



GUID Partition Table (GPT)

How to install an Operating System (OS) using the GUID Disk Partition Table (GPT) on an Intel® Hardware RAID (HWR) Array under uEFI environment.

Revision 1.0

December, 2009

Enterprise Platforms and Services Division

Revision History

Date	Revision Number	Modifications
<i>December 2009</i>	1.0	Initial release.

Disclaimers

Information in this document is provided in connection with Intel® products. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document. Except as provided in Intel's Terms and Conditions of Sale for such products, Intel assumes no liability whatsoever, and Intel disclaims any express or implied warranty, relating to sale and/or use of Intel products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright or other intellectual property right. Intel products are not intended for use in medical, life saving, or life sustaining applications. Intel may make changes to specifications and product descriptions at any time, without notice.

This document contains information on products in the design phase of development. Do not finalize a design with this information. Revised information will be published when the product is available. Verify with your local sales office that you have the latest datasheet before finalizing a design.

Designers must not rely on the absence or characteristics of any features or instructions marked "reserved" or "undefined." Intel reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them.

The "GUID Partition Table (GPT)" may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are available on request.

Intel, Pentium, Celeron, and Xeon are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.

Copyright © Intel Corporation 2009.

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

Table of Contents

1. Introduction to GUID Partition Table (GPT)	1
1.1 What is a GPT disk?	1
1.2 Why do we need GPT?.....	1
1.3 What's a GPT Disk benefits?	1
1.4 Which OS support GPT?	2
2. Install an OS into GPT Disk on Intel HWR Array	3
2.1 Preparation	3
2.2 RAID and BIOS Configuration	3
2.2.1 Plan A: RAID Configuration by EFI RAID BIOS Console (Recommended).....	3
2.2.2 Plan B: RAID Configuration by RAID BIOS Console	9
2.3 OS Installation	12
3. Look up the GPT Disk Properties	17
4. Backup	18

List of Figures

Figure 1 Boot Options	3
Figure 2 EFI command	4
Figure 3 EFI SAS Driver number	4
Figure 4 EFI SAS controller number	4
Figure 5 EFI SAS controller information	5
Figure 6 Start EFI RAID BIOS Console	5
Figure 7 EFI RAID BIOS Console	5
Figure 8 RAID BIOS Console	6
Figure 9 Configuration Wizard	6
Figure 10 Warning of data lost.....	7
Figure 11 Configuration Method	7
Figure 12 Drive Group Definition	7
Figure 13 Span Definition	8
Figure 14 Virtual Drive Definition	8
Figure 15 Virtual Drives	9
Figure 16 Boot from CD	9
Figure 17 Boot Options	10
Figure 18 Enter RAID BIOS Console.....	10
Figure 19 Controller Selection	11
Figure 20 Boot Options	11
Figure 21 Boot from CD	12
Figure 22 Confirm language, time, etc.....	12
Figure 23 Install Now	13
Figure 24 Selecting OS.....	13
Figure 25 License	14
Figure 26 Select type of installation	14
Figure 27 Load Driver	15
Figure 28 Create Partition.....	15
Figure 29 Starting installation	16
Figure 30 GPT Disk Properties	17
Figure 31 Load Optimized Defaults	18

< This page intentionally left blank. >

1. Introduction to GUID Partition Table (GPT)

1.1 What is a GPT disk?

The GUID Partition Table (GPT) was introduced as a part of the Extensible Firmware Interface (EFI) initiative. GPT provides a more flexible mechanism for partitioning disks than the older Master Boot Record (MBR) partitioning scheme that has been common to PCs.

A partition is a contiguous space of storage on a physical or logical disk that functions as though it were a physically separate disk. Partitions are visible to the system firmware and the installed operating systems. Access to a partition is controlled by the system firmware before the system boots the operating system, and then by the operating system after it starts.

1.2 Why do we need GPT?

MBR Extended Boot Records, the commonly used alternative to GPT, are constrained by supporting only four primary partitions, by temporary schemes such as container partitions, and by allowing volume size less than 2TB only. This inhibits their use in solutions that need more primary partitions or larger volume size.

A superior disk partition format that is well defined and self identifying would address these constraints while also allowing for greater reliability and better useability.

1.3 What's a GPT Disk benefits?

A GPT disk uses the GUID partition table (GPT) disk partitioning system.

GPT disks can grow to a very large size. The number of partitions on a GPT disk is not constrained by temporary schemes such as container partitions as defined by the MBR Extended Boot Record (EBR).

The GPT disk partition format is well defined and fully self-identifying. Data critical to platform operation is located in partitions and not in unpartitioned or "hidden" sectors. GPT disks use primary and backup partition tables for redundancy and CRC32 fields for improved partition data structure integrity. The GPT partition format uses version number and size fields for future expansion.

Each GPT partition has a unique identification GUID and a partition content type, so no coordination is necessary to prevent partition identifier collision. Each GPT partition has a 36-character unicode name, which means that any software can present a human-readable name for the partition without any additional understanding of the partition.

A GPT disk offers these benefits:

- Allows up to 128 primary partitions. (MBR disks can support up to four primary partitions and an infinite number of partitions inside an extended partition.)
- Allows a much larger volume size - greater than 2 TB, which is the limit for MBR disks.

- Provides greater reliability due to replication and cyclical redundancy check (CRC) protection of the partition table.
- Can be used as a storage volume on all x64-based platforms.
- Critical GPT data structures are stored twice on the disk: once at the start and again at the end. This behavior improves the odds of successful recovery in case of damage from an accident or a bad sector.
- Whereas MBR provides a 1-byte partition type code, GPT uses a 16-byte GUID (Globally Unique Identifier) value to identify partition types.

1.4 Which OS support GPT?

OS	Support Version	Boot from GPT on EFI
Windows 2003	Since SP1 64bit only	No
Windows XP	64bit only	Only 64bit
Windows Vista	Both 32 bit and 64bit	Yes
Windows 2008	Both 32 bit and 64bit	Yes
Windows 7	Both 32 bit and 64bit	Yes
Solaris	Since Solaris 10 Both 32 bit and 64 bit	No
FreeBSD	Since 7.0 Both 32 bit and 64 bit	Yes
Mac OS X	Since 10.4.0 (some features Since 10.4.6) Both 32 bit and 64 bit	Yes
Linux	Most of the Linux OS Both 32 bit and 64 bit	Yes

2. Install an OS into GPT Disk on Intel HWR Array

This document provides a step by step guide to install an OS into GPT Disk on Intel® Hardware RAID, under uEFI environment. The BIOS Setup Configuration is done on an Intel® Server Board as an example. The OS installation is done with Microsoft Windows 2008* as an example.

2.1 Preparation

Setup system with Intel® Server Board and Intel® Hardware RAID and 4 x 1TB HDDs.

NOTE: Currently only hardware RAID supports GPT partition.

2.2 RAID and BIOS Configuration

The hardware RAID can be configured by both RAID BIOS Console and EFI RAID BIOS Console. The **Plan A** is for EFI RAID BIOS Console. The **Plan B** is for RAID BIOS Console.

2.2.1 Plan A: RAID Configuration by EFI RAID BIOS Console (Recommended)

1. Press **F2** when system POST and enter system BIOS.

Switch to **Boot Options** tab, enable “**EFI Optimized Boot**” and “Use **Legacy Video for EFI OS**”.

NOTE: When EFI Optimized Boot is enabled, the <Ctrl> + <G> prompt does not come up during POST.

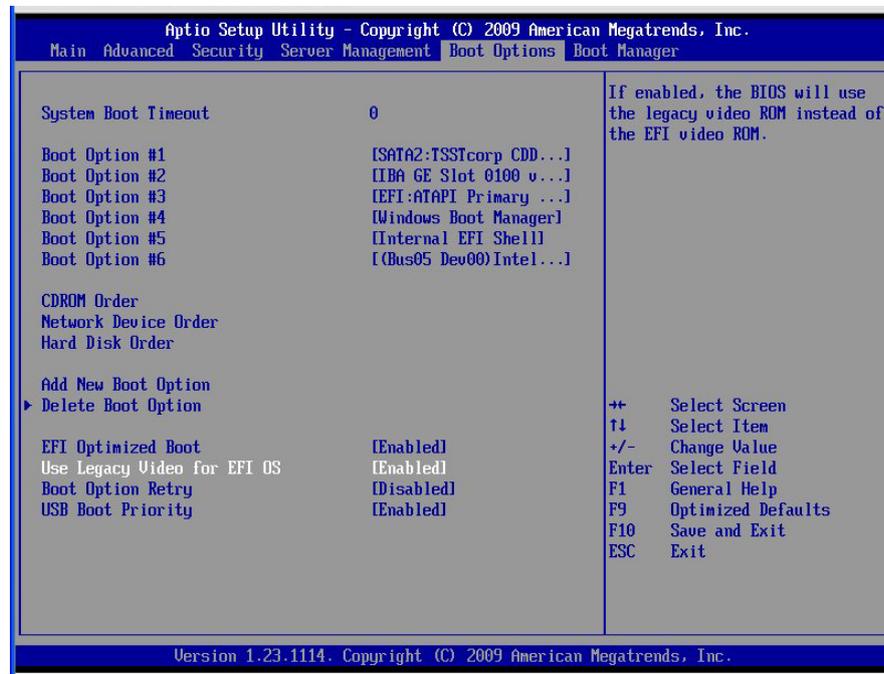


Figure 1 Boot Options

2. Reboot into EFI shell.
3. Type “**drivers**” to find out EFI SAS Driver number.

```
Shell> drivers_
```

Figure 2 EFI command

```
BA 0000000A ? - - - Serial Terminal Driver Terminal
BB 00000010 ? - - - UGA Class Driver UgaClass
BE 0000000A ? - - - Generic PCI 1394 GUID Driver Pci1394
BF 0000000A B - - 1 3 ISA Bus Driver IsaBus
C0 0000000A B - - 2 2 ISA Serial Driver IsaSerial
C1 00000001 ? - - - PilotII and National (R) PC8374 SIO PilotIIPc8374
C2 0000000A B - - 1 46 PCI Bus Driver PciBus
DF 03070700 B X X 2 2 Intel(R) PRO/1000 3.7.07 PCI-E OnboardNicEfi
10E 00000087 D - - 8 - AMI USB2.0 Driver AMIUSB
110 00000087 B - - 8 6 USB bus AMIUSB
111 00000001 D - - 2 - USB Keyboard driver AMIUSB
112 00000001 D - - 1 - USB Mouse driver AMIUSB
113 00000001 D - - 1 - USB Mass Storage driver AMIUSB
137 03050000 B X X 1 2 LSI EFI SAS Driver Acpi (PNP0A03,0)/Pc
```

Figure 3 EFI SAS Driver number

This SAS driver number is 137. The number 137 could be different, depending on the result of the EFI SAS driver number checking.

4. Type “**dh -d <SAS Driver number >**” to find out SAS controller number

```
Shell> dh -d 137
137: Image (Acpi (PNP0A03,0)/Pci (910)/Pci (010)/MemMap (11:0-77FF)) DriverBinding C
ComponentName Configuration Diagnostics
Driver Name : LSI EFI SAS Driver
Image Name : Acpi (PNP0A03,0)/Pci (910)/Pci (010)/MemMap (11:0-77FF)
Driver Version : 03050000
Driver Type : BUS
Configuration : YES
Diagnostics : YES
Managing :
Ctrl[136] : LSI MegaRaid SAS Controller
Child[16A] : Logical Channel
Child[16C] : Physical Channel
```

Figure 4 EFI SAS controller number

This SAS controller number is 136. The number 136 could be different, depending on result of the EFI SAS controller number checking.

5. You can type “**dh -d <SAS Controller number >**” to look up information of the controller.

```
Shell> dh -d 136
136: PciIo BusSpecificDriverOverride DevPath (.PNP0A03,0)/Pci(910)/Pci(010)
Controller Name : LSI MegaRaid SAS Controller
Device Path : Acpi(PNP0A03,0)/Pci(910)/Pci(010)
Controller Type : BUS
Configuration : YES
Diagnostics : YES
Managed by :
  Drv[137] : LSI EFI SAS Driver
Parent Controllers :
  Parent[54] : Acpi(PNP0A03,0)
Child Controllers :
  Child[16A] : Logical Channel
  Child[16C] : Physical Channel
```

Figure 5 EFI SAS controller information

6. And then you can type “`drvcfg -s <SAS Driver number > < SAS Controller number >`” to start EFI RAID BIOS Console.

```
Shell> drvcfg -s 137 136_
```

Figure 6 Start EFI RAID BIOS Console

The Controller Selection screen displays.

7. Select a controller and click **Start** to begin the configuration.

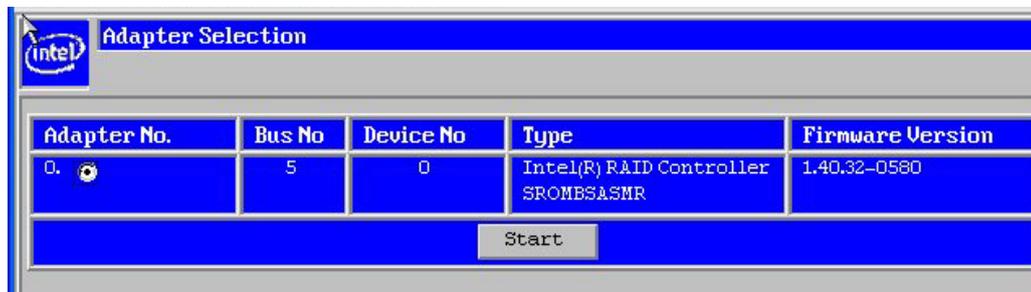


Figure 7 EFI RAID BIOS Console

8. Select **Configuration Wizard**.

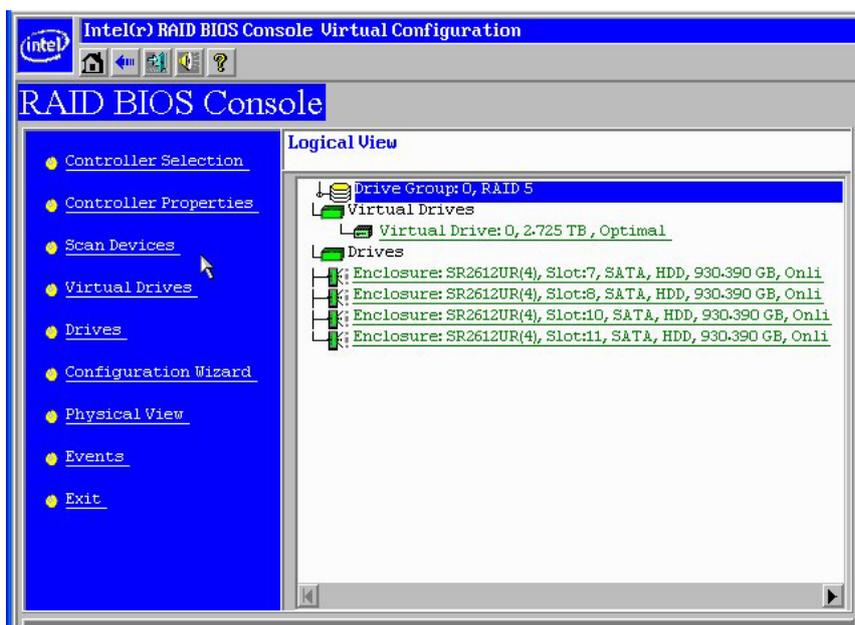


Figure 8 RAID BIOS Console

9. Choose **New Configuration** and click **Next**.

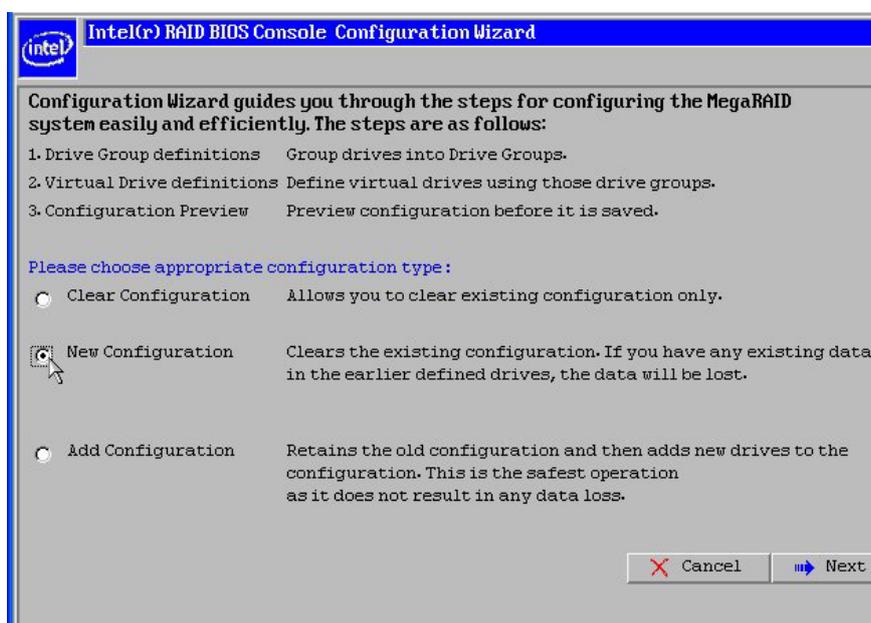


Figure 9 Configuration Wizard

10. Click **Yes** when the screen displays:
 "This is a Destructive Operation!
 Original configuration and data will be lost
 Select Yes, if desired so."



Figure 10 Warning of data lost

11. Choose **Manual Configuration** and click **Next**.

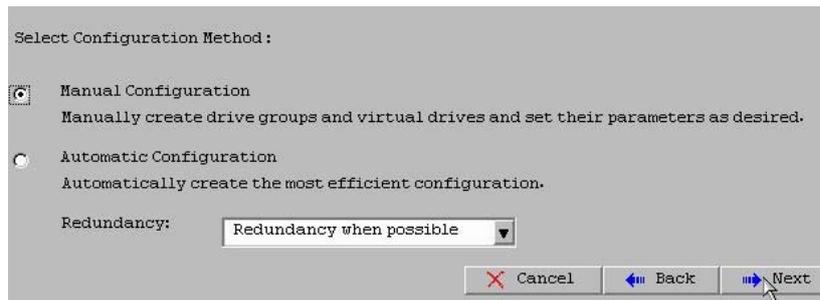


Figure 11 Configuration Method

12. Hold down the **<Ctrl>** key and **click each drive** you want to include in the array or the Drive Groups. Click **Add To Array**. If you make a mistake and need to remove drives, click **Reclaim**. And then click **Next**.

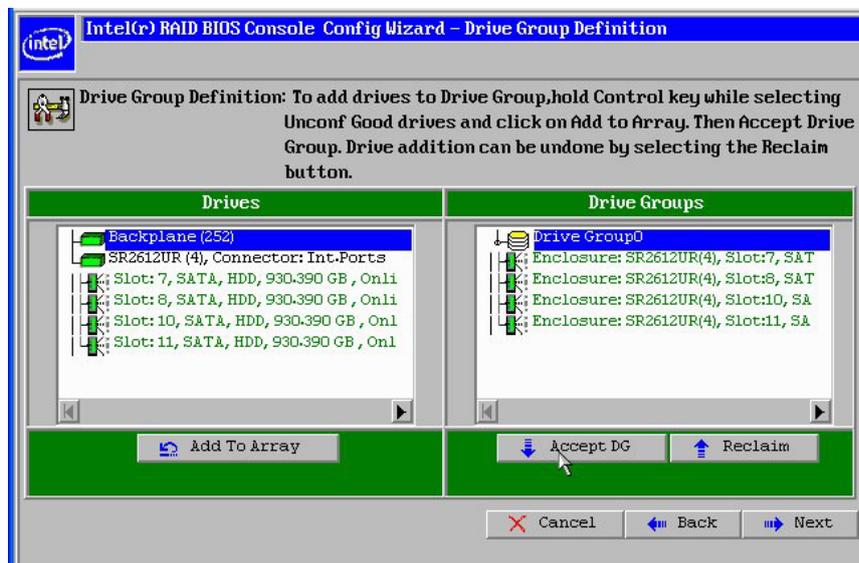


Figure 12 Drive Group Definition

13. Click **Add to Span** and then click **Next**.



Figure 13 Span Definition

14. On the Virtual Drive Definition window, select **RAID 5** from the first drop-down box. Change the size to **2.725 TB**. Then click **Next**.

NOTE: There is a prompt in green that shows the max size of each RAID Level.

If needed, change the stripe size, the policies for Access, Read, Write, IO, and Disk Cache and decide whether to use background initialization.

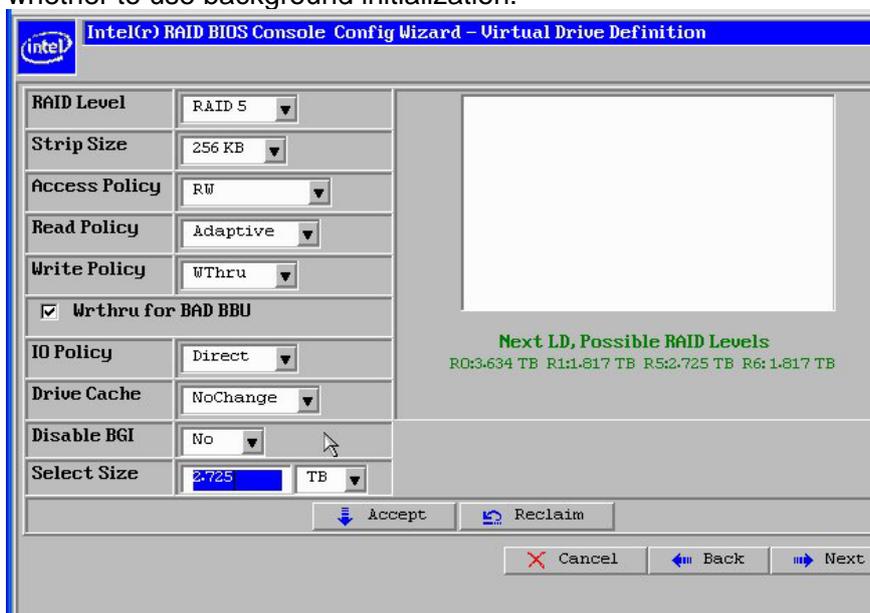


Figure 14 Virtual Drive Definition

15. Click **Accept** to accept the changes, or click **Reclaim** to delete the changes and return to the previous settings.
16. Click **Yes** to save the configuration, or click **NO** to return to the previous screens and change the configuration.

17. Click **Yes** to initialize the new drive.

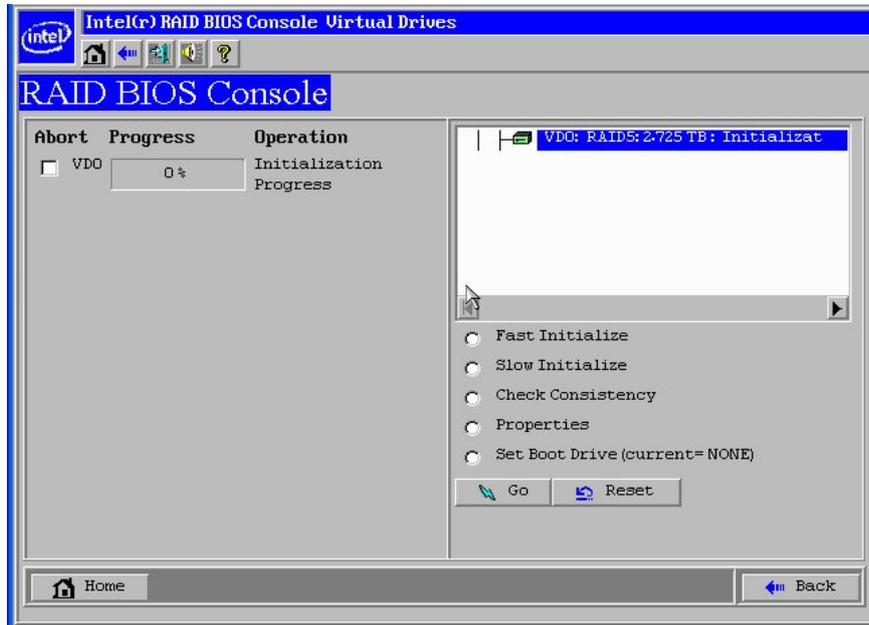


Figure 15 Virtual Drives

18. Click **Home** and then Click **Exit** to exit RAID BIOS Console.

19. Insert OS installation CD into CD-ROM.

20. Reboot into EFI shell.

21. Launch the installer under EFI. (\EFI\BOOT\BOOTX64.EFI)

NOTE: Here device fs0 is the OS installation CD.



Figure 16 Boot from CD

22. Press any key to boot from CD.

2.2.2 Plan B: RAID Configuration by RAID BIOS Console

1. Press **F2** when system POST and enter system BIOS

Switch to **Boot Options** tab, disable “**EFI Optimized Boot**” and “**Use Legacy Video for EFI OS**”.

Adapter No.	Bus No	Device No	Type	Firmware Version
0. 	5	0	Intel(R) RAID Controller SR0MBSASMR	1.40.32-0580
<input type="button" value="Start"/>				

Figure 19 Controller Selection

4. After that, follow the procedure of **Plan A** (start with step 7 and end with step 17) to finish RAID configuration.
5. Press **F2** when system POST and enter system BIOS
Switch to **Boot Options** tab, enable “**EFI Optimized Boot**” and “**Use Legacy Video for EFI OS**”.

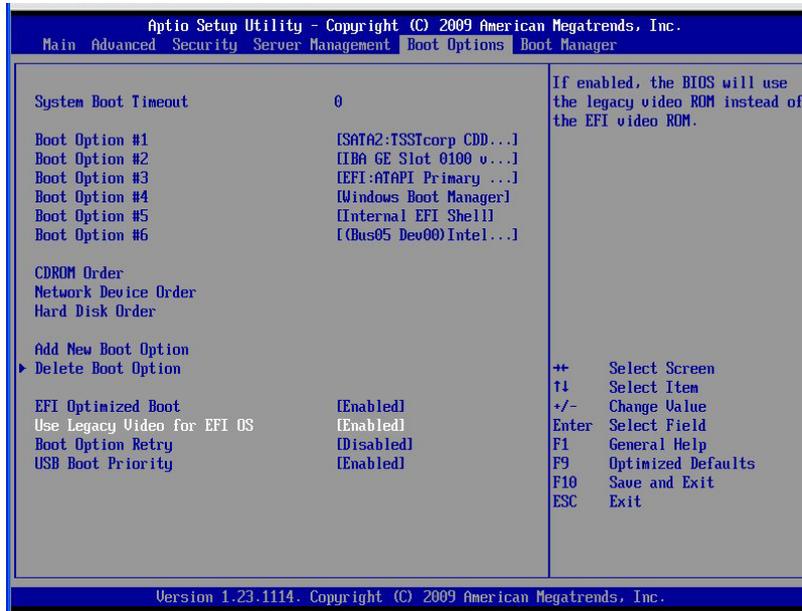


Figure 20 Boot Options

6. Insert OS installation CD into CD-ROM and reboot into EFI shell.
7. Launch the installer under EFI. (\EFI\BOOT\BOOTX64.EFI)

```
fs0:\EFI\BOOT> ls
Directory of: fs0:\EFI\BOOT

04/10/09 02:53p <DIR>          512 .
04/10/09 02:53p <DIR>          512 ..
04/10/09 09:53p                346,624 BOOTX64.EFI
          1 File(s)        346,624 bytes
          2 Dir(s)

fs0:\EFI\BOOT> BOOTX64.EFI_
```

Figure 21 Boot from CD

8. Press any key to boot from CD.

2.3 OS Installation

1. Click **Next** to confirm language, time, and so on.

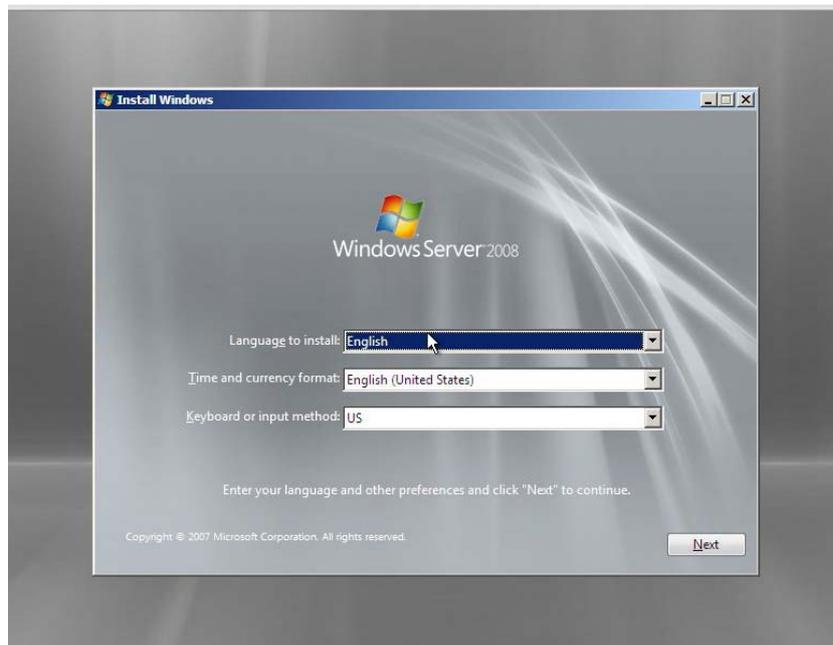


Figure 22 Confirm language, time, etc

2. Click **Install Now**.



Figure 23 Install Now

3. Select **standard installation** and click **Next**.

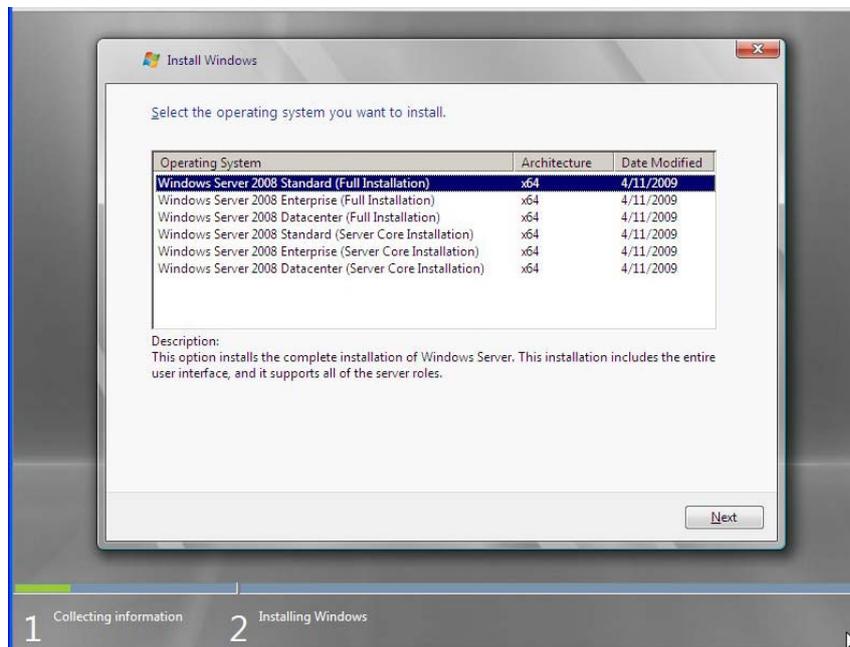


Figure 24 Selecting OS

4. Enable check-box to accept license and click **Next**.

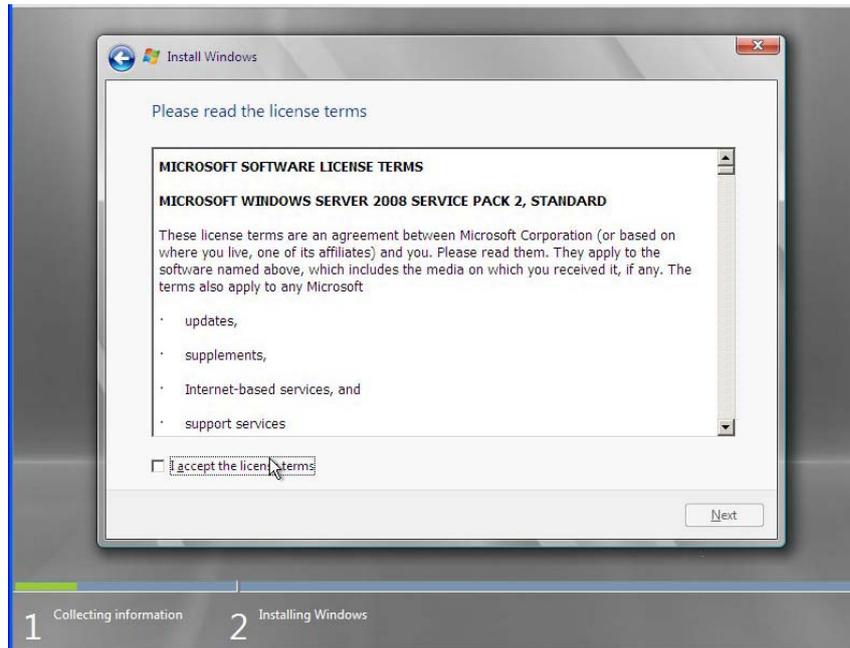


Figure 25 License

5. Select **Custom installation.**

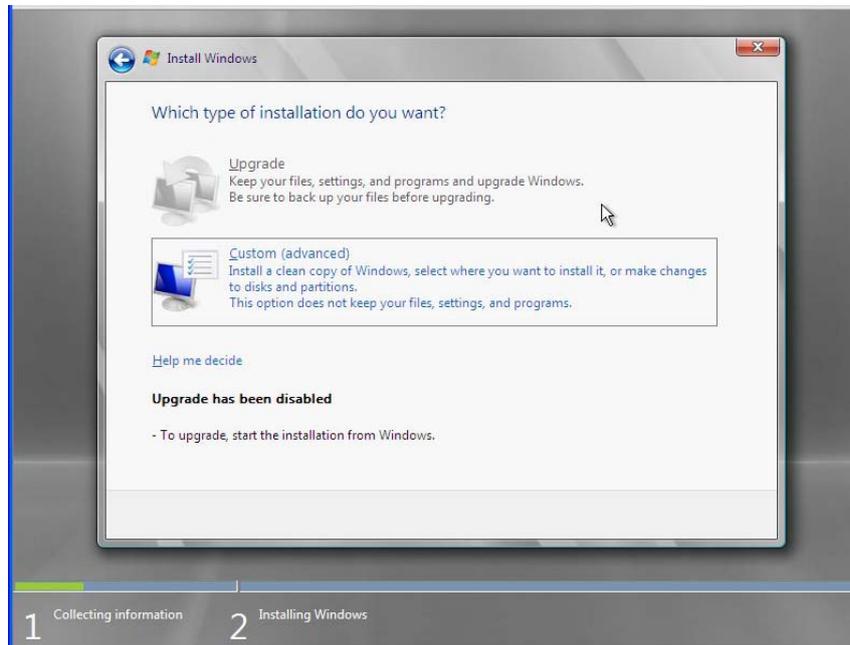


Figure 26 Select type of installation

6. Load Driver of Intel® Hardware RAID.

Install an OS into GPT Disk on Intel® HWR Array

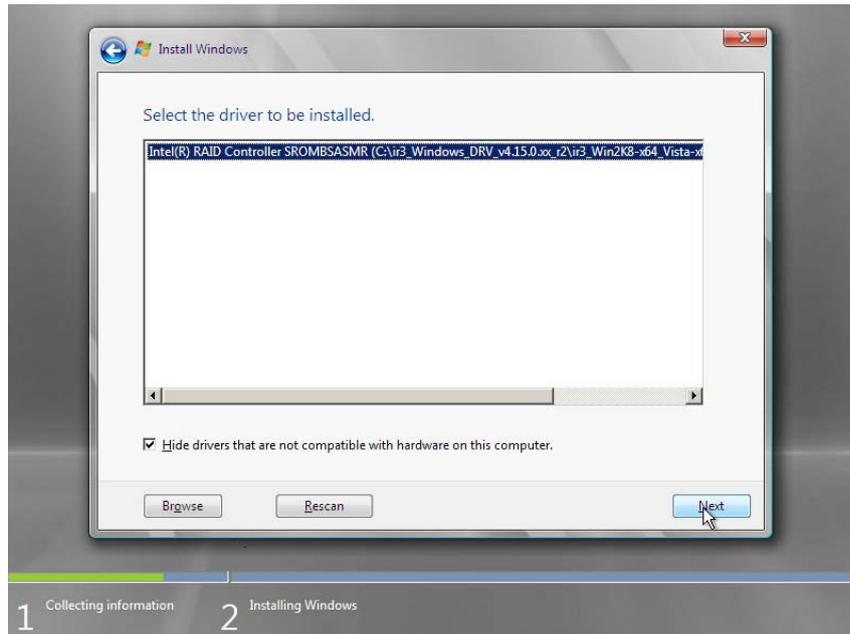


Figure 27 Load Driver

7. Setup a new partition larger than 2 TB.

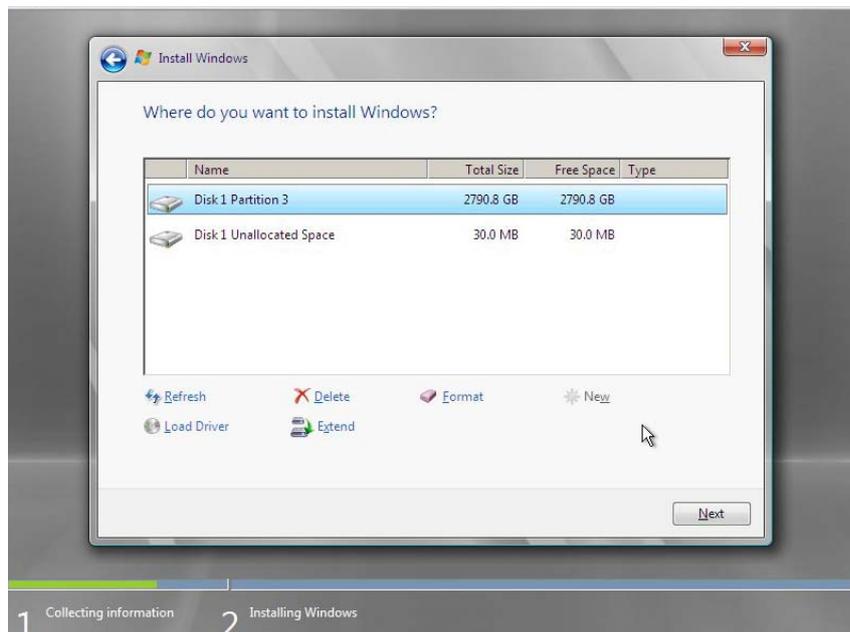


Figure 28 Create Partition

8. Click **Next** to start installation.

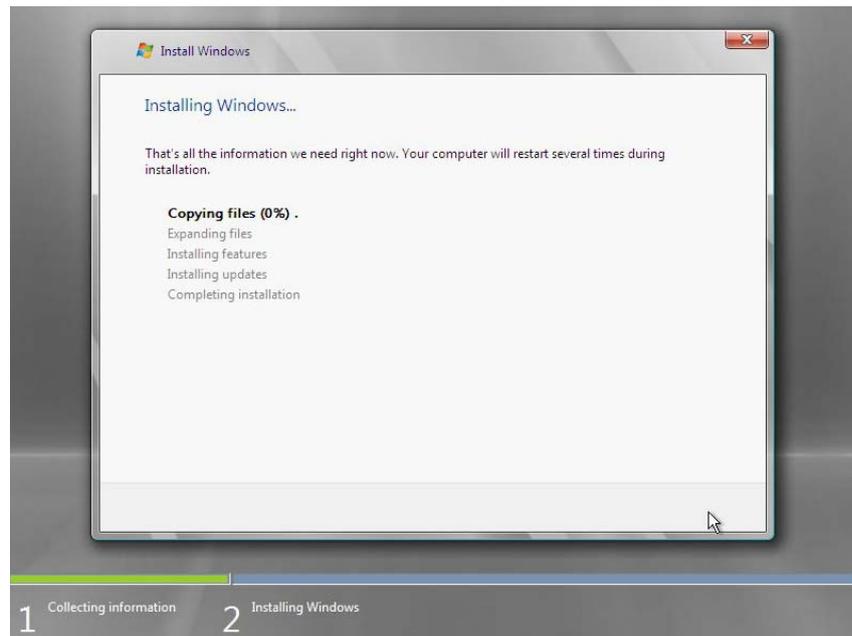


Figure 29 Starting installation

9. Installation completes.

3. Look up the GPT Disk Properties

You can go to **Disk Management** > Right click on **Boot Volume** > **Property** > **Hardware** tab > Double click on the disk > **Volumes** tab > Click **Populate**
It displays GPT with capacity 28***** MB. (Reserved space = 200 MB)

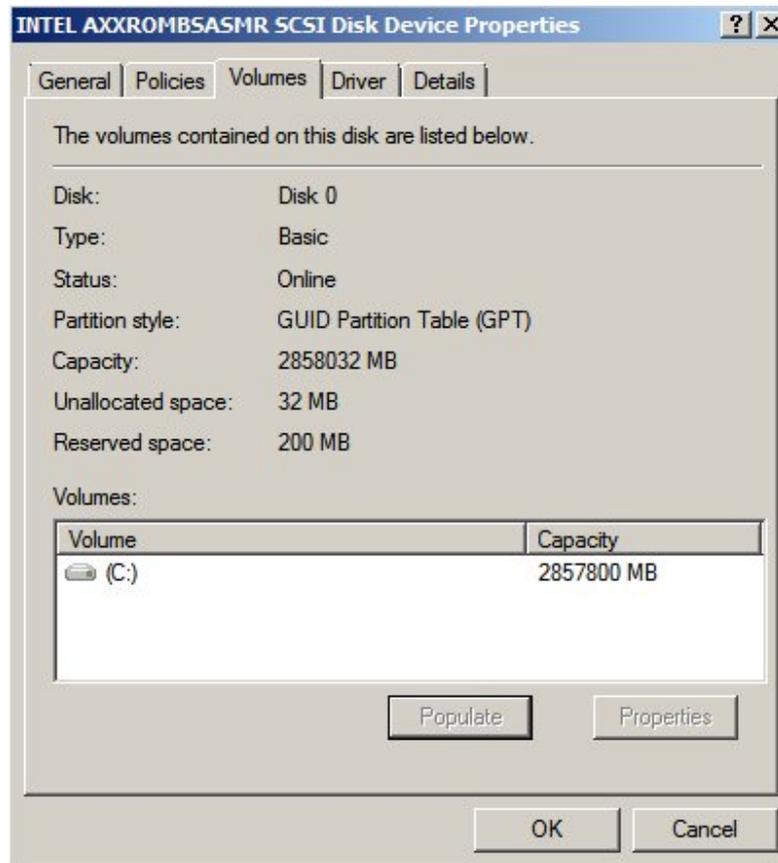


Figure 30 GPT Disk Properties

NOTE: Disable "EFI Optimized Boot" and "Use Legacy Video for EFI OS" in BIOS configuration after installation will cause the OS fail to boot up.

4. Backup

If you cannot install successfully with the above steps, you can try the following steps before RAID and BIOS configuration. These steps will change your entire BIOS configuration to the default configuration.

1. Press **F2** when system POST to enter system BIOS
2. Press **F9** or switch to **Exit** tab and select **Load Default Values**.
3. Click **Yes** when the screen displays:
“Load Optimized Defaults?”

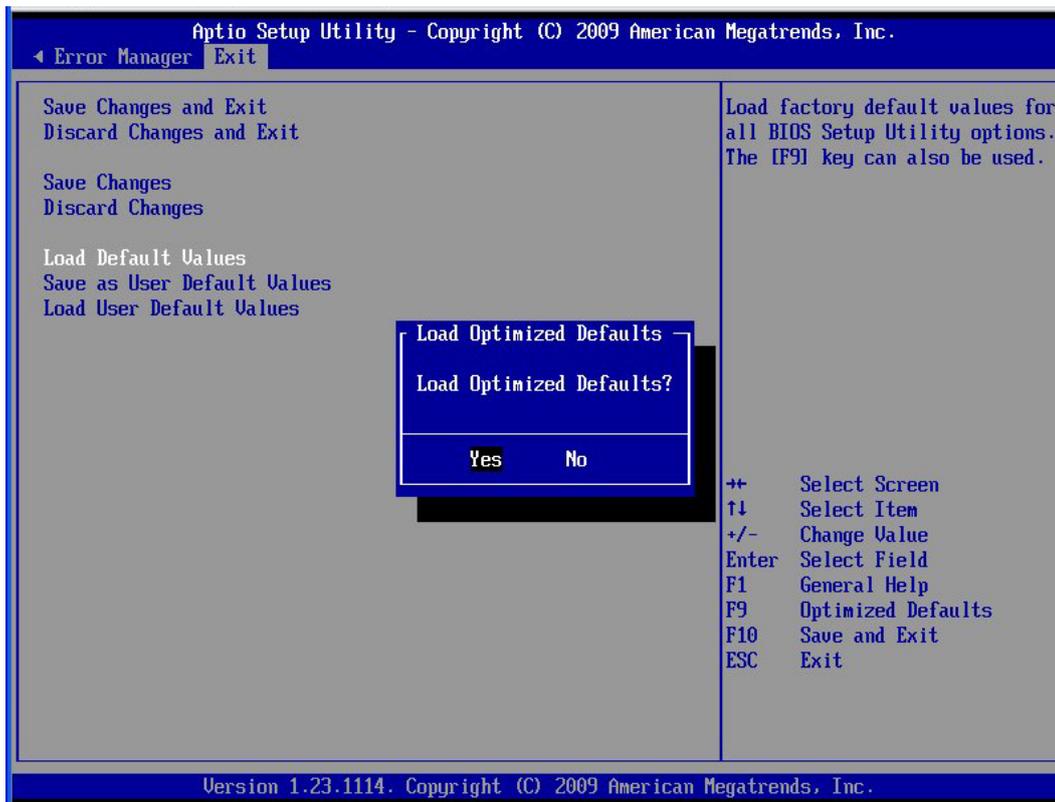


Figure 31 Load Optimized Defaults

4. Press **F10** to save and exit.
Click **Yes** when the screen displays: “Save Configuration and Reset?”