

Advanced Format Technology

White Paper

Introduction

As demand for increased areal density continues, improvements to media format efficiency are essential. In 2009 disk drive manufacturers deployed Advanced Format sectors with 4,096 bytes of user data as one step in improving format efficiency and reliability. Continued improvements will likely cause drive manufacturers to increase the Advanced Format sector size again within the next 5 years.

Advanced Format Overview

There are 3 basic methods for increasing capacity on the media:

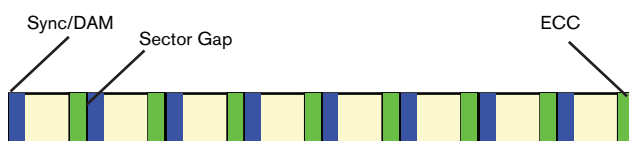
1. Increase the bit density with Advanced Formatting
2. Increase the number of tracks per inch
3. Increase the number of surfaces.

Increasing the bit density yields the best result. The benefit of increased bit density is that it occurs on every track and on every surface of the media. Each track is composed of a series of sectors. Currently the user data on the media is stored in 512 byte sectors. The storage industry is improving this legacy architecture by changing the size of the sectors on the media to store 4,096 bytes of data rather than 512 bytes of data.

Each sector has a gap, Sync/DAM (lead-in) and error correction information. Legacy architecture is very inefficient for ECC (Error Correction Code). It requires lots of overhead to support multiple blocks of ECC.

Figure 1

Legacy Architecture

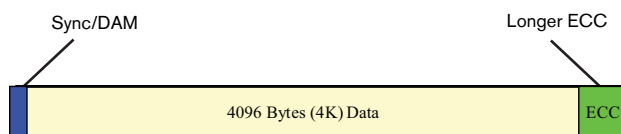


With Advanced Format technology we can remove Sync/DAM blocks, inter-sector gaps and 8 separate blocks of ECC, and gain approximately 7-11% in disk

space. Advanced Format media also provides an increase in data integrity by providing a more efficient error correction scheme via use of longer ECC code words.

Figure 2

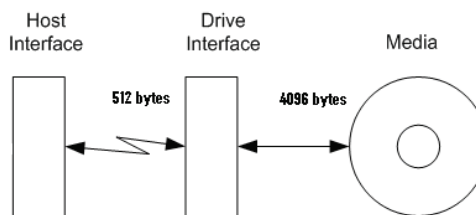
Advanced Format Architecture



Many disk drive interface technologies already allow for increased sector sizes. However, the 512-byte sector has been the standard for over 30 years. As a result, many points in a computer system (systems like personal computers, servers, DVRs, PSPs, and cell phones) have become inflexible and only work using 512-byte sectors. To maintain compatibility with these devices, Advanced Format media emulates a 512-byte device by maintaining a 512-byte sector at the drive interface.

Figure 3

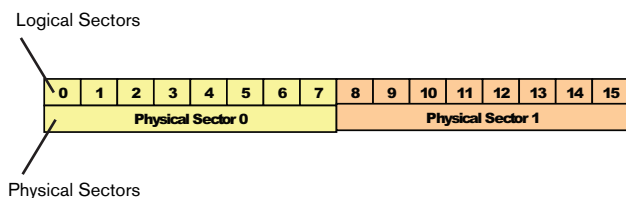
512 Byte Emulation



Advanced Format drives use Advanced Format media. Advanced Format media has Advanced Format sectors which are composed of eight 512 byte logical sectors per one 4,096 byte physical sector.

Figure 4

512-byte Emulated Device Sector Size



Benefits of Advanced Format

The Advanced Format technology paves the way for the drive industry to continue to increase areal density and develop higher capacity drives. Advanced Format technology improves burst error correction by 50% through the use of larger ECC (error correction code) code word.

Increased media format efficiency improves error rate capability by 2 orders of magnitude and increases data integrity.

Advanced Format technology is designed to work with the most current operating systems, such as Windows® Vista, Windows® 7 and Mac® operating systems. Like many new technologies, Advanced Format is not optimized for outdated operating systems such as Windows XP. For users who are still using Windows XP, WD offers WD Align software, a simple utility that allows Advanced Format drives operating under Windows XP to run at full performance. The WD Align software is available for download from WD's web site at <http://www.wdc.com/advformat>

References

The ATA8-ACS and SBC-3 standards have provisions for a disk drive to report Advanced Format sector sizes and other performance optimization information. These standards are used for SATA, SAS, USB, and IEEE 1394 based interface technologies.

Document References

Name	Location
ATA8-ACS	www.t13.org
SBC-3	www.t10.org



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