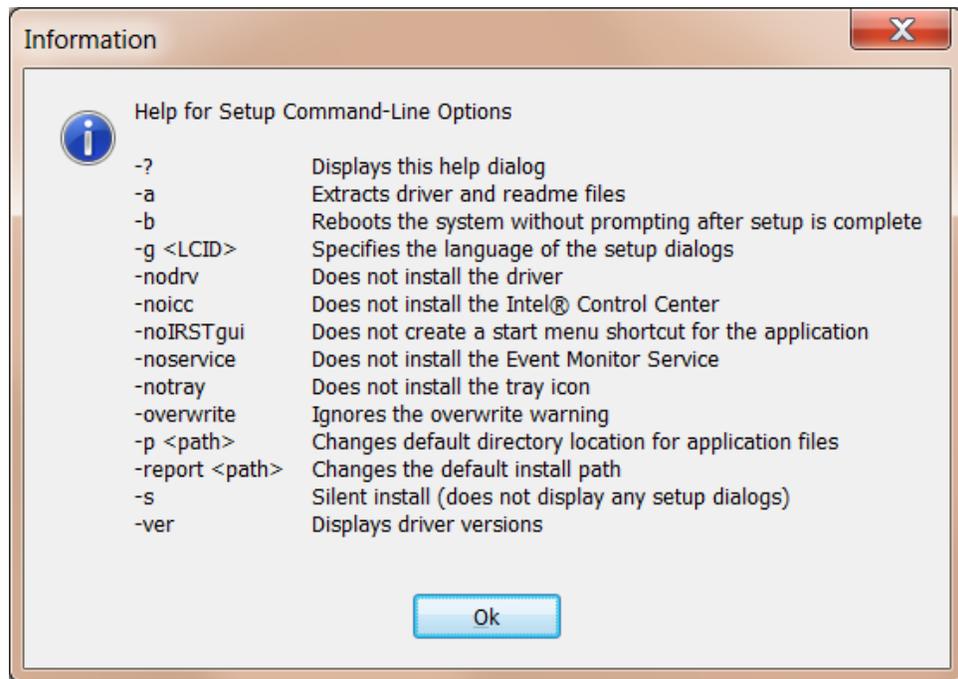
1. Open the Intel Rapid Storage Console and select **Preferences**.

2. Select the type of event to initiate a notification (all three may be selected).
3. Enter the email information.
   a. SMTP Host (required)
   b. Port
   c. Sender email address (required)
   d. Recipient email address (at least one required)
4. When done click **Apply Changes**.

Installation

HP desktops come with RAID software preinstalled. However, if reinstallation is necessary, use setup in combination with the supported flags (Version 9.5/9.6/10.1) as listed and described in the sample screen shot (version 10.1) below

```
Information                                                      X

 (i)   Help for Setup Command-Line Options

       -?              Displays this help dialog
       -a              Extracts driver and readme files
       -b              Reboots the system without prompting after setup is complete
       -g <LCID>       Specifies the language of the setup dialogs
       -nodrv          Does not install the driver
       -noicc          Does not install the Intel® Control Center
       -noIRSTgui      Does not create a start menu shortcut for the application
       -noservice      Does not install the Event Monitor Service
       -notray         Does not install the tray icon
       -overwrite      Ignores the overwrite warning
       -p <path>       Changes default directory location for application files
       -report <path>  Changes the default install path
       -s              Silent install (does not display any setup dialogs)
       -ver            Displays driver versions

                              Ok
```
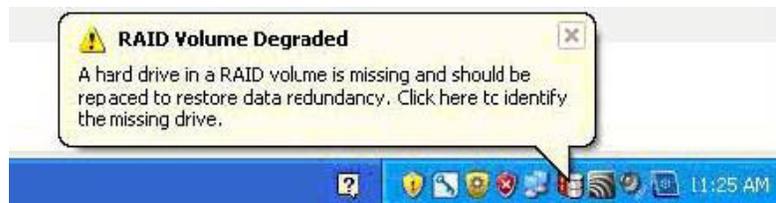
Note:

Flags and their parameters are not case-sensitive. Flags may be supplied in any order, with the exception of -S and -G, which must be supplied last. When using the -A flag, a target path may be specified using the -P flag, and the -G and -S flags are ignored. When using the -O and -G, flags there should be no space between the flag and the argument.

Table 8. Language support

Abbreviation	Language	
ara	Arabic (Saudi Arabia)	(0401)
chs	Chinese (Simplified)	(0804)
cht	Chinese (Traditional)	(0404)
csy	Czech	(0405)
dan	Danish	(0406)
nld	Dutch	(0413)
enu	English (United States)	(0409)
fin	Finnish	(040B)
fra	French (International)	(040C)
deu	German	(0407)
ell	Greek	(0408)
heb	Hebrew	(040D)
hun	Hungarian	(040E)
ita	Italian	(0410)
jpn	Japanese	(0411)
kor	Korean	(0412)
nor	Norwegian	(0414)
plk	Polish	(0415)
ptb	Portuguese (Brazil)	(0416)
ptg	Portuguese (Standard)	(0816)
rus	Russian	(0419)
esp	Spanish	(0C0A)
sve	Swedish	(041D)
tha	Thai	(041E)
trk	Turkish	(041F)

Degradation

In the unlikely event that one of your hard drives malfunctions, you will be notified with the following message:
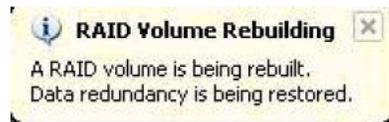

If this occurs, perform the following steps:

1. Run the Intel Rapid Storage Console application on the system experiencing a degradation to identify the hard drive that failed and to which port it is connected.

2. After identifying the hard drive, close all applications, shut down the operating system, power down the unit, unplug the power cord, and replace the defective hard drive.
3. After replacing the hard drive, automatic rebuild of the redundancy begins immediately after the system is powered up and operating system starts. The following message appears: