



Partition Offset Information

**Alignment Checker for Disk Drives
with
Large Physical Sectors and 512 Byte Emulation**

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Partition Offset Information

Partition Offset Information is a simple, single file Windows utility you can run to read and display the starting LBA for every partition. This tool detects disk drives that report themselves as large sector drives, typically 4KiB sectors, and analyzes the starting sector of a partition to see if the logical file system clusters are aligned to the disk drive or not. The *Partition Offset Information* utility was written in 2005 when Seagate Technology developed disk drives with 1KiB sectors. These drives were never released to standard distribution.

References

For a complete description of the characteristics of 4K Industry adoption of Large Sectors please refer to T13/1699-D Revision 6 (ATA-8 ACS), Annex E. Additional information is available at <http://www.bigsector.org>.

For information about File Systems and Clusters, please refer to some of the numerous online articles on the subject. Search on – file system cluster size – for a typical selection of articles.

QUICK 4K FAQ

What is 4K Sector?

Large-sector describes using a sector-size of 4096 bytes instead of 512 bytes per sector. To the host, the drive still has 512 byte sectors and no modifications to the BIOS/OS are needed at this time to address the data on the hard drive.

Why does the industry need to transition to 4K sectors?

Larger capacities per disk (areal density) have created a need for more format-efficiency (the ratio of data to non-data) on disks. Using 4096 bytes per sector allows for more data versus sector overhead (servo, address marks, ECC, etc) per byte, allowing the Hard Drive vendors to increase the capacity of a given disk by ~ 10%

Industry transition plans.

By Jan 2011, all hard disk drive (HDD) manufacturers will be supplying 4K drives. All software and industry manufacturing facilities must be capable of supporting 4K HDDs. Since the HDD looks like a 512byte drive to the host, the only real ramification is the performance impact of any misaligned writes on data partitions that are not 4K-friendly.

Why the need to align partitions in a 4K-sector drive?

The straight answer is to avoid performance penalty. As much as possible we want every partition to start with LBA offset that is aligned to drives physical 4k-sector to reduce the performance impact. Writes to the disk that are not "aligned" (written on modulo-8 sector counts) will require the HDD to first read up the original 4096 bytes, then merge the new write data with the existing 4096 bytes that are not changed, and then write that whole block of 4096 back to the disk. This causes an approximate 15-20ms excess overhead per write command that is not aligned properly. The only impact seen is during random write commands. There is no performance degradation when performing reads.

Which OS are affected by 4K sector?

Even though all operating systems will be seeing 512 byte sectors through the use of emulation technology on the drive controller only Windows Vista and Windows 7 are 4K sector-aware, meaning

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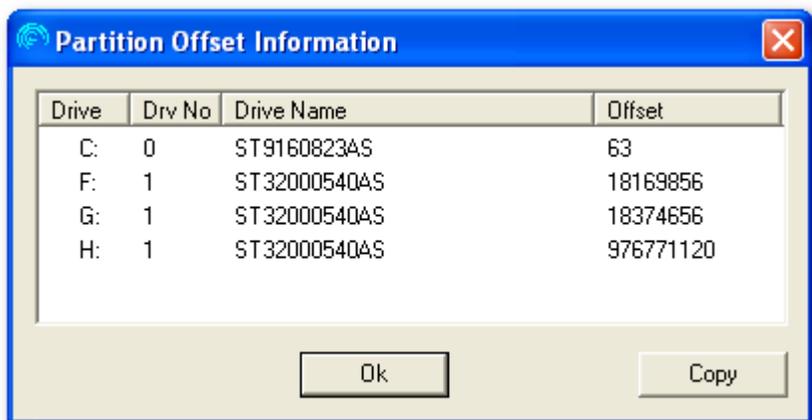
they will automatically align the data partitions on 4K byte sectors boundaries, matching the hard drive's physical sector layout. Linux and Mac OS are also 4ksector -aware.

Windows XP doesn't have this 4K awareness, and since the OS creates the first partition at LBA sector number 63 (common case), all following data-clusters will be misaligned, causing a noticeable performance impact. Each write process will now cause a Read-Modify-Write that introduces additional latency due to the required additional rotation of the hard drive. Drive imaging/cloning software will also be affected by partition misalignment in some cases if the software itself is not 4K-aware.

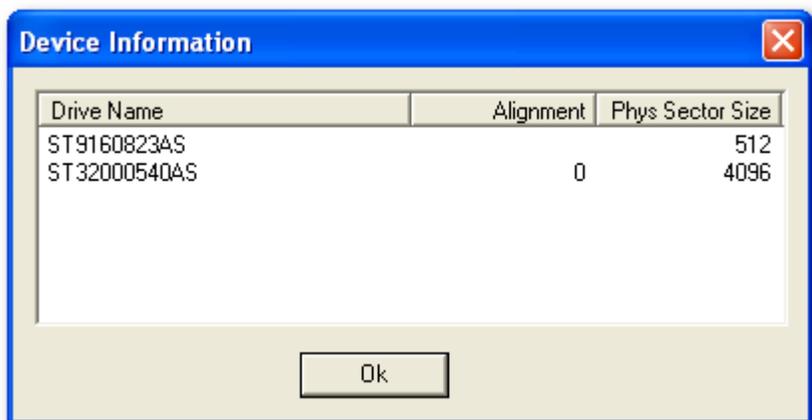
How to check if a partition is aligned?

Seagate has created a simple Windows utility, *Partition Offset Information*, to read and display the starting LBA for every partition. This tool can analyze the starting sector of a partition if it is misaligned or not.

In the example below, drive C: is a generic drive (ST9160823AS) with 512 bytes per sector. Drives F:, G: and H: are logical drives, all on the ST32000540AS which has a 4096 byte (4KiB) sector size and an Alignment of 0.



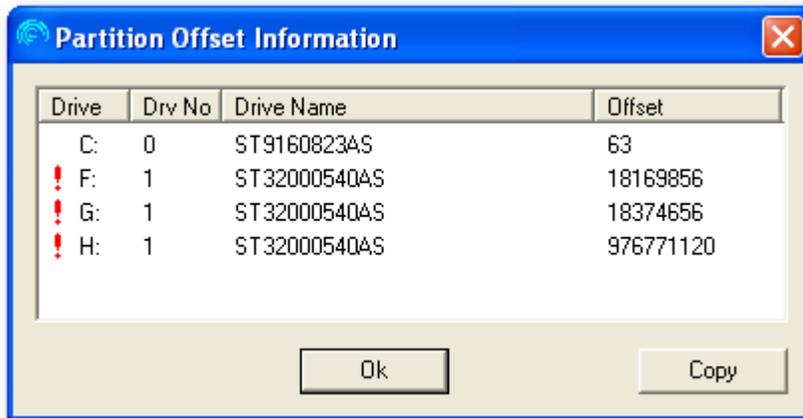
Drive	Drv No	Drive Name	Offset
C:	0	ST9160823AS	63
F:	1	ST32000540AS	18169856
G:	1	ST32000540AS	18374656
H:	1	ST32000540AS	976771120



Drive Name	Alignment	Phys Sector Size
ST9160823AS	0	512
ST32000540AS	0	4096

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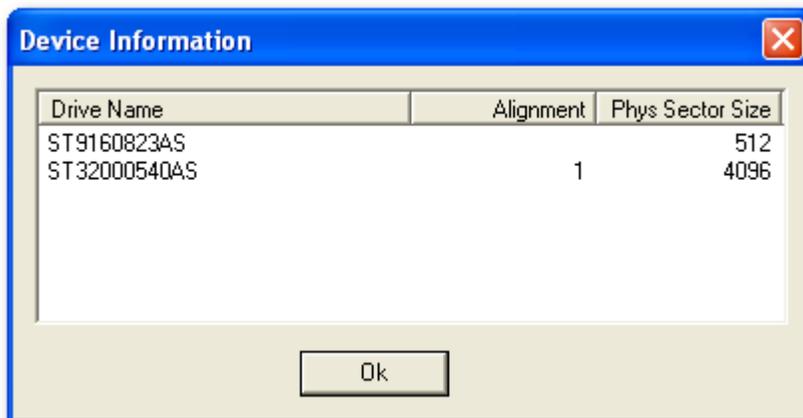
If the alignment on the ST32000540AS was 1, instead of 0, the display would look like this:



The dialog box titled "Partition Offset Information" displays a table with the following data:

Drive	Drv No	Drive Name	Offset
C:	0	ST9160823AS	63
! F:	1	ST32000540AS	18169856
! G:	1	ST32000540AS	18374656
! H:	1	ST32000540AS	976771120

Buttons: Ok, Copy



The dialog box titled "Device Information" displays a table with the following data:

Drive Name	Alignment	Phys Sector Size
ST9160823AS		512
ST32000540AS	1	4096

Button: Ok

Notice the the **RED** exclamation marks. These marks indicate that the Logical Volumes (drive letters) in this partitioning arrangement are not aligned with the physical sectors on the disk drive. Normal 4K disk drives will ship with Alignment 0. Drives with Alignment 1 and not typical and the example above is shown only for comparison purposes.

It is important to understand that the drive operates with the same reliability, but just a little bit slower when WRITING to the drive. It runs the same when READING which accounts for the majority of activity on a disk drive.

Partition Offset Information

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