# GPT Partitions

# MBR and GPT*

We've now discussed basic **M**aster **B**oot **R**ecord (**MBR**) booting and **B**asic **MBR** partitions

- *This booting & partition schema that has been very widely used since the early 1970s (half a century)*
- *Companion software called BIOS*
  - Basic Input/Output System
- *BMBR had limitations that had mostly been overcome*

About the year 2000 another schema was proposed

- *Overcame the BMBR limitations*
- ***G**lobally **U**nique **ID**entifier **P**artition **T**able*
  - **GUID P**artition **T**able, **GPT**

# GPT Partitions
## *GUID Partition Table*

**GPT**: A newer partition schema, began in ~2000

First used with ia64 & x86-64 UEFI systems

*ia64: Intel* Itanium-*based systems (fading)*

**UEFI**: **U**nified **E**xtensible **F**irmware **I**nterface

*Often referred to as just **EFI***

***EFI** is used in place of BIOS*

**GUID or UUID**

***G**lobally **U**nique **ID**entifier or **U**niversal **U**nique **ID**entifier*

*128-bit number that should uniquely identify something*

$2^{128} = 3.4 \times 10^{38}$ = 34 billion trillion trillion

# GPT and EFI

GPT can be used to boot the following OSs if the firmware used is EFI (not BIOS)

- *FreeBSD and most Linux distros*
- *Vista, Win7 and upward using x86-64 and EFI*
- *Windows 2003, 2008, 2012 and upward servers using ia64 with EFI*
- *MacOS from v10.4 onward*

GPT cannot be used to boot any Windows OS or MacOSX from a PC that has BIOS firmware

- *The firmware must be EFI, not BIOS*

# GPT and EFI

Many systems are now hybrid BIOS/EFI

- *Boot using either BIOS or EFI*
- *BIOS has usually taken precedence*

EFI criticisms

- *Overly complex without adding value*
- *Number of partitions limited to 128*
  - May have recently changed

If BIOS and MBR were updated, they would be adequate

- *Can exceed 128 partitions*

# GPT Volume Layout

MBR *(in LBA 0)*

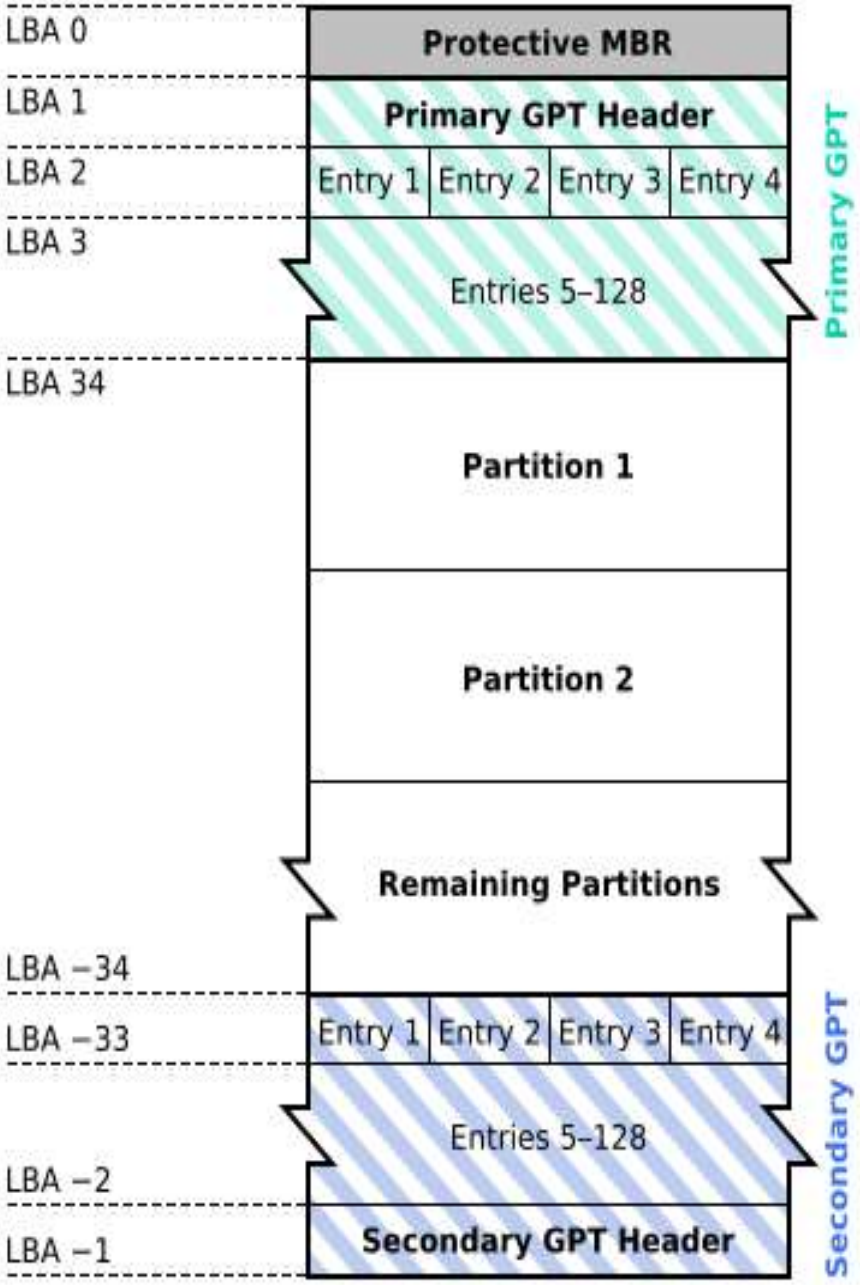
- Protective: *Prevents MBR-based software from overwriting GPT*
- Hybrid: *Allows GPT booting that starts in the MBR*

*GPT Header (in LBA 1)*

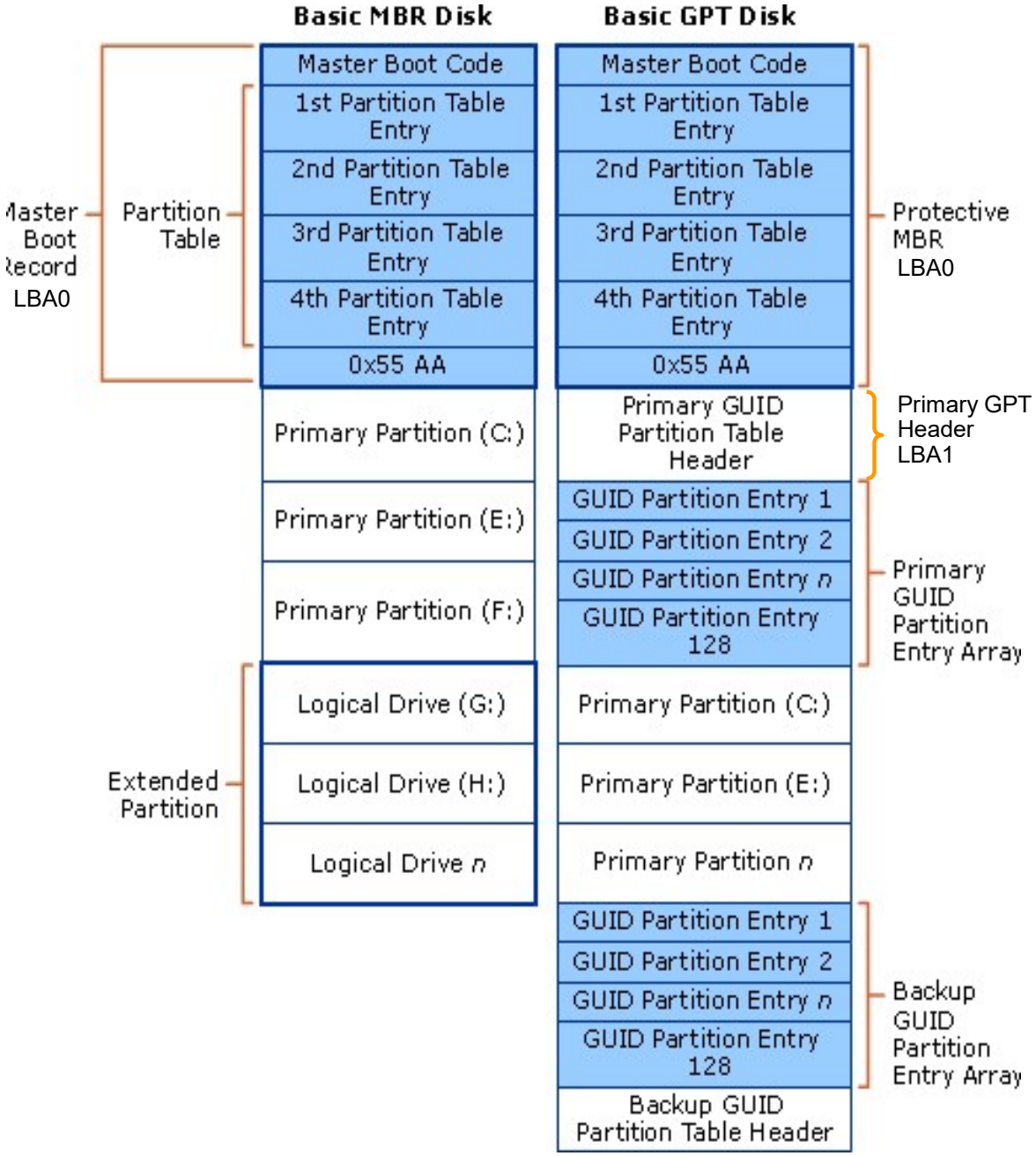
- *Identifies useable logical blocks*
- *Number of partitions for the drive*
- *Size of partition table* Entries
  - Reserves space for 128 entries each of 128 bytes
- *GUID (UUID) for entire volume*

Partition Table *(LBA3 - LBA33)*

Partitions *(LBA34-LBA$_{max}$ - 34)*



# MBR & GPT Drive Layout Comparison



# Protective MBR
## *LBA 0*

| Offset | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00000000000 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00000000016 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00000000032 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00000000048 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00000000064 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00000000080 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |

*Removed*

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00000000416 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00000000432 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 7B | 18 | 66 | F5 | 00 | 00 | 00 | 00 |
| 00000000448 | 02 | 00 | EE | FF | FF | FF | 01 | 00 | 00 | 00 | FF | FF | FF | FF | 00 | 00 |
| 00000000464 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00000000480 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00000000496 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 55 | AA |
| 00000000512 | 45 | 46 | 49 | 20 | 50 | 41 | 52 | 54 | 00 | 00 | 01 | 00 | 5C | 00 | 00 | 00 |

EFI PART

Protective MBR:

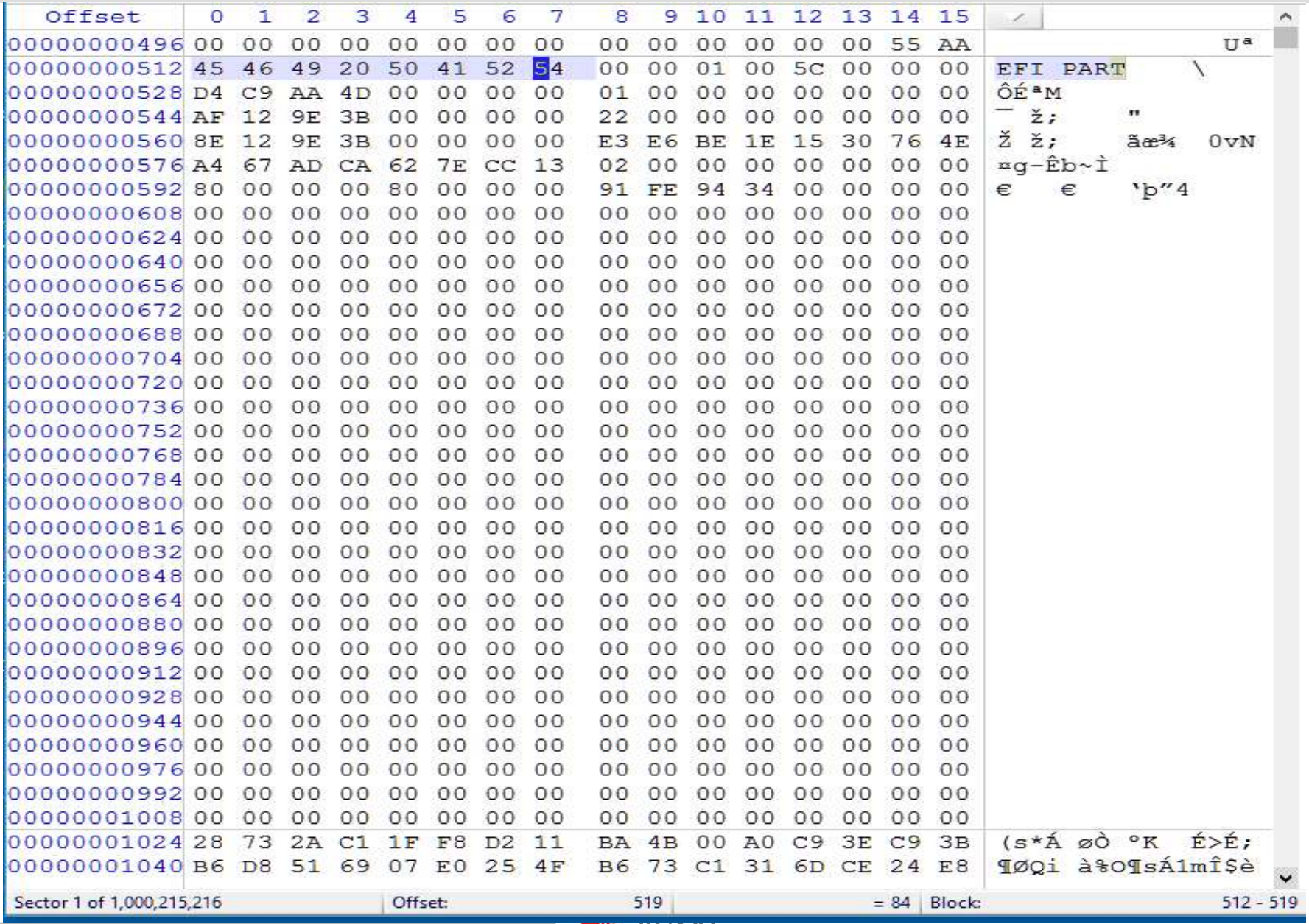
- Has no boot code, contains a single partition, type field is EE
- LBA 1 begins immediately with EFI PART *(EFI PARTition)*

# Protective MBR Partition Table Single Partition*

| Byte Range | Description | |
|---|---|---|
| 0–0 | Bootable Flag | `0x 00` |
| 1–3 | Starting CHS Address | `0x 00 02 00` = $512_{10}$ or $8192_{10}$<br>Not sure how to interpret this. |
| 4–4 | Partition Type | `0x EE`<br>Means that this is a GPT drive |
| 5–7 | Ending CHS Address | `0x FF FF FF`<br>All 1s means the end of the drive |
| 8–11 | Starting LBA Address | `0x 01 00 00 00` *(little endian)*<br>GPT starts in LBA 1 |
| 12–15 | Size in Sectors | `0x FF FF FF FF` *(little endian)*<br>All 1s means the end of the drive |

# GPT Header

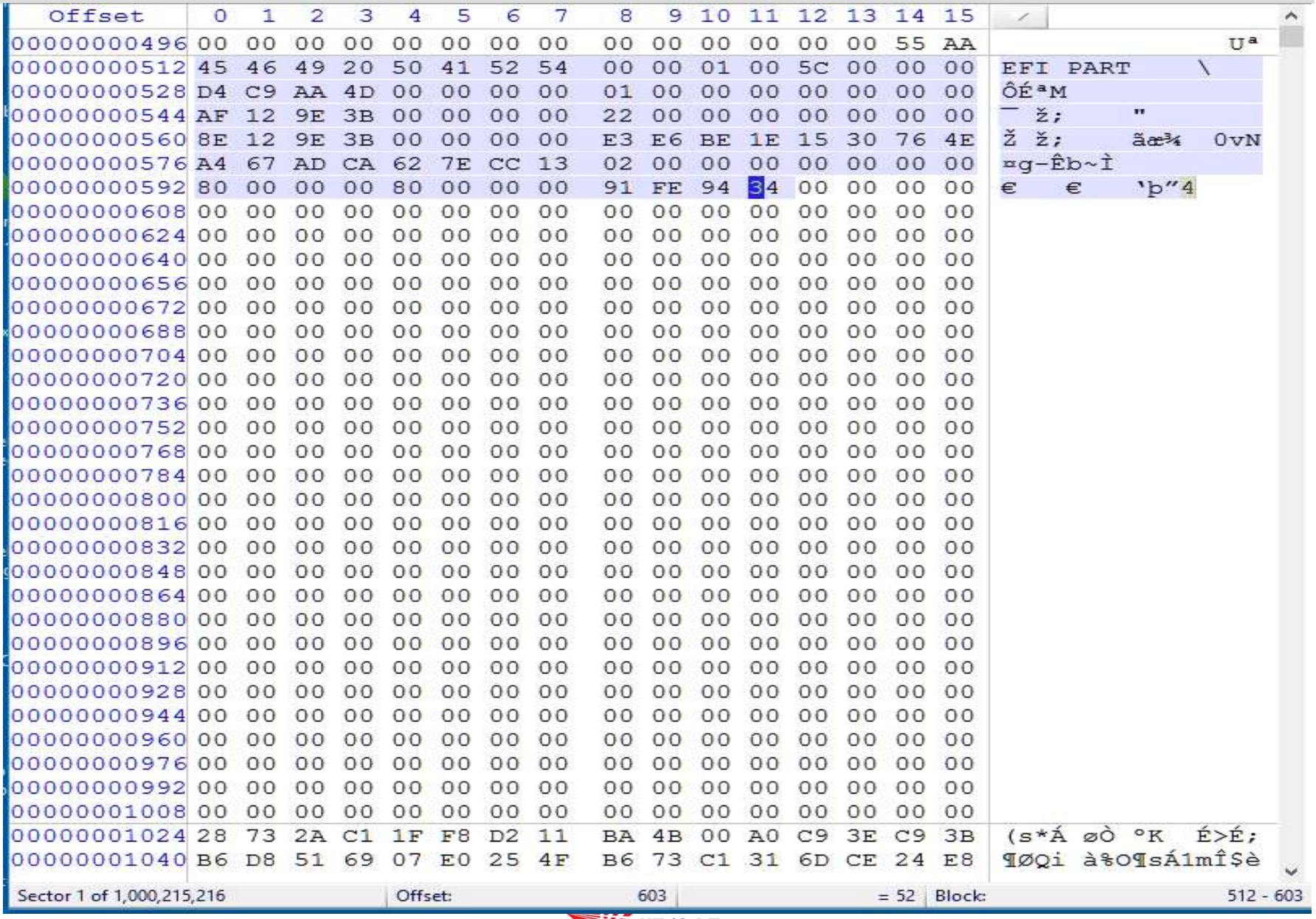
# A GPT Header: *EFI PARTition*



| Offset | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00000000496 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 55 | AA | U ª |
| 00000000512 | 45 | 46 | 49 | 20 | 50 | 41 | 52 | 54 | 00 | 00 | 01 | 00 | 5C | 00 | 00 | 00 | EFI PART \ |
| 00000000528 | D4 | C9 | AA | 4D | 00 | 00 | 00 | 00 | 01 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | ÔÉªM |
| 00000000544 | AF | 12 | 9E | 3B | 00 | 00 | 00 | 00 | 22 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | ¯ ž; " |
| 00000000560 | 8E | 12 | 9E | 3B | 00 | 00 | 00 | 00 | E3 | E6 | BE | 1E | 15 | 30 | 76 | 4E | Ž ž; ãæ¾ 0vN |
| 00000000576 | A4 | 67 | AD | CA | 62 | 7E | CC | 13 | 02 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | ¤g-Êb~Ì |
| 00000000592 | 80 | 00 | 00 | 00 | 80 | 00 | 00 | 00 | 91 | FE | 94 | 34 | 00 | 00 | 00 | 00 | € € 'þ"4 |
| 00000000608 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000624 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000640 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000656 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000672 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000688 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000704 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000720 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000736 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000752 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000768 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000784 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000800 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000816 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000832 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000848 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000864 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000880 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000896 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000912 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000928 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000944 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000960 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000976 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000992 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000001008 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000001024 | 28 | 73 | 2A | C1 | 1F | F8 | D2 | 11 | BA | 4B | 00 | A0 | C9 | 3E | C9 | 3B | (s*Á øÒ ºK É>É; |
| 00000001040 | B6 | D8 | 51 | 69 | 07 | E0 | 25 | 4F | B6 | 73 | C1 | 31 | 6D | CE | 24 | E8 | ¶ØQi à%O¶sÁ1mÎ$è |

Sector 1 of 1,000,215,216 | Offset: 519 | = 84 | Block: 512 - 519

# GPT Header



| Offset | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00000000496 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 55 | AA | U ª |
| 00000000512 | 45 | 46 | 49 | 20 | 50 | 41 | 52 | 54 | 00 | 00 | 01 | 00 | 5C | 00 | 00 | 00 | EFI PART \ |
| 00000000528 | D4 | C9 | AA | 4D | 00 | 00 | 00 | 00 | 01 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | ÔÉ ª M |
| 00000000544 | AF | 12 | 9E | 3B | 00 | 00 | 00 | 00 | 22 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | ¯ ž; " |
| 00000000560 | 8E | 12 | 9E | 3B | 00 | 00 | 00 | 00 | E3 | E6 | BE | 1E | 15 | 30 | 76 | 4E | Ž ž; ãæ¾ 0vN |
| 00000000576 | A4 | 67 | AD | CA | 62 | 7E | CC | 13 | 02 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | ¤g-Êb~Ì |
| 00000000592 | 80 | 00 | 00 | 00 | 80 | 00 | 00 | 00 | 91 | FE | 94 | 34 | 00 | 00 | 00 | 00 | € € ‘þ”4 |
| 00000000608 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000624 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000640 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000656 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000672 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000688 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000704 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000720 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000736 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000752 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000768 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000784 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000800 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000816 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000832 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000848 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000864 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000880 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000896 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000912 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000928 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000944 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000960 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000976 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000000992 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000001008 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 00000001024 | 28 | 73 | 2A | C1 | 1F | F8 | D2 | 11 | BA | 4B | 00 | A0 | C9 | 3E | C9 | 3B | (s*Á øÒ °K É>É; |
| 00000001040 | B6 | D8 | 51 | 69 | 07 | E0 | 25 | 4F | B6 | 73 | C1 | 31 | 6D | CE | 24 | E8 | ¶ØQi à%O¶sÁ1mÎ$è |

Sector 1 of 1,000,215,216 | Offset: 603 = 52 | Block: 512 - 603

# GPT Header Format
## *LBA 1*

| Byte Positions | Contents |
|---|---|
| 0-7 (8 bytes) | EFI PART (Hex 45 46 49 20 50 41 52 54) |
| 8-11 (4 bytes) | EFI version number. Currently 0x00 0x00 0x01 0x00 |
| 12-15 (4 bytes) | Header size. Usual size is 92 bytes (Hex little endian 5c 00 00 00) |
| 16-19 (4 bytes) | CRC-32 of GPT Header. (This field considered zero in doing calculation.) |
| 20-23 (4 bytes) | Reserved. Must be 0x00 0x00 0x00 0x00 |
| 24-31 (8 bytes) | LBA location of this GPT Header |
| 32-39 (8 bytes) | LBA location of backup copy of GPT Header |
| 40-47 (8 bytes) | Value of 1st LBA that can be used for an actual partition. Usual value is $34_{10}$ |
| 48-55 (8 bytes) | Value of last LBA that can be used for an actual partition. Usual value is # of sectors in disk - 34 |
| 56-71 (16 bytes) | Disk GUID (Also called UUID in some UNIX and Linux) |
| 72-79 (8 bytes) | Value of beginning LBA for partition entries. Integer power of 2 in primary GPT Header |
| 80-83 (4 bytes) | Number of partition entries (In WinHex example, $128_{10}$ ) |
| 84-87 (4 bytes) | Size of partition entries in bytes. Usually $128_{10}$ |
| 88-91 (4 bytes) | CRC-32 of partition array |
| 92-511 (420 bytes) | Reserved |

# GPT Partition Table

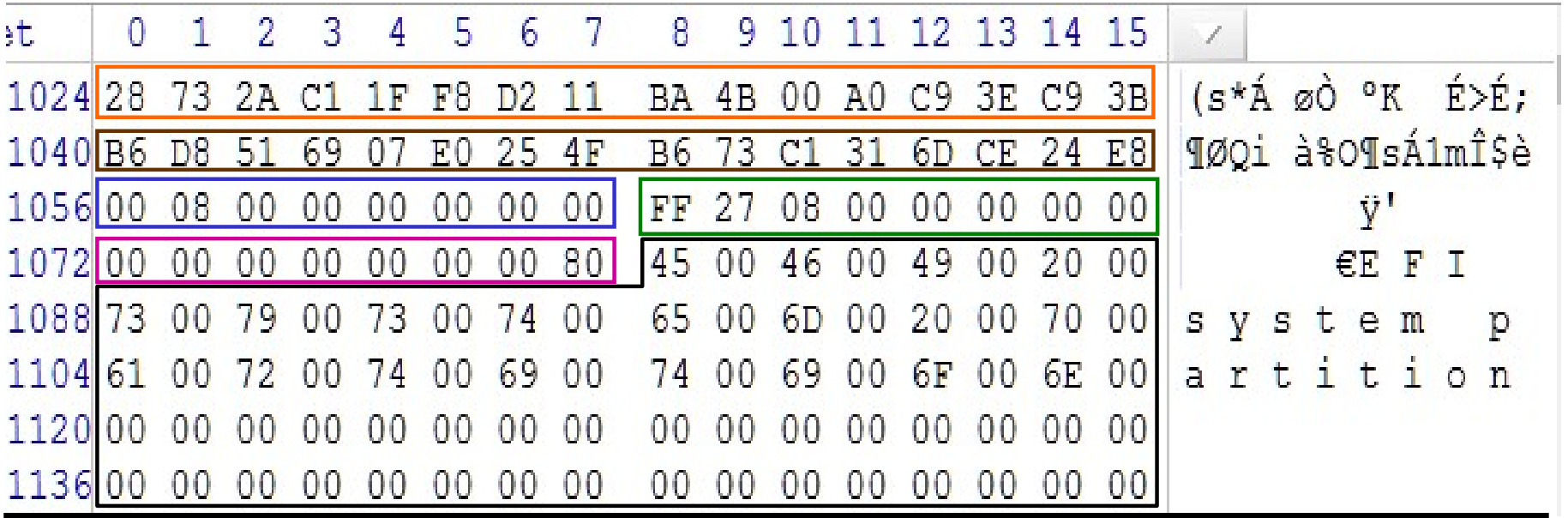
# GPT Partition Table: *4 of 6 Entries Shown*

| Offset | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00000001024 | 28 | 73 | 2A | C1 | 1F | F8 | D2 | 11 | BA | 4B | 00 | A0 | C9 | 3E | C9 | 3B |
| 00000001040 | B6 | D8 | 51 | 69 | 07 | E0 | 25 | 4F | B6 | 73 | C1 | 31 | 6D | CE | 24 | E8 |
| 00000001056 | 00 | 08 | 00 | 00 | 00 | 00 | 00 | 00 | FF | 27 | 08 | 00 | 00 | 00 | 00 | 00 |
| 00000001072 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 80 | 45 | 00 | 46 | 00 | 49 | 00 | 20 | 00 |
| 00000001088 | 73 | 00 | 79 | 00 | 73 | 00 | 74 | 00 | 65 | 00 | 6D | 00 | 20 | 00 | 70 | 00 |
| 00000001104 | 61 | 00 | 72 | 00 | 74 | 00 | 69 | 00 | 74 | 00 | 69 | 00 | 6F | 00 | 6E | 00 |
| 00000001120 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00000001136 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00000001152 | 16 | E3 | C9 | E3 | 5C | 0B | B8 | 4D | 81 | 7D | F9 | 2D | F0 | 02 | 15 | AE |
| 00000001168 | A6 | C4 | F1 | E2 | 5B | 30 | 96 | 44 | 91 | 4C | 24 | 3E | B0 | CF | A9 | 68 |
| 00000001184 | 00 | 28 | 08 | 00 | 00 | 00 | 00 | 00 | FF | 27 | 0C | 00 | 00 | 00 | 00 | 00 |
| 00000001200 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 80 | 4D | 00 | 69 | 00 | 63 | 00 | 72 | 00 |
| 00000001216 | 6F | 00 | 73 | 00 | 6F | 00 | 66 | 00 | 74 | 00 | 20 | 00 | 72 | 00 | 65 | 00 |
| 00000001232 | 73 | 00 | 65 | 00 | 72 | 00 | 76 | 00 | 65 | 00 | 64 | 00 | 20 | 00 | 70 | 00 |
| 00000001248 | 61 | 00 | 72 | 00 | 74 | 00 | 69 | 00 | 74 | 00 | 69 | 00 | 6F | 00 | 6E | 00 |
| 00000001264 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00000001280 | A2 | A0 | D0 | EB | E5 | B9 | 33 | 44 | 87 | C0 | 68 | B6 | B7 | 26 | 99 | C7 |
| 00000001296 | A7 | 22 | CE | 91 | 33 | B9 | 20 | 4E | B9 | 7B | 0C | CF | F1 | 7D | 62 | B2 |
| 00000001312 | 00 | 28 | 0C | 00 | 00 | 00 | 00 | 00 | FF | 3F | DD | 1D | 00 | 00 | 00 | 00 |
| 00000001328 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 42 | 00 | 61 | 00 | 73 | 00 | 69 | 00 |
| 00000001344 | 63 | 00 | 20 | 00 | 64 | 00 | 61 | 00 | 74 | 00 | 61 | 00 | 20 | 00 | 70 | 00 |
| 00000001360 | 61 | 00 | 72 | 00 | 74 | 00 | 69 | 00 | 74 | 00 | 69 | 00 | 6F | 00 | 6E | 00 |
| 00000001376 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00000001392 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00000001408 | A2 | A0 | D0 | EB | E5 | B9 | 33 | 44 | 87 | C0 | 68 | B6 | B7 | 26 | 99 | C7 |
| 00000001424 | F8 | B7 | 7F | 4D | BB | 5A | 8C | 48 | 83 | 83 | D1 | 71 | CB | D4 | 35 | 45 |
| 00000001440 | 00 | 40 | DD | 1D | 00 | 00 | 00 | 00 | FF | BF | F7 | 23 | 00 | 00 | 00 | 00 |
| 00000001456 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 42 | 00 | 61 | 00 | 73 | 00 | 69 | 00 |
| 00000001472 | 63 | 00 | 20 | 00 | 64 | 00 | 61 | 00 | 74 | 00 | 61 | 00 | 20 | 00 | 70 | 00 |
| 00000001488 | 61 | 00 | 72 | 00 | 74 | 00 | 69 | 00 | 74 | 00 | 69 | 00 | 6F | 00 | 6E | 00 |
| 00000001504 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 00000001520 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |

# GUID Partition Entry Format

| Byte Positions | | Contents |
|---|---|---|
| 0-15 | (16 bytes) | Partition Type as a GUID |
| 16-31 | (16 bytes) | Unique partition as a GUID |
| 32-39 | (8 bytes) | First LBA of this partition (little endian) |
| 40-47 | (8 bytes) | Last LBA of this partition (little endian). Often odd number |
| 48-55 | (8 bytes) | Attribute flags:<br>Bit 0: System. Do not repartition<br>Bit 2 & 3: Legacy MBR bootable partition value of 0x80<br>Bit 60: Read-only partition<br>Bit 62: Do not automount (don't assign drive letter) |
| 56-127 | (72 bytes) | Partition name (Up to 36 UTF-16 characters) |

# GPT Partition Table
## *First Entry*



| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1024 | 28 | 73 | 2A | C1 | 1F | F8 | D2 | 11 | BA | 4B | 00 | A0 | C9 | 3E | C9 | 3B |
| 1040 | B6 | D8 | 51 | 69 | 07 | E0 | 25 | 4F | B6 | 73 | C1 | 31 | 6D | CE | 24 | E8 |
| 1056 | 00 | 08 | 00 | 00 | 00 | 00 | 00 | 00 | FF | 27 | 08 | 00 | 00 | 00 | 00 | 00 |
| 1072 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 80 | 45 | 00 | 46 | 00 | 49 | 00 | 20 | 00 |
| 1088 | 73 | 00 | 79 | 00 | 73 | 00 | 74 | 00 | 65 | 00 | 6D | 00 | 20 | 00 | 70 | 00 |
| 1104 | 61 | 00 | 72 | 00 | 74 | 00 | 69 | 00 | 74 | 00 | 69 | 00 | 6F | 00 | 6E | 00 |
| 1120 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 1136 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |

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s y s t e m p
a r t i t i o n

| | | |
|---|---|---|
| 0-15 | (16 bytes) | Partition Type as a GUID |
| 16-31 | (16 bytes) | Unique partition as a GUID |
| 32-39 | (8 bytes) | First LBA of this partition (little endian) |
| 40-47 | (8 bytes) | Last LBA of this partition (little endian). Often odd number |
| 48-55 | (8 bytes) | Attribute flags: |
| 56-127 | (72 bytes) | Partition name (Up to 36 UTF-16 characters) |

# Installing Win8-64 and Beyond Requires Choosing