UEFI, Booting & Partition Management

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Unified Extendible Interface (UEFI)

- Modern computer and Windows are moving away from the traditional MBR based boot- up processes to hardware and software using UEFI
- Win 8 introduced UEFI
- *If Windows 8 is already installed using Legacy BIOS, it can't be converted to UEFI. A new OS installation is required.*

Understanding a computer boot up process

When you hit the power button of your PC, an execution begins that will eventually load the Operating System into memory.

This first execution depends on the partition structure of your hard disk.

We have two types of partition structures (or formats): *MBR and GPT.*

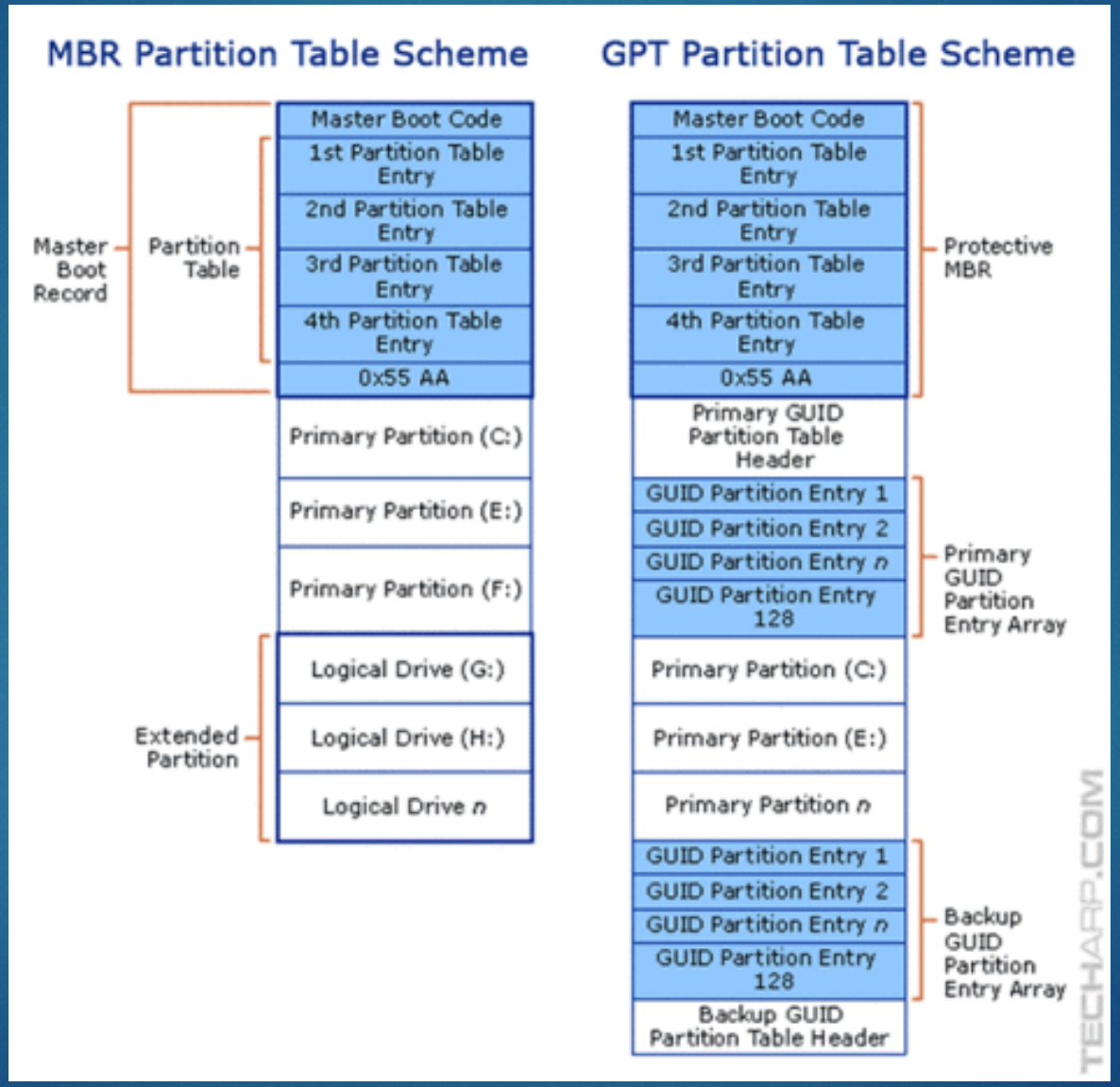
The partition structure on a drive defines three things:

- The structure of data on the drive.
- The code used during startup if a partition is bootable.
- Where a partition begins and ends.

MBR -Master Boot Record

GPT Globally Unique Identifier Partition Table = GUID Partition

A comparison of GPT and MBR partition structures



A comparison of GPT and MBR partition structures (2)

Max partition size in MBR is ~2TB whereas in UEFI it is ~9 ZetaBytes

One zettabyte (10^{21}) is approximately equal to a thousand exabytes or a billion terabytes.

MBR can have at max 4 primary partition whereas GPT can have 128.

MBR can store only one bootloader whereas GPT has a separate dedicated EFI System Partition(ESP) for storing multiple bootloaders.

The MBR Boot Process

Before the BIOS can detect the boot device, it goes through a sequence of system configuration functions starting with:

- Power-on-self-test.
- Detecting and initializing the video card.
- Displaying the BIOS start-up screen.
- Performing a brief memory (RAM) test.
- Configuring plug and play devices
- Identifying the boot device.

The first disk block is the MBR, and it has a size of 512 bytes. It contains three items that have to fit into this space:

- Stage one bootloader (440 bytes)
- Disk partition table (16 bytes per partition X 4 partitions) - MBR supports only
- 4 partitions
- Disk signatures (4 bytes)

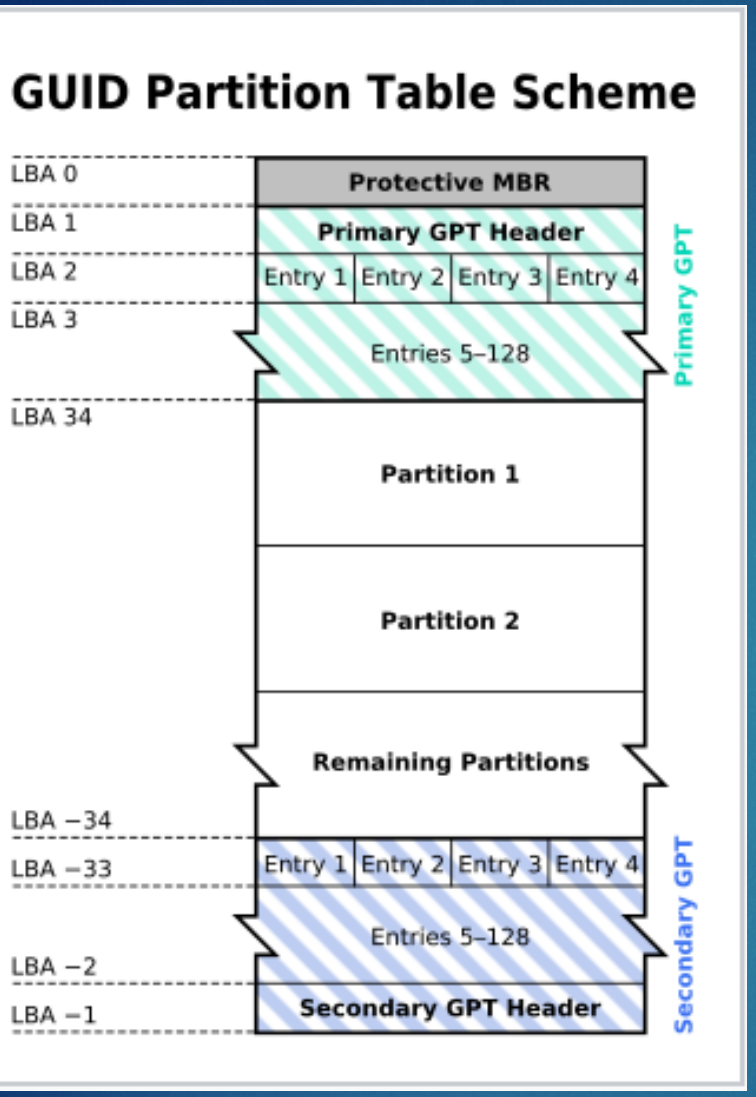
MBR process then loads the *Volume Boot Record* and finally the widows boot-loader *NTLRD* to load the Win OS

Booting with EUFI

- On computer power up , the UEFI first performs the system configuration functions such as power management, setting dates and other system management components just as in BIOS.

- UEFI then reads the GPT - GUID Partition Table.

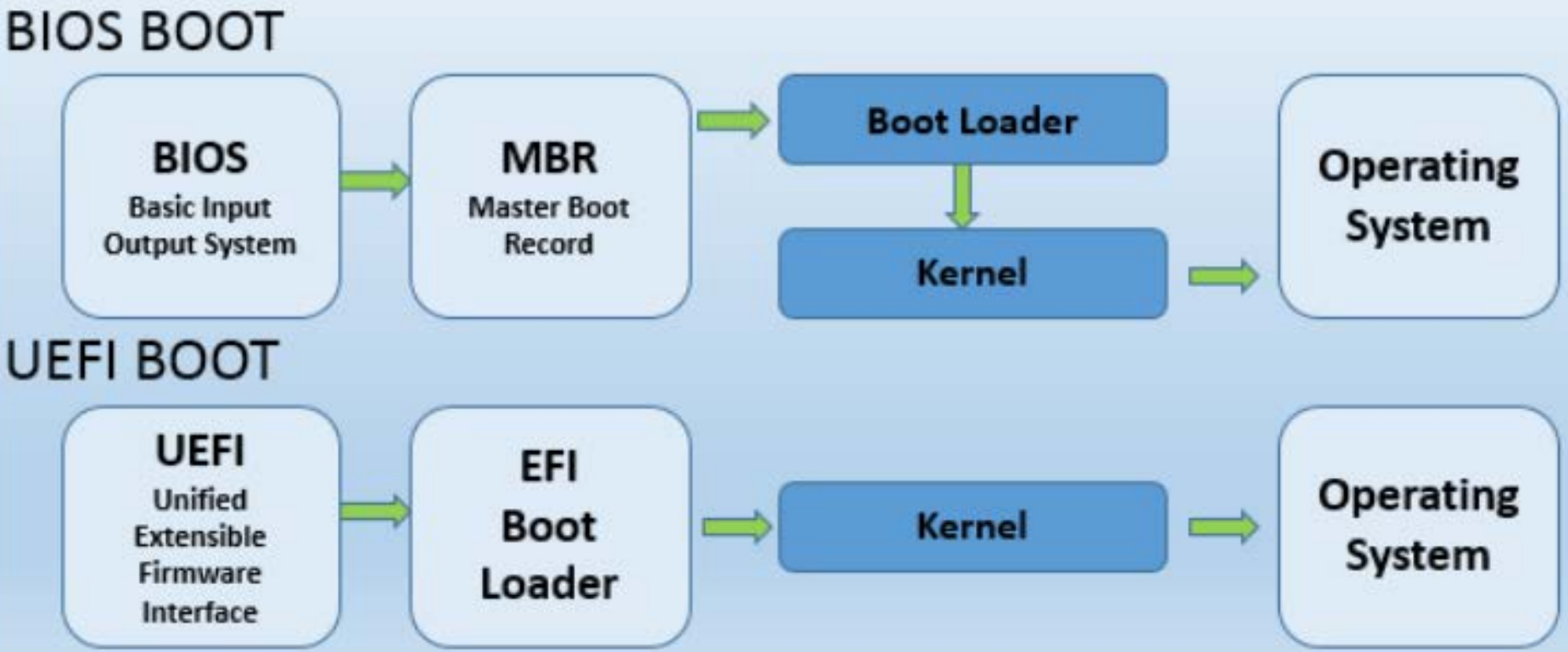
- GPT defines the partition table on a disk from which the EFI bootloader identifies the EFI system partition. The system partition contains bootloaders for all Operating Systems installed on other partitions on the hard drive. A bootloader initializes a windows boot manager which then loads the Operating System.



Operating system	Partition type	Globally unique identifier (GUID)[d]
(None)	Unused entry	00000000-0000-0000-0000-000000000000
	MBR partition scheme	024DEE41-33E7-11D3-9D69-0008C781F39F
	EFI System partition	C12A7328-F81F-11D2-BA4B-00A0C93EC93B
	BIOS boot partition[e]	21686148-6449-6E6F-744E-656564454649
	Intel Fast Flash (iFFS) partition (for Intel Rapid Start technology)[29][30]	D3BFE2DE-3DAF-11DF-BA40-E3A556D89593
	Sony boot partition[f]	F4019732-066E-4E12-8273-346C5641494F
	Lenovo boot partition[f]	BFBFAFE7-A34F-448A-9A5B-6213EB736C22
Windows	Microsoft Reserved Partition (MSR)	E3C9E316-0B5C-4DB8-817D-F92DF00215AE
	Basic data partition[g]	EBD0A0A2-B9E5-4433-87C0-68B6B72699C7
	Logical Disk Manager (LDM) metadata partition	5808C8AA-7E8F-42E0-85D2-E1E90434CFB3
	Logical Disk Manager data partition	AF9B60A0-1431-4F62-BC68-3311714A69AD
	Windows Recovery Environment	DE94BBA4-06D1-4D40-A16A-BFD50179D6AC
	IBM General Parallel File System (GPFS) partition	37AFFC90-EF7D-4E96-91C3-2D7AE055B174
	Storage Spaces partition	E75CAF8F-F680-4CEE-AFA3-B001E56EFC2D

BIOS vs UEFI

A Very Brief Explanation



Where Is the EFI File in Windows?

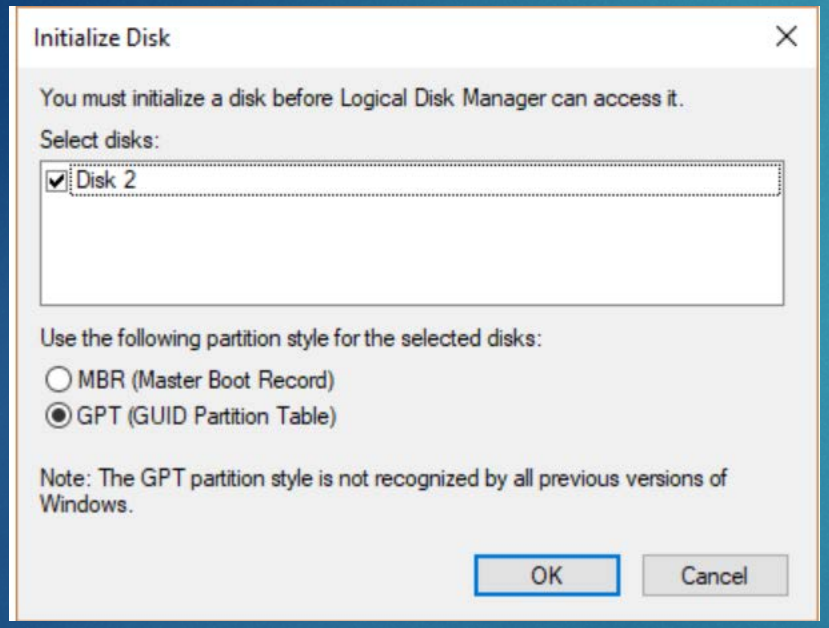
On a system with an installed operating system, the boot manager that exists as part of the motherboard UEFI firmware will have an EFI file location stored in the BootOrder variable. This might actually be another boot manager if you have an installed multi-boot tool but is usually just the EFI boot loader for your operating system.

Most of the time, this EFI file is stored on a special EFI system partition. This partition is usually hidden and does not have a drive letter.

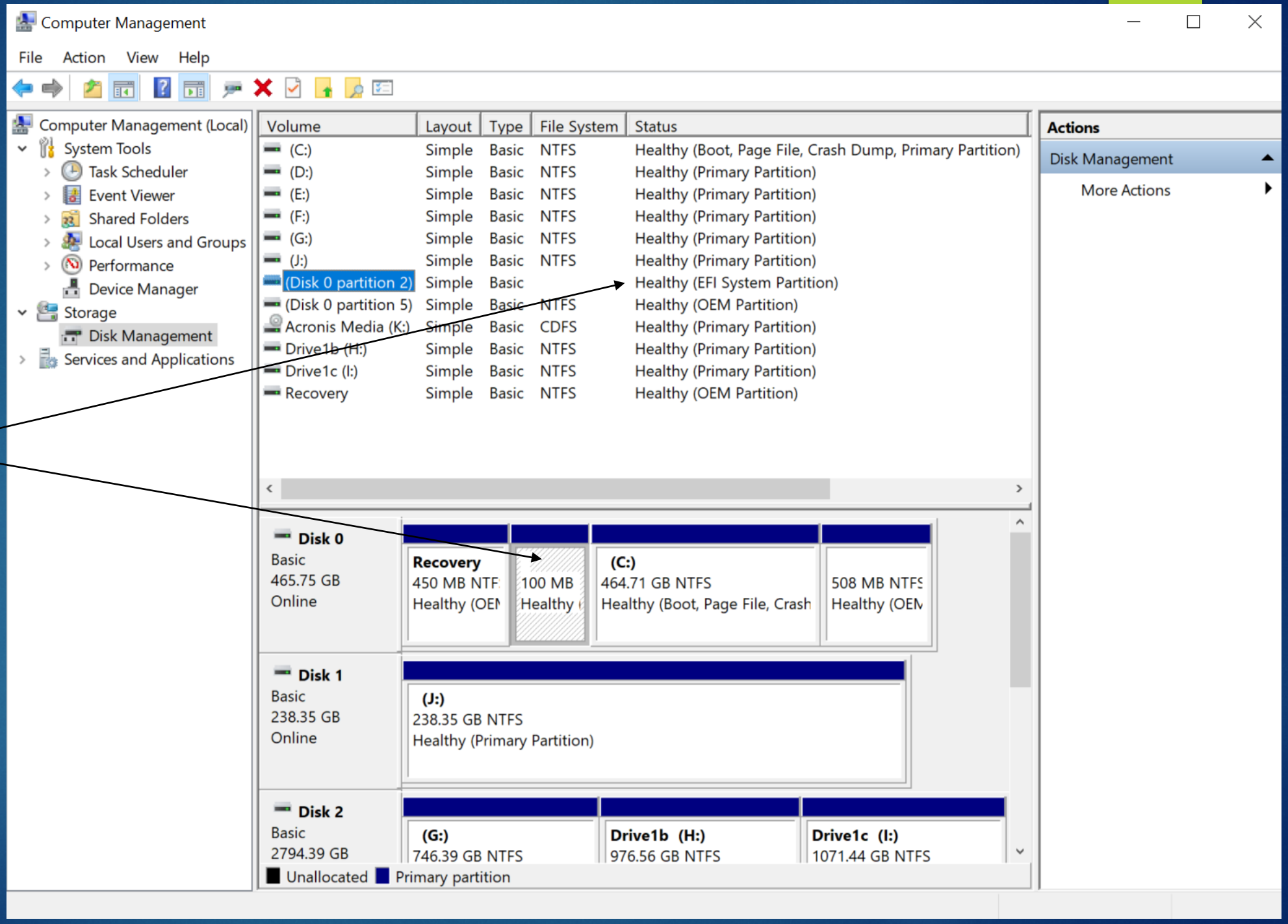
On a UEFI system with Windows 10 installed the EFI file will be located at the following location, on that hidden partition:

\EFI\boot\bootx64.efi

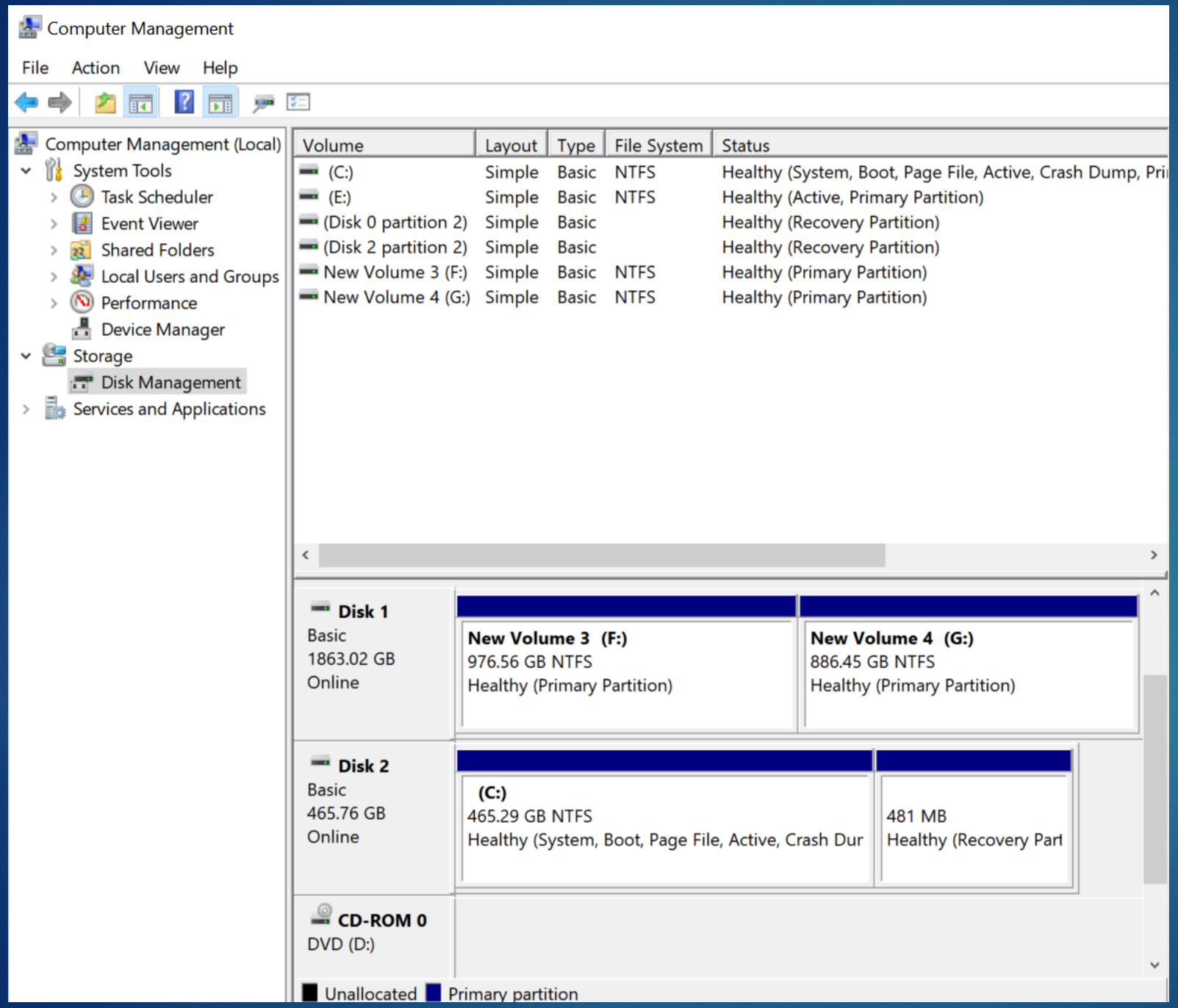
Partitioning a New HD



Most PCs use the GUID Partition Table (GPT) disk type for hard drives and SSDs. The older Master Boot Record (MBR) disk type is used by 32-bit PCs, older PCs, and removable drives such as memory cards.



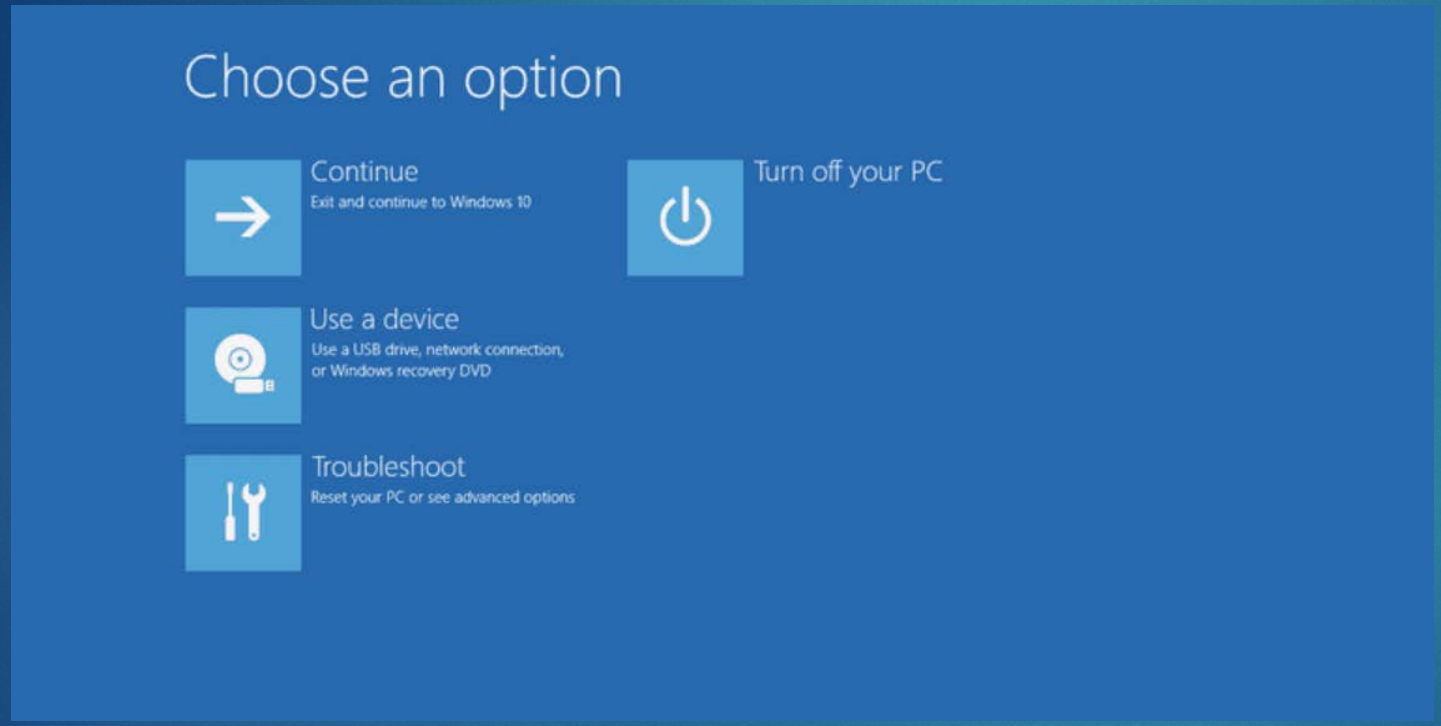
UFEI Partition



Recovery Partition

WIN 10 Won't boot!

The Advanced Startup Options menu should appear automatically after two consecutive startup errors.

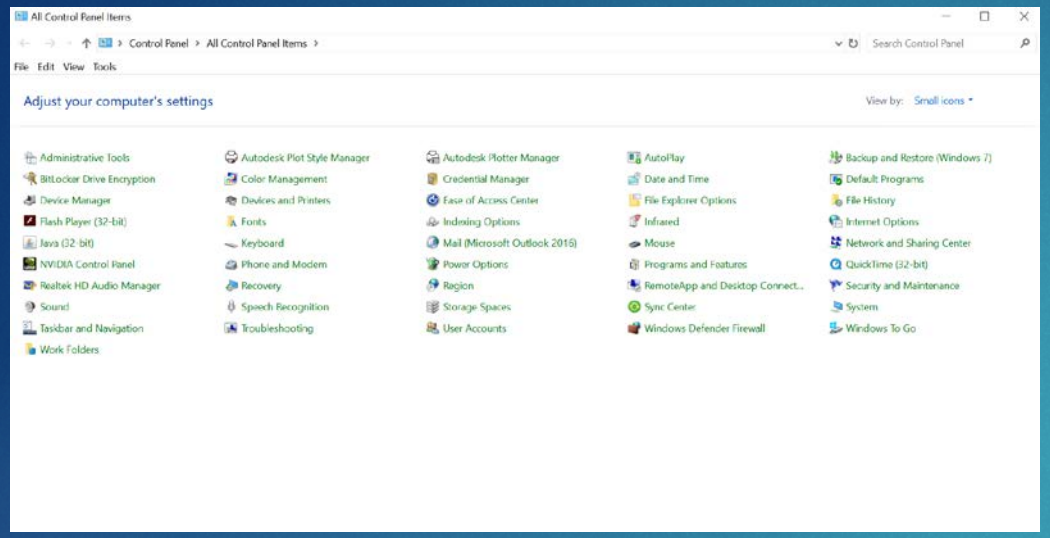


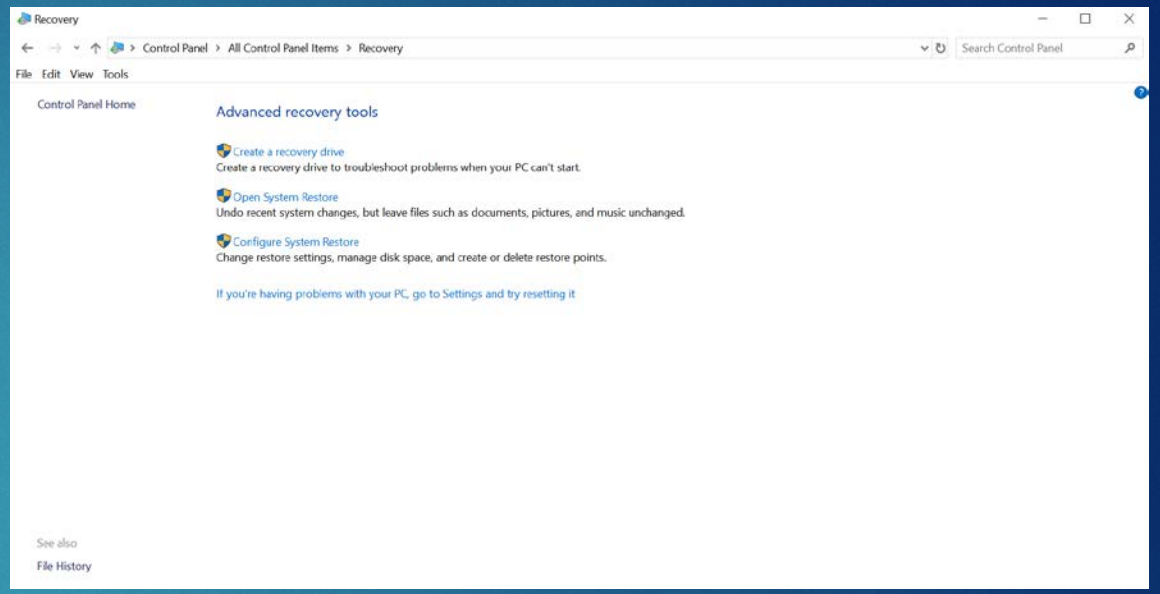
Boot From Your Windows 10/8 Installation Media

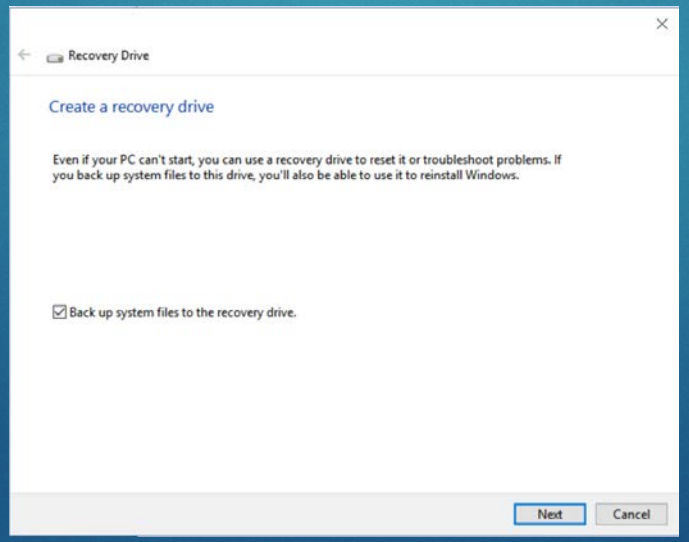
Boot From a Windows 10/8 Recovery Drive

Boot Directly to Advanced Startup Options (F11) also requires EUFI

Create a Recovery Drive







Creating Partitions on Harddisk drives

Basic Disk / Dynamic Disk

A basic disk allows one or more partitions to be created on an individual single harddrive.

Dynamic disks can use more that one harddisk drive to format a partition