

# DIY Storage System Guidance Using Intel<sup>®</sup> Server RAID Controllers

**Deployment Practices White Paper** 

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DIY Storage System Guidance Using Intel<sup>®</sup> Server RAID Controllers Deployment Practices White Paper

## **Revision History**

Date	<b>Revision Number</b>	Modifications
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## 1. Welcome

RAID (Redundant Array of Independent Disks) technology is commonly implemented in server usage models as an option to provide additional data protection. RAID solutions are now also found in other computer environments such as desktops, workstations, and external storage devices that support a large number of hard drives.

This guide provides detailed information on how to set up a storage hardware system using Intel<sup>®</sup> Server Boards and Intel<sup>®</sup> RAID controllers on Chenbro\* RM31616 Chassis, including information on how to install an Intel<sup>®</sup> RAID controller in a Chenbro\* RM31616 chassis in conjunction with an Intel<sup>®</sup> Server Board S50000XVN. The guide also provides information on how to attach cables for LED functionality and how to tune RAID subsystem performance for different storage applications. The document will not recommend or endorse any specific Operating System or Storage Application, but is intended to demonstrate how to integrate and configure the hardware in preparation for a storage application usage model.

## 2. Hardware Components

Quantity	Item	Manufacturer	Model
1	Intel <sup>®</sup> Server Board	Intel	S5000XVN
1	Chenbro* Chassis	Chenbro	RM31616
4 GB	Memory	Any supported memory	Please refer to the Tested Memory List at http://support.intel.com/support/motherboards/server/s5 000psl/sb/CS-022924.htm
2	Intel <sup>®</sup> Xeon <sup>®</sup> processors	Intel	Please refer to the Supported Processor List at http://support.intel.com/support/motherboards/server/sb/ CS-022346.htm
16	SATA 3.5-inch hard drives	Hitachi	HUA721010KLA330

#### Table 1. Hardware Components

## 3. Chenbro\* RM31616 Chassis Introduction

For additional details on the Chenbro\* RM31616 Chassis, visit http://www.chenbro.com.

Generality	Design Standard	EIA-RS310D	
	Sheet Metal Material	SGCC	
	Sheet Metal Thickness	1.2 mm	
	Plastic Material Type	ABS-HB	
Mother Board Support	Form Factor	Extended ATX – 12 x 13 (inches) CEB – 12 x 10.5 (inches) ATX – 12 x 9.6 (inches)	
Dimensions	mm (D x W x H)	660 x 432 x 132 (mm)	
	inch (D x W x H)	26 x 17 x 5.2 (inches)	
Drive Bays	Drive Bay (Internal 2.5-inch)	2	
	Drive Bay (Internal 3.5-inch)	1	
	Hot-swap HDD Trays	16	
	Slim CD-ROM	1	
	Slim FDD	1	
PSU Support	PSU Form	Redundant	
	Maximum Wattage	1000 W	
Front Panel	Switch/Controls	Power On/Off System Reset Alarm Mute USB 2.0 (x2)	
	Indicators	Power Status LED (x1) HDD Activity LED (x1) LAN Activity LED (x2) FAN Failure and Overheat Warning (x1)	
Expansion Slots & Rear	Rear Window	Standard	
Window	Slot Opening	7	
Security	Security Lock	N/A	
	System Security	Intrusion Switch	
System Cooling Fans	Middle	4x 80-mm (T=38 mm) hot-swap middle fans	
	Rear	Optional : 2x 80-mm (T=25 mm) rear fans	
Backplanes	Backplane (Model Number: 84H331610-009)	16-port Mini SAS Backplane with Mounting Bracket	
Cable	Cable (Model Number: 26H113215-028)	Mini SAS 36pin-to-Mini SAS 36pin (Host) (350 mm)	

#### Table 2. Chenbro\* RM31616 Chassis Features

#### Chenbro\* RM31616 Chassis Introduction DIY Storage System Guidance Using Intel® Server RAID Controllers Deployment Practices White Paper

Shipping Info	Cubic Feet	5.22
Net Weight (Kgs)		15.1
	Container Information (20')	188 (Single Packing)
	Container Information (40')	406 (Single Packing)
	Container Information (40'HQ)	455 (Single Packing)



Figure 1. Chenbro\* RM31616 Chassis

## 4. Set up the Storage Hardware System

For additional details on the Intel<sup>®</sup> Server Board and Intel<sup>®</sup> RAID Controller, visit <u>http://support.intel.com</u>.

### 4.1 Server Board Connector and Component Layout

The following figure shows the board layout of the Server board. Each connector and major component is identified by a letter. A description for each component is provided in the following table.



Figure 2. Intel<sup>®</sup> Workstation Board S5000XVN Layout

	Description		Description
А	PCI-X 64-bit, 100-MHz full-length / full-height	W	System fan 2 header
	slot 1		
В	PCI-X 64-bit, 133-/100-MHz full-length / full- height slot 2	Х	System fan 1 header
С	PCI Express* x4 <sup>[1]</sup> or PCI express* x8 <sup>[2]</sup> slot 3 (x8 physical connector)	Y	Processor power connector
D	PCI Express* x4 half-length / full-height slot 4 (x8 physical connector)	Z	USB header
Е	CMOS battery	AA	IDE connector
F	PCI Express* x16 full-length / full-height slot 6 (x16 physical connector)	BB	Enclosure management SATA SGPIO header <sup>12</sup>
G	CD-ROM line-in connector	CC	Intel <sup>®</sup> Local Control Panel header
Н	P12V4 connector	DD	Hot-swap backplane B header
Ι	Back panel I/O ports	EE	Enclosure management SAS SES I <sup>2</sup> C <sup>[1]</sup>
J	Diagnostic and Identify LEDs	FF	Hot-swap backplane A header
К	System fan 6 header	GG	SATA 0
L	System fan 5 header	HH	SATA 1
М	Main power connector	П	SATA 2 or SAS 0 <sup>[3]</sup>
Ν	Auxilliary power signal connector	JJ	SATA 3 or SAS 1 <sup>[3]</sup>
0	DIMM sockets	KK	SATA 4 or SAS 2 <sup>[3]</sup>
Р	Processor 1 socket	LL	SATA 5 or SAS 3 <sup>[3]</sup>
Q	Processor 2 socket	MM	USB port
R	Processor 2 fan header	NN	Front control panel header
S	Processor 1 fan header	00	SATA Software RAID 5 key connector <sup>[2]</sup>
Т	System fan 4 header	PP	SAS Software RAID 5 key connector <sup>[1]</sup>
U	System fan 3 header	QQ	Serial B / emergency management port header
V	IPMB connector	RR	Chassis intrusion header

#### **Table 3. Major Board Components**

Note 1: Avaiable with product codes S5000XVNSAS/S5000XVNSASR or BB5000XVNSAS/BB5000XVNSASR.

Note 2: Available with product codes S5000XVNSATA/S5000XVNSATAR or BB5000XVNSATA/BB5000XVNSATAR. Note 3: SAS connector available with product codes S5000XVNSAS/S5000XVNSASR or

BB5000XVNSAS/BB5000XVNSASR.

#### 4.2 **Board Front Panel Connector**

The board provides a 24-pin SSI front panel connector (J1E4) for use with Intel® and third-party chassis. The following table provides the pin-out for this connector.

	Pin	Signal Name	Description	Pin	Signal Name	Description
	1	P3V3_STBY (Power_LED_Anode)	Power LED +	2	P3V3_STBY	Front Panel Power
	3	Кеу	No Connection	4	P5V_STBY (ID LED Anode)	ID LED +
	5	FP_PWR_LED_N	Power LED -	6	FP_ID_LED_BUF_N	ID LED -
<ul> <li>ID LED</li> <li>System</li> <li>Status</li> <li>LINC 1 LINK/Activity</li> <li>SM Bus</li> <li>Chassis Intrusion</li> <li>NIC 2 Activity LED</li> </ul>	7	P3V3 (HDD_ACTIVITY_Anode)	HDD Activity LED +	8	FP_LED_STATUS_GREEN_N	Status LED Green -
	9	LED_HDD_ACTIVITY_N	HDD Activity LED -	10	FP_LED_STATUS_AMBER_N	Status LED Amber -
	11	FP_PWR_BTN_N	Power Button	12	NIC1_ACT_LED_N	NIC 1 Activity LED -
	13	GND (Power Button GND)	Power Button Ground	14	NIC1_LINK_LED_N	NIC 1 Link LED -
	15	BMC_RST_BTN_N	Reset Button	16	SMB_SENSOR_3V3STB_DATA	SMB Sensor DATA
	17	BND (Reset GND)	Reset Button Ground	18	SMB_SENSOR_3V3STB_CLK	SMB Sensor Clock
	19	FP_ID_BTN_N	ID Button	20	FP_CHASSIS_INTRU	Chassis Intrusion
	21	FM_SIO_TEMP_SENSOR	Front Panel Temperature Sensor	22	NIC2_ACT_LED_N	NIC 2 Activity LED -
	23	FP_NMI_BTN_N	NMI Button	24	NIC2_LINK_LED_N	NIC 2 Link LED -

Table 4. Front Panel SSI Standard 24-pin Connector Pin-out (J1E4)

Note: The Front Panel Connector is identified by "NN" in Figure 2.

LED

HDD

LED

Power

Button Reset -

Button

ID Button -

NMI

Temp Sensor -

00

00

23 24

## 4.3 Connection between Chassis and Server Board

The connections from a Chenbro<sup>\*</sup> chassis to the board are listed in the following table. The letters under the server board column correspond to the letters identified in Figure 2 for the server board and the pin numbers correspond to those defined in Table 4.

	Chassis	Server Board	Pin # (If needed)
	Main power connector	М	
	P12V4 connector	Н	
	Processor power connector	Y	
	System FAN 1	Х	
	System FAN 2	W	
	System FAN 3	U	
	System FAN 4	Т	
	Front USB connector	Z	
	Chassis intrusion connector	RR	
	Power LED	NN	1,5
ectior	HDD LED	NN	7,9
Conn	Power SW	NN	11,13
anel	RESET	NN	15,17
ront	LAN 1	NN	12,14
Ľ	LAN 2	NN	22,24

 Table 5. Connection between Chassis and Server Board

### 4.4 RAID Controller Installation

To install the RAID controller, follow these steps:

- 1. Power off the computer, all drives, enclosures, and system components. Remove the power cord from the computer.
- 2. Remove the chassis cover and access the PCI Express\* add-in card slots. See your server chassis documentation for instructions.
- 3. Align the controller's connector with a x8 or x16 PCI Express\* slot on the server board.
- 4. Press down gently but firmly to ensure that the card is properly seated in the slot, as shown in Figure 3. Secure the bracket to the computer chassis.

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### Figure 3. Inserting the Intel<sup>®</sup> RAID Controller SRCSASPH16I into a PCI Express\* Slot

## 4.5 Backplane Setup and Cable Connection

The 16-port mini SAS Backplane with mounting bracket in the Chenbro\* Chassis provides the SGPIO function support, which can be used to indicate HDD failure via a fault LED. SGPIO support is enabled on the backplane via two switches (See Figure 4)



Figure 4. Switches on the Backplane with Default Setting

The following table summarizes how to enable the SGPIO function support for the backplane.

SW-1	SW-2	SGPIO Function Setting
On	On	Enable HDD failure and access signal via SGPIO
On	Off	Enable HDD access signal via SGPIO
Off	On	Enable HDD failure signal via SGPIO
Off	Off	Disable HDD failure and access signal via SGPIO

#### Table 6. Backplane SGPIO Function Setting

Intel<sup>®</sup> RAID Controller SRCSASPH16I provides SGPIO support through the sideband of the SFF-8087 Mini-SAS 36-pin cable by default. To get failure and access LED support, the SW-1 and SW-2 on the backplane must be turned on.

- 1. Turn on SW-1 and SW-2 on the backplane to enable SGPIO function support
- 2. Connect the "Mini-SAS 36-pin SFF-8087 to SFF-8087" cables to the adapter mini-SAS connectors. Make sure the controller and cables are properly attached.
- 3. Connect other side of the cables into the backplane shipped with the chassis, as shown in Figure 5.



Intel<sup>®</sup> RAID Controller SRCSASPH16I

Figure 5. Backplane Wiring Illustration

## 4.6 Using Enterprise-class Drives

Enterprise-class hard drives should always be used on an enterprise-class system. Use of a desktop-class drive is not recommended due to I/O timeout incompatibilities, lower tolerances for vibration, and a lack of end-to-end data error detection and correction.

Hard drive manufacturers develop drives to meet specific customer requirements for reliability, capacity, performance, and power consumption. Using drives in the application for which they were designed ensures your data is available when and how you need it. Using drives outside of their intended application can negatively impact server productivity.

To get the best performance and avoid drive failures for this storage solution, Intel recommends using enterprise drives designed for 24 X 7 operation with a high workload. Please work with your drive vendor to source Enterprise Class SAS or SATA hard drives.

**Note:** SAS and SATA drives should not be mixed in the same enclosure. For information on selecting drives, refer to the *Enterprise-class versus Desktop-class Hard Drives White Paper* available at <u>http://support.intel.com/support/motherboards/server/</u>.

Setup Array using an Intel® RAID Controller DIY Storage System Guidance Using Intel® Server RAID Controllers Deployment Practices White Paper

## 5. Setup Array using an Intel<sup>®</sup> RAID Controller

Intel is committed to providing customers with stable, high-performance, and highly reliable RAID products. However, to optimize RAID performance for a specific application, customers must understand the key factors that can affect the performance of the RAID subsystem and the relationship between the target application and those key factors so that the array can be setup accordingly during system configuration.

The following sections introduce the key factors and then provide a demo for setting up a server for a surveillance application.

## 5.1 Basic Introduction of RAID Setting for Performance Optimizing

Optimizing the overall performance of a RAID subsystem requires careful consideration of several factors that can affect performance, including the controller and disk drive cache settings and the interaction of these settings with system applications. The following sections provide a limited discussion of some of these factors. For a full review of performance tuning, refer to the *Intel® RAID Controller Performance Optimization White Paper* available at <a href="http://support.intel.com/support/motherboards/server/">http://support.intel.com/support/motherboards/server/</a>.

**Note:** There are a variety of factors that can affect the performance of the RAID subsystem including PCI bus bandwidth, logical drive cache settings, stripe size, hard disk drive cache settings, RAID level, ratio of read versus write operations, ratio of sequential versus random operations, and the number of disks in an array.

### 5.1.1 RAID Level

The Intel<sup>®</sup> RAID controller SRCSASPH16I supports RAID levels 0, 1, 5, 6, 10, 50, and 60. To ensure the best performance, the optimal RAID level should be selected when the system drive is created. The optimal RAID level for a disk array depends on a number of factors:

- The number of physical drives in the disk array
- The capacity of the physical drives in the array
- The need for data redundancy
- The disk performance requirements

The following table provides a quick reference for RAID level selection. This information is simplified and may not be accurate with some applications or tests.

Application	Remarks	Recommendation
Operating System	Installation the operation system only.	R1
Application Server	Users access application from the server, but store data in the local system	R0 or R5
Developer Server	Users transfer data from the server to the local system, edit, and return it to the server	R5 or R6

#### Table 7. RAID Level Selection

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Application	Remarks	Recommendation
Mail Server	Users log on to the server and transfer data to/from the server	
		R5 or R6
Transaction Server	Hospital/Bank: Users randomly access data for creating new files	
	and updating exisitng files.	R5 or R6
Video Server	Users transfer large block of sequential data from the server, edit the data, and return the data to the server	
		R5
Web Server	Users log on to the server and view information, enter data, FTP,	
	etc.	R5

### 5.1.2 Stripe Size

For I/O intensive or small block random database access, striping the hard disks in the array with stripes larger than a single record, so that a record falls entirely within one or two stripes, will optimize performance. For data intensive environments or large block sequential access systems that access large records, small stripes (512-byte) cause each record to span across all the hard disks in the array. With each disk storing a portion of the data from the record, accesses are faster because the data transfer interleaves onto multiple disks. However, small stripes rule out multiple overlapped data operations because each access will typically involve all disks.

Small stripes require synchronized spindle disks to prevent degraded performance when accessing short records. Without synchronized spindles, each disk in the array may be at a different rotational position from when their data was written. Completing a disk access requires waiting until each disk has accessed its portion of the record, which can take an extra rotation of the disk platter on one or more disks. Greater the number of disks in the array, longer is the average access time for the array. Synchronized spindles ensure that every disk in the array reaches its data during the same rotation of their respective platters. The access time of the array becomes equal to the average access time of a single disk instead of approaching the product of access time and the number of disks in the array.

Choose the stripe size relative to both the I/O segment size and the number of hard disks in the array, so that most I/O operations either:

- Cross many stripes and involve all hard disks in the array. Or
- Do not cross stripes and involve only one hard disk.

### 5.1.3 Tuning Controller Cache Options

Tuning cache memory options on the RAID controller can improve performance. There are three settings available in the controller cache to allow fine tuning:

- Read Policy
- Write Policy
- I/O Policy

#### Setup Array using an Intel® RAID Controller DIY Storage System Guidance Using Intel® Server RAID Controllers Deployment Practices White Paper

The following table provides a quick reference for RAID settings. This information is simplified and may not be accurate with some applications or tests. For detailed performance tuning information, refer to the *Intel®* RAID Controller Performance Optimization White Paper available at <u>http://support.intel.com/support/motherboards/server/</u>.

#### Table 8. RAID Settings

I/O Policy	Direct I/O
Read Policy	Adaptive Read Ahead
Write Policy	Write Back*

\* A RAID controller battery should be used whenever virtual drive write-back cache is enabled and data is mission critical.

### 5.1.4 Hard Disk Cache

Disk drive cache can be enabled in the Virtual Drive Properties page of the RAID configuration utility. There is a risk of data loss using a hard drive cache; an overview is provided below.

Hard disk drive cache is located within the logic of the hard drive. Cache provides enhanced performance for sequential read access by retrieving adjacent data on the drive into the data buffer in case the host computer requests it. This process allows the data to be directly transferred from the drive's memory when it is requested rather than waiting for a disk access, which results in lower latency. Enabling the hard drive cache can also improve write performance by providing additional memory space for queued data. Write data can be queued in the disk cache and reported as written even though the data will not move from memory to the disk until disk access is available. This reduces the delay during disk I/O operations.

There is an inherent risk in holding data in the drive cache when a write has been acknowledged as complete but is not written to the disk. If the drive loses power, the data in the cache is lost before it is written to the disk. This can cause a "hole" in a data file, which makes the file unusable. Using a UPS mitigates this risk but does not eliminate it.

**Note:** A soft or hard reset (<Ctrl> + <Alt> + <Del> or the reset button) does not affect the completion of a disk write operation because the disk cache is flushed as long as drive power is maintained.

### 5.2 RAID Configration Demo for Applications

To set up a surveillance server, make sure that your storage system can provide large capacity for video data storage, and with optimized performance. To keep the video safe, store the application data (video data) separate from the operating system so that the application data is not impacted in case the operating system needs to be reinstalled.

To meet this requirement, create RAID 1 using 2 HDDs to only install the operation system without the application data. Then, create RAID 50 using 12 HDDs to create a large capacity for data storage to contain the surveillance application and data. The remaining hard drives can be used as online hot spares to help recover a failed drive utilizing the auto rebuild feature of the RAID controller.

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The following steps provide detailed instructions for setting up the arrays in the RAID BIOS console with the detailed array settings for optimizing performance:

1. When the host computer is booting, when prompted, hold down the **<Ctrl> key** and press the **<G> key** when the text 'Press **<**Ctrl**><**G> to enter the RAID BIOS Console' appears on the screen (see Figure 6).



Figure 6. Entering the RAID BIOS Console

The RAID BIOS Console starts after POST completes and the Adapter Selection screen appears as displayed in figure 7.

Adapter Selection				
Adapter No.	Bus No	Device No	Туре	Firmware Version
0. 😦	9	14	Intel(R) RAID Controller SRCSASPH16I	1.12.220-0560
			Start	

#### Figure 7. Adapter Selection Screen

2. If the system has multiple RAID controllers, select a controller, and click **Start** to continue. If the system has only one RAID controller, just click **Start** to continue.

Intel(r) RAID BIOS Console Virtual Configuration				
RAID BIOS Cons	ole l			
	Physical Drives			
Adapter Properties	Enclosure 252 ( 11 )			
Scan Devices	L 1252:0: SATA: UNCONF GOOD: 952720 MB: ATA Hitachi HUA721			
	252:1: SATA: UNCONF GOOD: 952720 MB: ATA Hitachi HUA721			
🖕 Virtual Disks	252:2: SATA: UNCONF GOOD: 952720 MB: ATA Hitachi HUA721			
	252:3: SATA: UNCONF GOOD: 952720 MB: ATA Hitachi HUA721			
👌 Physical Drives	252:4: SATA: UNCONF GOOD: 952720 MB: ATA Hitachi HUA721			
	252:5: SATA: UNCONF GOOD: 952720 MB: ATA Hitachi HUA721			
👩 Configuration Wizard				
🖕 Adapter Selection	Virtual Drives			
Physical View				
• Events				
) <u>Exit</u>				
	II			

The main screen of the RAID BIOS console appears (see Figure 8).

#### Figure 8. RAID BIOS Console Main Screen

3. Click Configuration Wizard to start the RAID Configuration Wizard for creating the RAID array.

The Configuration Wizard screen appears (see Figure 9).

Intel(r) RAID BIOS Console Configuration Wizard		
Current		
Configuration Wizard guides you through the steps for configuring the MegaRAID system easily and efficiently. The steps are as follows:		
1. Disk Group definitions	Group physical drives into Disk Groups.	
2. Virtual Disk definitions	Define virtual disks using those arrays.	
3. Configuration Preview	Preview configuration before it is saved.	
Please choose appropriate of	configuration type:	
Clear Configuration	Allows you to clear existing configuration only.	
O New Configuration	Clears the existing configuration. If you have any existing data	
	in the earlier defined drives, the data will be lost.	
2		
Add Configuration	Retains the old configuration and then adds new drives to the	
	configuration. This is the safest operation	
	as it does not result in any data loss.	
	🗙 Cancel 🔲 🗰 Next	

Figure 9. Configuration Wizard Screen

4. Select New Configuration and click Next.

A dialog box appears to warn you that data will be lost (see Figure 10).

5. Click <b>Yes</b> to continue.	
Intel(r) RAID BIOS Console Confirm Page	
(intel <sup>2</sup>	
This is a Destructive Operation	
Original configuration and data will be lost	
Soloct UFS if desired en	

Figure 10. RAID BIOS Console Confirm Page

6. On the next screen that appears (see Figure 11), select **Custom Configuration** and click **Next** to continue.

linka	Mintel(r) RAID BIOS (	Console Configuratio	m Wizard	
Curre				
Wiza or i (Cus	ard can define the mo f you are an experien stom Configuration).	st efficient configu nced user, Wizard can	ration for your system(Auto Configuration) take you through the steps	,
•	Custom Configuration	1:	Allows you to define all aspects of the configuration, disk groups, virtual disks, and their parameters.	d
0	Auto Configuration: (Recommended)	With Redundancy	Automatically creates redundant disk groups and virtual disks, where possible, and sets their parameters.	
•	Auto Configuration :	Without Redundancy	Automatically creates non-redundant disk groups and virtual disks, and sets their parameters.	
			🗙 Cancel	

Figure 11. RAID BIOS Console Configuration Wizard

7. On the DG Definition screen (see Figure 12), first select any two hard drives to make RAID 1.

Intel(r) RAID BIOS Console Config Wizard - DG Definition		
Disk Group Definition: To add drives to a Disk Group, hold Control key while selecting		
Unconf Good drive	es and click on Add to Array. Then Accept DG.	
Drive addition car	n be undone by selecting the Reclaim button.	
Physical Drives	Disk Groups	
AddtoArray	Reclaim	
	Cancel <b>(III)</b> Next	

Figure 12. DG Definition Screen

8. Hold down the **<Ctrl>** key and using the mouse to click on two unconfigured good hard drives in the Physical Drives panel on the left (see Figure 13), and click **AddtoArray** to move the drives to a proposed drive group configuration in the Disk Groups panel on the right (see Figure 14).

Intel(r) RAID BIOS Console Config Wizard	- DG Definition	
Disk Group Definition: To add drives to a Disk Group, hold Control key while selecting Unconf Good drives and click on Add to Array. Then Accept DG. Drive addition can be undone by selecting the Reclaim button.		
Physical Drives	Disk Groups	
Enclosure 252 ( :1 ) 252:0: SATA: UNCONF GOOD: 952720 MB 252:1: SATA: UNCONF GOOD: 952720 MB 252:2: SATA: UNCONF GOOD: 952720 MB 2252:3: SATA: UNCONF GOOD: 952720 MB 2252:4: SATA: UNCONF GOOD: 952720 MB 2252:5: SATA: UNCONF GOOD: 952720 MB 2252:6: SATA: UNCONF GOOD: 952720 MB 2252: SATA: UNCONF GOOD: 952720 MB 2252: SATA: UNC		
🔄 AddtoArray	🟫 Reclaim	
	🗙 Cancel	

Figure 13. DG Definition Screen – Selecting Devices

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Figure 14. DG Definition Screen – Device added

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9. Click Accept DG.

Intel(r) RAID BIOS Console Config Wizard	- DG Definition			
(interv				
Disk Group Definition: To add drives to a منا	Disk Group Definition: To add drives to a Disk Group, hold Control key while selecting			
Unconf Good drive	es and click on Add to Array. Then Accept DG.			
Drive addition car	n be undone by selecting the Reclaim button.			
Physical Drives	Disk Groups			
Enclosure 252 ( :1) 252:0: SATA: ONLINE: 952720 MB: ATA 2252:1: SATA: ONLINE: 952720 MB: ATA 2252:2: SATA: UNCONF GOOD: 952720 MB: 2252:3: SATA: UNCONF GOOD: 952720 MB: 2252:4: SATA: UNCONF GOOD: 952720 MB 2252:5: SATA: UNCONF GOOD: 952720 MB 2252:6: SATA: UNCONF GOOD: 952720 MB 2252:5: SA	DG0         :R0=1905440MB,R1=952720MB           252:0: SATA: ONLINE: 952720MB: ATA           252:1: SATA: ONLINE: 952720MB: ATA           DG1			
🔄 AddtoArray	👚 Reclaim 📐			
	X Cancel ښ Back 🕪 Next			

Figure 15. DG Definition Screen – Disk Group 0 Added

10. Hold down the **<Ctrl>** key while you select six unconfigured good hard drives in the Physical Drives panel on the left, and click AddtoArray to move the drives to a proposed drive group configuration in the Disk Groups panel on the right (see Figure 16).

(intel) Intel(r) RAID BIOS Console Config Wizard	- DC Definition		
Disk Group Definition: To add drives to a Disk Group, hold Control key while selecting Unconf Good drives and click on Add to Array. Then Accept DG. Drive addition can be undone by selecting the Reclaim button.			
Enclosure 252 (:1)         K:252:0: SATA: ONLINE: 952720 MB: ATA         K:252:1: SATA: ONLINE: 952720 MB: ATA         K:252:2: SATA: ONLINE: 952720 MB: ATA         K:252:3: SATA: ONLINE: 952720 MB: ATA         K:252:4: SATA: ONLINE: 952720 MB: ATA         K:252:5: SATA: ONLINE: 952720 MB: ATA         K:252:6: SATA: ONLINE: 952720 MB: ATA         K:252:6: SATA: ONLINE: 952720 MB: ATA         K:252:6: SATA: ONLINE: 952720 MB: ATA	DISK GPORPS		
AddtoArray	Accept DG Reclaim		
	X Cancel		

Figure 16. DG Definition Screen – Adding Devices to Device Group 1

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11. Click Accept DG to accept the changes.

Intel(r) RAID BIOS Console Config Wizard - DG Definition				
(interv				
Dick Crown Definition: To add drives to a Dick Crown, hold Control key while colecting				
Unconf Good drive	es and click on Add to Array. Then Accept DG.			
Drive addition car	n be undone by selecting the Reclaim button.			
Physical Drives Disk Groups				
Implosure 252 (:1)         I	DG1 :RO=5716320MB,R5=4763600MB, 252:2: SATA: ONLINE: 952720MB: ATA 252:3: SATA: ONLINE: 952720MB: ATA 252:4: SATA: ONLINE: 952720MB: ATA 252:5: SATA: ONLINE: 952720MB: ATA 252:6: SATA: ONLINE: 952720MB: ATA 252:7: SATA: ONLINE: 952720MB: ATA DG2 Reclaim			
	Cancel ( in Back in Next )			

Figure 17. DG Definition Screen – Disk Group 1 Added

12. Hold down the **<Ctrl>** key while you select the next six unconfigured good hard drives in the Physical Drives panel on the left, and then click **AddtoArray** to move the drives to a proposed drive group configuration in the Disk Groups panel on the right (see Figure 18).

Intel(r) RAID BIOS Console Config Wizard - DG Definition           Intel(r) RAID BIOS Console Config Wizard - DG Definition           Image: State of the state o			
Physical Drives Disk Groups			
Enclosure 253 ( :1) 253:0: SATA: UNCONF GOOD: 952720 MB 253:1: SATA: UNCONF GOOD: 952720 MB 253:2: SATA: UNCONF GOOD: 952720 MB 253:3: SATA: UNCONF GOOD: 952720 MB 253:4: SATA: UNCONF GOOD: 952720 MB 253:5: SATA: UNCONF GOOD: 952720 MB 253:6: SATA: UNCONF GOOD: 952720 MB 253:6: SATA: UNCONF GOOD: 952720 MB 253:6: SATA: UNCONF GOOD: 952720 MB	DG1 :R0=5716320MB,R5=4763600MB, 252:2: SATA: ONLINE: 952720MB: ATA 252:3: SATA: ONLINE: 952720MB: ATA 252:4: SATA: ONLINE: 952720MB: ATA 252:5: SATA: ONLINE: 952720MB: ATA 252:6: SATA: ONLINE: 952720MB: ATA 252:7: SATA: ONLINE: 952720MB: ATA 252:7: SATA: ONLINE: 952720MB: ATA DG2		
💁 AddtoArray	👚 Reclaim		
	🗙 Cancel 🚺 Back 🗤 Next		

Figure 18. DG Definition Screen – Adding Devices to Disk Group 2

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13. Click Accept DG to accept the changes.

Intel(r) RAID BIOS Console Config Wizard - DG Definition				
(Conterv				
Dick Group Definition: To add drives to a Dick Group, hold Control key while selecting				
Unconf Good drive	es and click on Add to Array. Then Accept DG.			
Drive addition car	n be undone by selecting the Reclaim button.			
Physical Drives Disk Groups				
Enclosure 252 ( :1 )	↓ _ DG2 :R0=5716320MB,R5=4763600MB,  \			
252:0: SATA: ONLINE: 952720 MB: ATA	253:0: SATA: ONLINE: 952720MB: ATA			
LEX:252:1: SATA: ONLINE: 952720 MB: ATA	253:1: SATA: ONLINE: 952720MB: ATA			
LK:252:3: SATA: ONLINE: 952720 MB: ATA	144: 253:3: SATA: ONLINE: 95/720MB: ATA			
252:4: SATA: ONLINE: 952720 MB: ATA	253:4: SATA: ONLINE: 952720MB: ATA			
252:5: SATA: ONLINE: 952720 MB: ATA	253:5: SATA: ONLINE: 952720MB: ATA			
1 - K:252:6: SATA: ONLINE: 952720 MB: ATA				
🔄 AddtoArray	👚 Reclaim			
	🗙 Cancel 🛛 🗰 Back 💷 Next			

Figure 19. DG Definition Screen – Disk Group 2 Added

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- 14. Click **Next** to continue.
- 15. On the Span Definition screen (see Figure 20), select **DG:0,Hole:0,R0,R1,952720MB**, and click **Add to SPAN**.

Intel(r) RAID BIOS Console Config Wizard - Span Definition		
Span Definition: To add array hole to a Span, select an array hole from the drop-down.Click on Add To Span. Array hole will be added to the span.Array Hole addition can be undone by selecting the Reclaim button.		
Array With Free Spe	ace	Span
DG:0,Hole:0,R0,R1,952720MB DG:0,Hole:0,R0,R1,952720MB DG:1,Hole:0,R0, R5, R6,952720 DG:2,Hole:0,R0, R5, R6,952720	DMB DMB	R
🔄 Add to SPAN		👚 Reclaim
		🗙 Cancel

Figure 20. Span Definition Screen – Adding an Array Hole

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16. Click Next.

Intel(r) RAID BIOS Con	sole ConfigWizard	- Span Definition		
Under 1				
Span Definition:	m: To add array hole to a Span, select an array hole from the drop-down.Click on Add To Span. Array hole will be added to the span.Array Hole addition can be undone by selecting the Reclaim button.			
Array With Free S	Space		Span	
DG:1,Hole:0,R0, R5, R6,952	720M	DG:0,R0, R1,9527	20MB	
💁 Add to SP	AN		Reclaim	
		X Cancel	<b>∢</b> ⊪ Back	m <b>)</b> Next

Figure 21. Span Definition Screen – Array Hole Added

17. On the VD Definition screen (see Figure 22), select **WBack** for the Write Policy and click **Accept** to finish RAID1 configuration.

(inte) Intel(r) R	AID BIOS Console Config	g Wizard - VD Definition
RAID Level	RAID1	
Strip Size	64 KB	
Access Policy	RU	
Read Policy	Normal 🔻	
Write Policy	WBack V	
🔽 Wrthru for	WBack WThru	
IO Policy		R0:1905440 R1:952720
Disk Cache Policy	NoChange 🔻	
Disable BGI	No 🔻	
Select Size	952720	
	📮 Acc	ccept 🔄 Reclaim
		🗙 Cancel 🛛 📢 Back 🔲 Next

Figure 22. VD Definition Screen – Configuring RAID 1

Intel(r) R	AID BIOS Console Config	Wizard - VD Definition
(incer/		
RAID Level	RAIDO	DG 0 :R1=OMB
Strip Size	64 KB	VDO: RAID1: 952720MB: Optimal
Access Policy	RW	
Read Policy	Normal 🔻	
Write Policy	WThru 🔽	
🔽 Wrthru for	BAD BBU	
IO Policy	Direct 🔽	Press Back Button To Add Another VD.
Disk Cache Policu	NoChange 🔻	
Disable BGI	No	
Select Size	O MB	
		🖕 Reclaim
		🗙 Cancel 🛛 🗰 Back 🖬 🗰 Next
		8

18. On the next screen (see Figure 23), click **Back** to start RAID50 configuration.

Figure 23. VD Definition Screen – RAID 1 Configured

19. On the Span Definition screen (see Figure 24), select **DG:1,Hole:0,R0,R5,R6,952720M** and click **Add to SPAN**.

Intel(r) RAID BIOS Console Config Wizard – Span Definition			
Concerv			
Span Definition:	To add array hole to a Span, select an array hole from the drop-down.Click on Add To Span. Array hole will be added to the span.Array Hole addition can be undone by selecting the Reclaim button.		
Array With Free S	Space	Span	
DG:1,Hole:0,R0, R5, R6,952	720M		
🖸 🖌 Add to SP.	AN 👌	🛉 Reclaim	
		🗙 Cancel	

Figure 24. Span Definition Screen – Adding an Array Hole

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Intel(r) RAID BIOS Console Config Wizard – Span Definition			
Span Definition: To add array i drop-down.Cli span.Array Ho Reclaim butto	To add array hole to a Span, select an array hole from the drop-down.Click on Add To Span. Array hole will be added to the span.Array Hole addition can be undone by selecting the Reclaim button.		
Array With Free Space		Span	
DG:2,Hole:0,R0, R5, R6,952720M		DG:1,RO, R5, R6,952720MB	
Add to SPAN		👚 Reclaim	
4		🗙 Cancel	

Figure 25. Span Definition Screen – Adding Second Array Hole

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21. Click **Next** to continue.

Intel(r) RAID BIOS Console Config Wizard - Span Definition			
Span Definition: To add array hol drop-down.Click span.Array Hole Reclaim button.	ion: To add array hole to a Span, select an array hole from the drop-down.Click on Add To Span. Array hole will be added to the span.Array Hole addition can be undone by selecting the Reclaim button.		
Array With Free Space	Span		
	DG:1,R0, R5, R6,952720MB DG:2,R0, R5, R6,952720MB		
Add to SPAN	👚 Reclaim		
4	🗙 Cancel 🗼 Back 🕪 Next		

Figure 26. Span Definition Screen – Array Holes Added

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22. On the VD Definition screen, select **RAID50** for the RAID Level (see Figure 27), and select **512 KB** for Strip Size, **WBack** for the Write Policy (see Figure 28), and modify the Select Size value to **9527200 MB** (see Figure 29).

(intel) Intel(r) RAID BIOS Console Config Wizard - VD Definition				
RAID Level	RAID 50			
Strip Size	RAID 60 RAID 50		UDU: RAIDI: 952720MB: Optimal	
Access Policy	RAID OO			
Read Policy	Normal			
Write Policy	WThru 🔽			
🔽 Wrthru for	BAD BBU			
IO Policy	Direct 🔽	8	Next LJ, Possible KHIJ Levels R00:11432640 R50:9527200 R60: 7621760	
Disk Cache Policy	NoChange 🔻			
Disable BGI	No 🔻			
Select Size	7621760 MB			
Accept Scelaim				
			🗙 Cancel 🛛 🗰 Back 👐 Next	

Figure 27. VD Definition Screen – Configuring RAID 50

RAID Level	RAID 50	DG 0:R1=0NB
Strip Size	512KB	
Access Policy	RU	
Read Policy	Normal 🔽	
Write Policy	WBack St	
🔽 Wrthrufo	r <mark>UBack</mark> UThru	
IO Policy		Next LD, Possible RAID Levels R00:11432640 R50:9527200 R60: 7621760
Disk Cache Policy	NoChange 👿	
Disable BGI	No 🔽	
Select Size	7621760 MB	
	📮 Acc	cept Reclaim
		🗙 Cancel 🛛 🦛 Back 💷 Next

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Figure 28. VD Definition Screen – Configuring RAID 50 Write Policy

Setup Array using an Intel <sup>®</sup> RAID Controller	DIV Storage System Guidance Using Intel®	Server RAID Controllers Deployment Practices White Paper
Setup Array using an inter MAID controller	on storage system doldance using inter	Server to be controllers beployment inactices white raper

(intel) Intel(r) R	AID BIOS Console Config	g Wizard - VD Definition
RAID Level	RAID 50	
Strip Size	512 KB	
Access Policy	RW	
Read Policy	Normal V	
Write Policy	WBack V	
🔽 Wrthrufor	BAD BBU	
IO Policy	Direct 💌	Next LD, Possible RAID Levels R00:11432640 R50:9527200 R60: 7621760
Disk Cache Policy	NoChange 🔻	
Disable BCI	No V	
Select Size	9527200 MB	
🖡 Accept 🔄 Reclaim		
		🗙 Cancel 🚺 Back 📫 Next
ß		

Figure 29. VD Definition Screen – Configuring RAID 50 Size

23. Click Accept to finish a RAID 50 configuration.

(intel) Intel(r) R	AID BIOS Console Config	Wizard - VD Definition
RAID Level	RAID 0	
Strip Size	512 KB	DG 1:R50=0MB
Access Policy	RW	DG 2:R50=0MB
Read Policy	Normal 🔻	VD1: RAID50: 9527200MB: Optimal
Write Policy	UThru 🔻	
🔽 Wrthru for	BAD BBU	
IO Policy	Direct 🔻	Press Back Button To Add Another VD.
Disk Cache Policu	NoChange 🔻	
Disable BGI	No 🔻	
Select Size	O MB	
		😭 Reclaim
		🗙 Cancel 🛛 🗰 Back 🖬 Next
		8

24. On the next screen, click Next to continue.

Figure 30. VD Definition Screen – RAID 50 Configured

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25. On the next screen (see Figure 31), click Accept to save this RAID configuration.



Figure 31. Configuration Wizard Preview Screen

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26. On the next screen (see Figure 32), click **Yes** in the warning dialog that appears to save this configuration.

Intel(r) RAID BIOS Console Confirm Page			
	Save this Configuration ?		
		ß	

Figure 32. RAID BIOS Console Confirmation Page – Save Configuration

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27. On the next screen (see Figure 33), click **Yes** in the warning dialog that appears to initialize.

(intel) Intel0	r) RAID BIOS Console Confirm Page
	All data on the new Virtual Disks will be lost. Want to Initialize?
	No Yes
	<u></u>

Figure 33. RAID BIOS Console Confirmation Page – Initialization

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28. Wait until the initialization completes (see Figure 34), and Click Home.

Intel(r) RAID BIOS Console Virtual Dis	ks
RAID BIOS Console	
	VD0: RAID1: 952720 MB: Optimal VD1: RAID50: 9527200 MB: Optimal
	C Fast Initialize
	O Slow Initialize
	C Check Consistency
	O Properties
	Set Boot Drive (current=0)
	🗞 Go 🔛 Reset
Home	ter Back

Figure 34. RAID BIOS Console Virtual Disks Screen

Intel(r) RAID BIOS Console Virtual Configuration				
PAID RIOS Console				
👝 Adapter Properties	Physical Drives			
· · · · · · · · · · · · · · · · · · ·	Inclosure 252 ( :1 )	X		
🖕 <u>Scan Devices</u>	1252:0: SATA: DGO: ONLINE: 952720 MB: ATA	Hitachi HUA721		
	LAK 252:1: SATA: DGU: ONLINE: 952720 MB: ATA	Hitachi HUA721		
o <u>Virtual Disks</u>	LIK 252:2: SATA: DGI: ONLINE: 952720 MB: ATA	Hitachi HUA721		
• Physical Drives	LAX:252:4: SATA: DG1: ONLINE: 952720 MB: ATA	Hitachi HUA721		
- Hysical brives	LT: 252:5: SATA: DG1: ONLINE: 952720 MB: ATA	Hitachi HUA721		
🖕 Configuration Wizard		<u> </u>		
Adapter Selection	Virtual Drives			
Physical View	DG 0:R1=OMB			
• Events	DG 1:R50=0MB VD1: RAID50: 9527200 MB: Optimal			
• Exit	UD1: RAID50: 9527200 MB: Optimal			
<u>}</u>				

29. Confirm the RAID1 and RAID50 configuration on the next screen (see Figure 35).

Figure 35. RAID BIOS Console Virtual Configuration Screen

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30. Click any one of the two remaining UNCONF hard drives in the Physical Drives section (see Figure 36).

Intel(r) RAID BIOS Console Virtual Configuration				
KAID DIOS COIIS				
Physical Drives				
Addpoer respercies	K;253:1: SATA: DG2: ONLINE: 952720 MB: ATA Hitachi HUA721			
Scan Devices	253:2: SATA: DG2: ONLINE: 952720 MB: ATA Hitachi HUA721			
	253:3: SATA: DG2: ONLINE: 952720 MB: ATA Hitachi HUA721			
👩 Virtual Disks	253:4: SATA: DG2: ONLINE: 952720 MB: ATA Hitachi HUA721			
	253:5: SATA: DG2: ONLINE: 952720 MB: ATA Hitachi HUA721			
🖕 Physical Drives	253:6: SATA: UNCONF GOOD: 952720 MB: ATA Hitachi HUA721			
	LEK:253:7: SATA: UNCONF GOOD: 952720 MB: ATA Hitachi UA72			
👌 Configuration Wizard				
🖕 Adapter Selection	Virtual Drives			
Physical View	DG 0:R1=ONB			
	DG 1:R50=0MB			
Events	VD1: RAID50: 9527200 MB: Optimal			
a Turia	DG 2 :R50=0MB			
• Exit	UD1: RAID50: 9527200 MB: Optimal			

Figure 36. RAID BIOS Console Virtual Configuration Screen – Selecting UNCONF Hard Drives

Intel(r) RAID BIOS Console Physical Drive 30		
RAID BIOS Co Revision Enclosure ID	ABOA	DG 0 :R1=0MB
Slot Number Device Type Connected Port	6 Disk 14	
Media Errors Pred Fail Count	0	. л. Г
SHS Hddress Physical Drive State Coerced Size	UNCONF GOOD 952720 MB	
Make Global HSP Make Dedicated HSP Enclosure Affinity Make Unconf Bad Prepare for Removal Locate		
Home VD Progress Info		

31. On the next screen (see Figure 37), select Make Global HSP and click Go to continue.

Figure 37. RAID BIOS Console Physical Drive Screen – Making Global HSP

32. On the next screen (see Figure 38), confirm that you made a global hot spare for your RAID configuration.

Intel(r) RAID BIOS Console Physical Drive 30			
RAID BIOS Console			
Revision	ABOA	DG 0 :R1=0MB	
Enclosure ID	253	DG 1 :R50=0MB	
Slot Number	6		
Device Type	Disk		
Connected Port	14		
Media Errors	0		
Pred Fail Count	0		
SAS Address	786e995fb2e7cbb2		
Physical Drive State	GL HOTSPARE		
Coerced Size	952720 MB		
🕤 Remove HOTSPARE	🕤 Locate		
	×	Go	
Home VD Progress Info 🛶 Back			
Save the Changes			

#### Figure 38. RAID BIOS Console Physical Drive Screen – Global HSP Configured

33. Use the remaining UNCONF hard drive to make another Global hot spare by repeating steps 30 through 32.

The system is now ready for Operating System and application installation. Intel recommends installing the RAID Web Console 2 Utility to provide online management of your raid configuration as well as to monitor RAID health. This application is available for Windows and Linux based operating systems.

## 6. Advanced Data Integrity Protection

### 6.1 Using a RAID Controller Battery

A RAID controller battery should be used whenever virtual drive write-back cache is enabled and data is mission critical.

Cache-to-cache I/O is much faster than any other type of I/O operation occurring on the data bus. It is faster to write data to the RAID adapter's cache memory than it is to write it directly to a storage device because the time required to spin target data under a read or write head is longer than the time required to perform the read or write to a memory device.

If the RAID Controller's write-back cache option is enabled, data is first written to the cache memory and the write is acknowledged, and then the RAID controller writes the cached data to the storage device when it is available to service the I/O request. However, this method of writing data first to cache memory, acknowledging the write as complete, and then completing the write when the drive is available carries inherent risk. Cached data on the RAID controller can be lost if the AC power fails before the cached data is written to the storage device. The Smart Battery mitigates this risk by providing battery power to the RAID controller memory and holding the data in the RAID cache memory until power is restored. The battery can hold data in the RAID controller's memory for up to 72 hours.

The Smart Battery accomplishes all of this by monitoring the voltage level of the DRAM modules on the RAID controller. If the voltage drops below a defined level, the Smart Battery switches the memory power source from the RAID controller to the battery pack. The battery pack provides power for the memory until the voltage returns to an acceptable level, at which time the Smart Battery circuit board switches the power source back to the RAID controller. Cached data is then written to the storage device just as though the power loss never occurred. The Smart Battery provides additional fault tolerance even when used with a UPS, which does not prevent a system power supply failure or other system internal power failure.

## 6.2 Using a UPS for Power Loss Protection

An uninterruptible power supply (UPS) is a battery-based system power supply that helps to protect electronic equipment from an unexpected loss of power.

There is no way to provide a battery backup of data that is temporarily stored in the hard disk cache but has not been written to disk. A power outage can corrupt the data on a server or make data unavailable to users. A UPS can reduce the chance of a power outage corrupting the data on a server. Although the addition of UPS is not a guarantee that data is not lost, it does add additional security.

A UPS is highly recommended to protect data in mission-critical configurations. Computers and accessories can suffer damage during a power outage or experience a loss of data that is in transit during the power outage.

## 7. Summary

Intel is committed to providing customers with a stable product that offers both high performance and high reliability. In this document, we provided guidance on how to set up a storage hardware system with enhanced data safety and high performance using Intel<sup>®</sup> server boards and Intel<sup>®</sup> RAID controllers in a Chenbro\* RM31616 Chassis.