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**

<table>
<thead>
<tr>
<th>Date</th>
<th>Revision Number</th>
<th>Modifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>December 2009</td>
<td>1.0</td>
<td>Initial release.</td>
</tr>
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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?

<table>
<thead>
<tr>
<th>OS</th>
<th>Support Version</th>
<th>Boot from GPT on EFI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows 2003</td>
<td>Since SP1</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>64bit only</td>
<td></td>
</tr>
<tr>
<td>Windows XP</td>
<td>64bit only</td>
<td>Only 64bit</td>
</tr>
<tr>
<td>Windows Vista</td>
<td>Both 32 bit and 64bit</td>
<td>Yes</td>
</tr>
<tr>
<td>Windows 2008</td>
<td>Both 32 bit and 64bit</td>
<td>Yes</td>
</tr>
<tr>
<td>Windows 7</td>
<td>Both 32 bit and 64bit</td>
<td>Yes</td>
</tr>
<tr>
<td>Solaris</td>
<td>Since Solaris 10</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Both 32 bit and 64 bit</td>
<td></td>
</tr>
<tr>
<td>FreeBSD</td>
<td>Since 7.0</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Both 32 bit and 64 bit</td>
<td></td>
</tr>
<tr>
<td>Mac OS X</td>
<td>Since 10.4.0 (some features Since 10.4.6)</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Both 32 bit and 64 bit</td>
<td></td>
</tr>
<tr>
<td>Linux</td>
<td>Most of the Linux OS</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Both 32 bit and 64 bit</td>
<td></td>
</tr>
</tbody>
</table>
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.
2. Reboot into EFI shell.
3. Type “drivers” to find out EFI SAS Driver number.

![Figure 2 EFI command](image)

```
Shell> drivers
```

![Figure 3 EFI SAS Driver number](image)

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

![Figure 4 EFI SAS controller number](image)

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

7. Select a controller and click **Start** to begin the configuration.
9. Choose **New Configuration** and click **Next**.

10. Click **Yes** when the screen displays:
   “This is a Destructive Operation!
   Original configuration and data will be lost
   Select Yes, if desired so.”
Install an OS into GPT Disk on Intel® HWR Array


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.

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

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](image)

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](image)

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”.

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Install an OS into GPT Disk on Intel® HWR Array

2. Reboot and press <Ctrl> + <G> to enter RAID BIOS Console when the screen displays: “Press <Ctrl><G> to enter the RAID BIOS Console”

3. The Controller Selection screen displays. Select a controller and click Start to begin the configuration.
Install an OS into GPT Disk on Intel® HWR Array

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”.

6. Insert OS installation CD into CD-ROM and reboot into EFI shell.

7. Launch the installer under EFI. (\EFI\BOOT\BOOTX64.EFI)
Install an OS into GPT Disk on Intel® HWR Array

8. Press any key to boot from CD.

2.3 OS Installation

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

2. Click Install Now.
3. Select **standard installation** and click **Next**.

4. Enable check-box to accept license and click **Next**.
5. Select **Custom installation**.

6. **Load Driver** of Intel® Hardware RAID.
7. Setup a new partition larger than 2 TB.

8. Click **Next** to start installation.
9. Installation completes.

Figure 29 Starting installation
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)

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?”

![Load Optimized Defaults](image)

Figure 31 Load Optimized Defaults

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