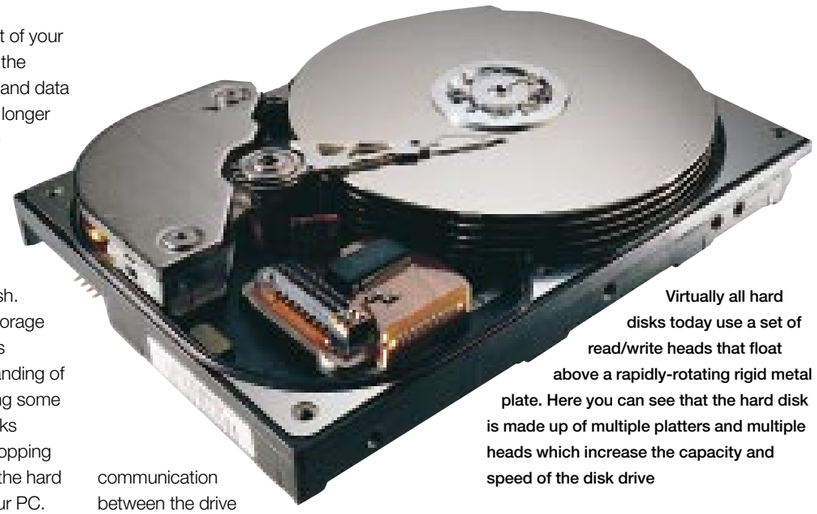
Hard disk know-how

Types, performance, upgrades and SCSI *vs* IDE. Eleanor Turton-Hill helps you get to know your hard disk.

The hard disk is that part of your system which holds all the programs, documents and data when your PC is switched off. The longer you have your computer, the more documents you create and the more data you store, the more valuable your hard disk becomes. In fact, hard disks which crack up can put small companies out of business in a flash.

In short, your hard disk is the storage place for your valuable work, so it's important to have a good understanding of how it works. Here, I'll be answering some common questions about hard disks including what to look for when shopping for one, how to upgrade and how the hard disk affects the performance of your PC.



Virtually all hard disks today use a set of read/write heads that float above a rapidly-rotating rigid metal plate. Here you can see that the hard disk is made up of multiple platters and multiple heads which increase the capacity and speed of the disk drive

How many types of hard disk are there?

It is now well known that the internal parts of the average home PC do not (alas) fit together like the bricks in a Lego set. However, as the personal computer market matures, universal standards are gradually making an impact on the design and compatibility of PC hardware. But it's a slow process and, as with many other consumer products, standardisation is a difficult and messy process.

One of the earliest and most significant standards introduced into PC hardware was IDE (Integrated Drive Electronics): a standard which controls the flow of data between the processor and the hard disk.

The IDE concept was initially proposed by Western Digital and Compaq in 1986 to overcome the performance limitations of earlier subsystem standards like ST506 and ESDI. The term IDE itself is not an actual hardware standard but the proposals which had been put forward were incorporated into an industry-agreed interface specification known as ATA (Advanced Technology Attachment). ATA defines a command and register set for the interface which creates a universal standard for communication between the drive unit and the PC.

One of the major innovations brought about by IDE was the integration of the disk controller functions onto the disk drive itself. The separation of the controller logic from the interface made it possible for drive manufacturers to enhance the performance of their drives independently — there were no performance-boosting features incorporated into the ATA interface itself.

Mass acceptance of the IDE standard hinged on its ability to serve the needs of the market in terms of the two most important criteria: cost and compatibility. Over the years, these two factors have been more significant to mainstream PC users than high performance and thus IDE has become established as a mass-market standard.

How is disk performance measured?

The speed of a hard disk can be measured in different ways and it is important to know exactly what figures are being quoted when you're shopping for a new one. The performance of your hard disk is very important to the overall speed of the system. A slow hard disk will hinder a fast processor like nothing else in your system can.

As an initial gauge, look for the drive's "average access time": the time taken by the drive to locate the track on which a piece of data is stored, and the specific place on that track where the data is sitting. This is usually quoted in milliseconds (ms).

In addition to "average access time", also look out for "transfer rates". The transfer rate is the speed at which the drive can deliver the data from the disk platters to the CPU. This is generally described in megabytes per second (Mb/sec).

In order to get an accurate view of a hard drive's performance, the average access time and the transfer rate should be looked at in tandem. Drive makers and dealers have a reputation for bending the truth on such issues and are often found to quote the fast access time of a drive, without any mention of the transfer rate —you'll see this in advertisements, too. Unfortunately, a high access time coupled with a slow transfer rate produces a slow drive.

Because access time is measured in milliseconds and transfer rate is measured in Mb/sec, the overall drive performance can be difficult to get your head around. Essentially, you're looking for the lowest possible access time and the highest possible transfer rate.

Another measure of hard disk performance, of which you should be aware, is "seek time" which is conveniently confused (by some people) with the access time. Seek time is also measured in milliseconds and defines the amount of time it takes a hard drive's read/write head to find the physical location of a piece of data on the disk. The seek time says absolutely nothing about the speed of a hard drive.

The importance of the access time and transfer rate is that they tell you how long a hard drive takes to locate and retrieve data.

How do I upgrade my hard disk?

Computer technology changes quickly. Every year, processor speeds increase and hard drive capacity grows. Before you know it, there's a new generation of feature-rich software waiting to cripple your poor aged PC. Sooner or later you'll have to face up to the fact that your machine is becoming outmoded, and find some way of dealing with this.

The speed of your hard disk has a major impact on the overall performance of your machine. Hard drives found in old computers tend to be physically large, slow, power-hungry and of limited capacity. If your machine is really ancient, a modern IDE hard disk would greatly improve performance.

Before splashing your money around, there are a few basic facts you need to know about your PC. First, take the lid off and look at the arrangement of components. The first and most obvious thing to find out is whether you actually have room for another hard disk.

Check up on the manufacturer of your hard drive and the drive's type (if you've lost your manual, look at the machine's setup screen) before you go shopping for a new hard disk because the BIOSs (Basic Input/Output System) in some older machines do not officially support IDE. Ask the dealer whether the new drive will work in a "master/slave" configuration with the old one and finally, cover yourself by checking that the drive you buy has a "no questions asked" return policy.

There are essentially two types of modern drive interface: SCSI and IDE (*see the panel*). We'll concentrate on the more common IDE variety. Unfortunately, adding a second IDE drive is not always a simple procedure, because not all IDE drives work to the same standard. If both your drives adhere to the ANSI standard (ATA), both drives should happily co-exist. If they are incompatible, you could end up throwing away your old one.

IDE drives can control two hard disks on the same cable and, in order to make them work together, one must be set up as a slave and the other as a master. This can be done fairly simply by moving a jumper at the back of the drive from one position to another. When you plug in the drive, make sure that the cable is plugged in the right way around, otherwise your machine will appear to be dead when you turn it on. Pin 1 is usually marked so that you can line up the cable in the correct way.

The hard disk which you buy will generally be faster than the one you've already got so set this one up as the master and your existing one as the slave. They'll work more efficiently together if you store your applications on the faster disk and data on the slow one.

Once you've physically connected your new hard drive to the machine, you will have to configure the PC's BIOS . The BIOS contains a series of entries such as number of heads, cylinders and sectors per track which define the type of hard drive in the machine.

Generally, you can get into the BIOS setup utility by pressing a key combination when you boot up. Here you'll need to configure the hard drive type number as well as other system configuration details. Make sure you have all the information you need before you go anywhere near your BIOS or you could end up frustrated for hours, or even days, trying to put it right.

IDE and SCSI

If you've ever leafed through one of our *PCW* computer group tests you couldn't fail to have noticed the many seemingly-incomprehensible acronyms like those I've already mentioned. They refer to interface standards which define the way in which the hard drive connects to your PC. In the first generation of computers, the electronics to manage the hard disk were placed on a separate controller card. Technology has moved on since then and the same advances in microchips, which have led to faster processors and cheaper memory, now enable the controller function to be placed on the disk itself.

■ Integrated Drive Electronics (IDE) is currently the most common hard drive interface and is also (not by coincidence) the least expensive. IDE disks are connected to an interface card by a cable which extends the signals from the bus inside the PC. The cable does not plug directly into the ISA bus so it either goes into an interface port on the main board, or into an interface card. The IDE standard supports two disks connected together, the first acting as a controller and the second as a slave, with both disks sharing a single I/O (input/output) address and interrupt.

■ Enhanced IDE (EIDE) is a much-upgraded version of IDE. All computers built since 1994 should have an EIDE hard disk controller and this provides many advantages over IDE. Firstly, EIDE can support four devices (instead of two) which don't necessarily have to be hard disks. They can also be CD-ROMs or tape drives compatible with the EIDE standard. Secondly, IDE was always restricted in that it would not support hard disks larger than 528Mb. The third, but certainly not least, improvement was in the massive increase in data throughput compared with standard IDE. This massive speed enhancement puts EIDE on an equal level with SCSI as a high-end drive interface.

■ SCSI (pronounced "scuzzy") stands for Small Computer Systems Interface and is another standard for connecting hard drives and peripherals to your PC. SCSI hard drives are very fast and very expensive. They act as good interfaces for high capacity hard drives used as network file servers and for very high-powered scientific and engineering applications. For the average user, it is not really worth spending lots of extra money on SCSI, especially as EIDE now provides similar performance results.

•PCW Contacts

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