New kit on the block

If your PC has lost its performance edge, it may be time for an overhaul. We show you how to upgrade your CPU and memory, and install a hard disk and DVD-ROM drive

Are you satisfied with your PC's performance? Perhaps Word doesn't load fast enough, or maybe Photoshop's taking just a bit too long to process those images. Wouldn't it also be nice to play your favourite game with the smooth photographic detail you know is hiding under the surface? Then again, perhaps your hard disk has simply run out of space.

Yes, time flies and what once seemed like a state-of-the-art PC now more closely resembles a museum relic. But before you resign yourself to buying a completely new system, consider upgrading a few key components. Over the following pages we'll consider which upgrades will give your flagging system the best bang for your buck. Better still, we've got step-by-step workshops explaining precisely how to upgrade your CPU, install a new hard disk and fit a DVD-ROM drive.

CPU upgrades – the early days

Upgrading the CPU is the first step to improved PC performance, and your choices essentially boil down to what kind of motherboard you have, and how much effort you're willing to put in, as far as changing settings is concerned.

If you're after the easy life and simply want to remove the old chip and slot in a new one without changing any settings, then check out dedicated upgrade packages from EverGreen (www.evertech.co.uk), PowerLeap (www.powerleap.co.uk) and Hypertec (www.hypertec.co.uk). These may be pricier than buying a naked CPU, but you're paying for ultimate ease of use and the minimum of disruption. Many of these upgrades only work on certain systems, or demand a BIOS update, so always check with these companies before buying.

If you have a PC with an Intel 486 CPU, then your best bet is to go for PowerLeap's PL-586/133, which costs £42.50 ex VAT. It uses an AMD 5 x 86 chip, which will run between 80 and 133MHz, depending on the 486 it replaces.

Original Pentium or AMD K5/K6 users running between 75 and 200MHz essentially have two options. The first employs either an Intel Pentium OverDrive or an IDT WinChip, both running at 233MHz; EverGreen's Spectra 233 uses the WinChip and costs £69 ex VAT. A better bet, if your system is compatible, is to go for an upgrade based on a faster AMD K6-2 processor. EverGreen's Spectra 400 uses one at 400MHz, and costs £119 ex VAT.

If you have a Pentium Pro, head on over to Hypertec, which offers a significant upgrade with its HyperRace Pro. Shelling out £213 ex VAT gets you a 700MHz Celeron upgrade package that just slots straight into any Socket 8 Pentium Pro system.

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GREAT EXPECTATIONS

The PC industry revolves around backwards compatibility but, sadly, that doesn't mean that the latest chip can simply be slotted inside your aging PC. For starters, it'll probably be the wrong shape, and it's also likely to run at a different voltage. Then there's the sad fact that even if you could place a Ferrari engine in a Mini chassis, you still wouldn't make a sports car – you should ensure the components around it are of a similar grade for the best results. It's important to be realistic and not necessarily expect miracles from a basic upgrade.

The bible during the upgrade process is the manual for your motherboard. This will have all the information detailing the types of slots and sockets in your system and the fastest or largest components it can handle. Note that since writing the manual, there will almost certainly have been an update to the BIOS that will allow the motherboard to handle newer components, so it's essential to head over to the support section on the board manufacturer's website for further details.

If you've lost the manual, fear not, for most of the manufacturer websites keep copies in electronic format. If you've lost the manuals and don't know the manufacturer, then still fear not, for the BIOS presents a String ID code upon startup that can identify the brand and model. For further details visit www.motherboards.org/moboidtools.html.

Finally, any hardware upgrade will involve opening up your PC and delving inside. If you have a small case, it may be tightly packed in there, so ensure you have plenty of light, space and patience. If you have to unplug any cables to get at a slot or socket, make sure you remember where they went!

Pentium II onwards

The Pentium II processor was sold at speeds from 233 to 450MHz and used a new interface with the motherboard called Slot 1. Intel has since returned to a socketed CPU interface, but some fast Pentium III processors are still available in the Slot 1 form factor.

Sadly, you can't necessarily swap your PII for the latest PIII. While the Slot 1 is the same shape, the newer CPUs require specific support from your motherboard's chipset. The first PIIs between 233 and 333MHz were sold with motherboards using Intel LX chipset, whereas later PIIs running between 350 and 450MHz required motherboards with Intel's newer BX chipset.

The LX chipset should support PPGA Celerons running up to 533MHz without modification, which may be available for about £40 from computer fairs or second-hand shops. Since the PPGA Celeron is a socketed CPU, you will need a 'Slocket' adaptor to fit them into a Slot 1 board, for example the Abit SlotKETIII, which is available from www.dabs.com (insert L7XWS in the quicklinx search box) for £12 ex VAT.

Owners of BX chipset Slot 1 motherboards have much better options, as they can accept just about any Pentium III or indeed Celeron CPU. Note that Celerons running faster than 533MHz, along with PIIIs running faster than 600MHz (or labelled with an E at the end), require a lower voltage which your motherboard may not offer.

The solution is to use a socketed 'FC-PGA' processor in a Slocket adaptor which features manual voltage adjustment. By changing the jumpers on the Slocket, it should instruct the motherboard to supply the correct voltage to the CPU – see How to upgrade an Intel Pentium II 350 workshop later. If the Slocket solution doesn't work, then you're limited to the CPUs running on the old voltage – that is, PIIIs up to 600MHz, without an E on the end.

If you already have a PIII running faster than 600MHz, your system should have no problem taking the very fastest PIIIs running up to 1,000MHz. Note that Celeron systems running faster than 533MHz should have FC-PGA sockets and hence also the ability to talk to the latest Intel PIII or Celeron CPUs.

AMD Athlon and Duron owners have an even easier upgrade path. If you have a Socket A motherboard, you can, in theory, pop in the latest AMD CPUs. But some older motherboards do not support the faster 266MHz FSB Athlons.

Owners of original Slot A Athlons running below 700MHz will need a new Socket A motherboard for a CPU upgrade, as there are no Slocket converters for AMD CPUs. Before you ask, it's not possible to put an AMD Athlon or Duron in an Intel Celeron or Pentium II/III system, or vice versa.

A new CPU may require a different front-side bus (FSB) speed, which will have to be set on your motherboard using physical jumpers or a BIOS adjustment; the main three settings are 66, 100 and 133MHz. In many cases the chipset will also drive the memory at the same speed as the FSB, so ensure that yours is up to the job – for example, an FSB of 133MHz requires PC133 memory. Some newer chipsets do, however, allow the memory to be driven at the FSB plus or minus 33MHz.

If you don't want to change your memory or indeed the FSB settings in the first place, then buy a new CPU that uses the same FSB speed as your original chip. Old PIIs running between 233 and 333MHz were on a 66MHz FSB, while PIIs between 350 and 450MHz were on a 100MHz FSB. Celerons up to 766MHz also use a 66MHz FSB, while PIIIs running at, say, 750, 800, 850MHz and so on (without the B label), employ a 100MHz FSB. PIIIs running at 866, 933 or 1,000MHz, or those with a B label, use a 133MHz FSB.

Memory

Increasing your memory is an extremely effective upgrade, especially if you have less than 64MB. The difference in performance can be astounding at every level, whether you're upgrading from 8 to 16MB, 16 to 32MB, 32 to 64MB or even 64 to 128MB. Windows goes faster overall and you can have more programs running at the same time. Over the past few years, though, memory has come in a variety of incompatible shapes, speeds and sizes, so the key to any upgrade is identifying what kind your PC requires.

If you have a PC with an Intel 486 or Pentium Pro processor, then chances are it uses SIMM memory cards. The oldest models employ 30pin SIMM cards, which need to be fitted in identical foursomes. These PCs usually feature eight SIMM slots. You used to be able to buy 30pin SIMMs up to 8MB each, but they are now quite hard to come by outside computer fairs and second-hand shops. Later 486s use wider 72pin SIMMs, which can be fitted one at a time and in different capacities; the fastest are called EDO.

These 72pin SIMMs are still available in 8, 16, 32, 64 and 128MB sizes, but are much more expensive than modern memory cards – 64 and 128MB 72pin SIMMs costs around £130 and £250 ex VAT respectively. Early Pentiums

HOW TO FIT A DVD-ROM DRIVE

1 With a DVD-ROM drive in your PC, you can watch great-quality movies and use the latest mega-encyclopaedias. DVD drives can also read CDs and they work in exactly the same way as conventional CD-ROM drives, so you could simply remove yours and swap it for a DVD-ROM drive. However, we want to keep our existing drive, as it may be a CD writer. Note that for standard DVD compatibility, you should be running Windows 98 or later.
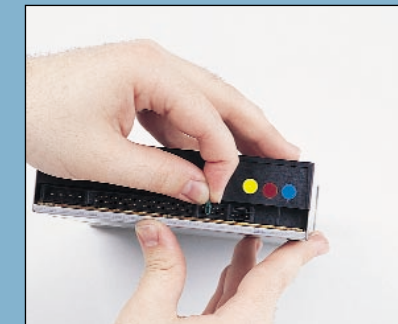

2 We're going to connect the DVD-ROM drive to the same cable/EIDE channel as the existing ROM drive, so one will have to be the Master and the other set as the Slave. It doesn't really matter which is which, so we'll leave the existing drive as the Master and set the jumper on the back of the DVD-ROM drive to Slave. The PC will assign an earlier letter in the alphabet to the Master drive.
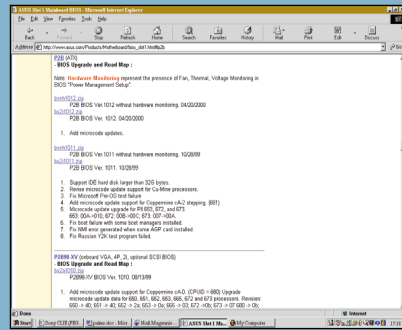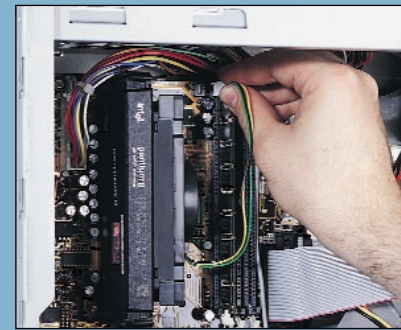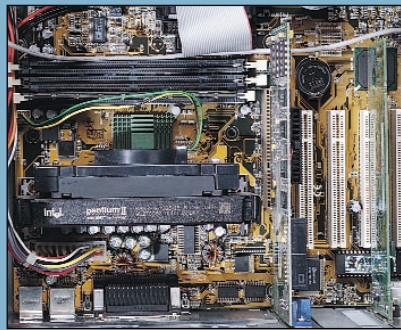

3 Now physically fit the DVD-ROM drive, by opening the PC case and sliding the drive into a spare 5.25in bay, usually below the existing ROM drive – you will also have to unclip a plastic panel on the front of the case to access the drive once it's fitted. Once slotted into its spare bay, screw it in securely. If there's only room for one 5.25in drive, then you'll need to replace your existing ROM drive with the new DVD model.
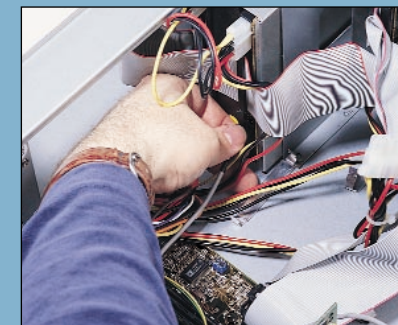
4 The wide flat ribbon cable from the back of your existing ROM drive should have a spare connector halfway down it. Connect this to the back of the DVD-ROM drive. Next connect a spare power plug – the ones with four coloured wires. Finally, there's an audio cable that takes CD music from the drive to your sound card. It's up to you if this is connected to your existing ROM drive or the new DVD. Some sound cards have a pair of plugs to take audio from two drives.
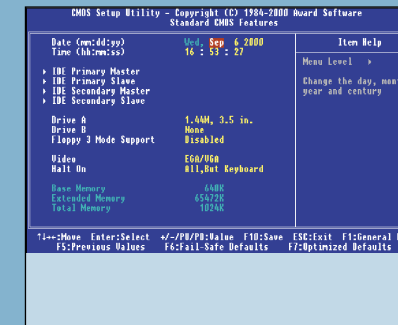
5 Your PC will have to know about the new drive, so switch it on and press DEL to enter the BIOS setup. In the first page of Standard CMOS Settings, ensure both the Secondary Master and Slave are set to AUTO. You may also have to go into the Advanced CMOS settings and Enable both the Secondary Master and Slave. Finally, choose the option to Exit, saving changes. Once restarted, your PC should recognise the new drive.
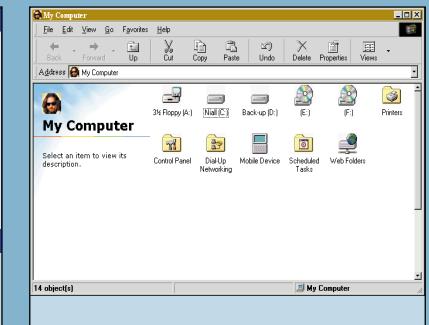
6 With Windows restarted, go to My Computer, where you'll see two ROM drives, labelled as D and E, or starting alphabetically after the last hard disk. If you have at least a 400MHz processor, you can now watch DVD movies with a software player. If your drive didn't come with one, consider MGI's SoftDVD MAX from www.mgisoft.com/video/dvdmax. Or you can buy it for £15 from www.dabs.com

QUICK TIP

Carefully study the manual for your motherboard as it will reveal your slots, sockets and the largest or fastest components that it can handle. You can download the manual from the motherboard manufacturer's website.
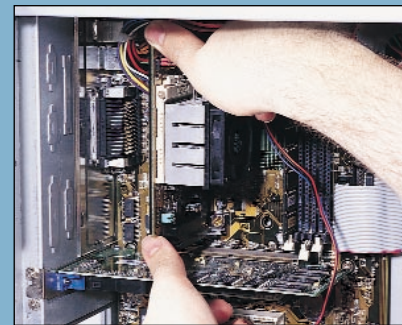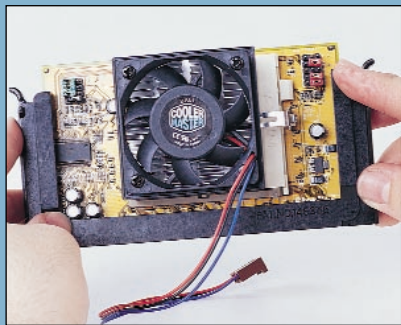
HOW TO UPGRADE AN INTEL PENTIUM II 350 TO A PENTIUM III 933

1 Some PCs are more upgradeable than others. One of the best systems to upgrade is a Pentium II with a motherboard sporting a BX chipset – check the main feature to see how to identify your chipset type. Our patient was an old 350MHz Pentium II system which used an Asus P2B motherboard, itself employing the BX chipset. Our goal was to upgrade it to a 933MHz FC-PGA Pentium III using an Abit SlotKETIII converter.

2 It's vital to update the motherboard BIOS to the latest version, in order to support modern chips. We checked the download pages of the Asus website at www.asus.com.tw, and found the P2B under the Slot 1 section. The instructions told us to download the latest 1012 BIOS and an updating utility, then copy them onto a bootable floppy disk. We restarted our PC with the floppy inserted, ran the updater and followed the instructions.
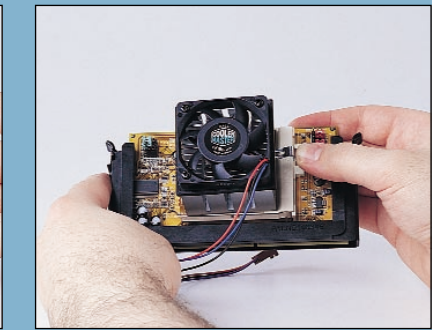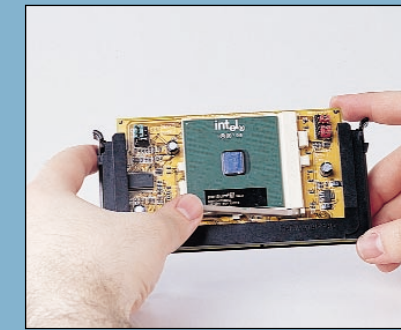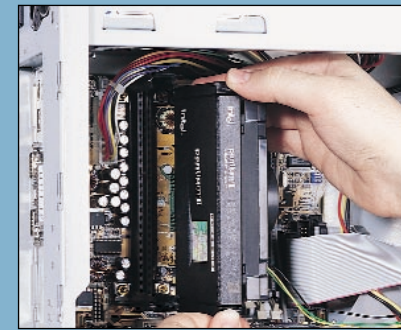
3 After unplugging the PC from the mains and opening the case, we wore an anti-static wrist strap to protect the internal components. The Pentium II cartridge is a rectangular black box about 2in thick and 4in long, which slotted into the upper half of the motherboard. Before removing the cartridge, we must first disconnect the power cable for its cooling fan from the board – this wire goes from the motherboard to the CPU cartridge.

4 Now we can remove the entire Pentium II cartridge. This is held in its slot by plastic retaining clips, which vary from system to system. Some should be pulled slightly outwards, while others simply require levers at the top of the clips to be pushed inwards. Either way, they will release the cartridge and allow it to be gently but firmly pulled out of its slot. Place it in an anti-static bag for protection.

5 Take the Abit SlotKETIII and pull open the lever on the side of the CPU socket. Now carefully take the new Pentium III CPU and insert it into the socket, ensuring that the CPU is the correct way round – it will only fit in one way. With the pins correctly lined up, carefully push the CPU all the way into the socket and push the lever down to lock the chip in position.

6 All CPUs need heatsinks and fans to keep them cool, so we bought a good one from www.overclockers.co.uk – any decent heatsink for an FC-PGA processor should do the trick. For best results, first spread a very thin layer of thermal paste on top of the small metal square in the middle of the plastic CPU frame – overclockers.co.uk also sells this. Finally, clip on the heatsink as instructed.

7 Pentium IIIs running faster than 600MHz or labelled with an E, along with Celerons faster than 533MHz, require just 1.6v compared to the 2v of earlier chips. Sadly, our old motherboard will supply 2v unless instructed otherwise. Fortunately, the slocket can do this by setting its voltage jumpers to 1.6v. Follow your slocket's instructions to set the correct voltage. You may also have to set a jumper to FC-PGA, Intel or 'Coppermine' to work with the 933MHz chip.

8 Now it's time to insert the slocket, complete with heatsink, into the empty Slot 1 interface on the motherboard. Turn it so that the heatsink is on the same side as the original Pentium II cartridge – this is normally with the heatsink furthest from your external ports. Now line up the slocket carefully inside the retaining clips, and gently but firmly push it all the way into the slot. Check to ensure it's gone in fully.
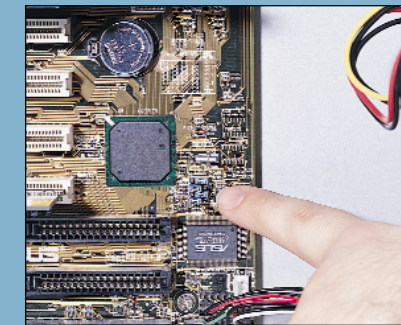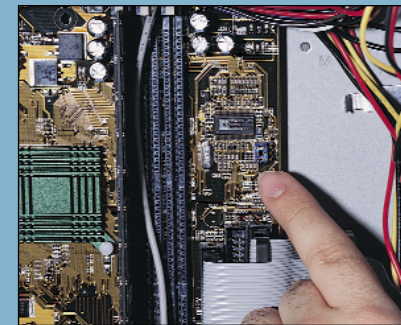
9 With the slocket in the slot and the retaining clips holding it firmly in place, it's time to connect the power plug for our new CPU cooling fan. This simply goes into the same plug where the old one was disconnected – it'll normally be labelled CPU-FAN on the motherboard. This plug has three pins, so make sure it's connected properly. It'll also only connect one way round.

10 Our old PII 350MHz used an FSB setting of 100MHz, but our new 933MHz PIII requires a setting of 133MHz. Most older motherboards change their FSB using jumpers identified in the manual, and on the P2B these are labelled FS0 to FS3. These should all be set to 1-2 to drive the FSB at 133MHz and the PCI bus at the correct 33MHz setting. Note that we will now need to use PC133 memory.

11 The PIII 933 uses an FSB multiplier of seven-times, and we must change the 3.5-times setting of our old PII 350 accordingly, using jumpers on the board labelled B0 to B3; these should be changed from 1-2, 1-2, 2-3 and 2-3 to 2-3, 1-2, 2-3 and 1-2 respectively. If you want to use your old memory and FSB settings, choose a chip designed for a 100MHz FSB, like the PIII 800E. This will, however, need the multiplier set to eight-times.

12 You're now ready to switch on your PC. First things first: if nothing appears on the screen, and/or the PC starts beeping furiously, then switch it off and ensure the CPU/Slocket is properly pushed into its slot. If everything's OK, the system will start and briefly identify the new chip. If you're not sure, get a copy of WCPUID from the FTP download section of www.h-oda.com and run it in Windows to identify the chip.

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could also use 72pin SIMMs, but they must be installed in identical pairs.

Today's systems most commonly use newer and wider 168pin DIMM cards, which take SDRAM memory, and can be installed one at a time in different sizes. Most current PCs can take two to four DIMMs at a time, although check the maximum memory your PC can handle – some chipsets, such as Intel's 810 and 815, can only address a total of 512MB.

Note that SDRAM is available in speeds of 66, 100 and 133MHz, but the latter, also known as PC133, will also work at the lower speeds. Since PC133 costs virtually the same as slower SDRAM, it's worth buying in case you upgrade your processor or motherboard at a later date. A 128MB PC133 SDRAM DIMM costs just £38 ex VAT.

Bang for your buck!
Some upgrades represent much better value than others. A memory upgrade can work wonders for your old system, but it may be too uneconomical. If you've got a PC that uses 72pin SIMMs and has only 16 or 32MB, it's well worth doubling it. But if you want to seriously expand your memory, the price of a 128MB 72pin SIMM is the same as buying a fast 128MB SDRAM DIMM, plus an 800MHz CPU and a new motherboard to house them both. Which would you prefer?

Doubling the speed of your CPU may not double the overall speed of your PC, but it will make a significant difference in all applications. Again, though, there are some upgrades that represent better value than others. The ready-made CPU upgrade packages may be relatively expensive, but require little or no delving into FSB, voltage or multiplier settings – you just plug and play.

The 400-500MHz AMD K6-2 upgrades for 75-200MHz systems will significantly improve performance, and represent fair value at around £120. If you've only got a 180MHz Pentium Pro, then the £213 Hypertec up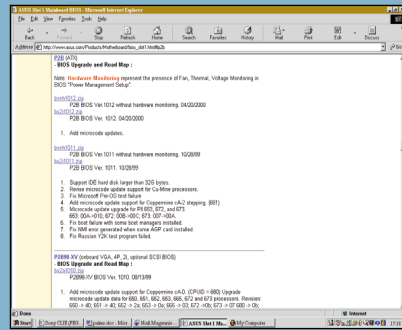grade to a 700MHz Celeron will also see a huge difference in performance. But look at the prices again. A naked 700MHz Celeron costs just £66 ex VAT, so you're paying quite a lot for the convenience of a simple swap. For £213 ex VAT, you could get the same 700MHz CPU, a new motherboard to house it, plus a 256MB PC133 SDRAM DIMM.

The people who can enjoy the best upgrading potential are those with Slot 1 motherboards, as they can talk to most of the latest components that remain reasonably priced. If yours has a BX chipset (PII 350 onwards), then you could upgrade all the way to a 1,000MHz FC-PGA Pentium III for £200 ex VAT, plus the £15 required for an appropriate Slocket converter to look after the voltage differences. You will,

HOW TO REPLACE YOUR HARD DISK
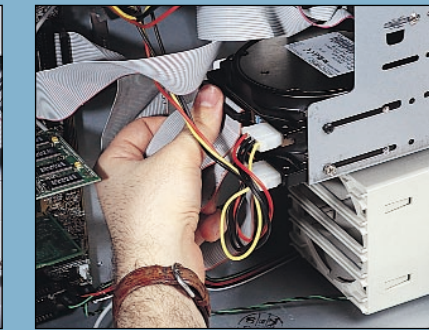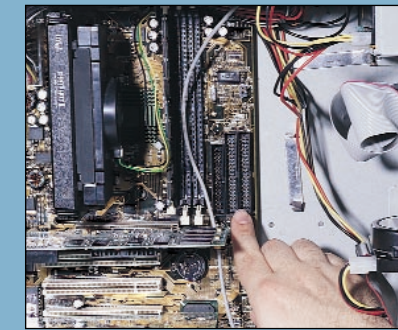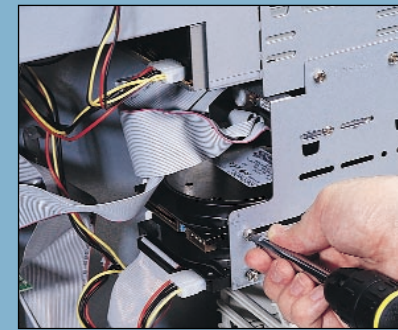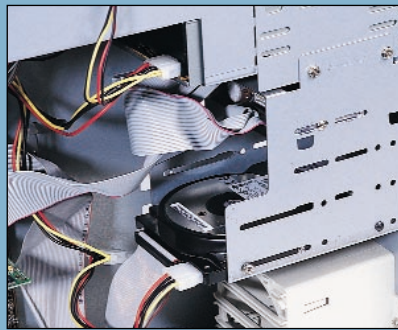
1 It doesn't matter how big your hard disk is, as you'll eventually fill it. Fortunately, it's dead easy to fit a new one as a Slave drive to your original Master drive, but here we're going to replace our old disk entirely for greater performance, capacity and reliability. We'll fit it, install Windows afresh, then copy our data over from our old drive. For a new installation, you'll need your Windows, drivers and application CDs.


2 To support large modern disks, it's essential to update the motherboard BIOS to the latest version. We checked the download pages at **www.asus.com.tw**, and found the P2B information under the Slot 1 section. The instructions told us to download the latest 1012 BIOS and an updating utility, then copy both onto a bootable floppy disk. We restarted our PC with the floppy inserted, ran the updater and followed the instructions.

3 As discussed in the introduction, we want the new disk to be the main 'C-drive', and in PC terms, that makes it the Master of the motherboard's Primary EIDE channel. There's normally a small jumper on the back or front of most hard disks that sets them to be either the Master or the Slave drive, but, since virtually every disk is delivered as the 'Master', we shouldn't need to change anything.

4 The next step is to open the case and mount the new hard disk. Most larger cases have space to accommodate at least one extra hard disk, so it should be easy to slide the new disk into a spare bay and screw it in securely at the sides. If your case doesn't have room, follow the rest of the steps and, once completed, remove the old disk and slot in the new one in its place.

5 Most boards have two EIDE channels, and each can support two drives, identified as the Master and Slave. Our new hard disk is going to be the Master, so we'll need to make the old disk the Slave by changing a jumper. This jumper will be on the front or back of the drive, and should be labelled. If it isn't, we can always plug it into the Secondary EIDE channel instead of the CD-ROM drive when we want to transfer its data later.

6 The flat wide 'ribbon' data cable should be unplugged from the old hard disk and inserted into the new one. This cable will have another connector halfway along it, and this should be plugged into the old disk. If your cable doesn't have plugs for two drives, then you can buy a new one for about £10. Finally, connect a spare power plug to the new disk. This will have four coloured wires going into it.
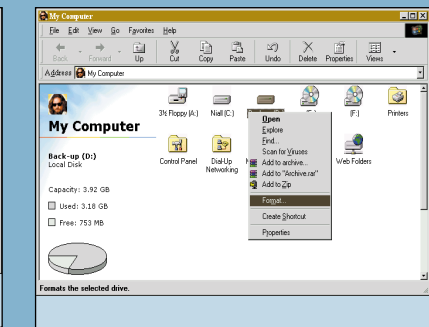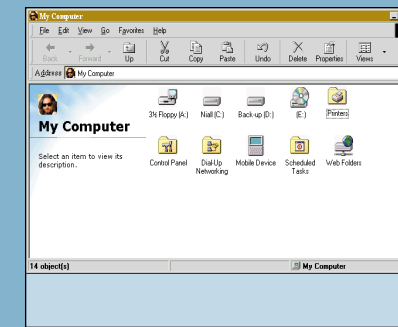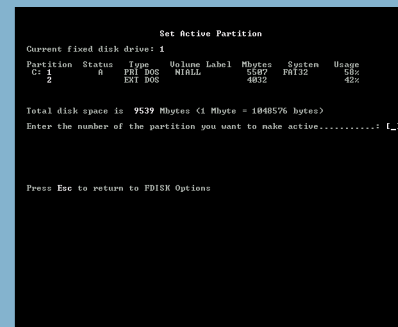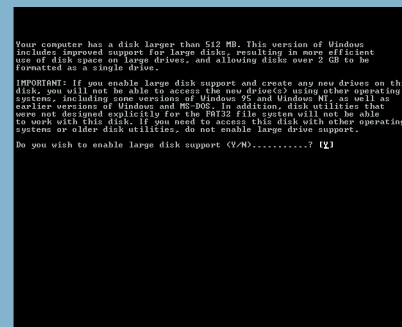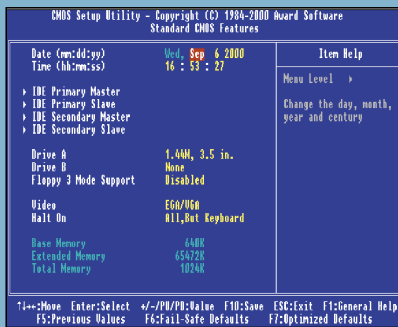
7 Your PC will now need to be told about the disks in its BIOS, so turn it on and press the DEL key to enter the Setup pages. BIOS settings vary, but you should normally start on the first page labelled Standard CMOS Settings, and set both the Primary Master and Slave to AUTO. You may also have to Enable the Primary Master and Slave in the Advanced CMOS Settings. Finally, choose to Exit Saving Changes.

8 Now you must partition your hard disk by inserting the Windows start-up floppy and CD, restarting your PC and selecting the option to start the computer. At the A:\ command prompt, type FDISK and say Yes to enable large disk support. Use option 5 to ensure you're working on your new drive (disk 1), go back to the main menu by pressing Escape, then enter option 1 to create a new partition, and 1 again to create a Primary partition.

9 While still in FDISK, ensure this new C disk partition is set as Active (main menu option 2), then press ESC and restart your PC. Boot from the Windows floppy and CD and choose the option to Setup Windows. This process will ask where you want to install Windows, and you should choose the unformatted space on drive C, as this is your new disk. The Windows setup will format the disk, which will take up to 30 minutes.

10 Windows will go through its normal installation process. This takes about 30-60 minutes and may ask for some information including the serial number (printed on paper inside the CD case), so make sure it's to hand. If Windows tries to start up from the old disk, switch off your PC and unplug the power cable to the old disk until your new installation is complete. You may prefer to have your old disk unplugged to ensure you don't accidentally repartition or format it in steps 8 and 9.

11 With Windows fully installed on the new disk, and the old drive reconnected if necessary, you can survey your hard work. Go to My Computer and you'll see a C and a D drive, with the CD-ROM now labelled as E. Drive C is your new disk, and D is your old one, so feel free to copy personal files from D to C, after which you can reformat drive D and use it as spare space.

12 Format your old disk by right-clicking on drive D and selecting Format – be certain this is what you want as the disk will be wiped clean! In the future you could add another drive, but always keep hard disks and CD-ROM drives on separate cables/EIDE channels, as the ROM drives will force the hard disks to run slowly. If you want more than two hard disks, buy an additional EIDE controller card to avoid connecting disks to the same cables as ROM drives.

however, need to ensure your motherboard is using the correct clock multiplier and FSB setting for the new CPU, and that your memory can handle a potentially higher speed – see How to upgrade an Intel Pentium II 350 workshop.

Such BX-based motherboards will also use SDRAM DIMM memory which, at the time of writing, cost just £70 ex VAT for 256MB. If your system uses DIMMs and has 64MB or less, then enjoy the currently low prices and upgrade to 128MB or higher. Most systems will greatly benefit from having up to 128MB and, if you're into graphics, video, or photo printing, then your system will appreciate more still.

Finally, if you're into games, then the best single thing you can upgrade is the graphics card. Even a modest PC can play great games if fitted with a state-of-the-art 3D graphics card, so consider upgrading if fast, smooth, detailed games are what you really desire. Do bear in mind that the latest graphics cards require an AGP slot on the motherboard, and older systems may only feature PCI slots at best. You can buy a GeForce2 MX and the Voodoos if you can find one in PCI versions, but they're not cheap and will again make you wonder whether it's time for a new motherboard.

Clearly, upgrading older PCs can be an expensive business, and you must decide for yourself if they're worth the trouble. Certainly you can insert faster CPUs, increase the memory and immediately enjoy their benefit, but their high cost will almost always match the price of a new motherboard plus superior memory and a fast chip.

It really boils down to whether you have the time, effort and ability to fit a new motherboard and effectively rebuild your PC, or if you just want a quick, easy fix. Remember, though, that new motherboards require 'ATX' power supplies and cases, and these didn't become common until the Pentium era. Even so, new cases and power supplies can be bought for around £60, so can still work out as part of an economical upgrade.

It's going to cost you quite a lot of money to upgrade a 486 or early Pentium system, but if you're after a quick and easy speed increase, it could be worth inserting a CPU upgrade or a small amount of extra memory. For really significant differences, though, the price outweighs the convenience and, if your CPU and memory upgrade is costing more than £300, we'd recommend considering a new motherboard with modern components instead.

If, however, you have anything from a Pentium II/BX chipset system onwards, then your upgrade options are cheap, fast and easy to fit. With little effort you can massively increase your memory, accelerate your graphics and seriously speed up your CPU.