Intel® Rapid Storage Technology Enterprise (Intel® RSTe) Software User's Guide

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1 Overview

The software described in this document is designed for use with Intel® Rapid Storage Technology enterprise (Intel® RSTe). Intel® RSTe will provide added performance and reliability for supported systems equipped with Serial ATA (SATA) devices, Serial Attached SCSI (SAS) devices, and/or solid state drives (SSD's) to enable an optimal enterprise storage solution. It offers many value-add features such as RAID and advanced SAS* and/or SATA* capabilities for the Microsoft* Windows*, Linux and other operating systems.

Supported Hardware

This manual covers the software stack that is shared across Intel® C600 series chipset based server products:

- Intel® Server Board S1400FP
- Intel® Server Board S1400SP
- Intel® Server Board S2600CO
- Intel® Server Board S2400SC
- Intel® Server Board S2400EP
- Intel® Server Board S2600WP
- Intel® Server Board S2400LP
- Intel® Server Board S1600JP
- Intel® Server Board S2400BB
- Intel® Server Board S2400GP
- Intel® Server Board S2600CP
- Intel® Server Board S2600GZ/GL
- Intel® Server Board S2600IP
- Intel® Server Board S2600JF
- Intel® Workstation Board W2600CR

Supported Operating Systems

Intel provides drivers for the following operating systems:

- Windows Server 2008
- Windows Server 2008 R2
- Windows 7
- Windows Server 2003

Software and Utilites

Intel® RSTe includes a set of software and utilities to configure and manage RAID systems. These include:

Pre-boot software

- Intel® RSTe RAID Legacy Option ROMs – There are two pre-boot based Option ROMs (including a RAID Pre-boot configuration utility). One for the AHCI (Advance Host Controller Interface) controller and the other for the SCU (Storage Controller Unit) controller.

- Intel® RSTe RAID UEFI (Unified Extensible Firmware Interface) Drivers – There are UEFI drivers for AHCI and SCU, and UEFI mode command line utilities for AHCI and SCU (named RCFGSCU.efi and RCFGAHCI.efi) to provide a RAID Pre-boot configuration environment.

Operating System running time software

- Intel® RSTe operating system AHCI/RAID driver. This driver will manage/control the SATA devices attached to the AHCI controller configured in either AHCI mode (pass-through) or RAID mode.

Note: *The server system's BIOS SETUP utility is used to select either AHCI or RAID modes for the AHCI controller.*

- Intel® RSTe operating system SCU/RAID driver. This driver provides a simple non-RAID (pass-through) as well as a full RAID solution. This will manage/control the SAS/SATA devices attached to the SCU ports.

Note: *The SCU controller will only have a RAID mode. Consequently, when booting from the SCU controller, the SCU pre-boot driver (Legacy OROM or UEFI driver) will be required.*

- Intel® RSTe GUI (Graphical User Interface). This is an application that can be used to manage RAID arrays and volumes on drives attached (only) to the AHCI and SCU controllers.
- Rstcli/rstcli64
- CIM plugin for Windows

Features Introduction

Some of the RAID features supported by Intel® RSTe include RAID level 0 (striping), RAID level 1 (mirroring), RAID level 5 (striping with parity) and RAID level 10 (striping and mirroring).

The new features introduced with Intel® RSTe include but are not limited to:

- RAID support for SAS devices
- SCU support for RSTe RAID 0/1/5/10
- Pass-through drives
- Hot Plug with I/O
- Hot Spare Disk
- Auto Rebuild on Hot Insert
- Rebuild & Migration Check Pointing
- NCQ (SATA) and CQ (SAS) support
- UEFI using common metadata
- SAS Expanders
- SMART Support
- Bad Block Management
- SAS & SATA controller configuration rules
- SAS & SATA drive roaming
- RAID Volume roaming between Linux* and Windows*
- On Line Capacity Expansion
- Large Stripe Size Support
- RAID-Ready

- Disk Coercion
- Manual & Auto Rebuild
- Instant Initialization
- Patrol Read
- SGPIO for SAS & SATA
- volume creation/verify
- Selectable Boot Volume
- Email Alerting
- CIM
- RAID Level Migration (RAID 0, 1, or 10 to RAID 5)
- Dirty Stripe Journaling
- Partial Parity Logging (PPL)
- Verify and Repair
- Auto Rebuild on Hot Insert
- Install/Uninstall Utility
- Configuration and Management Utilities

2 RAID Features

This section provides more detailed description of Intel® RSTe features.

Intel® RSTe Pre-boot Package

Intel® RSTe SATA RAID Legacy Option ROM

The Intel® RSTe will support an SATA RAID Legacy Option ROM. The BIOS configuration utility may provide an option to select the AHCI controller as the boot controller. When the system is configured to boot from the AHCI controller in RAID mode, the Intel® RSTe AHCI RAID Legacy Option ROM will be loaded and will provide the interface to the drives attached to the AHCI controller. The Intel® RSTe SATA RAID Legacy Option ROM will only support drives directly attached to the AHCI controller.

While booting, a BIOS Splash Screen will appear on the display (provided that there are a least two drives attached) that will show what is attached to the AHCI controller. There is also an option to stop the booting process and enter into the Intel® RSTe SATA RAID Legacy Option ROM user interface. This is done by pressing the [CTRL]-I key combination. Once entered, user interface will allow the user to create/manage/delete RAID volumes on drives attached to the AHCI controller. This is mainly used to create a RAID volume that can be used as the system OS boot device.

Intel® RSTe SCU RAID Legacy Option ROM

Intel® RSTe will provide support for an SCU RAID Legacy Option ROM. The BIOS configuration utility may provide an option to select the SCU controller as the boot controller. When the system is configured to boot from the SCU controller, the Intel® RSTe SCU RAID Legacy Option ROM will be loaded and will provide the interface to the drives attached to the SCU controller. The Intel® RSTe SCU RAID Legacy Option ROM will only support drives directly attached to the SCU controller.

While booting, a BIOS Splash Screen will appear on the display (provided that there are a least two drives attached) that will show what is attached to the SCU controller. There is also an option to stop the booting process and enter into the Intel® RSTe SCU RAID Legacy Option ROM user interface. This is done by pressing the [CTRL]-I key combination. Once entered, the user interface will allow the user to create/manage/delete RAID volumes on drives attached to the SCU controller. This is mainly used to create a RAID volume that can be used as the system OS boot device.

Intel® RSTe SATA RAID UEFI Driver

Intel® RSTe will provide support for an SATA RAID UEFI driver. This driver will provide the interface driver to the drives connected to the AHCI controller. The Intel® RSTe SATA UEFI RAID Driver will support only drives directly attached to the AHCI controller

Intel® RSTe SCU RAID UEFI Driver

Intel® RSTe will provide support for an SCU RAID UEFI driver. This driver will provide the interface driver to the devices connected to the SCU controller. The Intel® RSTe SCU RAID

UEFI Driver will support directly attached drives and will provide at least one level of SAS expander support.

Intel® RSTe Configuration Tools

The Intel® RSTe will support multiple ways for OEMs/ODMs and users to manage RAID arrays and volumes. There is a Pre-boot package, factory installation utilities and an optional end user GUI tool.

Intel® RSTe UEFI Command Line Interface (CLI) Utility

Intel® RSTe will provide support for a UEFI command line interface utility. An Intel® RSTe UEFI Command Line Interface (CLI) utility will be made available to manage RAID volumes when booted into the UEFI environment. The Intel® RSTe UEFI CLI utility will need to be launched from USB drive.

This Intel® RSTe UEFI CLI utility will provide a command line interface to the user to allow to create/manage/delete RAID volumes on drives attached to either the AHCI or SCU controllers. The utility will access the appropriate controller and is available when they system boots into the UEFI environment. This is mainly used to create a RAID volume that can be used as the system OS boot device.

***Note**: When the system is configured to boot using UEFI, the user must boot into the UEFI environment to manage the RAID volumes (check the status, initiate rebuilds, expand, etc.). RUN OFF OF A USB KEY*

Intel® RSTe Rstcli Utility

Intel® RSTe will provide support for a UEFI base command line utility that can be used in conjunction with the Legacy Option ROMs. There will be one Intel® RSTe RSTCLI utility for the AHCI controller and one for the SCU controller. The utility is accessed through UEFI bootable media (floppy drive or USB drive) and provides basic support for creating and managing RAID arrays and volumes without a dependency on the system OS being installed. (i.e. a factory environment that builds both Windows* and Linux* systems. Not all features will be supported at the launch of Intel® RSTe.)

Intel® RSTe Command Line Interface (CLI) Application and Linux* systems

Intel ® RSTe will provide support for a command line application that can run under a Windows* command prompt and/or a Windows* PE environments and. This application can be used to perform basic RAID operations (similar to the Rstcli utility) on the platforms that have or will have Intel® RSTe installed. Intel® RSTe CLI provides basic support for creating and managing RAID arrays and volumes without a dependency on the system OS being installed. (i.e. a factory environment that builds both Windows* and Linux* systems)

Intel® RSTe Graphical User Interface (Intel® RSTe GUI)

Intel® RSTe will provide support for a graphical user interface for management of RAID arrays and volumes. The Intel® RSTe GUI is used to manage RAID arrays and volumes on the devices attached to the ACHI and/or SCU controllers. It will be able to distinguish between direct attached devices and expander attached storage devices (expanders are only supported on the SCU controller.

Note: *Intel® RSTe GUI will provide RAID management functionality for up to 32 drives.*

Intel® RSTe Management Tools

Common Information Model (CIM)

Intel® RSTe will support an industry standard management API based on CIM model and Storage Management Initiative Specification (SMIS) specification. Samples of the CIM Profiles that will be included in the initial Intel® RSTe release are as follows:

- Host hardware raid controller profile
- Block services profile
- Physical asset profile
- Software inventory profile
- Generic initiator ports profile
- Direct attached target ports profile
- Job control profile
- Indication profile

Intel® RSTe will support an industry standard management API based on CIM model and Storage Management Initiative Specification (SMIS) specification (Linux).

This feature will be supported on platforms that have installed Linux, Windows* 7 and Windows* 2008R2 (64 and 32 bit).

Common Storage Management Interface (CSMI)

Intel® RSTe will support the Common Storage Management Interface (CSMI) for reporting RAID configurations and SMP, SSP, STP pass through.

Intel® RSTe System Configurations supported

This section addresses to physical components of the system configuration supported by Intel® RSTe.

SCU and AHCI Controller Support

Intel® RSTe will provide support for managing RAID volumes on drives attached to the AHCI ports.

Intel® RSTe will provide support for managing RAID volumes on drives attached to the SCU ports.

SAS Expander Support

Intel® RSTe will support expanders attached to the SCU controller (provide external HW drive and expander compatibility list). Intel® RSTe will not support the use of port multipliers on either the AHCI or SCU controller.

Pass-through drives

Intel® RSTe will support the ability to expose non-RAID configured disks (pass-through) to Host OS.

SCU Controller RAID Management Limitations

Intel® RSTe will support the RAID management of up to 32 physical drives attached to the SCU controller. Drives added beyond this limitation (up to a total of 128 drives) will be supported as pass-through drives but will not be validated as part of supported RAID array configurations. The Intel® RSTe GUI will allow up to 8 RAID volumes to be created across the 32 drives. For example, a RAID array that encompasses all 32 drives will result RAID volume limitation of up to 2 volumes (Matrix RAID allows 2 RAID volumes per RAID array).

No OS based software RAID (non-Intel® RSTe) limitations are imposed.

Hot Plug

Intel® RSTe will support the ability Hot Plug (remove and replace) disk drives on the AHCI controller whether or not I/O is being processed, provided that the capabilities are enabled in the BIOS.

Intel® RSTe will support the ability to Hot Plug (remove and replace) disk drives attached to the SCU controller whether or not I/O is being processed.

***Note**: The Hot Plug is not supported under Linux currently. Fix will be in future release.*

SCU & AHCI drive roaming

Intel® RSTe will support the ability to move RAID volumes on SATA drives between the AHCI and SCU controllers and have RAID arrays and volumes recognized, available and bootable via common metadata.

Volume Roaming between Linux* and Windows*

Intel® RSTe will support the ability to move RAID data volumes (configured appropriately) between Linux* and Windows* environments and the RAID data volumes will be recognized and available for use.

SGPIO on AHCI Controller

Intel® RSTe will support enclosure management, compliant to SFF-8485, to identify drive location or unit failures on the AHCI controller.

SGPIO on SCU

Intel® RSTe will support enclosure management, compliant to SFF-8485, to identify drive location or unit failures on the SCU.

NCQ (AHCI) and CQ (SCU) support

Intel® RSTe will support Native Command Queuing (SATA AHCI) and Command Queuing (SAS SCU).

SCSI Enclosure Service (SES) v2

Intel® RSTe will provide support management of enclosures that are compliant with SES (SCSI Enclosure Services) v2 attached to the SCU controller. Intel® RSTe will also support in-band management to SES compliant expanders attached to the SCU.

***Note**: SES is not supported under windows.*

Software RAID Functional Support

This section will focus on RAID specific features unless the particular requirement specifies differently.

Matrix RAID

Intel® RSTe will support up to two logical RAID volumes on the same array. A RAID array simply refers to the set of disk drives that can be formed into a RAID volume.

RAID 0/1/5/10 Volumes

Intel® RSTe will support base level RAID volumes on both drives connected to the AHCI or SCU controllers. RAID volume spanning across the AHCI and SCU controllers is not supported. SAS RAID 5 is not supported on SCU controller.

Simultaneous RAID Arrays

Intel® RSTe will provide support for RAID volume management on disks attached to the SCU controller separate from disks attached to the AHCI controller. However, Intel® RSTe will provide support for simultaneous RAID management on both.

Disk Coercion

Intel® RSTe will provide support for Disk Coercion. When a RAID volume is created, this feature will analyze the physical disks and will automatically adjust (round down) the capacity of the disk(s) to 97% of the smallest physical disk. This allows for the variances in the physical disk capacities from different vendors.

Hot Spare Disk

Intel® RSTe will support the ability to set a drive as a hot spare that would automatically be used to rebuild a failed or degraded RAID volume without any user interaction. This applies to both the AHCI and SCU controllers.

Auto Rebuild on Hot Insert

Intel® RSTe will support the ability to initiate an automatic RAID rebuild when a physical disk of the appropriate size is hot inserted into the same directly attached port that the failed drive was removed from. When configured appropriately, if a RAID volume issue occurs (failure, degradation, or SMART event) and the questionable drive is hot removed, if a drive of the appropriate size (new or and from an off-line RAID volume) is hot inserted into that same port, the volume will be rebuilt on the inserted drive.

Manually Invoked Rebuild

Intel® RSTe will provide a manual method to initiate a RAID volume rebuild if a hot spare has not been configured or is not available.

RAID SMART Support

Intel® RSTe will provide support for SMART Alerts for SAS and SATA disks. A SMART drive event response alert on failure will initiate rebuild to hot spare disk.

RAID-Ready Mode

A RAID-Ready system refers to a system that has been configured to support Intel® RSTe. The system BIOS has the appropriate pre-boot drivers and has been configured for RAID mode. RAID mode can be either:

- The system is configured to boot off the AHCI controller and it is in RAID mode
- The system is configured to boot off the SCU controller

Intel® RSTe will support an Intel® C600 series chipset based platform configured in RAID-Ready mode.

RAID Volume Creation with Data Preservation

Intel® RSTe will support the ability to preserve the data from one of the disks used for the volume creation. A non-RAID disk can be migrated to a RAID volume while retaining the existing data on that disk.

Note: When creating a system boot volume, the maximum stripe size supported is 128K.

In a RAID-Ready configuration, the user can take their single system drive and turn it into a supported RAID volume by using the Intel® RSTe GUI application. This process does not require the reinstallation of the operating system. All applications and data will remain intact.

The following are examples of RAID level creations that will be supported by Intel® RSTe:

- Individual pass-through to 2 16 drives for RAID 0
- Individual pass-through to 2 drive RAID 1
- Individual pass-through to 4 drive RAID 10
- Individual pass-through to 3 to 6 drive RAID 5

Instant Initialization

Intel® RSTe allows a newly created volume to be used immediately (no reboot required), protecting newly written data and creating parity data concurrently.

For a RAID 5 configuration that consists of 3 or 4 drives, the RAID volume will be shown as normal as soon as the volume is created. Parity will be computed and written with every RAID 5 write activity. For a RAID 5 configuration that consists of 5 or more drives, the parity initialization will begin as soon as the volume is created. This is done to improve the operational performance of RAID 5 volumes.

RAID Level Migrations

The RAID level migration feature in Intel® RSTe product enables and provides the ability to convert the contents of a drive (attached to the AHCI or SCU controller) into a RAID volume (RAID 0, RAID 1, RAID 5, or RAID 10). The RAID level migration feature also supports the ability to migrate from a one RAID volume to another.

The size of the hard drives determines how much time is required to complete the migration but the system will remain fully functional during the migration process. The only limitation is that some disk-intensive tasks may have slower performance during a RAID migration.

NOTE: Single volume per array only. This is dependent on required capacity and implicit array expansion.

The following are some examples of RAID level migrations supported by Intel® RSTe:

• N-drive RAID 0 to N+1 – 32 drive RAID 5 (where N can be 2 to 31)

• 2-drive RAID 1 to 3 - 32 drive RAID 5

• 4-drive RAID 10 to 4 - 32 drive RAID 5

RAID Reconfiguration (Stripe size)

Intel® RSTe will provide the ability to change stripe size on existing volumes (migration required). Intel® RSTe will support a stripe size migration in conjunction with a RAID level migration.

Note: Migration supports stripe sizes for the respective RAID levels supported. Stripe Size Support for (values are in Kilobytes):

• RAID 0 volumes – 4, 8, 16, 32, 64, 128, 256, 512, 1024

• RAID 10 volumes - 4, 8, 16, 32, 64, 128, 256, 512, 1024

• RAID 5 volumes - 4, 8, 16, 32, 64, 128, 256, 512, 1024

Expanded Stripe Size

Intel® RSTe will support the ability to expand the RAID volume stripe size for the following RAID volumes (values are in Kilobytes):

• RAID 0 volumes – 256, 512, 1024

• RAID 10 volumes – 256, 512, 1024

• RAID 5 volumes – 256, 512, 1024

Online Array / Volume Capacity Expansion

Intel® RSTe will provide the ability to add new drives to an existing array and expand existing volumes accordingly. This is supported only under RAID 0 and RAID 5.

Read Patrol

Intel® RSTe will provide support for Read Patrol, which checks the RAID volumes for errors that could result in a failure. The checks are done periodically in background and will verify all sectors of all RAID volumes that are connected to either the AHCI or SCU controllers. If an issue is discovered an attempt at corrective action is taken. Read Patrol can be enabled or disabled

manually. The background process begins when there is no I/O to the RAID volume, though it can continue to run while I/O's are being processed.

Verify and Repair

Intel® RSTe will provide support for Verify and Repair.

The RAID volume data verification process identifies any inconsistencies or bad data on a RAID 0, RAID 1, RAID 5, or RAID 10 volume.

The RAID volume data verification and repair process identifies and repairs any inconsistencies or bad data on a RAID 1, RAID 5, or RAID 10 volume.

The following describes what occurs for each RAID level:

Table 1. Verify and Repair

RAID Level	Verify	Verify & Repair
RAID 0	Bad blocks are identified	N/A
RAID 1	Bad blocks are identified	Bad blocks are reassigned
	Data on the mirror drive is compared to data on the source drive.	If the data on the mirror drive does not match the data on the source drive, the data on the mirror is overwritten with the data on the source.
RAID 5	Bad blocks are identified	Bad blocks are reassigned
	Parity is recalculated and compared to the stored parity for that stripe.	If the newly calculated parity does not match the stored parity, the stored parity is overwritten with the newly calculated parity.
RAID 10	Bad blocks are identified	Bad blocks are reassigned
	Data on the mirror is compared to data on the source.	If the data on the mirror does not match the data on the source, the data on the mirror is overwritten with the data on the source.

Check Pointing

Intel® RSTe will provide the ability to perform Check Pointing to be able to track forward progress on read patrol, array rebuilds and volume migration if interrupts occur. After resuming, the operation will restart from the last valid stage reached.

Bad Block Management

Intel® RSTe will provide support for Bad Block Management.

In the course of rebuilding a degraded RAID volume, where one of the member disks has failed or been removed, and is being replaced by a 'spare' drive, the redundant contents of the other drive(s) are read and then used to reconstruct data to be written to the spare drive. In case a read failure occurs sometime during this rebuild process, the data to be written to the spare will not be available and therefore lost. In this scenario, rather than mark the entire RAID volume as failed, we can mark only those sectors on the spare that are known to have indeterminate data, in a log of such bad sectors. This bad block management log can be used to reflect error status whenever any attempts are made to access those sectors of the spare.

Dirty Stripe Journaling

Intel® RSTe will provide support for Dirty Stripe Journaling (DSJ). DSJ is used to help speed up RAID 5 write power loss recovery by storing the write stripes that were in progress at the time of the failure. The DSJ allows rapid recovery without having to rebuild the entire volume. The DSJ is only utilized when disk write cache is DISABLED.

Partial Parity Logging (PPL)

Intel® RSTe will provide support for Partial Parity Logging (PPL). PPL is used to record the results of XORing old data with old parity. PPL is currently saved as part of the RAID member information and is only utilized when writing RAID 5 parity. It helps protect against data loss when a power failure or a system crash occurs by allowing data to be rebuilt by utilizing the PPL information.

OS Installation

Intel® RSTe will provide the OS appropriate RSTe driver files required for installation during the OS setup onto a drive or RAID volume attached to either the AHCI or SCU controllers.

Selectable Boot Volume

Intel® RST 3.0 will support the ability to select any volume as the OS boot volume. The OS installer will be able to install the operating system onto RAID volume. There will be no need for RAID management (e.g. volume creation/deletion) support from within OS installer.

Auto Rebuild

Intel® RSTe will provide support for the ability to automatically rebuild a failed or degraded RAID volume. This feature will begin when a member disk of the array has failed and a suitable replacement disk with sufficient capacity is available. As soon as the failure occurs the rebuild process will begin automatically, using the marked Hot Spare disk, without user intervention.

If a marked Hot Spare disk is not present, the automatic rebuild process will begin under the following conditions:

• Another free disk is plugged into the same directly attached physical location as the failed drive

• The newly inserted disk size is at least as large as the amount of space used per disk in the current array

• The newly inserted disk must be the same type (SAS/SATA) as the disk being replaced or the rebuild will not start.

• If the newly inserted disk contains Intel® RSTe (or Intel® RST) metadata with current status of member being offline or contains no Intel® RSTe (or Intel® RST) metadata.

• The newly inserted disk has not reported a SMART event.

The following table summarizes the functionality:

Table 2. Auto Rebuild

Controller	Auto Rebuild Support	Action
AHCI & SCU	Previously marked Hot Spare available.	Rebuild starts when spare found. This takes precedence over auto-spare disk.
AHCI	No Hot Spare previously marked	No auto rebuild: Manual steps required to rebuild array using new disk
SCU	Auto rebuild conditions described above are met.	Auto rebuild starts without any user intervention
SCU	One or more of the above conditions was not met.	No auto rebuild: Manual steps required to rebuild array using new disk

Automatic rebuild support will default to OFF for Intel® RSTe and can be enabled through the Intel® RSTe GUI.

Error Threshold Monitoring/Handling

Intel® RSTe will support the ability to initiate an automatic RAID rebuild to a marked hot spare drive in the event of a drive SMART event alert that indicates a failure. (Windows*Only)

Unified Extensible Firmware Interface (UEFI)

Intel® RSTe will support UEFI for the SCU and AHCI controllers using common metadata.

Disk Write Cache

Intel® RSTe will support the ability to enable/disable Disk Write Cache through the Intel® RSTe GUI. Disk Data Cache will be disabled by default.

RAID Volume Read Cache

Intel® RSTe will support the ability to enable/disable RAID Volume Read Cache through the Intel® RSTe GUI. RAID Volume Read Cache will be enabled by default.

Write Back Cache

Intel® RSTe will support the ability to enable/disable Write Back Cache through the Intel® RSTe GUI. Write Back Cache will be disabled by default.

Volume Cache Increase

Intel® RSTe will increase the volume cache size to 16MB for SCU volumes and 16MB for AHCI volumes.

RAID Volume Size

Intel® RSTe will provide support for RAID volumes that are larger than 2 Terabytes.

RAID Boot Volume Size

Intel® RSTe will provide support for RAID Boot volumes that are larger than 2 Terabytes.

Disk Monitor Service

Intel® RSTe will support the ability to provide a disk monitoring service. The service will be active by default and executed as a system service. The service will monitor the system for SMART and RAID volume state changes events. The changes will be logged in the system log.

Failed Drive Reinsertion

Intel® RSTe will support the ability to recognize a failed drive re-inserted into the array. If able, Intel® RSTe will attempt to rebuild the volume to that drive. If not able, Intel® RSTe will mark the drive accordingly in the GUI.

Drives Supported

Intel® RSTe will provide support for current production SATA drives from “any” manufacturer on the AHCI controller. SAS and SATA drives supported on the SCU controller are outlined in Appendix C (Hardware Compatibility List). There will also be support for drives that are larger than 2 Terabytes as well as drives that support 4KB physical (512B logical) sectors.

Safe Mode Support

Intel® RSTe will provide support for booting into Safe Mode for all supported OSs.

Non-Intel Controller Support

Intel® RSTe will not hinder, break or prevent operation of non-Intel® Controllers (SATA, PATA, SATA or RAID).

Device Configuration

Intel® RSTe will support the ability, at initialization, to read the system registry to get configuration setting in order to set the appropriate operational parameters.

Power Management

The Intel® RSTe product will support all the necessary power management functions required by the OSs.

Staggered Spin-up

Intel® RSTe will provide support for staggered spin-up on the SCU controller for those hard drives that support this feature.

Exporting SATA Drives on AHCI Controller

Intel® RSTe RAID Legacy Option ROMs will export those drives directly attached on a port order basis. This will be for both the AHCI controller.

ATAPI

Intel® RSTe will provide support for ATAPI devices. Intel® RSTe RAID Legacy Option ROM will only support HDD devices (not ATAPI).

Solid State Drives (SSD)

Intel® RSTe will support SSDs as if they are Hard Disk Drives.

AHCI Controller

Intel® RSTe will support TRIM on the AHCI controller in a non-RAID configurations.

SCU Controller

Intel® RSTe will support TRIM on the SCU controller in a non-RAID configurations.

Email Alerting and Notification

Note: *This feature has a platform specific limitation. It is supported only on Intel® C600 series chipset based platforms; not supported on legacy platforms/chipsets.*

Intel® RSTe will support email notification of certain storage events (see Appendix A for supported events). The Intel® RSTe 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 Intel® RSTe monitor service.

Configuration

The Intel® RSTe user application will 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:

SMTP host (required) - Port (required) - Return email address (required) - 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

Email Message Format

• Message header:

 Item1. Return email address: email address of the originating computer

 Item2. Recipient email address: email address of computer receiving the email notification

 Item3. Subject: system formatted subject content with product name, the storage system event level and the hostname of the originating computer

• Message body:

 Item4. Log file text: contains the text of the event as it is displayed in the event log

 Item5. System report: contains the system configuration information of the originating computer as seen in the Intel® RSTe GUI Preferences page.

• Optional text:

 Item6. This section is blank unless the originating computer's OS is in a language other than English. If the originating computer sends items 4 and 5 in non-English, the English translation of those two items will appear in this section (for test emails, only item 4 will be translated here)

Protocol Support

Email alert shall support SMTP host & SMTP port.

Error Conditions

See Appendix A for list of supported storage events and their notification mechanism:

• In the event of an SMTP server failure, the system will immediately attempt 3 retries. If the retries are unsuccessful, the system will discard the message without further attempts. The unsuccessful attempt will be written to the NT Event log.

• In the event of an improperly formatted email address in the "To' field, the alert will fail and the failure will be written to the NT Event log.

• In the event of an improperly formatted email address in the "From" field, the alert will fail and the failure written to the NT Event log.

• If the SMTP name entered during configuration is an invalid format, the alert will fail and the failure written to the NT Event log.

Utilities

Install/Uninstall Utility

Intel® RSTe will be available through the use of an install package. The install package will automatically install the proper RSTe driver and GUI that corresponds to the OS being installed on. There will also be a mechanism available to uninstall the driver and GUI.

NOTE: Great care must be taken when trying to perform the uninstall process. Removal of the driver could result in a system crash that could require a complete reinstallation of the operating system.

3 RAID OpROM Utility

This section provides an introduction to the Intel® RSTe OpROM Utility.

Enter Intel® RSTe OpROM Utility

To use Intel® RSTe, firstly ensure that the Intel® Server Board has RSTe enabled in its BIOS SETUP. To enable it, press F2 during server board POST, so as to enter BIOS SETUP. Go to Advanced – Mass Storage Controller Configuration – SATA/SAS Capable Controller, and choose INTEL(R) RSTe.

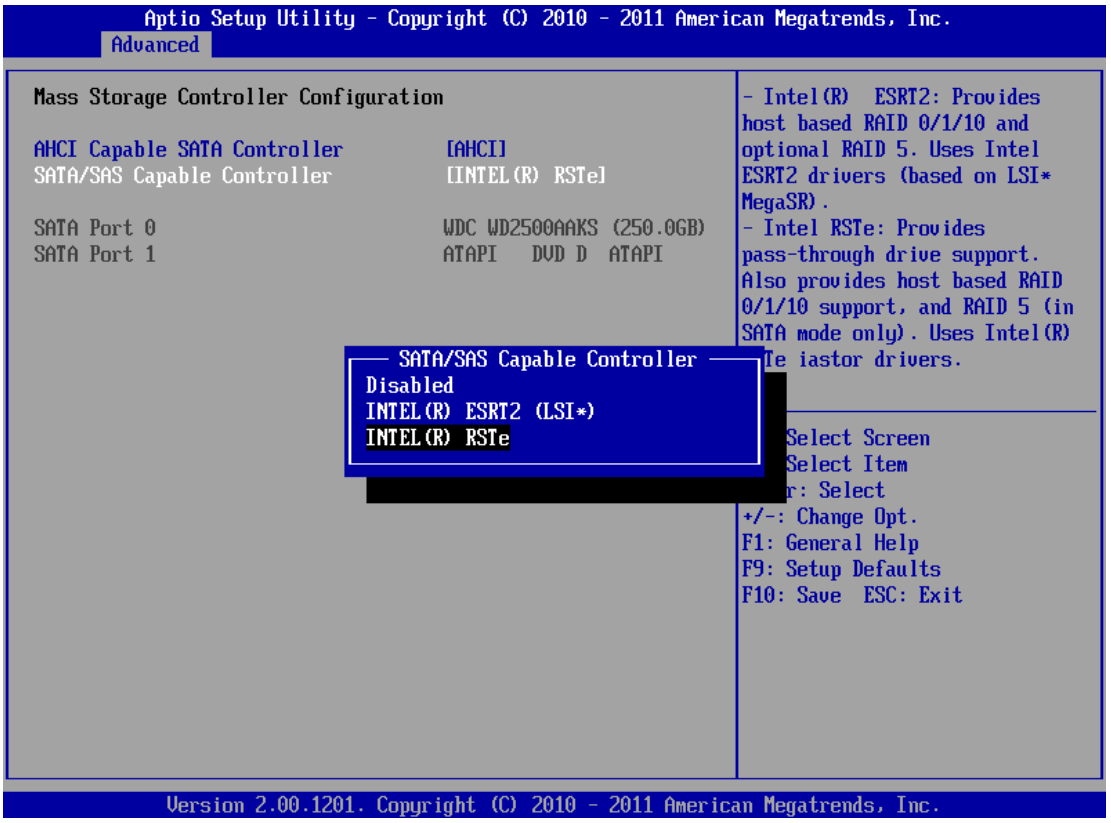


Figure 1. Enable RSTe

Note: *For Intel® Server Boards, it's recommended to disable Quiet Boot in Main Tab in BIOS SETUP, so as to automatically show Intel® RSTe scanning process during POST. If Quiet Boot is enabled, remember to press ESC at the beginning of each reboot to show Intel® RSTe scanning process during POST.*

During the POST, When seeing below screen indicating "Press <CTRL – I> to enter Configuration Utility", press Ctrl – I to enter the Intel® RSTe Configuration Utility.

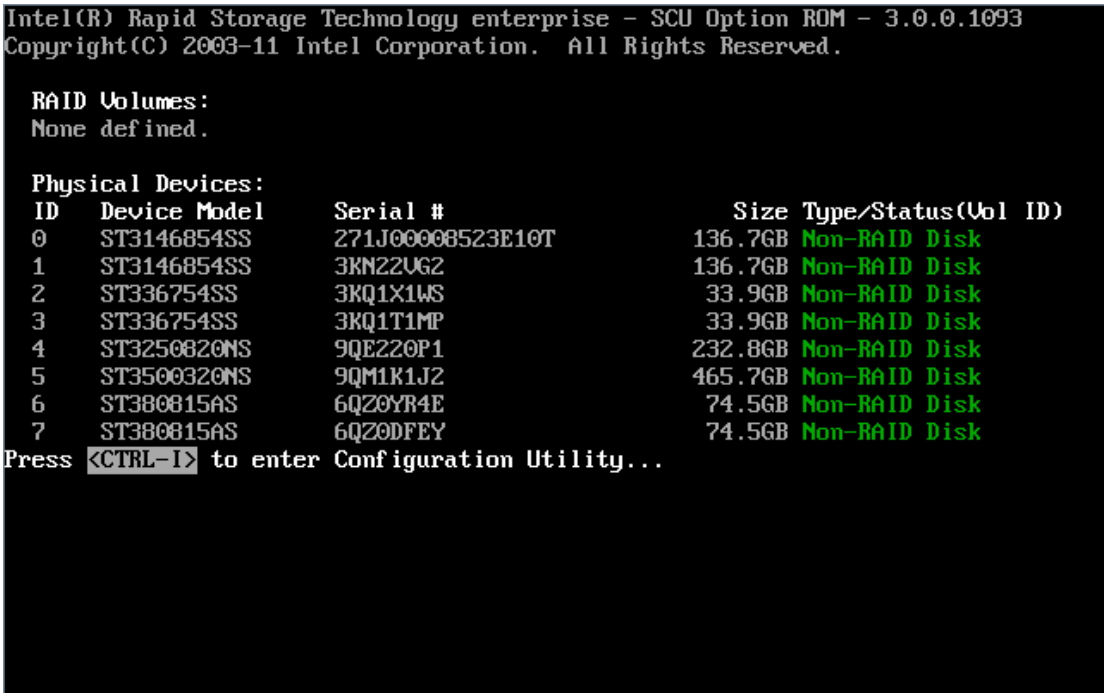


Figure 2. Post Screen

Inside the Intel® RSTe Configuration Utility, use Up and Down arrow keys to select and option among 1. Create RAID Volume, 2. Delete RAID Volume, 3. Reset Disks to Non-RAID, 4. Recovery Volume Options, 5. Exit. Use ESC key to exit. Use Enter key to enter the selected menu.

Note: *The functional keys on the keyboard are also indicated at the bottom of the screen. Always follow the hints from bottom of the screen whenever you don't know which keys to press to make progress.*

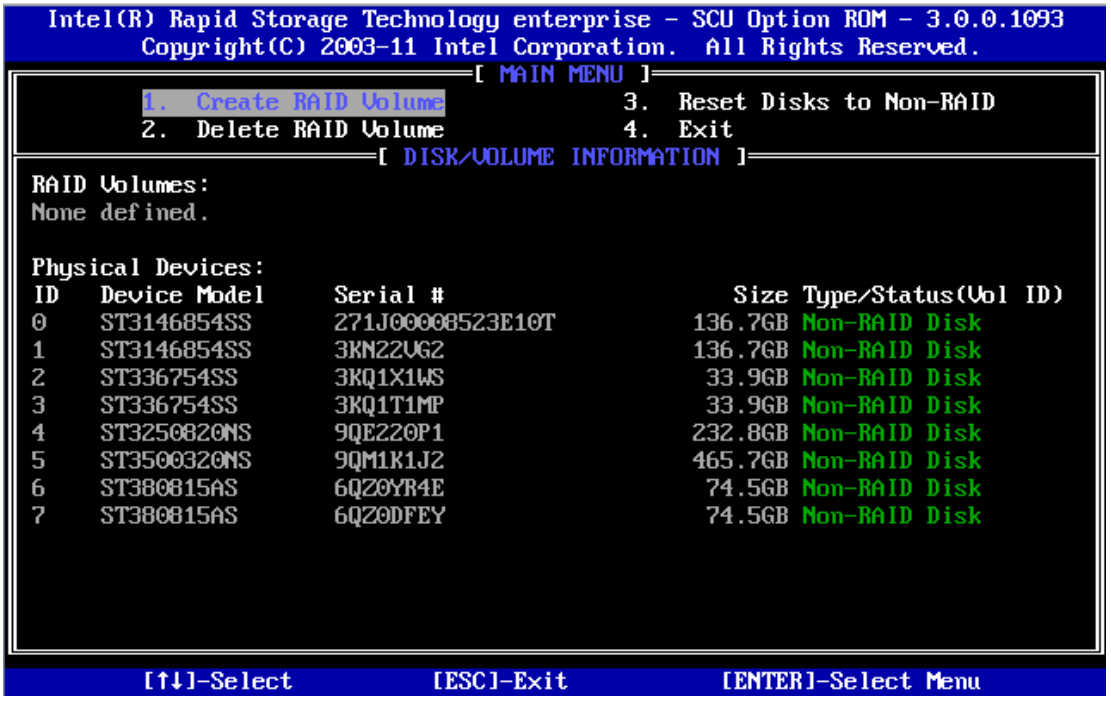


Figure 3. Intel® RSTe Configuration Utility

Create RAID Volume

Choose 1. Create RAID Volume and press Enter key, to enter the Create Volume Menu. To create a RAID volume, you can use default name (Volume0) or type in a customized name of the volume. Follow the HELP text on the screen to get more detailed introduction of this function.

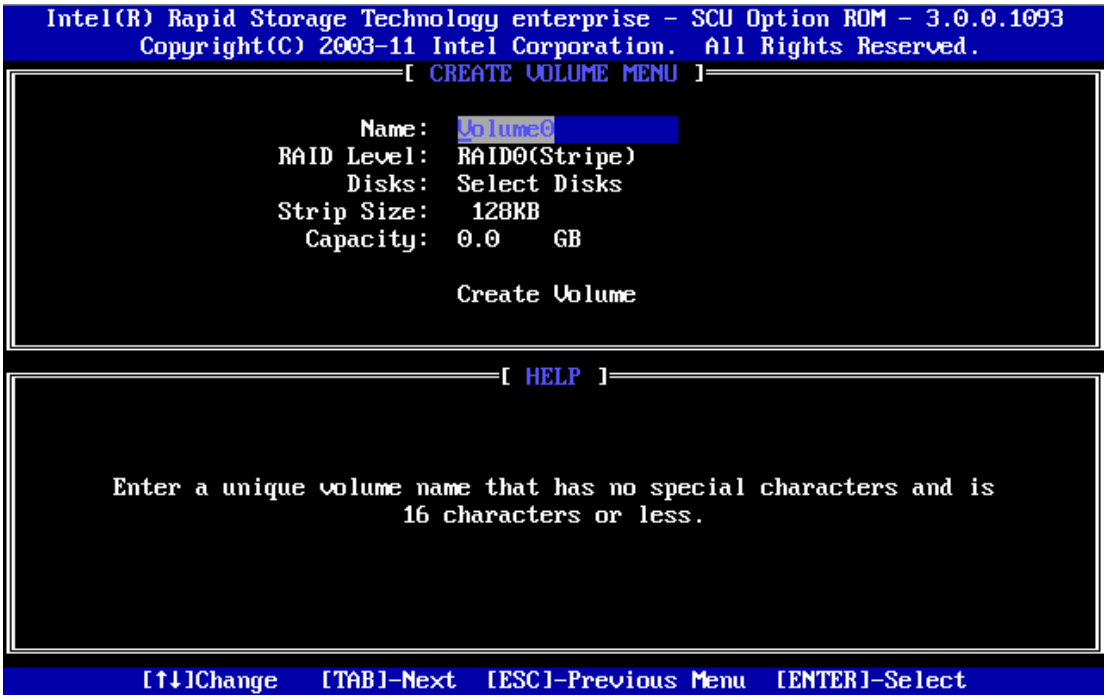


Figure 4. Create RAID Volume 1

After inputting a volume name, press Tab key (or Enter key) to go to the next setting – RAID Level. Use Up and Down arrow keys to change the RAID Level among RAID0(Stripe), RAID1(Mirror), RAID10(RAID0+1), and RAID5(Parity). Refer to the HELP text to get more details.

Note: *Recovery mode is to define one Master Disk to store data and one Recovery Disk to backup the data. The Recovery setup will be introduced in the following text.*

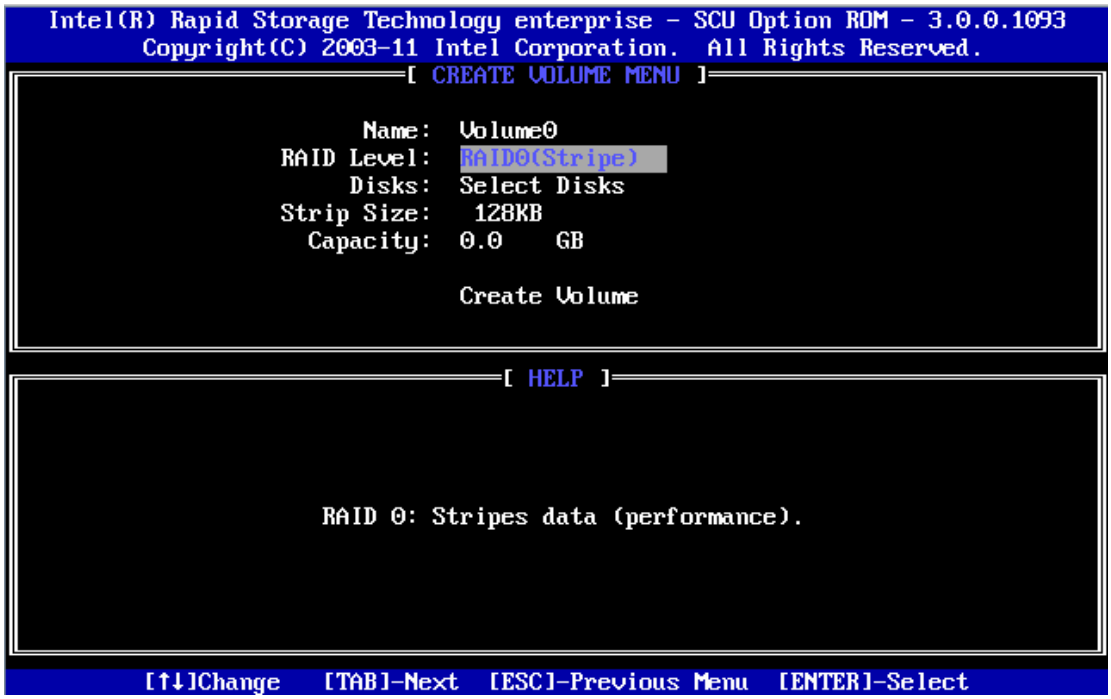


Figure 5. Create RAID Volume 2

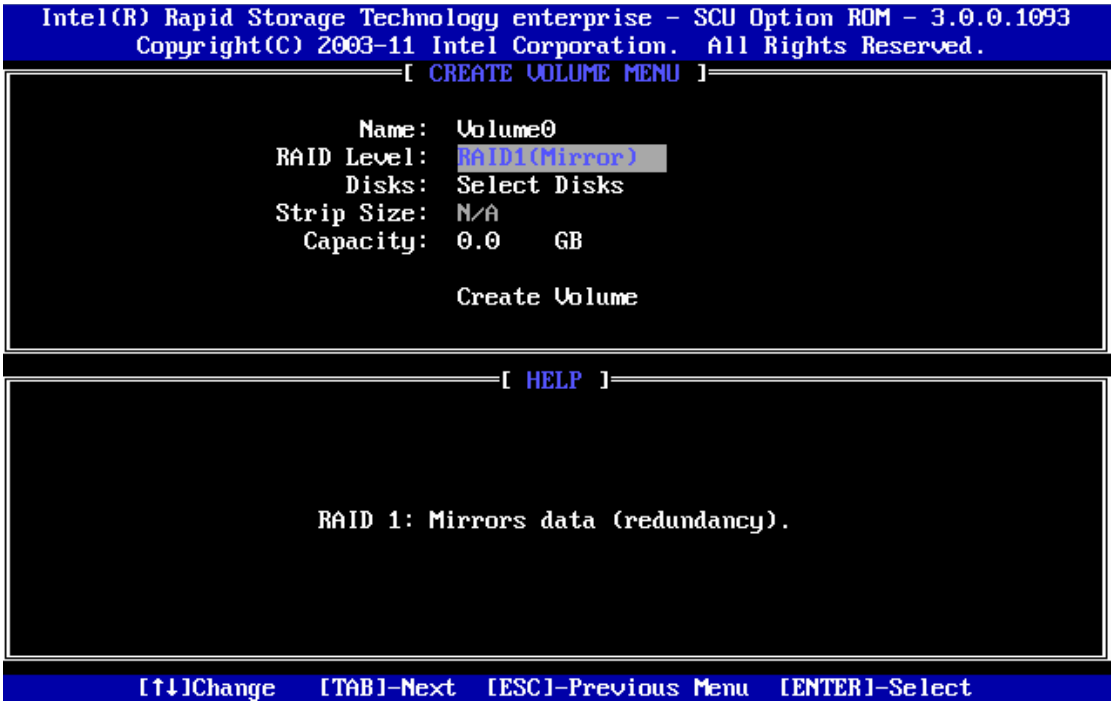


Figure 6. Create RAID Volume 3

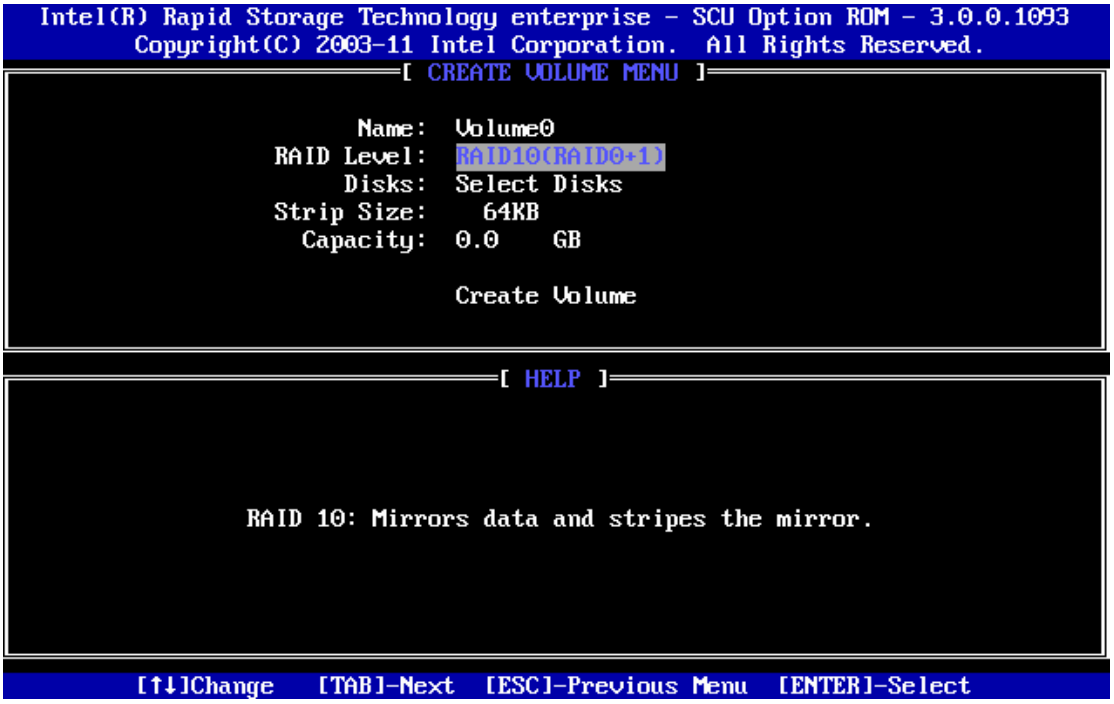


Figure 7. Create RAID Volume 4

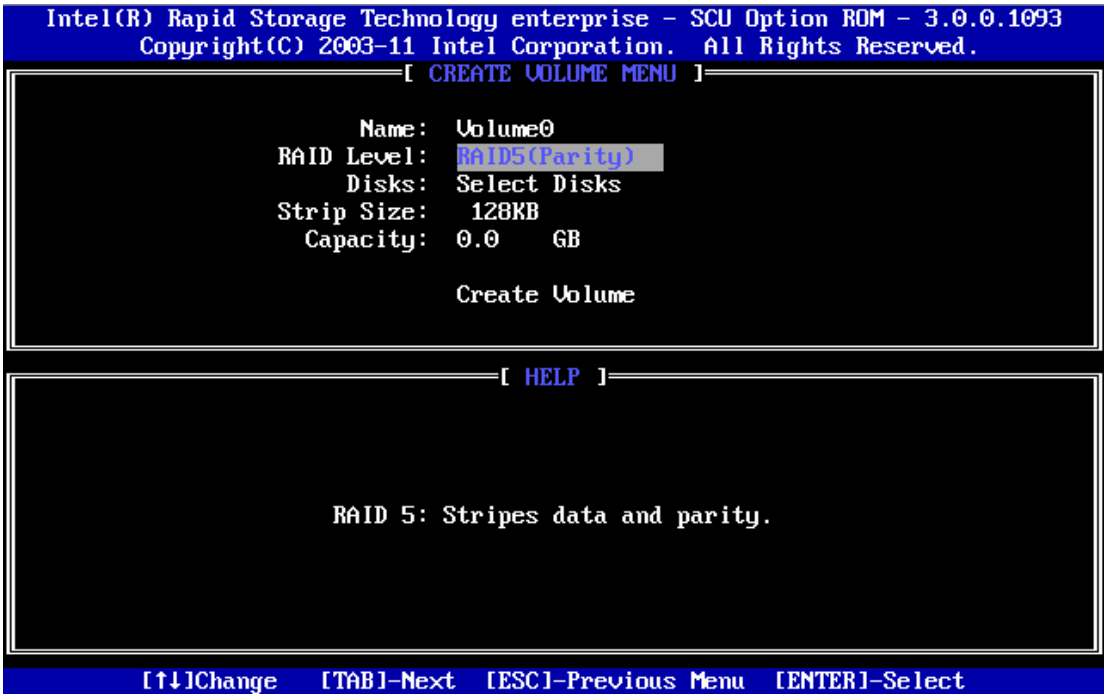


Figure 8. Create RAID Volume 5

After the choice, press Tab key (or Enter key) to go to the next setting – Disks.

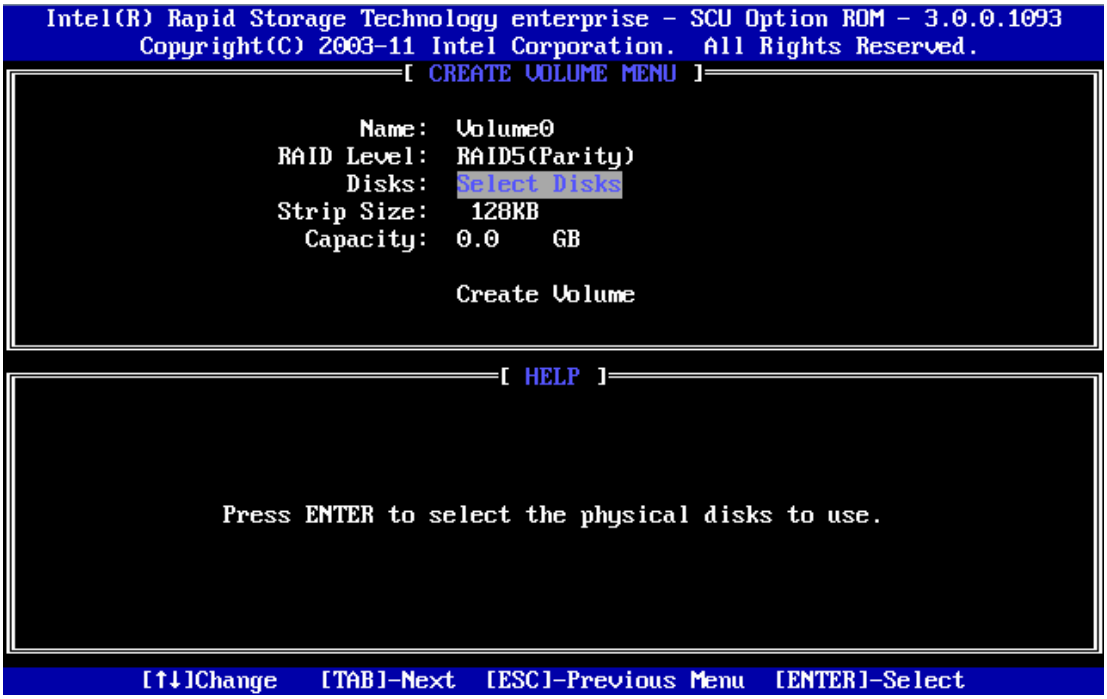


Figure 9. Create RAID Volume 6

Press Enter key to enter the Select Disks Menu. Follow the hints at bottom of the pop-up menu to select disks. In this example, RAID Level is set as RAID5(Parity), so that 3 or more disks need to be selected. The selected disks will have a green mark on the left side of their Port numbers. After the choices, press Enter key and follow the text on screen to finish this step.

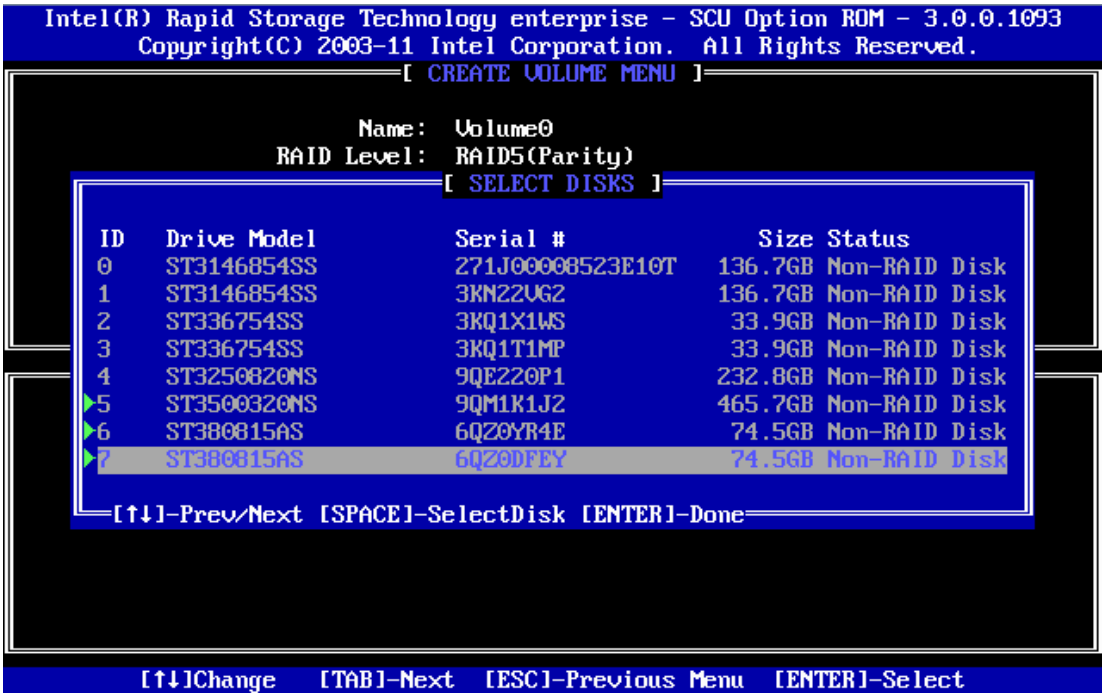


Figure 10. Create RAID Volume 7

In the Strip Size option, use Up and Down arrow keys to select the wanted stripe size. If you don't know which value to choose, follow the suggestion in the HELP text to set the value.

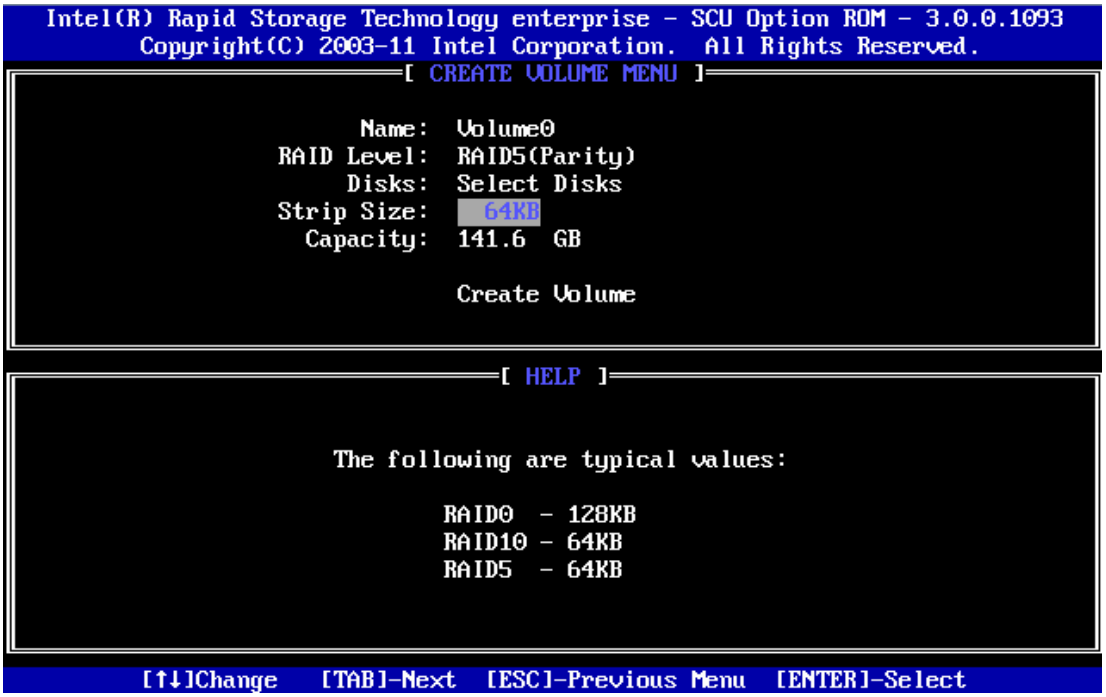


Figure 11. Create RAID Volume 8

In the Capacity option, either accept the default value, which is the largest possible volume, or type in a number as the volume size.

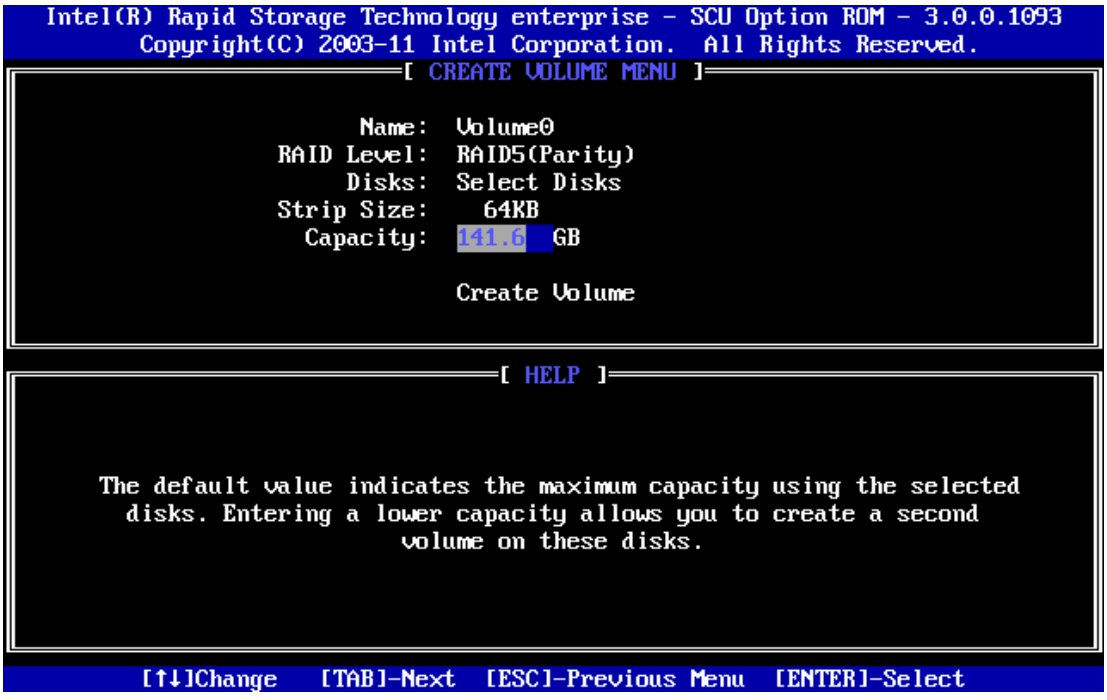


Figure 12. Create RAID Volume 9

In the Create Volume Option, when confirmed, press Enter key to create the RAID volume. A warning message will pop up on screen. Confirm if previous data is no longer needed, and press Y to go on creating the new RAID volume, or press N to cancel the creation.

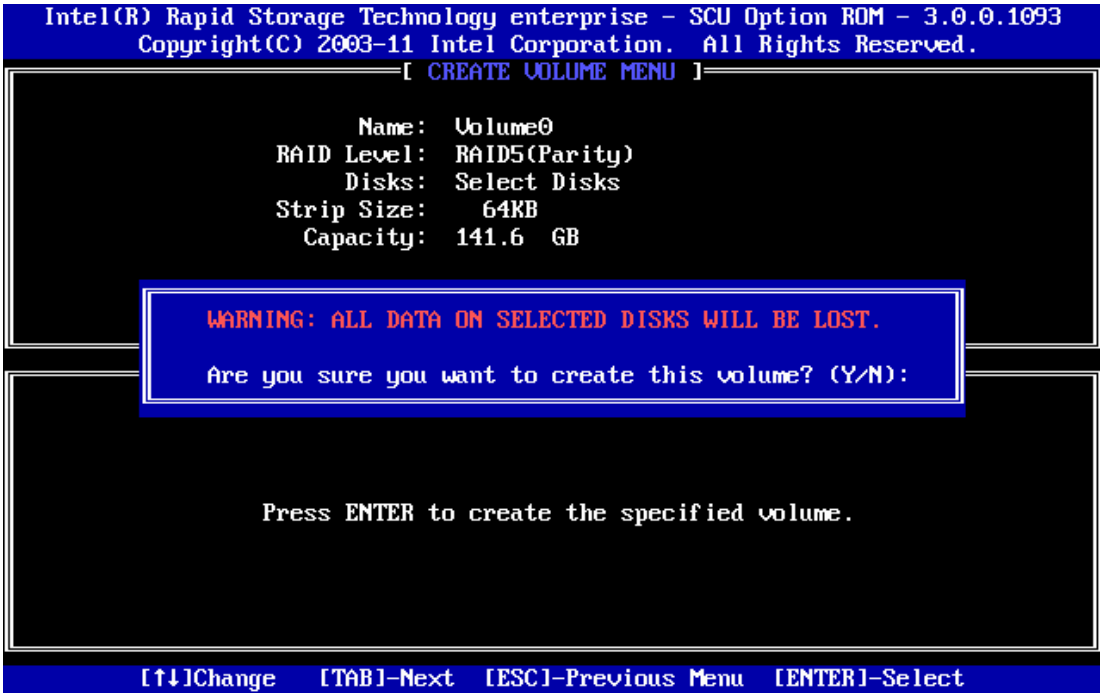


Figure 13. Create RAID Volume 10

After the RAID volume is created, the Disk/Volume information is displayed in middle of the main menu, listing the key information such as ID number, Name, RAID level, strip size, volume size, status and whether this is a bootable volume.

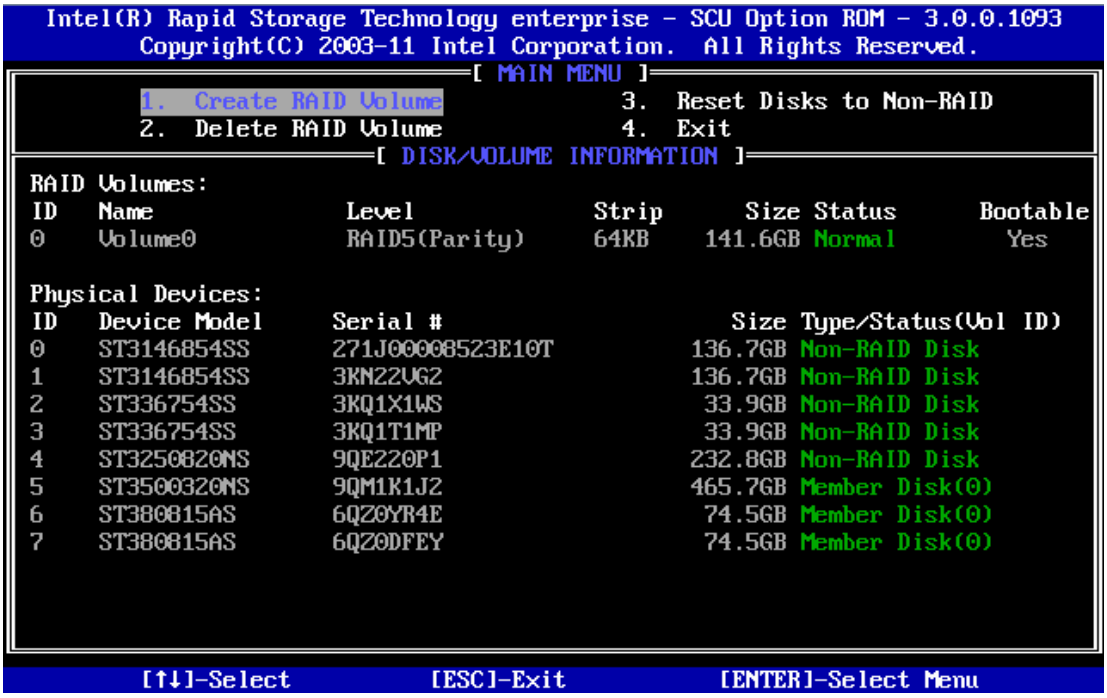


Figure 14. Create RAID Volume 11

Delete RAID Volume

For any RAID volume that is no longer needed, choose 2. Delete RAID Volume and press Enter key to enter the Delete Volume Menu, in order to remove the volume from the Intel® RSTe.

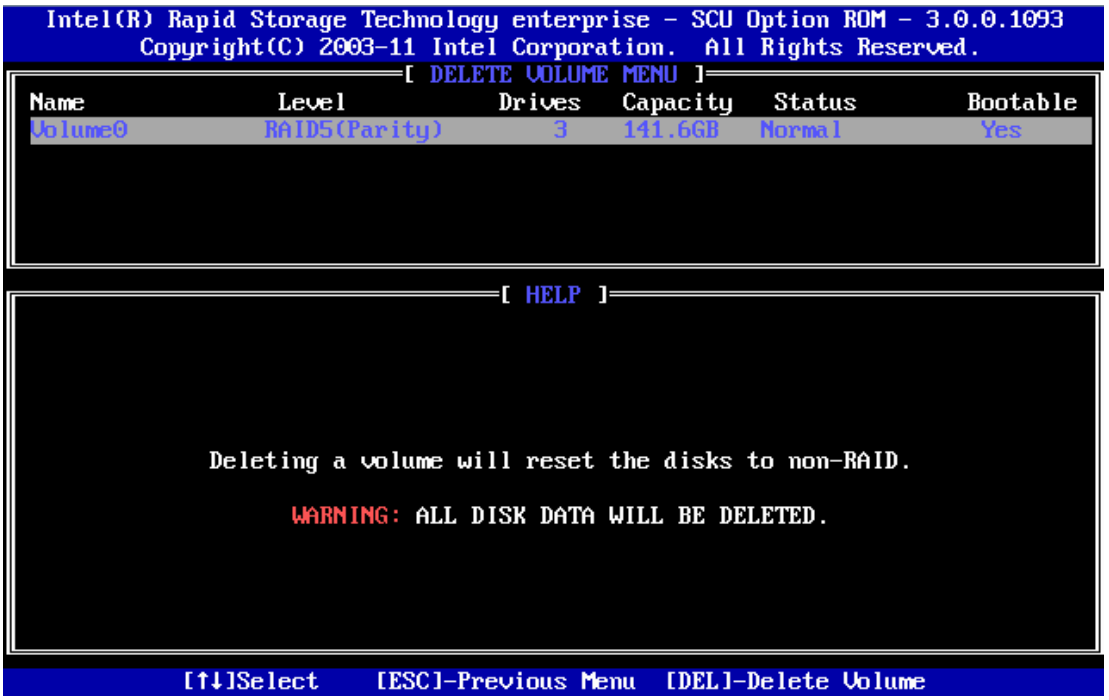


Figure 15. Delete RAID Volume 1

Use Up and Down arrow keys to select the RAID volume that is no longer needed. Press DEL key to delete the volume. A warning message will pop up on screen.

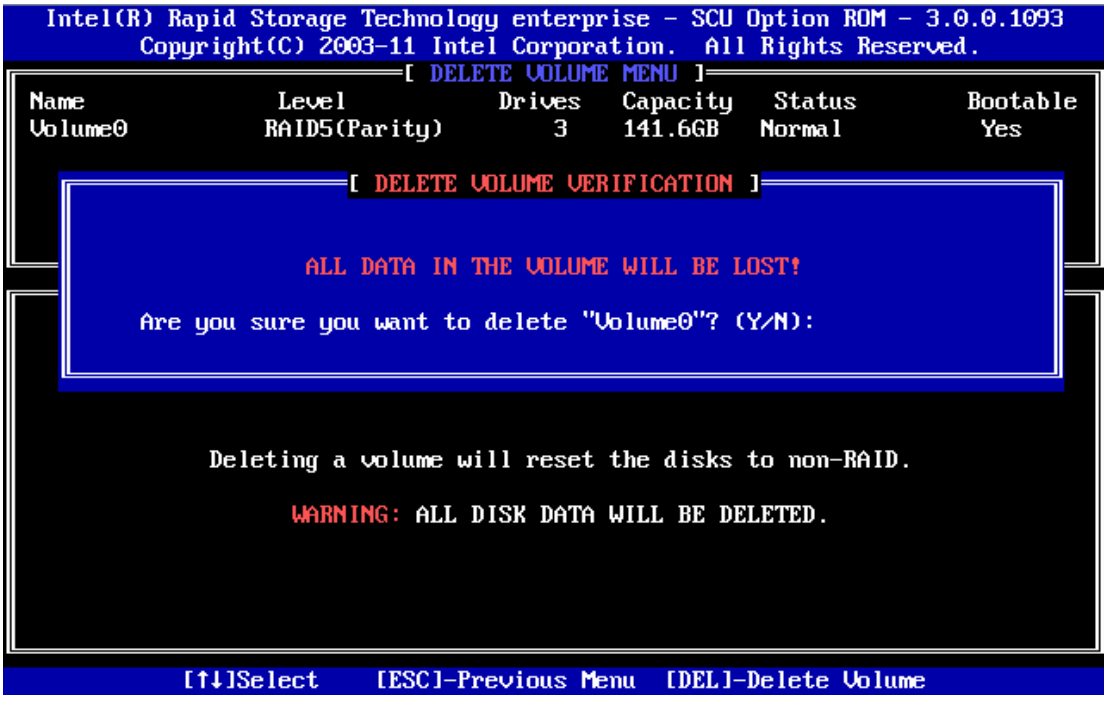


Figure 16. Delete RAID Volume 2

Double confirm if data on the volume can be deleted. Press Y to go on deleting the RAID volume, or press N to cancel the deletion.

Reset Disks to Non-RAID

This feature is used when specific disk needs to be set back to non-RAID mode. For example, in a RAID5 volume, if one disk is set to non-RAID mode, this disk can work in pass-through (non RAID) mode, or join in the configuration of another RAID volume. The RAID5 volume will be in degraded mode due to loss of this disk, and can be rebuilt if another disk joins this RAID5 volume. This feature is useful when specific drive needs to be replaced by another one.

In the Main Menu, choose 3. Reset Disks to Non-RAID and press Enter key to enter the Reset Disk Data option.

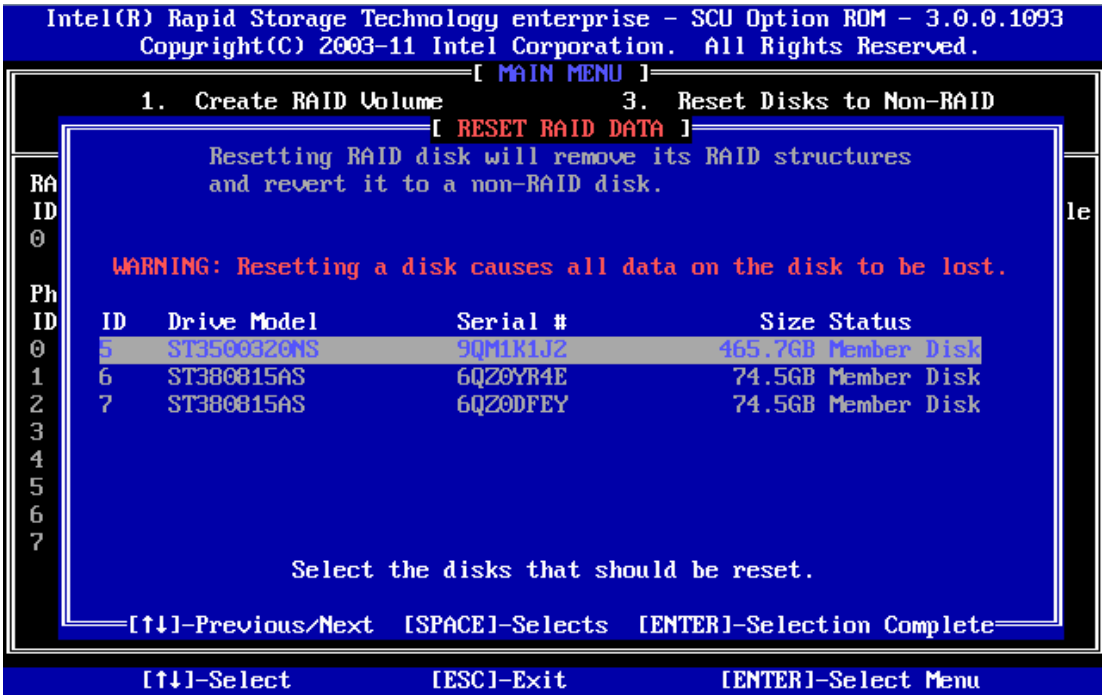


Figure 17. Reset Disks to Non-RAID 1

Use Up and Down arrow keys to select the target disk, and press Space key to mark the disk with a green mark on left side of its Port number. Press Enter key to reset this disk. A question will pop up at lower side of the screen.

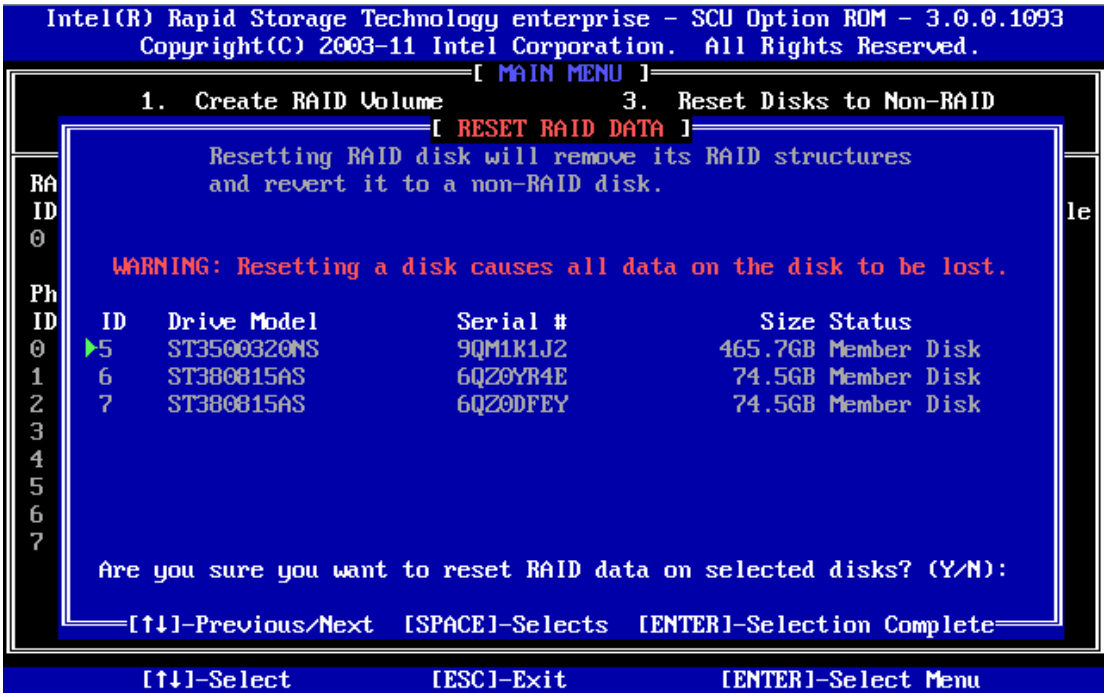


Figure 18. Reset Disks to Non-RAID 2

When confirmed, press Y to go on resetting this disk to Non-RAID mode. After this, if system detects both a “Degrade” volume and disk available for rebuilding, a Degraded Volume Detected window will pop up, asking for selecting a disk to initiate a rebuild.

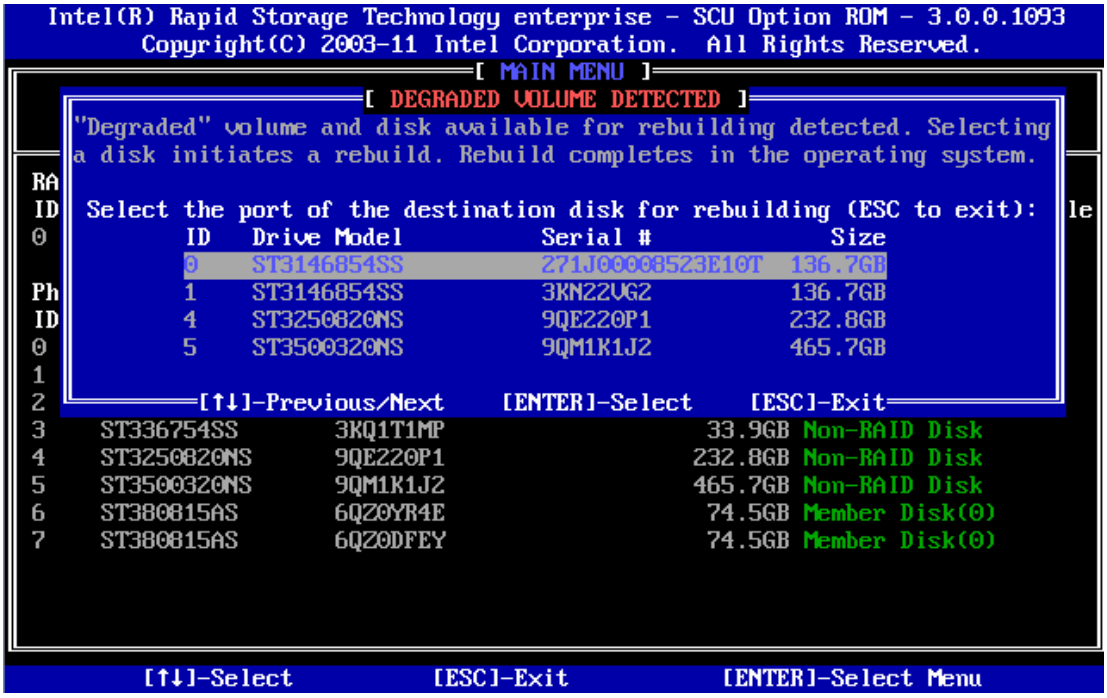


Figure 19. Reset Disks to Non-RAID 3

Choose an available disk and press Enter key to initiate the rebuild, or press ESC key to cancel a rebuild and leave the RAID volume in degrade status. Below screenshots show the RAID volume in rebuild status or in degraded status.

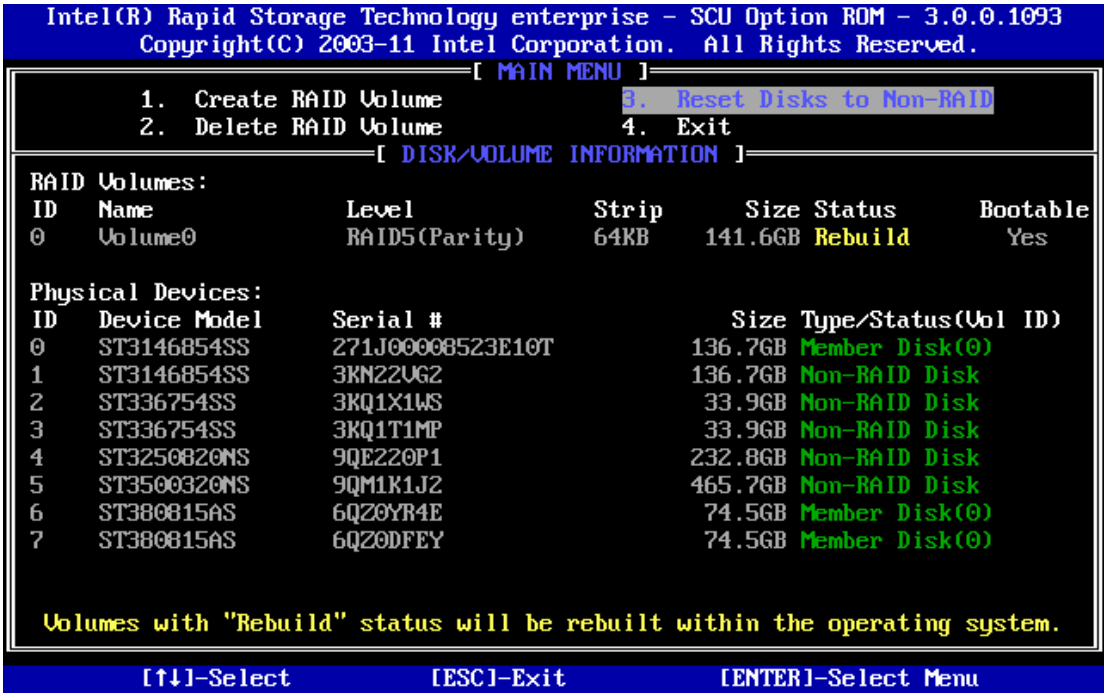


Figure 20. Reset Disks to Non-RAID 4

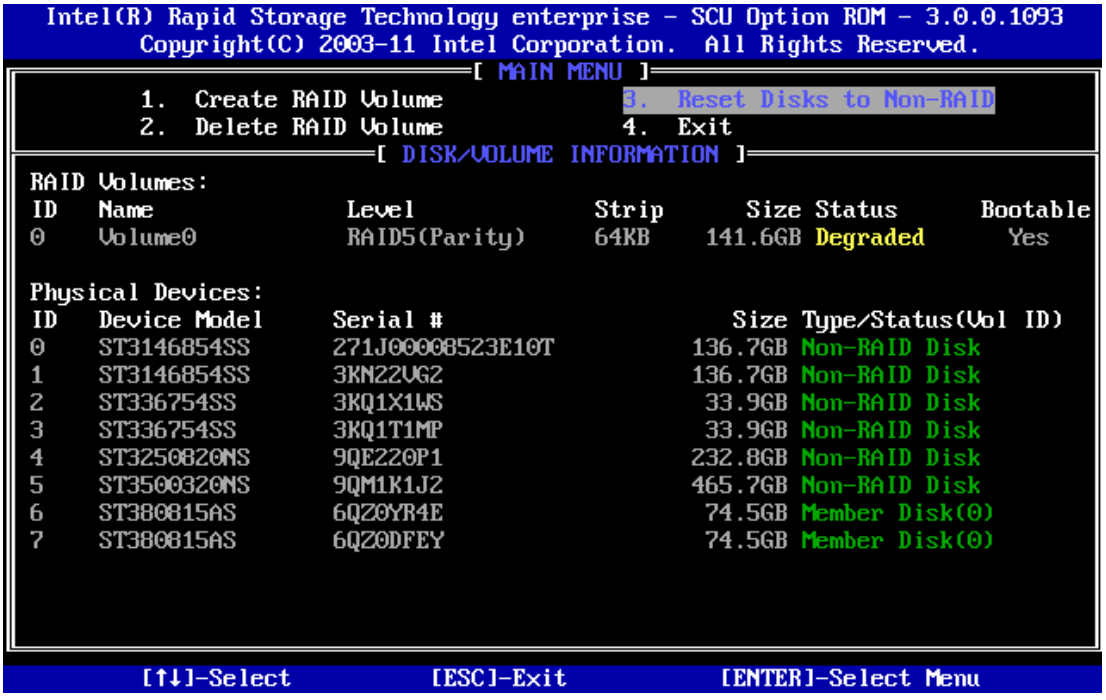


Figure 21. Reset Disks to Non-RAID 5

4 Operating Systems Installation and Driver Update

This section will focus on the operating system installation on the Intel® C600 series chipset based server boards, and driver update after the operating system is installed.

Installing Microsoft* Windows*

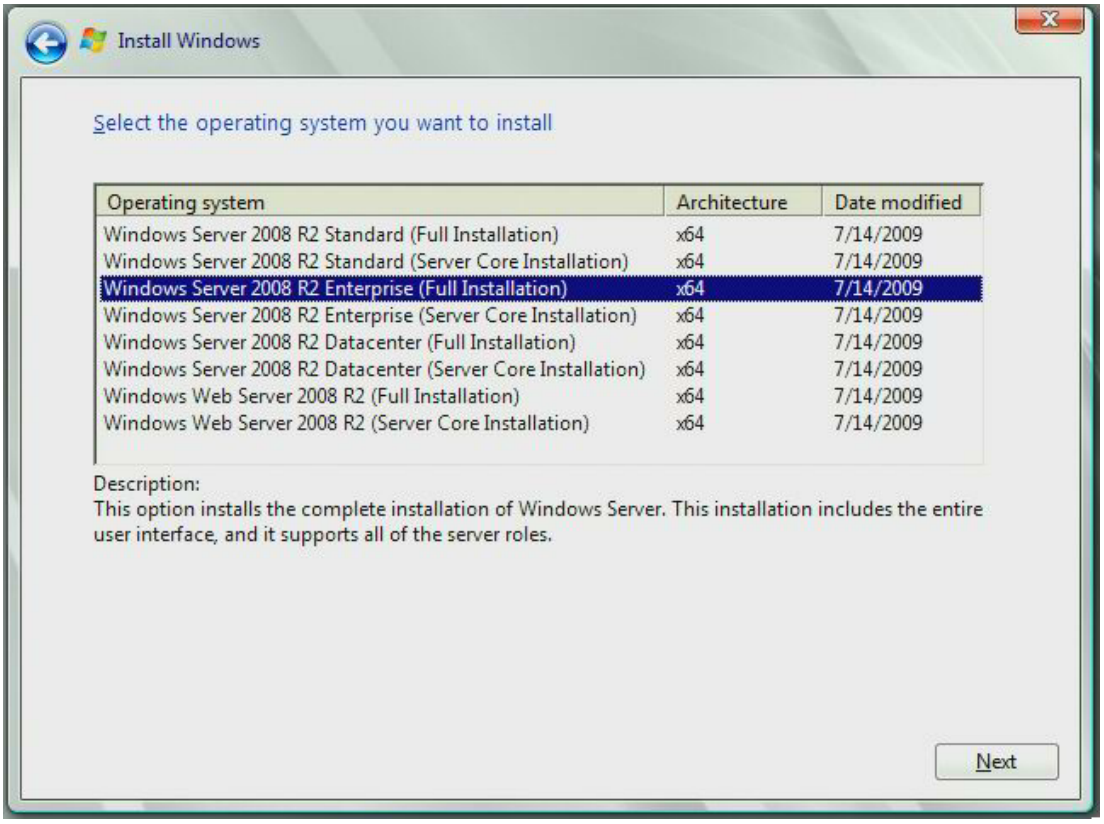
The following instructions will show how to install a Microsoft* Windows 2008 R2 onto a disk in Intel® RSTe non-RAID or RAID mode. For this example, the following is assumed:

- Intel® RSTe is enabled in the Intel® Server Board BIOS SETUP.
- The optical disk drive is attached to the Intel® Server Board.

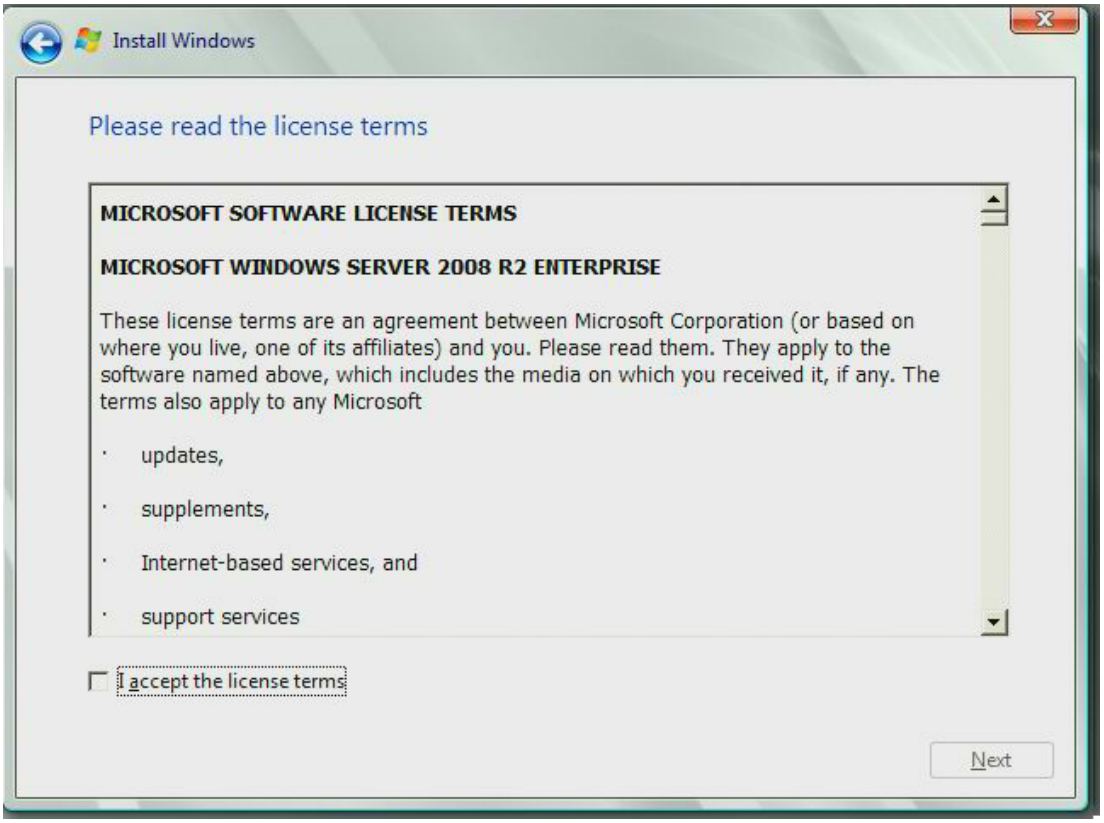
1. Select the desired language and select **Next**

2. Click on **Install now**

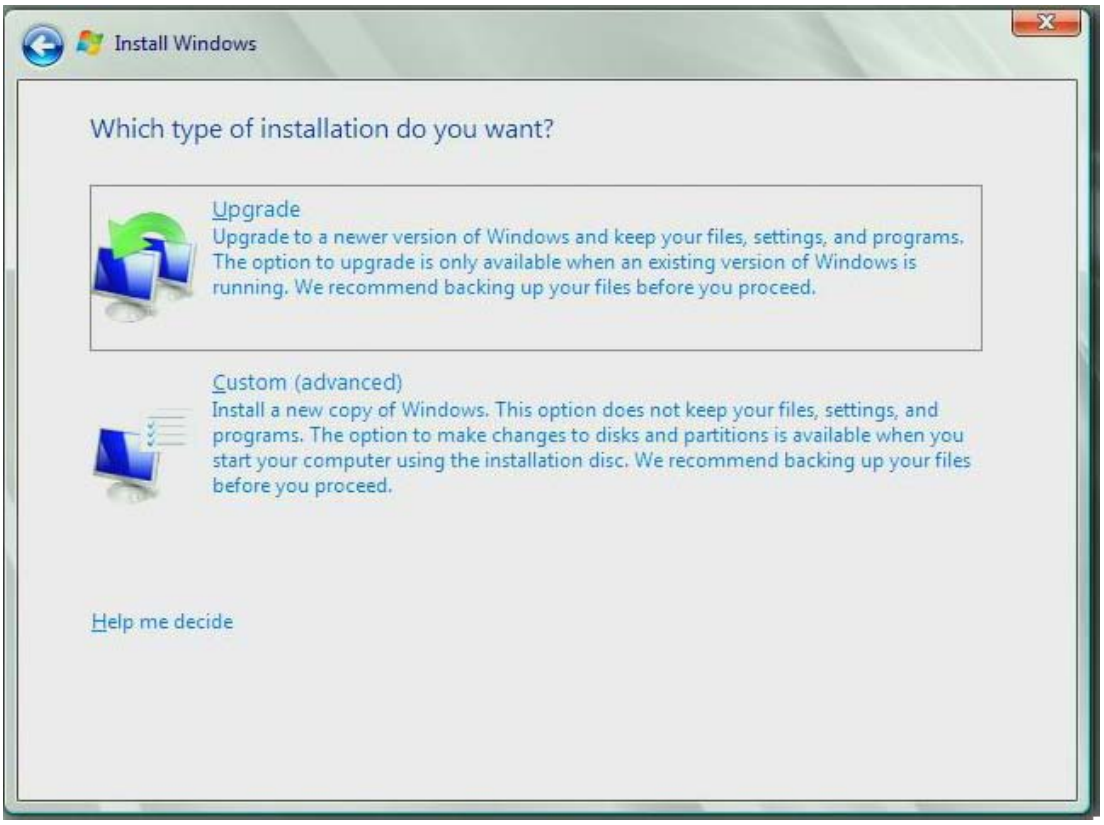
3. Select the desired OS version to install (if prompted) and select **Next**



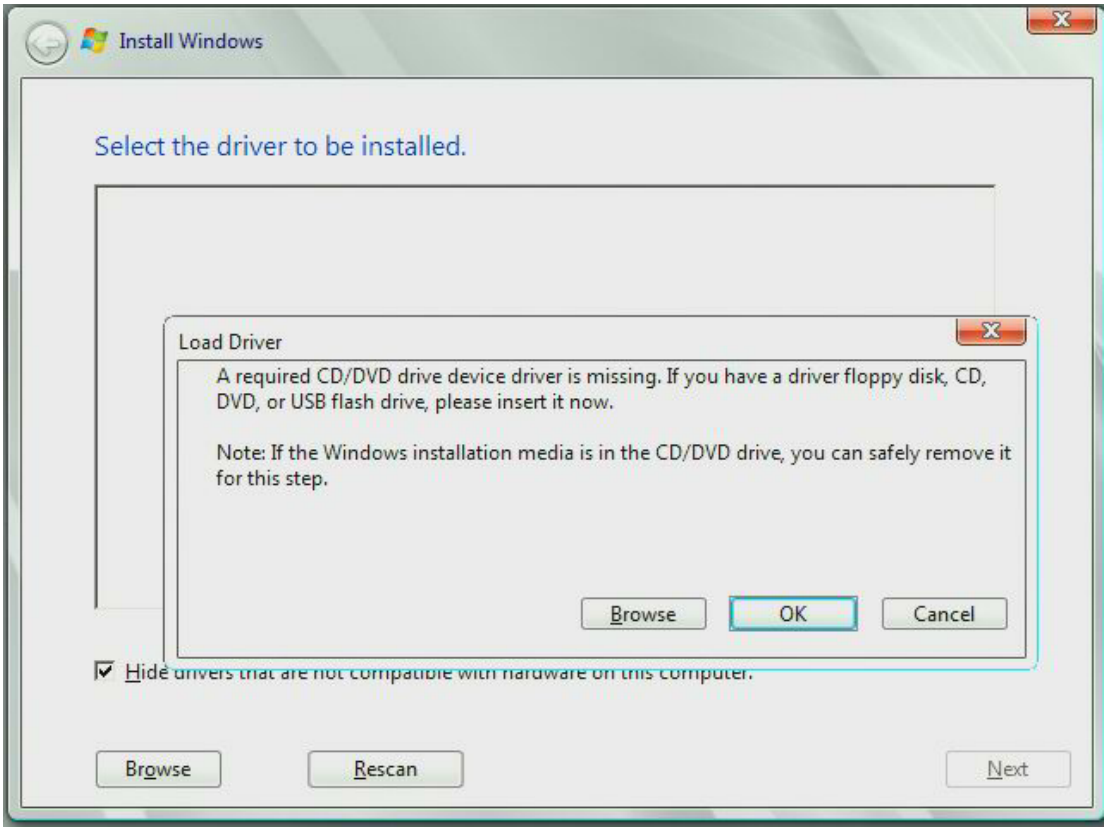
4. After reading the license terms select I accept the license terms and click on **Next**



5. Select **Custom (advanced)**

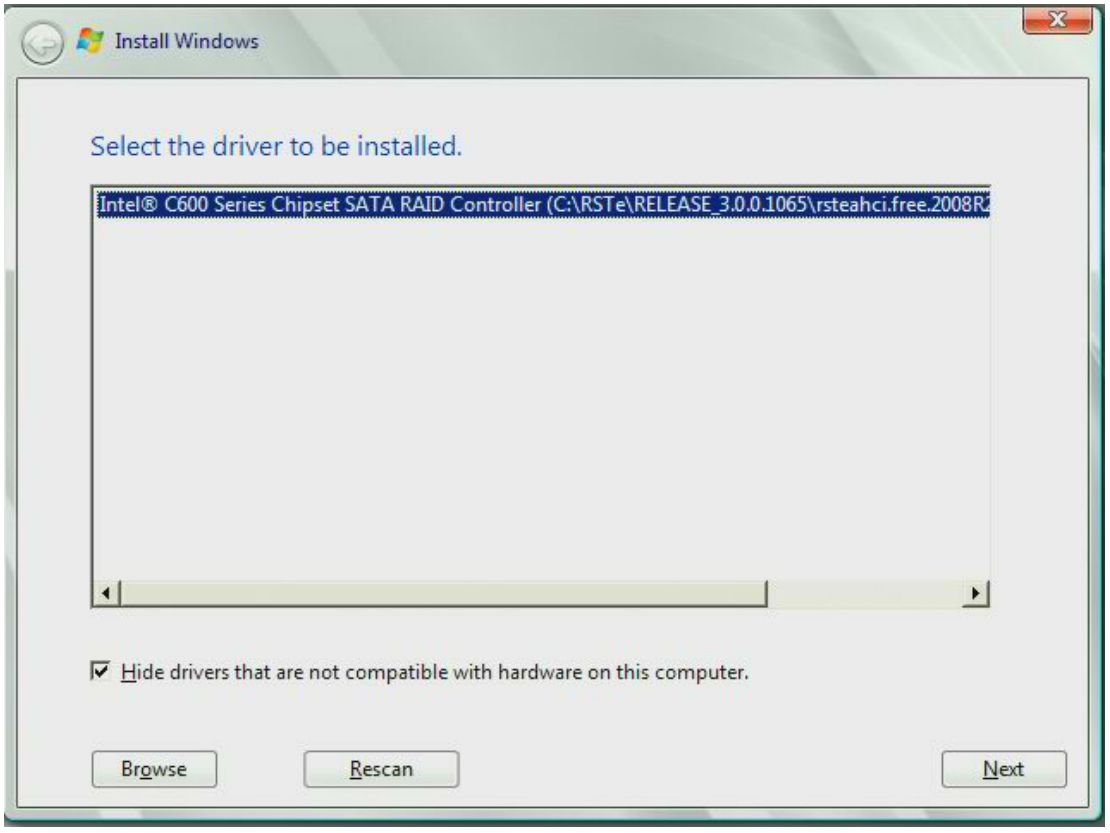


6. At this point if Intel® RSTe RAID volume is created, the Intel® RSTe driver must be loaded to continue loading the operating system installation information. Insert the USB drive that contains the RSTe driver and select **Load Driver** ,then select **Browse**

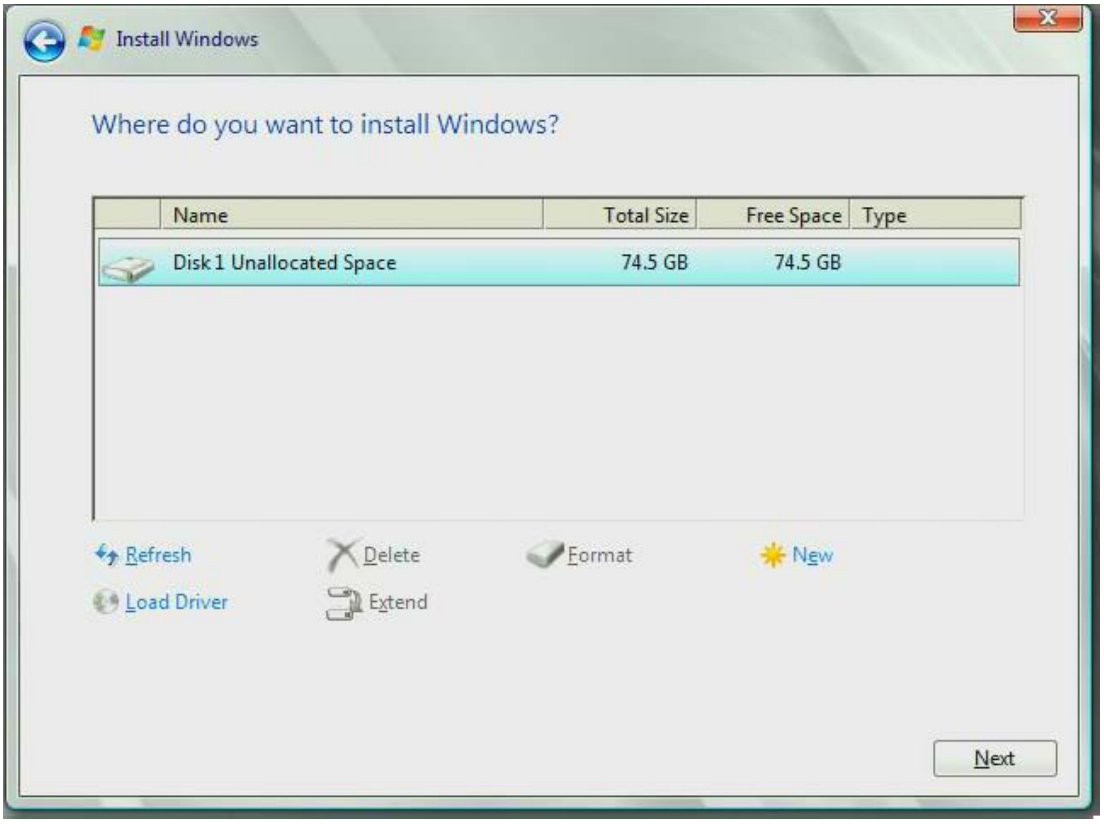


7. Navigate to where the Intel® RSTe driver is located.

8. The correct driver should be highlighted. If not, please highlight the appropriate driver and select **Next**



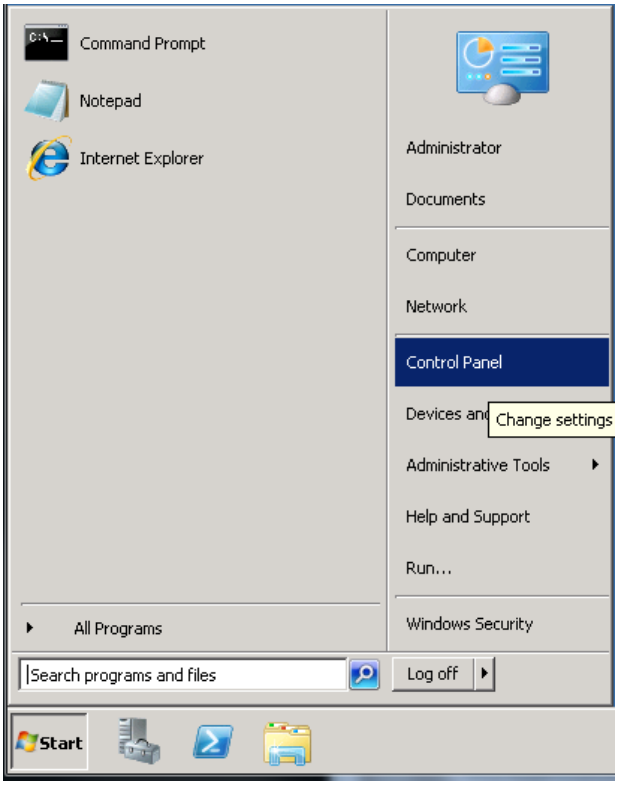
9. The remaining steps are the standard steps to complete the OS installation process.



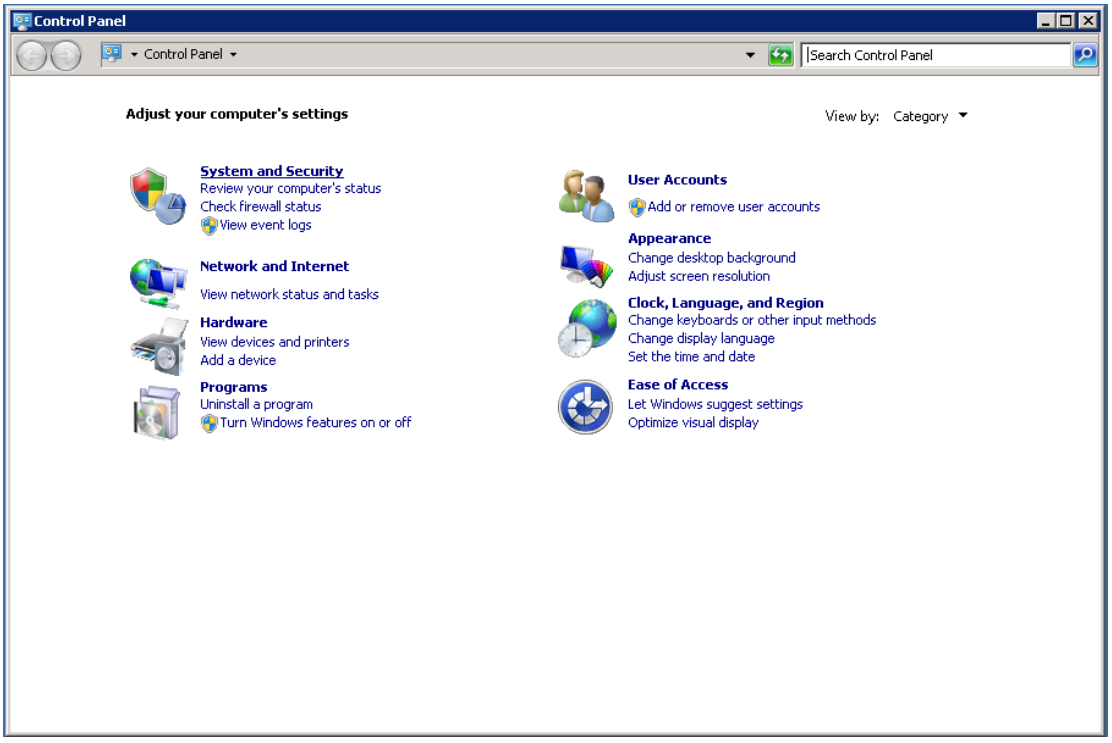
Manual Installation of the Intel® RSTe driver in OS

To install the Intel® RSTe driver manually, select Device Manager in the OS. Below is one of the ways to access Device Manager:

1. In windows, click **Start** and then slect **Control Panel**

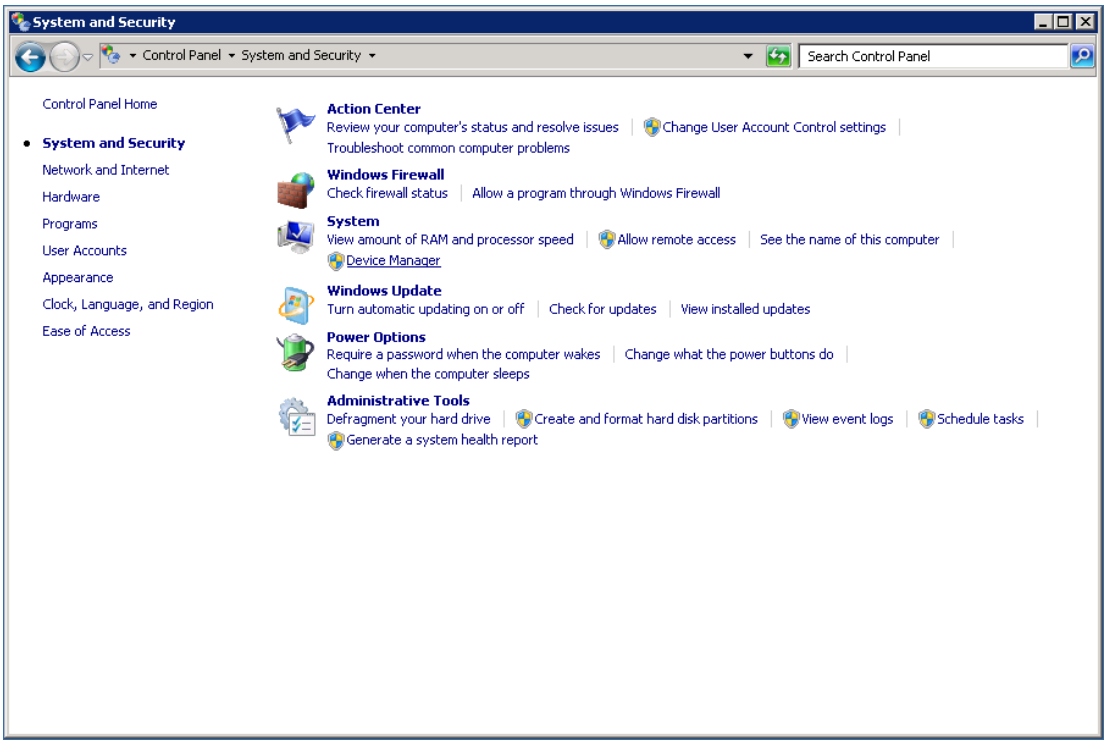


2. In windows, click **Start** and then slect **Control Panel**

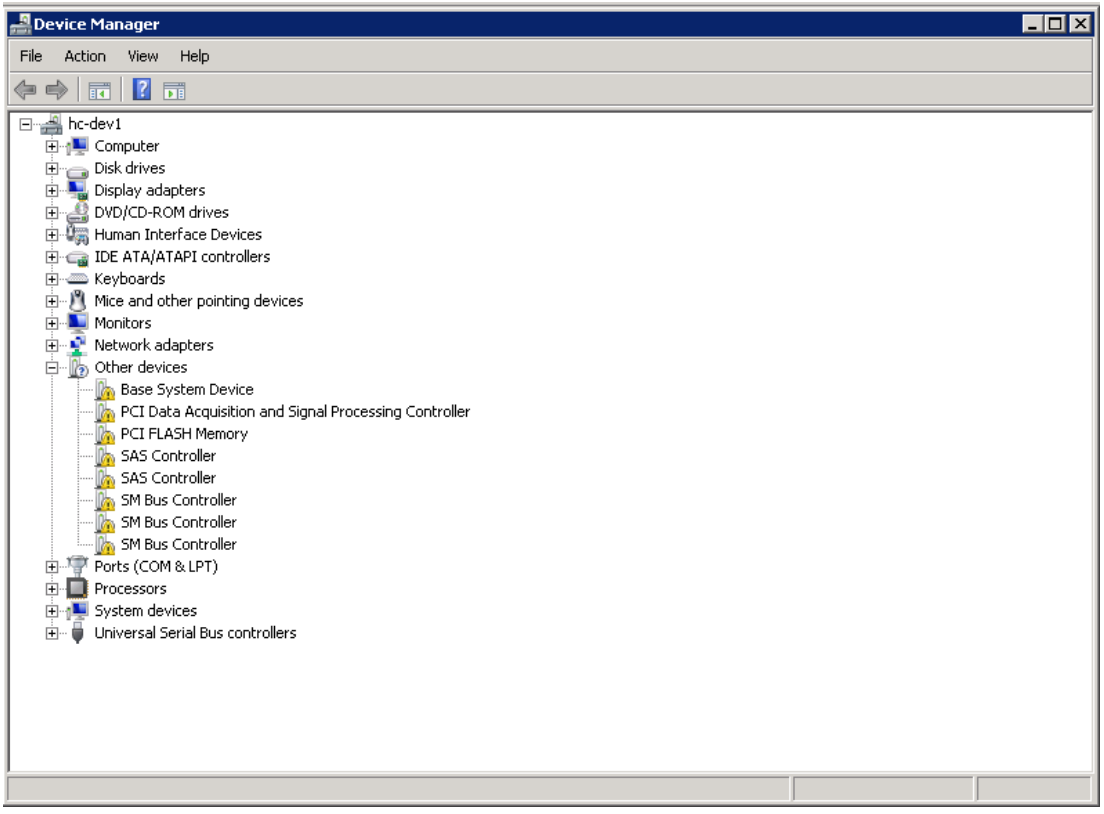


Step 3:

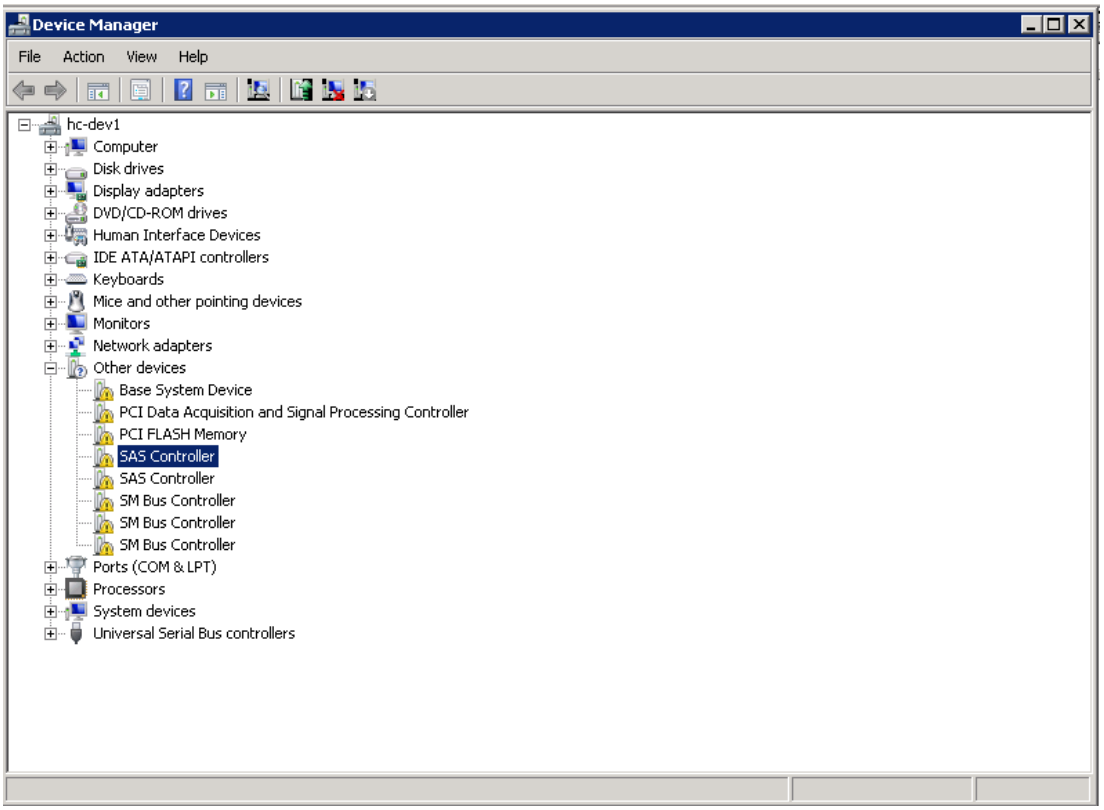
Select **System**



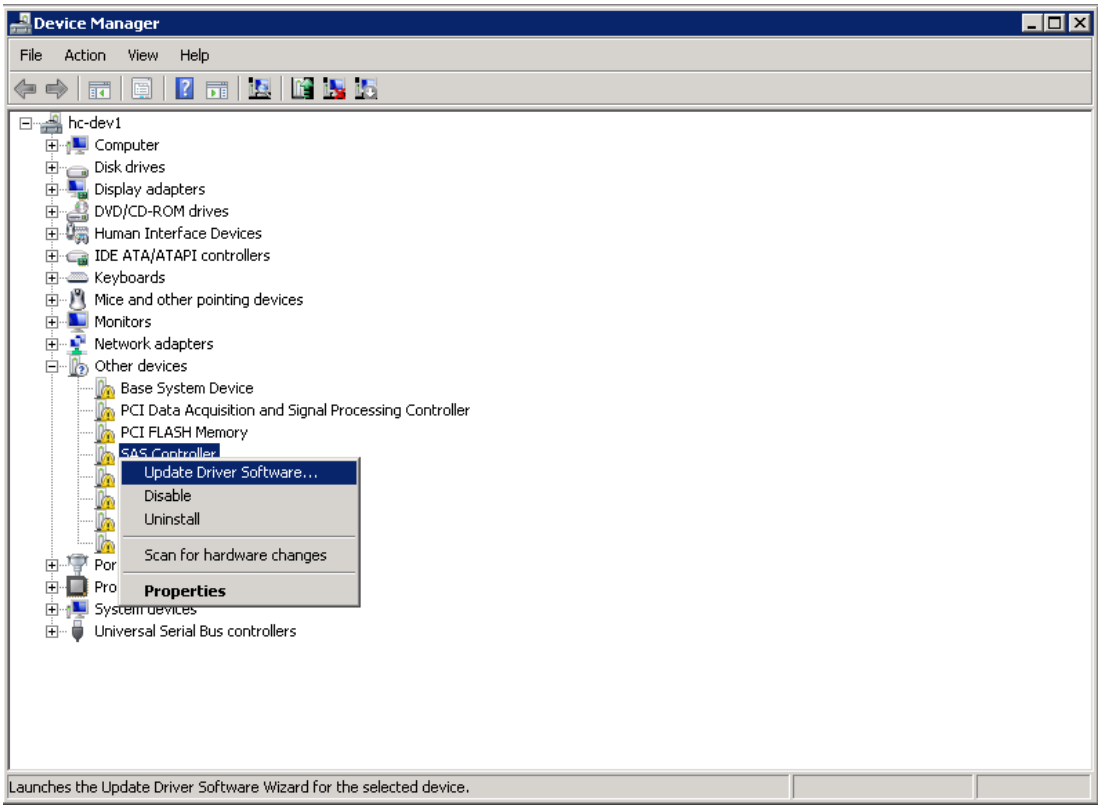
Step 4: Select **Device Manager**



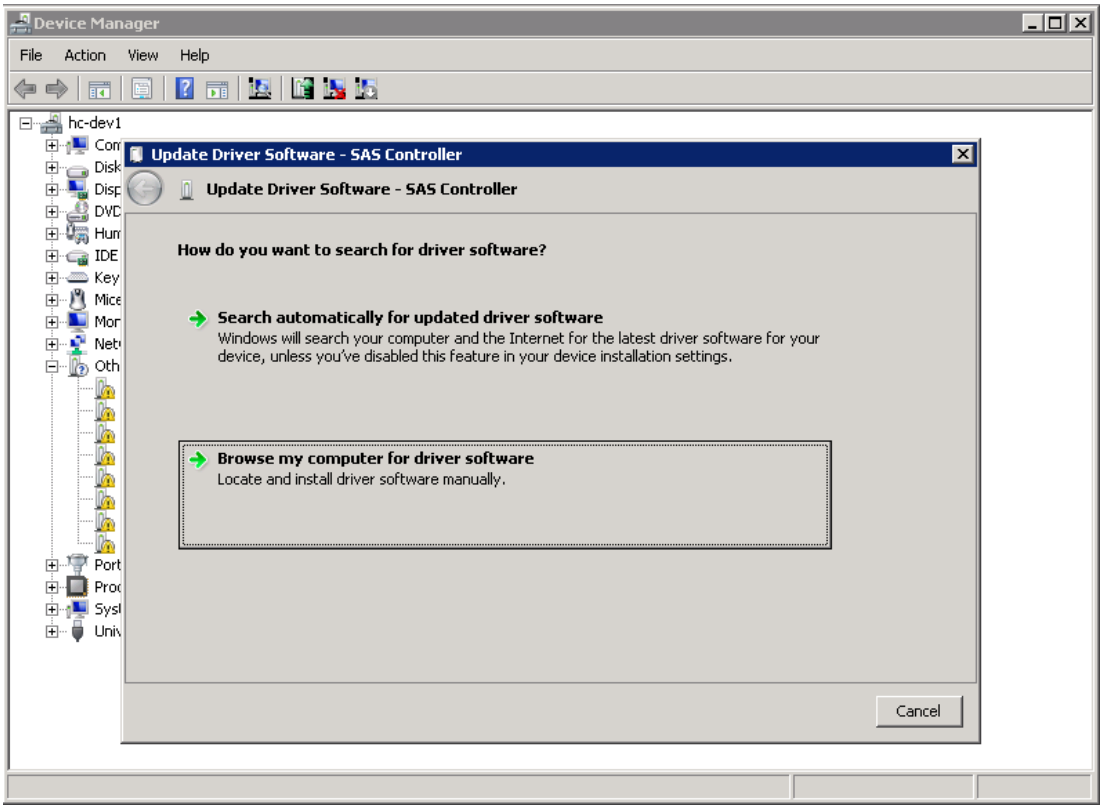
Step 5:


Device Manager
File
Action
View
Help
hc-dev1
Computer
Disk drives
Display adapters
DVD/CD-ROM drives
Human Interface Devices
IDE ATA/ATAPI controllers
Keyboards
Mice and other pointing devices
Monitors
Network adapters
Other devices
Base System Device
PCI Data Acquisition and Signal Processing Controller
PCI FLASH Memory
SAS Controller
SAS Controller
SM Bus Controller
SM Bus Controller
SM Bus Controller
Ports (COM & LPT)
Processors
System devices
Universal Serial Bus controllers

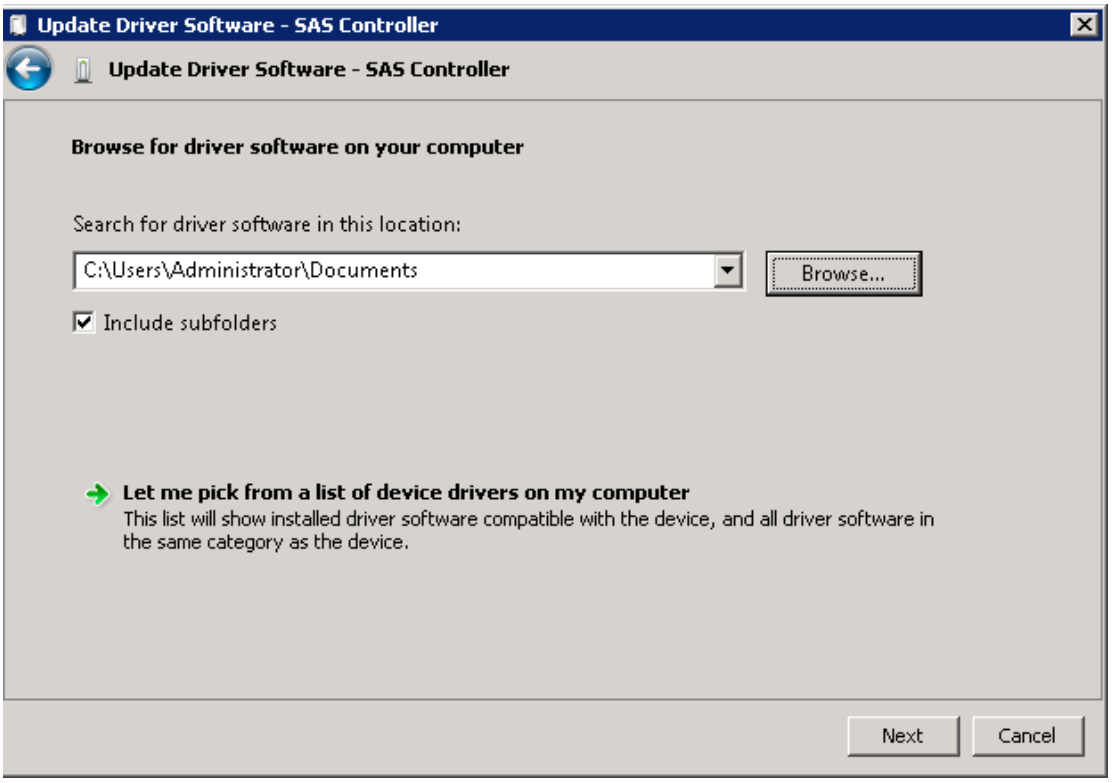
Step 6:


Device Manager
File Action View Help
hc-dev1
Computer
Disk drives
Display adapters
DVD/CD-ROM drives
Human Interface Devices
IDE ATA/ATAPI controllers
Keyboards
Mice and other pointing devices
Monitors
Network adapters
Other devices
Base System Device
PCI Data Acquisition and Signal Processing Controller
PCI FLASH Memory
SAS Controller
Update Driver Software...
Disable
Uninstall
Scan for hardware changes
Properties
Universal Serial Bus controllers
Launches the Update Driver Software Wizard for the selected device.

Step 7:

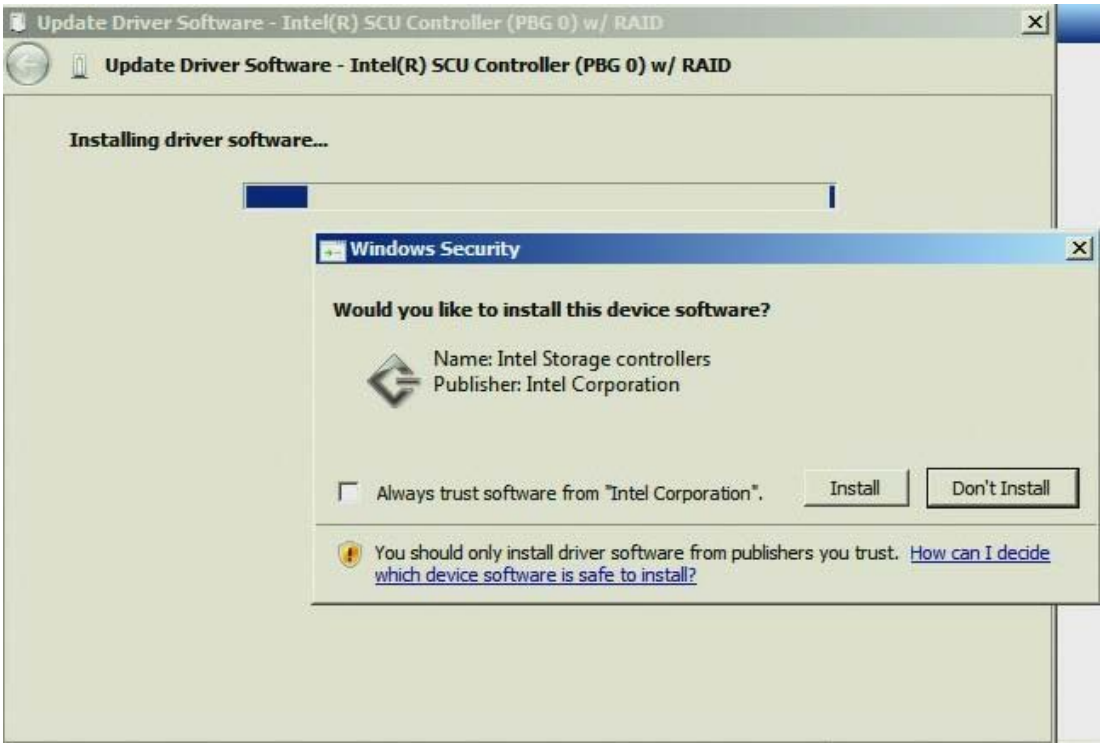

Device Manager
File Action View Help
hc-dev1
Update Driver Software - SAS Controller
Update Driver Software - SAS Controller
How do you want to search for driver software?
Search automatically for updated driver software
Windows will search your computer and the Internet for the latest driver software for your device, unless you've disabled this feature in your device installation settings.
Browse my computer for driver software
Locate and install driver software manually.
Cancel

Step 8: Select **Browse** to navigate where the driver resides

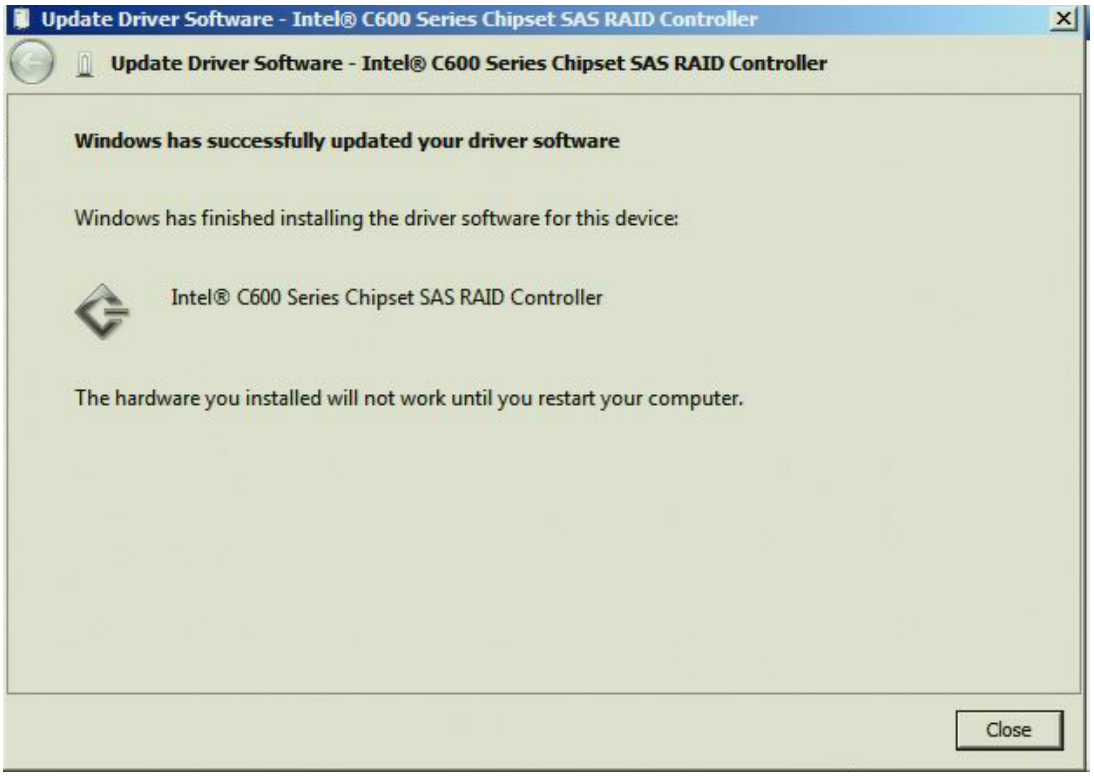


Step 9: Navigate to where the driver is located and select the INF file from the driver folder with that has the same OS version as the system.

Step 10:



Step 11:



Step 12: With the installation of the new driver, please select **Yes** to reboot the system.


System Settings Change
Your hardware settings have changed. You must restart your computer for these changes to take effect.
Do you want to restart your computer now?
Yes
No

5 Graphic User Interface Utility in Operating Systems

This section will focus on Intel® RSTe Graphic User Interface (GUI) Utility installation.

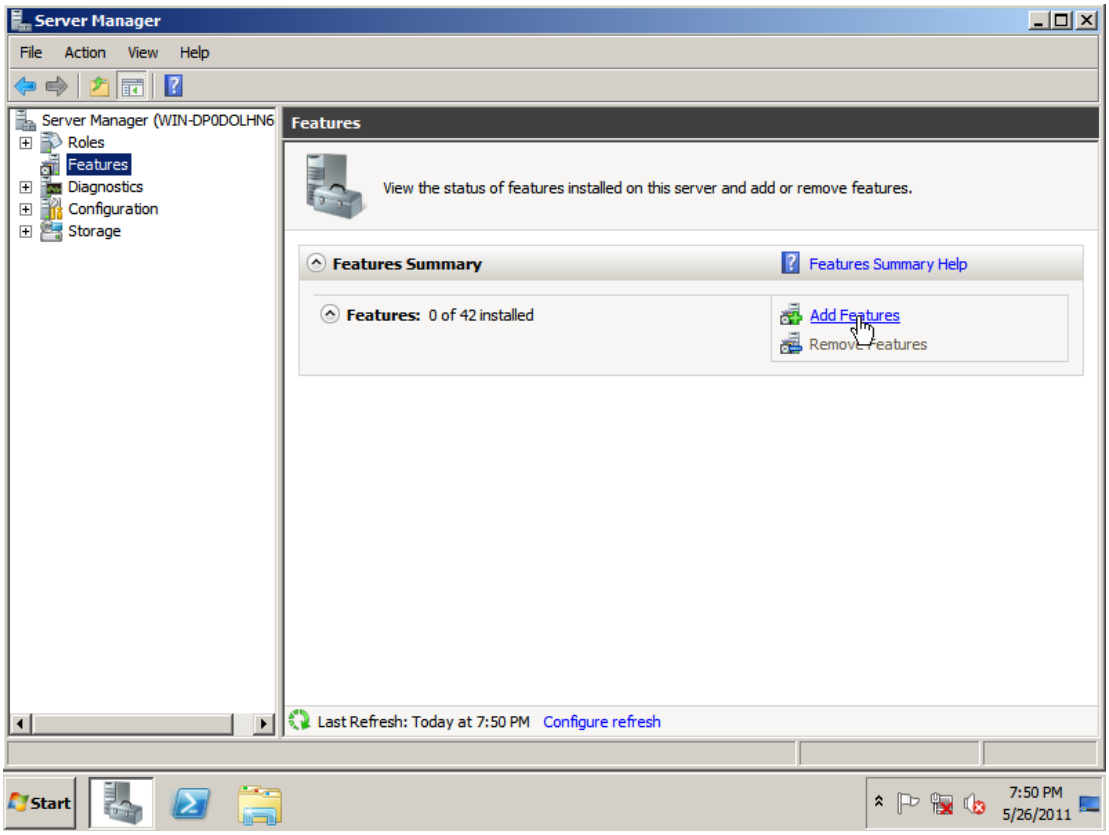
To install the Intel® RSTe GUI Utility, the Microsoft* .NET 3.5 or above must be installed and enabled.

Example of .NET 3.5 enabling in Windows 2008 R2*

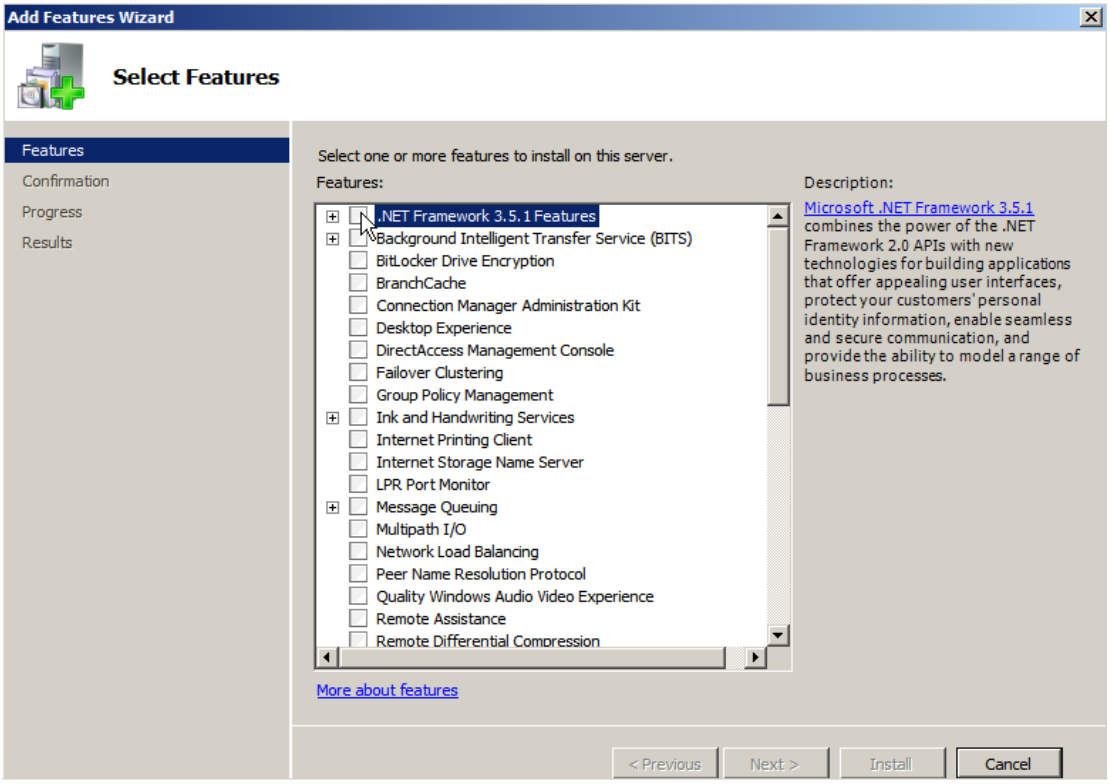
Microsoft* Window 2008 R2* default installation already includes the installation of .NET 3.5. The following steps show an example of how to enable it.

Choose Server Manager:

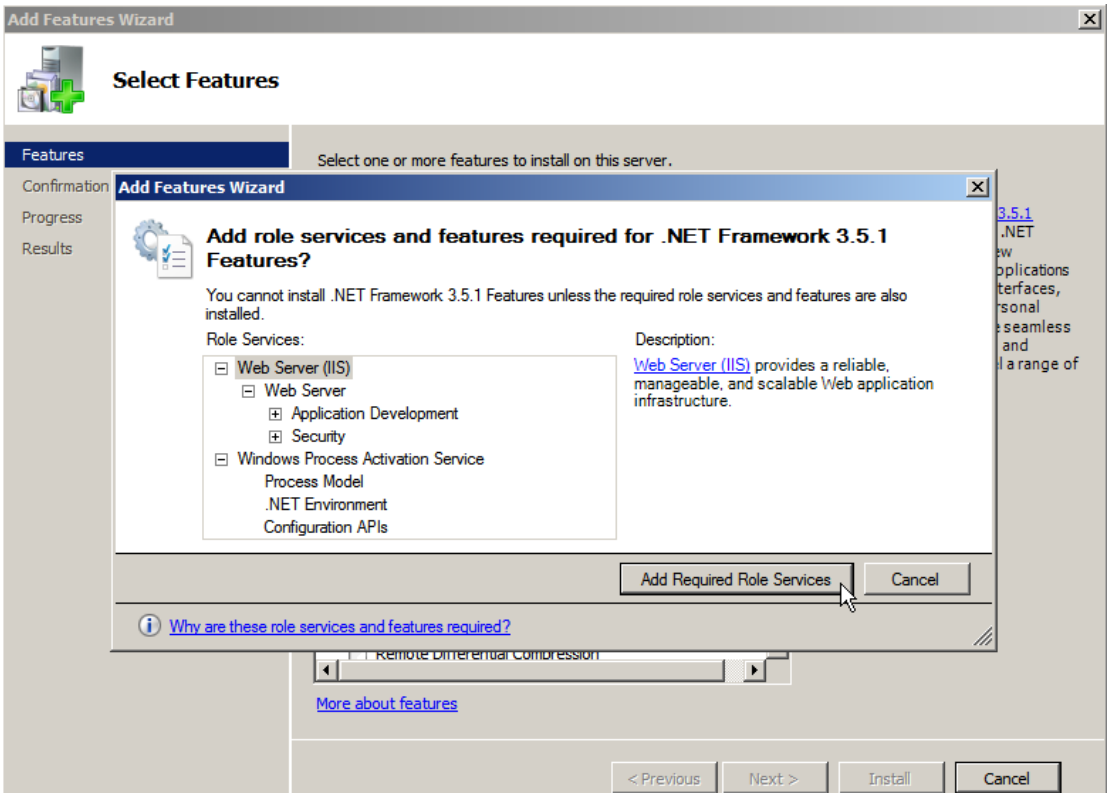
Click **Feature**, then click **Add Features**



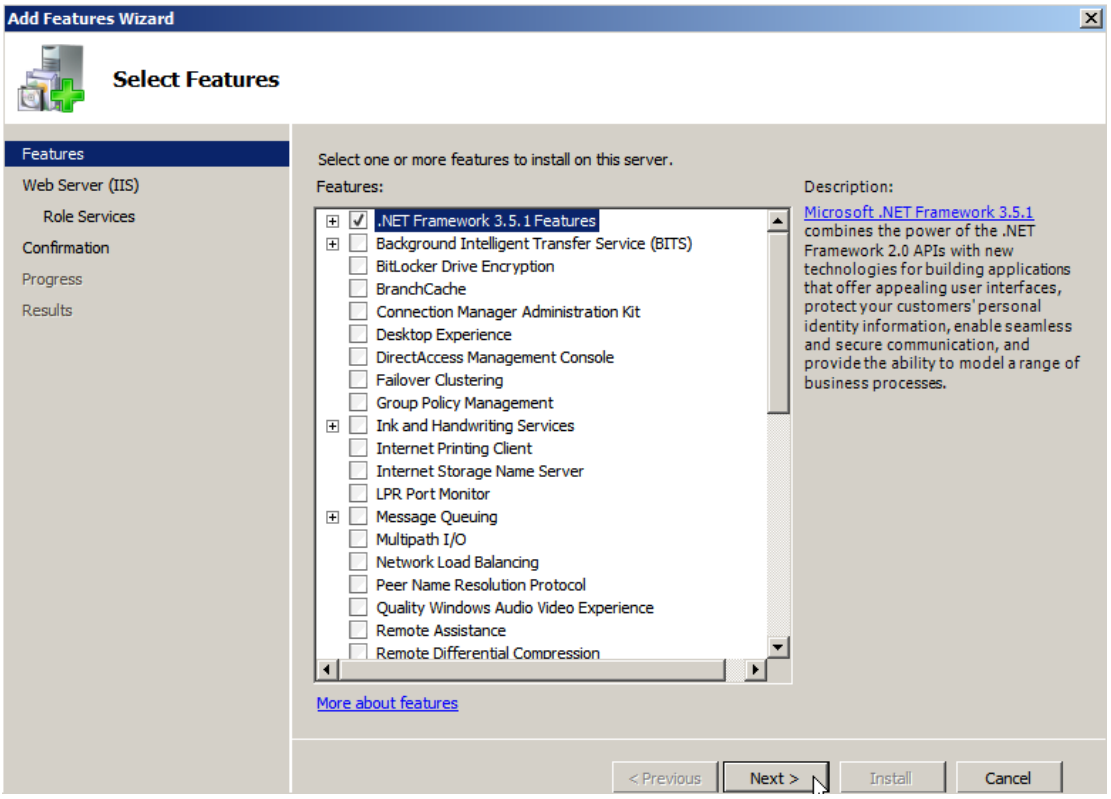
In the screen below, expand **.NET Framwork 3.5.1 Features** and check the **.NET Framework 3.5.1 Features.**



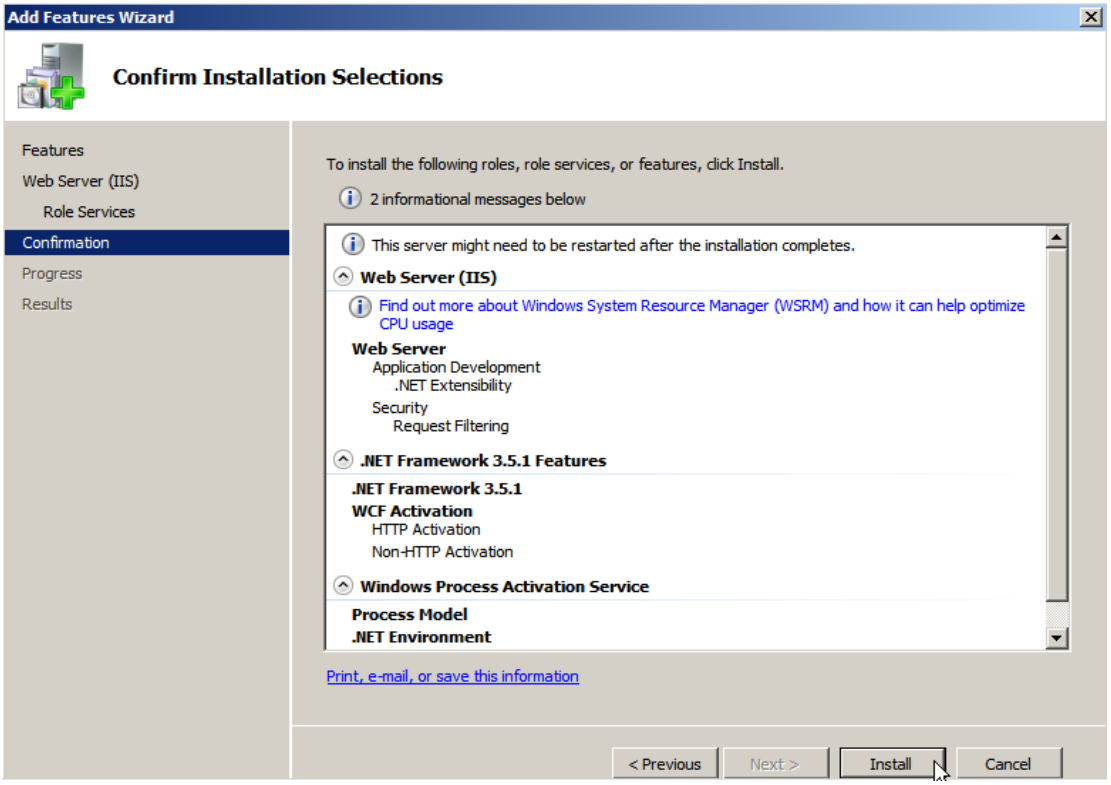
Click **Add Required Role Services**



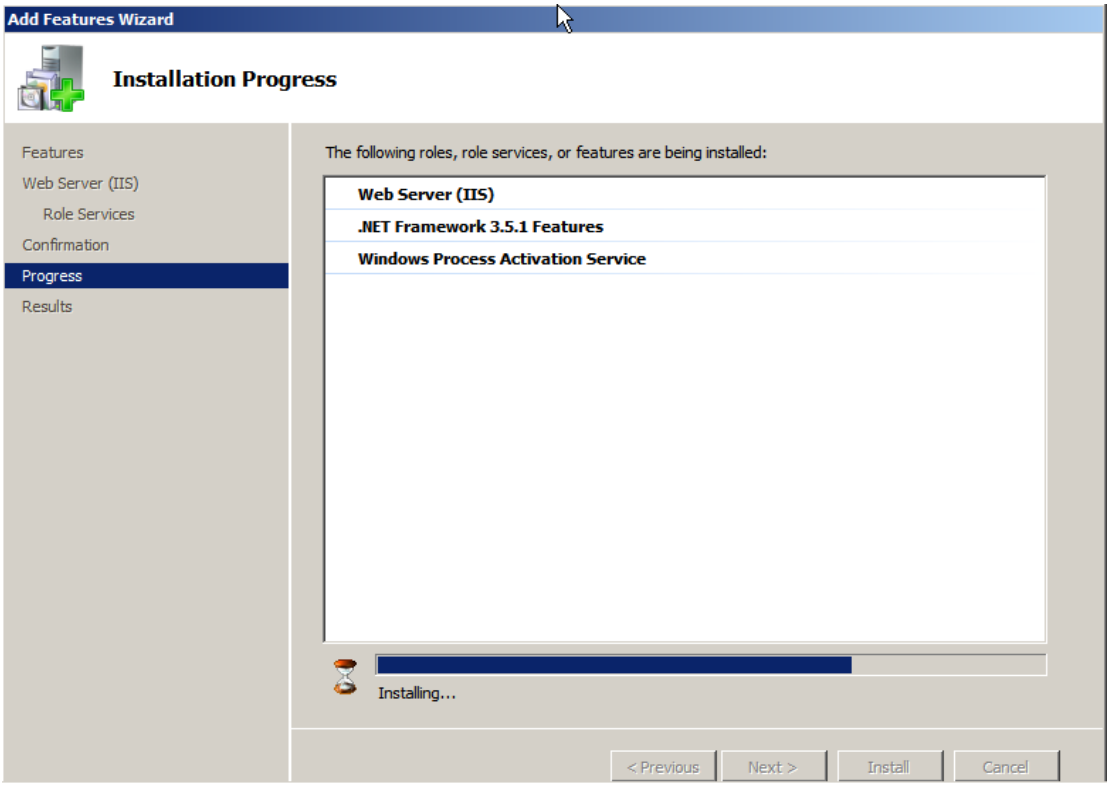
Click **Next**



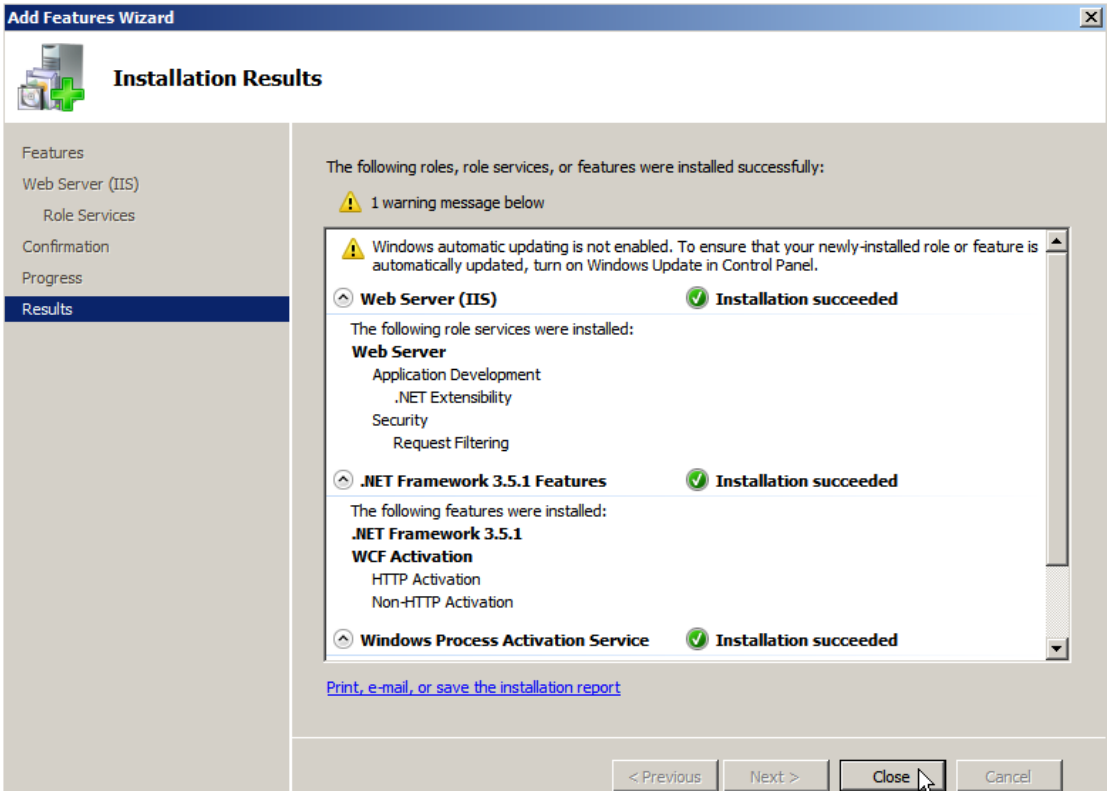
Click **Install**



Wait for the installation to go on



Click **Close** to finish



Intel® RSTe GUI Utility Installation

After .NET 3.5 or above is installed and enabled under Microsoft* Windows*, go to the GUI folder of the Intel® RSTe software package downloaded from http://www.intel.com . The installation file is a *.EXE file, with the name similar as iata_cd.exe, or else. Run this *.EXE file and follow the steps on screen to finish the installation.

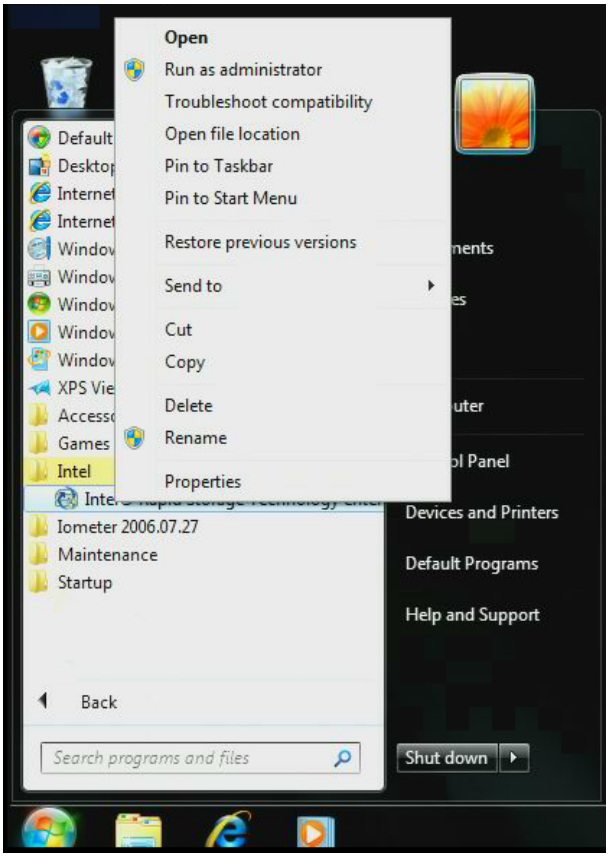
The Intel® RSTe GUI Utility enables the creation and deletion of RAID volumes, as well as other configuration and management features that the legacy OpROM doesn't support.

Open Intel® RSTe GUI Utility

There are 2 ways to launch the Intel® RSTe GUI. In both cases the UI needs to be launched with Admin privileges so please right click on the icon and select "Run as Administrator".

1) Launch via the desktop Icon.

2) Locate application through the Windows start menu and select **Run as Administrator**



3) Click on **Yes** to continue

Volume Creation

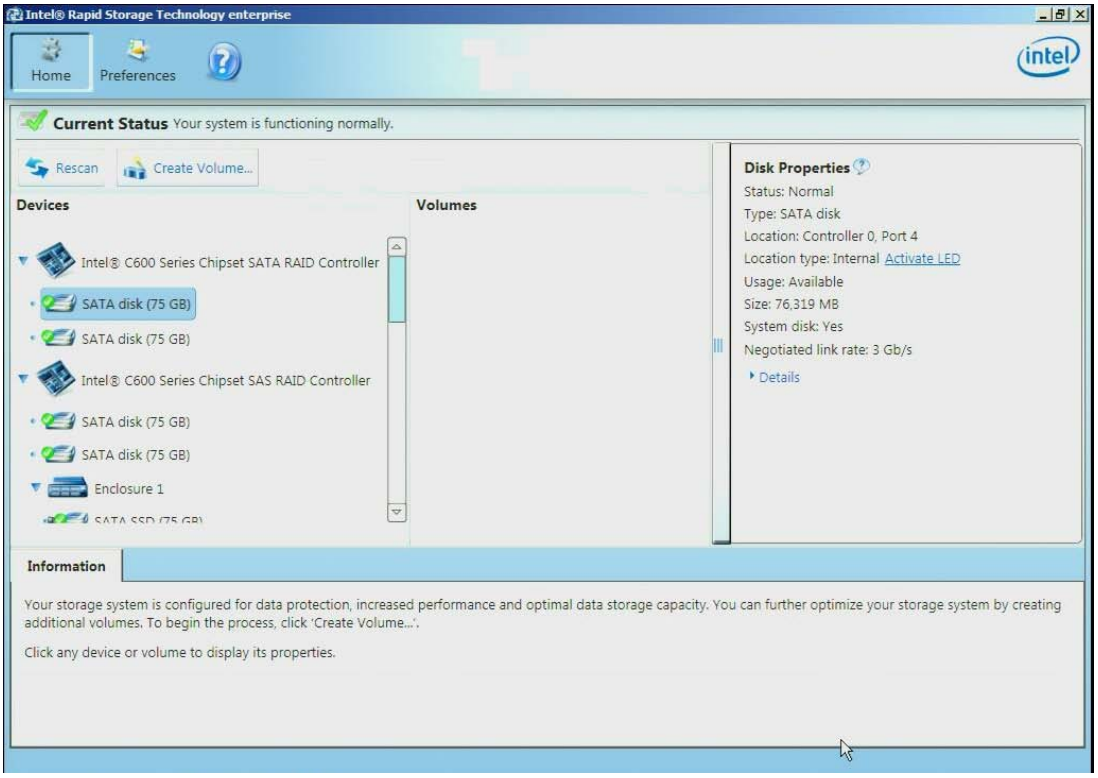
The following are some example of some RAID Volume Creations. In the examples the system has been configured to support Intel® RSTe. There are two SATA drives attached to the AHCI controller. There are also two SATA drives directly attached to the first two ports of the Intel®

C600 chipset based controller, and an expander connected to the last four ports of the Intel® C600 chipset based controller.

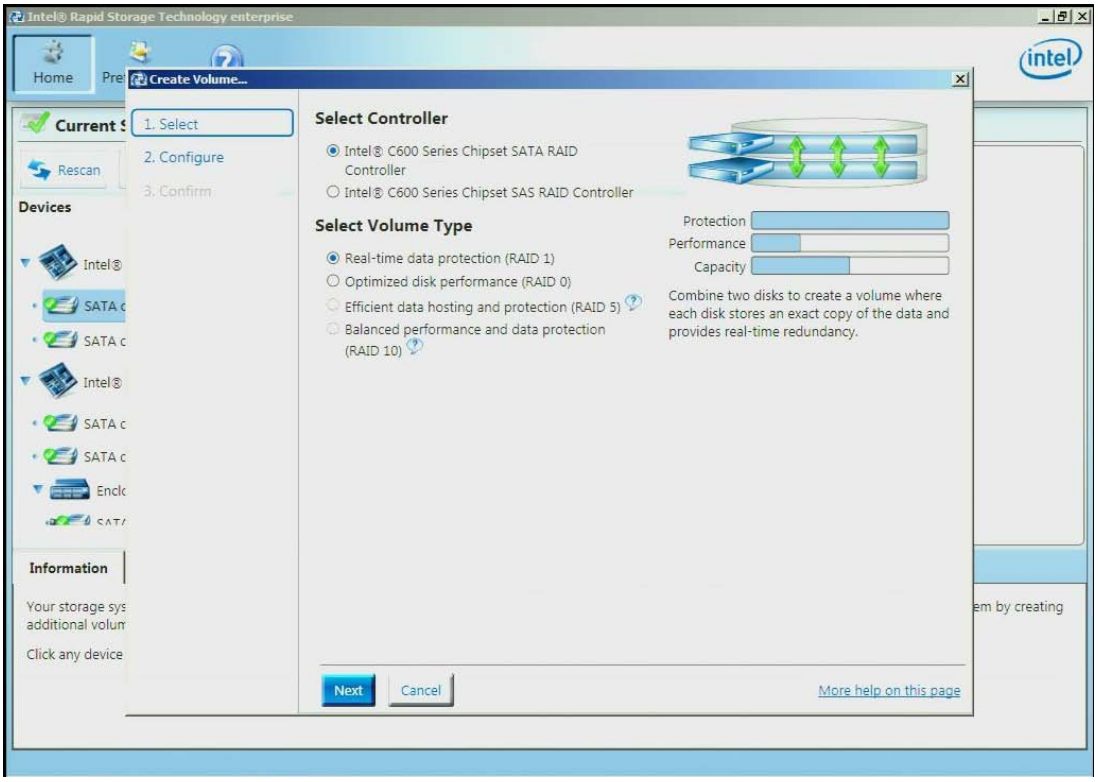
Create 2 Drive RAID 1 Boot Volume

The following example will step through the process of turning a single Boot disk into a 2 drive RAID 1 boot volume

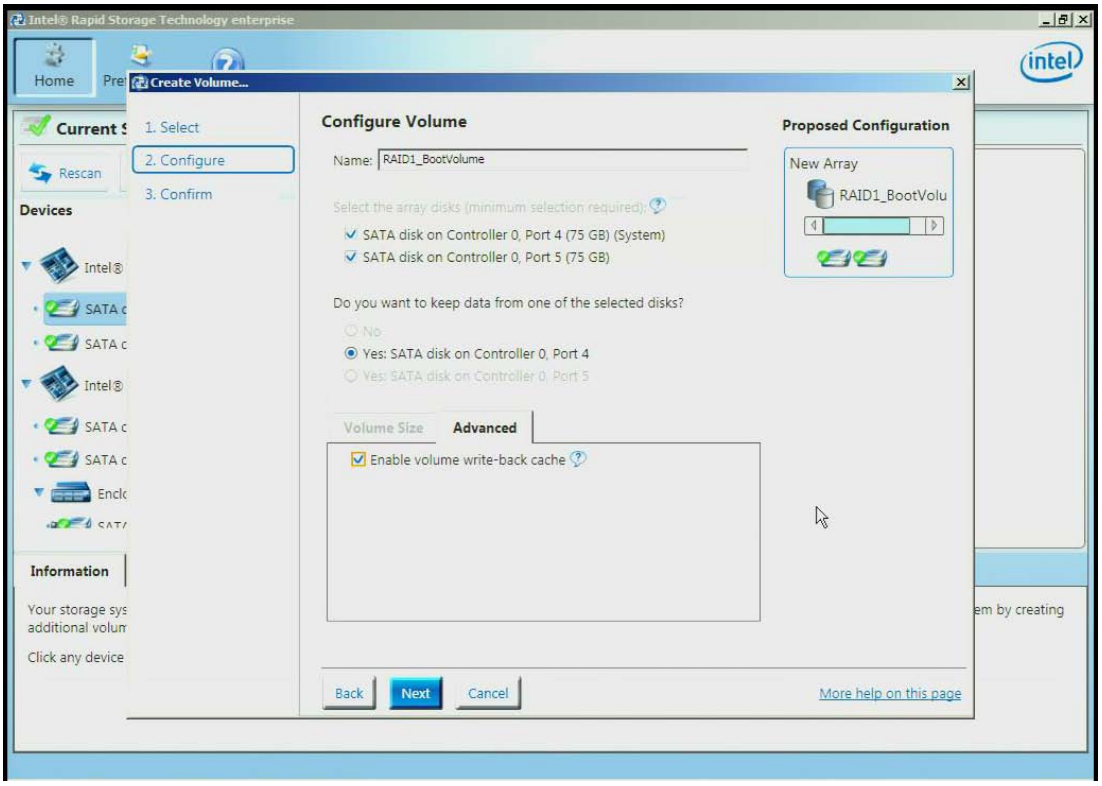
1. Select **Create** to begin the process



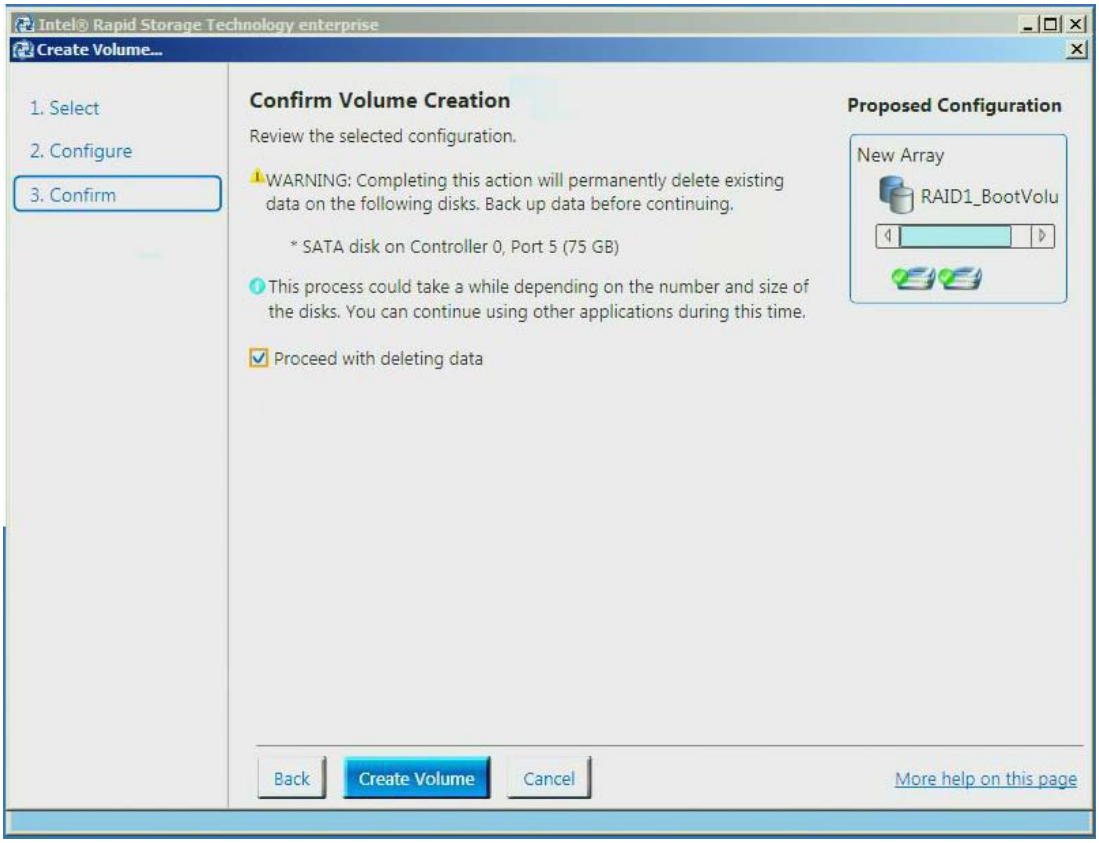
2. Select the **Intel® C600 series chipset SATA RAID Controller**, then select **Real-time data protection (RAID1)**. Finally select **Next** to continue.



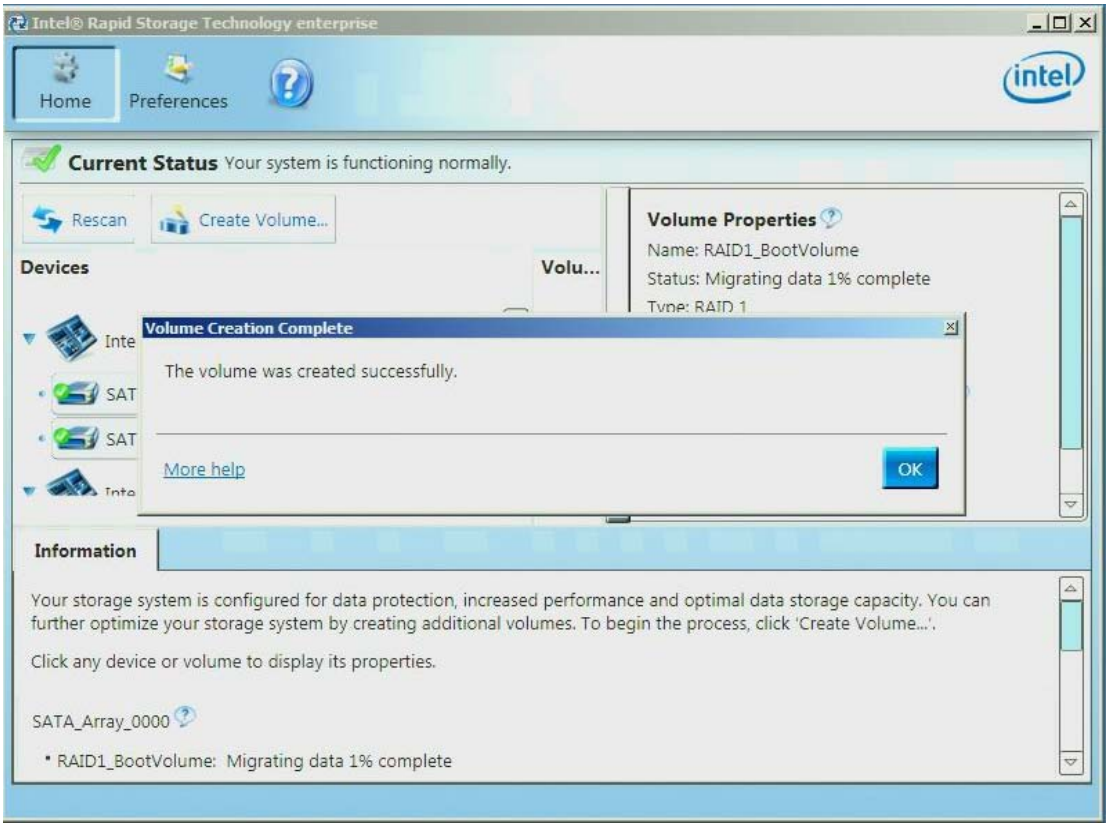
3. To configure the volume, you can first specify the **Name** of the volume. In this example it has been named **RAID1_BootVolume**. Next select the two drives to be included in the volume. Notice that for **Do you want to keep data from one of the selected disks** question, **Yes** has already been selected. Under the **Advanced** tab you can choose to **Enable volume write-back cache**. Once all of the desired options have been selected, click **Next** to continue.



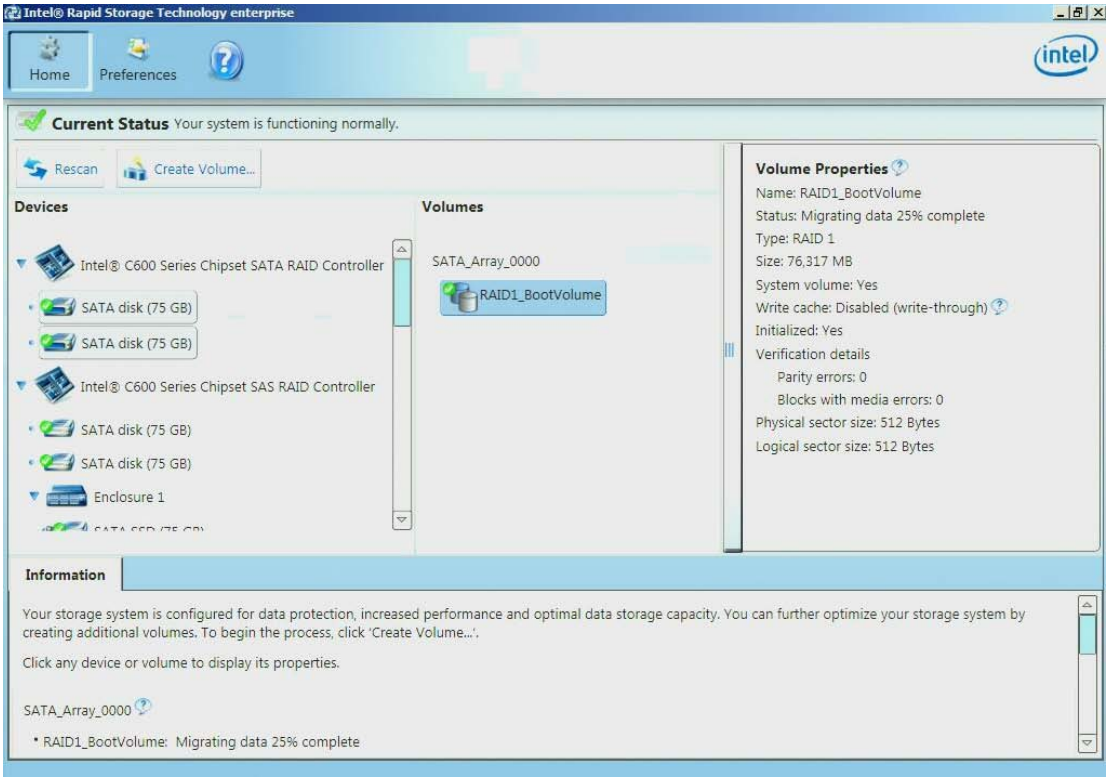
4. Under **Confirm Volume Creation** select **Proceed with deleting data** then click on **Create Volume**.



5. Click **OK** to continue



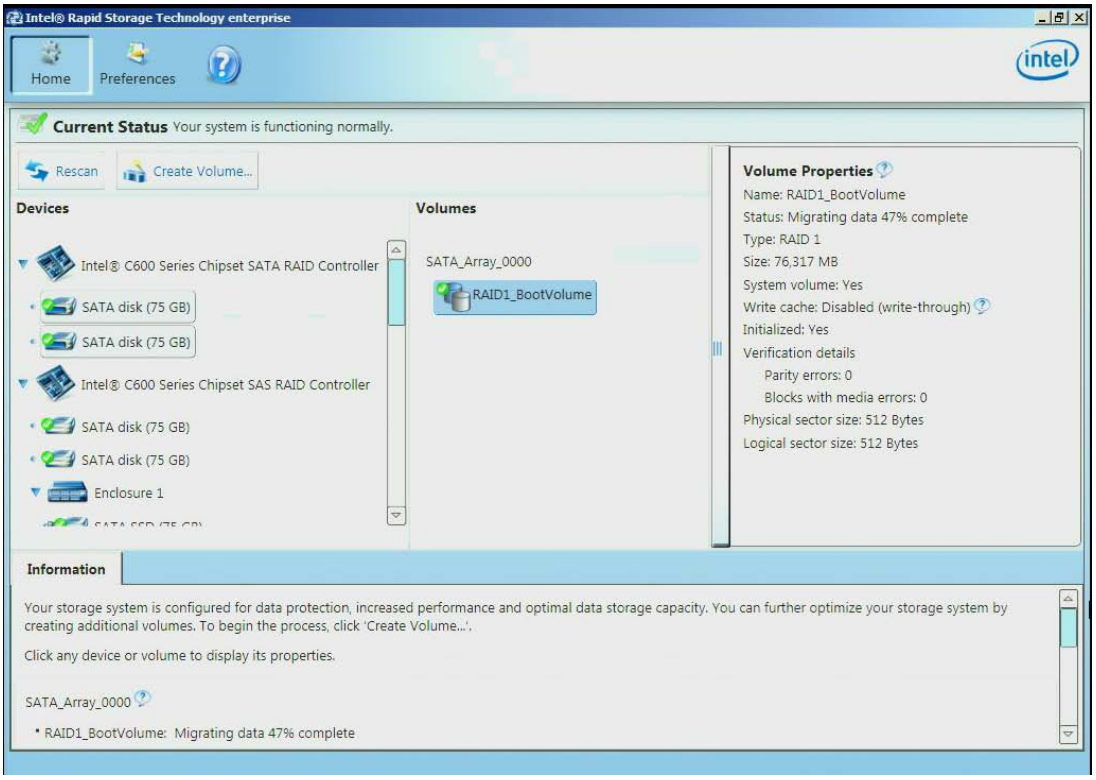
6. Under the Volumes section the new Array and RAID Volume are displayed. By selecting the RAID volume (RAID1_BootVolume), the Volume Properties (to the right) will appear with the current status and properties of the newly created RAID volume. The Boot Disk has successfully been migrated to a 2 drive RAID1 Boot Volume. The system will now be able to boot from this volume.



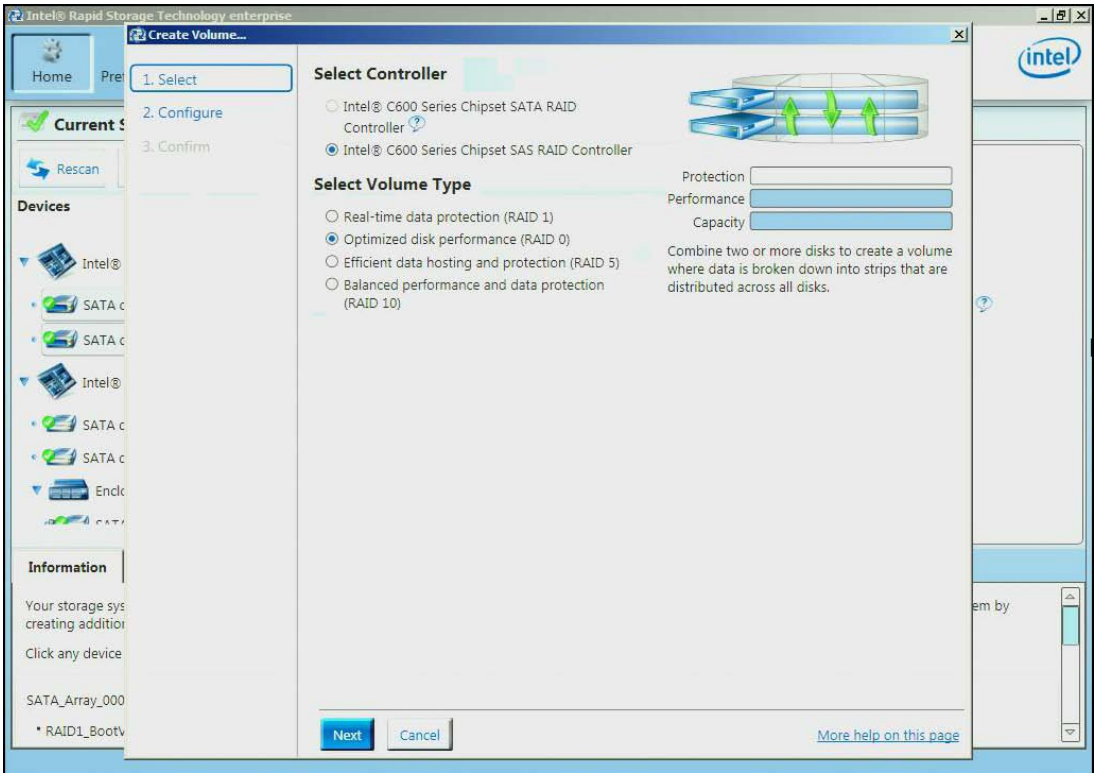
Create a 2 Drive RAID 0 Volume

In this example the two SATA drives that are directly connected to the Intel® C600 chipset will be made into a two drive RAID 0.

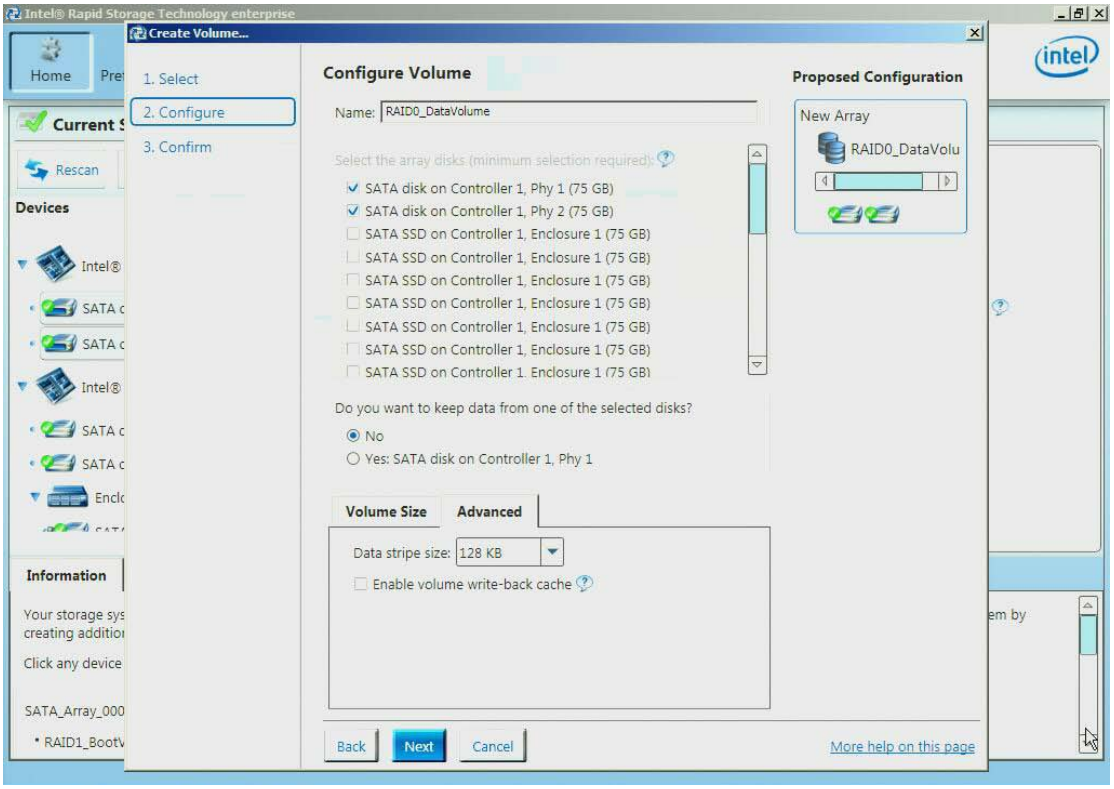
1. Select **Create Volume** to begin



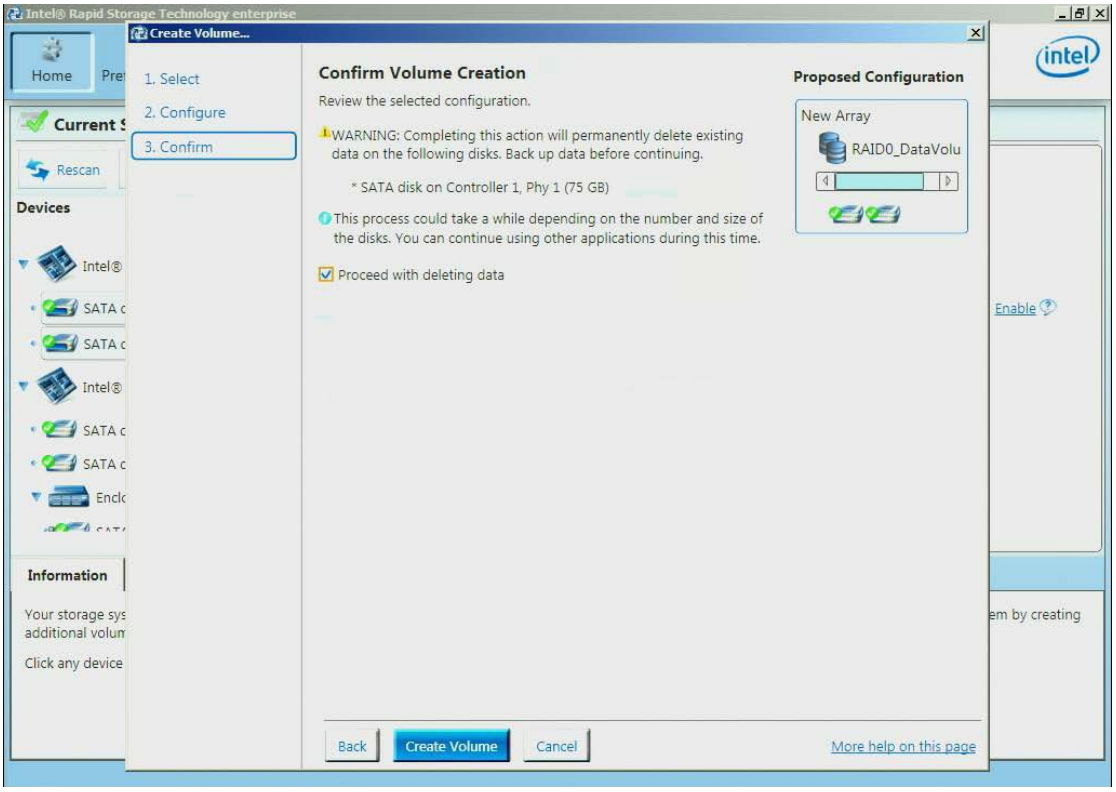
2. Select **Intel® C600 series chipset SAS RAID Controller**, then select the **Optimized disk performance (RAID 0)** option and then click **Next** to continue.



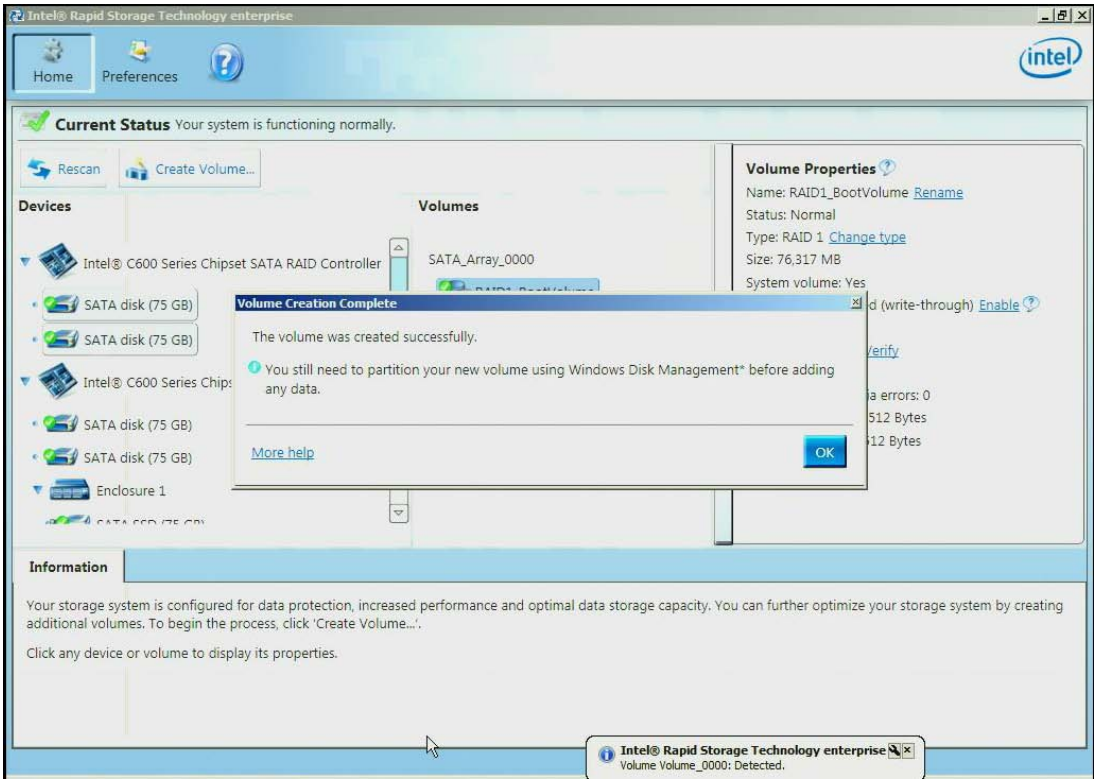
3. To configure the volume, you can first specify the **Name** of the volume. In this example it has been named **RAID0_DataVolume**. Next select the two drives to be included in the volume. Notice that for **Do you want to keep data from one of the selected disks** question, **No** has already been selected. The **Yes** option may be selected if desired. Under the **Volume Size**, the option to specify the size of the RAID volume is available. Under the **Advanced** tab you can specify the **Data stripe size** and/or choose to **Enable volume write-back cache**. Once all of the desired options have been selected, click **Next** to continue.



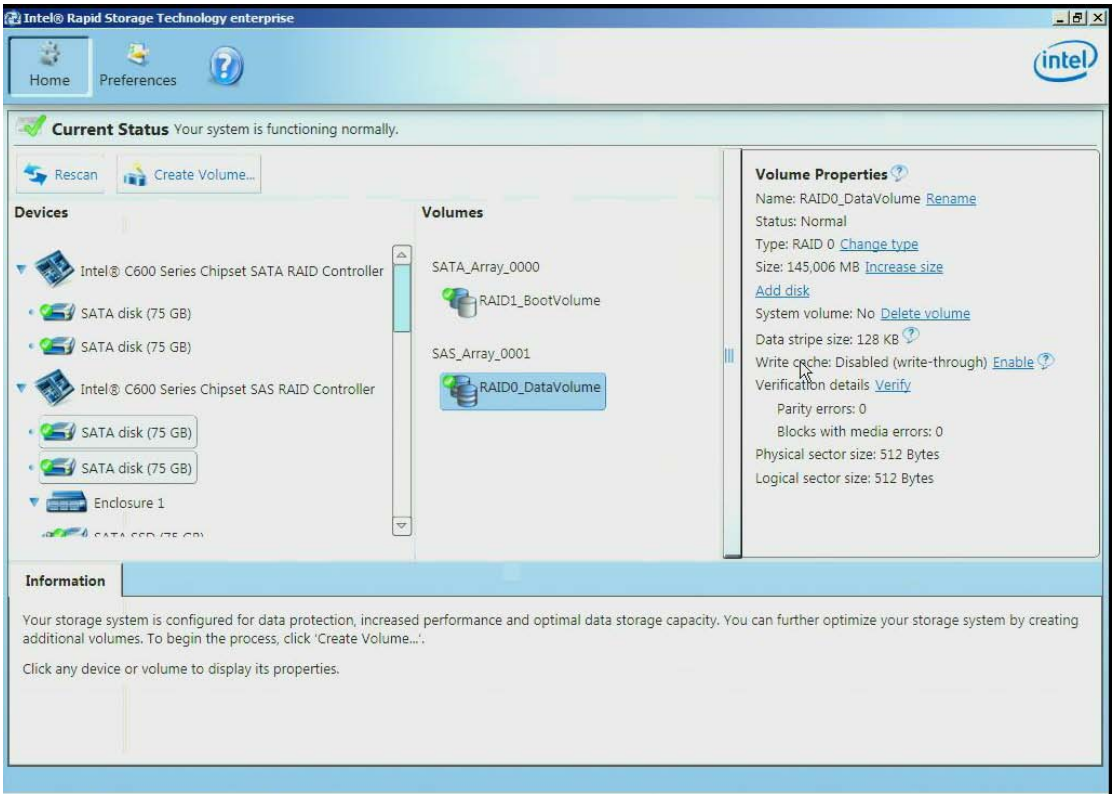
4. **Under Confirm Volume Creation**, select **Proceed with deleting data** (if the option appears) otherwise, click **Create Volume** to continue the process.



5. Click on **OK** to finish.



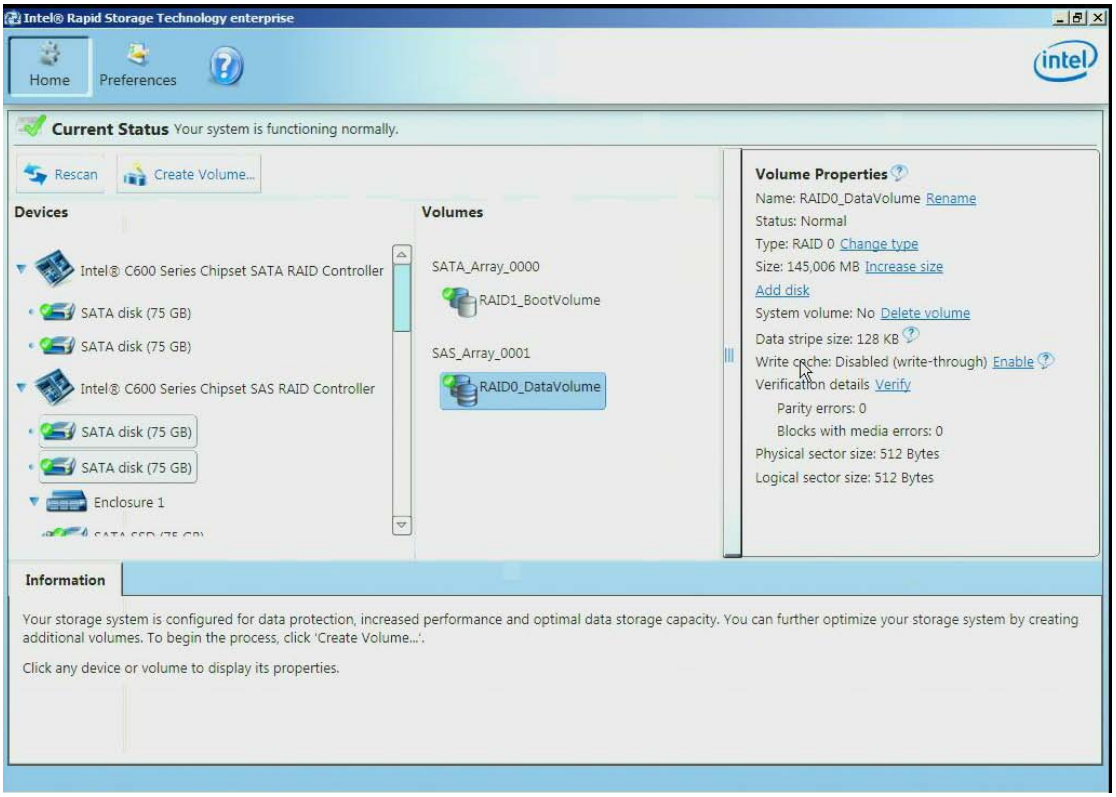
6. Under the Volumes section, the new Array and RAID Volume (RAID0_DataVolume) will appear. By selecting the RAID Volume, the Volume Properties section (to the right) will show the properly information of the newly created RAID volume



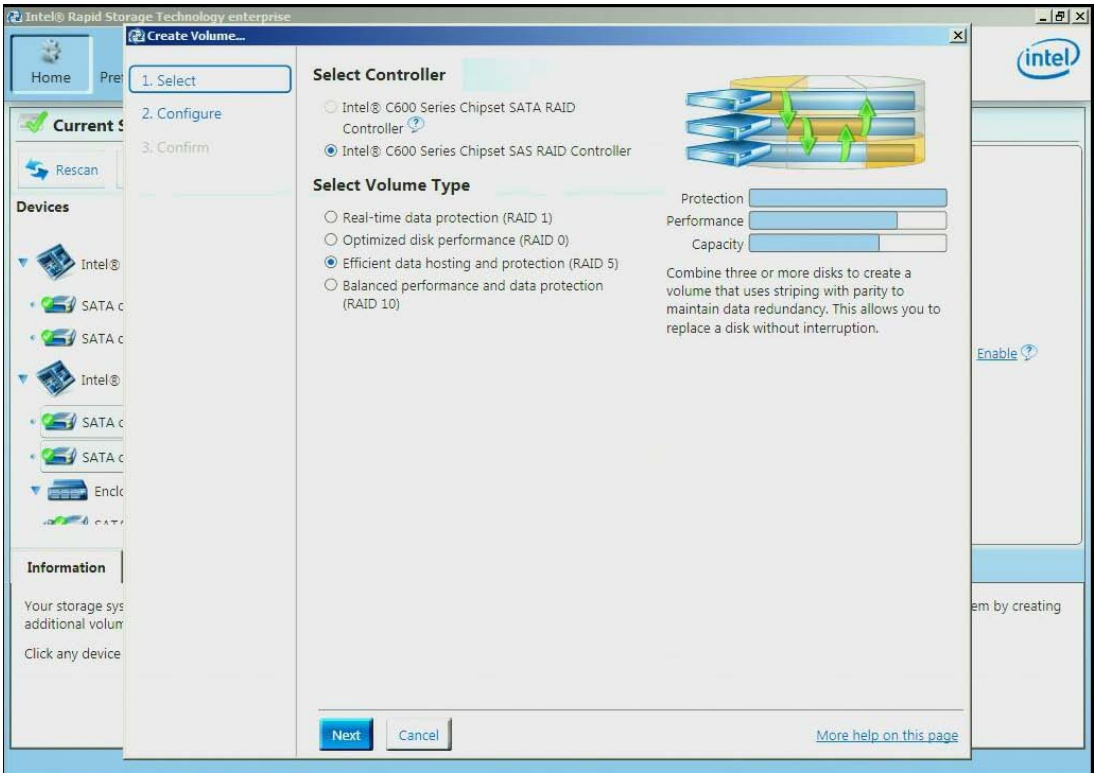
Create a 5 Drive RAID 5 Volume

In this example some of the disk drives that are in the attached enclosure will be used to create a 5 drive RAID 5 volume.

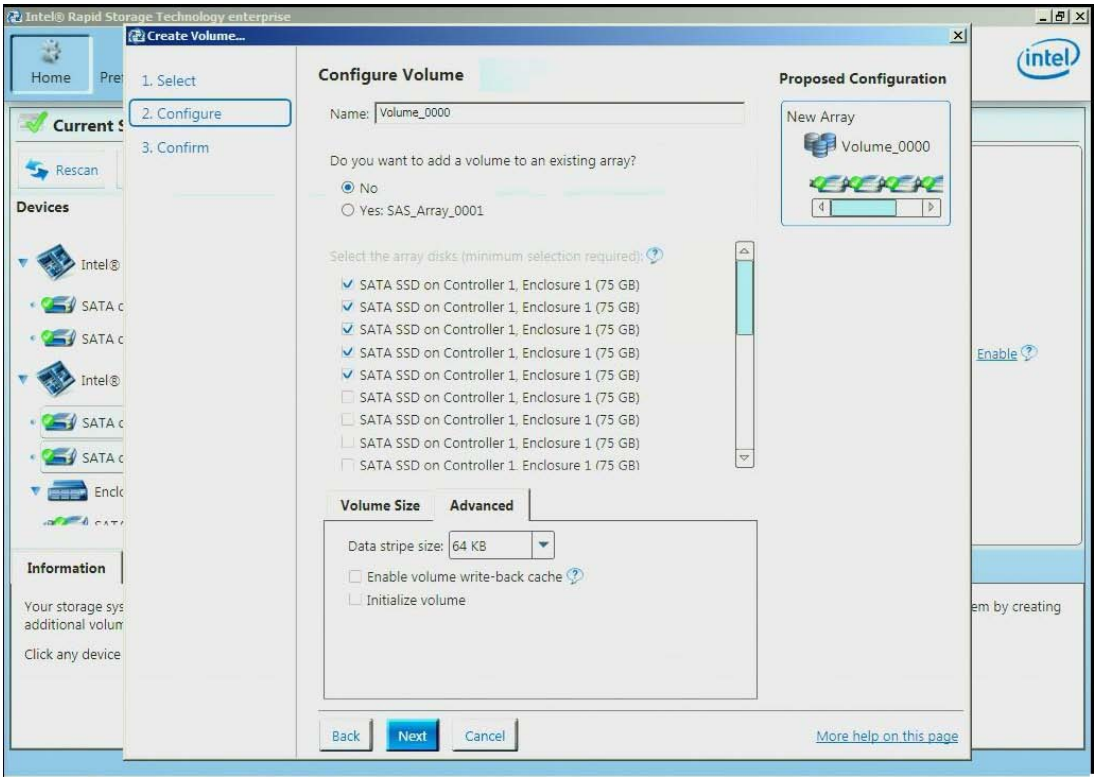
1. Click on **Create Volume** to begin



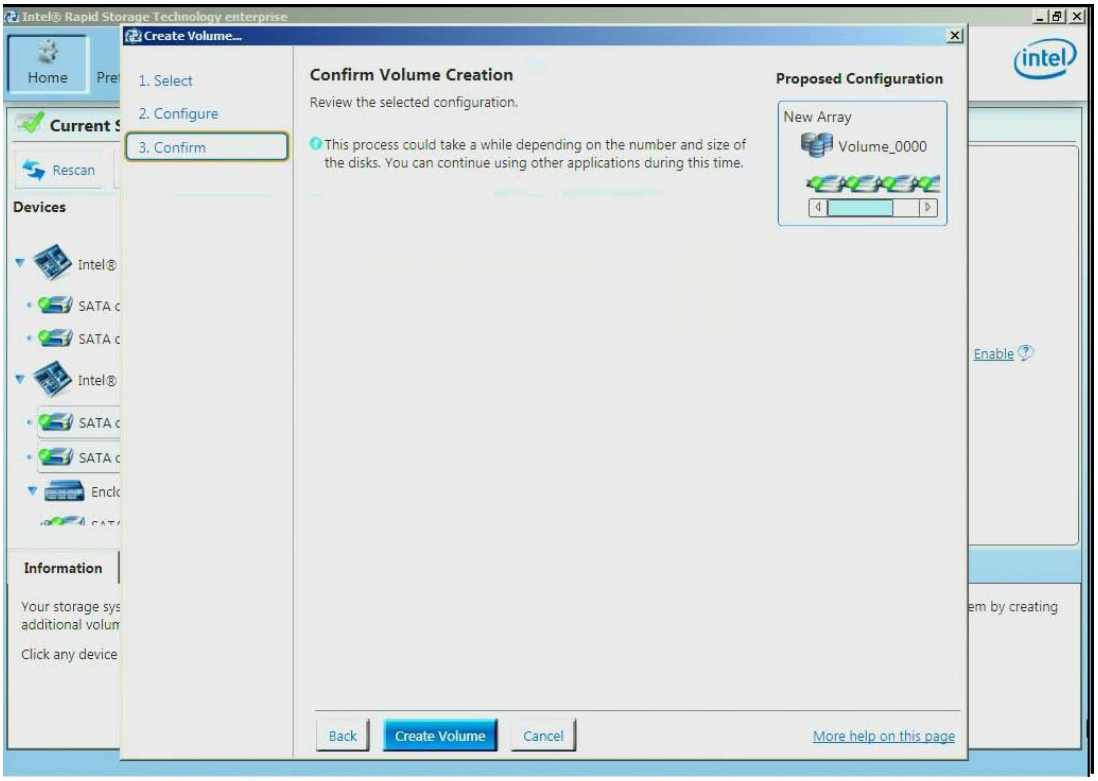
2. Select the **Intel® C600 series chipset SAS RAID Controller** and then select **Efficient data hosting and protection (RAID 5)** followed by **Next** to continue



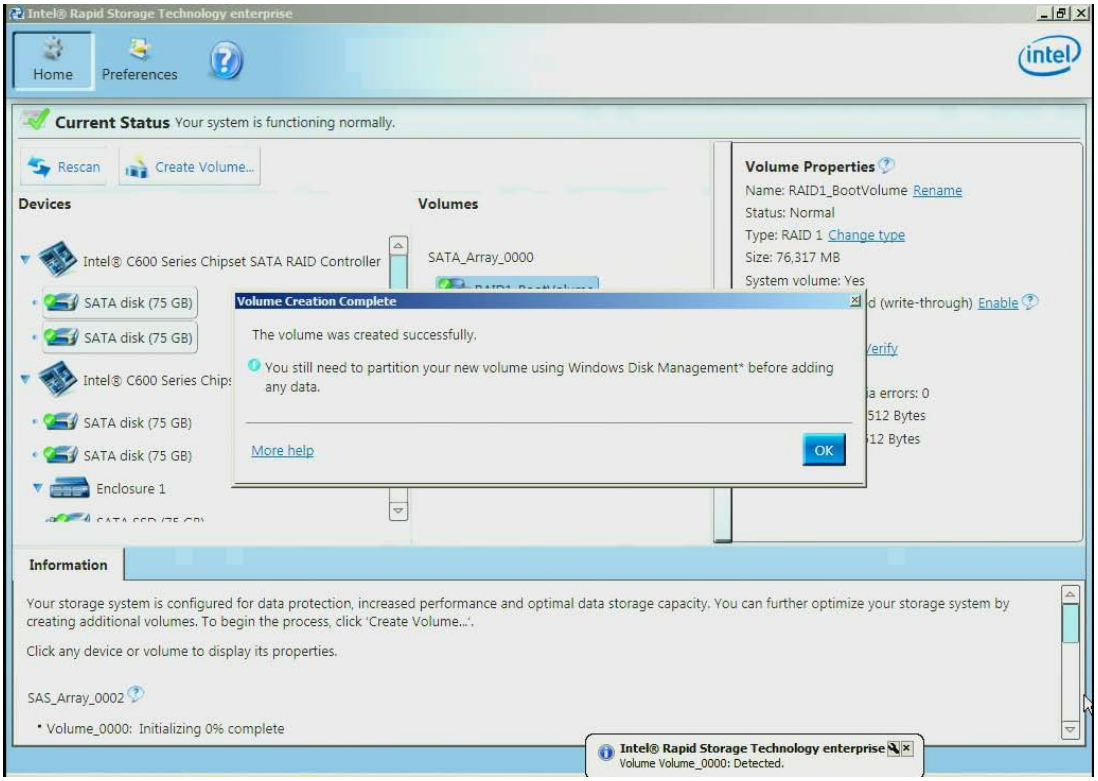
3. To configure the volume, you can first specify the **Name** of the volume. In this example, the default name is used **Volume_0000.** Next select the two drives to be included in the volume. Notice that for **Do you want to keep data from one of the selected disks** question, **Yes** has already been selected. Under the **Advanced** tab you can choose the **Data stripe size**, **Enable volume write-back cache** or **Initialize volume**. For a 5 drive RAID 5, the initialization will begin automatically. This is done to improve the operational performance of the RAID 5 volume. For RAID 5 volumes under 5 disks, the initialization process will not begin automatically. Once all of the desired options have been selected, click **Next** to continue.



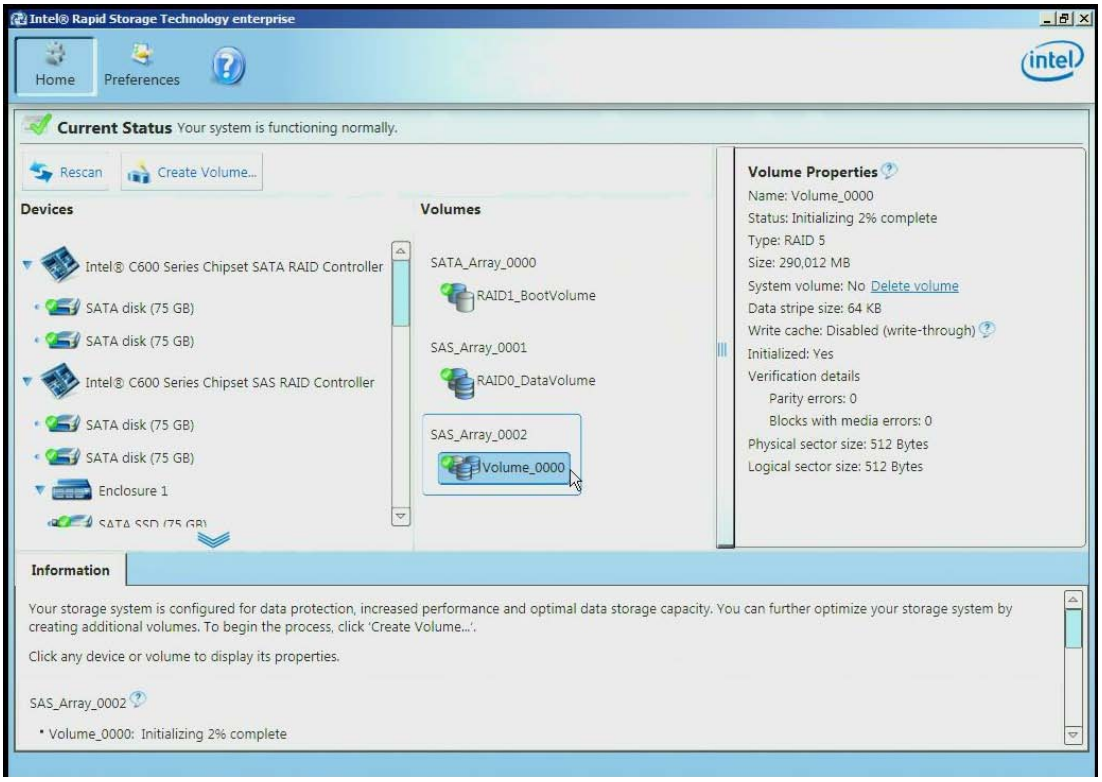
4. Under **Confirm Volume Creation**, select **Proceed with deleting data** (if the option appears) otherwise, click **Create Volume** to continue the process.



5. Click **OK** to finish



6. Under the Volumes section, the new Array and RAID Volume (RAID0_DataVolume) will appear. By selecting the RAID Volume, the Volume Properties section (to the right) will show the properly information of the newly created RAID volume.

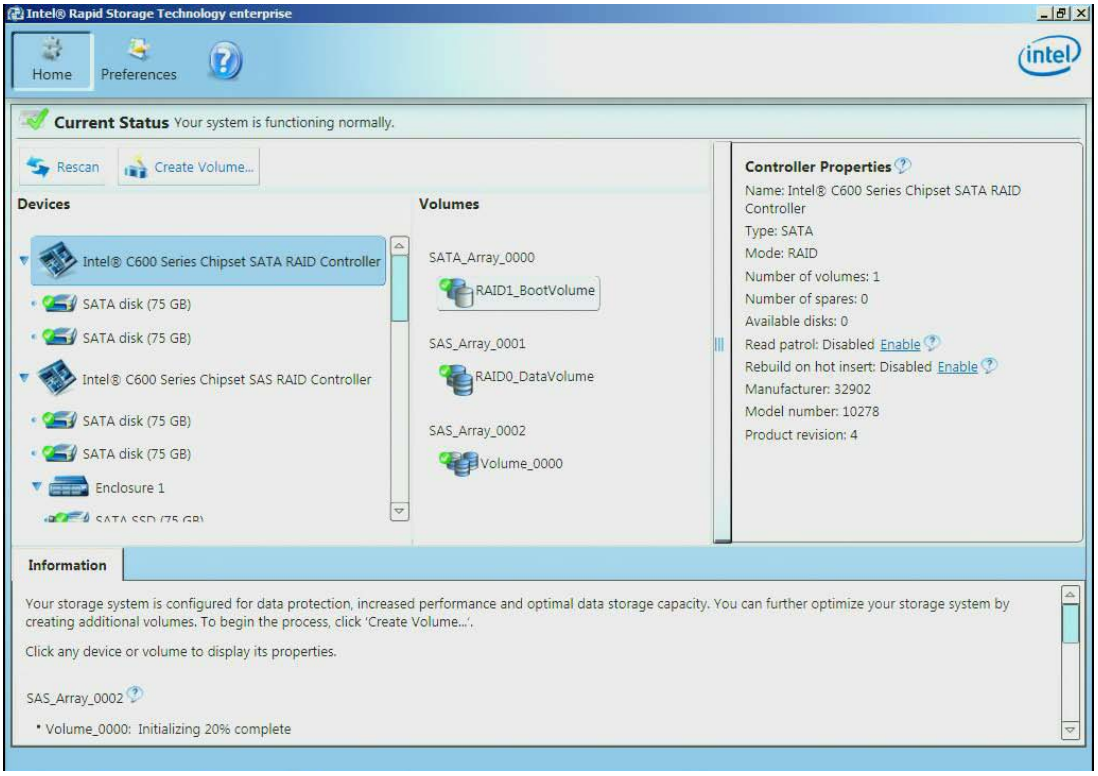


GUI Utility Overview

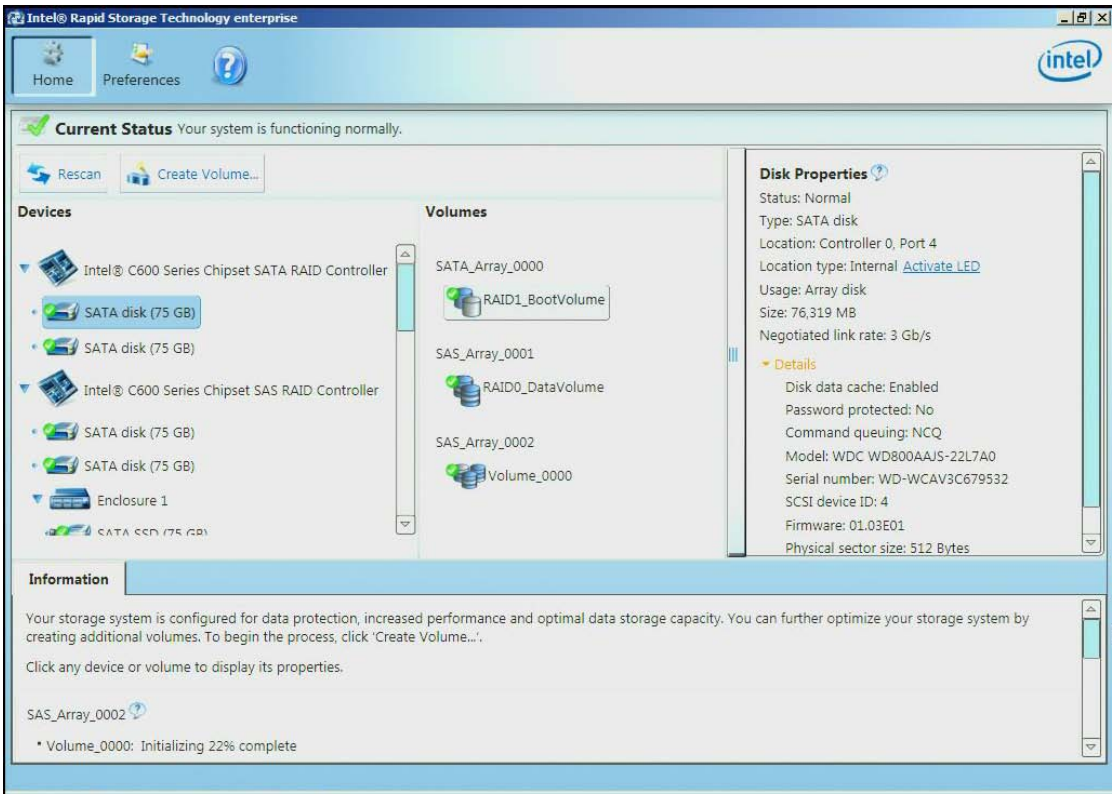
This section will go over the different part of the UI along with the information that can be obtained and actions that can be taken.

Devices

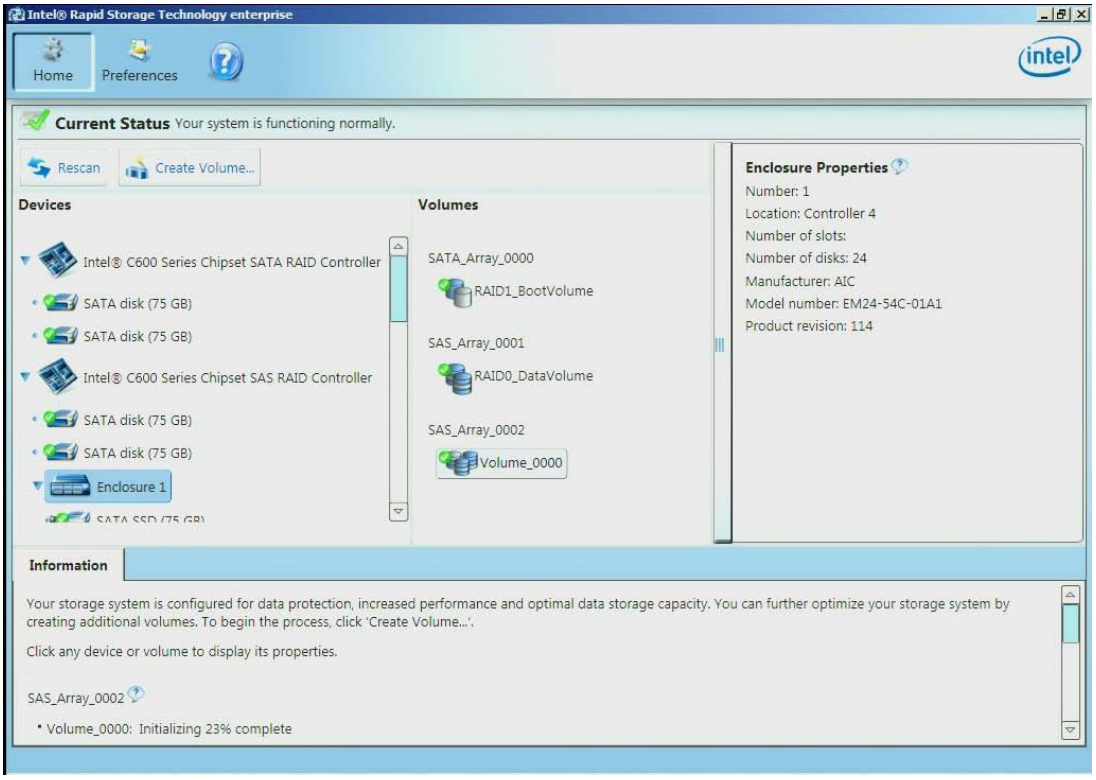
Under the Devices portion of the UI (to the left) there are the two controllers; the Intel® C600 series chipset SATA RAID Controller (when the AHCI Controller is set to RAID Mode) and the Intel® C600 series chipset SAS RAID Controller. By selecting a controller, the **Controller Properties** will appear to the right.



By selecting a specific drive, the **Drive Properties** will appear to the right.



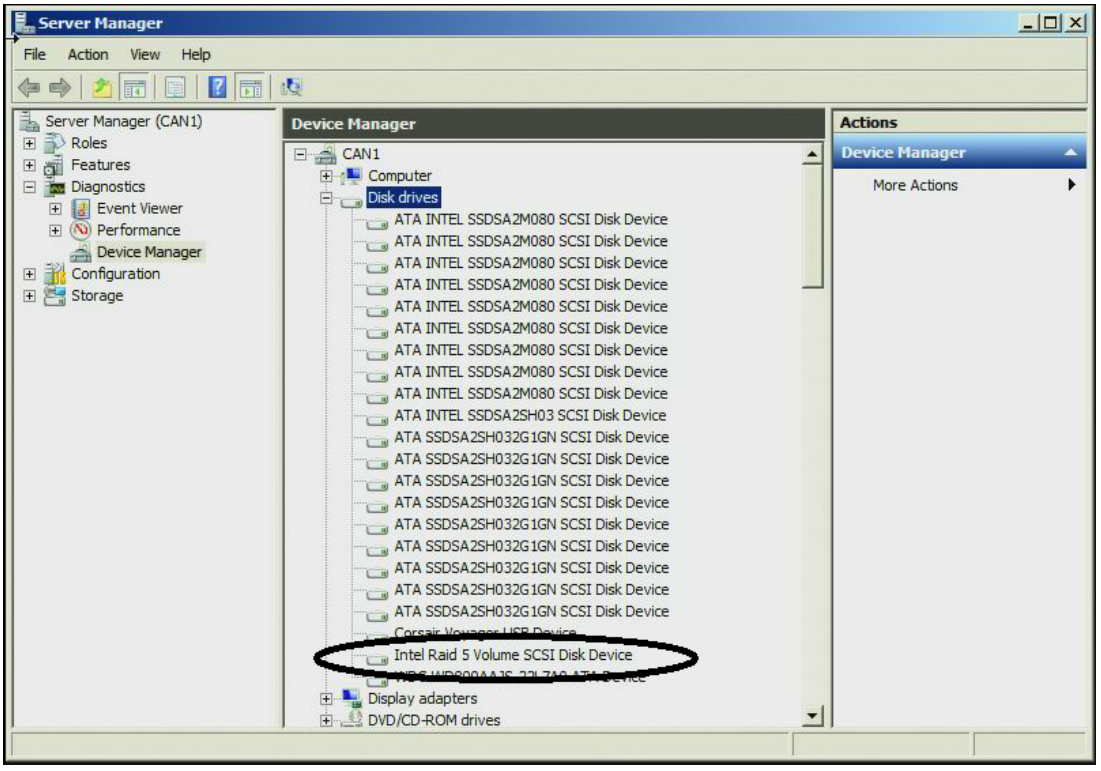
If the system has an enclosure and that happens to be selected, the **Enclosure Properties** will appear to the right.



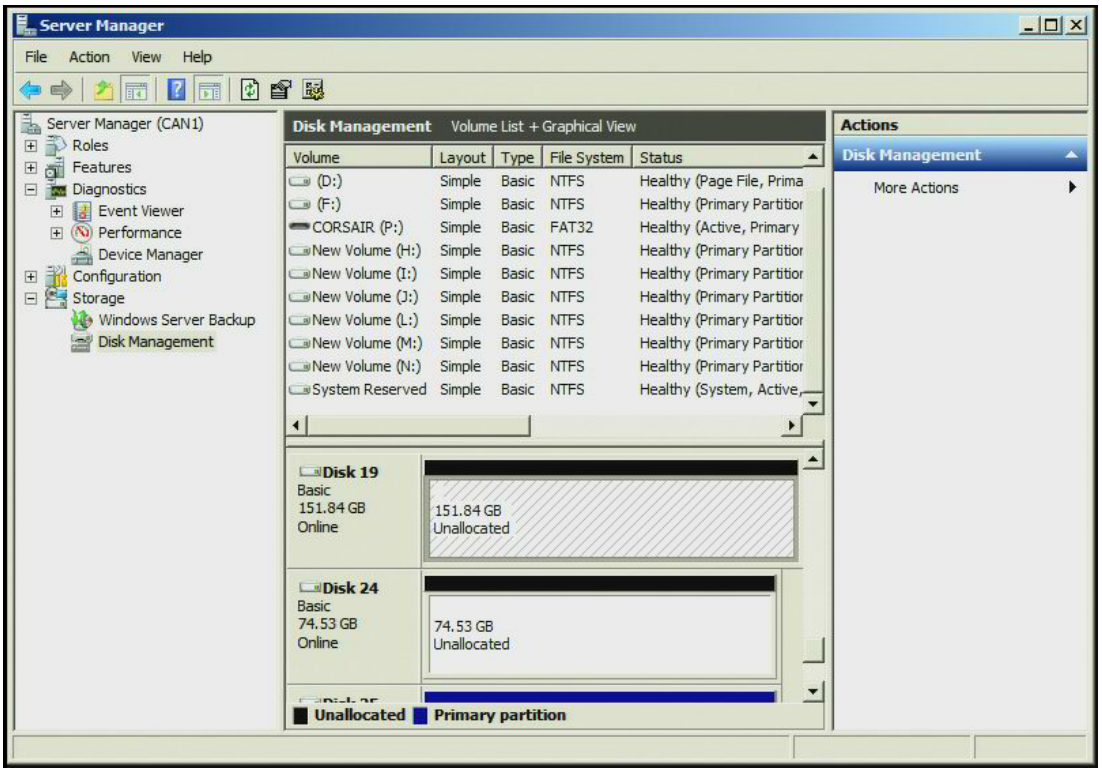
Viewing the RAID Volumes in Device Manager

Attached are some screen captures that show what Window* device manage may display after the RAID volume has been created.

1. Bring up **Computer Management** and select Windows* **Device Manager**. The newly created RAID volume should be shown under **Disk drives**



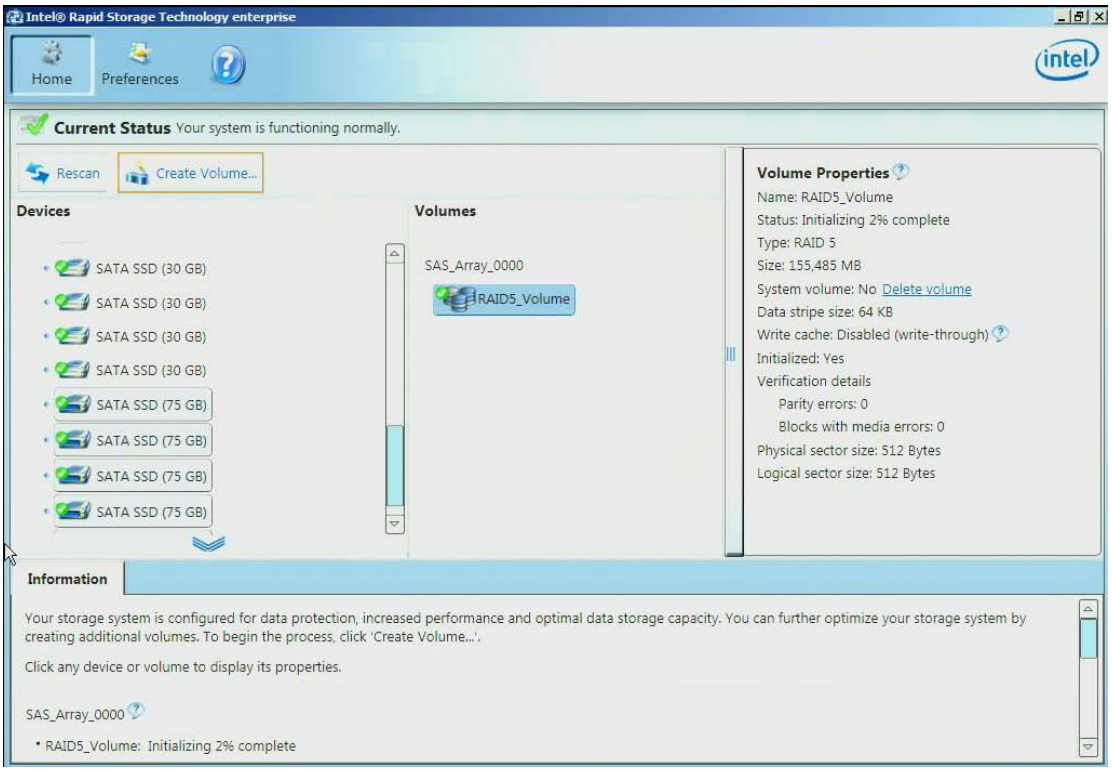
2. Under **Storage -> Disk Management**, the newly created RAID volume is now available to format.



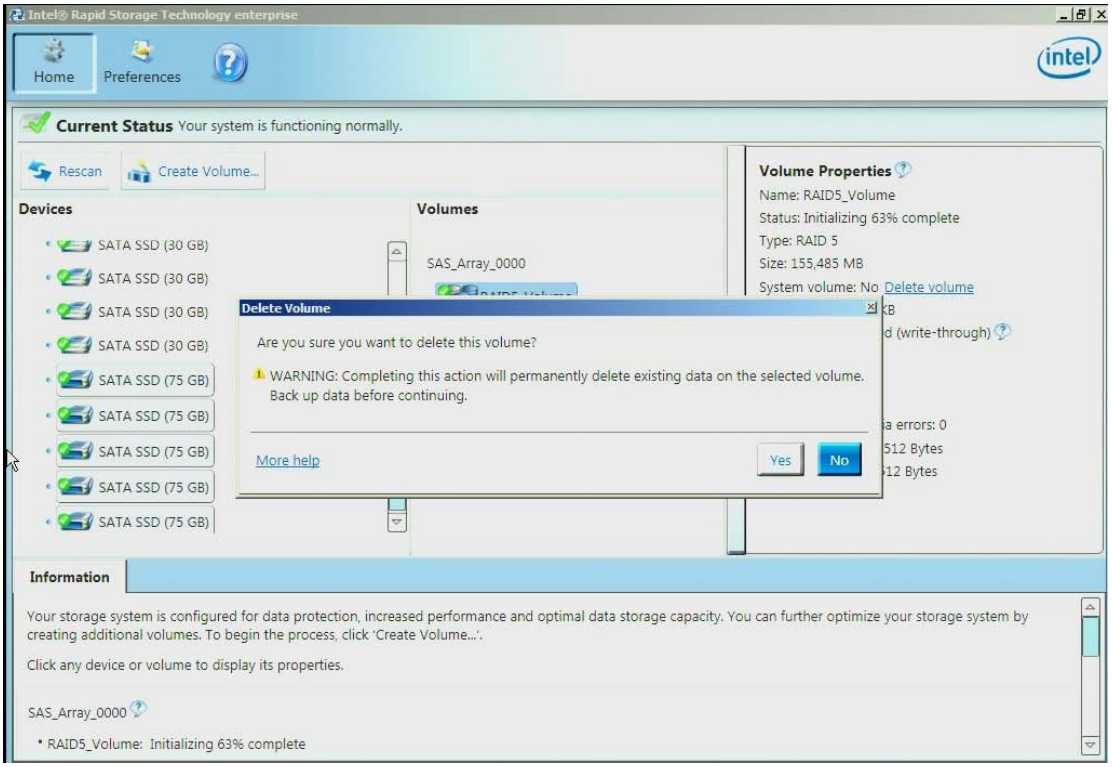
Volume Deletion

The following steps through the RAID Volume deletion process.

1. Select (left mouse click) the RAID Volume to be deleted in the middle under **Volumes**. Then on the right side under **Volume Properties** select **Delete Volume**.



2. Select **Yes** at the warning to complete the process.


Intel® Rapid Storage Technology enterprise
Home
Preferences
intel
Current Status Your system is functioning normally.
Rescan
Create Volume...
Devices
SATA SSD (30 GB)
SATA SSD (30 GB)
SATA SSD (30 GB)
SATA SSD (30 GB)
SATA SSD (75 GB)
SATA SSD (75 GB)
SATA SSD (75 GB)
SATA SSD (75 GB)
SATA SSD (75 GB)
Volumes
SAS_Array_0000
Volume Properties
Name: RAID5_Volume
Status: Initializing 63% complete
Type: RAID 5
Size: 155,485 MB
System volume: No Delete volume
Delete Volume
Are you sure you want to delete this volume?
WARNING: Completing this action will permanently delete existing data on the selected volume. Back up data before continuing.
More help
Yes
No
Information
Your storage system is configured for data protection, increased performance and optimal data storage capacity. You can further optimize your storage system by creating additional volumes. To begin the process, click 'Create Volume...'.
Click any device or volume to display its properties.
SAS_Array_0000
RAID5_Volume: Initializing 63% complete

6 Intel® RSTe Command Line Interface (RSTCLI) Utility Overview

RSTCLI is an end user command line utility used to do basic RAID operations on Intel® RSTe enabled systems. Intel® RSTe supports RAID0, RAID1, RAID5 and RAID10 volumes. RSTCLI supports creating RAID volumes through the create mode and managing RAID volumes through the Manage mode. In addition there are miscellaneous options such as help, status and version.

Options for Intel® RSTe are case sensitive. Both long and short versions of the options are given:

Table 3. Intel® RSTe Command Line Interface Utility Options

Flag	Name	Description
-C	*--create*	*Creates a volume and array if one does not already exist, creates a new volume on an existing array; used to denote Create Mode*
-I	*--information*	*Displays controller, array, volume, enclosure and disk information; used to denote Information Mode*
-M	*--manage*	*Manages specific components of arrays, volumes and disks; used to denote Manage Mode*
-m	*--modify*	*Modifies a volume or an array; used to denote Modify Mode*
-h	*--help*	*Prints documentation of how to invoke the program*
-r	*--rescan*	*Forces the system to rescan for hardware changes.*
-V	*--version*	*Prints version information*
-q	*--quiet*	*Suppress output for create, modify and manage. This will limit output to error return codes only. This mode is used to facilitate the use of command line scripts.*

General Usage

The general command line format of the RSTCLI is as follows:

rstcli [optional mode] <raid-device> [option]{[options]}<component-device>

Note: rstcli.exe is for 32-bit Windows* operating systems and rstcli64.exe is for 64-bit. For the purposes of this section, rstcli will be used.

To see all available commands and options enter the following:

rstcli –help

To obtain additional information on a particular optional mode enter the following command:

rstcli [mode] –help

Create

The create option is used to create RAID volumes. To create a RAID volume, enter the following:

rstcli --create --level x [--size y] [--strip-size z] --name string [--create-from-existing diskId] diskId {[diskId]}

Table 4. Create Options

Flag	Name
-C	--create *Creates a volume and array if one does not already exist. Creates a new volume on an existing array; used to denote Create Mode.*
-E <<host>-<bus>-<target>-<lun>>	--create-from-existing <<host>-<bus>-<target>-<lun>> *If data is to be migrated from one of the disks, specify the disk with this flag. Disk identifier is SCSI address.*
-l	--level
-n <Volume name>	--name <Volume name>
-s	--strip-size
-z <size in GB>	--size <size in GB> *Size in gigabytes. This is an optional switch. If switch is not used or size is specified to 0, then the maximum size available will be used.*

Create Examples:

-C -l 1 -n Volume 0-1-0-0 0-2-0-0

--create -l 0 -z 5 --name RAID0Volume 0-3-0-0 0-4-0-0 0-5-0-0

-C - 1 -E 0-1-0-0 -n VolumeWithData 0-2-0-0

--create –help

Information

The Information option will provide information on arrays, controllers, disks, enclosures and volumes. To obtain the desired information, enter the following:

rstcli --information --controller|--array|--disk|--enclosure|--volume {[device]}

Table 5. Information Options

Flag	Name
-I	*--information* *Displays controller, array, volume, enclosure, and disk information; used to denote Information Mode.*
-a	*--array* *Lists information about the arrays on the system.*
-c	*--controller* *Lists information about the controllers on the system.*
-d	*--disk* *Lists information about the disks in the system.*
-e	*--enclosure* *Lists information about the enclosures on the system.*
-v	*--volume*

	Lists information about the volumes on the system when used in Info mode. Stipulates the volume to act on in Modify or Manage.

Information Examples:

-I -v Volume

-I -d 0-5-0-0

--information --array Array_0000

--information –help

Manage

The Manage option will be used to manage specific components of arrays, volumes and disks. To perform the desired management function, enter one the following:

rstcli --manage --cancel-verify volumeName

--manage --delete volumeName

--manage --verify-repair volumeName

--manage --normal-volume volumeName

--manage --normal diskId

--manage --initialize volumeName

--manage --locate diskId {[diskId]}

--manage --delete-metadata diskId

--manage --not-spare diskId

--manage --volume-cache-policy off|wt|wb --volume volumeName

--manage --rebuild volumeName --target diskId

--manage --spare diskId

--manage --verify volumeName

--manage --write-cache true|false --array arrayName

Table 6. Manage Options

Flag	Name
-M	*--manage* *Manages specific components of arrays, volumes and disks; used to denote Manage Mode.*
-x <Volume name>	*--cancel-verify <Volume name>*
-D <Volume name>	*--delete <Volume name>*
-p <Volume name>	*--verify-repair <Volume name>* *Verifies and repairs the volume.*
-f <Volume name>	*--normal-volume <Volume name>* *Marks failed volume as normal.*
-F <<host>-<bus>-<target>-<lun>>	*--normal <<host>-<bus>-<target>-<lun>>* *Marks failed disk as normal.*
-I <Volume name>	*--initialize <Volume name>* *Initializes the redundant data on a volume.*

-L <<host>-<bus>-<target>-<lun>>	*--locate <<host>-<bus>-<target>-<lun>>* *Locates device and blinks the LED.*
-T <<host>-<bus>-<target>-<lun>>	*--delete-metadata <<host>-<bus>-<target>-<lun>>*
-N <<host>-<bus>-<target>-<lun>>	*--not-spare <<host>-<bus>-<target>-<lun>>* *Resets a spare disk to available.*
-P <Volume name>	*--volume-cache-policy <Volume name>* *Sets volume cache policy to either off, wt (write-through) or wb (write-back)*
-R <Volume name>	*--rebuild <Volume name>*
-S <<host>-<bus>-<target>-<lun>>	*--spare <<host>-<bus>-<target>-<lun>>*
-t <<host>-<bus>-<target>-<lun>>	*--target <<host>-<bus>-<target>-<lun>>* *Indicates the pass-through disk for a rebuild.*
-U <Volume name>	*--verify <Volume name>*
-w <true or false>	*--write-cache <true or false>*

Manage Examples:

--manage --spare 0-3-0-0

-M -D VolumeDelete

-M --normal 0-2-0-0

--manage -w true -array Array_0000

-M -U VolumeVerify

--manage –help

Modify

The Modify option is used to modify volumes and arrays. To perform a modification, enter the one of the following:

rstcli --modify --volume VolumeName --add diskId {[diskId]}

--modify --volume VolumeName --expand

--modify --volume VolumeName --level L [--add diskId {[diskId]} [--strip-size s]

--modify --volume VolumeName --name n

Table 7. Modify Options

Flag	Name
-m	*--modify*
-A <<host>-<bus>-<target>-<lun>>	*--Add <<host>-<bus>-<target>-<lun>>*
-X	*--expand*
-l <0, 1, 5, 10>	*--level <0, 1, 5, 10>* *Raid level options are 0, 1, 5 and 10.*
-n	*--name*
-s <size in KB>	*--strip-size <size in KB>* *Strip size in kilobytes (2^10 bytes). Valid for RAID 0, RAID 5 and RAID 10. Options are 4, 8, 16, 32, 64 and 128.*
-v	*--volume*

Modify Examples:

-m -v Volume_0000 -A 0-3-0-0 0-4-0-0

-m --volume ModifyVolume --level 5

--modify -v Volume -n RenameVolume

--modify --help

Rescan

The Rescan option is used to force the system to rescan for hardware changes. To perform a system rescan, enter the following:

rstcli –-rescan (or -r)

Quiet

The Quiet option is used to suppress output for create and manage. This option is not valid for information mode. To initiate quiet mode, enter the following:

rstcli —quiet (or –q)

Ignore

The Ignore option is used to ignore the rest of the labeled arguments that follow this flag. To use the Ignore options, enter the following:'

rstcli —ignore_rest (or --)

Version

The Version option will print the version information of the driver, OROM, middleware and rstcli components that are installed on the system

rstcli —version

This output will resemble the following:

Intel(R)RSTCLI

Middleware Version: <major>.<minor>

Driver Version: <major>.<minor>

OROM Version: <major>.<minor>

Return Codes

Return codes listed are generalized. Specific details returned will depend on the call being made.

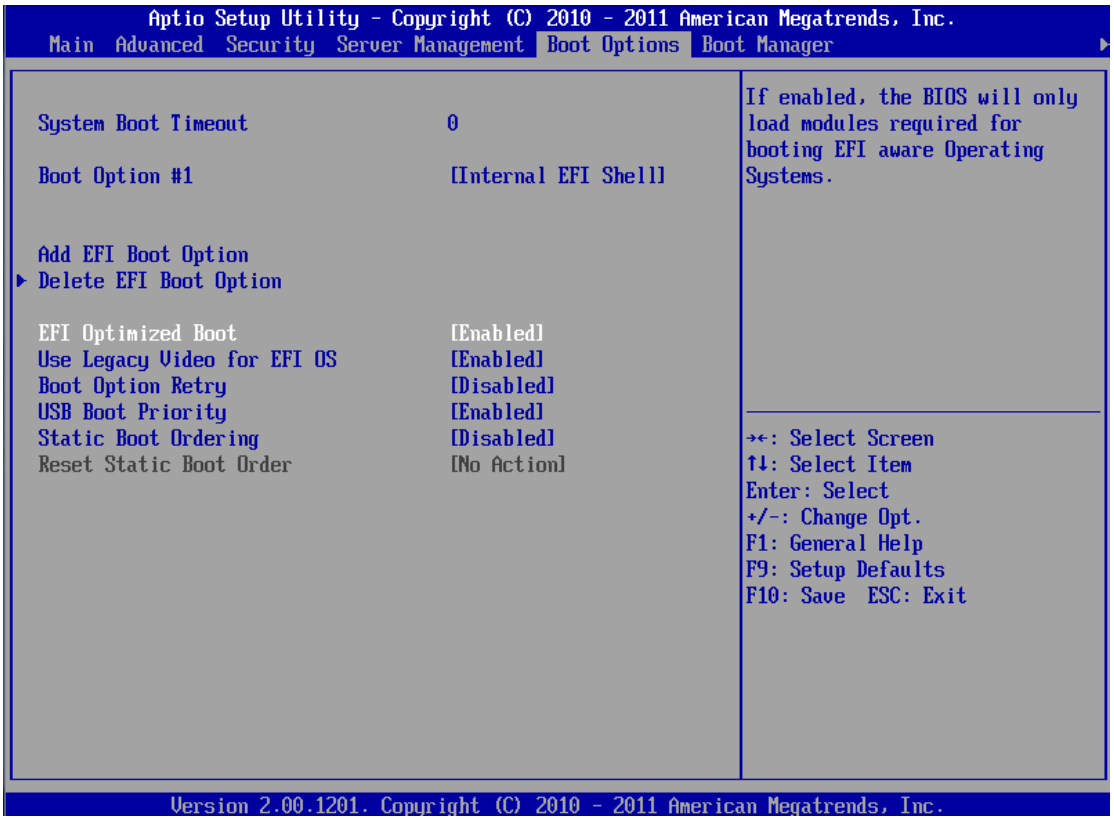
Table 8. Return Codes

	Return	Description
	SUCCESS	Successful completion of request
	FAILURE	At least some part of request failed
	INVALID_REQUEST	Unrecognized command; request formatted incorrectly
	INVALID_DEVICE	Request not formatted correctly, device passed in does not exist. Detail return message will include device identifier and operation. Detail message will be returned unless --quiet switch is used.
	REQUEST_FAILED	Request was formatted correctly but failed to execute. Detail message will be returned unless --quiet switch is used.
	REQUEST_UNSUPPORTED	Request is not supported on this system. Request was formatted correctly, but is not supported on this system (this would probably indicate a bug, as unsupported requests should result in an INVALID_REQUEST return).
	DEVICE_STATE_INVALID	Device specified in this request is not in a state that supports this operation. Detail message will include device identification and state that device is in. Detail message will be returned unless --quiet switch is used.
	INVALID_STRIP_SIZE	Strip size is not supported
	INVALID_NAME	Name of volume is too long or has invalid characters
	INVALID_SIZE	Size requested is invalid
	INVALID_NUMBER_DISKS	Number of disks is invalid
	INVALID_RAID_LEVEL	RAID level requested is not valid

7 UEFI based RCFGSCU and RCFGAHCI Utility

The UEFI based RCFGSCU and RCFGAHCI are end user command line utilities used to do basic RAID operations on Intel® RSTe enabled systems. Intel® RSTe supports RAID0, RAID1, RAID5, and RAID10 volumes. RSTCLI supports creating RAID volumes through the create mode and managing RAID volumes through the Manage mode. In addition there are miscellaneous options such as help, status and version.

To use the UEFI based RCFGSCU and RCFGAHCI, EFI Optimized Boot option must be enabled in server board BIOS SETUP – Boot Option – EFI Optimized Boot.



After above step, ensure to insert a USB key with RCFGSCU and RCFGAHCI included to the USB port on the server system. Enter UEFI Shell, go to the directory where the utilities are located, and then can run these commands.

RCFGSCU Utility Usage

RCfgScu.efi [/?] [/Y] [/Q] [/C:vol_name] [/SS:strip_size] [/L:raid_level] [/S:vol_size] [/DS:disk_ports] [/D:vol_name] [/X] [/I] [/P] [/U] [/ST] [/SP] [/V]

/? Displays Help Screen. Other options ignored.

/Y Suppress any user input. Used with options /C, /D, /SP & /X.

/Q Quiet mode / No output. Should not be used with status commands.

COMMANDS - Only one at a time unless otherwise specified.

/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 or /ST.

/U Do not delete the partition table. Only valid with /C on RAID 1 volumes.

/SP Marks the selected drive(s) as spare(s). Use with /DS

/ST Display Volume/RAID/Disk Status.

/V Display version information

RCFGAHCI Utility Usage

RCfgahci.efi (or named as RFfgsata.efi) [/?] [/Y] [/Q] [/C:vol_name] [/SS:strip_size] [/L:raid_level] [/S:vol_size]
[/DS:disk_ports] [/D:vol_name] [/X] [/I] [/P] [/U] [/ST] [/SP] [/V] [/RRT] [/Sync]
[/M] [/EM] [/ER] [/ACCEL] [/RA] [/SD]

/? Displays Help Screen. Other options ignored.

/Y Suppress any user input. Used with options /C, /D, /SP & /X.

/Q Quiet mode / No output. Should not be used with status commands.

COMMANDS - Only one at a time unless otherwise specified.

/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 or /ST.
/U Do not delete the partition table. Only valid with /C on RAID 1 volumes.
/SP Marks the selected drive(s) as spare(s). Use with /DS
/ST Display Volume/RAID/Disk Status.
/V Display version information
/RRT Create a recovery volume. Only valid with /C. Requires /M.
/Sync Set sync type for 'Recovery' volume. Only valid with /RRT.
/M Specify the port number of the Master disk for 'Recovery' volume. Only
valid with /RRT.
/EM Enable only master disk for recovery volume
/ER Enable only recovery disk for recovery volume
/EM and /ER actions will result in change from Continuous Update mode
to On-Request.
/ACCEL Specify the volume to accelerate and acceleration mode
vol_name1 - volume to accelerate
cache_vol - the volume to use as cache
mode - "enh" for enhanced, "max" - maximized
/RA Removes the Disk/Volume Acceleration.
/SD Synchronizes the data from the cache device to the Accelerated Disk/Volume.

Appendix A

The table below is Storage System Events Detected by Monitor Service (IAStorDataMgrSvc)

Notes: *NAI = Notification Area Icon. NAI true only if the user selected to receive notification under Preferences in the UI*

Notes*: For Email Notify detail, refer to* ***Email Alerting and Notification*** *in* ***Software RAID Functional Support*** *in Section 2 –* ***RAID Features****.*

Table 9. Storage System Events

Event Type	Event Level	String	Event Displayed		
			NAI	Event log	Email Notify
Disk Triggered Events					
Failed	Error	Disk on port {n}: Failed. Open the application for details.	Yes	Yes	Yes
S.M.A.R.T.	Warning	Disk on port {n}: At risk. Open the application for details.	Yes	Yes	Yes
Unlocked	Info	Disk on port {n}: Unlocked.	Yes	Yes	Yes
Added	Info	Disk on port {n}: Detected.	Yes	Yes	Yes
Removed	Info	Disk on port {n}: Removed.	Yes	Yes	Yes
Volume Triggered Events					
Failed	Error	Volume {0}: Failed. Open the application for details.	Yes	Yes	Yes
Degraded	Warning	Volume {0}: Degraded. Open the application for details.	Yes	Yes	Yes
Detected	Info	A new volume was found.	Yes	Yes	Yes
RebuildComplete	Info	Volume {0}: Rebuilding complete.	Yes	Yes	Yes
VerifyStop	Info	Volume {0}: Verification complete.	Yes	Yes	Yes
VerifyAndRepairStop	Info	Volume {0}: Verification and repair complete.	Yes	Yes	Yes
MigrationComplete	Info	Volume {0}: Data migration complete.	Yes	Yes	Yes
InitializeComplete	Info	Volume {0}: Initialization complete.	Yes	Yes	Yes
Unlocked	Info	Volume {0}: Unlocked.	Yes	Yes	Yes
NotPresent	Info	Volume {0}: No longer present on system.	Yes	Yes	Yes
RebuildStarted	Info	Volume {0}: Rebuilding in progress.	Yes	No	No
VerifyStarted	Info	Volume {0}: Verification in progress.	Yes	No	No
VerifyAndRepairStarted	Info	Volume {0}: Verification and repair in progress.	Yes	No	No
MigrationStarted	Info	Volume {0}: Data migration in progress.	Yes	No	No
InitializeStarted	Info	Volume {0}: Initialization in progress.	Yes	No	No
General Events					
Server start failed	Error	Server failed to start. Additional information:	No	Yes	Yes
Event manager started	Info	Started the event manager.	No	Yes	Yes