



Large Capacity Drives

Information Sheet

Hard drive industry meets the technological challenges of implementing 3 TB SATA hard drives

Introduction

SATA hard drives are now capable of storing up to 3 TB of data on a single hard drive. At such high capacities certain compatibility issues arise. WD is leading the way in the industry, providing you with solutions to mitigate these compatibility issues when implementing 2.19 TB and larger drives.

This Information Sheet helps clarify how you can take advantage of the latest in large capacity drive technology on today's systems with standard components. WD provides solutions for using current, off-the-shelf systems; you don't have to wait for the rest of the ecosystem to catch up.

Optimizing Standard Systems for Large Capacity Drives

Limitations of 512-byte Sector Size

Older operating systems such as the Windows® XP computing environment with a legacy BIOS and Master Boot Record (MBR) partition table scheme encounter a barrier at 2.19 TB because they can address only up to 2^{32} logical blocks x (sector size) capacity and the most commonly used sector size is 512 bytes. Do the math and you get a capacity limitation of 2.19 TB (2,199,023,255,552 bytes). Some operating systems, such as Windows XP, only support booting from an MBR (Master Boot Record) partition formatted drive; therefore, there are limitations when attempting to move to a higher capacity drive. The system's BIOS and operating system drivers need to agree on capacity and geometry of a hard drive to boot and operate correctly. Agreement must take place across several software layers to successfully boot a system.

WD Provides Solutions for Moving Beyond 512-byte Sector Size (Greater than 2.19 TB)

Given WD's areal density leadership, WD is leading the way in providing solutions for drives larger than 2.19 TB by working collectively with industry partners, system providers, and operating system vendors. Support for drives larger than the current 2.19 TB capacity barrier means implementing these solutions to successfully integrate high capacity drives.

Considerations for operating systems:

- Booting to a large capacity drive requires a system with Unified Extensible Firmware Interface (UEFI) using Globally Unique Identifier (GUID) Partitions. Windows will require a 64-bit version of the operating system.
- Secondary storage is available for 32-bit and 64-bit operating systems using GPT Partitioning in conjunction with legacy or UEFI systems.
- Windows XP does not support newer partition types, such as GPT, that allows for implementing drives greater than 2.19 TB. XP is not currently supported.
- USB attached storage solution providers have solved many of the issues associated with Large Drives within the USB Bridge firmware. Some present large capacity drives as single drive using larger sector sizes while others present the large capacity drive as one or more than one smaller drives to the host. Please consult the USB Bridge provider for additional details on their solution implementations.

	Windows XP 32-bit	Windows XP 64-bit	Windows Vista® 32-bit	Windows Vista 64-bit	Windows 7 32-bit	Windows 7 64-bit	Mac® OS 10.5 Leopard	Mac OS 10.5 Snow Leopard	Linux OS
Boot Drive	*1	*1		Supported *5		Supported *5	Supported *4	Supported *4	Supported *2
Secondary Drive	*1	*1	Supported	Supported	Supported	Supported	Supported *4	Supported *4	Supported *2
Supplied HBA Required*3			Yes	Yes	Yes	Yes			Yes
USB External Storage	Supported *6	Supported *6	Supported *6	Supported *6	Supported *6	Supported *6	Supported *6	Supported *6	Supported *6

¹* Presently WD does not directly provide support for these applications. We have worked extensively with our partners and solutions may be available. HBA and RAID Controller vendors may have developed solutions for these applications.

²* Linux solutions are available. Please consult your Operating System provider for use with Large Capacity drives.

³* An available PCI-E slot for the HBA is required. Supported by using the native Windows Advanced Host Controller Interface (AHCI) drivers only.

⁴* Apple Bootcamp is presently not supported. Support is limited to the operating system only.

⁵* Boot support requires a system with UEFI Support and a 64 bit version of the OS.

⁶* Check with USB Bridge provider to verify if and how Large Drives are supported.



Large Capacity Drives

Industry Advances Make Large Capacity Drives Possible

There are several advances in the industry that make large capacity drives possible:

Use Larger Sector Sizes

One way to break the 2.19 TB boundary would be to use a larger sector size and keep the number of addressable blocks the same. By using sector sizes of 4096 (4K) bytes this would allow for systems to address a maximum capacity of $2^{32} \times 4096$ bytes or 17.59 TB. Unfortunately, WD has determined through testing that is not feasible at this time due to many application incompatibilities with devices using sector sizes above 512 bytes. However, hard drive manufacturers are working with industry partners to implement larger native sector sizes in the future.

WD has transitioned to using sector sizes of 4096 bytes or a 4 KB physical sector size on some hard drive models; this is referred to Advanced Format (AF) technology. Although the drive may be using a sector size of 4096 bytes to store data on the media, it reports and emulates a disk using 512 bytes (512e) to avoid application incompatibilities.

Use GPT Instead of MBR

The solution adopted by the industry is to use GUID Partition Tables, otherwise known as GPT, instead of Master Boot Record (MBR) partition tables. UEFI is a community effort by many companies in the computer industry to modernize the booting process. This partitioning method provides for up to 18 Exabyte (2^{64}) of Logical Block Addressing. UEFI capable systems are already shipping, and many more are in preparation. Booting a current Windows operating system from a drive larger than 2.19 TB requires that the system have UEFI support, a 64-bit version of the OS and will create and use GPT partitions.

The UEFI specification defines a new model for the interface between operating systems and platform firmware. The interface consists of data tables that contain platform-related information, plus boot and runtime service calls that are available to the operating system and its loader. Together, these provide a standard environment for booting an operating system and running pre-boot applications.

Implement WD's Interim Solutions for Implementing Large Capacity Drives

Existing legacy (non-UEFI) BIOS motherboards and GPT-ready operating systems such as Windows Vista or Windows 7, combined with the appropriate storage class drivers, can use drives larger than 2.19 TB as secondary storage; but there are a number of host bus adapter (HBA) and chipset vendors that do not currently offer drivers that support drives larger than 2.19 TB. To provide a solution for these types of compatibility issues, WD is bundling large capacity WD Caviar® Green™ 2.5 TB and 3 TB drives with an AHCI-compliant HBA that, once installed, allows the operating system to use a known driver to correctly support large capacity drives. This bundle provides a short-term solution until the time when updated storage drivers and system software with support for large capacity drives become available.

Illustrative Example: Should an end user decide to add a secondary drive to an existing desktop computer system that incorporates a chipset such as an Intel-based chipset on a legacy (non-UEFI) motherboard running an operating system such as Windows, the 3rd party storage class driver may not properly support a drive larger than 2.19 TB. If the large capacity drive is attached directly to the native motherboard SATA controller, the 3rd party driver may attach to the drive and the driver will not recognize the drive's full capacity, resulting in an incompatibility issue. An attempt to uninstall the driver could render the whole system inoperable.

However, when the drive is connected to the WD-bundled HBA, a Windows operating system would load native AHCI drivers that would correctly support large capacity drives and allow normal partitioning and use of the drive.

The example above is only one of many cases where the WD bundled HBA will solve the problem due to an incompatible driver.

How You Can Take Advantage of Large Capacity Drives

WD provides many options that you can use to take advantage of large capacity drives, even on current computer system configurations with today's technologies.

- Implement the WD bundle (large capacity WD Caviar Green 2.5 TB and 3 TB drives with an AHCI-compliant HBA) to allow your system's operating system to use a known driver to correctly support large capacity drives
- Implementing a large capacity WD drive as the system start up drive will require a system with UEFI support and will use GPT partitions. Windows will require a 64 bit version of the operating system.
- Implementing a large capacity WD drive in legacy systems will enable using the large capacity drive as secondary storage and will use GPT partitions.

Review the considerations for Windows-based operating systems above to help determine what options are available for implementing large capacity drives on your current systems, and to help you plan future operating system and computer system purchasing plans.

Contact your WD representative for additional information and assistance with implementing large capacity drives or visit our website at <http://products.wdc.com/largecapacitydrives>.

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