

The Hard Disk

Writing a text or revising a spreadsheet and saving it...editing a map or digital photo and saving it...a seemingly unlimited amount of data, all stored inside the computer on the hard disk. I know what it is, I know what it does, but how does it work?

The hard disk of a computer stores digital information in a relatively permanent form. It was invented in the 1950s and then called the "fixed disk". The size began at 20 inches in diameter and the capacity was no more than a few megabytes; today the diameter is 3.5 inch whilst the capacity goes up to 250 gigabytes. Later, these discs were renamed the hard disk to distinguish them from the floppy disk, which features a flexible plastic film that holds the magnetic surface. A typical hard disk consists of:

- a sealed aluminium box with magnetic platters and arm
- motors to spin the platters and move the arm
- electronics to control the read/write mechanism and to assemble the domains on the drive into bytes (reading) and turn bytes into magnetic domains (writing).

The platters that typically spin at 3,600 or 7,200rpm during operation are manufactured to amazing tolerances and are mirror-smooth. The mechanism driving the arm is light and very fast; the arm can move from hub to edge and back up to 50 times per second! Have a look at one, and be astonished.

Data Storage

To enable data storage the magnetic surface of a platter is formatted into sectors and tracks; the yellow concentric circles are tracks and the blue pie-shaped wedges are sectors on a track. A sector contains a fixed number of bytes, for example 256 or 512. At either drive or operating system-level, sectors are often grouped into clusters. During low-level formatting the drive is prepared to hold blocks of bytes by writing the start points and end points of every sector onto the platter. Next, during high-level formatting the drive is prepared to hold files by writing into the sectors file-storage structures, such as a file-allocation table. Data is stored as a collection of bytes called files.

Examples of what bytes may represent are:

- ASCII codes of text characters
- software application instructions
- data base records
- GIF image pixel colours.

Irrespective of what the file represents, it is always a string of bytes.

Performance

Speed and capacity are the major performance parameters. Speed concerns data rate, which is the number of bytes/second that the drive can deliver to the CPU, and seek time, which is the time that passes between a CPU request for a file and the start of sending the first byte of the file. Capacity is the number of bytes a drive can hold. Both speed and capacity have improved spectacularly over recent years. Unfortunately, hard disks are vulnerable; dust can ruin the disk in a split second, whilst shaking can make the arm collapse. This makes them unsuited for incorporation in surveying instruments, but today a geomatics office without hard disks is unthinkable.