DIY Storage System Guidance Using Intel® Server RAID Controllers

Deployment Practices White Paper

Revision 1.0

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Enterprise Platforms and Services Division - Marketing

Revision History

Date	Revision Number	Modifications
April 2009	1.0	Initial release.

Disclaimers

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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® Server Boards and Intel® RAID controllers on Chenbro* RM31616 Chassis, including information on how to install an Intel® RAID controller in a Chenbro* RM31616 chassis in conjunction with an Intel® 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

Table 1. Hardware Components

Quantity	Item	Manufacturer	Model
1	Intel® 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/s5000psl/sb/CS-022924.htm
2	Intel® Xeon® 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

3. Chenbro* RM31616 Chassis Introduction

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

Table 2. Chenbro* RM31616 Chassis Features

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 Window	Rear Window	Standard
	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)

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® Server Board and Intel® RAID Controller, visit http://support.intel.com.

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.

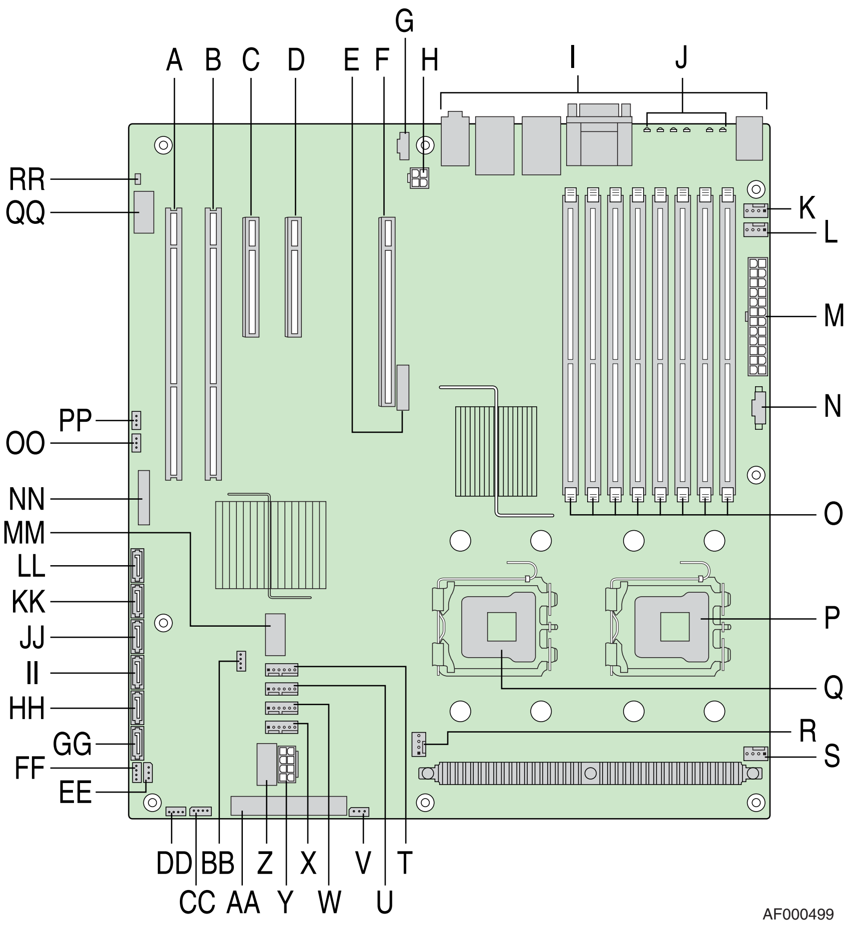


Figure 2. Intel® Workstation Board S5000XVN Layout

Table 3. Major Board Components

	Description		Description
A	PCI-X 64-bit, 100-MHz full-length / full-height slot 1	W	System fan 2 header
B	PCI-X 64-bit, 133-/100-MHz full-length / full-height slot 2	X	System fan 1 header
C	PCI Express* x4[1] or PCI express* x8[2] 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
E	CMOS battery	AA	IDE connector
F	PCI Express* x16 full-length / full-height slot 6 (x16 physical connector)	BB	Enclosure management SATA SGPIO header[2]
G	CD-ROM line-in connector	CC	Intel® Local Control Panel header
H	P12V4 connector	DD	Hot-swap backplane B header
I	Back panel I/O ports	EE	Enclosure management SAS SES I^2C[1]
J	Diagnostic and Identify LEDs	FF	Hot-swap backplane A header
K	System fan 6 header	GG	SATA 0
L	System fan 5 header	HH	SATA 1
M	Main power connector	II	SATA 2 or SAS 0 [3]
N	Auxilliary power signal connector	JJ	SATA 3 or SAS 1 [3]
O	DIMM sockets	KK	SATA 4 or SAS 2 [3]
P	Processor 1 socket	LL	SATA 5 or SAS 3[3]
Q	Processor 2 socket	MM	USB port
R	Processor 2 fan header	NN	Front control panel header
S	Processor 1 fan header	OO	SATA Software RAID 5 key connector[2]
T	System fan 4 header	PP	SAS Software RAID 5 key connector [1]
U	System fan 3 header	QQ	Serial B / emergency management port header
V	IPMB connector	RR	Chassis intrusion header

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

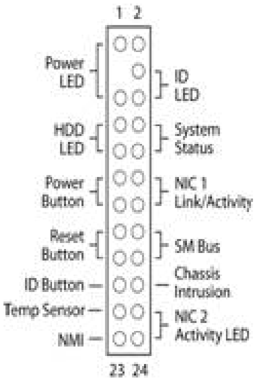
Note 2: Available with product codes S5000XVNSATA/S5000XVNSATAR or BB5000XVNSATA/BB5000XVNSATAR.

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.

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



Pin	Signal Name	Description	Pin	Signal Name	Description
1	P3V3_STBY (Power_LED_Anode)	Power LED +	2	P3V3_STBY	Front Panel Power
3	Key	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 -
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 -

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

4.3 Connection between Chassis and Server Board

The connections from a Chenbro* 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.

Table 5. Connection between Chassis and Server Board

	Chassis	Server Board	Pin # (If needed)
	Main power connector	M	
	P12V4 connector	H	
	Processor power connector	Y	
	System FAN 1	X	
	System FAN 2	W	
	System FAN 3	U	
	System FAN 4	T	
	Front USB connector	Z	
	Chassis intrusion connector	RR	
Front Panel Connection	Power LED	NN	1,5
	HDD LED	NN	7,9
	Power SW	NN	11,13
	RESET	NN	15,17
	LAN 1	NN	12,14
	LAN 2	NN	22,24

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.

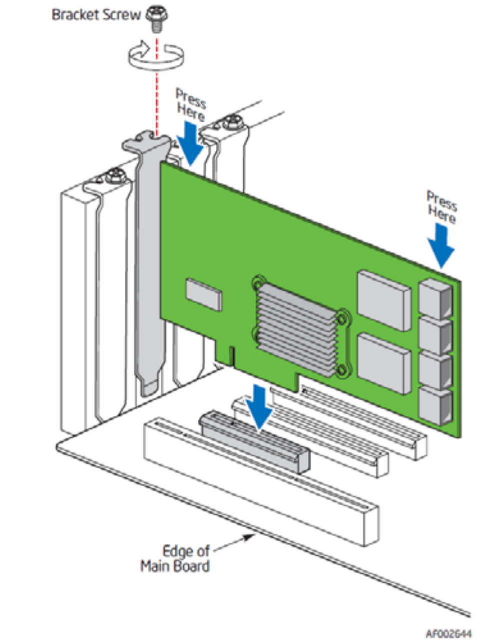


Figure 3. Inserting the Intel® RAID Controller SRCSASPH16I into a PCI Express* Slot

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)

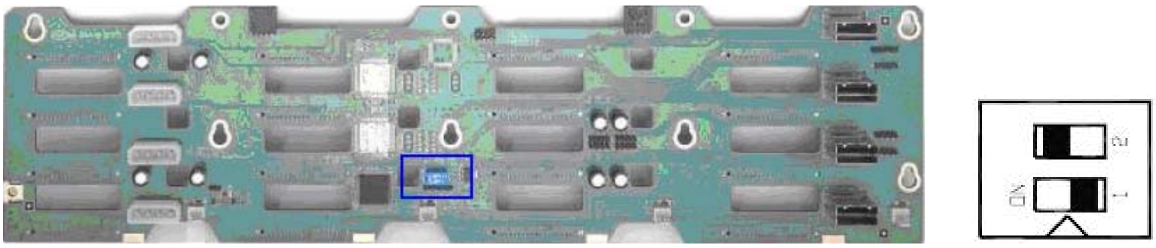


Figure 4. Switches on the Backplane with Default Setting

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

Table 6. Backplane SGPIO Function Setting

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

Intel® 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.

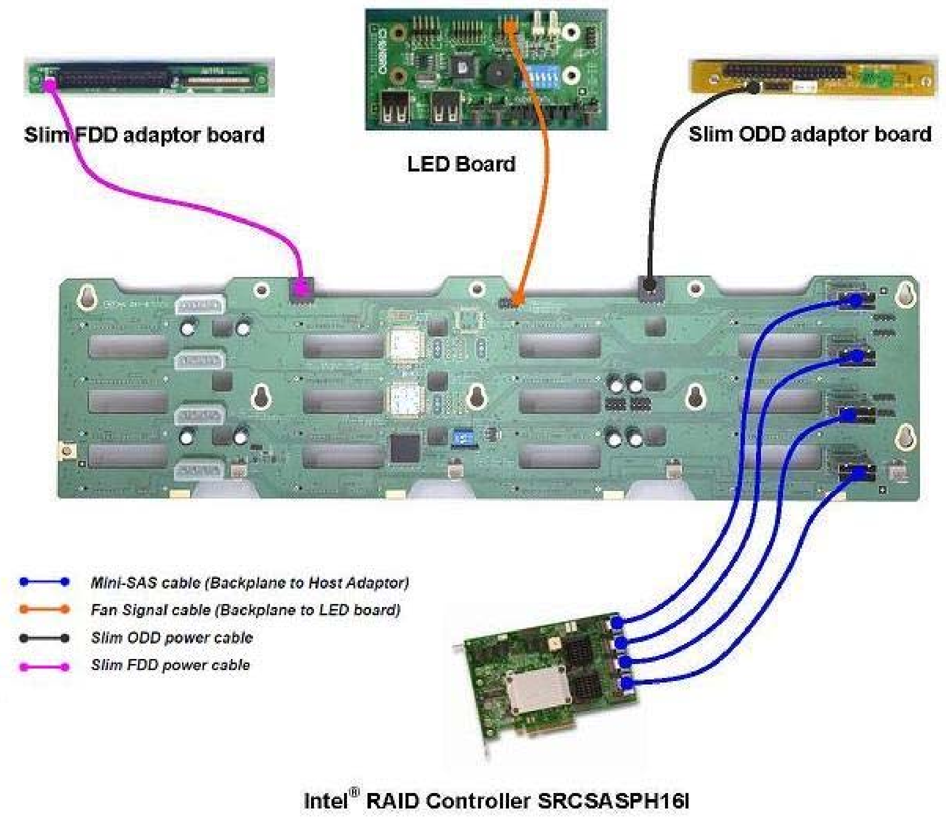


Figure 5. Backplane Wiring Illustration

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 http://support.intel.com/support/motherboards/server/.

5. Setup Array using an Intel® 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 http://support.intel.com/support/motherboards/server/ .

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® 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.

Table 7. RAID Level Selection

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

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

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 http://support.intel.com/support/motherboards/server/.

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.

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).

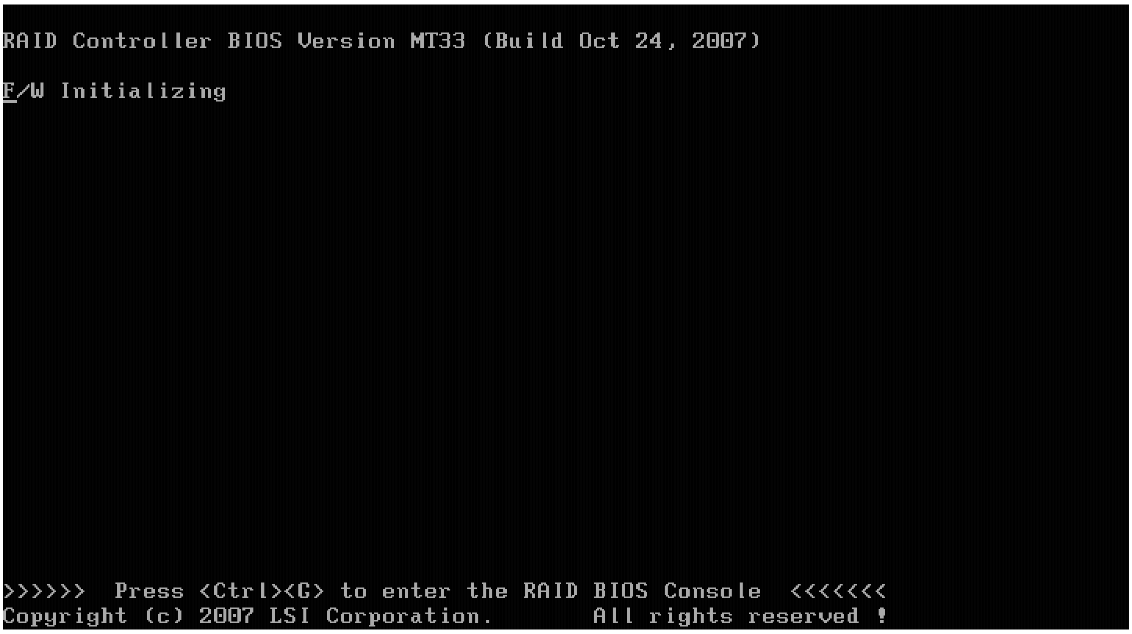


Figure 6. Entering the RAID BIOS Console

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

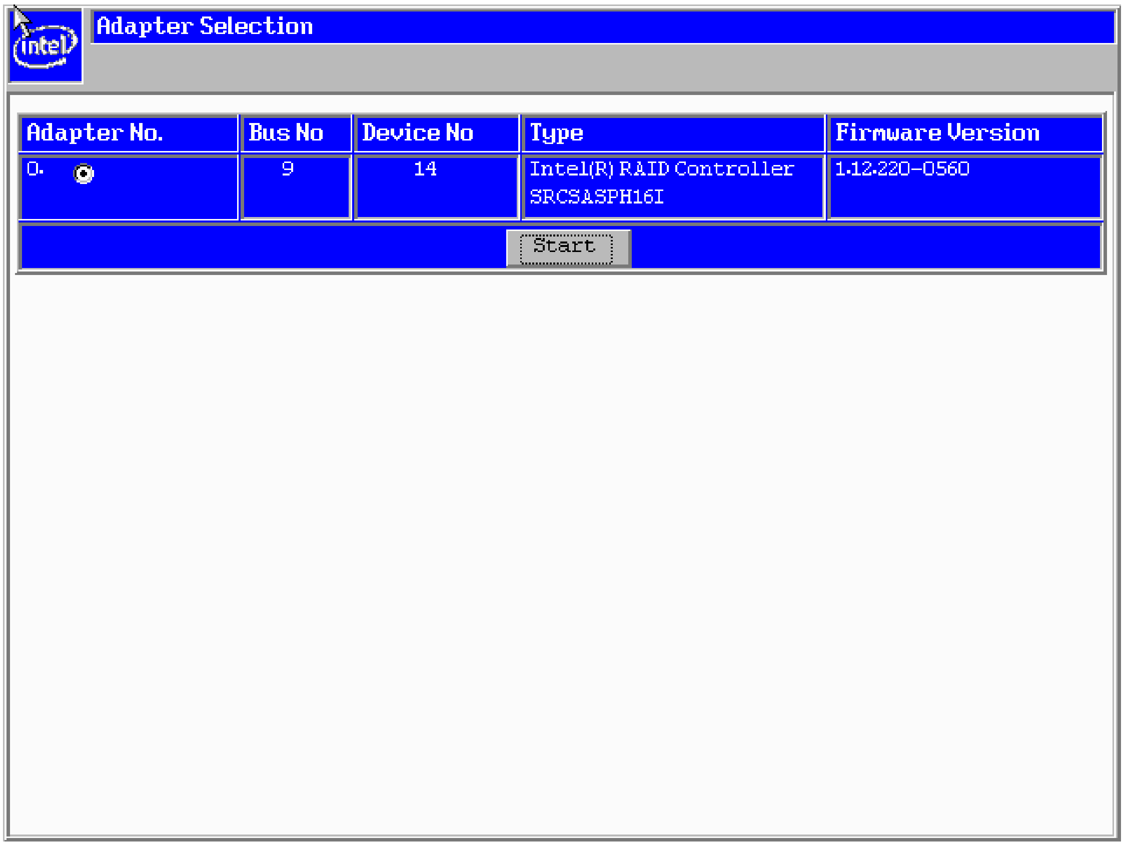


Figure 7. Adapter Selection Screen

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.

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

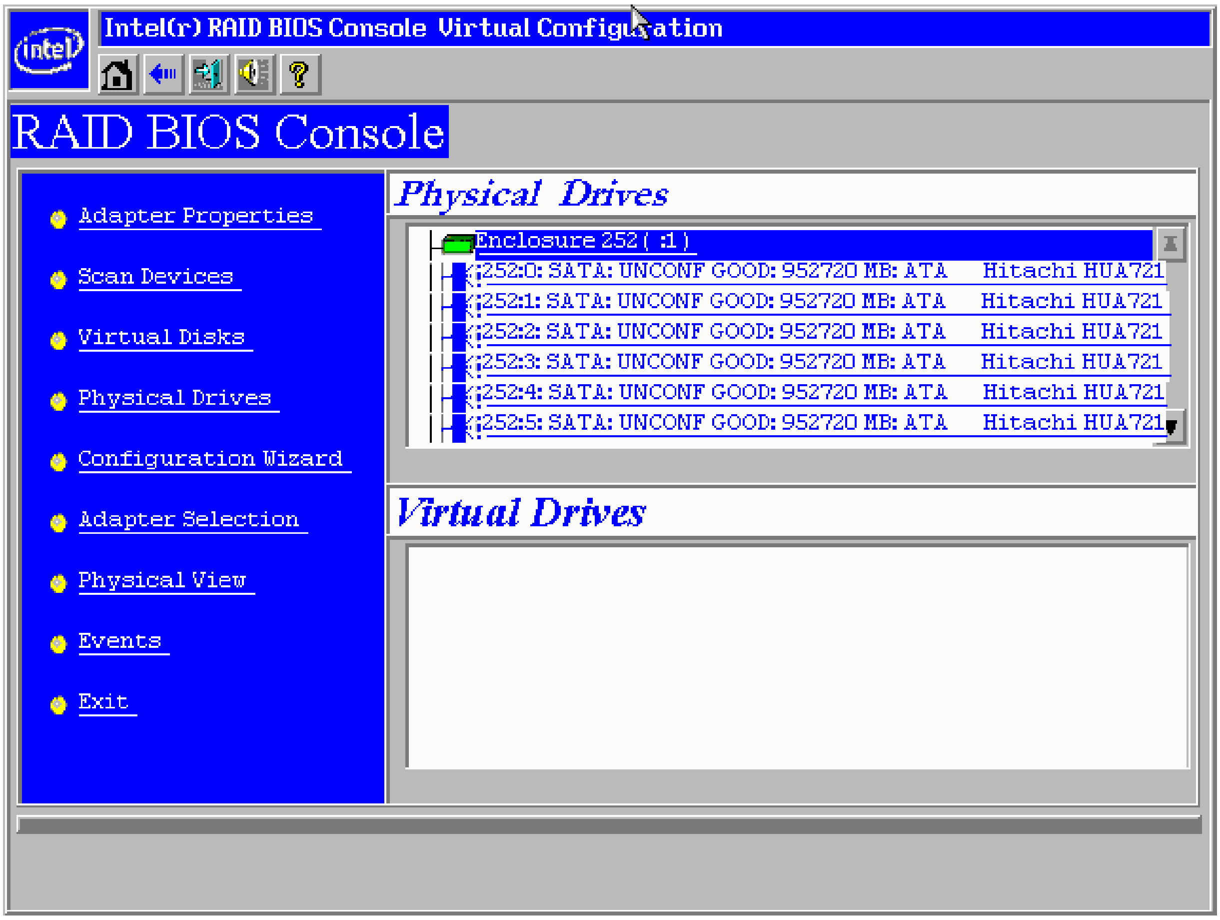


Figure 8. RAID BIOS Console Main Screen

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

The Configuration Wizard screen appears (see Figure 9).

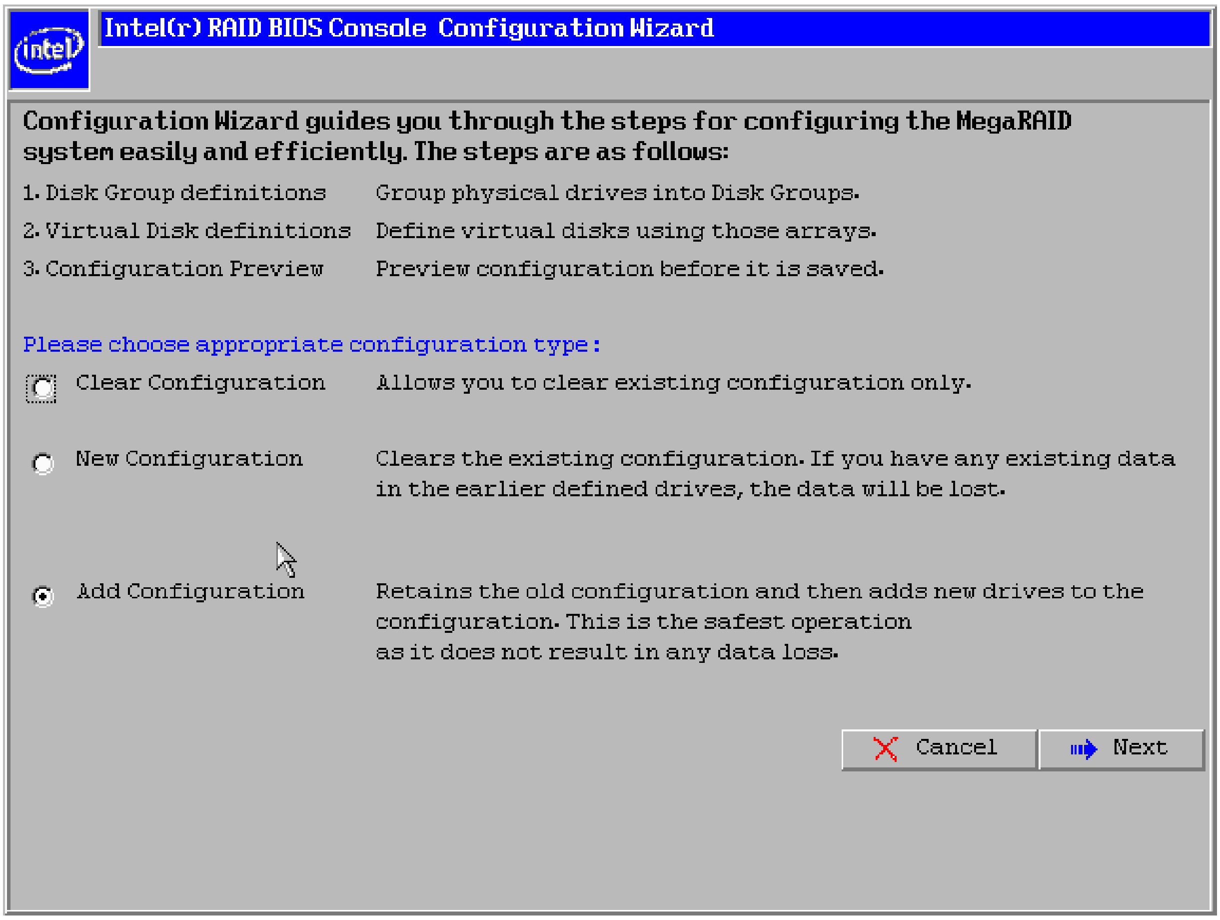


Figure 9. Configuration Wizard Screen

4. Select New Configuration and click Next.

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

5. Click **Yes** to continue.

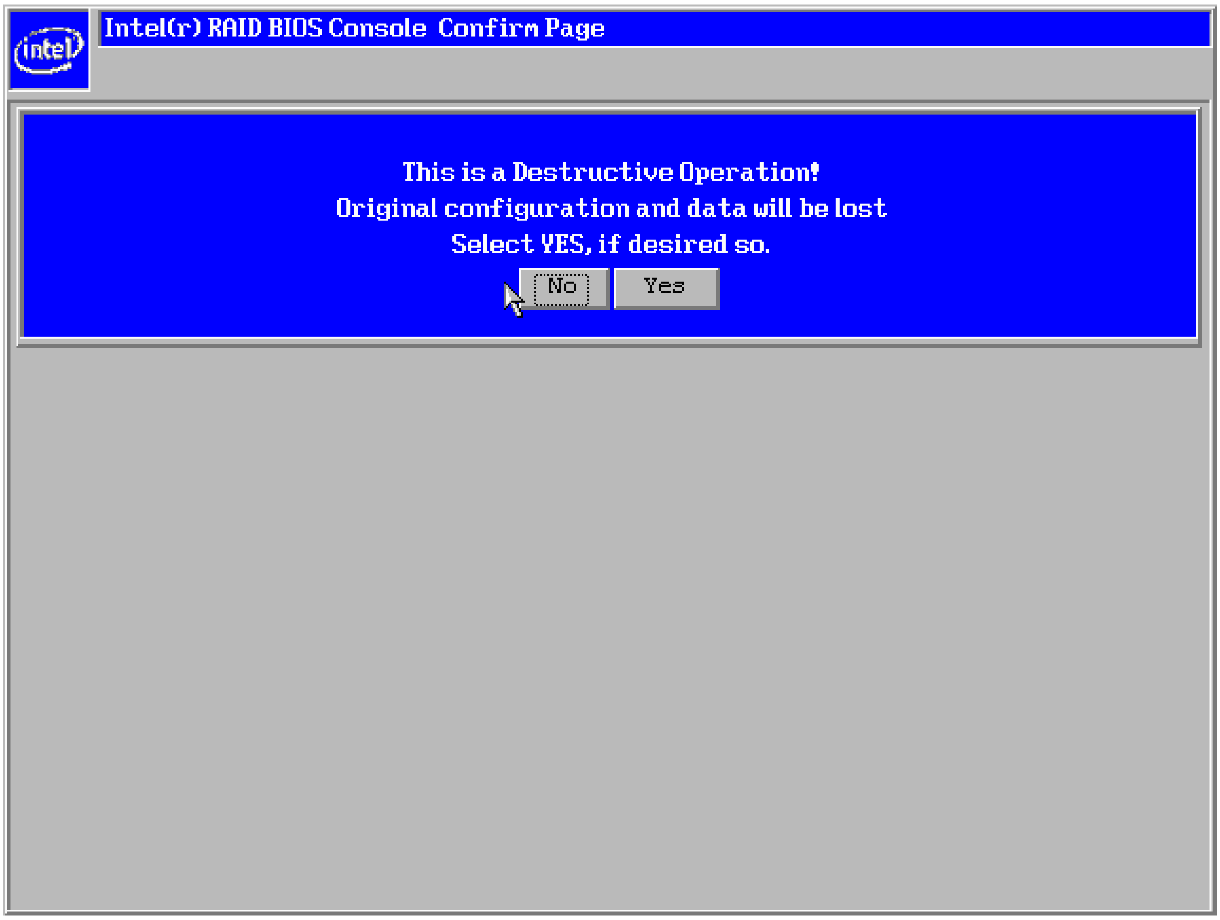


Figure 10. RAID BIOS Console Confirm Page

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

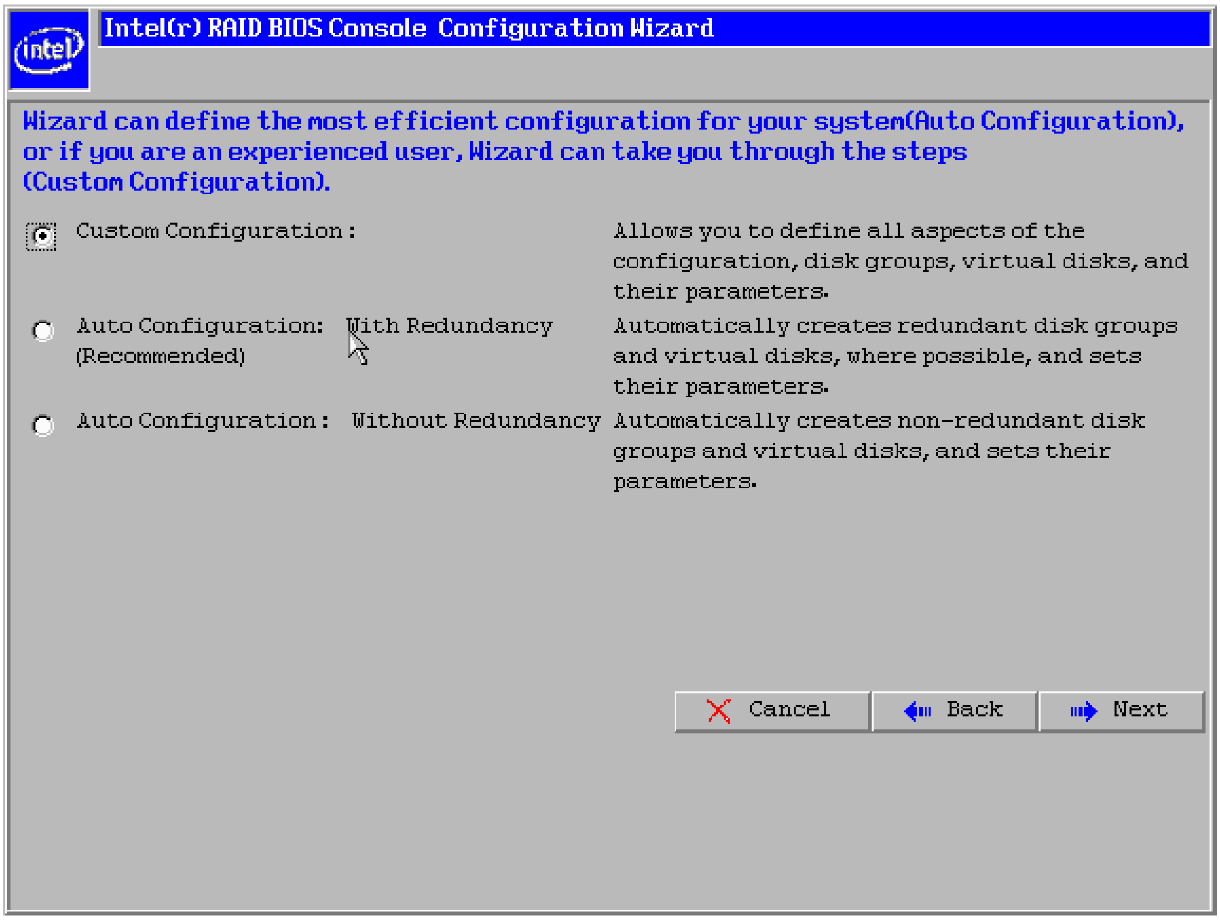


Figure 11. RAID BIOS Console Configuration Wizard

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

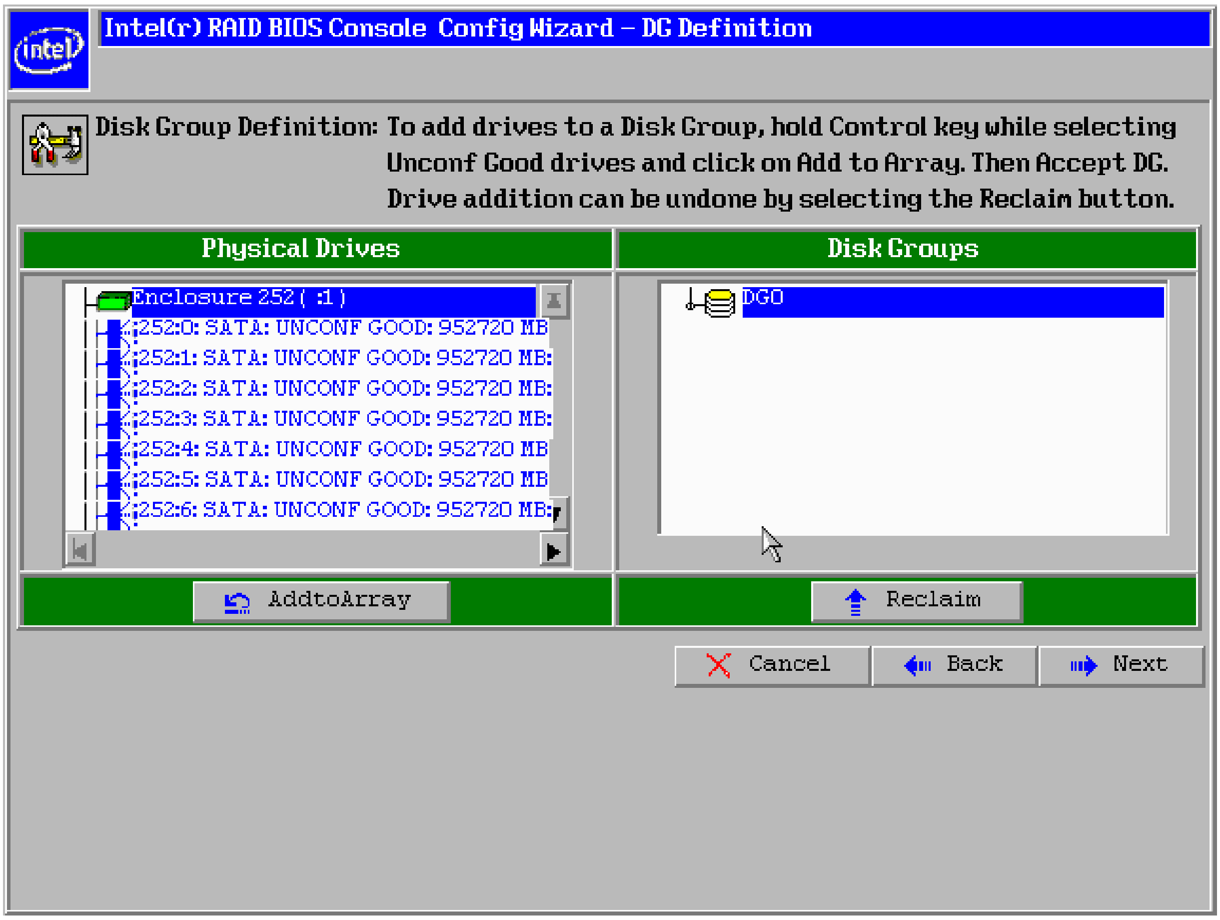


Figure 12. DG Definition Screen

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).

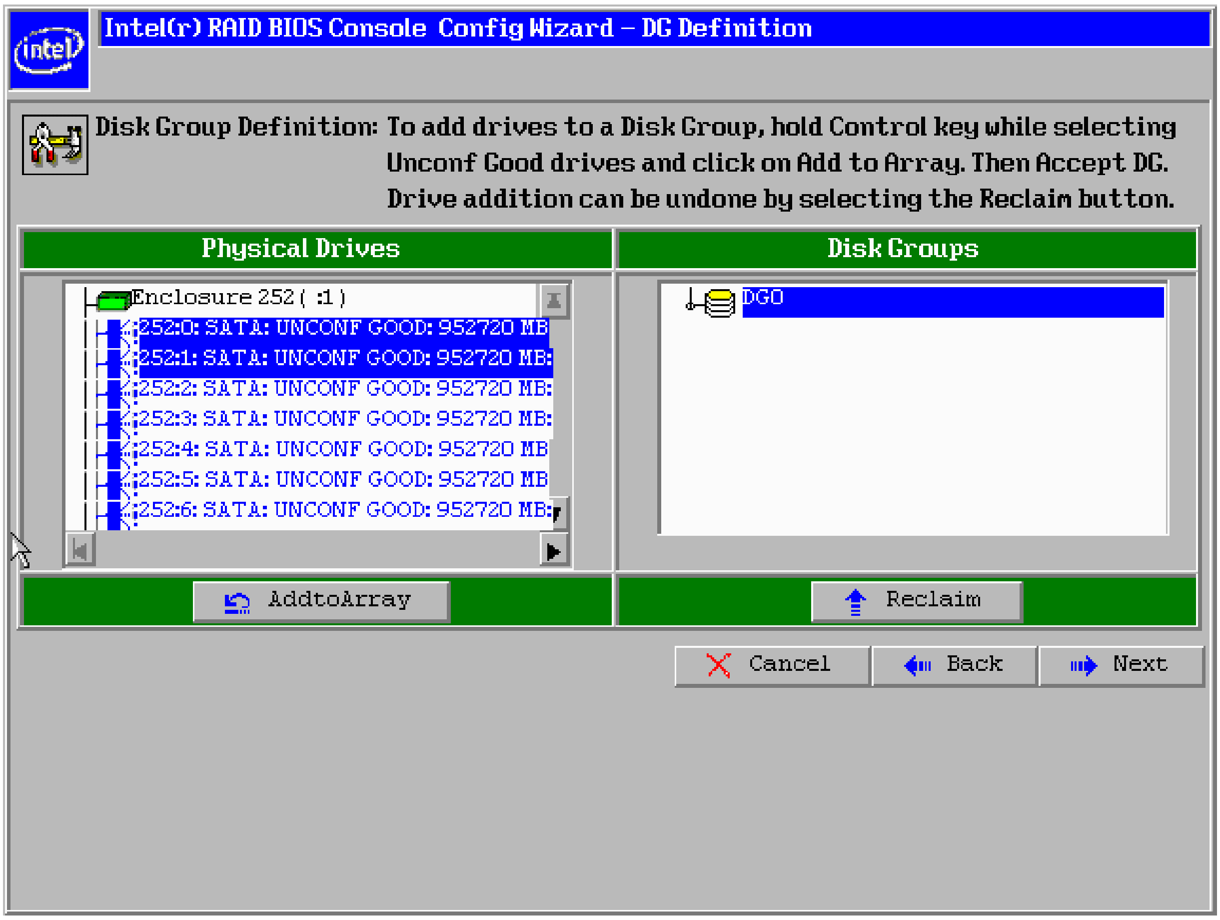


Figure 13. DG Definition Screen – Selecting Devices

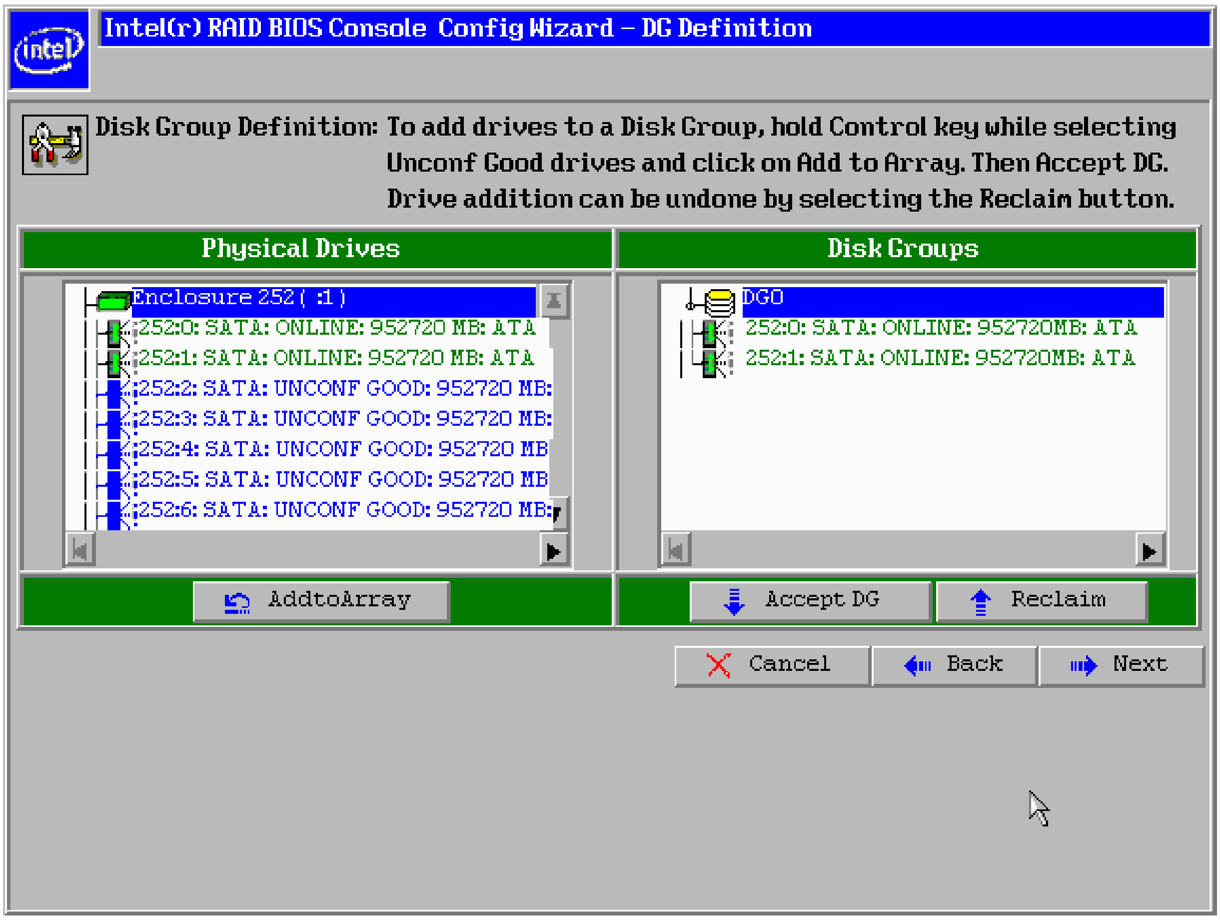


Figure 14. DG Definition Screen – Device added

9. Click **Accept DG**.

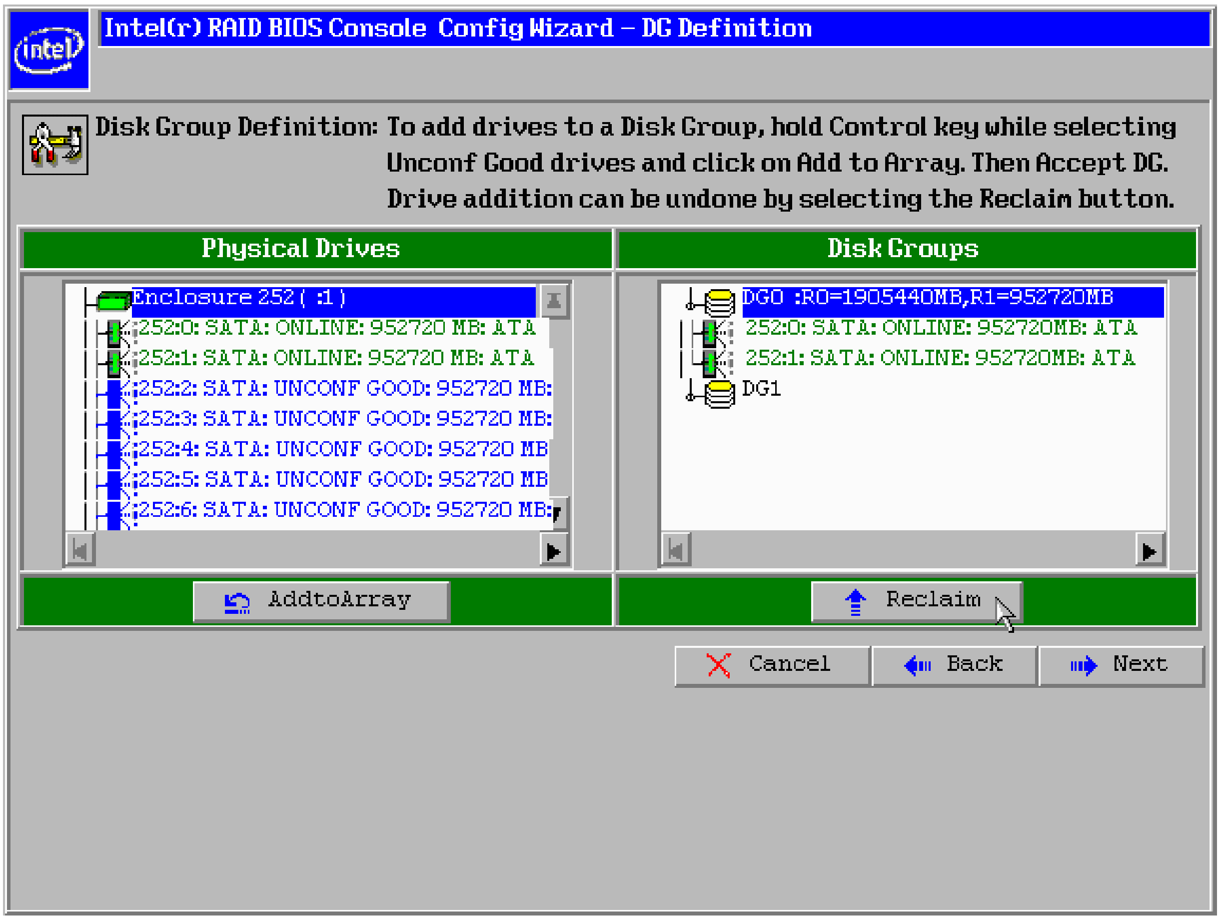


Figure 15. DG Definition Screen – Disk Group 0 Added

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).

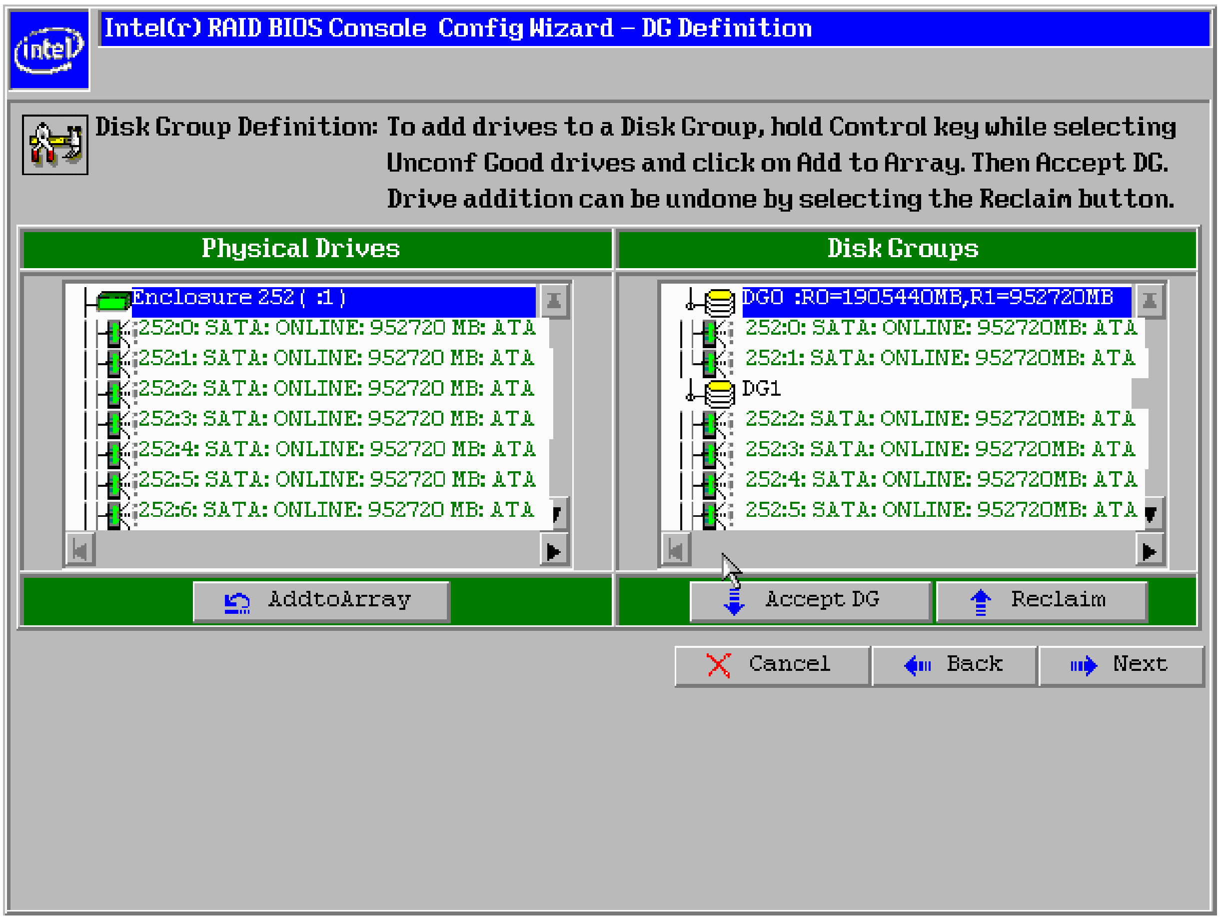


Figure 16. DG Definition Screen – Adding Devices to Device Group 1

11. Click **Accept DG** to accept the changes.

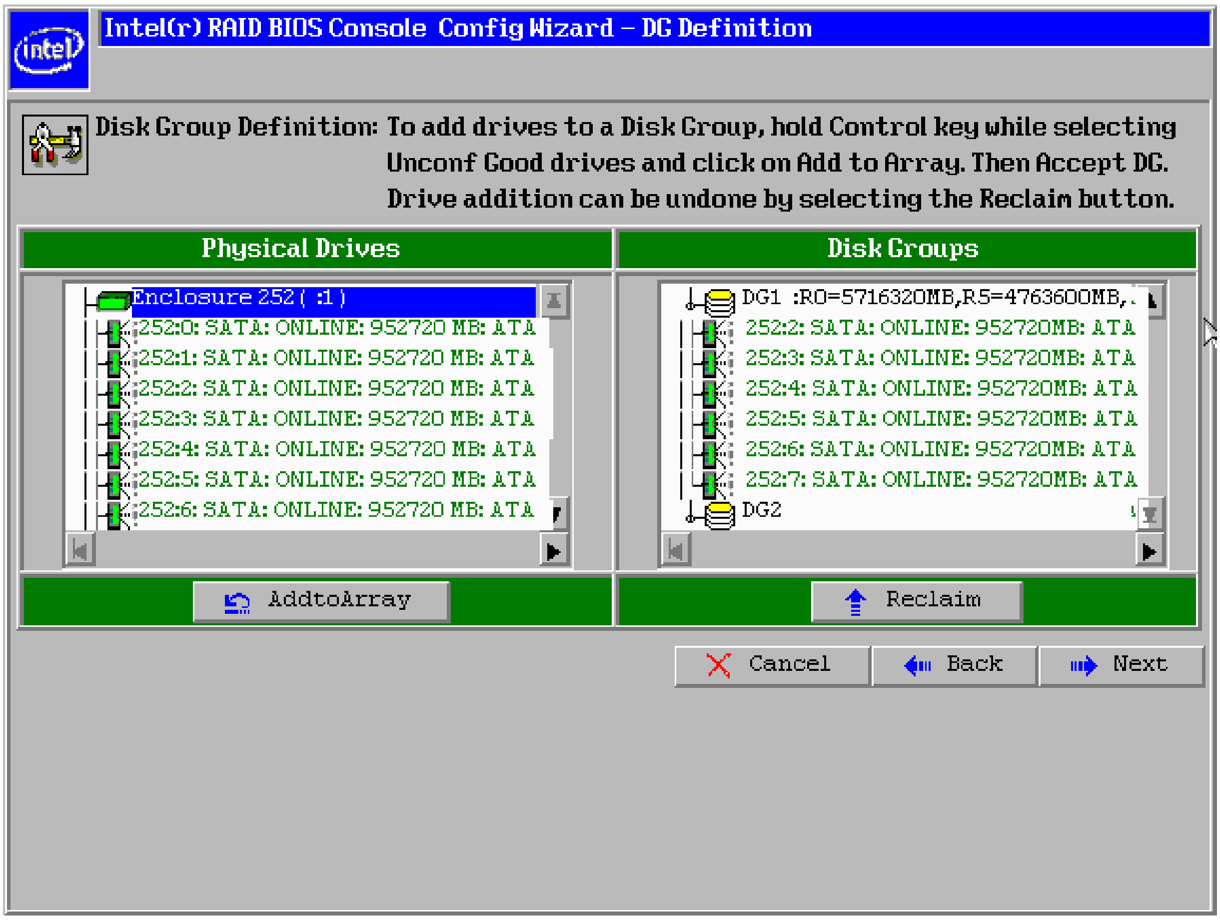


Figure 17. DG Definition Screen – Disk Group 1 Added

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).

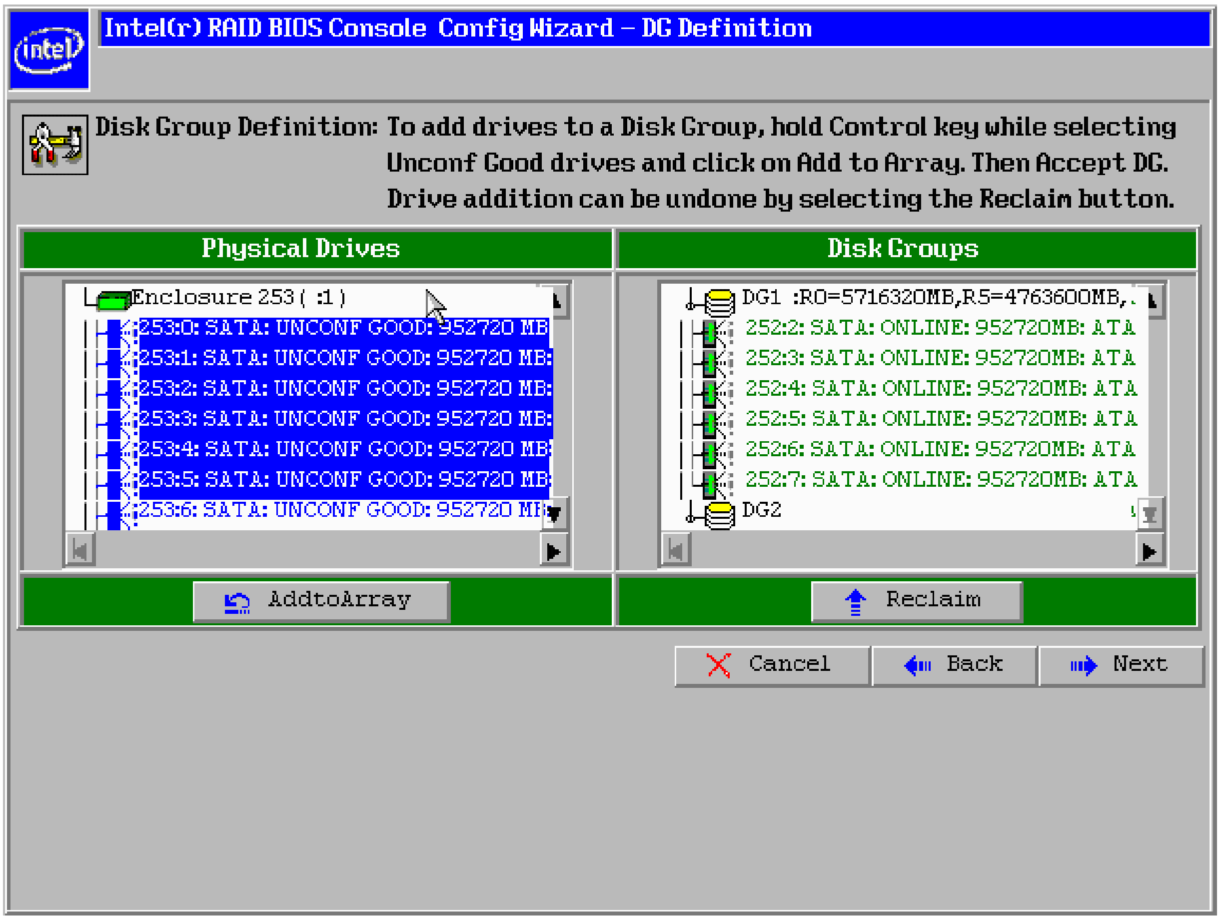


Figure 18. DG Definition Screen – Adding Devices to Disk Group 2

13. Click **Accept DG** to accept the changes.

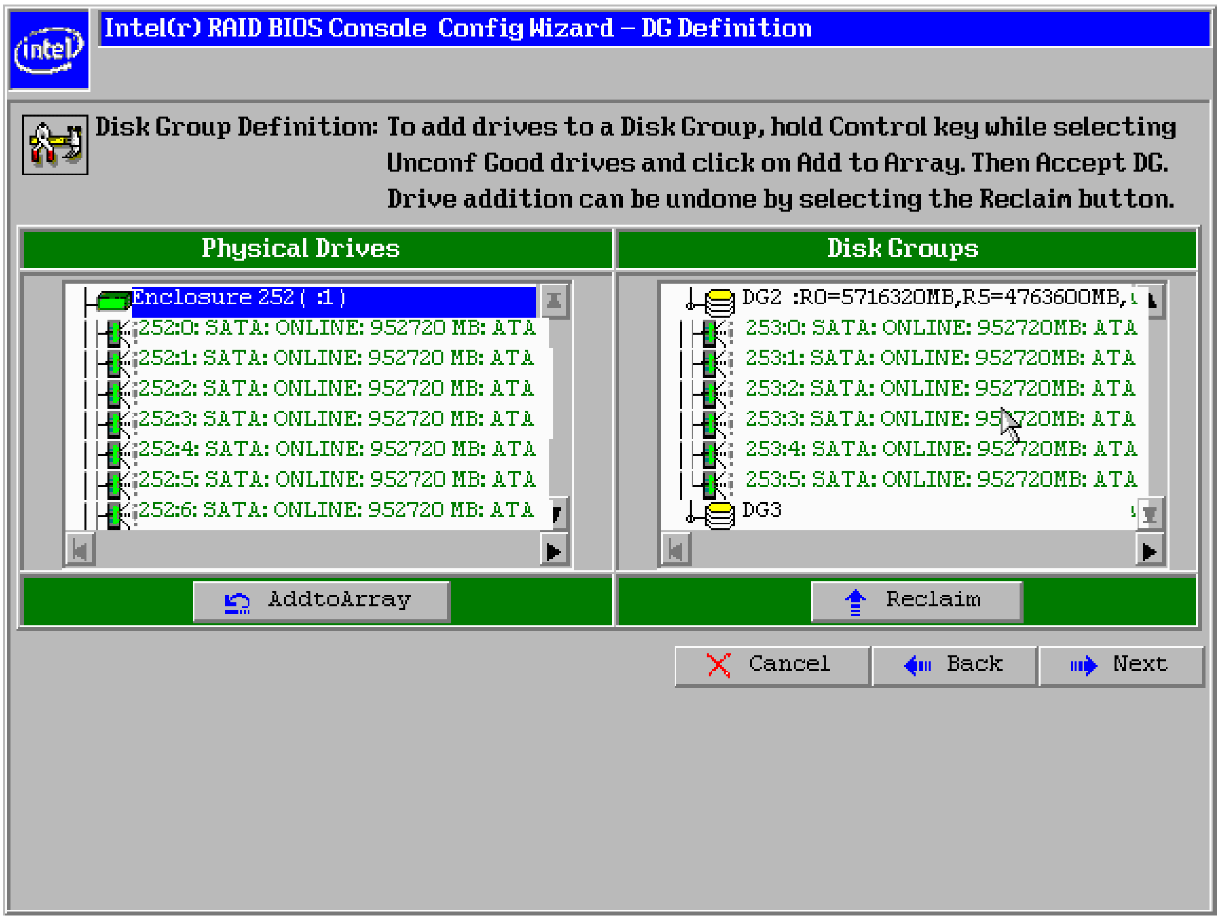


Figure 19. DG Definition Screen – Disk Group 2 Added

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**.

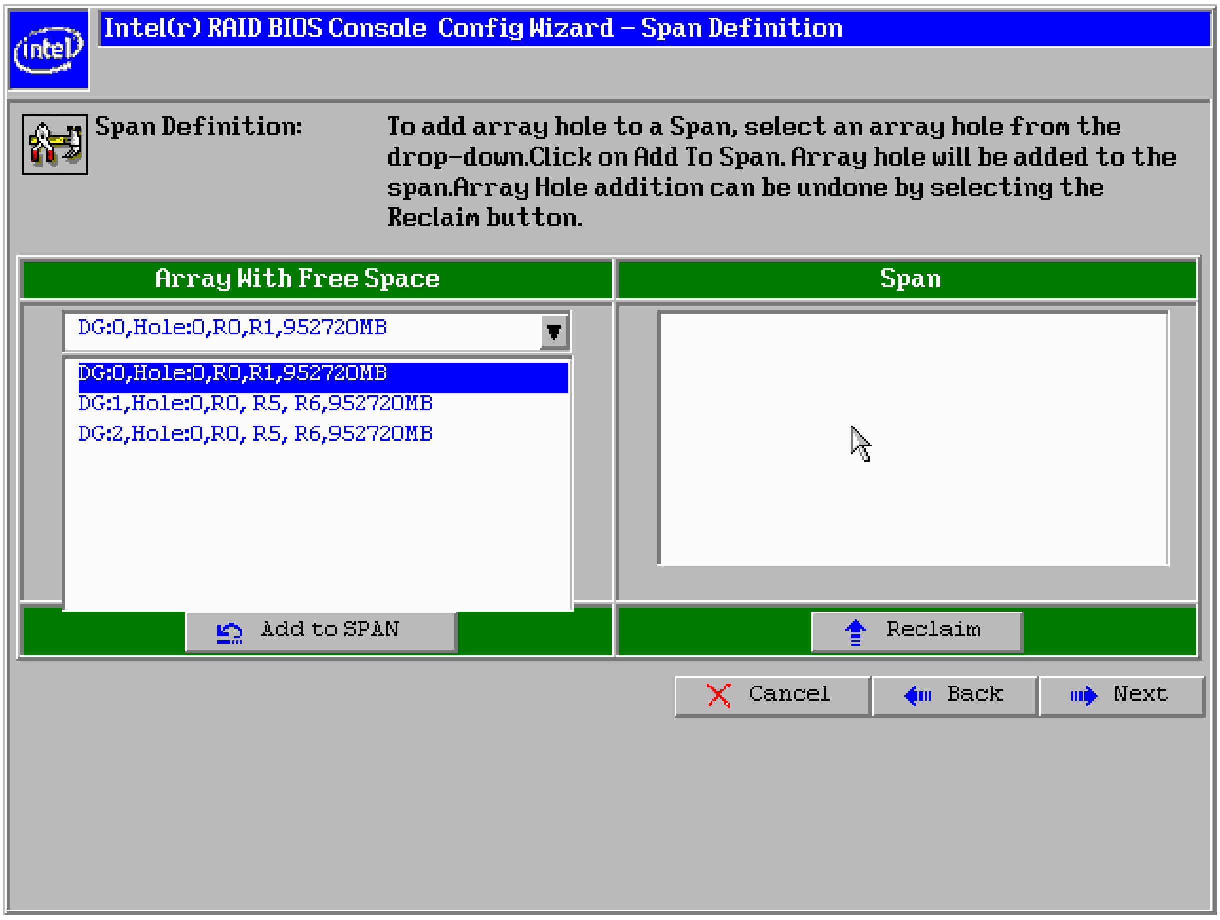


Figure 20. Span Definition Screen – Adding an Array Hole

16. Click **Next**.

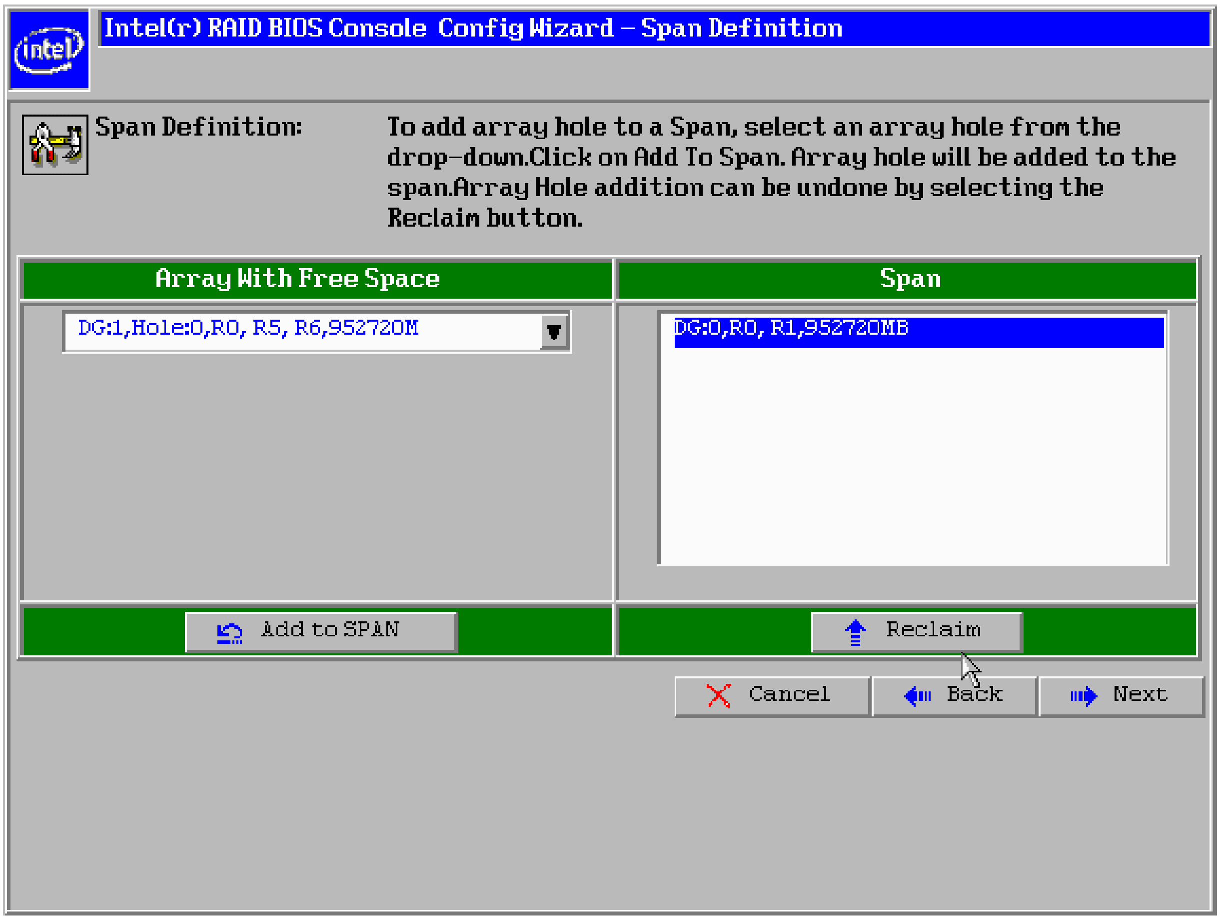


Figure 21. Span Definition Screen – Array Hole Added

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

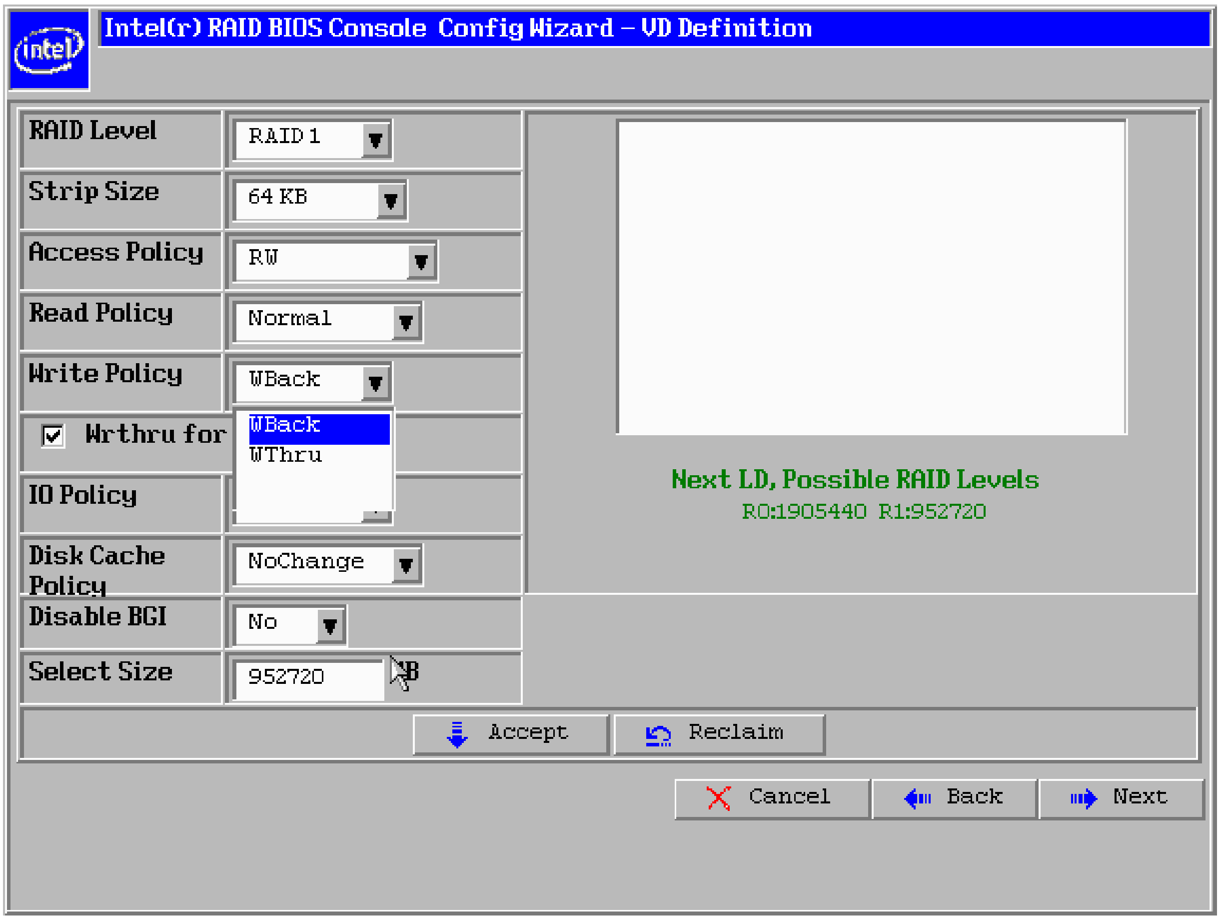


Figure 22. VD Definition Screen – Configuring RAID 1

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

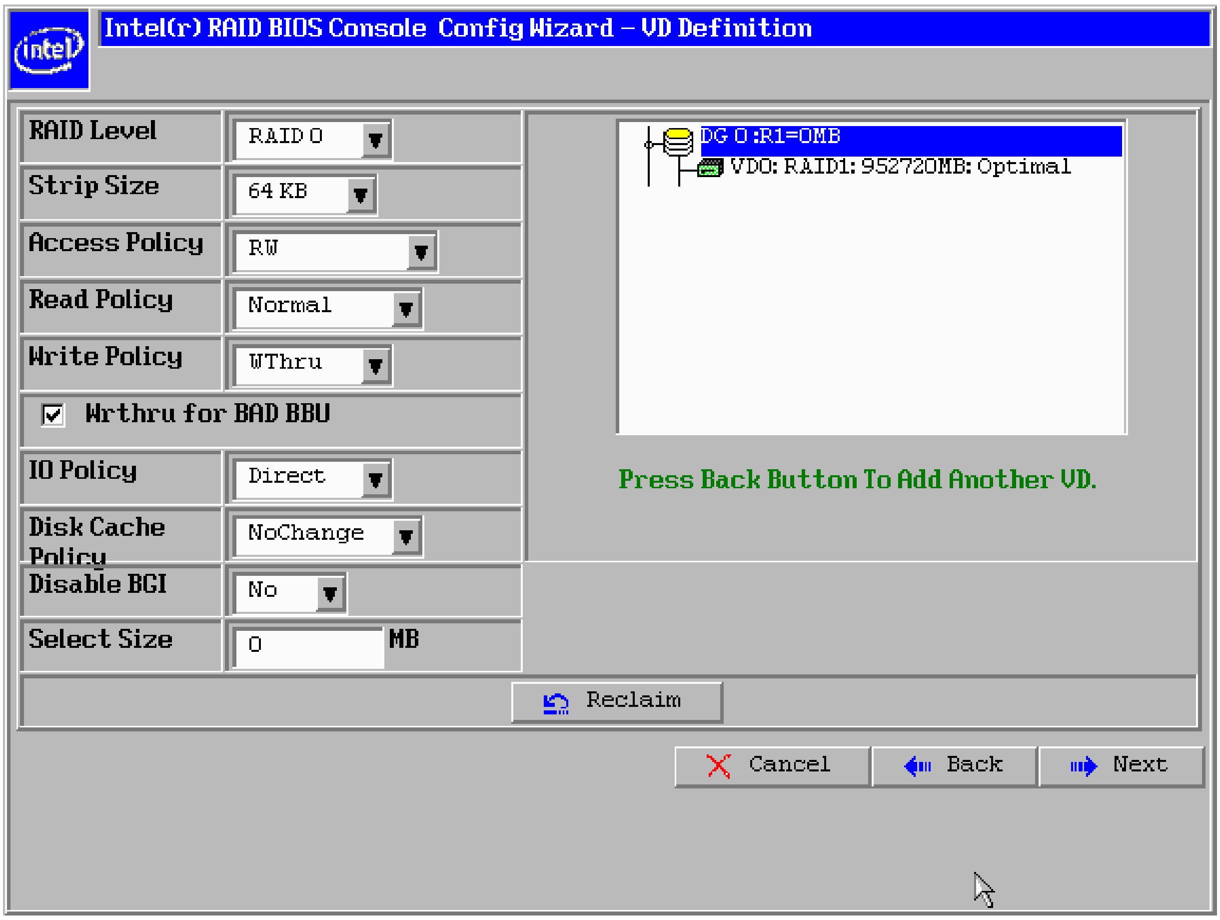


Figure 23. VD Definition Screen – RAID 1 Configured

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

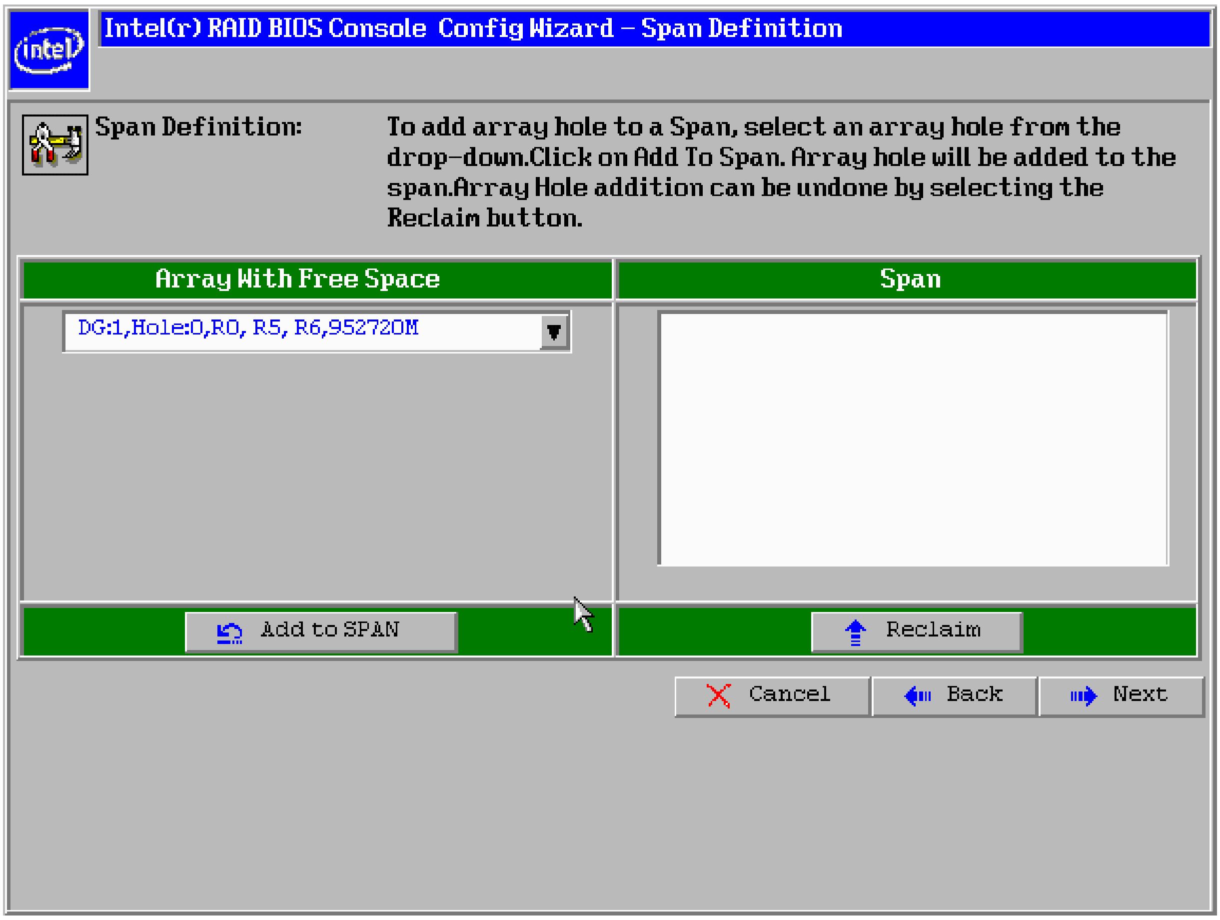


Figure 24. Span Definition Screen – Adding an Array Hole

20. Then, select **DG:2,Hole:0,R0,R5,R6,952720M** and click **Add to SPAN**.

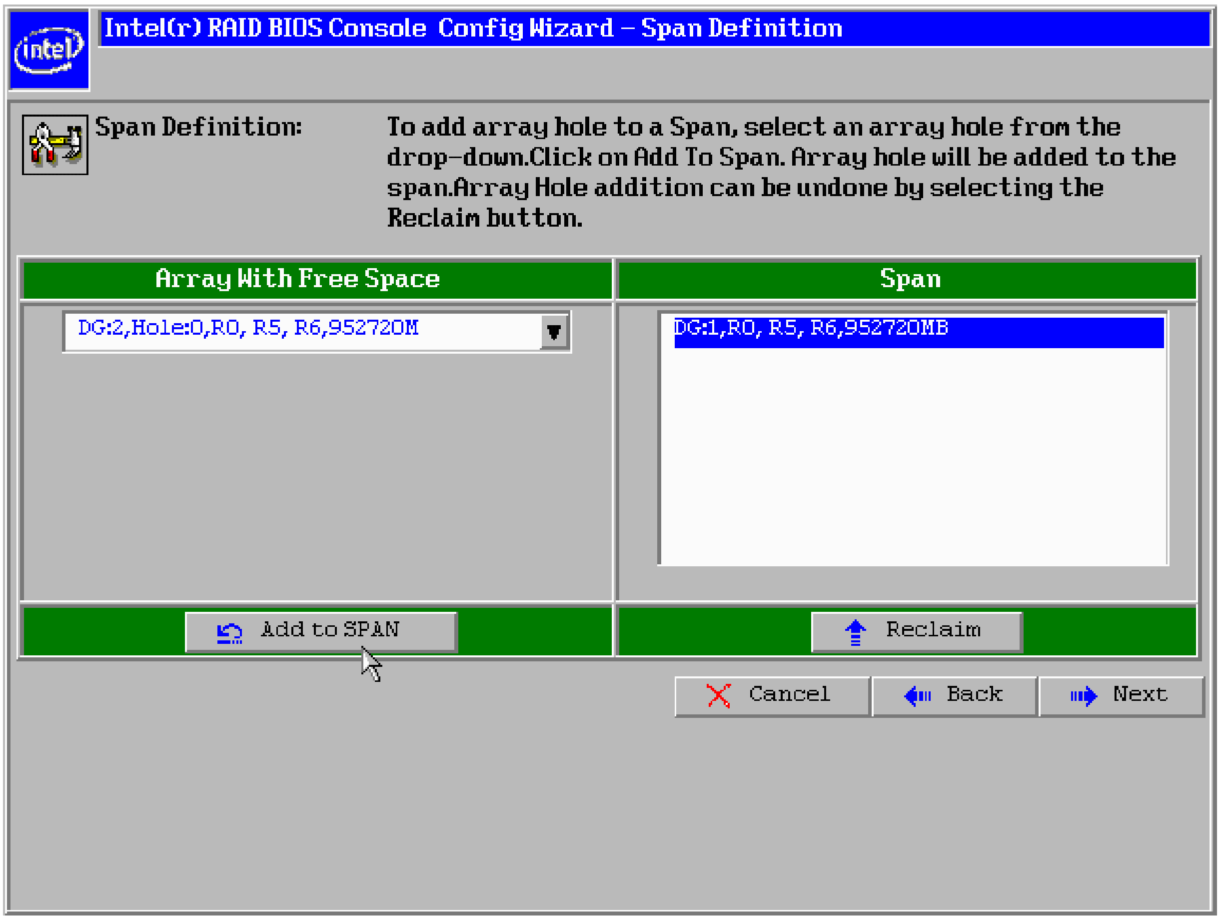


Figure 25. Span Definition Screen – Adding Second Array Hole

21. Click **Next** to continue.

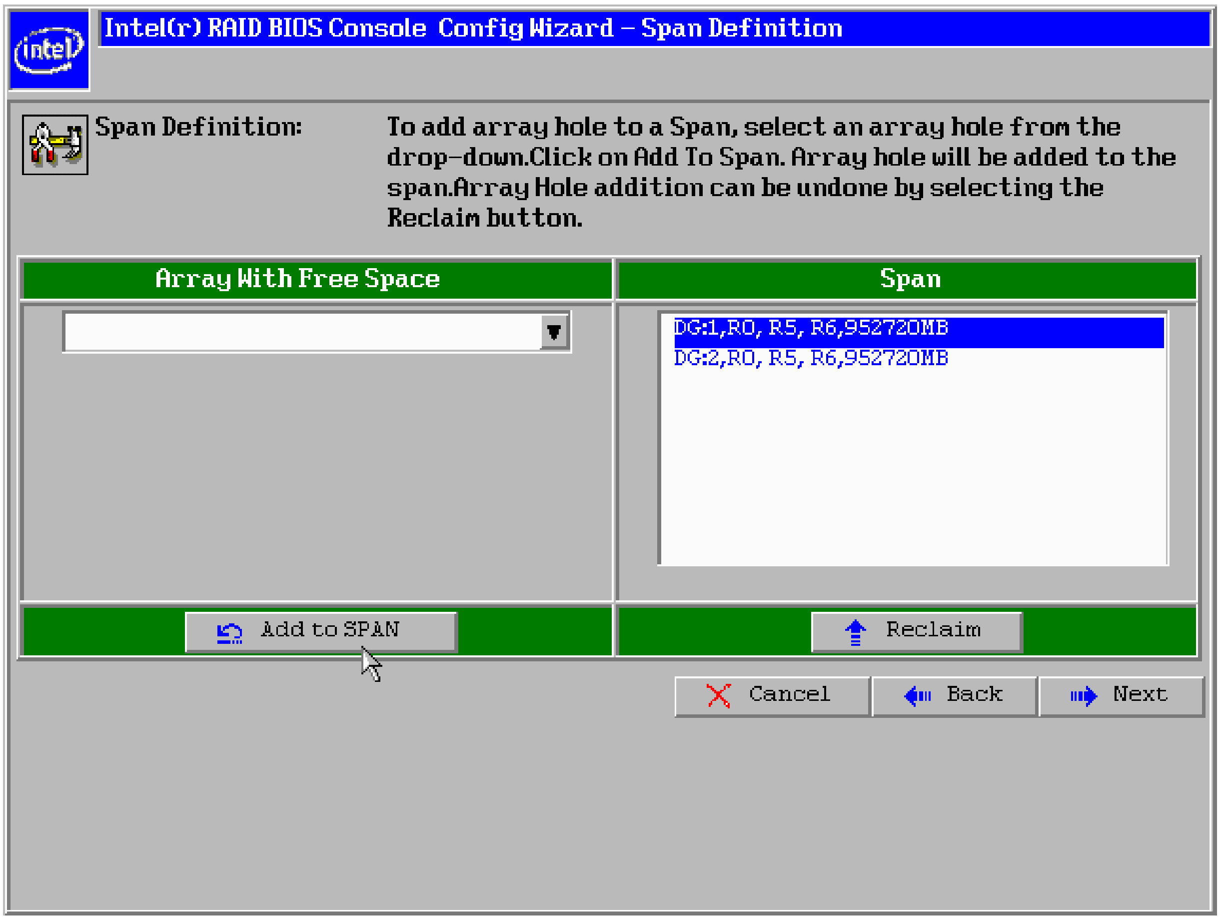


Figure 26. Span Definition Screen – Array Holes Added

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).

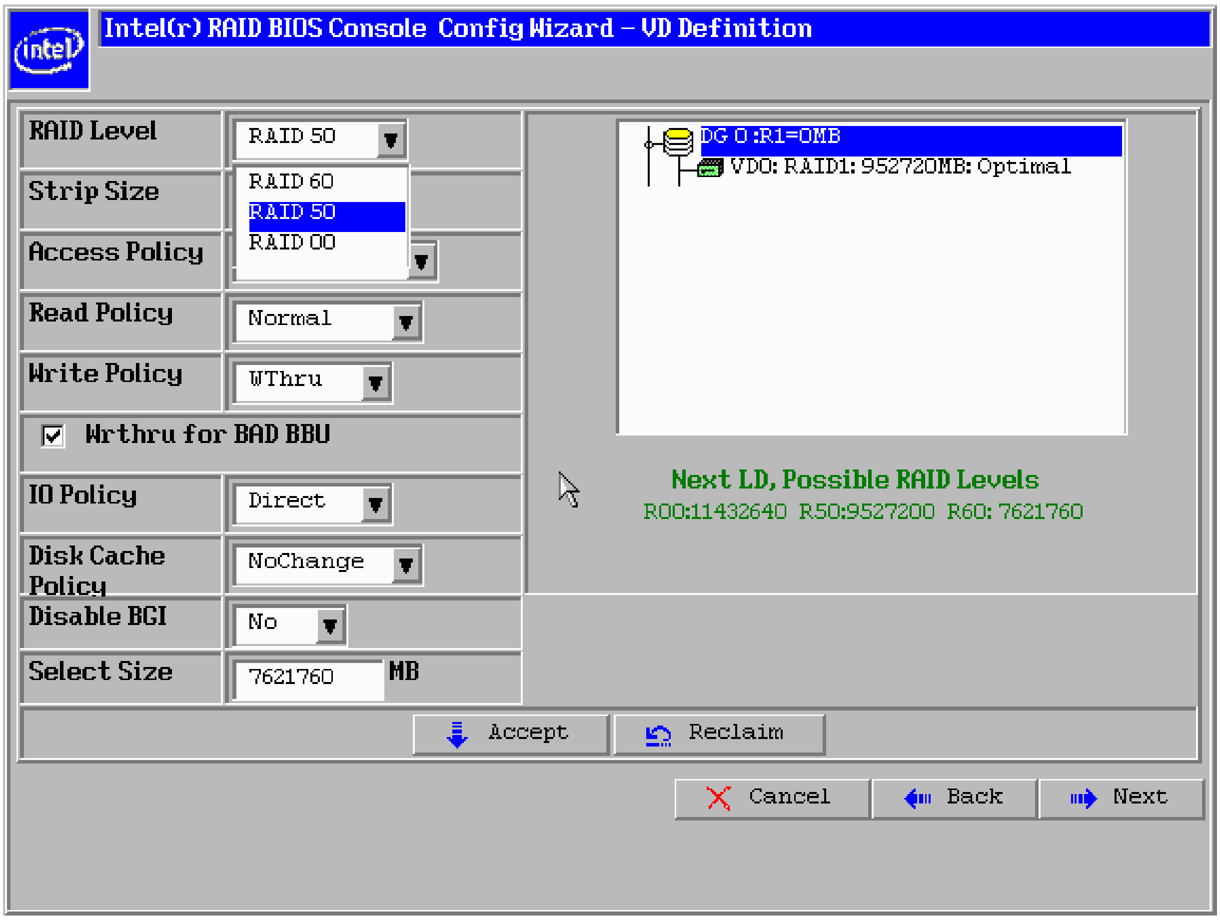


Figure 27. VD Definition Screen – Configuring RAID 50

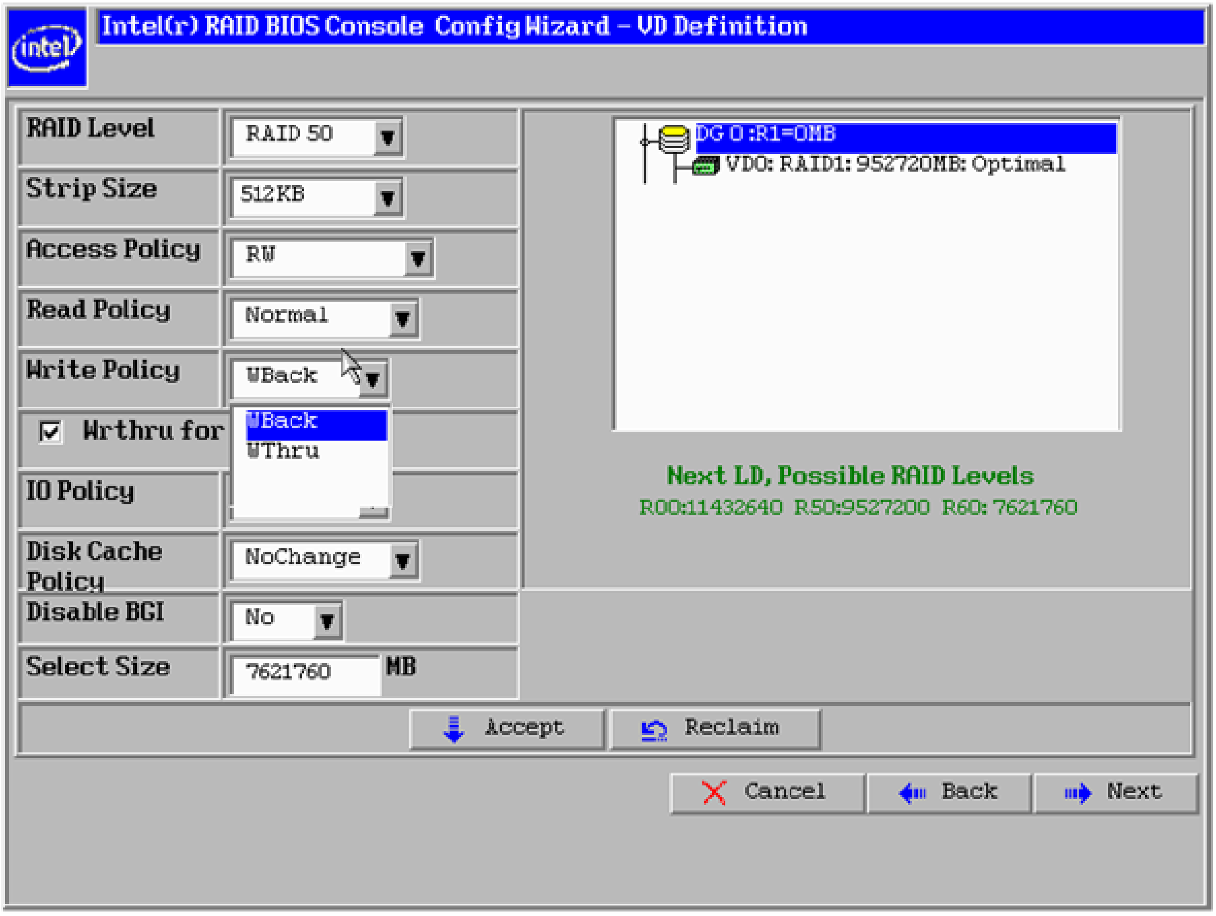


Figure 28. VD Definition Screen – Configuring RAID 50 Write Policy

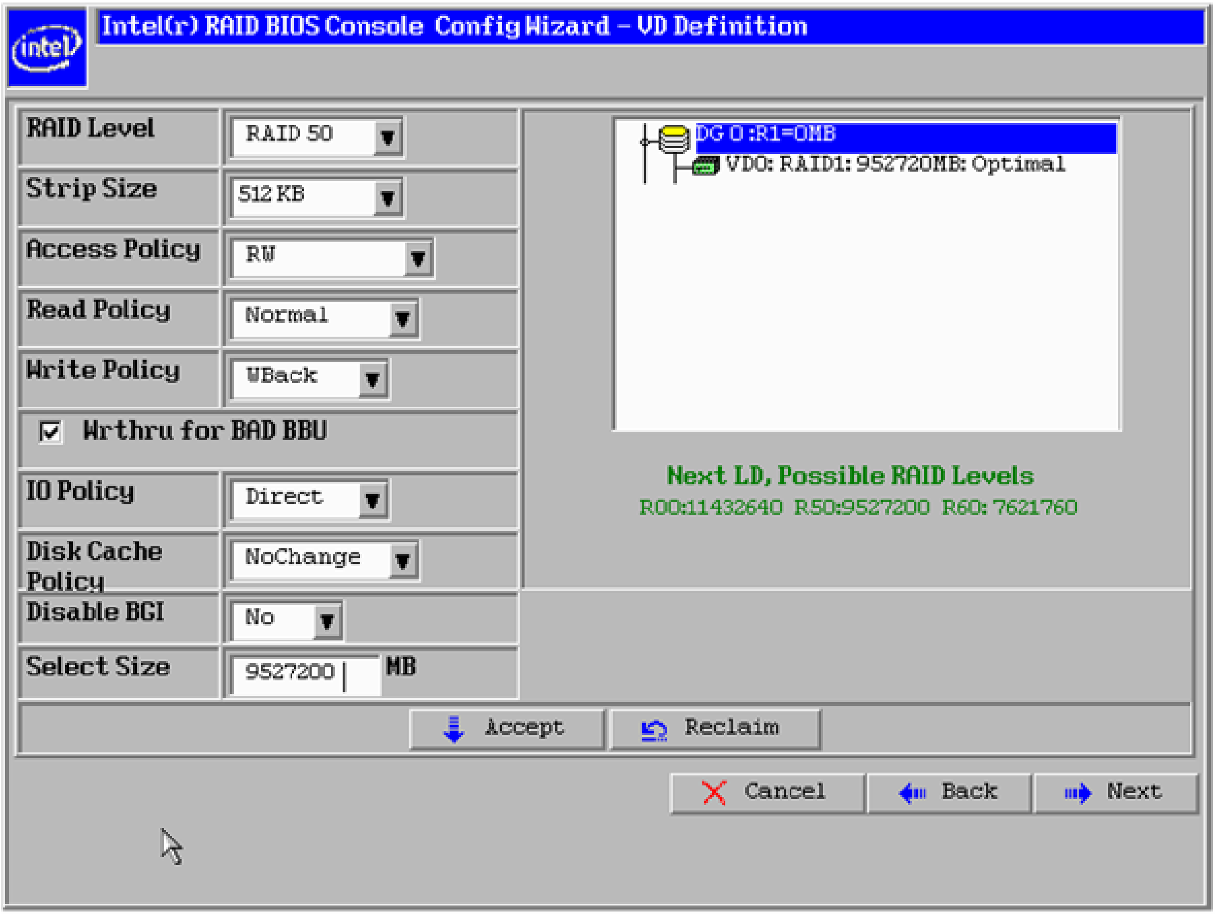


Figure 29. VD Definition Screen – Configuring RAID 50 Size

23. Click Accept to finish a RAID 50 configuration.

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

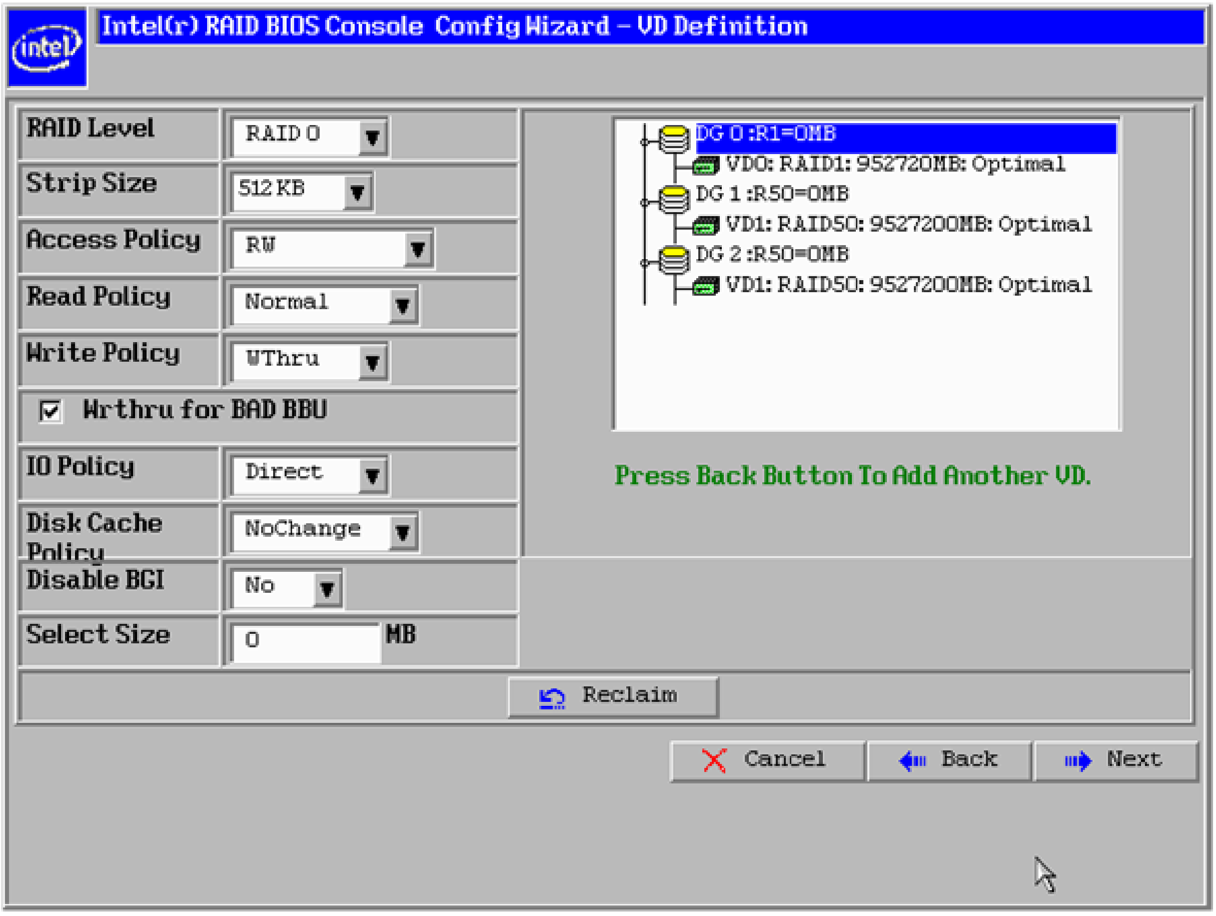


Figure 30. VD Definition Screen – RAID 50 Configured

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

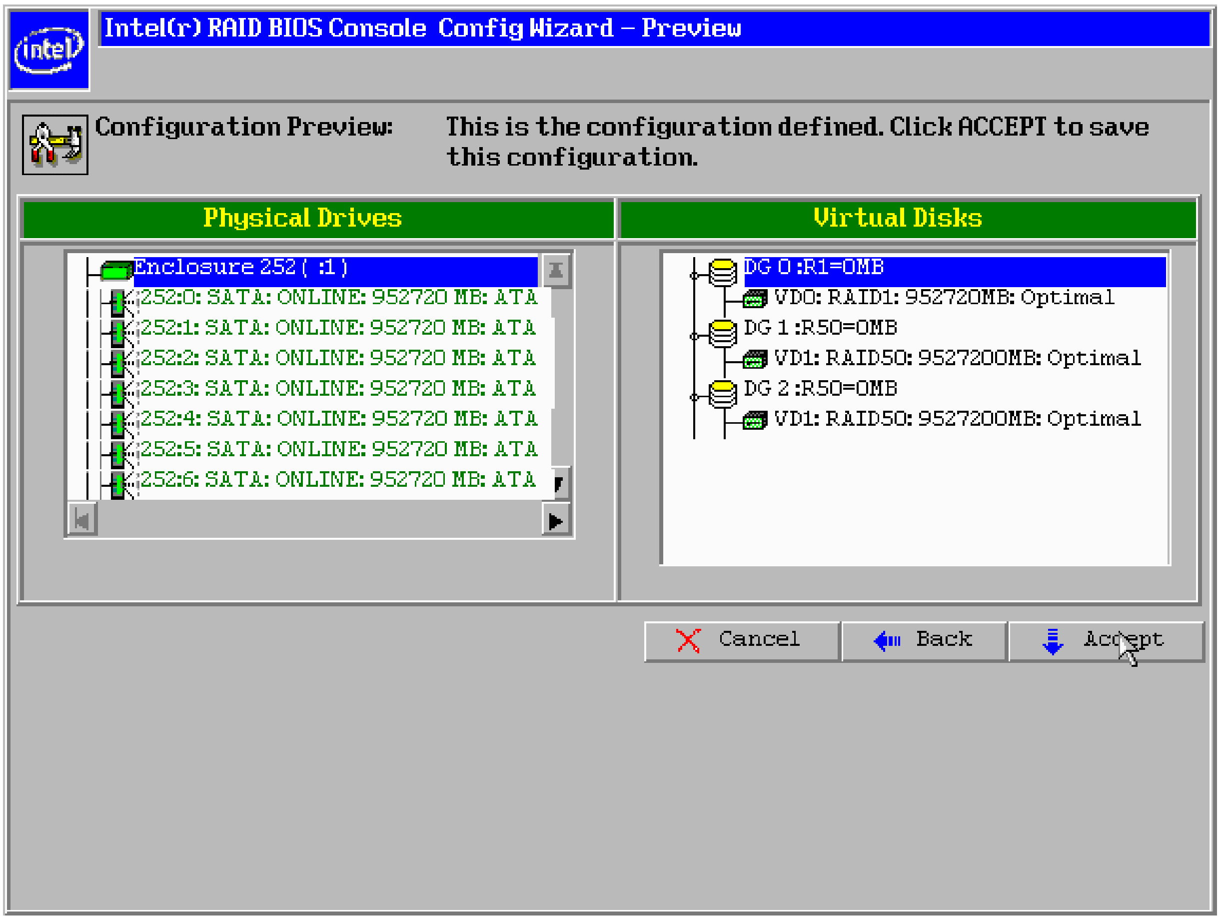


Figure 31. Configuration Wizard Preview Screen

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

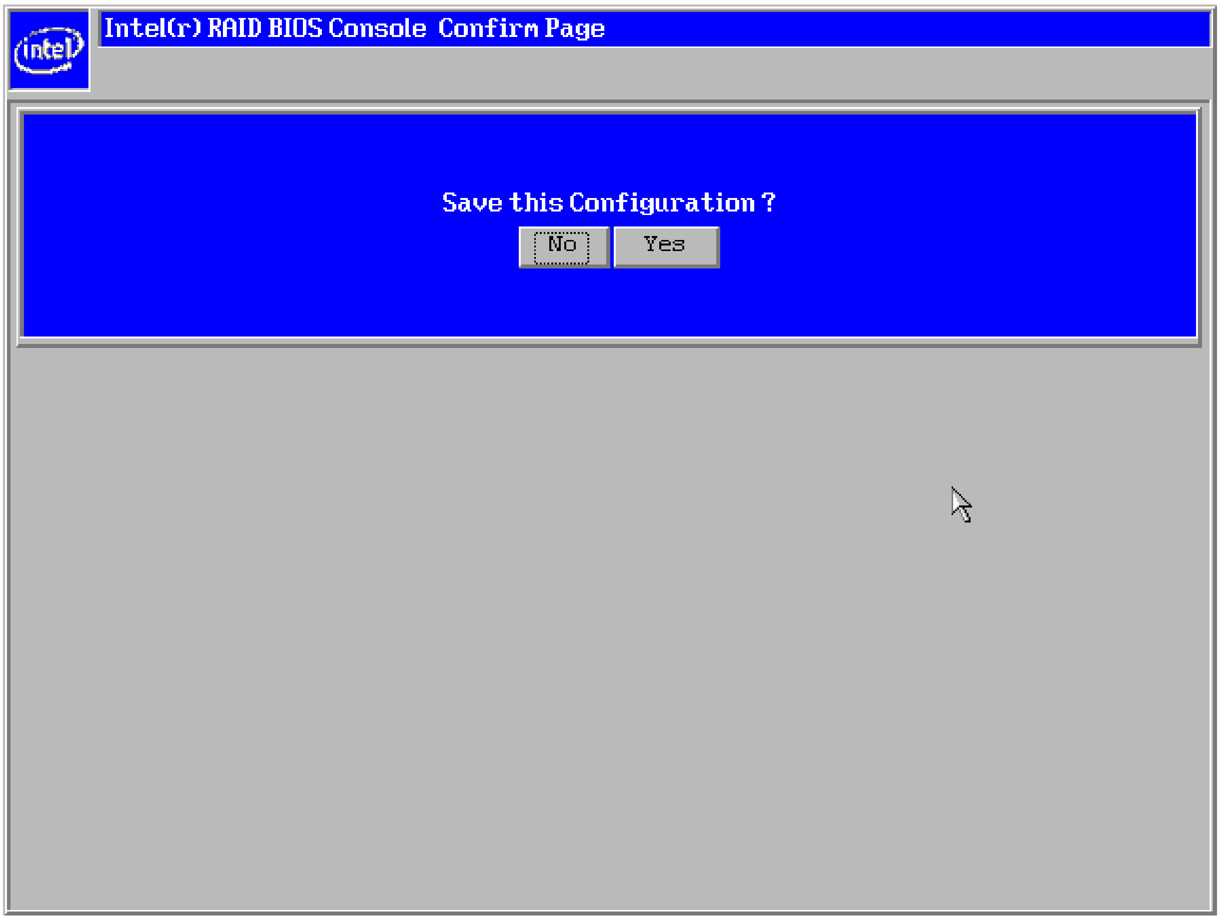


Figure 32. RAID BIOS Console Confirmation Page – Save Configuration

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

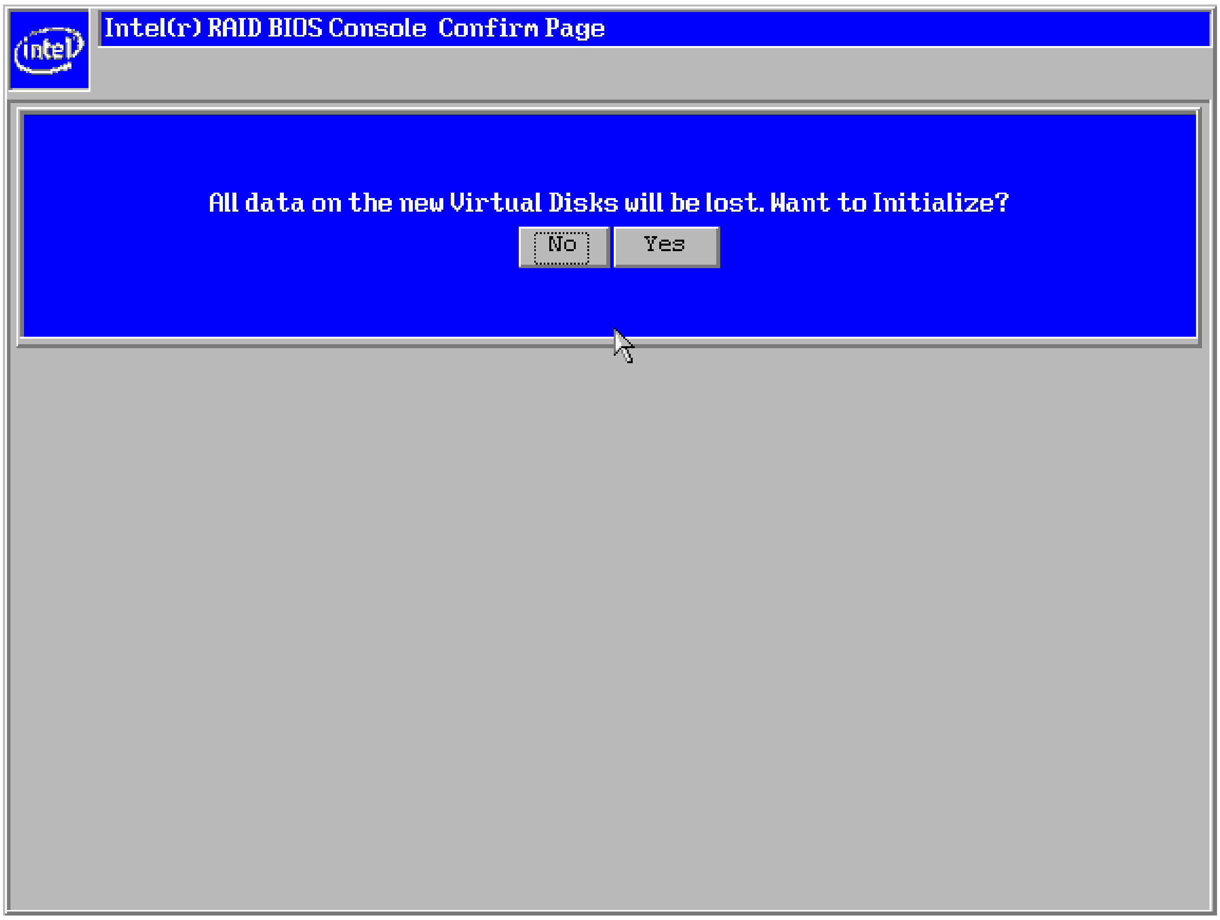


Figure 33. RAID BIOS Console Confirmation Page – Initialization

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

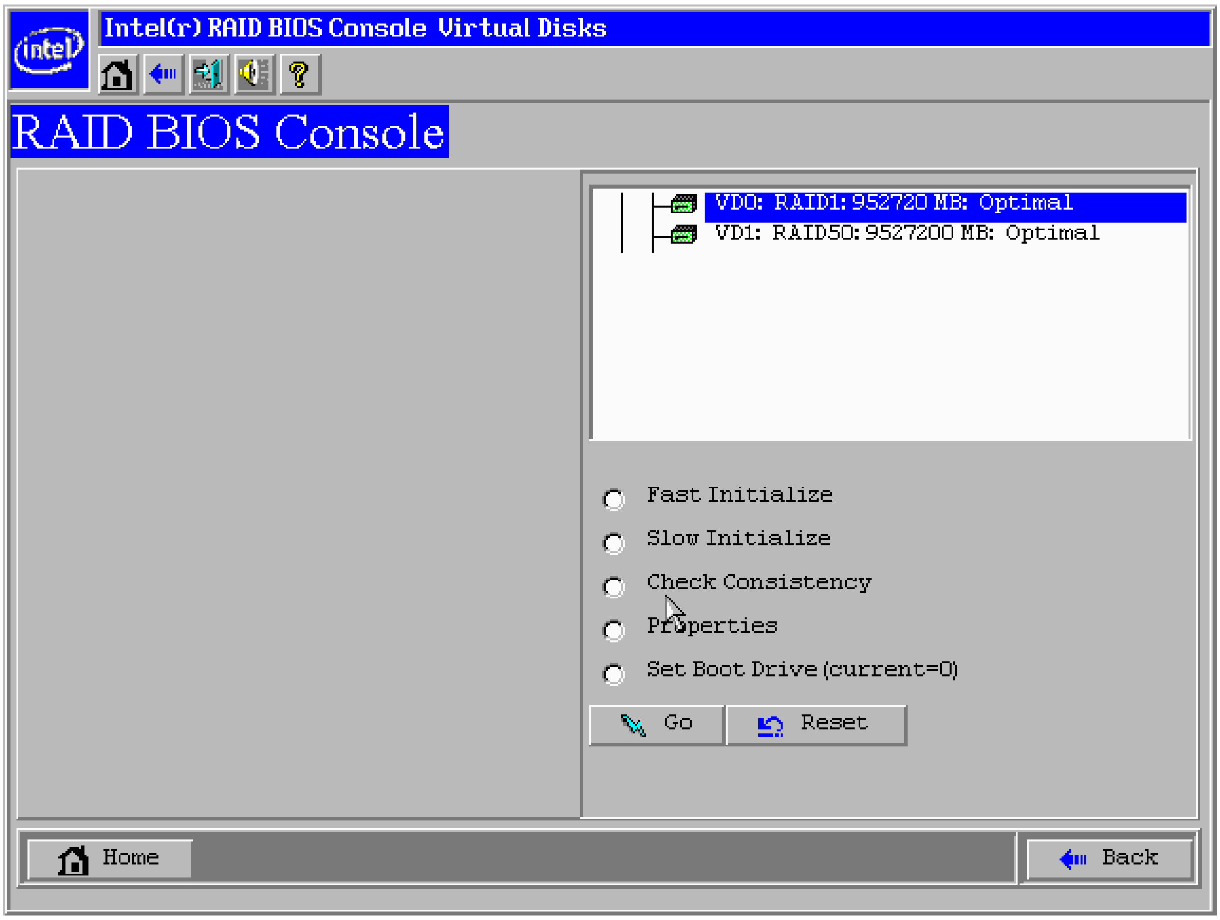


Figure 34. RAID BIOS Console Virtual Disks Screen

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

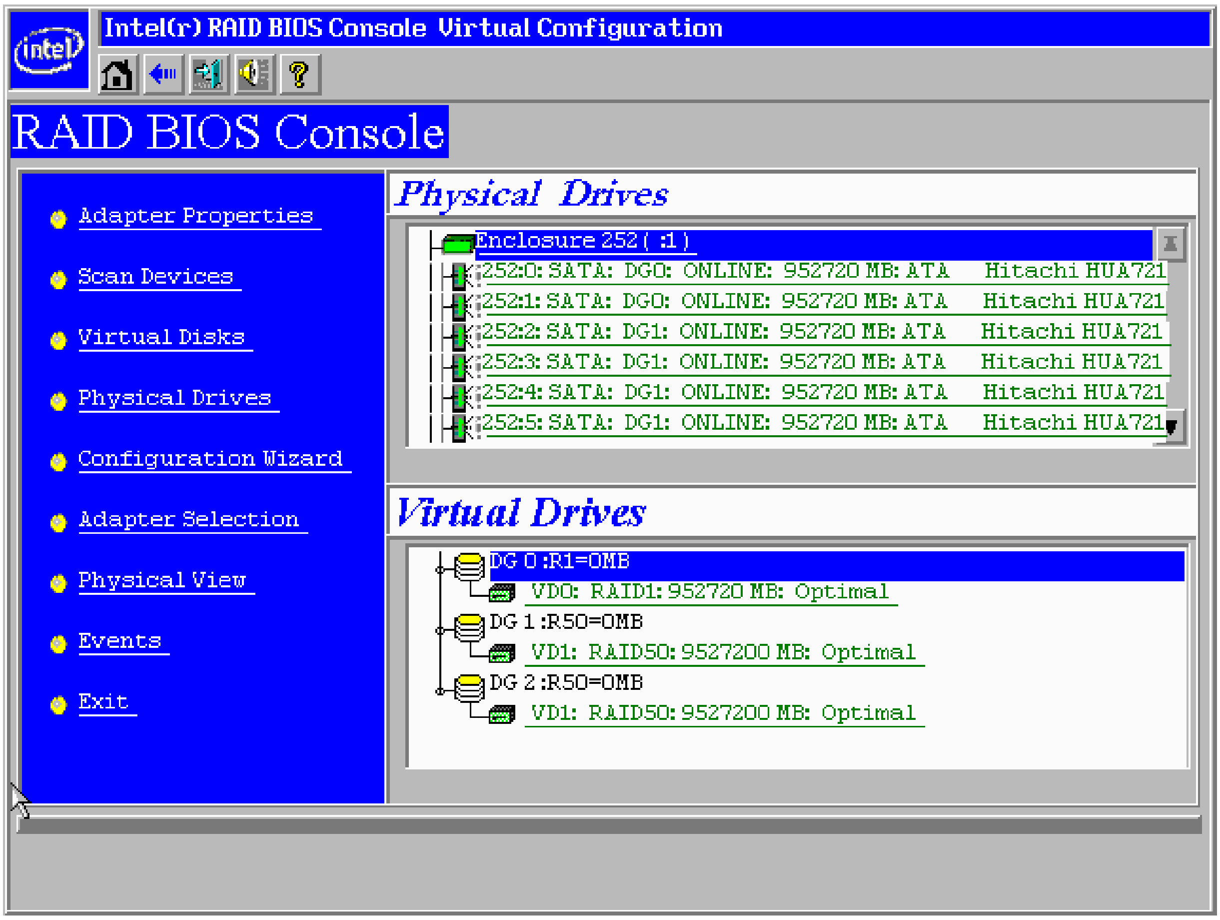


Figure 35. RAID BIOS Console Virtual Configuration Screen

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

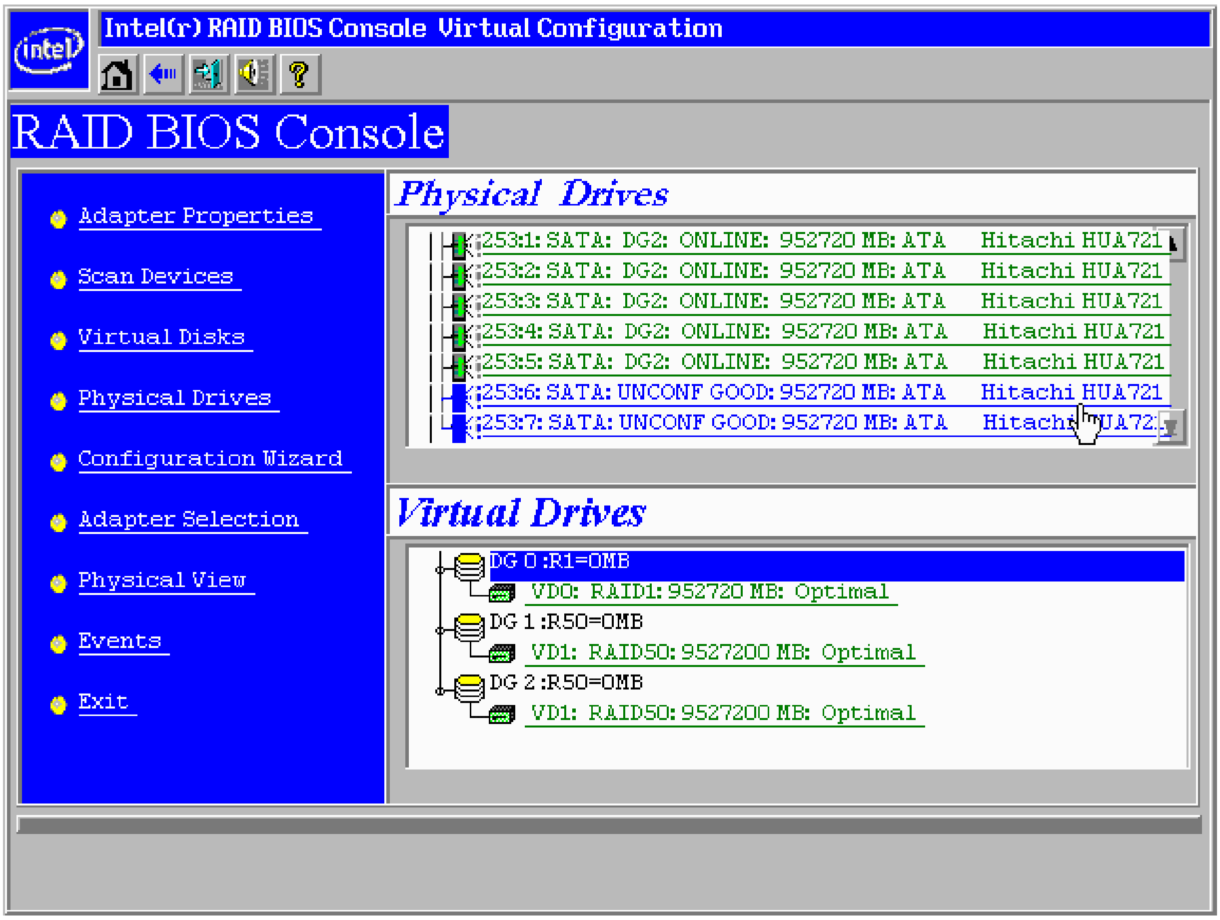


Figure 36. RAID BIOS Console Virtual Configuration Screen – Selecting UNCONF Hard Drives

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

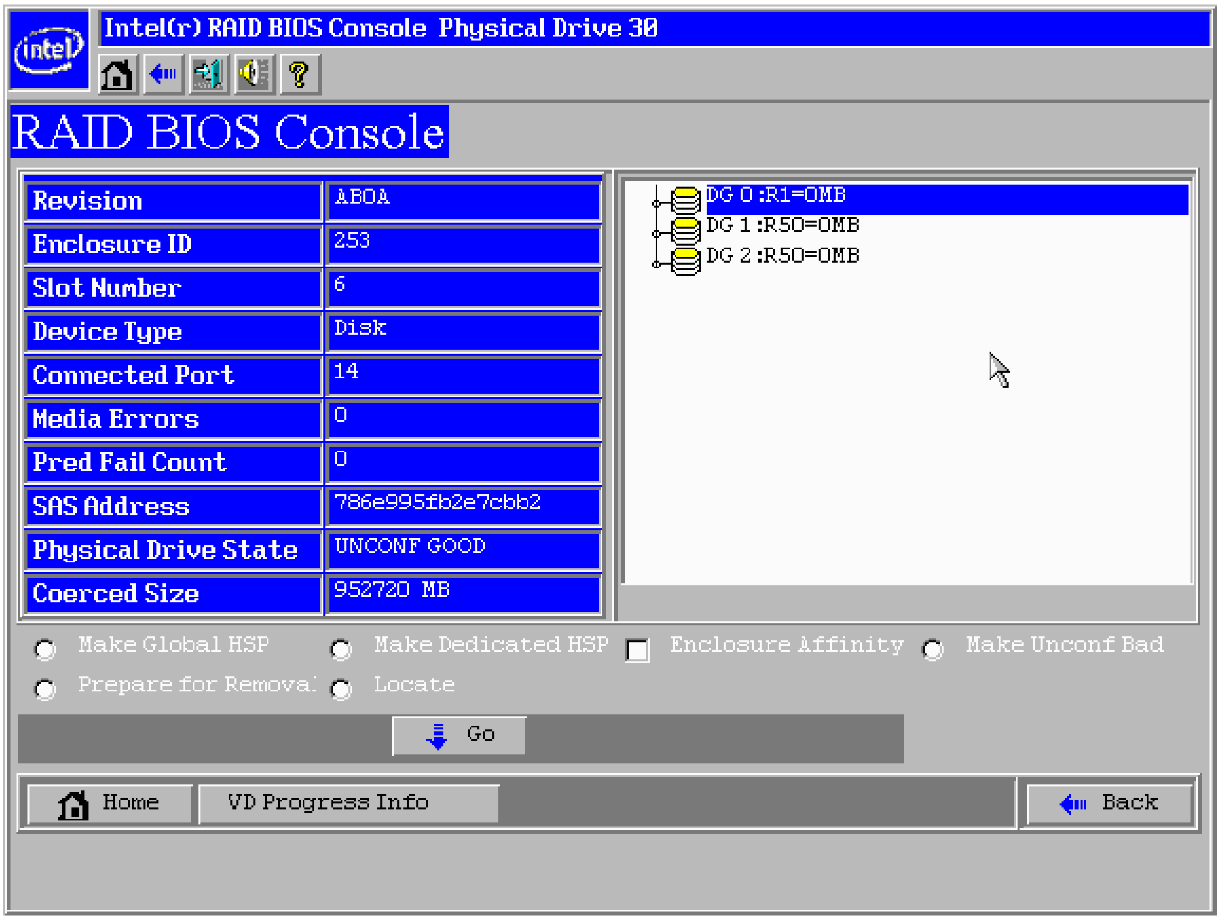


Figure 37. RAID BIOS Console Physical Drive Screen – Making Global HSP

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

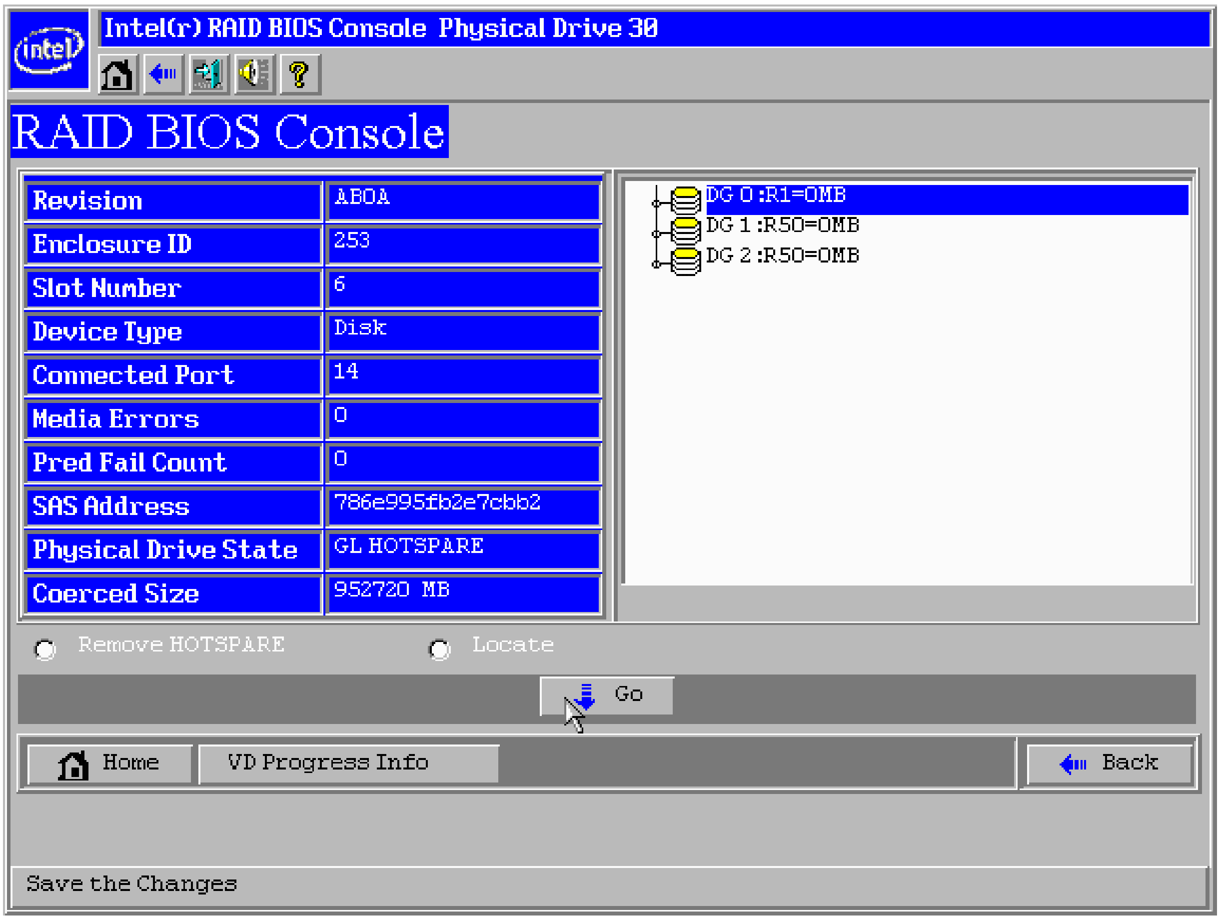


Figure 38. RAID BIOS Console Physical Drive Screen – Global HSP Configured

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® server boards and Intel® RAID controllers in a Chenbro* RM31616 Chassis.