Intel® Rapid Storage Technology

OEM Technical Guide

For the Intel® Rapid Storage Technology 10.0 Software Release

Revision 1.0

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Contents

Revision history

Revision Number	Description	Revision Date
0.7	Initial PC Preliminary Release Version	March 2010
0.9	Production Release Version	March 2010
0.91	• Added section 1.2 and subsection 1.2.1 • Updated section 13.5 (added ACPI note) • Removed VRA support	August 2010

1 About This Document

1.1 Purpose and scope of this Document

This document will assist customers in evaluating, testing, configuring, and enabling RAID and AHCI functionality on platforms using the *Intel® Rapid Storage Technology* software for the chipset components as listed in the product's Readme.txt file.

This document also describes installation procedures, RAID volume management such as creating, deleting, and modifying volumes, common usage models, and any special notes necessary to enable customers to develop their RAID-compatible products.

1.2 What's new in this Revision

1.2.1 Correcting Microsoft* Windows 7 (Win7) WHQL test failure

For Internal SATA ports with interlock switches, the RST driver will set Removable=TRUE in the IRP_MN_QUERY_CAPABILITIES handler. This causes Win7 to show the internal device in its own "container" which is used to describe devices that are external to the system. For example, a CD-ROM on an interlocked switch in a Win7 system, under 'Devices and Printers',
You can see that the CD-ROM on the interlocked SATA port shows up separately in the top-level 'Devices' view. This can result in a platform WHQL test failure.

There is a whitepaper describing use of Removable device capability bits on Win7 by bus drivers:
http://www.microsoft.com/whdc/Device/DeviceExperience/ContainerIDs.mspx.

In order to correct this issue to pass the platform WHQL test, RST recommends the OEM to take the following action:
In the system BIOS, define an _EJ0 ACPI method on the interlocked port. _EJ0 will signal to the ACPI driver to set Removable for the RST driver and still mark the device as internal to the system such that it does not show in its own container. The implementation is to use a registry key for each port to tell RST whether to set Removable bit or not. If _EJ0 ACPI method is defined in the system BIOS by the manufacturers, they can tell RST not set Removable bit. For example,
[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\iaStor\Parameters\Port 1]
"EJ0IsDefined"=dword:1
If 1, _EJ0 will set Removable bit instead of RST. If 0, no _EJ0 defined so RST will set Removable bit. The default value is 0.

2 Intel® Rapid Storage Technology

Intel® Rapid Storage Technology provides added performance and reliability for systems equipped with serial ATA (SATA) hard drives to enable optimal PC storage solution. It offers value-add features such as RAID and advanced Serial ATA* capabilities for the Microsoft* Windows* operating systems (for detailed OS support, review the Release Notes for each software release).

The RAID solution supports RAID level 0 (striping), RAID level 1 (mirroring), RAID level 5 (striping with parity) and RAID level 10 (striping and mirroring).

A configuration supporting two RAID levels can also be achieved by having two volumes in a single RAID array that use Intel Rapid RAID Technology. Targeted for mobile, desktops, workstations and servers, this RAID solution addresses the demand for high-performance or data-redundant platforms.

2.1 Overview of RAID Levels

RAID 0 (striping)   RAID level 0 combines two or more hard drives so that all data is divided into manageable blocks called strips. The strips are distributed across the array members on which the RAID 0 volume resides. This improves read/write performance, especially for sequential access, by allowing adjacent data to be accessed from more than one hard drive simultaneously. However, data stored in a RAID 0 volume is not redundant. Therefore, if one hard drive fails, all data on the volume is lost.

The RAID 0 volume appears as a single physical hard drive with a capacity equal to twice the size of the smaller hard drive.

The Intel® ICH9 I/O Controller and later chipsets (all desktop) with Intel Rapid Storage Technology allows up to six drives to be combined into a single RAID 0 array, providing additional scaling of storage performance.

RAID 1 (mirroring)   RAID level 1 combines two hard drives so that all data is copied concurrently across the array members that the RAID 1 volume resides on. In other words, the data is mirrored across the hard drives of the RAID 1 volume. This creates real-time redundancy of all data on the first drive, also called a mirror. RAID 1 is usually used in workstations and servers where data protection is important.

The RAID 1 volume appears as a single physical hard drive with a capacity equal to that of the smaller hard drive.

RAID 5 (striping with parity)	RAID level 5 combines three or four hard drives so that all data is divided into manageable blocks called strips. RAID 5 also stores parity, a mathematical method for recreating lost data on a single drive, which increases fault tolerance. The data and parity are striped across the array members. The parity is striped in a rotating sequence across the members.
	Because of the parity striping, it is possible to rebuild the data after replacing a failed hard drive with a new drive. However, the extra work of calculating the missing data will degrade the write performance to the volumes. RAID 5 performs better for smaller I/O functions than larger sequential files.
	RAID 5, when enabled with volume write-back cache with Coalescer, will enhance write performance. This combines multiple write requests from the host into larger more efficient requests, resulting in full stripe writes from the cache to the RAID5 volume.
	RAID 5 volume provides the capacity of (N-1) * smallest size of the hard drives, where N >= 3 and <=4.
	For example, a 3-drive RAID 5 will provide capacity twice the size of the smallest drive. The remaining space will be used for parity information.
RAID 10 (striping and mirroring)	RAID level 10 uses four hard drives to create a combination of RAID levels 0 and 1. The data is striped across a two-disk array forming a RAID 0 component. Each of the drives in the RAID 0 array is mirrored to form a RAID 1 component. This provides the performance benefits of RAID 0 and the redundancy of RAID 1.
	The RAID 10 volume appears as a single physical hard drive with a capacity equal to two drives of the four drive configuration (the minimum RAID 10 configuration). The space on the remaining two drives will be used for mirroring.

2.2 Typical usage model for RAID levels

RAID 0	This provides end-users the performance necessary for any disk-intensive applications; these include video production and editing, image editing, and gaming applications.
RAID 1	This provides end-users with data redundancy by mirroring data between the hard drives.
RAID 5	This provides end-users with good performance and data redundancy by striping data and parity across all the hard drives. The write performance is enhanced with volume write-back cache.

RAID 10 This provides end-users with the benefits of RAID 0 (performance) and RAID 1 (data mirroring).

3 Intel® Rapid Storage Technology

Intel Rapid Storage Technology contains three core components:

- Intel® Rapid Storage Technology software

- Intel® Rapid Storage Technology option ROM

- Intel® RAID Configuration utility

- Intel® RAID Cmd utility

3.1 Intel® Rapid Storage Technology Software

The Intel® Rapid Storage Technology software includes:

- the Intel Rapid Storage Technology driver component that provides SATA AHCI support as well as RAID capability for the supported Microsoft* Windows operating systems

- the Intel® Rapid Storage Technology User Interface (a 32-bit Windows application). In RAID mode the UI provides the management interface for the RAID subsystem.

Note: The UI is not required in AHCI mode as it provides no management capability of the storage subsystem.

The driver requires a supported RAID-enabled Intel® I/O Controller Hub (ICH) or Peripheral Controller Hub (PCH) and will recognize its unique device ID and sub-class code. Because of this, the driver must be installed before the Windows operating system is installed onto a RAID volume or a single SATA hard drive connected to the RAID controller. The driver, in conjunction with the Intel® Rapid Storage Technology option ROM, will provide boot support for a two to four drive RAID array. The driver, with the Intel® Rapid Storage Technology UI, provides RAID volume management (create, delete, migrate) within the Windows operating system. It also displays SATA* device and RAID volume information.

3.2 Intel® Rapid Storage Technology Option ROM

The Intel® Rapid Storage Technology option ROM is a standard Plug and Play option ROM that adds the Int13h services and provides a pre-OS user interface for the Intel Rapid Storage Technology solution. The Int13h services allow a RAID volume to be used as a boot hard drive. They also detect any faults in the RAID volume being managed by the RAID controller. The Int13h services are active until the RAID driver takes over after the operating system is loaded.

The Intel® Rapid Storage Technology option ROM expects a BIOS Boot Specification (BBS) compliant BIOS. It exports multiple Plug and Play headers for each non-RAID hard drive or RAID volume, which allows the boot order to be selected from the system BIOS's setup utility. When the system BIOS detects the RAID controller, the Intel® Rapid Storage Technology *option ROM* code should be executed.

The Intel® Rapid Storage Technology option ROM is delivered as a single uncompressed binary image compiled for the 16-bit real mode environment.

3.3 Intel RAID Configuration Utility

The Intel® Rapid Storage Technology RAID Configuration utility is an executable with capabilities similar to the Intel® Rapid Storage Technology option ROM. It can operate in 16-bit MS-DOS* mode. It provides customers with the ability to create, delete, and manage RAID volumes on a system within a DOS environment. For ease of use, the utility has command line parameters that make it possible to perform these functions by using DOS scripts or shell commands.

The RAID Configuration utility has two main modes. The first one uses command line parameters. Below is a snapshot of the help text displayed when using the -? flag. It shows the usage for all supported command line flags necessary for creating, deleting, and managing RAID volumes.

The second mode of operation is console mode (applicable for RAIDCfg only). If this utility is executed without any command line flags, a console interface identical to that of the Intel® Rapid Storage Technology option ROM is presented and is fully functional within the DOS environment. The mode requires user interaction; however, it may be used to create, delete, and manage RAID volumes from a DOS environment when the Intel Rapid Storage Technology option ROM is unavailable.

3.3.1 RAIDCfg Utility for MS-DOS*

The command syntax for the Intel® RAID Configuration utility is shown below:

```
=======================================================================

RaidCfg.exe [/?] [/Y] [/Q] [/C:vol_name] [/SS:strip_size]
[/L:raid_level]
            [/S:vol_sizel] [/DS:disk_ports] [/D:vol_name] [/X] [/I] [/P]
[/ST] [/STD] [/STV] [/F:vol_name] [CnG:vol_name] [/Sync]

/?    Displays Help Screen.  Other options ignored.
/Y    Suppress any user input. Used with options /C, /D, /X, & /F.

/Q    Quiet mode / No output. Should not be used with status commands.
      COMMANDS - Only one at a time.
/C    Create a volume with the specified name.
      /S, /DS, /SS, & /L can be specified along with /C.
/SS   Specify strip size in KB.  Only valid with /C
/L    Specify RAID Level (0, 1, 10, or 5).  Only valid with /C
/S    Specify volume size in GB or percentage if a '%' is appended.
      Percentage must be between 1-100.  Only valid with /C
```

```
/DS    Selects the disks to be used in the creation of volume.
       List should be delimited by spaces.
/D     Delete Volume with specified name.
/X     Remove all metadata from all disks. Use with /DS to delete
       metadata from selected disks.
/I     Display All Drive/Volume/Array Information.  /P can be specified.
/P     Pause display between sections. Only valid with /I.
/ST    Display Volume/RAID/Disk Status.
/STD   Display delimited Disk Status

Port,Model,SerialNumber,FirmwareVersion,Array,Status,Size,Free,Type
/STV   Display delimited Volume Status
       Index,Level,StripSize,Size,Status,Bootable,Array,Name
/F     Repair failed RAID0 Volume.
/CnG   Create an Intel® Rapid Recover Technology volume. To be used with
/C  and /DS.
/Sync Set sync type for Intel® Rapid Recover Technology volume. Only
valid with /CnG
/M     Choose port number of the Master disk for Intel® Rapid Recover
Technology volume. Only valid with /CnG
======================================================================
```

4 Creating a RAID Volume

RAID volumes can be created three different ways. The method most widely used by end-users is to use the Intel® Rapid Storage Technology application in Windows*. The second method to create a RAID volume is to use the Intel® Rapid Storage Technology option ROM user interface. The third way, which is only available to OEMs only, is using the Intel® RAID Configuration utility.

4.1 Using the Intel® Rapid Storage Technology Application

1. Run the Intel® Rapid Storage Technology Console from the following Start menu link within Windows :

2. Start→Programs→Intel->Intel® Rapid Storage Technology or

3. Start->All Programs->Intel->Intel® Control Center->Intel® Rapid Storage Technology if Intel® Control Center is installed.

Based on the available hardware and your computer's configuration, you may be able to create a volume by selecting the 'easy to use' options such as 'Protect data' under 'Status', or by selecting a volume type under 'Create'. Based on the number of non RAID disks available to you and the size of the disks the user will only be able to see the possible volume creation options… (i.e.: if you have only two disks …you can only see options to create RAID 0,RAID1 and Recovery(IRRT) ; if you have three disks, you can only see options for creating RAID 0, RAID 1, RAID5 and Recovery)

> **NOTE:** To create a volume the user must be in admin mode and the system must be in RAID Ready mode with two or more hard disks connected to it.

4. Instructions to create a volume by selecting volume type under 'Create'

   a. After selecting the volume type to create, click on 'Next'

   b. Now configure the volume by providing the volume name, selecting the hard disks to be part of the volume and strip size if applicable

   NOTE: When configuring a volume, the application will only list the SATA disks that meet the min requirements to be part of the volume. Based on the first disk selected or the order of selection, some disks may become grayed out if one or more requirements are not met. Changing the order of selection generally helps re-enable disks that were grayed out. For Ex: If the first selection is a system disk, only disks that are of equal or greater size will be presented for selection and other remains grayed out. For more information on disk requirements refer 'creating a volume' under help file in the UI.

   c. Once the disks are selected for volume creation, the user will be presented with option, if you want preserve data on which selected disk. Click on 'Next' and select the 'Create Volume' button.

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5. After the RAID volume is created, you will be shown a dialog box stating that the RAID volume was successfully created and you will you will need to use Windows Disk Management or other third-party software to create a partition within the RAID volume and format the partition. Click OK to close this dialog box.

6. After formatting the partition, you may begin to copy files to, or install software on, the RAID volume.

4.1.1 Using the Intel® Rapid Storage Technology option ROM User Interface

1. Upon re-boot, you will see the option ROM status message on the screen – press CTRL-I to enter the Intel Rapid Storage Technology option ROM user interface.

2. In the Main Menu, select option #1 'Create RAID Volume'. Enter the name you want to use for the RAID volume, then press Enter.

3. Select the RAID level by using the arrow keys, then press Enter.

4. Press Enter to select the disks to be used by the array that the volume will be created on. Press Enter when done.

5. Select the strip size (128 KB is the default for RAID 0) by using the arrow keys, then press Enter when done.

6. Enter the size for the RAID volume in gigabytes. The default value will be the maximum size. If you specify a smaller size, you will be able to create a second volume in the remaining space using the same procedure.

7. After this is done, exit the Option ROM user interface.

4.2 Using the RAID Configuration Utility

Run "raidcfg.exe" (DOS environment) or "raidcfg32.exe" (Windows environment) with the following command line flags to create a RAID volume.

The following command line will instruct the utility to create a RAID 0 volume named "OEMRAID0" on the hard drives on Port 0 and 1 with a strip size of 128 KB and a size of 120 GB:

```
C:\>raidcfg.exe /C:OEMRAID0 /DS:0 1 /SS:128 /L:0 /S:120
C:\>raidcfg32.exe /C:OEMRAID0 /DS:0 1 /SS:128 /L:0 /S:120
```

The following command will create a RAID volume using all of the default values. It will create a RAID 0 volume with a strip size of 128 KB on the two hard drives in the system. The volume will be the maximum size allowable.

```
C:\>raidcfg.exe /C:OEMRAID0
```

The following command line will display usage for all support command line parameters:

```
C:\>raidcfg.exe /?
C:\>raidcfg32.exe /h
```

Note:

Selecting the strip size is only applicable for RAID 0, RAID 5, RAID 10 levels, but not for RAID 1

5   Deleting a RAID Volume

RAID volumes can be deleted in three different ways. The method most widely used by end-users is the Windows user interface utility. The second method is to use the Intel Rapid Storage Technology Option ROM user interface. The third way, used by OEMs only, uses the RAID Configuration utility.

5.1   Using the Windows User Interface Utility

1. Run the Intel Rapid Storage Technology Console from the following Start menu link:

    a. Start→Programs→Intel->Intel® Rapid Storage Technology or

    b. Start->All Programs->Intel->Intel® Control Center->Intel® Rapid Storage Technology if Intel® Control Center is installed.

2. Under 'Status' or 'Manage' Click on the volume you want to delete. The user will be presented with the volume properties on the left.

3. Click on 'Delete volume'

4. Review the warning message, and click 'Yes' to delete the volume.

5. The 'Status' page refreshes and displays the resulting available space in the storage system view. You can now use it to create a new volume.

5.2   Using the Option ROM User Interface

1. Upon re-boot, you will see the Intel® Rapid Storage Technology option ROM status message on the screen – press CTRL-I to enter the option ROM user interface.

2. Within this UI, select option #2 'Delete RAID volume'.

3. You should be presented with another screen listing the existing RAID volume.

4. Select the RAID volume you wish to delete using the up and down arrow keys.

5. Press the Delete key to delete the RAID volume

6. Press Y to confirm.

Note: Option #3 'Reset Hard Drives to Non-RAID' in the Intel® Rapid Storage Technology option ROM user interface may also be used to delete a RAID volume. This resets one or more SATA hard drives to non-RAID status, by deleting all metadata on the hard drives. This has the affect of deleting any RAID volumes

present. This function is provided for re-setting the hard drives when there is a mismatch in RAID volume information on the hard drives. The option #2 'Delete RAID Volume' on the contrary, will allow deleting a volume at a time, while retaining the existing RAID array metadata (i.e. Matrix RAID).

5.3 Using the RAID Configuration Utility

Run "raidcfg.exe" (DOS environment) or "raidcfg32.exe" (Windows environment) with the following command line flag to delete a RAID volume. The following command line will instruct the utility to delete a RAID 0 volume named "OEMRAID0"

```
C:\>raidcfg.exe /D:OEMRAID0
C:\>raidcfg32.exe /D:OEMRAID0
```

The following command line will display usage for all support command line parameters:

```
C:\>raidcfg.exe /?

C:\>raidcfg32.exe /h
```

6 Common RAID Setup Procedures

6.1 Build a SATA RAID 0, 1, 5 or 10 System

This is the most common setup. This configuration will have the operating system striped for RAID 0, or mirrored for RAID 1, or striped with parity for RAID 5, or stripped and mirrored for RAID 10 across two or up to four SATA hard drives (depending on the RAID configuration). To prepare for this, you must have the Intel® Rapid Storage Technology F6 driver on a floppy disk or USB flash drive. See the procedure for creating this floppy further down in this document.

1. Assemble the system using a motherboard that supports Intel® Rapid Storage Technology and attach appropriate number of SATA hard drives depending on the RAID level that will be built.

2. Enter System BIOS Setup and ensure that RAID mode is enabled. This setting may be different for each motherboard manufacturer. Consult the manufacturer's user manual if necessary. When done, save and exit BIOS Setup.

3. Upon re-boot you will see the Intel® Rapid Storage Technology Option ROM status message on the screen – press CTRL-I to enter the Intel® Rapid Storage Technology Option ROM user interface.

4. Within this UI, select option '1. Create RAID Volume'. When 'Create RAID Volume' menu is displayed, fill the following items:

    a. Name: Enter a volume name, and press Enter to proceed to next menu item,

    b. RAID Level: select RAID level (0, 1, 5, or 10), and press Enter to proceed to next menu item;

    c. Disks: press Enter on 'Select Disks' to select the hard drives to be used for your configuration.

    d. Within the 'SELECT DISKS' window, choose the hard drives and press Enter to return to the 'MAIN MENU'.

    e. Strip Size: Applicable for RAID levels 0, 5, and 10 only. You may choose the default size or another supported size in the list and press Enter to proceed to the next item.

    f. Capacity: The default size would be the maximum allowable size summation of all the drives in your configuration. You may decrease this volume size to a lower value. If you specified a

lower capacity size volume, the remaining space can be utilized for creating another RAID volume at a later time. Press Enter to proceed to the next item.

    g.   Create Volume: Press Enter to Create a volume.

    h.   Press 'Y' to confirm the creation of volume.

5. After this is done, exit the Intel® Rapid Storage Technology option ROM user interface by pressing the Esc key or Option #5.

6. Begin OS setup by booting from the installation CD.

7. At the beginning of Windows Setup, press F6 to install a third-party SCSI* or RAID driver with Windows XP or previous OS or 'load driver' for Vista and later OS. When prompted, insert a floppy disk containing the Intel® Rapid Storage Technology F6 driver. After reading the floppy disk, the 'Intel® PCH I/O RAID Controller selection will be presented -- select this driver to install.

8. Finish the Windows installation and install all necessary drivers.

9. Install the Intel® Rapid Storage Technology software via the CD-ROM included with your motherboard or download the software from Intel's website on the Internet. This process will add the Intel® Rapid Storage Technology application that can be used to manage the RAID configuration.

6.2   Build a SATA "RAID Ready" System

The following steps outline how to build an Intel "RAID Ready" system with OS installed on a single SATA hard drive. A "RAID Ready" system can be upgraded to RAID 0, RAID 1, RAID5 or RAID 10 at a later time using the RAID migration feature built into Intel® Rapid Storage Technology. This feature enables you to install additional SATA hard drives, and then migrate to a RAID level volume without re-installing the operating system.

1. Assemble the system using a motherboard with a RAID-enabled Intel ICH or PCH with the Intel® Rapid Storage Technology OROM integrated into the BIOS and attach <u>one</u> SATA hard drive.

2. Enter System BIOS Setup; ensure that RAID mode is enabled. This setting may be different for each motherboard manufacturer. Consult your manufacturer's user manual if necessary. When done, exit Setup.

3. Begin Windows Setup by booting from the installation CD.

4. At the beginning of Windows Setup, press F6 for Windows XP or previous OS or load driver for Vista or later OS to install a third-party SCSI or RAID driver. When prompted, insert a floppy disk containing the Intel® Rapid Storage Technology F6 driver with Windows XP or previous OS or can use a CD/DVD or USB with Vista or later OS. After reading the floppy disk, select the correct controller to install the driver.

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5. Finish the Windows installation and install all necessary drivers.

6. Install the Intel® Rapid Storage Technology software via the CD-ROM included with your motherboard or after downloading it from Intel's website on the Internet. This process will add the Intel® Rapid Storage Technology application that can be used to manage the RAID configuration and to use the Intel® Rapid Storage Technology migration feature to migrate a "RAID Ready" configuration to a RAID 0, RAID 1, RAID 5, RAID 10 configuration.

6.3 Migrate to RAID 0 or RAID 1 on an Existing "RAID Ready" System

If you have an existing "RAID Ready" system as defined in section 6.2, then you can use the following steps to migrate from a single-drive non-RAID configuration to a two drive RAID 0 or RAID 1 configuration. The resulting configuration will be identical to that created by the procedure in section 6.1. To prepare for this, you will need to install another SATA hard drive with a capacity equal to or greater than the capacity of the hard drive being used as the source hard drive.

1. Note the port number of the source hard drive already in the system; you will use this to select hard drive for preserving data for the migration.

2. Install the second SATA hard drive on the available SATA port.

3. Boot Windows, then install the Intel® Rapid Storage Technology driver, if not already installed, using the setup package obtained from a CD-ROM or from the Internet. This process will install the necessary Intel® Rapid Storage Technology application and start menu links.

4. Open the Intel® Rapid Storage Technology application from the Start Menu and select the volume type under Create from the Actions menu. Click on 'Next'

5. Under the configure options provide the volume name , select disks

6. When the disks are selected, the user will be presented the option to select the disk on which to preserve the data. Here the user need to select the right disk on the which the data needs to preserved and migrated

7. After the migration is complete, reboot the system. If you migrated to a RAID 0 volume, use Disk Management from within Windows in order to partition and format the empty space created when the two hard drive capacities are combined. You may also use third-party software to extend any existing partitions within the RAID volume.

6.4 Migrate an Existing Data Hard Drive to a RAID 0 or RAID 1 Volume

If you are booting from a parallel ATA (PATA*) drive that contains the operating system, you may use the Intel® Rapid Storage Technology to create a RAID 0 or RAID

1 volume on two SATA drives. Also, if you have a single SATA hard drive that contains program or personal data, you may use the migration feature to use this hard drive as the source hard drive for a migration. After the migration is completed, you will have a two hard drive RAID 0 volume where data is striped or a two hard drive RAID 1 volume where the data is mirrored across the two SATA hard drives. To do this, the Intel ICH or PCH must be enabled in the BIOS and you must have the Intel® Rapid Storage Technology software installed.

Begin with a system where you are booting from a PATA hard drive. Make sure the Intel ICH or PCH SATA controller's RAID mode is enabled and the Intel® Rapid Storage Technology is installed. Then do the following:

1. Note the serial number of the SATA hard drive that is already installed. You will use this to select it as the source hard drive when initiating the migration.

2. Physically attach the second SATA hard drive to the available SATA port.

3. Boot to Windows, install the Intel® Rapid Storage Technology driver, if not already installed, using the setup package obtained from a CD-ROM or from the Internet. This process will install the necessary Intel Rapid Storage Technology Console and start menu links.

4. Open the Intel® Rapid Storage Technology application from the Start Menu.

5. Follow steps 4 to 7 in section 6.3

6.5   Migrating from one RAID volume type to another volume type

RAID level migration allows an existing RAID configuration to be migrated to another RAID configuration. The following migrations are possible.

NOTE: Not all migrations are supported on all chipsets. The support varies depending on the chipset and the ports supported on the chipset (For supported migrations for each chipset please review the Intel Rapid Storage Technology product requirements document):

Change Type from	To
2-disk recovery volume	2-disk RAID 1
2-disk RAID 1	2-disk recovery volume
2-disk RAID 1	2-disk RAID 0 3, 4, 5 or 6-disk RAID 0 3, 4, 5 or 6-disk RAID 5
2-disk RAID 0	3, 4, 5 or 6-disk RAID 5
3-disk RAID 0	4, 5 or 6-disk RAID 5
4-disk RAID 0	5 or 6-disk RAID 5
4-disk RAID 10	4, 5 or 6-disk RAID 5

NOTE: In order for the migration options to be accessible, the minimum required SATA hard drives for the RAID level have to be met.

Please follow the procedure illustrated below

1. Start the Intel Rapid Storage Technology application:

    a. Start→Programs→Intel->Intel® Rapid Storage Technology or

    b. Start->All Programs->Intel->Intel® Control Center->Intel® Rapid Storage Technology if Intel® Control Center is installed

2. Under 'Status' or 'Manage', in the storage system view, click the array or volume to which you want to modify. The volume properties now display on the left.

3. Click 'Change type'.

4. Under 'Status' or 'Manage', in the storage system view, click the array or volume to

5. In the 'Change Volume Type' dialog, type a new name if you want to change the default name.

6. Select the new volume type, and then click 'OK'.

7. The 'Manage' page refreshes and reports the new volume type.

8. After the migration starts, you can view the migration progress under status.

9. When the Status field indicates volume as 'Normal', the migration is complete.

6.6   Create a RAID volume on SATA while booting to PATA

This configuration is for users who would like to use a RAID 0 volume as a high performance data drive or use the data redundancy properties of RAID 1. Starting with a configuration where the system is booting to a Windows, with system disk being a Parallel ATA hard drive, the user can add two SATA hard drives and create a RAID volume on them.

1. Physically install two SATA hard drives to the system.

2. Enter System BIOS Setup; ensure that RAID mode is enabled. This setting may be different for each motherboard manufacturer. Consult your manufacturer's user manual if necessary. When done, exit Setup.

3. Boot to Windows; install the Intel® Rapid Storage Technology driver, if not already installed, use the setup package obtained from a CD-ROM or from the Internet. This process will install the necessary Intel Rapid Storage Technology Console and Start menu links.

4. Use the Intel® Rapid Storage Technology application to create a RAID 0 volume on two SATA drives according to the procedure in section 6.1 of this document.

5. After the RAID volume is created, you will need to use Windows Disk Management or other third-party software to create a partition within the RAID volume and format the partition. At this point, you may begin to copy files to, or install software on, the RAID volume.

6.7 Build a RAID 0 or RAID 1 System in an Automated Factory Environment

This is a two-part process.

1. Create the master image of the Windows installation; you will load these on the system before they are delivered to the customer.

2. Apply this image to a system that has two SATA hard drives installed with a RAID 0 or RAID 1 volume.

This procedure will apply the image to the RAID volume so that the system may boot from it and the operating system will be fully striped by the RAID 0 volume or mirrored by the RAID 1 volume. The same procedure, and master image, could be applied to a single SATA hard drive to create a "RAID Ready" system.

6.7.1 Part 1: Create the Master Image

1. Build a RAID 0 or RAID 1 System as described in section 6.1 of this document.

2. Install the Intel® Rapid Storage Technology driver from the CD-ROM included with your motherboard or after downloading it from the Internet. This will install the Intel® Rapid Storage Technology Console that can be used to manage the RAID configuration in Windows*.

3. Use third-party software to create an image of the RAID volume as if it were a physical hard drive or create an image of the partition within the RAID volume containing the operating system, program and data files.

4. Store it in a place where it can be accessed by systems on the assembly line.

6.7.2 Part 2: Apply the Master Image

1. Assemble the system using a motherboard that supports Intel® Rapid Storage Technology and attach two SATA hard drives.

2. Enter System BIOS Setup; ensure that RAID mode is enabled. This setting may be different for each motherboard manufacturer. Consult your manufacturer's user manual if necessary. When done, exit Setup.

3. Within a DOS environment, use the Intel RAID Configuration utility (raidcfg.exe) to create a RAID volume. The following command line will instruct the utility to

create a RAID 0 volume named "OEMRAID0" on the hard drives on Port 0 and 1 with a strip size of 128 KB and a size of 120GB:
C:\>raidcfg.exe /C:OEMRAID0 /DS:0 1 /SS:128 /L:0 /S:120.
The following command line will display all supported command line parameters and their usage: C:\>raidcfg.exe /?

4. The system does not need to be rebooted before moving on to the next step. If there are no PATA hard drives in the system, the RAID volume created will become the boot device upon reboot.

5. Use third-party software to apply the image created in Part 1 to the RAID volume you created in Part 2.

7 RAID Volume Data Verification and Repair Feature

This feature became available starting with Intel® Matrix Storage Manager 6.1.

7.1 Verify and Repair Volume Feature

The RAID volume verification feature identifies any inconsistencies or bad data on a RAID 0, RAID 1, RAID 5, or RAID 10 volume and reports the number of inconsistencies or number of blocks with media errors found during RAID volume data verification.

When the verification process is complete, a dialog will appear that displays the number of verification errors, verification errors repaired and blocks with media errors that were found.

Follow the below steps to start RAID volume data verification

1. Under 'Status' or 'Manage' click on the RAID volume you want to perform the verify operation under 'storage system view'. The volume properties now display on the left.

2. Click on 'Advanced' and then Click on 'Verify'

3. For RAID 0 the verification process starts once you click 'verify'. For RAID1, 5, 10, Recovery Volumes, a dialog box with check box option to repair the errors found automatically during the verification process is present. If the user wants to perform repair you can select this box and then click 'verify'.

4. The verification progress is shown under 'Status'

5. When the verification process is complete and the volume status is set to normal. Now you can click on the volume under 'Status' or 'Manage'. Under the volume properties to the left under 'Advanced' you can view the number of verification errors, verification errors repaired and blocks with media errors that were found.

8 Intel® Rapid Recover Technology

Intel® Rapid Recover Technology (IRRT) is supported on ICH8M-E and later mobile platforms and ICH9R/DO and greater desktop platforms. This technology utilizes RAID 1 functionality to copy data from a designated Master drive to a designated Recovery drive. The size of the Master drive must be less than or equal to the size of the Recovery drive. When a Recovery Volume is created, complete capacity of the Master drive will be used as the Master Volume. Only one Recovery Volume can exist on a system. There are 2 methods of updating the data on the Master to the Recovery drive. They are:

- Continuous Update Policy

- On Request Update Policy

When using the continuous update policy, changes made to the data on the Master drive while the recovery drive is not available are automatically copied to the recovery drive becomes available. When using the Update on request policy, the Master drive data can be restored to a previous state by copying the data on the recovery drive back to the Master drive.

Some of the advantages of Intel® Rapid Recover Technology are:

- More control over how data is copied between master and recovery drives

- Fast volume updates (only changes to the Master drive since the last update are copied to the recovery drive)

- Member hard drive data can be viewed in Windows* Explorer

- Better power management on mobile systems by spinning down the Recovery drive when in On Request Update Policy mode or when the Recovery drive goes offline when in Continuous Update Policy mode.

Applications: Critical data protection for mobile systems; fast restoration of the Master drive to a previous or default state.

8.1 Creating a Recovery Volume through the RAID Option ROM

A Recovery Volume consists of two disks – a primary disk and a recovery disk.

A Recovery Volume can be created through the RAID Option ROM or through Intel® Rapid Storage Technology application.

Follow the below steps to create a Recovery Volume through the OROM

1. Enter the OROM by pressing the Ctrl and I keys early during system POST.

2. Under the 'Create RAID' volume option, select the option to create a Recovery Volume.

3. Select the Primary disk and the Recovery disk.

Note: The Primary disk size must be less than or equal to the Recovery disk size.

 OROM Recovery menu provides the following options

1. Enable Only Recovery Disk

2. Enable Only Master Disk

8.2   Creating a Recovery Volume through the Intel® Rapid Storage Technology Application

To create a Recovery Volume through the Intel® Rapid Storage Technology application, the system needs to be configured in RAID mode with 2 drives. Boot the system and open the Intel® Rapid Storage Technology application.

Follow the below steps to create a Recovery Volume

1. Under 'Create' select the volume type as 'Flexible data protection (Recovery)' and click 'Next'

2. Under the 'Configure Volume' you can change the default volume name if you want, then select the 'Master' disk and then the 'Recovery' disk. Now change the 'update' mode if needed to 'On Request'. The default selection is 'Continuous'.

3. Once all the above selections are made, click 'Next'

4. Under 'Confirm' review the selected configuration. If you are not ok with the configuration click 'back' or click 'create volume' if you are fine with the configuration.

5. Now you will see a dialog box with warning message and read the warning message before clicking 'ok' to make sure you are erasing data on the right disk.

6. Once you click 'ok' the volume creation starts and progress of the volume creation can be viewed under status. Once the status is set to 'normal' the volume creation is completed.

7. The system will synchronize the Primary with the Recovery disk once after the creation of the Recovery Volume.

8.3   Changing Recovery Volume modes

When you have a recovery volume on your system in 'Continuous' mode or 'On Request' mode and you need to change the mode of the recovery volume, follow the below steps

1. Open Intel® Rapid Storage Technology application.

2. Under 'Manage' or 'Status' click on the recovery volume under the storage system view on right where you need to change the update mode. The volume properties now display on the left view

3. Click 'Change mode' and then click 'yes' to confirm.

4. The page refreshes and the volume properties report the new update mode. NOTE: Disabling the continuous update policy requires the end-user to request updates manually. Only changes since the last update process are copied. The recovery volume will remain in On Request Policy until the end-user enables continuous updates.

8.4   Update Recovery Volume in On Request Update Policy

When the recovery volume is 'On Request' mode on your system and you need to synchronize the data between both the master and recovery disk, follow the below instructions

1. Open Intel® Rapid Storage Technology application.

2. Under 'Status' or 'Manage', in the storage system view, click the recovery volume. The volume properties now display on the left.

3. Click 'Update data'.

4. A dialog box is shown stating that the only changes since the last update will be copied. Select the check box if you don't want this confirmation message to display each time you request an update. Click 'Yes' to confirm.

5. The progress of update process can be viewed under 'Status' or 'Manage'.

8.5   Access Recovery Drive Files

When data recovery to the master disk of a recovery volume is required, you can use 'access the recovery disk files' option. This action is only available if a recovery volume is present, in a normal state, and in on request update mode. Follow the below instructions to access the recovery drive file when you have a recovery volume in 'on request' mode on your system (If the recovery drive is not in continuous mode, use the instructions in section 8.3 to change the mode)

1. Open the Intel® Rapid Storage Technology application.

2. Under 'Status' or 'Manage', in the storage system view, click the recovery volume. The volume properties now display on the left.

3. Click on 'Access recovery disk files'.

4. Now you can view recovery disk files using Windows Explorer.

NOTE The Recovery driver can only be accessible in read only mode and data updates are not available in that state

8.6   Hide Recovery drive files

This action is only present when the recovery driver is on request mode and the recovery drive files are accessible. Follow the below instructions to hide the recovery drive files

1. Open the Intel® Rapid Storage Technology application.

2. Under 'Status' or 'Manage', in the storage system view, click the recovery volume. The volume properties now display on the left.

3. Click 'Hide recovery disk files'.

4. Now the recovery driver files are no longer accessible in Windows Explorer.

5. The page refreshes and data updates on the volume are now available.

8.7   Scenarios of Recovering Data

Scenario 1:
What happens if the Recovery drive that is part of the Intel® Rapid Recover Technology volume fails or gets stolen?

Solution:
When a Recovery drive that is part of a Intel® Rapid Recover Technology volume fails, follow the below steps to set up a new disk as the Recovery drive.
1. Shut down the system.
2. Remove the failed Recovery disk and insert a new hard drive. The size of the new drive must be greater than or equal to the Master drive.
3. Boot to the Master drive and open Intel® Rapid Storage Technology application.
4. Under 'Status' or 'Manage', in the storage system view, click the recovery volume to be rebuilt. The volume properties now display on the left.
5. Click on 'rebuild to another disk'
6. Now a dialog box is shown requesting you to select one of the non RAID disks to rebuild the volume.
7. Once the disk selection is complete, click 'rebuild'
8. Now you can view the progress of the build under 'Status' or 'Manage'

Scenario 2:
What happens if the Master Drive fails and/or the user would like to do a reverse synchronization to a new Master Drive?

Solution:

If the Recovery Volume was in Continuous update policy when the Master drive crashed, then the system will continue to function off of the Recovery drive.

If the Recovery Volume was in Update on Request policy, then a Master drive failure may result in a BSOD.

In either case, follow the below steps to create a new Master drive using the Recovery Drive.

1. Shut down the system.
2. Remove the old Master disk and connect a new Hard Disk Drive to be designated as the new Master disk. **Note:** The size of the new Master drive should be less than or equal to the Recovery disk.
3. Power on the system. It will automatically boot from the Recovery drive. After the operating system is running, select the Intel® Rapid Storage Technology Console from the Start Menu.
4. Under 'Status' or 'Manage', in the storage system view, click the recovery volume to be rebuilt. The volume properties now display on the left.
5. Click on 'rebuild to another disk'.
6. Now a dialog box is shown requesting you to select one of the non RAID disks to rebuild the volume.
7. Once the disk selection is complete, click 'rebuild'.
8. Now you can view the progress of the build under 'Status' or 'Manage'.

Scenario 3:

What is the expected behavior if a power failure occurs (and no battery supply available) in the middle of migration for each of the below?
- Creating a Recovery Volume (migration)
- Updating a Recovery Volume (Copy some files from Master drive to Recovery drive)
- Verify and Repair a Recovery Volume
- Recovering a Recovery Volume (copy from a Recovery drive to a Master Drive

Solution:

In each case, upon the next reboot, the migration, or Verifying a Recovery Volume, or Verify and Repair a Recovery Volume or Recovering a Recovery Volume operation would continue normally starting from where it had been interrupted by the power failure.

In the case where the Recovery Volume was getting updated or was being recovered, if it were a fast synchronization, then if writes had been in progress while the power was lost, then it would result in a dirty shutdown. As a result, the fast synchronization would degenerate to a slow synchronization or a complete update.

Note: If the system is running is on battery, the volume will not synchronize if it is in continuous update policy. If the volume is in Update on Request policy, then the synchronization will be successful.

Additional comments: need to call out that an on update volume should first be updated before the recovery disk is valid.

Scenario 4:

One a system with configured with Intel® Raid Recover Technology, a user would like to revert the Master Drive Data to a Previous State.

Solution:

If the Recovery Volume is set to the 'On Request' update policy, you can revert the Master drive data to the state it was in at the end of the last volume update process. This is especially useful when a virus is detected on the Master drive or guests use your system.

1. Restart the system. During the system startup, press Ctrl-I to enter the user interface of the Intel® Rapid Storage Technology option ROM.
2. In the 'MAIN MENU' select 'Recovery Volume Options'.
3. In the 'Recovery Volume Options' menu, select 'Enable Only Recovery Disk' to boot from the recovery drive.
4. Exit the option ROM and start up Windows*.
5. After the operating system is running, select the Intel® Rapid Storage Technology application from the Start Menu.
6. Under 'Status' or 'Manage', in the storage system view, click the recovery volume to be recovered. The volume properties now display on the left.
7. Click on 'recover data' and then click 'ok' on the dialog box.
8. Now you can view the progress of the recovery under 'Status' or 'Manage'.
9. Once the recovery of the volume is completed, you can reboot to the Master drive.

9 System Running off Recovery Drive

The "System Running off Recovery Drive " is an existing feature in the current UI but is documented here for the sole purpose of providing Validation and Localization with the flow of expected behavior for test pass preparation.

9.1 Drive Offline or Missing

System Configuration	2 hard drives: recovery drive connected, Master drive offline or missing
Product Condition	Recovery Volume created with recovery drive normal and Master drive offline or missing

- Access UI OROM – Note that the Master drive is designated as an offline disk or Master drive missing
- Select option 4 Recovery Volume Options
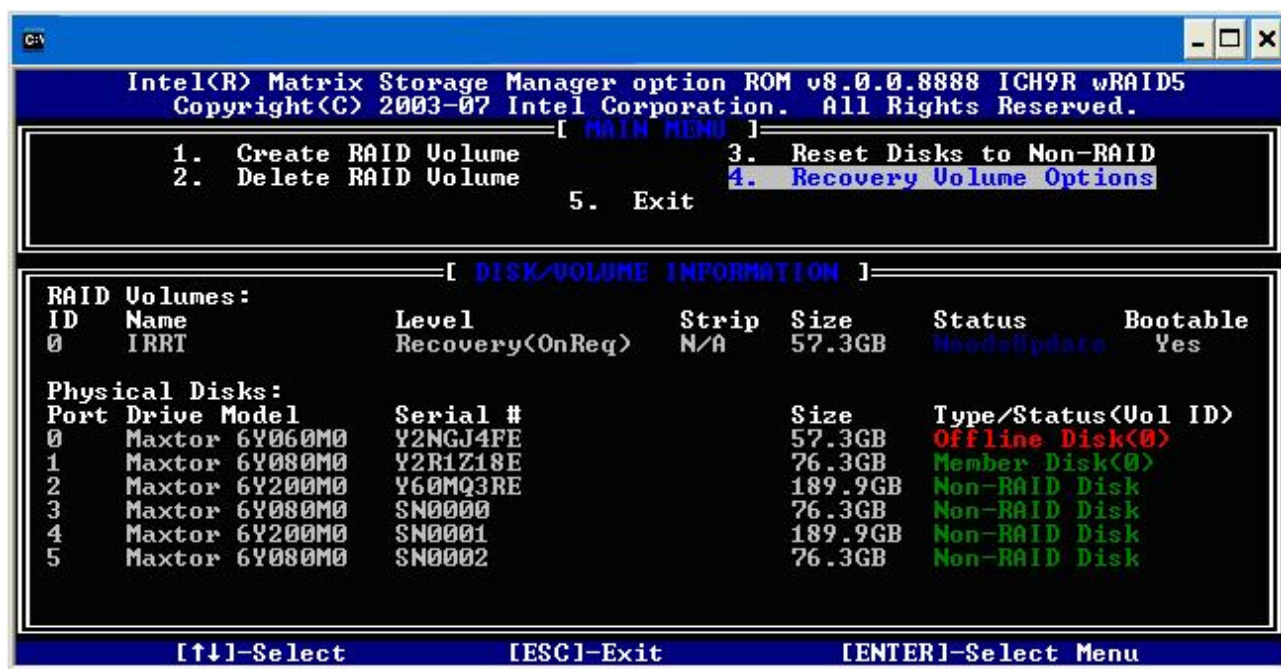
Then Select Option 2 Enable Only Recovery Disk.

10 Pre-Installation of the Intel® Rapid Storage Technology Driver

The Intel® Rapid Storage Technology driver must be installed before installing OS on a RAID volume or when in AHCI mode. Intel® Rapid Storage Technology AHCI driver can be installed over Vista's native AHCI driver.

10.1 Pre-Installation Using the "F6" Method

1. When you start installing Windows XP and older operating systems, you may encounter a message stating, "Setup could not determine the type of one or more mass storage devices installed in your system". If this is the case, then you are already in the right place and are ready to supply the driver. If this is not the case, then press F6 when prompted at the beginning of Windows setup.

2. Press the 'S' key to select 'Specify Additional Device".

3. You should be prompted to insert a floppy disk containing the manufacturer-supplied driver into the A: drive. This disk should contain the driver which includes:
   Note: For Windows Vista you can use Floppy, CD/DVD or USB.

   - Driver binary (iastor.sys),

   - INF files (iastor.inf and iaAhci.inf),

   - cat files (iaStor.cat and iaAhci.cat) and

   - TxtSetup OEM file (txtsetup.oem).

These should be in the root directory of the floppy.   See Section 7.3 for instructions on making a driver installation disk.

For Windows Vista:

1. During the Operating system installation, after selecting the location to install Vista click on 'Load Driver' button to install a third party SCSI or RAID driver.

2. When prompted, insert the floppy disk or media (Floppy, CD/DVD Or USB) you created in step 3 and press Enter.

3. You should be shown a list of available RAID / SCSI Adapters.

4. Select the appropriate Intel RAID controller and press ENTER.

5. The next screen should confirm that you have selected the Intel® RAID controller. Press ENTER again to continue.

6. You have successfully installed the Intel® Rapid Storage Technology driver, and Windows setup should continue.

7. Leave the disk in the floppy drive until the system reboots itself. Windows setup will need to copy the files from the floppy again after the RAID volume is formatted, and Windows setup starts copying files.

10.2   Unattended Installations of Microsoft Windows XP

To install the driver as outlined in the Microsoft document, "Deployment Guide Automating Windows NT* Setup" use the TXTSETUP.OEM file included in this package and insert the lines below into the UNATTEND.TXT file. This method is also available for Microsoft Windows XP operating system. For Windows XP, extract the iaStor.inf, iaAhci.inf, iaStor.sys, iaStor.cat, iaAhci.cat, and Txtsetup.oem files.

For Microsoft Windows XP, insert the following text into the UNATTEND.TXT file:

For system in RAID mode:

[MassStorageDrivers]

"Intel® 82801IR/IO SATA RAID Controller (ICH9R/IO)" = OEM

[OEMBootFiles]

iaStor.inf

iaStor.sys

iaStor.cat

Txtsetup.oem

For systems in AHCI Mode:

[MassStorageDrivers]

"Intel® 82801IR/IO SATA AHCI Controller (ICH9R/IO)" = OEM

[OEMBootFiles]

iaAhci.inf

iaStor.sys

iaAhci.cat

```
Txtsetup.oem
```

10.3   Creating a Floppy Disk containing the Intel Rapid Storage Technology Driver

This procedure should be used to create a floppy disk containing the Intel Rapid Storage Technology driver for use in installing the driver using the "F6 method".

10.3.1   Method 1 – Using Install applications

1. On a system running Microsoft Windows, download the Intel® Rapid Storage Technology package or obtain it from your Intel representative. The package contains the following files:

   - iata_enu.exe (English only executable)

   - iata_enu.zip (English only zip package)

   - iata_cd.exe (Multi-language executable)

   - iata_cd.zip (Multi-language zip package)

2. For convenience copy the above files into the C:\ drive.

3. Insert a blank, formatted floppy disk into the A: drive.

4. Unpack the iata_enu.zip or iata_cd.zip files. The setup.exe will be located in path "..\iATA_ENU\Disk1" for English version.

5. Choose the language in which you want the driver to be supported and execute the commands described below. From Windows command prompt, type the following commands:

6. Using Setup.exe – English version:
   ```
   a. C:\>setup.exe –a –p c:\IAAdriver
   ```

7. Using iata_enu.exe - English version (Alternate Method):
   ```
   a. C:\>iata_enu.exe –a –a –p c:\IAAdriver
   ```

8. Using iata_cd - Multi-language version:
   ```
   a. C:\>iata_cd.exe –a –a –p c:\IAAdriver
   ```

   **Where `C:\IAAdriver` is an already existing folder on the `c:` drive

9. After this is done, copy the driver binary files, INF files and the txtsetup.oem file from the local directory `C:\IAAdriver\Driver` to the root directory of the floppy.

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10.3.2   Method 2: Using F6 application

On system running Windows, download the application f6flpy32.zip for 32-bit operating system or f6flpy64.zip for 64-bit operating system to your local drive.

1. Double click on the zip file and extract the files on to your system and then copy all the files on to the floppy.

2. Now your floppy disk will have the valid Intel® Rapid Storage Technology Driver which can be used for F6 method.

11　Determining the version of the RAID driver

There are two ways to do this. The first is to use the Intel® Rapid Storage Technology. It reports the current version of the driver installed. The second is to locate the driver (iaStor.sys) itself and view its properties.

11.1　Using Intel Rapid Storage Technology Console

1. Run the Intel® Rapid Storage Technology application from the following Start Menu path:

2. Start→All Programs→Intel →Intel® Rapid Storage Technology

3. Click on 'help' and select 'system report' under it. '

4. Now click on 'Intel® Rapid Storage Technology'. Under it you can view the driver version in the following format: W.X.Y.ZZZZ

   a. W = this number indicates the major release version

   b. X = maintenance release version

   c. Y =

5. This is the current version of the user interface utility installed on your system. The W.X.Y portion is the product release number; the ZZZZ portion is the build number.

11.2　Using Intel Rapid Storage Technology File Properties

1. Locate the file "iaStor.sys" within the following path:

   <System Root>\Windows\System32\Drivers

2. Right Click on "iaStor.sys" and select Properties

3. Select the "Version" tab

4. At the top of this tab, there should be a parameter called "File version". Next to it is the version of the driver currently installed on your system. It should have the same format and version as the one you obtained using the Intel® Rapid Storage Technology application.

11.3 Determining the Version of the Option ROM

There are two way to determine the version of the Intel® Rapid Storage Technology option ROM integrated into the system BIOS. Use the following procedure to determine the version.

11.3.1 Using the Intel Rapid Storage Technology Console

1. Follow the procedure illustrated in section 11.1

2. Look for the parameter RAID Option ROM version.

11.3.2 Using the Intel Rapid Storage Technology Option ROM User Interface

1. Early in system boot-up, during post, or when you see the "Intel® RAID for Serial ATA" status screen output, type CTRL-I. This will open the Option ROM user interface.

2. The following banner will be displayed:

3. Intel® Rapid Storage Technology option ROM v W.X.Y.ZZZZ ICH10R/DO

4. W.X.Y.ZZZZ is the version of the Option ROM currently installed on your system. The W.X.Y portion is the product release number; the ZZZZ portion is the build number.

12 Uninstalling

Important NOTE: Uninstalling the Intel® Rapid Storage Technology driver could potentially cause an end-user to lose access to important data within a RAID volume.

This is because the driver can only provide functionality for the Intel ICH or PCH SATA RAID controller. Therefore, Intel does not provide a way to permanently remove the driver from the system. However, disabling the SATA RAID Controller causes the operating system to not use the RAID driver.

The uninstall application that is included with the Intel® Rapid Storage Technology software can remove all components except the RAID driver (i.e. it removes the UI application, Start Menu links, Control Panel Applet, etc.).

Use the following procedures to remove the Intel® Rapid Storage Technology software or to disable the SATA RAID controller:

12.1 Uninstalling the Intel® Rapid Storage Technology driver (except the RAID Driver)

1. Run the Uninstall program from the following start menu link:

2.   Start→All Programs→Intel->Intel® Rapid Storage Technology →Uninstall

3. The first dialog box that appears gives you the option of un-installing all components of the Intel® Rapid Storage Technology software except the RAID driver. Click OK to do so.

4. The next dialog box is a confirmation that you would like to un-install all components of the software except the RAID driver. Click 'Yes' to confirm.

5. All components of the software will be un-installed except the RAID driver. You should no longer see any Start menu links to the UI application or a control panel applet for Intel® Rapid Storage Technology. However, the RAID configuration should still function normally.

12.2 Disabling the RAID Driver by Disabling the RAID Controller

1. Enter System BIOS Setup and disable RAID Mode. This setting may be different for each motherboard manufacturer. Consult your manufacturer's user manual if necessary. When done, exit Setup.

2. Reboot the system. You should no longer see the RAID Option ROM status screen during boot, and you should no longer see the Intel ICH or PCH SATA RAID controller in Device Manager.

3. At this point, Windows will no longer be using the RAID driver and you will not have Intel RAID functionality. All data contained in existing RAID volumes will no

longer be accessible. To re-enable Intel RAID functionality, re-enter System BIOS Setup and re-enable RAID mode.

Uninstall Note: End-users can use this same procedure to disable the SATA RAID Controller if necessary. In fact, the uninstall program used in section 12.1 of this document will display a text file with a similar procedure. Run the Uninstall Program, click Cancel when presented with the first dialog box, then click 'Yes' at the second dialog box to read the text document containing the procedure.

13   Registry Customizations

After installation of the Intel® Rapid Storage Technology, the registry will contain keys to allow customization of several features. The registry key used to customize the Intel® Rapid Storage Technology is at the following path:

HKEY_LOCAL_MACHINE/SOFTWARE/Intel/Intel® Matrix Storage Manager

13.1   Tray Icon Configuration

13.2   Customize Support URLs in Rapid Storage Technology Console

The Intel® Rapid Storage Technology application Help Menu, Submenu Support when selected will display a pop-up window with the support URLs as shown in the figure below:
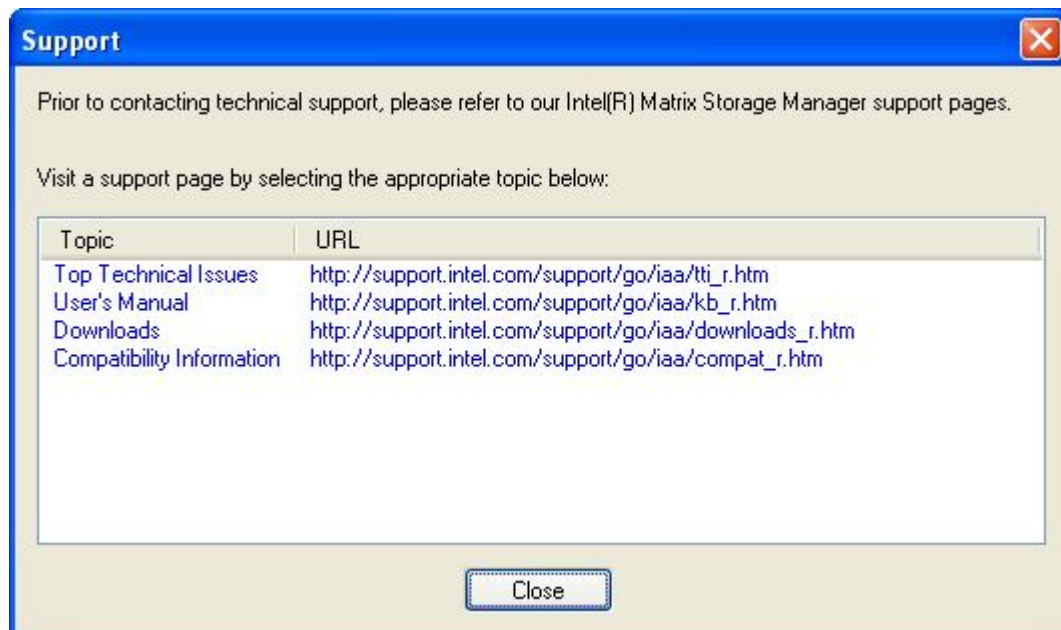
These URLs can be changed to be OEM-specific by following the procedure listed below:

Method 1: Manual Registry

1. Run Regedit.exe from command prompt.

2. Select "HKEY_LOCAL_MACHINE\SOFTWARE\Intel\Intel Matrix Storage Console" key.
3. Add STRING values in the following form:
ResourceN   REG_SZ   myurl
ResourceNURL   REG_SZ   http://www.myurl.com

Where N is any value from 0-49.

Method 2: Using SetupCfg.reg

Edit the setcfg.reg file and append the following lines:

[HKEY_LOCAL_MACHINE\SOFTWARE\Intel\Intel Matrix Storage Console]
"Resource0URL"="http://www.xxx.com"
"Resource0"="Test xxx"
"Resource1"="Test yyy"
"Resource1URL"="http://www.yyy.com"
"Resource3"="Test zzz"
"Resource3URL"="http://www.zzz.com"
"Resource4"="Test aaa"
"Resource4URL"="http://www.aaa.com"

13.3   Disable the pop-up Window with BIOS incompatibility Warning

When a window warning is displayed in Intel® Rapid Storage Technology, as shown in the figure below, follow the procedure given below if you intend to suppress the warning.

Method 1:

Check the "Do not show this message again" box.

Method 2: Registry entry

1. Run `regedit.exe` from the command prompt.

2. Select "HKEY_LOCAL_MACHINE\Software\Intel\Intel Matrix Storage Console" key.

3. Add a new string "PlugInRAID.pin_CompatibilityMsg" with value to enable or disable:

   - "PlugInRAID.pin_CompatibilityMsg"=dword:00000000

   - dword:00000000 – Disable

   - dword:00000001 - Enable

4. Exit the Regedit application.

5. Open Intel® Rapid Storage Technology from Start menu.

6. Confirm the above window is not displayed.

13.4   Native Command Queuing Settings

Native Command Queuing (NCQ) is enabled by default on both mobile and desktop platforms.

NCQ can be enabled or disabled using the below registry key.

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\iaStor\Parameters\SATA

"NCQEnable"=dword:00000000; Native Command Queuing (1=Enabled)

13.5   Zero Power ODD Settings

Beginning with the Intel® RST 10.0 release and the Intel® Mobile Express Chipset SATA AHCI and the Intel® Desktop/Workstation/Server Express Chipset SATA AHCI controllers (PCH), the product supports the zero-power ODD feature (also referred to as ZPODD). It is intended to allow an unused ODD to be powered off, and then powered on only upon receipt of demand requests or when the ODD eject button is pressed.   This goal is achieved by utilizing ACPI** methods to change the power condition of the drive when several platform (HW) conditions exist.

**Note: This is not supported on Windows XP and older operating systems.

Associated with this feature are two registry keys located at
[KEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\iaStor\Parameters]

1. ZPODD enable/disable

```
[KEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\iaStor\Parameters\]
```

```
"OddZeroPowerEnable"=dword(0, 1)
```
> This key determines a platform's eligibility for the feature. When the value is zero then this feature will be disabled.   When the value is non-zero or not present the feature will be enabled.   Default value will be enabled (**1**).

2. ODD idle timeout

```
[KEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\iaStor\Parameters\]
```

```
"SecondsToOddZeroPower"=dword:(30, 300)
```
> This key determines the idle timeout value. When the value is zero then this feature will be disabled. The value is the number of seconds the ODD must be idle (defined as a period of time in which no non-GESN commands are received; minimum value is 30 and maximum value is 300) before the ODD will be powered off.   The default value is **60.** If the registry value is set to a value outside this range then the default value of 60 seconds will be used.

14 Link Power Management with Intel® Rapid Storage Technology

Intel® Rapid Storage Technology implements the Link power management (LPM) feature described by the Serial ATA specification to overcome the power demand of a high-speed serial interface, SATA and providing the capability of SATA at the minimum power cost. LPM, when used in conjunction with a SATA hard drive that supports this feature, enables lower power consumption. LPM was initially enabled by default on mobile platforms starting with ICH6M with Intel® Matrix Storage Manager. Starting with ICH9R this feature has also been supported on desktop platforms with Intel® Matrix Storage Manager 7.5 release but not enabled by default.

Beginning with the Intel® Rapid Storage Technology 10.0 release, LPM support is enabled by default on both mobile and desktop platforms. OEM's who wish to modify the default settings for LPM on their platforms can follow the instructions in the following section(s).

14.1 Instructions to disable/enable LPM

After system is setup with OS and Intel® Rapid Storage Technology installed, follow the below instructions to modify the default LPM support.

NOTE: Beginning with the Intel® Rapid Storage Technology 10.0 release, the registry keys are no longer populated in the Windows registry by default. The RST driver does not require the registry keys to be present to support the default settings.

1. Go to **Start->Run**
2. Type in **RegEdit** and hit the Enter Key.
3. Go to the below mentioned location to insert or configure the registry keys for LPM
   NOTE: OEM's need to configure the LPM settings by port. Ports are numbered starting with zero (please refer the desired platform EDS for the number of ports supported on that platform)
HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\iaStor\Parameters\Port0
HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\iaStor\Parameters\Port1
   …
HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\iaStor\Parameters\Port5

4. Now add the following registry keys under the registry location mentioned in step3, if they are not available (These registry keys are not available by default, they can be added by using automated scripts, .reg files, executable utilities, etc).   If you find the below registry keys already available, you can modify the values for desired support. Values are modified on a port by port basis so modify all ports that you wish the changes to be supported on. **

"**LPM**"=dword: 00000001 {dword: 00000000->Disable; dword: 00000001->Enable} [default = Enabled]

"**LPMSTATE**"=dword: 00000000 {dword: 00000000->Partial; dword: 00000001->Slumber} [default = Disabled] (*Note: the driver ignores this key when the LPM key's value is not set to 1. So when LPM value is 0, this value is N/A.*)

"**LPMDSTATE**"=dword: 00000001 {dword: 00000000->Partial; dword: 00000001->Slumber} [default = Enabled]

"**DIPM**"=dword: 00000001 {dword: 00000000->Disable; dword: 00000001->Enable} [default = Enabled]

****Warning:** *If you edit the registry incorrectly, you can cause serious problems that may require you to reinstall your operating system. Intel does not guarantee that problems that are caused by editing the Registry incorrectly can be resolved.*

14.2   Safe Removal with LPM on hot plug capable ports

Please contact your Intel® Rapid Storage Technology representative (AE or FAE) for additional information pertaining to this feature.

NOTE: Request access to *Reference Manual for Safe Removal with Link Power Management (LPM) on Hot Plug Capable Port (HPCP)* white paper (Doc # 445153): (**http://www.intel.com/cd/edesign/library/asmo-na/eng/445153.htm**)

15   SGPIO

SGPIO (Serial General Purpose I/O Bus) in an enclosure management protocol defined by the specification SFF 8485. This messaging protocol is used to control LED's. Beginning with the Intel® Rapid Storage Technology 9.6 SGPIO is supported on ICH10R/D0 and later platforms.

15.1   Activate port LED

"Activate port LED" provides the user with a mechanism to identify the drive plugged into that port. Once the user has selected this function via the Intel® Rapid Storage Technology application, the SGPIO LED on the enclosure that associated with that port will blink for a period time.

"Activate port LED" will only be enabled and available to the user after a RAID volume has been created. In the Intel® Rapid Storage Technology application, the user will need to select a disk that is a member of an array in order to "Activate port LED" for that disk.

The following is an example of the Intel® Rapid Storage Technology application view with the "Activate port LED".
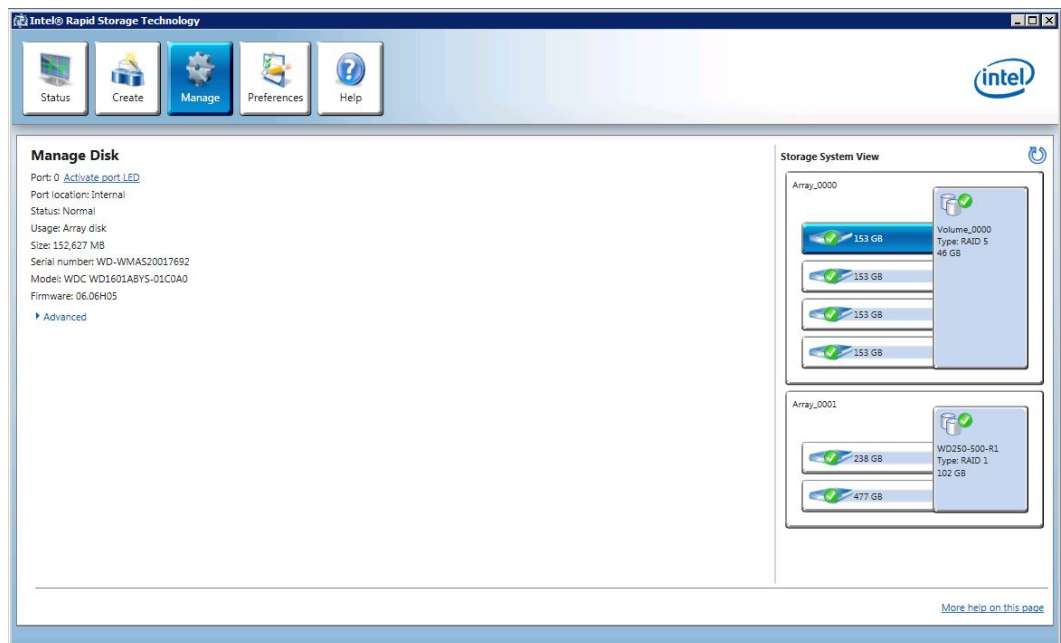
15.2 FAIL LED

When a disk encounters a failure condition that the causes the Intel® Rapid Storage Technology driver to mark it as FAILED, it will illuminate the SGPIO LED associated with the drive so that it is "on".

The user will be able to go into the Intel® Rapid Storage Technology application to see which drive in the array has been marked as "FAILED" and will be able to manage accordingly.

15.3 SMART LED

When a disk encounters a SMART event condition causes that the Intel® Rapid Storage Technology driver to mark it as such, it will illuminate the SGPIO LED associated with the drive so that it is "on".

The user will be able to go into the Intel® Rapid Storage Technology application to see which drive in the array has been marked as "SMART Event" and will be able to manage accordingly.

15.4 Rebuild LED

When a condition is encountered that results in a RAID Volume Rebuild, the Intel® Rapid Storage Technology driver will illuminate the SGPIO LED, associated with the drive being rebuilt so that it will "blink". Once the rebuild has completed, the Intel® Rapid Storage Technology driver will set the SGPIO LED so that it will stop blinking (i.e. turn it "off").

15.5 Migrate LED

When a condition is encountered that results in a RAID Volume Migration, the Intel® Rapid Storage Technology driver will illuminate the SGPIO LED, associated with the drive being migrated so that it will "blink". Once the migrations process has completed, the Intel® Rapid Storage Technology driver will set the SGPIO LED so that it will stop blinking (i.e. turn it "off").

16 RAID Option ROM and Utilities

There is a unified RAID Option ROM (raid_or.bin) and RAID Utilities (RAIDCFG.exe and RAIDCPLY.exe) beginning with the Intel® Rapid Storage Technology 9.6 release. This unified OROM package is supported on the platforms identified below when enabled for RAID. With this RAID Option ROM, these platforms now support all RAID functionality based on the hardware configuration.

Supported Chipsets					
Intel® Desktop/ Workstation/ Server Express Chipset SATA	Intel® 5 Series Chipset (PCH)	Intel® 4 Series Chipset, ICH10R/ ICH10DO	Intel® ICH9M R	Intel® 3 Series Chipset, ICH9/ ICH9R/ ICH9DO	Intel® ICH8R
Yes	Yes	Yes	Yes	Yes	Yes

17   User Interface

Microsoft .NET Framework 3.0 or newer is required to be installed on the system in order for the Intel® Rapid Storage Technology User Interface to operate.

17.1   Configure Email Notification

Beginning with the Intel® RST 10.0 release and Intel 6 Series chipsets (PCH) and later, the product will support email notification of certain storage events (see Appendix B of the Intel® RST Technical Product Specification for a list of supported events). The Intel® RST UI will provide the interface for enabling/disabling and configuring the email notification feature. **The default setting in the UI is 'disabled'**.

The email notification feature allows the user to configure the platform to send alert / notification emails for each storage subsystem event that gets reported by the RST monitor service (IAStorDataMgrSvc).

17.1.1   Configurable Settings

The Intel® RST UI application shall provide the interface to allow the user to configure the email alert notification feature via the 'Preferences' tab of the UI (*user must be logged on with administrative privileges*).
- User can enable/disable the email notification feature
- User can configure the level of storage system events to be sent via email notification (Storage system Information, Warning, and/or Error). Any combination of the three alert levels can be configured to trigger an email notification
- User can configure the email settings:
    - o SMTP host (required)
    - o Port (required)
    - o Return email address (required)
    - o Recipient email addresses (one address required, up to 3 maximum)
- User can configure the Email alert / notifications to send test emails to all addresses specified

18 HDD password support with RAID volumes

Intel® Rapid Storage Technology supports password protected HDDs to be RAID array member disks and pass-thru disks. The product will rely on the BIOS implementing for most of the ATA Security support. There is a whitepaper available called "Implementing Intel® Matrix Storage Manager Compatible Support for ATA Security in BIOS" available on CDI that describes the necessary BIOS design for compatibility with the Intel Rapid Storage Technology. Rapid Storage Technology product will handle the RAID and hot-plug related behavior w.r.to password protected disks.

18.1 HDD Password Use cases

If at least one unlocked member disk and one locked member disk (with relevant data for the volume) are connected, then a RAID volume will be designated as Locked.

Scenario	Action	Result	Comments
RAID1 Volume Disk 1 – Locked Disk 2 - Unlocked Volume – Locked (Both disks have relevant data)	Remove Disk 1 (locked disk)	Volume becomes unlocked and Degraded. User can rebuild volume unto a new unlocked disk.	The user had authority to access Disk 2 which has the same data as Disk 1, by removing the locked drive the user can access Disk 2.
RAID1 Volume Disk 1 – Locked Disk 2 – Unlocked Volume – Degraded Disk 1 has old data and caused the volume to go Degraded.	None	N/A	The user has access to Disk 2 because the data on Disk 1 is old and irrelevant.

Scenario	Action	Result	Comments
RAID5 Volume Disk 1 – Locked Disk 2 – Unlocked Disk 3 – Unlocked Volume – Locked (All disks have relevant data to Volume)	Remove Disk 1 (locked disk)	Volume becomes unlocked and Degraded. User can rebuild volume onto a new unlocked disk.	The user had authority to access Disk 2 and Disk 3 which has all the data needed to rebuild the volume, by removing the locked drive the user can access Disk 2 and Disk 3 as a Degraded Volume.
IRRT Volume Master Disk – Locked Recovery Disk - Locked (external port docking station) Volume – Locked (Both disks have relevant data)	User connects laptop to docking station and unlocks Recovery disk and Master Disk and boots. Then user takes the laptop from the docking station and leaves the external drive connected to power	The recovery drive can be connected to a new laptop and the information can be used to rebuild an IRRT volume if the power was maintained, because the drive is still in an unlocked state.	Similar situation to a user leaving a laptop unlocked and unattended.

19 TRIM

Win7 and ATA8 introduce support for TRIM support for improving the performance and life-span of Solid State Disks (SSD). Beginning with the Intel® Rapid Storage Technology 9.6 release, the product allows the pass-through of the TRIM command on SSD's that support TRIM.

19.1 TRIM command pass-through support: Windows 7

Win7 and ATA8 introduce OS support for the TRIM command. Support for the TRIM command allows Windows 7 to pass information directly to the Solid State Disk (SSD) that identifies sectors that can be deleted. The SSD will then go through and clear out that information in the background thereby minimizing the chances of an "Overwriting" process happening at crucial times. The SSD is also free to do some additional optimizations with those sectors. E.g. an SSD can pre-erase any sector that has been TRIM'ed. The TRIM command improves the long term Write performance and the life-span of SSDs.

19.1.1 AHCI Mode

In AHCI mode, the Intel® Rapid Storage Technology driver only passes through the TRIM command to be processed by the SSD.

19.1.2 RAID Mode

19.1.2.1 TRIM on pass-thru disks

The Intel® Rapid Storage Technology driver processes the host ATA Data Set Management (DSM) TRIM command on any pass-thru disks that support ATA DSM / TRIM in accordance with the ATA-8 specification.

19.1.2.2 TRIM on RAID volumes

The Intel® Rapid Storage Technology driver does not support TRIM commands on RAID volumes.

20 Glossary

Term	Definition
ATA	Advanced Technology Attachment
BIOS	Basic Input/Output System
BOM	Bill Of Materials
CD	Compact Disc
Chipset	Term used to define a collection of integrated components required to make a PC function.
Hard drives	Physical hard drives attached to a RAID controller
DOS	Disk Operating System
GB	Giga-byte
HDD	Hard Drive
I/O	Input/Output
ICH	I/O Controller Hub
ICH9	Intel® 82801IR/DO SATA RAID Controller
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 OS needed information about driver filenames, driver components, and supported hardware.
Intel® Option ROM (OROM)	Standard Plug and Play option ROM that provides a pre-operating system user interface for the Intel RAID implementation.
MB	Mega-byte
Migration	Term used to describe the movement of data from one configuration or usage model to another.
OEM	Original Equipment Manufacturer
Option ROM	A code module built into the System BIOS that provides extended support for a particular piece of hardware. For this product, the Option ROM provides boot support for RAID 0/1/5/10 volumes, and provides a user interface for configuring and managing RAID 0/1/5/10 volumes.
OS	Operating System
PATA	Parallel ATA
PCI	Peripheral Components Interconnect
PFW	Package for the Web
PIO	Programmed Input Output

Term	Definition
PnP	Plug and Play
Port 0..3	Term used to describe the point at which a SATA drive is physically connected to the SATA Controller. Port n is the nth of the four available ports in ICH9 systems, where n=0..3
RAID	Redundant Array of Independent Disks
RAID 0	A RAID level where data is striped across multiple physical hard drives (aka striping)
RAID 1	A RAID level where data is mirrored between hard drives to provide data redundancy (aka mirroring)
RAID 5	A RAID level where data and parity are stripped across the hard drives to provide good read/write performance and data redundancy. The parity is stripped in a rotating sequence (aka Stripping and rotating parity).
RAID 10	A RAID level where information is striped across a two disk array for system performance. Each of the drives in the array has a mirror for fault tolerance. (aka Stripping and mirroring)
RAID volume	A block of capacity allocated from a RAID Array and arranged into a RAID topology. Operating Systems typically interpret a RAID volume as a physical hard drive.
RAM	Random Access Memory. Usually refers to the system's main memory
ROM	Read Only Memory
SATA	Serial ATA
SCSI	Small Computer System Interface
SP#	Service Pack (number)
Strip	Grouping of data on a single physical hard drive within a RAID volume
Stripe	The sum of all strips in a horizontal axis across physical hard drives within a RAID volume
UI	User Interface