



# Intel® Rapid Storage Technology enterprise 3.0

Technical Product Specification (TPS) Document

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*Revision 1.2*

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## Revision History

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458224	0.5	Pre-Alpha Release	Sept 21, 2010
458224	0.51	Added descriptions for Dirty Strip Journaling, Partial Parity Logging and Verify and Repair features	Sept 22, 2010
458224	0.65	Minor Corrections and Clarifications	December, 2010
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458224	0.72	Alpha Release	April, 2011
458224	0.73	Minor Corrections and Clarifications	April, 2011
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458224	0.82	Update Pre-OS requirements for OROMs Updated Upgrade ROM #9 Device ID	Sept, 2011
458224	0.84	Updated Supported Operating Systems	Nov, 2011
458224	0.85	Updated Hardware Compatibility List	Dec, 2011
458224	1.0	Updated to correct various mistakes and updates.	March, 2012
458224	1.1	Updated to correct various mistakes and updates.	June, 2012
458224	1.2	Updated information regarding expanders	July, 2012



# 1 Introduction

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This is the Technical Product Specifications for the Intel® Rapid Storage Technology enterprise (Intel® RSTe) 3.0 product. The intent of this document is to present the functional requirements (or features) that make up this product. Although this document has references to Linux, the main intent is to describe the features that will be in the Windows® base Intel® RSTe 3.0 drivers.

## 1.1 ACRONYMS

The following acronyms will be used throughout this document.

Table 1-1. Common Acronyms

Term	Definition
AHCI	Advanced Host Controller Interface
ATA	Advanced Technology Attachment
ATAPI	Advanced Technology Attachment Packet Interface
BIOS	Basic Input / Output System
Chipset	A term used to define a collection of The PNHCI components required to make a PC function.
CIM	Common Information Model
CLI	Command Line Interface
Cougar Point	Platform Controller Hub
CSMI	Common Storage Management Interface
DMA	Direct Memory Access
DOS	Disk Operating System
DIPM	Device Initiated Power Management
DSJ	Dirty Stripe Journaling
Disk's Write Cache	A memory device within a hard drive, which is allocated for the temporary storage of data before that data is copied to its permanent storage location.
EN	Entry Server
EP	Efficient Performance
GB	Giga-byte

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Term	Definition
HDD	Hard Disk Drive
HIPM	Host Initiated Power Management
Hot Plug	A term used to describe the removal or insertion of a SATA hard drive when the system is powered on.
ICH	Input / Output Controller Hub
IHV	Independent Hardware Vendor
LPM	Link Power Management
MB	Mega-bytes
NAI	Notification Area Icon
NCQ	Native Command Queuing
NTFS	NT File System
ODD	Optical Disk Devices
ODM	Original Design Manufacturer
OEM	Original Equipment Manufacturer
OROM	Option ROM
OS	Operating System
PCH	Platform Control Hub
Port	The point at which a SATA drive physically connects to the SATA controller.
PPL	Partial Parity Logging
PRD	Product Requirements Document
RHEL	Redhat Enterprise Linux
RRT	Rapid Recover Technology
RST	Rapid Storage Technology
RSTe	Rapid Storage Technology enterprise
SAS	Serial Attached SCSI
SATA	Serial ATA
SCU	Storage Controller Unit
SES	SCSI Enclosure Service
SGPIO	Serial General Purpose I/O
SMART	Self-Monitoring, Analysis and Reporting Technology: an open standard for developing hard drives and software systems that automatically monitors a hard drive's health and reports potential problems.
SLES	SUSE Linux Enterprise Server
SMIS	Storage Management Initiative Specification
SSD	Solid State Device - non volatile memory
UI	User Interface
UEFI	Unified Extensible Firmware Interface



## 1.2 Intended Use

This document is intended to give detailed information on the technical features of the Intel® Rapid Storage Technology enterprise (Intel® RSTe) 3.0 product.

## 1.3 Intended Audience

The intended audience of this document is OEMs, ODMs, IHV, System Integrators, and end users requiring detailed information of the new features and technical specifications of the Intel® RSTe 3.0 product. It contains only information pertaining to the initial features introduced with the Intel® RSTe 3.0 product.



## 2 Product Overview

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The Intel® RSTe 3.0 product supports the Romley based enterprise storage platforms that contain the Advanced Host Controller Interface (AHCI) and the Storage Controller Unit (SCU). Intel® RSTe 3.0 is the enterprise version of Intel® Rapid Storage Technology (RST) and 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) to enable an optimal enterprise storage solution. It offers value-add features such as RAID and advanced SAS\* and/or SATA\* capabilities for various Operating System (for detailed OS support, review the Release Notes for each software release).

Some of the RAID features supported by Intel® RSTe 3.0 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 3.0 include but are not limited to:

- RAID support for SAS devices
- System Management (i.e. CIM provider and CSMI)
- Read Patrol

This document outlines and explains the key features available with the Intel® RSTe 3.0 product.

### 2.1 Intel® RSTe 3.0 Major Components

Intel® RSTe 3.0 is based on the Windows\* Storport Miniport device driver model. This provides for improved performance along with simplified functional maintainability. Intel® RSTe 3.0 contains the following core components:

1. Intel® RSTe 3.0 will provide a Pre-OS package for BIOS vendors and OEM/ODMs developing their own BIOS. The Pre-boot package will contain the binary images necessary to be compiled into the system BIOS to support Intel® C600 series chipset based platforms. The components of the Pre-boot package are as follows:
  - a. Intel® RSTe 3.0 RAID Legacy Option ROMs
  - b. There are two pre-boot (Int13 BIOS) based drivers (including a RAID Pre-boot configuration utility). One for the AHCI (or SATA) controller and the other for the SCU controller.
  - c. Intel® RSTe 3.0 RAID Unified Extensible Firmware Interface (UEFI) Drivers - There are two pre-OS UEFI drivers and UEFI command line utilities to provide a Pre-boot RAID configuration environment. One of the UEFI drivers will support the AHCI (or SATA) controller while the other one will support the SCU controllers..
2. Intel® RSTe 3.0 OS runtime software package



- a. AHCI/RAID driver - The Intel® RSTe 3.0 AHCI Storport miniport driver is an Intel proprietary driver that runs directly within the Windows\* Storport driver framework. 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 system BIOS Configuration utility is used to select either AHCI or RAID modes for the AHCI controller.

- b. SCU RAID driver - The Intel® RSTe 3.0 SCU Storport miniport driver is an Intel proprietary driver and runs directly within the Windows\* Storport driver framework. This driver will support/manage/control SAS and/or SATA devices connected to the SCU controller. It will support both non-RAID (pass-through) as well as a full RAID configuration.  
Note: The SCU controller does not currently support a non-RAID mode of operation analogous to "AHCI Mode" on the AHCI controller.
- c. Graphical User Interface (Intel® RSTe 3.0 GUI) - This is an application that can be used to manage RAID arrays and volumes on drives attached (only) to the AHCI and SCU controllers.

### 3. Intel® RSTe 3.0 RAID Utility

- a. Intel® RSTe 3.0 Command Line Interface (CLI) utility - An Intel® RSTe 3.0 RAID command line management application will be available to OEM/ODMs for their factory/manufacturing environments. This application is designed to operate as a scripting tool and runs in either Windows\* PE or a Windows\* Command Prompt window
- b. Intel® RSTe AHCI RAIDCFG utility - A DOS based Intel® RSTe 3.0 RAID configuration utility will be available to OEM/ODMs for their factory/manufacturing environments. This utility that helps manage drives attached to the AHCI controller in a manufacturing environment.
- c. Intel® RSTe SCU RAIDCFG utility - A DOS based Intel® RSTe 3.0 RAID configuration utility that helps manage drives attached to the SCU controller in a manufacturing environment.

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## 2.2 Supported Platforms/Chipsets/SKUs

### 2.2.1 Romley Platforms

- Intel® Server Series (Sandy Bridge) Chipset-based platform CRBs with the Intel® C600 series chipset (PCH)
  - Waimea Bay (High End Desktop, 1 CPU)
  - River City (Workstation, 2 CPUs/Sockets)
  - Harbor City (EN Server, 2 CPUs/Sockets)
  - Rose City (EP, 2 CPU)
  - Potter City (EX, 4 CPUs/Sockets)

## 2.3 Intel® C600 series chipset SKU's

SKUs	-A	-B	-D	-T
Features	(SATA Only)			
AHCI - SATA2 Ports (3Gb/s)	4	4	4	4
AHCI - SATA3 ports (6Gb/s)	2	2	2	2
SCU ports (3Gb/s)	4	4	8	8
Intel® RSTe AHCI RAID Support	0/1/10/5	0/1/10/5	0/1/10/5	0/1/10/5
Intel® RSTe SCU RAID Support	0/1/5/10	0/1/10*	0/1/10*	0/1/5/10

\* Intel® RSTe 3.0 RAID 5 supported on SATA Only configurations with specific BIOS enabled settings.

Please reference CDI/IBL Document No. 454672 for information on properly configuring the PCHSTRP16 strap in BIOS. It is Intel's recommendation that the PCHSTRP16 strapping be left to the default -T SKU value.

### 2.3.1 Upgrade ROM Options

Intel® RSTe 3.0 will provide support for the Intel® C600 series chipset Upgrade ROM feature. When the Upgrade ROM is implemented to modify the -A SKU of the Intel® C600 series chipset, the Intel® RSTe 3.0 driver will not be required to be changed, updated or reinstalled.



Upgrade ROM SKU #	SCU Ports	Protocol	RSTe SCU RAID 5	Equivalent SKU (Device ID)
Intel® C600 series chipset-A with no upgrade ROM	4 ports	SATA Only	Yes	-A (1D6Bh)
1	4 ports	SATA/SAS	No	-B (1D69h)
2	4 ports	SATA/SAS	Yes	(1D65h)
5	8 ports	SATA/SAS	No	-D (1D68h)
6	8 ports	SATA/SAS	Yes	-T (1D60h)
9	8 ports	SATA Only	Yes	(1D6Ah)

## 2.4 Unsupported Features

The following is a list is a non-comprehensive list of features that will not be supported in Intel® RSTe 3.0:

- Web Browser RAID configuration utility
- ATA\_PASS\_THROUGH IOCTL not supported under the Storport Miniport Model
- RAID array and volume(s) Spanning across the AHCI and SCU ports
- SCSI Enclosure Service (SES) Out of Band Management Support
- Port-Multipliers
- SATA RAID Legacy OROM support for Optical Devices
- SCU RAID Legacy OROM support for SAS Expanders
- SCU RAID Legacy OROM support for Optical Devices
- SCU UEFI Driver support for Optical Devices
- Intel® Rapid Recovery Technology (Intel® RRT)
- Expander support on AHCI controller
- Hard Drive Password
- Zero Power ODD
- NVSRAM
- Link Power Management (LPM)
- Time Limited Error Recovery (TLER)
- Installing Windows 2003 to a RAID Volume



- Combining all 8 SCU ports into a single X8 Wide Port connection - this configuration will behave as a single X4 Wide Port connection.
- SCU Controller operating at 6 Gb/s - Please refer to the latest C600 series chipset Sightings Report and/or Spec. update



## 2.5 Key Product Features

The product features described in this section, along with additional functionality. The following is a summary of the key features of this product.

Name	Key Features	
RAID 0/1/5/10 on SAS	<ul style="list-style-type: none"> <li>• SCU support for Matrix RAID 0/1/5/10</li> <li>• Pass-through drives</li> <li>• Hot Plug with I/O</li> <li>• Hot Spare Disk</li> <li>• Auto Rebuild on Hot Insert</li> <li>• Rebuild &amp; Migration Check Pointing</li> <li>• NCQ (SATA) and CQ (SAS) support</li> <li>• UEFI using common metadata</li> <li>• SAS Expanders</li> <li>• SMART Support</li> <li>• Bad Block Management</li> <li>• SAS &amp; SATA controller configuration rules</li> <li>• SAS &amp; SATA drive roaming</li> <li>• RAID Volume roaming between Linux* and Windows*</li> <li>• On Line Capacity Expansion</li> <li>• Large Stripe Size Support</li> <li>• RAID-Ready</li> </ul>	<ul style="list-style-type: none"> <li>• Disk Coercion</li> <li>• Manual &amp; Auto Rebuild</li> <li>• Instant Initialization</li> <li>• Read Patrol</li> <li>• SGPIO for SAS &amp; SATA</li> <li>• volume creation/verify</li> <li>• Selectable Boot Volume</li> <li>• Email Alerting</li> <li>• CIM</li> <li>• RAID Level Migration (RAID 0, 1, or 10 to RAID 5)</li> <li>• Dirty Stripe Journaling</li> <li>• Partial Parity Logging (PPL)</li> <li>• Verify and Repair</li> <li>• Auto Rebuild on Hot Insert</li> </ul>
Utilities	<ul style="list-style-type: none"> <li>• Install/Uninstall Utility</li> <li>• Configuration and Management Utilities</li> </ul>	
Intel® RSTe 3.0 (Window only)	Intel® RSTe 3.0 provides software for high-performance for SAS and SATA RAID + <ul style="list-style-type: none"> <li>▪ Matrix RAID for two RAID volumes on single array</li> <li>▪ Improved user interface for enhanced usability</li> </ul>	

### 2.5.1 Operating Systems Supported

#### 2.5.1.1 Microsoft OS Support

Intel® RSTe 3.0 will support both 32 and 64 bit versions of the following Microsoft OSs:

- Windows\* Vista
- Windows\* 7
- Windows\* Server 2008 SP2
- Windows\* Server 2008 R2 (64 bit only)
- Windows\* Server 2003
  - The “In Box” installation image for Windows 2003 does support the Microsoft Storport Miniport Driver Model. Microsoft made enhancements to the Storport Miniport architecture that was implemented following the release of Windows 2003.

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Microsoft has made a Hot-Fix available for download. The issue will only be encountered when accessing a RAID volume. Detailed instruction on applying the Hot-Fix to the installation images can be found:

- [http://technet.microsoft.com/en-us/library/cc766320\(ws.10\).aspx](http://technet.microsoft.com/en-us/library/cc766320(ws.10).aspx)
- To install Windows 2003:
  - Install to a single Pass-thru disk, and then apply the appropriate Hot-Fix to bring the Storport driver up to current standards. The hotfix can be downloaded at: <http://support.microsoft.com/kb/932755>. Reboot the system and use RST GUI to create the desired RAID Volume from the existing boot drive.
- Windows\* PE 3.0

## 2.5.2 Open Source Operating Systems Support

Intel® RSTe 3.0 will support the latest minor revision (dot release) of the latest shipping major revision of the Open Source OS (such as Linux).

- Red Hat Enterprise Linux Server\* (x32 and x64) (Contact Red Hat for details)
- Novell SuSE Linux Enterprise Server\* (x32 and x64) (Contact Novell for details)

Core functionality support will also be provided for the N-1 minor revision via a driver back port, Zstream and Driver Update Disk processes beginning with the following:

- Red Hat Enterprise Linux Server\* (x32 and x64) (Contact Red Hat for details)
- Novell SuSE Linux Enterprise Server\* (x32 and x64) (Contact Novell for details)

Support for Open Source version greater than the above specified N-1 version will not be supported.

## 2.5.3 Virtualization OS Support

Intel® RSTe 3.0 will support the following Virtualization Operating Systems.

- VMware\* (Contact VMware for details)
- Hyper-V
- Xen\*
- KVM

## 2.5.4 Intel® RSTe 3.0 Pre-OS Package

The Intel® RSTe 3.0 will provide binary images that will be compiled into the system BIOS to provide a Pre-Boot driver to the AHCI and SCU controllers. The BIOS vendor (or the OEM/ODMs developing their own BIOS) will take these images and compile them into their BIOS package for Intel® C600 series chipset based platforms. How they are included and how the information is presented is up to the BIOS

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vendor (or the OEM/ODMs developing their own BIOS). The Intel® RSTe 3.0 Pre-OS package will support the following:

- ACHI Controller configured for RAID Mode
- Using AHCI Legacy OROM to creating a bootable RAID volume on drives connected to the AHCI controller
- Booting from a bootable drive or RAID volume on drives connected to the AHCI controller
- SCU Controller
- Using SCU Legacy OROM to create a bootable RAID volume on drives directly attached to the SCU Controller
- Using a UEFI driver to support UEFI boot environment to provide access the devices attached to either the AHCI or SCU controllers.
- Using a UEFI Command Line Interface (CLI) utility to create bootable RAID volumes on drives attached to either the AHCI or SCU controller.

An example of how a BIOS vendor (or the OEM/ODMs developing their own BIOS) may implement the Intel® RSTe 3.0 Pre-OS package is by adding some configuration options to the BIOS configuration utility (not addressed in this document). The BIOS configuration utility may provide the following configuration options:

- An option for the user to select which controller they would like to boot from (AHCI or SCU).
- An option to select which pre-boot environment to use (Legacy Option ROM or UEFI)
- An option to select which mode to configure the Intel® C600 series chipset AHCI controller (AHCI or RAID mode)
  - When AHCI mode is selected the BIOS's own AHCI int13 driver or (UEFI driver) will be used instead of the Intel® RSTe 3.0 AHCI RAID Legacy Option ROM (or Intel® RSTe 3.0 UEFI driver). In this mode, the Intel® RSTe 3.0 AHCI driver will function as a pass-through driver. No RAID functionality will be allowed on the AHCI controller.
  - When RAID mode is selected, the Intel® RSTe 3.0 AHCI RAID Legacy Option ROM (or Intel® RSTe 3.0 RAID UEFI driver) will be loaded and used by the system BIOS to access the devices connected to the AHCI controller.

When the SCU controller is selected as the boot controller, the system BIOS will need to load and use either the Intel® RSTe 3.0 SCU RAID Legacy Option ROM or the Intel® RSTe 3.0 UEFI driver to access the drives connected to the SCU controller. The Intel® RSTe 3.0 Pre-boot package will support only one mode of operation (RAID Mode) on the SCU controller.

The Intel® RSTe 3.0 Pre-boot package will support only one boot method, either Legacy OROM or UEFI, but not both.

Both the Intel® AHCI RAID Legacy Option ROM and the Intel® SCU RAID Legacy Option ROM will only support drives that are direct attached to their respective controllers.

#### 2.5.4.1 Intel® RSTe 3.0 SATA RAID Legacy Option ROM

The Intel® RSTe 3.0 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 3.0 AHCI RAID Legacy Option ROM will be loaded and will provide the interface to the drives attached to the AHCI controller. The Intel® RSTe 3.0 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 3.0 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.

*It is required for the SATA RAID Legacy Option ROM to be used in PCI 3.0 compliant BIOS's only.*

#### 2.5.4.2 Intel® RSTe 3.0 SCU RAID Legacy Option ROM

Intel® RSTe 3.0 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 3.0 SCU RAID Legacy Option ROM will be loaded and will provide the interface to the drives attached to the SCU controller. The Intel® RSTe 3.0 SCU RAID Legacy Option ROM will only support drives directly attached to the SCU controller.

When using the RSTe 3.0 SCU RAID Legacy Option ROM, the system BIOS must support the INT15 function call to obtain the OEM Parameter information programmed into SPI Flash. Please reference the platform's BIOS Writer's Guide for more information.

NOTE: The RSTe 3.0 SCU RAID Legacy Option ROM may not work properly if the OEM Parameters have not been properly programmed into SPI Flash.

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 3.0 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.

*It is required for the SCU RAID Legacy Option ROM to be used in PCI 3.0 compliant BIOS's only.*

#### 2.5.4.3 Intel® RSTe 3.0 SATA RAID UEFI Driver

Intel® RSTe 3.0 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 3.0 SATA UEFI RAID Driver will support only drives directly attached to the AHCI controller

#### 2.5.4.4 Intel® RSTe 3.0 SCU RAID UEFI Driver

Intel® RSTe 3.0 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 3.0 SCU RAID UEFI Driver will support directly attached drives and will provide at least one level of SAS expander support.

NOTE: The RSTe 3.0 SCU RAID EFI driver may not work properly if the OEM Parameters have not been properly programmed into SPI Flash. Please reference the platform's BIOS Writer's Guide for more information.



## 2.5.5 Intel® RSTe 3.0 Configuration Tools

The Intel® RSTe 3.0 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.

### 2.5.5.1 Intel® RSTe 3.0 UEFI Command Line Interface (CLI) Utility

Intel® RSTe 3.0 will provide support for a UEFI command line interface utility. An Intel® RSTe 3.0 UEFI Command Line Interface (CLI) utility will be made available to manage RAID volumes when booted into the UEFI environment. The Intel® RSTe 3.0 UEFI CLI utility will need to be **launched from USB drive**.

This Intel® RSTe 3.0 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 only available when they system boots into the UEFI shell. 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 Shell to use this utility to manage the RAID volumes (check the status, initiate rebuilds, expand, etc.).

### 2.5.5.2 Intel® RSTe 3.0 RAIDCFG Utilities

Intel® RSTe 3.0 will provide support for a DOS base command line utility that can be used in conjunction with the Legacy Option ROMs. There will be one Intel® RSTe 3.0 RAIDCFG utility for the AHCI controller and one for the SCU controller. The utility is accessed through DOS 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)

### 2.5.5.3 Intel® RSTe 3.0 Command Line Interface (CLI) Application

Intel® RSTe 3.0 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 RAIDCfG utility) on the platforms that have or will have Intel® RSTe 3.0 installed. Intel® RSTe 3.0 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)

### 2.5.5.4 Intel® RSTe 3.0 Graphical User Interface (Intel® RSTe 3.0 GUI)

Intel® RSTe 3.0 will provide support for a graphical user interface for management of RAID arrays and volumes. The Intel® RSTe 3.0 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 3.0 GUI will provide RAID management functionality for up to 32 drives.

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\* Other brands and names may be claimed as the property of others.



## 2.5.6 Intel® RSTe 3.0 Management Tools

### 2.5.6.1 Common Information Model (CIM)

Intel® RSTe 3.0 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 3.0 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 3.0 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).

### 2.5.6.2 Common Storage Management Interface (CSMI)

Intel® RSTe 3.0 will support the Common Storage Management Interface (CSMI) for reporting RAID configurations and SMP, SSP, STP pass through.

## 2.5.7 Intel® RSTe 3.0 System Configurations supported

This section addresses to physical components of the system configuration supported by Intel® RSTe 3.0.

### 2.5.7.1 AHCI Controller Support

Intel® RSTe 3.0 will provide support for managing RAID volumes on drives attached to the AHCI ports.

### 2.5.7.2 SCU Controller Support

Intel® RSTe 3.0 will provide support for managing RAID volumes on drives attached to the SCU ports.

### 2.5.7.3 SCU OEM Parameters

Intel® RSTe 3.0 will provide support for the OEM to define some of their own operational parameters (i.e. SAS Addresses) into the PDR region of SPI Flash. This information will be passed to RSTe 3.0

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\* Other brands and names may be claimed as the property of others.



components from the BIOS who will access the OEM parameters. Please review the platform BIOS Writer's Guide for more details.

#### 2.5.7.4 SAS Expander Support

Intel® RSTe 3.0 will support 1 expander attached to an SCU controller (provide external HW drive and expander compatibility list). Intel® RSTe 3.0 will not support the use of port multipliers on either the AHCI or SCU controller.

#### 2.5.7.5 Maximum Hard Drives supported

Intel® RSTe 3.0 will provide support for the following quantity of physical disks (direct attached or through SAS expanders):

- SKU -A:
  - Physical Disks (Pass Through and RAID):
    - Single SCU configuration (SATA disks only) - 4
    - AHCI - 6
      - 3 Gb/s - 4
      - 6 Gb/s - 2
  - Maximum number of RAID volumes on the direct attached physical disks:
    - SCU - 4
    - AHCI - 4
- SKU -B:
  - Physical Disks (Pass Through and RAID):
    - Single SCU configuration (SAS and SATA supported) - 32
    - AHCI - 6
      - 3 Gb/s - 4
      - 6 Gb/s - 2
  - Maximum disks managed by Intel® RSTe 3.0 RAID - 32
  - Maximum number of RAID volumes on the direct attached physical disks:
    - SCU - 4
    - AHCI - 4

**NOTE:** With both SKUs -A and -B, all of the SCU traffic is moved up to the processor through the DMI uplink, which is shared by the other components managed by Intel® C600 series chipset.

- SKU -D and -T:
  - Physical Disks:
    - Dual SCU configuration (SAS and SATA supported) - 64
    - AHCI
      - 3 Gb/s - 4
      - 6 Gb/s - 2
  - Maximum disks managed by Intel® RSTe 3.0 RAID - 32



- Maximum number of RAID volumes on the direct attached physical disks:
  - SCU - 8
  - AHCI - 4

There is no OS RAID software limitations imposed.

### 2.5.7.6 Pass-through drives

Intel® RSTe 3.0 will support the ability to expose non-RAID configured disks (pass-through) to Host OS. Please refer to section 2.5.7.5 for additional information.

### 2.5.7.7 SCU Controller RAID Management Limitations

Intel® RSTe 3.0 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 64 drives) will be supported as pass-through drives but will not be validated as part of supported RAID array configurations. The Intel® RSTe 3.0 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 3.0) limitations are imposed.

### 2.5.7.8 Hot Plug

Intel® RSTe 3.0 will support the ability to 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 3.0 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.

### 2.5.7.9 SCU & AHCI drive roaming

Intel® RSTe 3.0 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.

### 2.5.7.10 Volume Roaming between Linux\* and Windows\*

Intel® RSTe 3.0 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.

### 2.5.7.11 SGPIO on AHCI Controller

Intel® RSTe 3.0 will support enclosure management, compliant to SFF-8485, to identify drive location or unit failures on the AHCI controller.

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\* Other brands and names may be claimed as the property of others.



### 2.5.7.12 SGPIO on SCU

Intel® RSTe 3.0 will support enclosure management, compliant to SFF-8485, to identify drive location or unit failures on the SCU.

### 2.5.7.13 NCQ (AHCI) and CQ (SCU) support

Intel® RSTe 3.0 will support Native Command Queuing (SATA AHCI) and Command Queuing (SAS SCU).

### 2.5.7.14 SCSI Enclosure Service (SES) v2

Intel® RSTe 3.0 will provide support management of enclosures that are compliant with SES (SCSI Enclosure Services) v2 attached to the SCU controller. Intel® RSTe 3.0 will also support in-band management to SES compliant expanders attached to the SCU.

## 2.5.8 Software RAID Functional Support

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

### 2.5.8.1 Matrix RAID

Intel® RSTe 3.0 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.

### 2.5.8.2 RAID 0/1/5/10 Volumes

Intel® RSTe 3.0 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.

### 2.5.8.3 Software RAID 5 on SAS SCU

Intel® RSTe 3.0 will support software RAID 5 on Intel® C600 series chipset-T SKUs as an optional feature. This feature is enabled by means of the "upgrade ROM" capabilities or by purchasing the -T SKU of Intel® C600 series chipset.

### 2.5.8.4 Simultaneous RAID Arrays

Intel® RSTe 3.0 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 3.0 will provide support for simultaneous RAID management on both.

### 2.5.8.5 Disk Coercion

Intel® RSTe 3.0 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 95% of the smallest physical disk. This allows for the variances in the physical disk capacities from different vendors.



### 2.5.8.6 Hot Spare Disk

Intel® RSTe 3.0 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.

### 2.5.8.7 Auto Rebuild on Hot Insert

Intel® RSTe 3.0 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.

### 2.5.8.8 Manually Invoked Rebuild

Intel® RSTe 3.0 will provide a manual method to initiate a RAID volume rebuild if a hot spare has not been configured or is not available.

### 2.5.8.9 RAID SMART Support

Intel® RSTe 3.0 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.

### 2.5.8.10 RAID-Ready Mode

A RAID-Ready system refers to a system that has been configured to support Intel® RSTe 3.0. 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 3.0 will support an Intel® C600 series chipset based platform configured in RAID-Ready mode.

### 2.5.8.11 RAID Volume Creation with Data Preservation

Intel® RSTe 3.0 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 3.0 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 3.0:

- 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

### 2.5.8.12 Instant Initialization

Intel® RSTe 3.0 will support 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.

### 2.5.8.13 RAID Level Migrations

The RAID level migration feature in Intel® RSTe 3.0 product will enable 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 3.0:

- 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

### 2.5.8.14 RAID Reconfiguration (Stripe size)

Intel® RSTe 3.0 will provide the ability to change stripe size on existing volumes (migration required). Intel® RSTe 3.0 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

### 2.5.8.15 Expanded Stripe Size

Intel® RSTe 3.0 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

### 2.5.8.16 Online Array / Volume Capacity Expansion

Intel® RSTe 3.0 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.

### 2.5.8.17 Read Patrol

Intel® RSTe 3.0 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.

### 2.5.8.18 Verify and Repair

Intel® RSTe 3.0 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:

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



<b>RAID 10</b>	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.

### 2.5.8.19 Check Pointing

Intel® RSTe 3.0 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.

### 2.5.8.20 Bad Block Management

Intel® RSTe 3.0 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.

### 2.5.8.21 Dirty Stripe Journaling

Intel® RSTe 3.0 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

### 2.5.8.22 Partial Parity Logging (PPL)

Intel® RSTe 3.0 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.

### 2.5.8.23 OS Installation

Intel® RSTe 3.0 will provide the OS appropriate RSTe 3.0 driver files required for installation during the OS setup onto a drive or RAID volume attached to either the AHCI or SCU controllers.



### 2.5.8.24 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.

### 2.5.8.25 Auto Rebuild

Intel® RSTe 3.0 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 3.0 (or Intel® RST) metadata with current status of member being offline or contains no Intel® RSTe 3.0 (or Intel® RST) metadata.
- The newly inserted disk has not reported a SMART event.

The following table summarizes the functionality:

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® RSTe3.0 and can be enabled through the Intel® RSTe 3.0 GUI.



### 2.5.8.26 Error Threshold Monitoring/Handling

Intel® RSTe 3.0 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)

### 2.5.8.27 Unified Extensible Firmware Interface (UEFI)

Intel® RSTe 3.0 will support UEFI for the SCU and AHCI controllers using common metadata.

### 2.5.8.28 Disk Write Cache

Intel® RSTe 3.0 will support the ability to enable/disable Disk Write Cache through the Intel® RSTe 3.0 GUI. Disk Data Cache will be disabled by default.

### 2.5.8.29 RAID Volume Read Cache

Intel® RSTe 3.0 will support the ability to enable/disable RAID Volume Read Cache through the Intel® RSTe 3.0 GUI. RAID Volume Read Cache will be enabled by default.

### 2.5.8.30 Write Back Cache

Intel® RSTe 3.0 will support the ability to enable/disable Write Back Cache through the Intel® RSTe 3.0 GUI. Write Back Cache will be disabled by default.

### 2.5.8.31 Volume Cache Increase

Intel® RSTe 3.0 will increase the volume cache size to 16MB for SCU volumes and 16MB for AHCI volumes.

### 2.5.8.32 RAID Volume Size

Intel® RSTe 3.0 will provide support for RAID volumes that are larger than 2 Terabytes.

### 2.5.8.33 RAID Boot Volume Size

Intel® RSTe 3.0 will provide support for RAID Boot volumes that are larger than 2 Terabytes.

### 2.5.8.34 Disk Monitor Service

Intel® RSTe 3.0 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.

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\* Other brands and names may be claimed as the property of others.



### 2.5.8.35 Failed Drive Reinsertion

Intel® RSTe 3.0 will support the ability to recognize a failed drive re-inserted into the array. If able, Intel® RSTe 3.0 will attempt to rebuild the volume to that drive. If not able, Intel® RSTe 3.0 will mark the drive accordingly in the GUI.

### 2.5.8.36 Drives Supported

Intel® RSTe 3.0 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.

### 2.5.8.37 Safe Mode Support

Intel® RSTe 3.0 will provide support for booting into Safe Mode for all supported OSs.

### 2.5.8.38 Non-Intel Controller Support

Intel® RSTe 3.0 will not hinder, break or prevent operation of non-Intel® Controllers (SATA, PATA, SATA or RAID).

### 2.5.8.39 Device Configuration

Intel® RSTe 3.0 will support the ability, at initialization, to read the system registry to get configuration setting in order to set the appropriate operational parameters.

### 2.5.8.40 Power Management

The Intel® RSTe 3.0 product will support all the necessary power management functions required by the OSs.

### 2.5.8.41 Staggered Spin-up

Intel® RSTe 3.0 will provide support for staggered spin-up on the SCU controller for those hard drives that support this feature.

### 2.5.8.42 Exporting SATA Drives on AHCI Controller

Intel® RSTe 3.0 RAID Legacy Option ROMs will export those drives directly attached on a port order basis. This will be for both the AHCI controller.

### 2.5.8.43 ATAPI

Intel® RSTe 3.0 will provide support for ATAPI devices. Intel® RSTe 3.0 RAID Legacy Option ROM will only support HDD devices (not ATAPI).

### 2.5.8.44 Solid State Drives (SSD)

Intel® RSTe 3.0 will support SSDs as if they are Hard Disk Drives.



## 2.5.8.45 TRIM Command (Non-RAID Mode): Windows\*7<sup>1</sup>

**Note:** This feature is not an end-user visible feature. There is no Intel® RSTe 3.0 application or user interface control to configure the feature. Registry settings are provided for OEM use.

Win7 and ATA8 introduce OS support for the TRIM command. Support for the TRIM command allows Windows\*7 to pass information 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.

### 2.5.8.45.1 AHCI Controller

Intel® RSTe 3.0 will support TRIM on the AHCI controller in a non-RAID configurations.

### 2.5.8.45.2 SCU Controller

Intel® RSTe 3.0 will support TRIM on the SCU controller in a non-RAID configurations.

## 2.5.8.46 Email Alerting and Notification<sup>2</sup>

Intel® RSTe 3.0 will support email notification of certain storage events (see Appendix B for supported events). The Intel® RSTe 3.0 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 3.0 monitor service.

### 2.5.8.46.1 Configuration

The Intel® RSTe 3.0 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

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\* Other brands and names may be claimed as the property of others.

<sup>1</sup> Legacy feature; introduced in the Intel® RST 9.6 Release.

<sup>2</sup> This feature has a platform specific limitation. It is supported only on Intel® C600 series chipset based platforms; not supported on legacy platforms/chipsets.



### 2.5.8.46.2 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 3.0 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)

Figure 1 Email Format **Error Reference source not found**.shows detail of how an email alert is formatted.

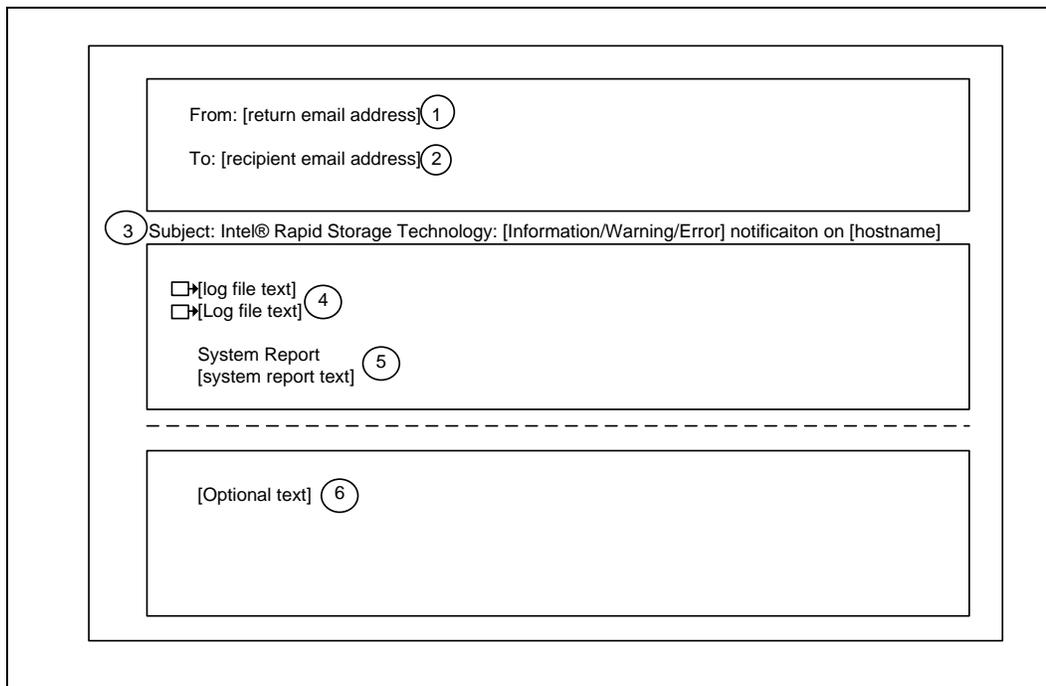


Figure 1 Email Format

### 2.5.8.46.3 Protocol Support

Email alert shall support SMTP host & SMTP port.



#### 2.5.8.46.4 Error Conditions

See Appendix B 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.

### 2.5.9 Utilities

#### 2.5.9.1 Install/Uninstall Utility

Intel® RSTe 3.0 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 Features, Specifications, and Specification Updates***

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### **3.1 New Features and Supported Specifications Introduced in Intel® RSTe 3.0**

This section intentionally left blank because this is the first release of Intel® RSTe 3.0 based product.

### **3.2 Updated Features/Specifications Implemented in Intel® RSTe 3.0**

This section intentionally left blank because this is the first release of Intel® RSTe 3.0 based product.



## 4 *Product Certifications*

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### 4.1 WHQL

The Intel® RSTe 3.0 driver is required to be logo certified on the Microsoft Windows\*WLK 1.5 test suite for storage device drivers.

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\* Other brands and names may be claimed as the property of others.



## 5 Appendix A

Table 5-1. Relevant Specifications

ATA/ATAPI-7 ( <a href="http://www.t13.org/Documents/UploadedDocuments/project/d1532v3r4a-ATA-ATAPI-7.pdf">http://www.t13.org/Documents/UploadedDocuments/project/d1532v3r4a-ATA-ATAPI-7.pdf</a> )
ATA Command Set 2 ( <a href="http://www.t13.org/Documents/UploadedDocuments/docs2009/d2015r2-ATAATAPI_Command_Set_-_2_ACS-2.pdf">http://www.t13.org/Documents/UploadedDocuments/docs2009/d2015r2-ATAATAPI_Command_Set_-_2_ACS-2.pdf</a> )
ATA8-ACS-8 ( <a href="http://www.t13.org/Documents/UploadedDocuments/docs2007/D1699r4c-ATA8-ACS.pdf">http://www.t13.org/Documents/UploadedDocuments/docs2007/D1699r4c-ATA8-ACS.pdf</a> )
SATA 1.0 Specification ( <a href="http://www.serialata.org">http://www.serialata.org</a> )
SATA II Specification ( <a href="http://www.serialata.org">http://www.serialata.org</a> )
SATA 3 ( <a href="http://www.sata-io.org/documents/SATA-Revision-3.0-Press-Release-FINAL-052609.pdf">http://www.sata-io.org/documents/SATA-Revision-3.0-Press-Release-FINAL-052609.pdf</a> )
Serial Attached SCSI - 2 (SAS-2) ( <a href="http://www.t10.org">http://www.t10.org</a> )

Table 5-2. Relevant Documents

CDI / IBL #	Title/Location
<b>Reference Documents</b>	
441979	Intel® 6 Series Chipset/ Intel® C200 Series Chipset/ Intel® C600 series chipset Platform Controller Hub (PCH) BIOS Specification Update – NDA
473093	Intel Patsburg PhyTune Tool -RC Ver 2.0  Note: This package contains the PhyTune tool along with the SASAddress efi utility. Please refer to the documentation included in the package for additional information.
453321	Intel® Server Platform Services Manageability Engine Firmware for Patsburg chipset Chipset Product Line Firmware Startup Guide
454672	PatsburgChipset SPI Programming Guide
450911	Patsburg Chipset External Design Specification (EDS)
445721	Patsburg Chipset External Design Specification (EDS) Specification Update - NDA
458143	Sandy Bridge-E Processor External Design Specification (EDS) - Volume One of Two
459924,	Sandy Bridge-E Processor External Design Specification - Volume Two of Two



CDI / IBL #	Title/Location
30051	RS - Intel® 6 Series Chipset/ Intel® C200 Series Chipset/ Intel® C600 series chipset Platform Controller Hub (PCH) BIOS Spec  <i>Contact you Intel FAE to get access to this document through Anacapa</i>
Kit 33272	Intel® Server Platform Services Alpha SPS_02.01.01.009.0  Note: This package is the Intel® Server Platform Services Manageability Engine Firmware for Intel® C600 series chipset Product Line - Alpha Full Release and contains key tools such as FITc and fpt for the Intel® C600 series chipset  <b>This document can be downloaded from ARMS/VIP</b>
<b>RST Legacy Requirements Documents</b>	
443658	<i>Intel® Rapid Storage Technology (Intel® RST) 9.6 Product Requirements Document (PRD) Differences Document: <a href="http://www.intel.com/cd/edesign/library/asm-na/eng/443658.htm">http://www.intel.com/cd/edesign/library/asm-na/eng/443658.htm</a></i>
409399	<i>Intel® Rapid Storage Technology 9.5 Product Requirements Document (PRD) Differences Document : <a href="http://www.intel.com/cd/edesign/library/asm-na/eng/409399.htm">http://www.intel.com/cd/edesign/library/asm-na/eng/409399.htm</a></i>
375707	<i>Intel® Matrix Storage Manager 8.5 Product Requirements Document (PRD) Differences Document :</i>
373388	<i>Intel® Matrix Storage Manager 8.0 Product Requirements Document (PRD) : <a href="http://www.intel.com/cd/edesign/library/asm-na/eng/373388.htm">http://www.intel.com/cd/edesign/library/asm-na/eng/373388.htm</a></i>
<b>Technical Guides / White papers</b>	
N/A	<i>Intel® Rapid Storage Technology OEM Technical Guide: (location) Intel® Validation Internet Portal (VIP <a href="https://platformsw.intel.com/">https://platformsw.intel.com/</a> ) in each major or maintenance release version of Intel® Rapid Storage Technology release.</i>
445153	<i>Reference Manual for Safe Removal with Link Power Management (LPM) on Hot Plug Capable Port (HPCP) : <a href="http://www.intel.com/cd/edesign/library/asm-na/eng/445153.htm">http://www.intel.com/cd/edesign/library/asm-na/eng/445153.htm</a></i>



## 6 Appendix B

Table 6-1. Storage System Events Detected by Monitor Service (IAStorDataMgrSvc)

Event Type	Event Level	String	Event Displayed		
			NAI <sup>1</sup> (Notification Area Icon)	Event Log	E-Mail Notify <sup>2</sup>
<b>Disk Triggered Events</b>					
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
<b>Volume Triggered Events</b>					
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



Event Type	Event Level	String	Event Displayed		
			NAI <sup>1</sup> (Notification Area Icon)	Event Log	E-Mail Notify <sup>2</sup>
InitializeStarted	Info	Volume {0}: Initialization in progress.	Yes	No	No
<b>General Events</b>					
Server start failed	Error	Server failed to start. Additional information:	No	Yes	Yes
Event manager started	Info	Started the event manager.	No	Yes	Yes

**NOTES:**

1. NAI true only if the user selected to receive notification under Preferences in the UI
2. Refer to Email Section above for Email feature support



# 7 Appendix C

## 7.1 Hardware Compatibility

### 7.1.1 External Hardware Compatibility

The embedded file indicates the current list of external hardware used in validation and is subject to change without notice. Please contact your factory representative for questions on any specific hardware item.

#### Enterprise SAS Drives

Vendor	Family	Model Name/Number
Fujitsu	AL9Se Series (2.5")	MAY2036RC
Fujitsu	AL9LX Series (3.5")	MAX3036RC,
Fujitsu	AL10Se Series (2.5")	MBB2 Series
Seagate	SAS	Barracuda ES.2 7.2k rpm
Seagate	SAS	Cheetah 15k.6 (3.5")
Seagate	SAS	Cheetah 15K.4 (3.5")
Seagate	SAS	Cheetah 15K.5 (3.5")
Seagate	SAS	Cheetah 15K.7
Seagate	SAS	Savvio 10K.1 (2.5")
Seagate	SAS	Savvio 10K.2 (2.5")
Seagate	SAS	Savvio 15K.1 (2.5")
Seagate	SAS	Cheetah NS
Hitachi	Ultrastar 15K147 3.5" (Viper A)	HUC101473CSS300,
Hitachi	Ultrastar 15K147 3.5" (Viper B)	HUS153014VLS300, HUS153073VLS300
Hitachi	Ultrastar C10K147	HUC101473CSS300,



	2.5" (Cobra B)	
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**Enterprise SATA Drives**

Vendor	Family	Model Name/Number
Fujitsu	A160 (2.5") 7200 RPM FDE Option Extended Duty	MHZ2080BK
Hitachi	Ultrastar A7k1000 (3.5") 7.2rpm	
Seagate	Barracuda 7200.10 Serial ATA	
Seagate	Barracuda 7200.11 Serial ATA	
Seagate	Barracuda ES	
Western Digital		WD1002FAEX
Western Digital		WD6000HLHX

**Expanders and Enclosures**

Vendor	Model Number
AIC	XJ1100
Xyratex	RS1603X
Supermicro	CSE-M28x
Promise	Vtrak E-Class E310
	Vtrak J-class
Supermicro	SC836E1-R800V

