E-IDE add-ee-oh

Tread lightly through the seven steps to installing an Enhanced IDE hard disk: your PC's performance depends on it. Roger Gann is your guide.

In last month's column I showed you how to upgrade your PC to Enhanced IDE, which not only allows it to see the full capacity of today's enormous hard disks, but gives you other benefits, too, such as lightning-fast data transfer rates and a second IDE channel for other devices such as CD-ROM drives and tape streamers. This month I'll be completing the job by taking you step-by-step through the process of installing an Enhanced IDE hard disk and preparing it for use.

Fitting a bigger hard disk is perhaps the most popular upgrade that users undertake and it's not too difficult to see why. The arrival of Windows, and Windows 95 in particular, has led to an explosion in the amount of disk space occupied by a PC's operating system, it's applications and data. Given plenty of RAM, many older PCs are more than capable of running the new disk-hungry 32-bit operating system, but their small, 170Mb hard disks just aren't big enough to hold the new operating system as well as all your apps.

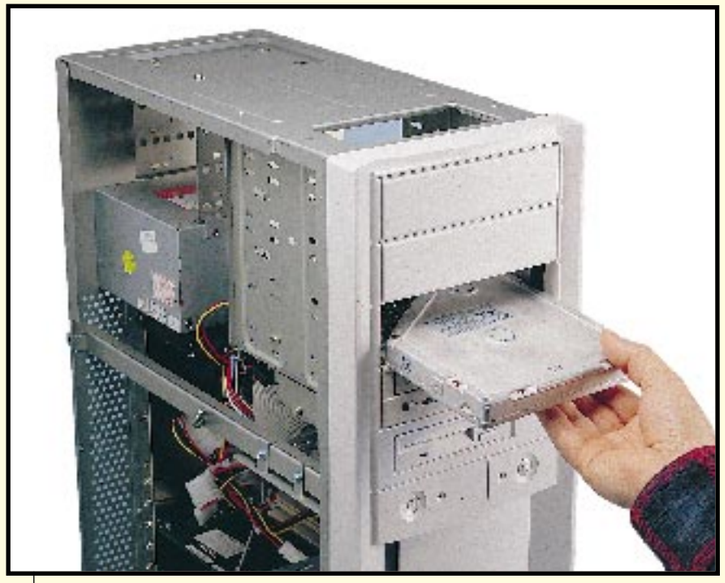
The hard disk I used in the upgrade was the latest Quantum drive, the 2.5Gb Bigfoot. This is different to any other Enhanced IDE drive you can buy simply because of its form factor. Unlike its rivals, which fit a 3.5in drive bay, the Bigfoot harks back to a bygone age and fills a 5.25in bay.

It's one of the cheapest EIDE drives you can buy, but it's not the fastest. This is partly due to its slower, 3,600rpm spin speed and the diameter of its platters, which means its heads have more ground to cover, resulting in a so-so average access time of 15ms. However, the larger platter size does have some compensation: its tracks are correspondingly longer and the heads thus don't have to move about quite so much. As a result, on small record transfers, its data transfer rate is up there with the market leaders.

Step by Step

Preliminaries

Take the time to prepare a bootable floppy and make sure it actually boots beforehand. Copy these DOS utilities on to it: FDISK, FORMAT, SYS and SCANDISK. Don't forget, we won't be using the special driver software that often comes with large drives, as we'll be relying on our new EIDE's interface card's on-board BIOS to support our new, large, hard disk directly.

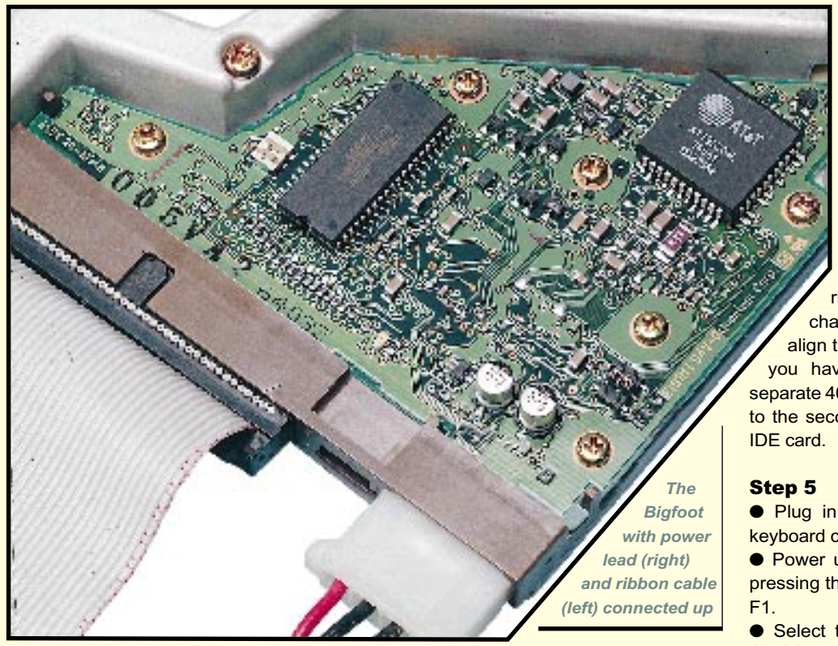


The Quantum Bigfoot is different to other EIDE drives as it will fill a 5.25in drive bay

Step 1

● Yes, I know it's boring and repetitious, but when you're dealing with electrical appliances you have to take safety precautions: so power down and unplug the PC from the mains, and disconnect all other leads, such as printers and mice. Before handling any electrical components, discharge any static electricity you might be carrying by earthing yourself: touch a metal pipe, for instance, or the PC's chassis; if you have an anti-static wrist strap, put it on.

● Undo the four or five screws and take the lid off of the PC.



The Bigfoot with power lead (right) and ribbon cable (left) connected up

Step 2

● Check out the drive fixings and where it's going to fit in the PC – you'll need a free drive bay for the new drive. The Bigfoot doesn't need any special mounting hardware but its 5.25in size means you'll have to put it in an externally accessible 5.25in drive bay, rather than a 3.5in internal bay, which is a minor niggle.

● Try and place it close to the EIDE interface as IDE ribbon cables tend to be short. Note that due to the very high data transfer rates made possible by E-IDE, you have to be careful about the ribbon cable used; for example, you mustn't use one longer than 18ins. Make sure you have the right mounting hardware, too, things like bolts or rails.

● Offer the drive up to the drive bay and make sure it doesn't foul anything else. Many modern drives list the geometry details on the label, so make a note of this before installation. If this drive replaces an older drive, remove it.

Step 3

● As we're fitting a single drive, there's no need to move any jumpers on the drive and it should work in its default configuration. However, if you're adding it as a second drive, one drive will have to be nominated as a 'master' and the other as a 'slave' – this will entail some jumper-shuffling on both drives, so have their respective user guides handy. Luckily, most modern drives now feature explanatory labels which describe the jumper settings and drive geometry, and this is true of the Bigfoot. At a pinch, if you can spare the second IDE channel, you can always leave the original drive as a master and simply plug it in to the secondary IDE channel.

Step 4

● Slide the drive into a vacant 5.25in bay and tighten up the mounting bolts. Insert a spare power lead (which can only be fitted one way).

● Now fit the 40-way data ribbon cable to the drive. Most modern ribbon cables are polarised to prevent you from inserting them the wrong way round, but others aren't, so look for a red or coloured stripe on the ribbon cable. This indicates 'Pin 1'; look at the socket on the drive (and on the interface card) for the Pin 1 label to correctly orientate the plug.

● Plug the other end of the ribbon into the primary E-IDE channel interface, making sure to align the coloured edge with Pin 1. If you have an IDE CD-ROM, use a separate 40-way ribbon cable to connect it to the secondary IDE channel on the E-IDE card.

Step 5

● Plug in the mains leads, video and keyboard cables, and power up the PC.

● Power up and enter CMOS setup by pressing the appropriate key, e.g. DEL or F1.

● Select the hard-disk option from the CMOS setup menu. Many modern BIOSes now offer auto-detection; they'll interrogate the drive's firmware to find out its values. Choose this option, if available, otherwise select Drive Type 47 or 'User defined'. This allows you to plug in the drive geometry values manually; these will be detailed in the documentation and, most probably, on the drive itself. You'll be asked for the number of cylinders, heads and sectors per track, plus exotica like Write Pre-compensation and Landing Zone.

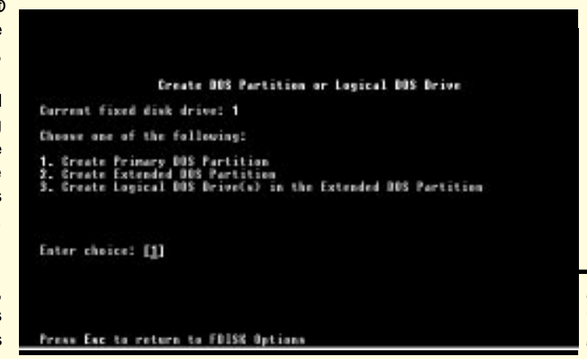
● Save the changes and quit Setup. Reassemble the PC, put the lid back on, do up the screws, plug all the cables back in and power up the PC.

Step 6

● We now have to partition the hard disk. This is done using FDISK, so boot from your previously prepared bootable floppy and load FDISK.

● Select 1 (Create DOS Partition) and 1 again (Create Primary DOS partition). Choose to make the entire drive one partition if that is what you want (*but see overleaf*).

● Quit FDISK and



FDISK presents you with a list of simple menu options

Hard disk health and efficiency

If you read the section, ÒThe importance of partitioningÓ *(opposite)*, itÕs easy to see how storage efficiency, the ratio of wasted space (or Òoverhang Ó) to usable disk space, drops dramatically as cluster size increases.

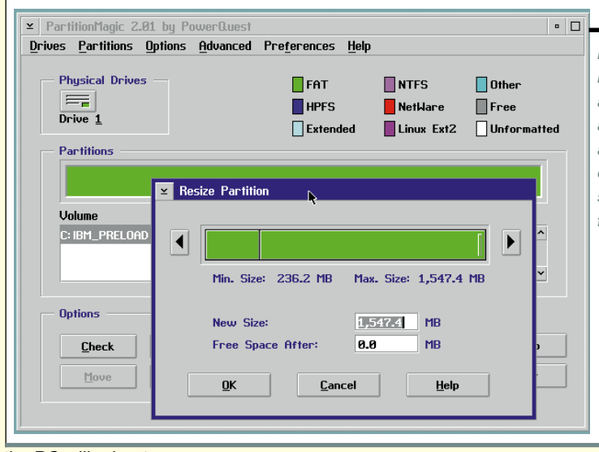
Luckily, there is a very simple solution to this problem, and that is to partition the drive into smaller volumes, thus reducing the cluster size and raising storage efficiency in the process. This is easier said than done, however: repartitioning canÕt normally be done on the fly and the process will zap all the data on your hard disk, so youÕll have to back it up first and restore it later. This is doubly irritating for purchasers of new PCs (which are typically supplied unpartitioned) who might want to repartition right away: these PCs often come with lots of pre-installed software as well, such as ÒOffice SuiteÓ bundled software, which is sometimes supplied without master floppies Ñ another twist of the knife.

Partitioning is carried out using the old DOS utility, FDISK. Simply delete the original single partition and create a Primary DOS Partition *just under* one of the size thresholds listed here (i.e. 255Mb or 511Mb, rather than 256Mb or 512Mb). Next, create an Extended Partition occupying the rest of the drive, and from this carve out Ò logical drivesÓ of 255Mb or 511Mb size. You then have to reboot and format each partition to make it usable.

So far, IÕve only come across one PC manufacturer, Gateway, that partitions new PCsÕ hard disks. The P5-200 comes with a 2.5Gb hard disk and the one I looked at was split into a 500Mb primary partition, containing all the program files, and a 2Gb extended partition. This was completely empty and so would be very easy to carve up with FDISK.

There are a number of alternatives to this painful route. Curiously, disk compression software such as DriveSpace and Stacker alleviates the overhang problem because it allocates file space on a per-sector basis. Stacker 4.0 is particularly efficient in this regard, as it allocates file space on a per-byte basis and so overhang is eliminated. It might seem daft to want to compress a huge disk merely to get over a DOS limitation, but there is a way around this. If youÕve got the Windows 95 Plus! Pack, itÕs possible to run DriveSpace 3 on a ÒNo compressionÓ setting on a drive partition up to 2Gb in size. This will give you high storage efficiency and minimal speed losses from running a disk compression utility.

Or, you can use PartitionMagic 2.0, which *does* allow you to adjust partition sizes on the fly. The latest version covers DOS and Windows 95 as well as OS/2. Written by US software developer, PowerQuest, itÕs available here in the UK from POW! Distribution (see *PCW Contacts*). Not only does PartitionMagic allow you to grow and shrink partitions at will, simply by grabbing an on-screen slider, it also overcomes the problem of file overhang and will dynamically resize disk clusters to smaller, more efficient sizes. It also increases the number of root directory entries to 1,024, which is useful under Windows 95 where long file names can



Partition Magic actually allows adjustment of partition sizes on the fly

the PC will reboot.

Step 7

● We now have to high-level format it, using FORMAT: boot from your system floppy and use FORMAT C: /S to format the drive and transfer the system files to it.

Once this has been done, remove the floppy and reboot the PC to ensure it actually boots from the hard disk. And thatÕs it. Your new hard disk is ready and you can start installing software on itÉ

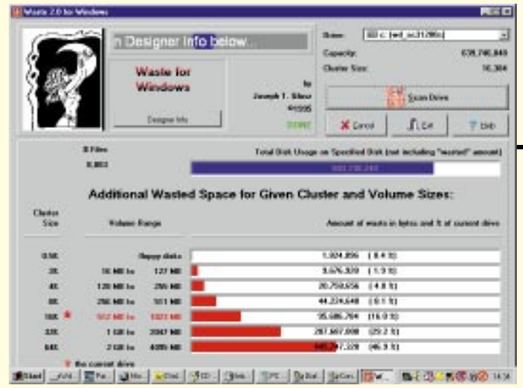
The importance of partitioning

But, thatÕs not quite ÒitÓ you see, weÕve partitioned our new hard disk in a particularly daft way; as a single volume. While this undoubtedly makes for a simple life (after all, you only have to deal with just one drive letter), because the disk is so large, it also makes for very inefficient use of its space.

I illustrate this with an old chestnut I always trot out: a friend ran out of space on a 500Mb drive so he bought a new 1.1Gb drive, partitioned it as a single volume, and copied the contents of the 500Mb drive over to the new one. On this new drive, the data took up not 500Mb, as you might expect, but closer to 700Mb Ñ *shurely shome mishtake?*

The cause of this chronic loss of space can be traced back to the origins of MSDOS and MicrosoftÕs decision to use a File Allocation Table or FAT file system. Originally, each entry in the FAT referred to a single 512-byte sector on the hard disk. Unfortunately, the FAT isnÕt open-ended and has a fixed maximum of 65,536 entries. This one-to-one FAT entry to disk sector mapping was okay for disks up to 65,536 x 512 bytes or 32Mb in size. In fact, up until MSDOS 4.0, 32Mb was the maximum size of hard disk supported by DOS. But how does DOS cope with disks bigger than 32Mb?

Simple: it breaks the one-to-one FAT entry to disk sector relationship by making each FAT entry represent *more than one* disk sector. So, for drives up to 128Mb in size, each FAT entry represents a 2Kb ÒclusterÓ of four 512-byte sectors. And from there on up, as disk size doubles, so does cluster size: up to 256Mb itÕs 4Kb/eight sectors; up to 512Mb itÕs 8Kb/16 sectors, and so on.



This monthÕs cover CD has a selection of hard-disk utilities including Waste for Windows, which analyses your hard disk for wasted space

Drive Capacity	No. of sectors	Cluster size
<128Mb	4	2Kb
128Mb to 255Mb	8	4Kb
256Mb to 511Mb	16	8Kb
512Mb to 1Gb	32	16Kb
>1Gb	64	32Kb

Note that both Windows NT 3.51 and OS/2 Warp use superior file systems (NTFS and HPFS) and so arenÕt afflicted with this problem.

HereÕs how this arrangement becomes inefficient: under the FAT file system, disk space is allocated to files in whole clusters, and a file canÕt occupy less than a cluster. So, if you have a 4Kb cluster, a 1Kb file will consume one cluster and the remaining 3Kb of disk space in that cluster is unusable, which is tragic but acceptable. But if you have a large hard disk, with, say, 32Kb clusters, this Òoverhang Ó of wasted space rockets to a massive 31Kb, which is very bad news indeed.

A 1Kb file is an extreme example, but on average, every file will waste half a cluster. So if youÕve got a 1.2Gb hard disk, this means that every file will be wasting 16Kb of disk space. When my aforementioned friend moved his data from a 500Mb drive to a 1.1Gb drive, he ÒcrossedÓ two jumps in cluster size, from 8Kb to 32Kb, and in so doing lost 200Mb of disk space; about 20 percent of

PCW Contacts

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PartitionMagic 2.0 costs £69.95 (plus VAT and P&P) from POW! Distribution **01202 716726**