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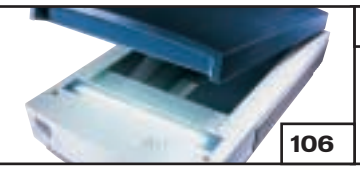

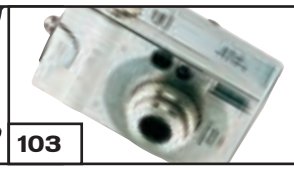

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Piracy of games and PC software is as rife as ever, but does Microsoft really have the answer?

Pirates ahoy!

I recently found myself in Hong Kong and, succumbing to an impulse of consumerism, I decided to go shopping for a shiny new PlayStation2. I ventured into the Golden shopping arcade on Kowloon and wandered the aisles wide eyed at the vast amount of computer entertainment housed under one roof. However, one thing amazed me far more than the sheer scale of the premises, and that was the modification that had been made to every PlayStation2 on sale. Every single retailer that I approached was selling PlayStation2 machines that had been 'chipped' for playing pirate software.

Even though the PlayStation2 incorporates a DVD drive, most of the software is still shipping on CD-ROM disc, so these modification chips fool the machine into playing games that have been copied to CD-R. Even the few games that do ship on DVD-ROM weren't safe, with ingenious pirates extrapolating the data and discarding non-essential files to bring the capacity below the 650MB CD-R limit. Considering how new the PS2 is, I was stunned that chips for converting it to play pirate software had appeared so quickly. Of course, the cynical among us will wonder if the machine was designed to be so easy to crack, making it a more attractive purchase. After all, it's doubtful that the original PlayStation would have sold so well if it wasn't so easy to chip up for cheap pirate games. Sony will, of course, deny this rumour and has already implemented a hardware change to get around the chipping. Although, no matter how good a mousetrap Sony comes up with, someone is bound to invent a better mouse.

Sega thought it had solved the piracy problem when it released its Dreamcast console. Instead of using CD or DVD technology, Sega plumped for a proprietary format called GD-ROM. The GD-ROM is basically a high-capacity CD that can store 1GB of data. The plan behind this design was that since no-one would produce GD-ROM writing equipment or even the blank media, it would be impossible to pirate the games. Unfortunately for Sega the proprietary format has not been enough to put off the pirates. Recently released on the web is a download that can be burnt to CD and run in a Dreamcast. Once inserted, this disc will display a new boot profile that will allow games to be run from CD-R instead of GD-ROM.

However, no matter how alarming the piracy situation on games consoles is, it's but a drop in the ocean compared with the PC.

Microsoft is currently in the midst of a big media campaign and crackdown on software piracy, feeling that it's losing millions of dollars as a result of it. That said, the situation is considerably different to the console market. A retail game costs in the region of £40, whereas a full retail copy of Microsoft Office Premium will set you back over £600. For some home users that's more than the cost of their PC. Obviously there are cheaper alternatives available but, let's face it, the PC productivity world revolves around Microsoft Office. I'm not condoning piracy here in any way, but I can't help thinking there'd be less of it if PC applications were more affordable to the masses.

Microsoft's solution to unofficial installation of its operating systems looks set to be the end of OS distribution. Instead of receiving the OS on CD-ROM when you buy a new PC, it will be pre-installed with a backup image on your hard disk. It will also be locked to the motherboard BIOS to stop the image being used on another PC. Unfortunately, I've heard no decent explanation of what happens if your hard disk crashes or if you want to change your motherboard, thus losing the BIOS key.

I'm not condoning piracy, but I can't help thinking there'd be less of it if PC applications were MORE AFFORDABLE TO THE MASSES

Of course, this plan will not only save Microsoft revenue through less piracy, but also save it millions by removing the cost of disc production and distribution.

Ultimately I think that every user would rather have an original product complete with manuals than a pirate copy, but consumers need to feel that they're getting value for money. If the price of essential software like operating systems dropped to a reasonable level the piracy market might start to wither and die.

Riyad Emeran, Editor

PERSONAL COMPUTER WORLD

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WELCOME TO THE SEPTEMBER 2000 PERSONAL COMPUTER WORLD COVER DISCS

September COVER DISCS

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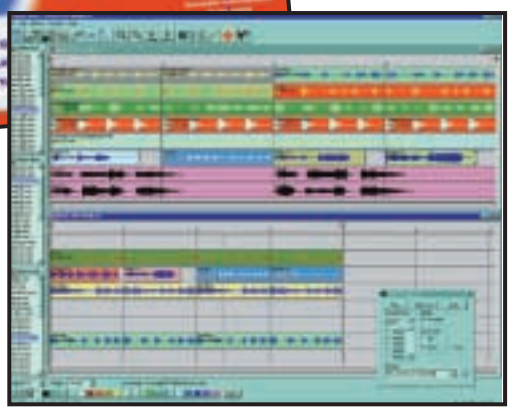
Starring this month is the full program of the award-winning MAGIX music maker 2.0, plus a sound pool of more than 780 music samples. We've also got Xara 3D – to help you create great-looking, 3D text headings for use on the web. To avoid getting bitten by the next computer virus, we've got protection in the form of AVG AntiVirus 6 (free edition) – a capable and comprehensive anti-virus package that even includes free monthly updates. You'll also find MusicMatch jukebox, PC MacLan trial version, Aquatica screensaver, and the powerful email package, Eudora.

MAGIX Music Maker 2.0 FULL VERSION *see box below



You don't need to be able to sight read music to benefit from MAGIX Music Maker. Just stitch together the hundreds of samples available here and come up with your own top 10 hit!

MAGIX Music Maker 2.0 makes it easy for anyone to compose music, quickly and intuitively. You need no musical training – just good ideas. Drag and drop music samples from the huge sound library directly into Music Maker's eight-track arranger.

Features include an unlimited mixdown function (so you won't run out of tracks); professional effects such as reverb, echo, filter, distortion, fade-in and out and media link for video-soundtrack editing and MIDI integration.

The basic elements needed for creating music are all included on the cover disc. Professional music makers and sound designers have created hundreds of samples (music and sounds) which are just waiting to be arranged by a simple mouse click.

All the important functions operate while playing, meaning that you can load another sound from the CD and place it, move it, blend it or even delete it again without interrupting playback.

All the samples on the cover disc are in 16bit, stereo and at 44.1 KHz – absolutely top CD-quality. If, however, you want to save memory or use the arrangement for video sound mixing, you can convert the music maker samples to 22KHz and/or mono. This way you'll save up to three-quarters of your memory capacity and be able to make long arrangements using that much less juice.

The samples are listed in a structured order on the CD so that you can quickly find matching drum loops or harmonising chords. An arrangement made from multiple samples can be saved at any time in a single hard-disk file (MIX-function), so that memory can be freed up and more tracks for new samples made available.

Hardware requirements

Music maker runs on any computer with a 386DX CPU and 4MB of RAM or more, with at least 10MB of available hard drive space, VGA graphics card, CD-ROM drive, a 16bit sound card and Windows.

- We recommend a minimum 486/33 with 8MB of RAM and 100MB of available hard drive space(for MIX-files and effects).
- Music maker runs on Windows versions 3.11, 95 and NT.
- Synchronized playback of AVI videos requires 8MB of memory; 16bit colour is recommended.

Important

More than 780 music samples are included with MAGIX music maker – across many genres of music from rock and pop to house, techno and jungle.

*This software was originally sold as a two-CD set. In order to squeeze it all onto a single CD-ROM, we have had to leave out some of the files from the Sound Pool. The DVD edition of *PCW* contains the full set of 1,200 samples recorded at 100bpm, 120bpm, 140bpm, and 160bpm. (The CD-ROM edition, therefore, does not include the 160bpm samples for reasons of space, but we will be including them on a subsequent CD to complete your set.)

Xara 3D V1

FULL VERSION

Xara3D is a 'slimware' Windows application designed specifically for creating high-quality, compact 3D textual headings, either still or animated, for use on the web.

The fact that it is small and compact does not mean that Xara3D is low quality or produces inferior results compared to more complex 3D programs; on the contrary, it produces better output, and is faster than just about anything else.

'Bloatware', while often capable, includes so many features that most people never get to use more than 10 per cent of the functionality. It's often huge, impractical to download over the Internet, requires large amounts of disk space and is nearly always so complex that to use its advanced features takes a considerable learning effort.

Xara3D is designed to be a program that does one thing and does it supremely well. It is also dead simple to use. It's small enough to be easily downloaded from the Internet.

Xara3D produces high-quality three-dimensional text images and nothing else. These images would typically be used on web pages although they can be used anywhere. Xara3D can create animated rotating 3D images with ease (AVI movie or GIF). You have control over the text, the font, the depth of the 3D extrude, the type of the bevel on the text and the lighting. You can position and rotate the text just by dragging and it updates the image in realtime, interactively. You resize the image just by resizing the window. It couldn't be easier.

It's easy to make web pages more dynamic

Xara3D allows you to:

- alter the 3D extrude length
- alter the lighting (three adjustable lights)
- alter bevel (15 different bevel types with adjustable bevel size)
- alter the font and size as well as changing between matt and shiny text
- use real-time 3D positioning, simply by dragging the image on-screen
- quickly create smooth colouring with realtime shaded rendering
- select background colour or texture to match web page backgrounds
- full realtime anti-aliasing gives best possible on-screen quality
- output files as JPEG, GIF or BMP
- minimise file size and maximise quality through palette optimisation
- output animated GIF or AVI movie sequences of rotating text
- use any TrueType font – three fonts are included free

Reader offer

Xara3D 4 can normally be purchased over the Internet from the Xara site for about £26 (ex VAT), but readers of *PCW* can buy a full copy of Xara3D 4 at the upgrade price online.

Just follow the upgrade link on the cover disc or go to the VNU Business Publications offer page at: www.club.xara.com/x3dupgradevnu.asp.

A Xara3D 4 CD with the program, tutorial movie, Xara3D sample graphics, over 800 textures and 50 TrueType fonts, screensaver etc will be sent in the post.

Xara3D 4 runs under Win 95/98 or NT 4.0.

Full details on Xara3D 4 can be found at: www.xara.com/xara3d.

A comprehensive program walkthrough can be found at www.xara.com/xara3d/helpv4.

Using the cover disc

The *PCW* cover disc uses a web-browser-style interface. As well as cutting the time needed for development, content designed for the web can be easily ported to the disc (and vice versa). Compatibility issues are reduced as your browser has been installed to work on your individual PC. However, to get full functionality from it, you will need to use Microsoft Internet Explorer (version 4 or later). This is because we use a special ActiveX plug-in that allows us to install software directly from the browser, without all the options, dialogs and security warnings you normally get. Unfortunately, Netscape doesn't properly support this software. For non-Microsoft users, we've included a small installer that will run when you insert the disc, or when you run the program PCW.EXE in the root of the disc. Of course, you can still launch the main browser to read all about the software on this month's disc.

IMPORTANT

Please note that we cannot give support on individual programs contained on this disc.

If you have problems running the disc or any of its content, please follow these guidelines:

- Faulty disc (ie, the disc is physically damaged and will not load) – return the disc for a replacement to: PCW September cover disc, TIB plc, HelpLine Returns, Unit 5 Triangle Business Park, Pentrebach, Merthyr Tydfill, Mid Glamorgan CF48 4YB, quoting ref 'PCW Vol 23 No 9'
- You have problems installing/running the software. Check the support page on the CD, or the support website at www.pcw.vnunet.com/cd. You should also check the manufacturer's website
- For general difficulties call 01685 354726
- If you're still stuck, drop us an email at pcwcd@vnu.co.uk – we may be able to help

AVG AntiVirus 6.0 FREE EDITION

Reliable protection!

This special FREE version of AVG AntiVirus will help you protect your PC against attack and damage by computer viruses. As well as being completely free, it offers an excellent level of protection together with regular updates you can download from the web.

AVG Anti-Virus System's high detection rate is continuously certified by independent ICSA laboratories. AVG 6.0 Anti-Virus System uses the latest revolutionary technologies – Virus Stalker and Active Modular Core. AVG Virus Alert Network will bring you the latest information, the virus alerts and announcements of the latest AVG features through your email on a regular basis and absolutely free of charge. You can find out more by visiting the AVG website at www.grisoft.com.

Features of AntiVirus 6.0 include:

- AVG Resident Protection
- AVG Email Scanner
- AVG On-Demand Scanner
- FREE updates on a monthly basis
- Automatic Update feature
- Easy-to-use interface
- Automatic Healing of infected files.

In order to start using AVG AntiVirus you will need to register your software by visiting the AVG website and answering a few questions. You will then be given your own unique serial number. Registration is free, and the process is handled automatically!

Why not visit the AVG website for the latest information about AVG AntiVirus? Please note: you will need to have an Internet connection in order to register your copy of AVG AntiVirus.

Undelete 2.0 TRIAL

Undelete is a file recovery system designed and developed for use on Windows NT/2000 networks from the ground up. It provides an immediate file recovery solution for files accidentally deleted and lost between backups or faulty backups, and eliminates the need to search through backup tapes.

Undelete 2 captures and retrieves all deleted files, not just the ones that land in the Windows NT/2000 Recycle Bin, including files deleted over the network, from the Command Line or from within a program. It can restore files over the network with ease and even copes with those deleted from shared drives. Why not visit Executive Software's website to find out more?

www.diskeeper-europe.com

ZoneAlarm FULL VERSION

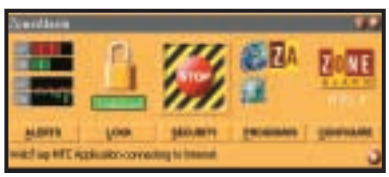
With the approach of unmetered Internet connections, PCs are becoming more vulnerable to intrusion. ZoneAlarm provides protection for all Internet users. Combining the safety of a dynamic firewall with control over applications' Internet use, ZoneAlarm gives protection against thieves and vandals roaming the web and makes ironclad Internet security easy to use.

If you think no-one's trying to get into your PC, give ZoneAlarm a spin – and be prepared for a shock! ZoneAlarm is a superb utility that you won't want to be without. To find out more about this program and check for the latest updates, visit www.zonelabs.com.

With Stealth Mode enabled, ZoneAlarm's Firewall renders your computer invisible to the Internet and potential intruders. If you can't be seen, you can't be attacked. Because you tell ZoneAlarm how you use your computer, the firewall only allows traffic that you understand and initiate.

You can feel even safer when leaving your computer because the ZoneAlarm Internet Lock blocks Internet traffic while your PC is unattended or you are not using the Internet. The Internet Lock can engage automatically along with your computer's screensaver or after a set period of inactivity – you have absolute control over the use of your always-on connection.

ZoneAlarm delivers comprehensive protection with its easy-to-use interlocking security services. Unlike any other security utility, ZoneAlarm incorporates a firewall, Application Control, the Internet Lock, dynamically assigned Security Levels, Zones and MailSafe. Combined, these elements yield the strongest security possible.



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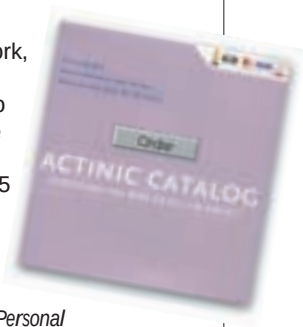

The Internet is no longer just a network, it's a marketplace. Entrepreneurs who use the web can be open for business 24 hours a day, 365 days a year – and find that sales are easier to fulfil and gathered at less cost. This month, *Personal Computer World* offers you the chance to set up and run your own online sales site with a free **30-day live trial** of Actinic Catalog (RRP £300 ex VAT) – the UK's leading ecommerce solution from Business ISP Zen Internet. (Actinic Catalog is an all-British product). Actinic Catalog is self-installing and easy to use. It enables you to publish an illustrated, online catalogue without design or technical expertise. You'll find more details on the cover disc.

PCW COVER DISCS BROUGHT TO YOU IN ASSOCIATION WITH:

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MusicMatch, Eudora and PC MacLan

MusicMatch is so versatile it will cater for all your musical needs, including MP3s

MusicMatch Jukebox 5.1, the software that lets you record, get, organise and play digital music, now also offers:

- FREE CD-quality MP3 encoding
- Seamlessly integrated CD burning
- Online artist bios, cover art, album notes, streaming sample clips, with links to other music you'll appreciate if you like the track you're listening to
- A new music matching feature – find music to match your tastes
- Auto-update feature – without having to download the whole program
- Stunning visualisations. Download and install direct from the jukebox. The one you mustn't miss is G-Force. You can get this from the MusicMatch site. Download and installation is performed seamlessly from within MusicMatch.

MusicMatch Jukebox is the fastest, easiest to use and most powerful personal jukebox software on the planet. It's the only free jukebox software that lets you record unlimited CD-quality MP3s. It features an easy, one-step process for recording MP3s from CDs, vinyl and cassettes. Industry-leading Fraunhofer MP3 encoding technology delivers recording speeds up to 12 times faster than real time – up to twice as fast as most other products. Integrated CDDB support automatically adds artist, album title and song names to new MP3s when connected to the Internet

Support for the ID3v.2 tagging standard lets you add cover art, liner notes, lyrics and artist bios to MP3s. There's additional support for recording in Windows Media Audio (WMA) and WAV formats.

The integrated 'two-click' CD burning system lets you create custom audio CDs or MP3 CDs containing up to 150 tracks. MusicMatch supports most standard CD-R and CD-RW drives. You can create compilation CDs using saved playlists or by selecting individual tracks – an easy-to-read capacity meter tells you when you've filled up your disc with music.

You can access and download more than 39,000 free tracks on the Internet. Songs downloaded from the Internet are automatically added to your Music Library. 'Buy CD' links let you purchase CDs from Amazon.com and Barnesandnoble.com. You can sample thousands of streamed audio clips and view cover art, liner notes and artist bios while listening.

System requirements: 166MHz processor or better; Windows 95/98, NT4 or Windows 2000; 32MB of RAM; 30MB of hard drive space; Microsoft Internet Explorer; SVGA or higher resolution monitor; four-speed CD-ROM drive; mouse; keyboard; SoundBlaster-compatible card; speakers; CD-writer installed and functional (for creating CDs in Jukebox 5.0); video card and installation of Microsoft's Media Player 6.4 for video.

Aquatica

If you liked the Microsoft's Windows Aquarium screensaver, you'll love this. Three-dimensional-looking, brightly coloured fish swimming around your desktop. You can even download additional backgrounds and fish from Club Aquatica.

Eudora Email version 4.32

This powerful professional-quality email software is now offered free. You'll find all the features you'd expect from a top-notch email client. Here are some of them:

- Find messages quickly with Eudora's powerful search functions
- Address emails quickly and easily with automatic name completion
- Manage multiple email accounts easily and discretely within the single program
- Send and receive email in the background
- Enjoy the advantages of a word processor with spell checking and the ability to choose font, formatting and colour settings
- Engage in more complete communications through easy handling of attachments and the ability to view HTML and graphics right in the body of a message.

Eudora lets you get creative with your email

Miramar Systems, Inc.

PC MacLan

Thanks to the recent success of Apple's iMac, many homes and offices will now have both PCs and Macs. If you want to find a simple way of getting the two platforms to talk to each other, there's really only one choice. If you want to connect Macs and Win 95/98 PCs in a peer-to peer network, you will need PC MacLan, from Miramar Systems. Windows 95/98 PCs access Mac resources directly through Network Neighborhood, while Macs view PC drives via the Chooser. The PC MacLans print services also permit your Windows 95/98 PC to print to any AppleTalk printer as if it were locally connected.

PC MacLan software for Windows 95/98 includes support for IP (Internet Protocol), giving your Windows 95/98 PC access to any AppleShare IP Server in your office, a branch office on your Wide Area Network (WAN), or any other location worldwide via either the Internet or standard phone lines.

This trial version will give you access to the full functionality of PC MacLan. The only restriction, other than nag screens, is that it times out after three hours, after which you will have to restart the connection again.

Important

The programs described on this page are not accessible via the *PCW* menu, but you can install them simply by using Windows Explorer. The installation files can be found in the following folders:

\Software\Aquatica\aq_scr.exe
\Software\Eudora432\Eudora432.exe
\Software\Musicmatch\mmjb51118eng.exe
\Software\PC_MacLan_trial\pcm72.exe

What's on the DVD

You'll find everything from the cover disc, plus all these great packages below, six months' worth of *PCW* group tests and the new Essentials section, packed with more than 50 utilities, add-ins, and demos. Finally, there's 10 of the best games demos.

M.Y.O.B version 6

The full version of the world's leading accounting and financial management package for small businesses. M.Y.O.B. provides everything you need to run the accounts of a small business, including:

- Nominal ledger
- Chequebook
- Flexible invoicing
- Records and analyses sales
- Tracks debtors and identifies slow payers
- Automatically creates and tracks purchase orders
- Records creditors; reminds of expiring discounts
- Handles quotes and estimates
- Flexible stock management
- Financial and management reporting
- Report customiser
- Job management
- Card file with contact management
- Custom forms designer
- To do list
- Interactive cash flow for 'What If?' analysis
- Officelink/script/link
- VAT reports
- Clear bank account reconciliation.

PCW readers can upgrade to the latest version of M.Y.O.B. at a discount price. You'll find details plus a form on the DVD.

AutoStreet 2000 Lite

Just in case you missed it last month, here's another chance to get your hands on the full version of this great new route-planning software, AutoStreet 2000.

PhotoPaint 2000/Ability Office

If you can't afford PhotoShop, the full version of PhotoPaint 2000 has most of the features, including layers, undo/redo, tons of filters and a professional range of tools. Image Enhancement tools include brightness/contrast, hue/saturation, colour levels and histograms.

There are complex selection tools for

applying changes even to only parts of images. Selections can be added or subtracted and manipulated with Border, Similar, Expand/Contract and Free Transform Tools. There's a powerful Gradient Editor, supporting Linear, Bilinear, Radial, Square, Conical Symmetric, Conical Asymmetric, Spiral Clockwise and Spiral Anticlockwise. PhotoShop only supports the first three.

The Brush Editor supports brushes of any shape, with user-controlled opacity, colour and mode. There are no fewer than 94 filters in 10 groups. PhotoPaint 2000 also supports 25 image file formats.

When you install PhotoPaint, a 30-day trial of Ability Office is also installed. Fully compatible with Microsoft Office, it offers spreadsheets, databases and a word processor.

Attica Interactive World Atlas

This is the essential multimedia reference atlas for education, business, and the home. Features include:

- Detailed mapping of the world
- Gazetteer of 150,000 places and geographical features
- Over 1,200 photos plus audio hotspots, 15 minutes of video
- Customisable maps
- Extensive countries database.

CheckIt 5

CheckIt 5 is a powerful 32bit Windows diagnostic utility that tests your hardware and reports system information. It helps you pinpoint problems, test system components, locate system conflicts and restore Windows' Registry and system files.

The first time it runs, CheckIt performs a multi-step collection process that gathers hardware configuration information and performance data. The Snapshot records this information for use in comparisons. In future, when the software checks out your system, if you don't get a smiley face, you've probably got cause for concern. CheckIt will then try and identify the problem. CheckIt includes benchmarking, too.

Ground Control

An adrenaline rush of real-time action and strategy, Ground Control is unlike any other real-time strategy. Features include incredibly detailed 3D landscapes and a controllable camera that allows you to view the battle from any position.

MDK2

MDK 2 includes all of the intrigue and humour established by the earlier title. But now there are even more enemies, weapons and items, plus enhanced character models and game levels.

Deus Ex

The year is 2052 and the world is a dangerous and chaotic place. Terrorists operate openly. Talk, fight or use your skills to get past the obstacles set in your path.

Need For Speed – Porsche

This demo gives you a single cross-country trip, racing against up to seven opponents – all driving Porsches.

Arabian Nights – episode 1

This new game from Visiware is a world first, in that it's being sold, in episodes, over the Internet. We've got episode one for you – Melissa's Letter – free. The graphics are superb, with an atmospheric soundtrack and locations and fast-paced action.

PCW group tests

Six months worth of product testing from the pages of *PCW*. The group tests are presented as Adobe Acrobat files.

Plus there's the *PCW* Essentials collection, extra hot game demos and much more.

Starting the DVD-ROM

The DVD should auto-start, just like the CD. If it doesn't, double-click the DVD-ROM icon in My Computer or, alternatively, run the file PCW.EXE on the root of the DVD. Check out the support website at **www.pcw.vnunet.com/cd** for late-breaking news on the programs on the disc.

Send your news and views to news@pcw.co.uk

news

edited by Clive Akass

contents

Gates fights back with new web platform and Java rival

Microsoft has come back fighting with a fresh assault on the web following the big anti-trust ruling that could force it to split into two companies.

It has announced a new platform called .Net designed to dominate the web as Windows has ruled the desktop. Bill Gates boasted that it will cost as much to develop as putting a man on the moon... £1.25b.

Components will roll out over the next three years, with some appearing this year.

Fundamental is the use of HTML's 'grown-up' sibling XML, which allows machines of any flavour to exchange structured information.

The strategy includes the launch of a new object-oriented language called C#, seen as a direct rival to Java. This will use Microsoft's Visual Studio development environment and is designed to allow C and C++ coders to use their existing skills.

There will be compilers for different hardware to give C# the 'write once, use anywhere' portability of Java. C#, which will be available this year in beta, will also talk XML.

Java is an increasing threat to Microsoft's development tools, despite resentment at Sun's tight rein on it (see page 36). Microsoft is trumpeting .Net's own use of open standards such as XML to allay fears that it is simply shifting the base of its hegemony.

Microsoft says non .Net devices will be able to interact with its systems, but the 'richest experience' will come from .Net clients. The platform will also require Microsoft development tools and third parties will be encouraged to create apps that work with Microsoft email, instant messaging, calendar, identity, storage and directory online services.

Microsoft is thus trying to hook users into services that could provide regular long-term revenues. Clearly, it also hopes to corner the emerging market in new appliances such as web TVs.

The craftiest aspect is what Microsoft calls the 'Universal Canvas', which makes a single working environment out of the operating system, browser and applications.

This has been the direction Microsoft has been pushing Office and Explorer for some time. Essentially, it means that the browser changes from being a largely read-only to a read-write environment.

It also sidesteps the break-up threat in a way that some believe will enable Microsoft to win whatever the outcome of its appeal – *see Tim Bajarin on page 44.*

WAP confusion

BT Cellnet countered claims that WAP services have flopped with figures showing it had sold 175,000 WAP phones in the three months up to July. But this does not show how many people are using WAP and it falls well short of a predicted 500,000 users, despite massive advertising and subsidies on handsets.

According to the *Financial Times*, the figure is further distorted by the fact that organised gangs have bought half a million subsidised phones from Cellnet and others for resale abroad.

Meanwhile watchdog Oftel criticised Cellnet for preventing some users from accessing rival WAP sites. User can now request an unblocking code.

Also on the WAP front, Microsoft has said Pocket Internet Explorer will not support WAP natively. Dilip Mistry, mobility solution marketing manager, told a TechEd conference in Europe: 'It is not a rich Internet experience for end users.' *More flak for WAP – page 38.*

Pentium 4 named

Intel's next-generation processor, codenamed Willamette, is to be called the Pentium 4, the company says. It will debut later this year at 1.4GHz and supports a 400MHz bus.

But the emphasis in the mainstream market seems to be shifting from processor speed to factors such as price and power consumption. *See Transmeta forces rethink – page 26.*

Samsung's 15in SM150MP and 17in SM170MP LCD panels, which include a TV tuner, let you watch TV while you work. They cost £999 and £1,819 ex VAT respectively. Telephone 0800 521652 for details

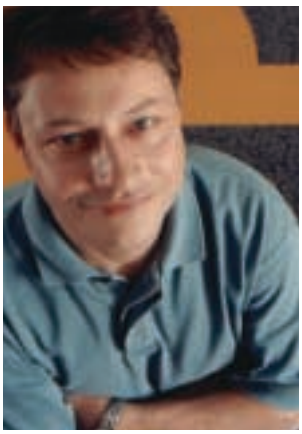
Short stories

ROAMING OFFER

A startup called Mint Telecom is offering global cards with no roaming deposits that allow you to use your mobile phone from anywhere in the world for a flat 85p per minute calling, or 42.5p receiving.

The service works with pre-pay phones that do not normally allow global roaming or require special deposits. But your phone has to be able to take a new SIM card – some operators lock them out – and, of course, must support the bandwidths in use in the area from which you call.

You pay £34 to sign up, but this includes 300 minutes of phone calls from anywhere.
www.mint-tele.com



DO ME A FAVOUR

Tim Ellis (above) has launched a site called Favourites Online where you can store your favourite web links for access from anywhere, effectively creating your own net portal. Also available at the site is a Java application that allows you to have the portal on your desktop, regardless of whether you are online.
www.onlinefavourites.com

FLIP TIP

A £48 utility called Flip Album enables you create photo albums on CD for distribution after events such as weddings.
www.printsbypost.com

PROCESSORS

Crusoe forces Intel rethink

Intel showed signs of being rattled about its chips' power consumption as several manufacturers demonstrated prototype laptops using Transmeta's low-drain Crusoes.

A couple of days before the Crusoe demonstrations at PC Expo in New York, it announced no fewer than five new mobile processors – including a 600MHz PIII, operating at 1.1v, which it said draws less than 1w 'on average' in low-power mode.

This claim was met with some scepticism, but the chip is sure to be considerably more frugal than the previous mobile 600MHz PIII which drew as much as 13w. Intel also launched a 750MHz mobile PIII and mobile 500MHz, 600MHz and 650MHz Celerons.

Intel's SpeedStep technique for limiting power has only two states, with clock rates and operating voltage switching down during battery operation.

AMD's rival PowerNow has 32 states, in theory allowing consumption to be tailored more precisely to changing needs. Crusoes can adjust their power drain by switching voltage and clock rates in 0.05v and 33MHz increments. They are said to draw as little as 10mw when 'ticking over' and average around 1w on typical tasks – a fraction of the consumption of Intel's recent mobile chips.

Crusoe-based DayTripper prototype webpad ...aiming for a day's work per charge

Screens account for more power drain than processors, but Transmeta's aim is to produce machines that run on one charge for a working day.

Gateway and AOL are jointly developing a Crusoe-based webpad and several vendors showed Crusoe models at Computex in Taiwan (see page 28), but the protoypes at PC Expo came from Fujitsu, Hitachi, IBM and NEC.

It is unclear if these will go into production. Leo Suarez, IBM's programme director for worldwide marketing, said: 'We need do some tuning of the power-management circuitry and talk to our customers to gauge their interest.'

Another contender in this market is National Semi-conductor with its integrated Geode chips. These have built-in graphics and other subsystems and are said to draw less than 1w.

Detlev Kunz, vice-president and general manager for Europe, said that power drain must be estimated on the basis of the whole system. 'A chip like the Crusoe will need more peripheral chips that also draw power,' he said.

Transmeta is working with S3 to integrate a graphics subsystem.

At issue is the importance of speed over price and power drain at a time when even entry-level PCs are more powerful than many need.

Battery drain will be critical in the market for webpads and untethered appliances. Even on desktops people may prefer to sacrifice speed for a chip that doesn't need a noisy fan. But it would not be hard for Intel to come up with competitive, low-power, lower-speed chips.

CLIVE AKASS
ADDITIONAL REPORTING BY JO TICEHURST AT PC EXPO

...as midfield chip battle hots up

Intel also launched three new Celerons to counter the threat from resurgent AMD in the high-sales desktop market where users are no longer willing to pay huge premiums to get the fastest and latest chips.

The 633MHz, 667MHz, and 700MHz Celerons, using 0.18micron technology, were announced only a week after AMD began shipping its well-received 600MHz, 650MHz, and 700MHz Durons, low-cost versions of the Athlon.

Volume prices for all six were virtually the same, adjusting for clock speeds: £86, £106, and £120 respectively for the Celerons; £70, £96, and £120 for the Durons.

Meanwhile, chipset maker VIA, already a thorn in Intel's side (see page 28), aimed for Intel's soft underbelly with the announcement of a Cyrix III chip running at between 500MHz and 600MHz for the value PC market.

VIA bought the Cyrix name and high-end x86 technology from NatSemi, but oddly the new processor is based on the old IDT WinChip. Prices for the chips, which use the old 370 socket, could be as low as £30.

Fast ADSL, slow rollout

A 'Love-Bug' type virus and continuing tests by BT have delayed the mass rollout of fast asymmetric digital subscriber line (ADSL), scheduled to start in July.

BT said service providers that will sell the high-speed connections had failed to provide sufficient triallists for high-volume tests to identify possible problems such as crosstalk, when signals in adjacent lines interfere with each other.

Installations were also disrupted when engineers imposed a two-week 'data freeze' after their files were hit by a virus. This effectively blocked all new installations, at least in the London area.

There were also signs that BT staff are still going through a learning process, with contradictory information being given to callers. One service provider was said to be 'incandescent' about BT delays.

But companies such as BT OpenWorld and Thus (parent of Demon Internet) are starting to install ADSL links for businesses – cheaper home connections will not be available until later this year.

ADSL piggy-backs an RF signal onto a standard phone line to provide always-on Internet access downstream at speeds of up to 2Mbits/sec – tests have reached as high as 8Mbits/sec. Initial services will offer 500Kbits/sec down and 256Kbits/sec up.

This is only one of several DSL technologies. US vendor Paradyne has accused watchdog Oftel of favouring BT by blocking Paradyne offering a high bit-rate digital subscriber line (HDSL) service providing a 2Mbits/sec link in both directions.

BT, which has a final say on what equipment can be installed on its network, claims this would affect its ADSL transmissions.

Lights, MiniDisc, action

Sony pioneered the use of the humble floppy for storage on its early Mavica cameras and it has used an MD (MiniDisc) drive on a video camera. Its 2.1megapixel Mavica MVC-1000 boasts a mini-CD writer providing 156MB of write-once storage on 3in CD-R discs (right). The model is due to ship in the US this August and prices are not yet known.

www.sony.com

Short stories

FLAT-RATE OFFER

A new 1p-per-minute 24 x 7 web access service provides better value than unmetered services, claims OneTel.Net. The company charges no connection or monthly fees and users do not need to switch phone companies.

OneTel.Net also claims that users will not suffer the slow and congested service that has been reported on some unmetered services. It says its service would cost the average home, spending between six and eight hours a month on the web, a maximum of £4 a month.

www.onetel.net.uk

0800 634 1954

HANDHELD RISK

Security experts have warned that virus writers could switch their attention from PCs to handhelds, which some believe will be the major web access device within a couple of years. Symantec has already prototyped an anti-virus product for the Palm Pilot. The company's chief technology officer Ron Moritz said ubiquitous new devices 'pose new risks and challenges'.

BT demands royalties from ISPs over hyperlink patent

BT claims to have invented and patented hyperlinks, which are fundamental to the World Wide Web, and is claiming millions of dollars in royalties.

The company is claiming the money from US service providers because, according to a BT spokesman: 'It is not practical to license every Internet user – it would be nonsensical.'

BT says the patent dates back to its early Viewdata online services that included Prestel. It applied for a US patent in 1976, but didn't receive it until 1989. Its hyperlink patents have expired in other countries.

The BT spokesman cited the high licence fees enjoyed by other technology companies. IBM alone receives in excess of £63m a year in fees for the use of its intellectual property. 'We only want what is fair,' the spokesman added.

Critics say the patent is invalid because others had the idea first. Some cite Ted Nelson's 1971 book *Dream Machines*, and its 1974 follow-up *Computer Lib*, which coined the word 'hypertext'.

Others trace the idea to a paper, entitled *As We May Think*, which was published by US academic Vannevar Bush in 1945.

Tim Pearson, a council member of Britain's ISP Association, said: 'It doesn't surprise me that this is crawling out of the woodwork because we've seen a general increase in the aggressive use of patents.'

He added: 'I don't think BT will win itself many friends.'

It's a counter claim from General Motors... they've filed a patent for the wheel

Riyad Emeran reports from Computex 2000 in Taipei and finds the future is twice as bright for VIA.

VIA unveils RAMBUS rival

Taking pride of place on VIA's stand was 266MHz double data rate (DDR) SDRAM memory. Existing PC SDRAM is either 100MHz or 133MHz, with only the hideously expensive RDRAM running faster.

This new memory will handle two processes per clock cycle and increase memory bandwidth to 2.1Gbytes/sec.

VIA has been working closely with industry leaders such as NEC, Samsung and Toshiba to ensure swift adoption of the new standard and should have a chipset that supports the new memory within a couple of months.

Both AMD and Intel are looking to support DDR SDRAM, so bus speeds and, consequently, overall system performance should see a significant increase in the near future.

See Gordon Laing – page 41

DVD+RW ready to roll

Philips was pushing its DVD+RW technology in Taipei. It's been over three years since Philips, Sony and HP broke away from the DVD forum to create a separate rewritable DVD standard, but we're yet to see any products.

One of the original arguments for DVD+RW was that it could store 3GB per side rather than the 2.6GB DVD-RAM standard. Unfortunately, it was decided that the 3GB version should not be released, instead waiting for the implementation of 4.7GB per side capacity.

The other advantage of DVD+RW is that the discs can be read in any DVD drive, whether consumer or ROM. Philips has shown many demonstrations of this compatibility, but we'll reserve judgement until we see a drive ourselves.

However, Philips had mock-ups of both a consumer video recorder and a ROM drive, based on DVD+RW technology.

Philips has assured us that the consumer video recorder will be available by the end of the year, with the ROM drive appearing in early 2001. We can't help feeling that we've heard it all before.

Palm pretender

Acer is a huge company that seems to be able to turn its hand to almost anything and now it's decided that Palm has had its own way for too long.

The Acer SlimMate is a PDA that, quite simply, looks just like the Palm V. Obviously there are a couple of cosmetic differences, but at a glance you would think that it was a Palm.

The SlimMate is powered by a 16bit RISC CPU running at 48MHz, backed up by 48MB of memory used for applications and storage. The operating system is designed by Acer and the monochrome screen looks every bit as good as Palm's.

What was most impressive, however, was that Acer already has several snap-on modules for the unit, turning it into a GPS tracker, or a GSM phone, or even a digital camera.

Unfortunately, Acer has no plans to release the SlimNote in Europe until some time next year, instead choosing to concentrate on the Chinese market. Consequently, there is currently no indication of price, but don't think about importing one unless you can read Chinese.

Crusoe handheld

Proving that it was more than just a groundbreaking news story, Transmeta put in an appearance at Computex 2000 (see page 26). Nestling on the FIC (First International Computing) stand was the Aqua 3200 WebPAD. This handheld web browser sports the Transmeta TM 3200 CPU, running at 400MHz, along with 64MB of onboard memory and a 16MB Compact Flash card. The device runs mobile Unix, displayed on its 7.4in, DSTN, 640 x 480, LCD touch screen.

Connectivity comes via the inbuilt, wireless LAN module, but it also sports USB and IrDA. It's doubtful that a device such as this will take off in Europe, since its functionality is limited. It does, however, prove that Transmeta has more than just good ideas up its sleeve .

Gentle PC leads from front

For a long time the desktop PC has shunned some great connection protocols seen in mobile devices. Although every motherboard since early 1996 has supported IrDA, we've never seen PCs with infra-red ports at the front. Likewise, the PC Card standard that's become a lifeline for notebook users never made an impact on the desktop, even though it would be a great feature. Add to this the fact that sound ports and USB connectors are always mounted at the rear of a PC chassis, making it a real pain to connect anything and you start to wonder if the PC was designed to specifically make our lives harder.

The Gentle PC – it all makes sense

Taiwanese company A-Standard Computer Systems has come up with the answer, the Gentle PC.

This slim PC system can be mounted flat or on its side, depending on your preference, but what's more impressive is the connectivity. At the front of the case you'll find an IrDA port for connecting to a notebook, PDA or mobile phone. Also, hidden behind a flap are a set of sound ports, a FireWire connector and a couple of USB ports. There's even a floppy/PC Card combo drive as an option.

Whether we see this box in the UK depends on whether a PC company decides to distribute it.

Short stories from Networks Telecom 2000

INTEL NETWORK
Intel launched a local network system for homes and small offices. The InBusiness product range centres around a server that incorporates LAN/Internet connectivity using ISDN or DSL – with a firewall, printer sharing and an eight-port 10-BaseT hub thrown in for good measure. However, the LAN support is for 10Mbits 10-BaseT only and there is no support for USB printers.
www.intel.com

SLEEPING GIANT
Digi International launched an ISDN adaptor card that accepts incoming fax, data or voice calls, even when the host PC is in sleep mode. The DataFire Micro takes an average seven seconds to wake up a PC, according to Digi. It costs £60 ex VAT.
www.digi.com

VOIP PHONE
Electronic Frontier launched a Voice over IP (VoIP) phone called the Ipico, manufactured by Lucid VON. It consists of a smart box that converts analog voice or fax audio from standard phones to VoIP data and routes it to similar boxes over a LAN or WAN. It can be connected directly to up to eight analog phone or fax ports, or connected to a small office switchboard.
www.elecfron.com

Ian Burley reports from Networks Telecom 2000 in Birmingham.

First GPRS handhelds

The spotlight was on emerging General Packet Radio System (GPRS) wireless links this year at Britain's big network show.

BT Cellnet, which has already launched a GPRS service for corporate customers, announced that later this year it will be trialling an adapted GPRS version of the stylish Blackberry email handheld that has been a success in the US.

The Blackberry, made by Canadian company Research in Motion (RIM), can work with Microsoft Exchange or Lotus Notes systems. It uses an i386 processor but lacks a web browser.

Vodafone, which is promising to launch its GPRS service by the end of the year, showed some pre-launch service demos, including WAP over GPRS.

RIM's Blackberry email platform. There is also a version with a larger screen and keyboard

Vodafone will be offering packages based around the Casio PocketPC and Psion handhelds.

GPRS has taken a bit of a back seat after the recent fuss about the third-generation Universal Mobile Telecommunications System (UMTS) broadband wireless licences. Early GPRS handsets are in short supply and delivering nothing like the promised 100Kbits/sec. Current systems deliver only 27Kbits/sec, about three times as fast as current GSM phones – although, unlike GSM, the GPRS service is always on.

A Cellnet spokesperson claimed the speed would increase to five times that of GSM in a few months, and to 100Kbits in less than a year.
www.rim.net

New boost for HomeRF

Bluetooth mania, after all the spring hype, was more subdued than expected, but there was a discernible increase in the profile of wireless LAN solutions. This is largely due to the widening adoption of the 11Mbits/sec 802.11 standard.

Nighthawk Electronics announced that it is adding Nokia 802.11 kit to its range and Elsa has introduced 802.11 products.

Wireless LAN specialist Proxim, of RangeLan fame, privately previewed its Harmony product line, aimed at enterprise and service provider deployments. Also highlighted was Proxim's proprietary OpenAir standard-based Symphony product range aimed at home and small-office customers.

In addition, Proxim is involved in the beleaguered HomeRF combined voice and data standard.

But HomeRF was recently given a boost with news that US federal restrictions will be relaxed to enable it to evolve into a higher performance standard – at the moment it is limited to a tenth of the maximum 802.11 data rate.

Proxim was basking in the afterglow of its finalised acquisition of rival Farallon. Farallon adds Apple Mac-compatible technologies to the Proxim armoury.

Proxim also let slip that it is working on wireless LAN products with integrated Bluetooth. However, Proxim dismisses suggestions that Bluetooth could be a wireless LAN platform in its own right.
www.proxim.com

PCs could pack 'data by mains' networking

German firm Polytrax was pushing its wireline networking, which uses a building's mains wiring for a local data network. The company is seeking trade and manufacturing partners to establish the technology in devices such as modems.

The technology, which is currently in prototype form only, is limited by European technical regulations to around 200Kbits/sec, but the unrestricted US market could push it to megabit levels.

Polytrax has more ambitious plans than wireline modems. A spokesman said its long-term goal is to persuade motherboard and PC manufacturers to integrate it into their hardware.

So maybe, one day, plugging your PC into the power socket will be rather more meaningful than part of simply powering up.
www.polytrax.com

Short stories

IBM THINKS LINUX
IBM has added support for Linux to two of its Thinkpad notebooks as part of its effort to push the open-source operating system further into the enterprise. Caldera's OpenLinux eDesktop 2.4 will come preconfigured on its A20m and T20. The company will also begin certifying other Linux distributors including SuSE, Red Hat and TurboLinux. Dell already offers Red Hat Linux 6.1 pre-installed on its Latitude CPx and Inspiron 7500 systems.

SMUT SURFERS
One in three UK web surfers, almost a third of them women, look at X-rated websites, claims a new survey. It also found that 40 per cent of the most visited sites contain porn. The number of UK Internet users grew by 15 per cent to 9.9 million in the six months to May, according to the research by Net Value. Of these 6.1 million were men and 500,000 were pensioners. The average time online also rose, by 84 minutes, to just over six hours a month – apparently as a result of free or low-cost unmetered access.

RAVEN DELAY
Lotus has postponed the release of its Raven knowledge management suite until the end of the year. The software, which aggregates Internet content and personal productivity files into a single portal, was originally expected to ship this summer.

HOME FIREWALL
A product from Symantec is designed for home users who fear that new always-on broadband connections will leave their machines vulnerable to intruders. Norton Personal Firewall 2000 costs £39.99 inc VAT.
www.symantecstore.com

Sun clings to Java reins

Sun faces increasing opposition to its tight rein over Java as the programming language celebrates its fifth birthday – and faces a new rival in the form of Microsoft's C# (see page 25).

But IDC analyst Rikki Kirzner said Java is challenging Microsoft's Visual Basic as the most popular means of developing applications.

However, Java has lost ground among the influential open-source community, where critics have accused Sun of turning its back on true standardisation efforts. Major vendors, especially Microsoft, are pushing for an independent standards body.

But Sun is committed to deciding on Java's technical future via its consultative Java Community Process (JCP). Pat Sueltz, software products and platforms group president, said Sun retained its tight hold to nurture the language and maintain innovation. Sueltz said: 'We did the same thing with the network file system with Solaris (Sun's version of Unix) and just turned that over to the standards body.'

Cambridge-based Tadpole's J-Slate handheld, which runs Java apps, was honoured with a nomination for Best Mobile Wireless Solution at the JavaOne developers' conference in San Francisco
www.tadpole.co.uk

But at the JavaOne conference in San Francisco, Sun appeared to be loosening its grip when it announced the creation of two executive committees to oversee the JCP, one handling desktop and server development, and the other dealing with embedded applications.

Gartner analyst Mark Driver said that, though this hardly constitutes democracy its does give JCP members, like IBM and Oracle, more input and control. He added that Java expects a number of vendors to release a range of devices using the revamped Java 2 Micro Edition.

However, if Sun's move does not satisfy critics there could be 'more aggressive efforts' to introduce compliant clones outside the company's control.

JOHN GERALDS, VNUNET.COM

Compaq iPAQs Linux in challenge to CE

In a blow to Microsoft, Compaq has ported Linux to its latest iPAQ H3600 handheld. The iPAQ was built around the latest PocketPC operating system, also known as Windows CE 3.0.

There is no question of Linux replacing the Microsoft operating system for the iPAQ but it could present a longer-term threat. The port is part of Compaq's Open Handheld programme, an initiative aimed at developing applications for mobile computers using open-source code.

PocketPC has been easily the best received version of Windows CE to date but the handheld market is dominated by Palms, especially in the US. Compaq was one of only five vendors at the PocketPC launch earlier this year to announce products based on the OS.

Linux for the iPAQ can be downloaded from a Compaq site: www.handhelds.com. However, the site warns: 'If this installation fails then your iPAQ could become unusable.'

Compaq is providing software components including drivers, X-Terminal emulation, handwriting recognition, touchscreen and multimedia support. It also provides hardware specifications for both the iPAQ and its Expansion Pack system.

See iPAQ review on page 89.

Additional reporting vnunet.com

Linux lovers get the bug

Linux fans were asking for trouble when they boasted of the open-source operating system's security in the wake of the Love Bug virus that struck Windows, only to be affected themselves. A bug in the kernel allows attackers to gain access to files through a variety of programs, including Sendmail. It affects versions 2.2.15 and earlier, and some 2.4.0 versions – code that exploits the flaw has been posted widely. Sendmail 8.10.2 has been released with a patch but users are advised to update their Linux kernel to version 2.2.16.

Psion is redefining portable radio in a way that could upset the 3G applecart, says Clive Akass.

Enter the DAB handers

Radio lovers are bound to feel ambivalent about Digital Audio Broadcasting (DAB). They will welcome the boost in quality and the fact that it does not trail off as you travel down the motorway. But a major attraction of radio is that it is sound only: it is an affable companion, not an attention-grabbing tyrant like TV. You can listen as you do other things. But will this be the case with DAB, which can carry non-audio data, including images?

The issue has been academic for most people until recently because DAB receivers have been prohibitively expensive. This hasn't prevented major radio stations offering DAB services – the BBC has invested millions in the technology over the past five years. The uptake is even higher in other European countries such as Germany.

Now, as we reported last month, Psion is about to launch an affordable (if not, at £299, cheap) DAB receiver called a Wavefinder (right) that links into a desktop PC via the USB port. More exciting is the fact that the company plans to marry the receiver to the handheld computer.

You might well ask what is the point: we have TV, so why not leave radio to the audio it does so well? In fact, at present, there is not enough bandwidth to deliver anything like a TV service. Regulations limit non-audio content to about 35Kbytes/sec per channel. This is around the data rate of a dialup modem but it is considerably higher than that available on GSM phones and even, in practice, emerging GPRS.

Currently, DAB data is used mainly to deliver scrolling text with information about music being played. The BBC has also experimented with sending pictures and 'carouselling', or repeatedly broadcasting, the top-level web pages of BBC Online.

Wavefinder should be an excellent way of experimenting with other uses before the system goes mobile. 'The point is that with the PC you get a back channel,' said Geoff Kell, commercial director of Psion Infomedia.

An obvious application here is for adverts or even music sales. 'You could hear a piece of music and buy it on the spot,' said Kell.

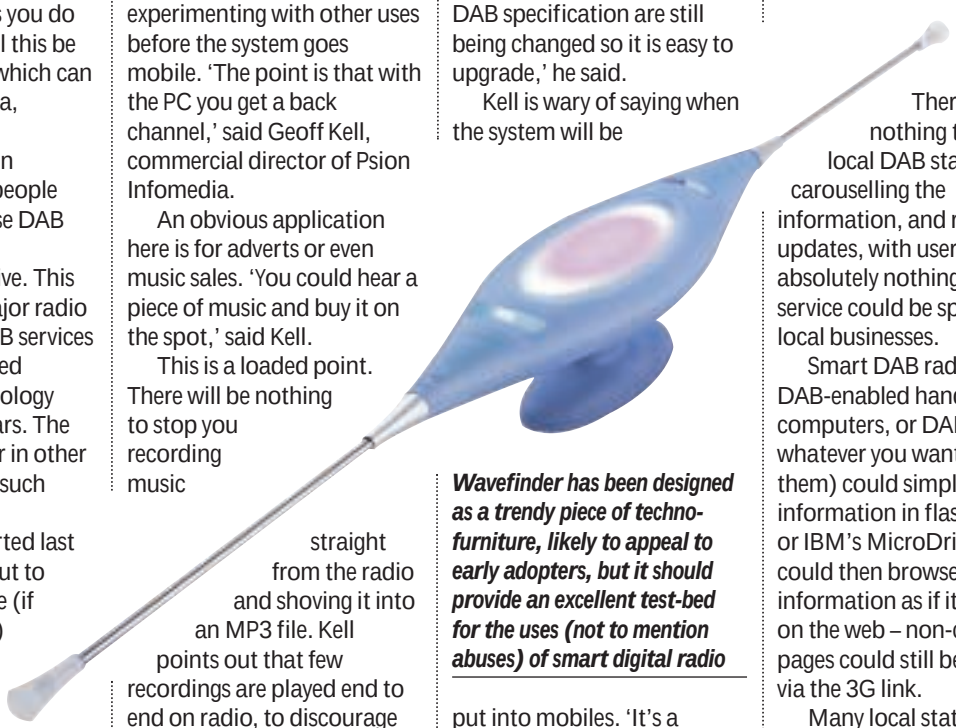
This is a loaded point. There will be nothing to stop you recording music straight from the radio and shoving it into an MP3 file. Kell points out that few recordings are played end to end on radio, to discourage piracy. However, with DAB the quality will be better than from analog broadcasts and the computer can make recording a simple drag-and-drop operation.

'We don't use the word copying. We say "time shifting",' said Kell ironically. Copying is illegal. Time shifting is a perfectly legitimate advantage of smart radio. You can choose what you want to listen to in advance and record it by simply clicking a listing. Then you can listen to it when it suits you.

At least you will be able to do this when the software is ready. Psion is still working on it. The version Kell showed me scans the airwaves to find available stations and lists them as icons on your desktop.

Psion has bought a 7.4 per cent stake in London-based DAB specialist RadioScape, its partner in the project. 'We are concentrating on a software-based solution because bits and pieces of the DAB specification are still being changed so it is easy to upgrade,' he said.

Kell is wary of saying when the system will be put into mobiles. 'It's a chipset issue,' he said. 'The chips used currently draw far too much power for something driven by a battery.'



Wavefinder has been designed as a trendy piece of techno-furniture, likely to appeal to early adopters, but it should provide an excellent test-bed for the uses (not to mention abuses) of smart digital radio

But of course mobiles too will have a back channel, either using GSM, GPRS or third-generation UMTS cellular links. Kell believes DAB will 'complement' the kind of services planned for 3G mobiles. However, if I owned one of the companies that invested billions in a 3G licence, I would look very hard indeed at DAB's ability to grab my potential revenues.

A big 3G money spinner is expected to be local information: you drive into a new area, prod your phone or mobile and get a list of nearby petrol stations, hotels, flower shops, traffic jams or whatever.

This is an extremely inefficient way to deliver the information because it is sent separately to each user, who has to pay a commensurately high premium. There would be nothing to stop local DAB stations carouselling the information, and regular updates, with users paying absolutely nothing. The service could be sponsored by local businesses.

Smart DAB radios (or DAB-enabled handheld computers, or DAB-hands, or whatever you want to call them) could simply cache the information in flash memory or IBM's MicroDrive. The user could then browse the information as if it were live on the web – non-cached pages could still be accessed via the 3G link.

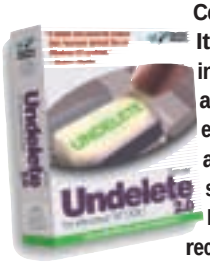
Many local stations already offer DAB and the rest are getting in on the act. They are not the only ones. ITN has done a deal with programme maker UBC to deliver DAB content. This will initially be targeted at Wavefinder users, but could clearly be extended to mobiles.

Kell agrees that, as with all these convergent technologies, nobody really knows how smart radio will be used. It is a technological canvas, awaiting the painter. But, when you can buy a good analog radio for a tenner, DAB prices will have to come down a lot more before the technology finds a mass market.

Short stories

UNDELETE 2K

Executive Software Europe claims its new Undelete 2.0 was only the second utility to be awarded Windows 2000 Certification.



It comes in network and server editions and also supports NT4. It can recover all deleted files, including those that bypass the Recycle Bin. A 30-day trialware version is on this month's cover disc or you can download it from www.undelete-europe.com

CELLPHONE CE

Microsoft and Samsung have launched a joint project to develop 'super cellphones' using Mobile Explorer and Windows CE 3.0. Their first GSM 'feature phones' capable of web browsing and accessing corporate intranets will ship later this year. Dilip Mistry, mobiles marketing director at Microsoft, said: 'These will be very inexpensive handsets.' Devices using the rival Symbian operating system are not expected to ship until next year.

HOT XML EDITOR

The latest version 2.0 of SoftQuad's XMetal offers a Word-like interface, supports validation, forms and script editing, and expanded customisation options. It is designed for people who need to re-publish the same information in different media. A sister product to HTML editor HotMetal Pro, it costs £300 per single-issue licence. www.softquad.com

NOTEBOOK ZIP

Iomega has launched an internal version of its 250MB Zip drive for use in notebooks. www.iomega-europe.com

WAP under more fire

WAP is coming under increasing fire even though online services are falling over themselves to open gateways for it.

A recent report from analyst Ovum warned that the technology, designed to deliver information for tiny mobile screens, was in danger of being overhyped. Foreign analysts have gone further, saying it is a dead duck.

Handheld market leader Palm has eschewed WAP for the new mobile portal it has launched in Europe. Meanwhile, arch-rival Symbian has licensed a non-WAP iMode from Japanese mobile provider NTT DoCoMo. This is based on a cut-down version of HTML and a packet-switched wireless protocol, which has a claimed 6.92 million subscribers in Japan and is adding 20,000 users a day.

David Potter, chairman of Symbian partner Psion, told business leaders at Europe's Seventh Annual CEO Summit in London: 'While WAP is very worthy, it is also a little boring.' He added: 'iMode is really interesting, offering entertainment, messaging, transactions, games and screensavers, and is inexpensive.'

Psion is also developing alternative delivery systems such as DAB (see page 37), which could cut into WAP revenues.

IT and customer service managers believe interactive TV will generate more sales than WAP and other mobile services, according to a survey by customer-service specialist Graham Technology.

Anti-wappers (this reporter included) argue that WAP is trying to do something that, for a mass market at least, will be practicable only when the cellphone is truly integrated into a mobile computer with a usable screen and input system.

Pro-wappers point to the huge, unexpected popularity of SMS messaging among young people despite the difficulty of keying text into mobile phones.

But WAP is far from dead. Michele Mackenzie, an analyst at Ovum, said it will improve when packet-switched GPRS services arrive in the UK. She added: 'There is a lot of industry backing for WAP and it is difficult to see it failing.'

CLIVE AKASS AND VNUNET.COM

IBM boosts MicroDrive to 1GB

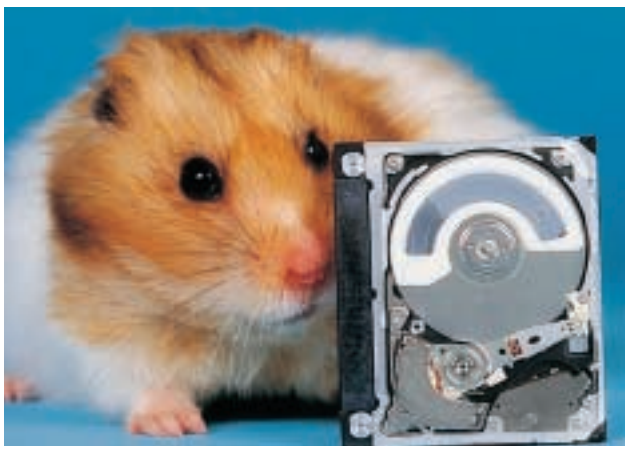
IBM has tripled the maximum capacity of its MicroDrive hard disk to 1GB – a density of 12.4Gbits/sq in and equivalent to 12 CDs.

IBM claims the drives, which fit into any Compact Flash II slot, support a maximum sustained data rate of 4Mbytes/sec – faster than flash memory.

Digital cameras are seen as a major market for the drives, which could store hundreds of high-resolution images. But cheap high-capacity storage could have a major affect on WAP services.

The more users have, the more easily they will be able to cache free-to-air music and programmes from DAB (Digital Audio Broadcasting – see page 37) or even TV satellite broadcasts.

Prices of the MicroDrive are nowhere near cheap enough, though the US price of the 340MB version will drop from around £312 to £186 when the new capacities ship this autumn. A 512MB one will cost about £250 and the 1GB around £310.



Small but cute – and the hamster's not bad either!

European product marketing manager John Fox said capacities will increase further and the cost per megabyte will drop. He said flash memory could not yet match MicroDrive capacities.

But those prices could come under pressure from solid-state memory if SanDisk president Eli Harari is to be believed. He predicted earlier this year that prices will drop by up to 30 per cent a year as capacities soar to the point where flash memory replaces all mechanical storage on mobile devices.

www.ibm.com/harddrives

NETWORKING

Intel is courting danger by backing RDRAM as rivals plug cheaper DDR, warns Gordon Laing.

Perils of fast memory syndrome

Most knowledgeable PC users could tell you that RAMBUS is the company behind RDRAM memory technology. Many will also have an opinion about RDRAM's price and performance compared to SDRAM. But few realise RAMBUS has been around for 10 years and owns patents for memory interfaces implemented in plain old SDRAM, not to mention Double Data Rate (DDR) SDRAM. In other words, RAMBUS owns intellectual property on virtually every computer system in the world.

Think about that for a moment: if RAMBUS exercises its patents, anyone who makes any kind of SDRAM memory owes it licensing fees. Indeed, the company has been chasing Hitachi through the courts claiming that SDRAM and DDR memory that the latter manufacturers infringes RAMBUS' patents. Hitachi has been pushing the anti-monopoly angle, hoping the other big memory manufacturers would support it.

Then on 15 June, memory giant Toshiba bit the bullet and signed a new licence agreement with RAMBUS for SDRAM, DDR SDRAM and the controllers that interface with them. Clearly on a high, RAMBUS unveiled the next day what it described as 'the world's fastest memory bus technology'. Combining DDR with multi-level signalling to transfer four bits per clock cycle, the new Quad RAMBUS Signalling Levels (QRSL) technology could deliver as much as 12.8GB per second from a 64bit bus. Toshiba liked the sound of this and agreed to license QRSL too.

Hitachi couldn't hold out any longer and on 22 June it agreed to pay RAMBUS a settlement fee and royalties. With the litigation out of the way, it could proceed with the much-rumoured sale of its memory division to NEC.

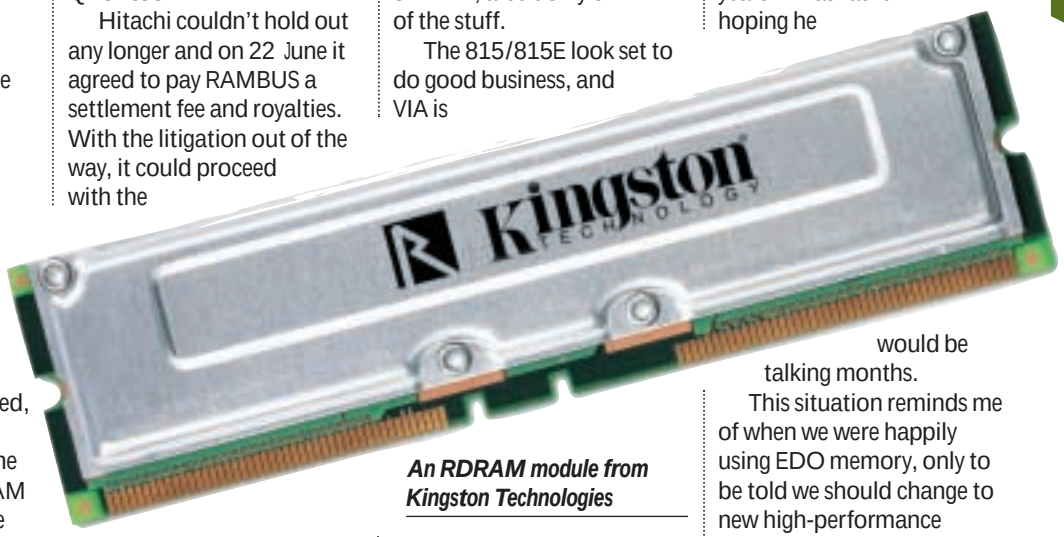
So good news all in all for RAMBUS, a company that doesn't get its hands dirty with any kind of manufacture and prefers to deal exclusively with its intellectual property. But where does this leave the memory technologies? Is RDRAM the future, or does SDRAM in plain DDR or even QRSL flavour stand a chance?

Intel remains committed to RDRAM but the company was hardly cock of the roost at June's Computex show in Taiwan, where confidence in non-Intel products was at an all-time high. The company is still recovering from the impact of its RDRAM-related MTH/820 chipset problems. It showed off its new 815 and 815E chipsets which have native support for PC133 SDRAM, albeit only 512MB of the stuff.

The 815/815E look set to do good business, and VIA is promising two new chipsets to support emerging 266MHz DDR SDRAM (see page 28). The new Pentium 4 (formerly known as Willamette) and its accompanying chipset are designed for RDRAM – but will Intel ever change its mind in favour of SDRAM?

I had the chance to ask its CEO Craig Barrett, at the opening of Intel's Wireless Competency Centre in Stockholm. He said: 'Intel's goal is to get RDRAM affordable and working with Willamette.' He admitted that RDRAM issues 'were more complicated than first anticipated', but stressed that Intel had 'no plans to abandon RDRAM'. On the recent QRSL announcement he said that it seemed like there was 'a new fastest memory technology every day.'

Yet RDRAM remains much more expensive than SDRAM today and, in our SYSmark tests, offers no compelling performance advantage. Rob Eckelmann, Intel's European general manager, admitted at the same event that RDRAM was too expensive. I asked him when it would become affordable, to which he replied: 'It won't be multiple years.' I was rather hoping he would be talking months.



An RDRAM module from Kingston Technologies

This situation reminds me of when we were happily using EDO memory, only to be told we should change to new high-performance SDRAM, which was incompatible with our old motherboards. SDRAM cost more but it wasn't three times the price and we didn't really have an alternative. RDRAM may be the long-term memory solution but with DDR SDRAM just around the corner it is not a compelling buy today.

The recently agreed RAMBUS royalties may push up the price of SDRAM, but it will still have a significant edge over RDRAM for some time. This a dangerous situation for Intel, which is effectively saying you must commit to uncompetitively priced memory if you want to use the Pentium 4, or most of its Pentium III solutions. With increasingly tempting offers from AMD and VIA, Intel will have to work very hard to retain desktop customers in the future.

NetFinity and beyond

IBM has developed a technology that it claims will double memory capacity without having to add extra physical memory.

The Memory eXpansion will be used initially in IBM's NetFinity servers but will migrate to other machines. It caches most used data and code close to the processor and uses hard-wired algorithms to compress other data on the fly.

John Geralds, vnunet.com

Esnooping Bill shows criminals the way to getting away with it on the web, warns Clive Akass.

The worldwide hiding place

Proposed legislation giving police and security services unprecedented access to your emails may have already proved to be counter-productive, as it highlights how easy it is to hide incriminating information on the web.

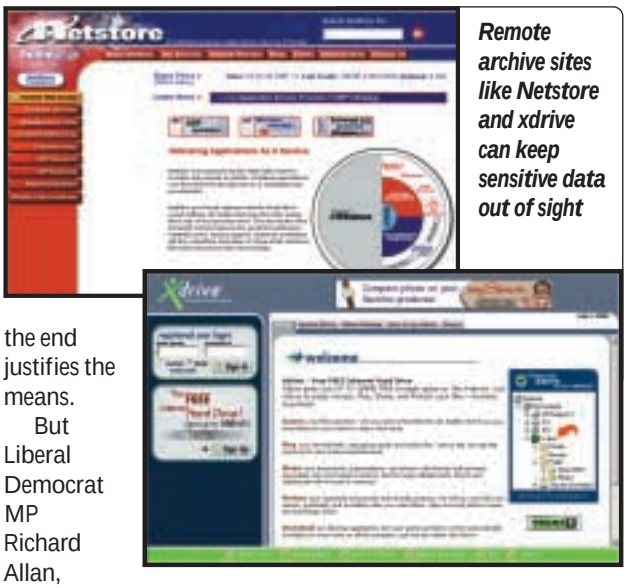
The Regulation of Investigatory Powers (RIP) Bill, due to be passed in October, has come under attack for other reasons and is almost certain to be watered down following a rough passage through the House of Lords.

It empowers police to obtain warrants to access specific files, in the same way that a warrant is required in order to search a house. However, you risk two years in jail if you refuse to reveal decrypt keys.

One amendment approved in the Lords overturns a requirement that it is up to you to 'prove' that you don't know or have forgotten the keys – contravening the principle that you are innocent until proved guilty, begging the question of whether it's possible to prove a negative.

Security services will monitor Internet traffic via 'black boxes' housed by service providers. Again they will need a warrant – in theory at least – to read the content of communications, but there is nothing to stop them tracking the sites you visit.

Critics claim that ecommerce firms, fearful of contravening confidentiality clauses, will migrate to places like Ireland, which have less draconian secrecy laws. Some firms may also fear Government-sponsored industrial espionage. Home Secretary Jack Straw argues that the threat of computer-aided crime is so great that the end justifies the means.



Remote archive sites like Netstore and xdrive can keep sensitive data out of sight

But Liberal Democrat MP Richard Allan, chairman of the cross-party information select committee, said the Bill makes sense only if it can be enforced – and he has launched an investigation into ways in which the measures could be evaded. 'I warned the minister in committee that... alternative technology would provide ways of working round it,' he said. Methods include:

- Direct links: Sensitive documents can be encrypted and sent by a direct modem-to-modem link, as was common before the Internet went mainstream. It can be done using Windows Hyperterminal or any 'old fashioned' comms program.
- Steganography: This is the hiding of messages within innocent looking files. Currently, its main use is to watermark digital images. The data is spread across pixels in such a way that the image is not affected. Alternatively, data can be hidden in inaudible frequencies within a music file – though care must be taken with compression, which may strip these frequencies out.

Police might still be able to insist that you tell them how to extract steganographic data – but they have to know that it is hidden in the first place. Caspar Bowden, director of the independent Foundation for Information Policy Research, said: 'By analogy, you are no longer talking about whether someone has the key to a safe, the question is whether they even have a safe.'

But perhaps the easiest way to hide data is to use remote archives. These are perfectly legitimate services but, like safe-deposit boxes, which are often used to stash stolen goods, they can be of as much use to criminals as to their potential victims. They range from companies such as Netstore (www.netstore.com), that offer industrial-strength backup solutions, to free US sites such as www.xdrive.com that act like an extra, password-protected hard drive – except that it can be accessed via a browser from anywhere in the world.

(A utility at the site claims to integrate the facility into Windows Explorer, so that it functions almost exactly like an extra drive. It would not work with the Windows Millennium beta I'm running but browser access is quick and easy.)

Netstore, which pioneered the idea in Britain, is horrified by the idea that it might be used by criminals. Co-founder and chief technology officer Jeff Maynard said: 'Netstore makes a lot of sense for all sorts of reasons but not as a way around any legislation – we would, of course, comply with any lawful request from a court or other authority.'

Nevertheless remote archives do offer two levels of protection. First, as with steganography, the investigating authorities would have to know about the hidden files. This could be the case if they have been monitoring a criminal's Internet use, or if a computer's browsing record was left intact on a hard disk. But criminals could easily use a service like xdrive from public access points like cybercafes or libraries.

Secondly, even if police did know about an archive it is far from clear whether RIP could enforce the release of decrypt keys to files resting, as in the case of xdrive, physically in the US.

It is also hard to see how the likes of former pop star Gary Glitter could have been prosecuted, as the law stands, for child-porn images held abroad. In practice many criminals are as careless as he was and are convicted on the basis of data that could have easily been hidden. The irony of the RIP Bill is that, by forcing criminals to look at simple workarounds, it may actually encourage their use of the Internet. After all, the web makes the whole world their hiding place.

Additional reporting by vnunet.com.

Gloat ye not over the anti-trust case, Bill Gates could be in a win-win situation says Tim Bajarin.

Microsoft at the Pearly Gates

Conversation over breakfast at a quaint resort in Maine, where I stayed recently, turned, for two days running, to the subject of the Microsoft anti-trust case. To my surprise almost everyone at these tables was pro Microsoft. In the US there is a growing sense that the Government is sticking its nose in too many businesses. Some analysts think the Microsoft case went too far and that a backlash is in the offing.

Microsoft clearly bungled its defence, but I have had a chance to read its full 39-page response to the ruling in which it states its case firmly and eloquently. It points out major legal inconsistencies and shares evidence in Microsoft's favour.

A friend who sat in court every day of the trial said after reading the document that he is now convinced Microsoft will get the case overturned. The twist is that the result is meaningless anyway.

When it was first filed two years ago, the case rested on the fact that Microsoft bundled its Internet Explorer browser with Windows.

Netscape called for an anti-trust investigation, claiming that this move would put it out of business. Many believed Netscape simply wanted to force Microsoft to bundle its Navigator browser as well; interestingly, that was not the real issue at all.

Netscape understood clearly that the next major development platform would be for the Internet, evolving not so much from Windows as from the next generation of browsers.

Once Microsoft started tying its Windows development platform to its browser platform, software developers began defecting to it in droves – eclipsing Netscape's own development platform, which had until then been highly successful.

Netscape's Jim Clark (pictured in his company's early days) has criticised the US Government's plans to split development of Microsoft's IE browser from the OS company

While the lawsuit has been extended to cover many other issues, Microsoft has clearly become the dominant player in browsers. Meanwhile, Netscape has lost its chance to become a prime Internet development platform.

So, when the US Government won the case and had to suggest a remedy, it was in a quandary. The PC and Internet markets have changed dramatically since this case started. More importantly, Microsoft has had to change direction in order to position itself for the next wave of development, which involves PDAs, WAP phones and other Internet appliances as much as PCs.

By splitting up Microsoft into two companies, one for applications and the other for operating systems, the US Government would give Microsoft a golden spoon. This is because it insists that the browser be developed by the applications company – thus giving Microsoft the ability to create the next web development platform, via its new .Net strategy, regardless of the outcome of the case.

This problem came into sharp focus when Jim Clark, co-founder and chairman of Netscape, blasted the Government move, saying the browser should be with the OS company. But the Government has no choice but to put the browser with the applications group in order to keep its case intact.

As I sat through Microsoft's recent presentation about its .Net strategy, I sat back and laughed at this whole situation. Microsoft has in essence split itself up already by starting to integrate the browser and applications into a new development platform that, in the end, can sit on top of any operating system, including Linux and Unix – although it will work best with Windows. The important issue is that Microsoft's browser and application tools form the heart of a next-generation Internet development platform and support all the major open standards such as XML and SOAP.

There is a gamble here for Microsoft. It assumes people will be willing to pay for using applications on the new browser-based development platform.

Sun Microsystems, Oracle and most major application vendors also believe that some day this is how software will be used.

But the main point is that even if Microsoft should somehow lose to the Government and is broken up, it will still be the big winner.

PC-based operating systems will become less important even though they will still have the lion's share of this market. And if Microsoft can create a browser/application-based development platform, which works better on devices that have some type of Microsoft OS on board, it will be well on its way towards extending its franchise beyond the PC.

It could actually become an even bigger and more successful company in the future. Put in this light, you can easily see why Bill Gates is doing commercials on TV stating that the 'best is yet to come!'

The Celeron will have a tough time when the next budget chips are released, says Gordon Laing.

The cheap chip challenge

It's hard not to notice that virtually every penny of Intel's advertising budget is spent promoting the Pentium – can you imagine how the poor neglected Celeron feels? On the upside, the Celeron can sleep happy in the knowledge that it provides a great price over performance ratio to both entry-level buyers and hardware enthusiasts who know how to squeeze every last drop out of it. After all, the latest FC-PGA Celerons running at 566MHz or above are essentially nothing less than Pentium IIIs with half their on-die Level 2 cache and a 66MHz front-side bus (FSB). But get ready for bouts of insomnia, Celeron, as AMD's Duron CPU looks set to give you sleepless nights.

AMD recently had Intel grinding its teeth by releasing ever-faster Athlons. However, like the first PIIIs, the Athlon employed off-die Level 2 cache, running as slow as one-third of the CPU clock. So while Intel and AMD announced 1GHz CPUs within two days of each other, the PIII's full-speed Level 2 cache ran at 1,000MHz, compared to 333MHz on the Athlon – and it makes a big difference to performance. AMD has now re-addressed the balance by matching the PIII's 256KB full-speed Level 2 cache on its new Thunderbird Athlons.

Will we see 'Slocket A' cards, allowing Durons and Thunderbirds to be used in existing Slot A motherboards?

At first glance, the Duron appears to be to the Thunderbird what the Celeron is to the Pentium III – a budget version with cut-down specifications. So saying, it's worth looking at what's hiding under the hood.

Like the Celeron, AMD sells the Duron at slower clock speeds than its premium counterpart. Like the Celeron, the Duron has fast, on-die Level 2 cache, but what's this? Where the Celeron has half of the PIII's Level 2 cache, the Duron has only one-quarter of the Thunderbird – that's 128KB versus 64KB and one-nil to Intel. Look a little closer and those Celerons faster than 566MHz also talk to their Level 2 cache using the PIII's 256bit interface, compared to a mere 64bit interface on the Duron (and Thunderbird).

On the upside, the Duron has 128KB of Level-1 cache, compared to 32KB (16 + 16) on the Celeron which, when added to the Level 2 cache, lets AMD quote a total 'on-chip' cache of 192KB, compared to 160KB on the Celeron. Then there's the issue of the FSB. As a differentiator to its PIII line, Intel still designs Celerons to use a 66MHz FSB and normally drives their memory at the same speed. In comparison, the Duron employs the same Double Data Rate (DDR) technology of the Athlon, thereby chatting to its chipset at 200MHz, albeit only driving memory at 100 or 133MHz, depending on the chipset. It's still a big difference, though.

As we've discovered, the chipset and memory type in a system have a massive impact on performance. Until forthcoming solutions from AMD, SiS, and ALI arrive, the Duron is only officially supported by VIA's KT133 chipset, which is essentially the same as the earlier KX133, except that it supports AMD's new Socket A form factor. With the launch of the Duron and Thunderbird Athlons, AMD is dumping its Slot A CPU interface in favour of the 462-pin Socket A.

A small number of Slot A Thunderbirds have been produced for testing in old AMD 750 chipset systems, but as far as end users are concerned, Sockets are the future. Will we see 'Slocket A' cards, allowing Durons and Thunderbirds to be used in existing Slot A motherboards? Sadly, it looks unlikely, at least for the old KX133 chipset, which does not support the new CPUs.

So it looks like we'll have to invest in a new Socket A motherboard, although at least these will take both Durons and Thunderbirds. If you're interested in AMD's new CPUs, though, I'd wait until October when VIA's KT266 chipset arrives, supporting new 266MHz DDR SDRAM. A version for Intel CPUs is due a month earlier.

It's certainly an interesting time for budget CPUs. VIA's Cyrix III 'Joshua' chip is a cheap alternative for Socket 370 systems and Intel won't let the Celeron go without a fight. Then again, the Duron seems attractive: at the end of June we checked UK chip prices and found the 650MHz Duron at £89, compared to £90 for the 566MHz Celeron (inclusive of VAT). So long as the high power consumption of the Duron coupled with volume manufacturing isn't a problem, then AMD could again rule the value PC market that Intel fought so hard to capture. Is that the sound of grinding silicon teeth I hear?

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With our GSM system fragmenting daily, Barry Fox wonders who will step in to pick up the pieces?

Variations on a theme

Americans, with three different and incompatible digital cellphone systems, say they envy Europe's simplicity of a single GSM standard.

But there are already three variants of GSM: the original (used by Cellnet and Vodafone) works at 900MHz, while Orange and One2One are at 1,800MHz and the GSM services in the US are at 1,900MHz. So dual- or triple-band phones are needed for international roaming. Although it should be possible to take the SIM card from any GSM phone and use it in another, service operators interlock cards, phones and networks. Mobile Internet access, which is creating the need for higher data rates, is further fragmenting the standard.

Wireless Application Protocol (WAP) phones have been available for a year and have been absurdly over-hyped. Market analyst Ovum has already pronounced a 'backlash' of consumer disappointment. Setting up a WAP phone can involve 100 key strokes. So service operators send the settings as an SMS message. But helplines have to be able to help users store and load the settings message. Often they can't.

In Japan, NTT's DoCoMo I-mode service is a roaring success with SEVEN MILLION USERS, blowing WAP away

Telecoms watchdog Oftel has now said it has no powers to stop cellphone companies ripping off consumers with national or premium-rate helplines that cannot help or give wrong advice. Exactly what useful purpose does Oftel serve? Answers on a postcard.

Most networks and services either offer free WAP phones, or give them to anyone who pushes for one. For example, Breathe promises a voice-activated WAP service later this year, with free phones and no subscription.

The third-generation mobile systems will deliver much higher data speeds, but at prices which reflect the £5b each of the five operators paid for their licences and the similar cost of building a new infrastructure. Meanwhile, existing operators are readying stopgap systems, that introduce more incompatibility.

France Telecom just paid £25b for Orange and promises a 'wire-free future'. But the takeover creates a split in standards that will stop New Orange subscribers roaming with multimedia across the English Channel.

In September 1998, Orange promised subscribers a video-cellphone which uses proprietory technology developed by the University of Strathclyde. Although Orange could initially show only mock-up dummies, finished phones are now working. They rely on a 28.8Kbits/sec link obtained by ganging together two 9.6Kbits/sec cellphone data channels and modifying the error correction to increase each to 14.4Kbits/sec.

Orange will use this High Speed Circuit Switched Data (HSCSD) system, delivering 28.8Kbits/sec to laptop PCs and handheld devices with plug-in PC Cards.

Although the promised service launch is now six months late, Hans Snook, chief executive of New Orange, insists it will happen soon. 'The network is all ready to carry HSCSD but we have been hamstrung by hardware supplier Nokia,' he grumped.

Cellnet, Vodafone and One2One have all rejected HSCSD and are readying the incompatible General Packet Radio System (GPRS). This exploits the fact that multimedia devices handle data in bursts, so data from each of several devices can be chopped into labelled packets and the data capacity of several channels pooled. Devices can then transmit and receive bursts at over 100Kbits/sec.

'I have yet to see any GPRS devices,' said Snook. Funny, because Snook's new owner, France Telecom, runs the Itineris network, which started a GPRS service in May and says the whole of France will be covered by the end of the year.

In Japan, NTT's DoCoMo I-mode service is a roaring success with seven million users, blowing WAP away. I-mode can handle conventional HTML, whereas WAP sites have to rewrite their pages. Like GPRS, DoCoMo I-mode is a packet system. Users can be charged for data moved, not time online. A Dutch telecoms provider is working with NTT on a European I-mode service.

So far, the Japanese have been squeezed out of the Western cellphone market by giants Motorola, Nokia and Ericsson. Japan is waiting in the wings to pounce, just as it did with fax machines, VCRs and laptop PCs. The duffness of WAP and the HSCSD-v-GPRS pantomine gives it a window of opportunity.

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Cutting out the publishing middleman is attractive, but Brian Clegg doesn't think it'll work.

To ebook or not to ebook

For trendy businesses the Internet is an unparalleled opportunity – at least until the bubble bursts – but for some, it's a source of fear. A horrible word hangs over book publishers like the blade in Poe's *The Pit and The Pendulum* – disintermediation (I said it was horrible). All publishers, whether heavyweight book companies, such as HarperCollins or magazine publishers like VNU, are middlemen. They take writers' words, package them, distribute them and extract revenue from the buying public. This is a very necessary service. While desktop publishing and computer typesetting mean it's easy to produce your own book, all you achieve is a mouldering pile of print in your garage. With a million other titles to choose from, chances are WH Smith and friends will turn up their noses at your offering, so it will never reach the public.

Enter the ebook. Just write your matchless prose, set it up on an ebook site and wait for the money to come rolling in. The packaging is trivial, the Internet handles worldwide distribution and the web server collects the cash. Writer to reader with no publisher involved. Disintermediation. Of course, this didn't seem a threat until big-name authors started to take part, but Stephen King set the cat among the pigeons by publishing a novella this way. From the publisher's viewpoint, the rot has set in.

Now publishers (not surprisingly) argue that they add value. They point out that most writers have the design sense of a halibut; it's the publisher that adds the zappy cover that makes you want to buy the book. It's the publisher that filters out thousands of unreadable manuscripts. And it's the publisher that delivers the physical book into our hands. In reality, though, many of these arguments are dubious. After all, it's usually an independent designer that develops the cover, and no doubt direct edesign services will spring up alongside ebook vendors.

As for the filtering role, it's certainly true that a published book will usually be readable and relevant – but there are plenty of good books that never make it into print. For those who only buy books by an author they know, there would be no real difference. For the more adventurous reader, an ebook emporium should be able to give tasters of a much wider range of writer before buying, opening up choice.

While it's easy to shoot down most of the publishers' claims, the one about producing the physical book needs attention. There is something special about a book. It's quite different from a document produced at work, or even a newspaper or magazine. A book might not be ideal for every use – CD-ROM encyclopaedias are demonstrably better – but when you want to sit down and read, a book is compact, robust and kinaesthetically satisfying, as psychologists would say. So what's the alternative? Ebooks on PC monitors are non-starters. A screen is neither clear nor convenient enough for comfortable reading. A palmtop gives you portability, but you lose even more detail – the page is too small and low resolution compared with print – and the device is too delicate to be thrown into a beach bag. Printing isn't a solution either. No-one wants to print off a whole book, and unbound A4 sheets simply aren't practical. The difficulty of reading ebooks makes them currently little more than novelties.

One day, though, the technical problems will be overcome. Last year IBM announced flexible transistors that could be sprayed onto sheets of plastic to produce a screen that could be rolled up and stuck in the pocket – a precursor to electronic paper. Recognising that technology will eventually succeed, some publishers are trying to avoid being squeezed out by getting involved themselves. The UK's largest independent business publisher Kogan Page, for instance, is trying out 200 of its titles in ebook form to see what will happen. These will be available alongside printed versions in online bookshops like Barnes and Noble, as well as from ebook sites. But don't expect many ebestsellers. Ebooks will grow in popularity and may eventually kill publishers, but any panic is premature. Traditional books will put up more of a fight than vinyl records ever did.

Enter the ebook. Just write your matchless prose, SET IT UP ON AN EBOOK SITE and wait for the money to come rolling in

brianc@pcw.co.uk

We all want privacy and security, says David Fearon, but unfortunately they don't go hand in hand.

A private matter?

I have to confess that on the all-important issue of my electronic privacy, I don't fit the usual mould of Internet geeks to whom it's a subject to get into a screaming rage over. It's just not something I've ever had cause to get worked up about. I've never produced anything important or revolutionary enough to worry about the security of my emails in the face of possible corporate espionage. And if I thought that any of Her Majesty's finest were taking the trouble to monitor my electronic communiqués, well, I'd probably be quite flattered. At least, that's how I used to think.

Recently, I've had cause to do some research into cryptography. Now governments, even big ones such as the US, are terrified of modern cryptography. It's generally accepted that a decent strong encryption algorithm, such as the IDEA algorithm used in Phil Zimmerman's PGP, will be secure against even the world's most powerful computers for decades to come. Naturally, the fact that a single individual with a PC can hide any digital information from the planet's largest governments makes them a bit nervous.

So, while I'm doing my research and sending emails back and forth, I get sucked into the paranoid mindset of the cryptographer. Have my emails been flagged by some supercomputer buried in Reading because they contain sensitive encryption-related keywords? If the Government's Regulation of Investigatory Powers Bill is passed, that type of scenario may become a reality.

Under the Bill, the UK Government could gain all sorts of powers, not only over encryption schemes, but also the routine interception of plain emails. Hop over to www.cyber-rights.org for more information. Suddenly, and for about five minutes, I become the world's most fanatical electronic privacy campaigner. Then I wander into the living room and switch on the news and my views do a rapid about-turn: the top story is the conviction of nail bomber David Copeland.

It was reported after Copeland's conviction on several counts of murder that he learned how to make bombs via the Internet. A couple of years back, when the mass media jumped at any chance to portray the Internet as a sea of corruption for the sake of a juicy story, I'd have taken that assertion with a pinch of salt. But now, with so many people having web access, I'm fully prepared to believe that Copeland learned how to build his awful devices solely via the anonymity of the web and it's possible, although I've no proof, that if he hadn't had web access, he would have stood more chance of being been noticed by the police before he killed two men and an expectant mother last year.

I walked down Old Compton Street the day before the bomb in the Admiral Duncan pub went off, so the Copeland case is something I've been particularly aware of, but it's something that concerns us all. It's true that we need to be incredibly vigilant where incursions into electronic civil rights are concerned, but at the same time we need to curb knee-jerk reactions of opposition to any government-led surveillance initiatives.

I disagree with electronic rights campaigners that claim a criminal who's going to commit a crime will do it whether the Internet is there or not. As far as I'm concerned it's an undeniable fact that the Internet makes it easier to commit certain types of crime. Whether it's the irresistible ease of firing up Napster and illegally downloading the tune that's been floating around your head, the porn sites that rip off people stupid enough to give them their credit card numbers, or the darker and thankfully rarer information-gathering forays of the likes of Copeland, that near-perfect anonymity and ease of information retrieval make the web a one-stop shop for the nascent baddie.

I'm fully prepared to believe that Copeland learned how to build his awful devices solely via THE ANONYMITY OF THE WEB

The world always needs opposing points of view, and the Internet is no exception. Hopefully, with the governments frantically pulling in one direction and the electronic privacy lobby heaving away in the other, neither side will win the tug of war and we'll end up with a sensible compromise that will allow me to send my emails without fear of a commando raid on my house, but will also go some way to ensuring that deranged monsters, such as Copeland, get stopped before they destroy any more people's lives.

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letters

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PATENTLY CONFUSING

I read the article entitled 'Patently absurd' in the July issue with some concern. The main thrust of the feature was that the granting of patents in the field of computer software is being badly managed. The author even went to the extreme of referring to the 'murky world of patenting laws', 'sinister and self-interested motives' and even to 'a badly policed jungle where might is right and lawmakers are out of their depth'. Words worthy of a thriller!

As a patent attorney I am concerned that this is overly negative and can easily lead the reader to misunderstand the position in Europe. I must confess that I agree the position in the US has swung very much in favour of the applicant for a patent. The US courts have made it quite clear that there is no bar to patenting computer software even for business methods so long as a 'useful, concrete and tangible result' is achieved.

Hence, not only large software houses but also many small businesses have woken up to the fact that protection is available for their ideas embodied in software. The problem has been that this awakening has caught out the US Patent and Trade Mark Office and it is taking steps to improve the quality of the examination process.

The position in Europe is, I believe, much better. The procedure for granting patents in Europe before the European Patent Office and the UK Patent Office generally takes much longer. Under European practice a patent will only be granted for an invention, which is a technical advance.

It is generally acknowledged that it is more difficult to get a patent in Europe than in the US. Unfortunately (or in some minds fortunately) there has been very little litigation in Europe in the field of software. This can be attributed partly to the time delay in getting patents granted in Europe. However, I believe that the main reason is the bias in the US towards the patent owner: under the US system there is a strong assumption that the patent is valid and the courts will try to interpret the patent as being valid once granted by the US Patent and Trade Mark Office.

With regard to the global issue, the patent laws as they exist are restricted to national jurisdictions. Thus a software dealer or manufacturer must consider the US law if the US is a market for the software or if the Internet is involved. Also, because of the global nature of the Internet, any Internet developer providing a commercial presence on the web must give due consideration to the situation in the US.

DR JOHN COLLINS

NIALL MAGENNIS replies >

Dr Collins was also kind enough to clarify some issues covered in our feature. The first was our definition of 'obvious/non-obvious' as used in patent law. In Europe any public disclosure anywhere in the world, by whatever means, of the technology prior to the filing of a patent application will invalidate a patent so long as it discloses sufficient detail to enable someone to understand and make the invention.

The situation in the US is more complex. There, the patent system is based on the principle that the first person to invent something is entitled to a patent, whereas in Europe the first person to file a patent for an invention not previously in the public domain is entitled to a patent. The US operates a 12-month grace period during which disclosure of the invention by the inventor(s) will not invalidate a subsequently filed patent.

Also we said that 'an idea or a process may not be patented'. While it is correct to say that ideas on their own are not patentable, an idea or process can be patented if it is embodied in a physical product. Software certainly comprises a physical product when carried by a medium such as a floppy disk or an FTP protocol signal over the Internet. This is the physical entity that is purchased: software as an idea is not what is purchased.

PLAYING FINANCIAL RUSSIAN ROULETTE

Deciding the time was right to buy a PC, I searched all of the main brands, but in the end decided to build my own.

I created a spreadsheet with ratings and prices for the various products suitable for my PC. That came out at £1,620 inc VAT, which was above my £1,500 limit. Having 14 weeks before I started my A-Level computing course I thought I'd wait a bit until the price decreased and then I could start building... but this was not to be.

Within a few days, the hard drive I was planning to buy increased by a few pounds, and then the memory shot through the roof, jumping by almost £50. I dropped the spec to something a little less nippy costing £1,550 and contemplated starting – but I disciplined myself as, once again the prices of components rose.

Why is it that the components fluctuate so much when the demand and supply does not change much – especially with RAM? Surely individual components should fall in price rather than increase. I have decided to hold

back from building a PC at the moment and will use the school facilities.

STUART HOLYWELL

SCOTT MONTGOMERY replies ›

There's always a bit of financial Russian roulette involved in building a PC from scratch, and you regularly find yourself stung by prices dropping mere days after you've parted with your cash. The reason for these fluctuations range from varying exchange rates, to geographical disasters hitting the producing countries. Computer fairs are a good place to pick up some bargains, but apart from that it's all patience and opportunity buying. Follow the prices for the parts you want and when you think they've bottomed out, buy them – and don't look back...

POWER OF A COUCH POTATO

PCs are getting cheaper, Internet access is now more or less free and almost half the homes in this country are connected. Like the video recorder, the PC has become a standard household item. But that could all be about to change, due to the power – or lethargy – of the couch potato who has no interest in computers or the net, because 'it ain't on TV'. So, if they won't get off their backsides, the new technology must come to them. And what better way could there be to reach them than through their TVs?

In the near future TVs will not only show endless repeats, but also function as computers, DVD recorders and phones. The computers in these new combinations will be like many TV programs – dumbed down (half the population still haven't worked out how to program their videos yet). When the new, do-it-all, TVs begin to make an impact, their prices will fall rapidly until almost every home has one. Is it possible that the common PC will become a specialist item? If so, it follows that it will have a specialist price. Still, we'll all be happy to pay more for our PCs if it means one couch potato can use their TV to look at and talk to another couch potato, eating pizza. Won't we?

ALAN AITCHISON

NIK RAWLINSON replies ›

I don't doubt that the PC as we know it will become a specialist item. Even today there is little incentive to buy a fully-fledged computer when something like a Dreamcast or PS2 will do everything you need. As for programming the video, let's hope that the TV-connected net appliances of the future will be as foolproof as a toaster or we're in for trouble. *See Reviews p71*

LETTER OF THE MONTH

I WANT TO BREAK FREE...

I had to reply to Richard Lee's letter, 'Deny responsibility and let the users suffer' in the July issue of *PCW*. I agree that buying proprietary software is like buying a car with the bonnet welded shut: if it breaks down, you have to pester the manufacturer for a fix. If they don't give you one, you're out in the cold.

The software market is a free one; so it follows that if licence agreements that disclaim warranty are prevalent, it is because computer users have decided it doesn't matter that they will be helpless in the event of a software fault. We have accepted such licence agreements, and so we must take at least part of the blame for today's problem.

There is an alternative to proprietary software: GNU-style free software (see www.gnu.org). 'Free' in this instance refers to freedom, not price. Here, the bonnet is not welded shut; users have source code available and are free to take the software to any programmer and pay them to fix it, just as it is possible to take a car to any mechanic. The developers of free software almost always disclaim warranty, but that doesn't matter in this instance as users are not helpless – they can have the software fixed themselves in the unlikely event that the developers are unwilling to do so. Not being able to sue the developer is a small price to pay for such freedom.

So a strong argument for not forcing software developers to give users warranties is that, if such a law were passed, free software development would have to cease. Free software developers usually work collectively; no one individual or company has exclusive control over what goes in. Such people cannot afford to take responsibility for their own and others' mistakes. A law such as Mr Lee describes would also curb software development in academic institutions and in non-profit settings. It would be possible to force only large software companies to give warranties, but this is discriminatory: everyone is entitled to equal treatment under the law.

Consumers have power over businesses in a free market. If we want to solve the problem of proprietary software with no warranty, we must all choose software that doesn't have these problems. I have moved over to Linux for this and many other reasons. I no longer use any proprietary software at home, because I do not want to support companies that deny me freedom.

ANDREW MEDWORTH

CLIVE AKASS replies ›

Open-source software is not yet ready for the mass market, as Linux guru Linus Torvalds recently admitted; users who can barely cope with Windows cannot be expected to mess with source codes and version control. Warranties seem a good idea but they would bog down development: I'd rather have a 98 per cent working Windows 2000 now than a perfect, legally watertight version in 2020. Warranties are not workable because you cannot guarantee the unguaranteeable: no-one can be absolutely sure complex software is bug-free. Products are, in practice, released when the bug level is considered tolerable. Commercial pressure being what it is, that is too early too often. But if a product simply does not work you still have recourse to the law.

PHOTOGRAPH GETTYONESTONE

REVIEWS

contents

The end is nigh for today's PC

Jason Jenkins
SENIOR STAFF WRITER

Many have predicted the end, but few could say for sure when it would come. Now we have a better idea. The Internet TV we have reviewed on page 85 doesn't mark the end of the road for the PC as we know it, but it brings us one step closer.

The PC market has seen astronomical growth over the past few years, fuelled by consumers. They have been buying PCs for three main reasons: to use programs like Word, Excel and PowerPoint, to play games and, crucially, to access the Internet. To do all three, however, has meant that consumers had to buy a machine with components many times more powerful than those used to put men on the moon. This type of machine is often fantastically expensive and no sooner has it been bought, than the tremendously powerful components start to look less impressive as new ones are brought to market, instantly wiping a third off your investment.

And, of course, the story never ended there – configuration problems, crashes, lost data, reinstallations: you name it, and every PC will experience it at some stage in its lifetime.

Games consoles have been around for donkey's years, but now more homes than ever play host to one. And with the upcoming launch of the Playstation 2, together with the ever-expanding reach of the Dreamcast, that trend is set to continue. Consoles don't have the same problems as PCs. They are cheaper to buy and they just work – put a disc into a console and you'll be playing games in no time. Try and do the same thing on a PC and you'll probably be downloading new drivers for the next half hour before you can start.

The Internet TV we had in our offices, and other products like it, will remove the need to buy a PC specifically to access the Internet. Like consoles, Internet TVs are true plug-and-browse devices, with no system hangs, reboots or corruptions. Admittedly, the Internet is not currently designed to be viewed on your average television, but as surely as there are now pages optimised for viewing on a mobile phone, more and more sites and content will be changed to accommodate the lower resolution of a telly.

So, if you don't need a PC to play games or browse the Internet, what do you need one for? This is the question most PC manufacturers are asking themselves. They've done some predictions and their figures make gloomy reading for them. But it would be wrong to write off the humble PC just yet. What we will see over the coming months and years is the PC becoming much more of a specialist device, rather than a consumer 'must have' item. This is why PC vendors are starting to diversify. High-end workstations, video-editing machines and professional-standard music PCs are being sold by an increasing base of manufacturers in an attempt to protect themselves when their core market – consumers buying a PC for surfing the Internet, gaming and wordsmithing – collapses.

The PC will become much more of a specialist device, rather than a consumer 'must have' item

The era of the PC as an all-encompassing consumer device is coming to an end, and a good thing it is too. Despite hardware and software designers' best efforts, the PC is still not a consumer-friendly plug-and-play device, and it never will be. The sooner we get to the stage where accessing the Internet is as simple as plugging in a new television, the faster the promised social and economic benefits of the Internet will become evident.

ratings

★★★★★	EXCELLENT
★★★★	VERY GOOD
★★★	AVERAGE
★★	BELOW AVERAGE
★	POOR

Panrix Fusion SCSI 933

The first dual-FC-PGA system is impressive – and a 22in screen is thrown in for good measure.

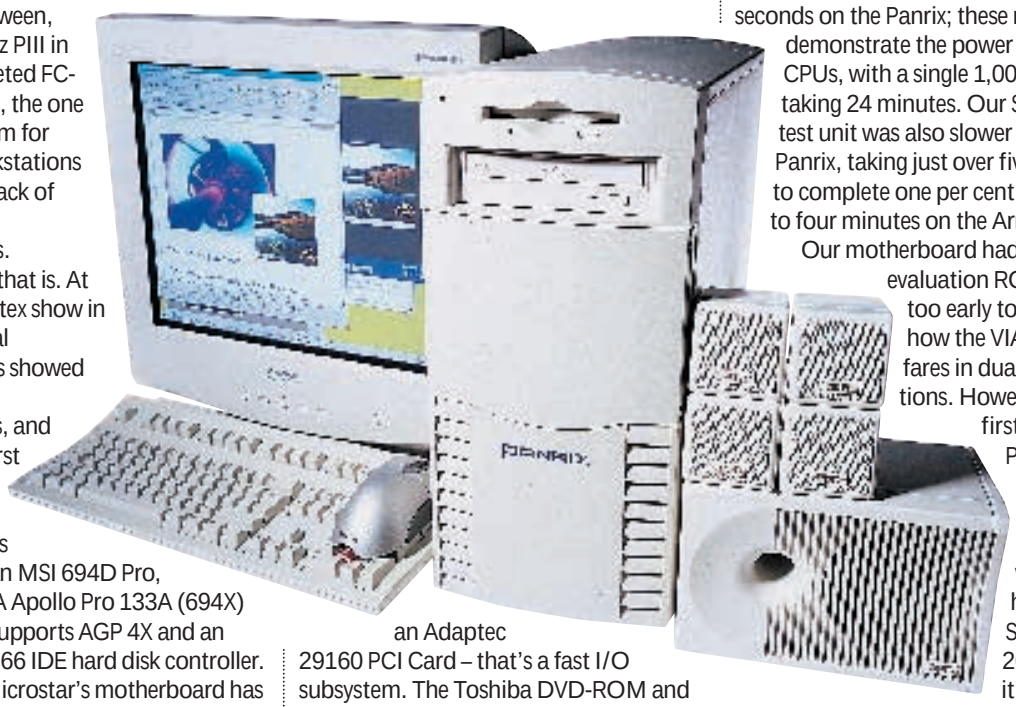
Over the past few months we've tested several interesting dual-processor systems, but all have had one thing in common: they employ Slot 1 Intel CPUs. While there's essentially no performance difference between, say, a 933MHz PIII in Slot 1 or socketed FC-PGA housings, the one crucial problem for high-end workstations has been the lack of dual-FC-PGA motherboards.

Until now that is. At June's Computex show in Taiwan, several manufacturers showed dual-FC-PGA motherboards, and Panrix is the first to build us a system with one. Panrix has plumped for an MSI 694D Pro, based on a VIA Apollo Pro 133A (694X) chipset. This supports AGP 4X and an UltraDMA33/66 IDE hard disk controller. In addition, Microstar's motherboard has four DIMM slots housing up to 2GB of SDRAM, and enthusiasts will welcome 11 overclocked FSB (front-side bus) speeds between 133MHz and 200MHz. Versions of the motherboard are available with a 1394 (FireWire) controller, and a Promise UltraDMA100 controller, which can talk to an additional four IDE drives.

At the business end, Panrix has fitted a pair of speedy Intel Pentium III 933MHz FC-PGA CPUs and a pair of 128MB PC133 DIMMs; that's a total of 256MB, and two spare memory slots. Graphics are supplied by a Hercules 3D Prophet, based on the supremely quick nVidia GeForce 2 GTS chipset, with an impressive 64MB of DDR memory. The card features TV output via an S-Video socket with composite converter, and a DVI digital display connector, along with the conventional analog VGA port.

Complementing the graphics card is a good 22in Mitsubishi Diamond Plus 200 monitor with a perfectly flat Diamondtron NF aperture-grille tube with a 51cm/20in viewable diagonal. With a maximum horizontal scanning frequency of 108KHz, it'll handle impressive non-interlaced resolutions up to 1,800 x 1,440 at 72Hz. There's also a pair of 15-pin VGA ports and a USB upstream port to control the monitor.

On the storage front, as the system name suggests, Panrix has fitted a SCSI hard disk: a Quantum Atlas 10K 18WLS 10,000rpm Ultra160 drive, connected to



an Adaptec 29160 PCI Card – that's a fast I/O subsystem. The Toshiba DVD-ROM and HP 9100 CD-RW drives are, however, connected to the secondary IDE channel on the motherboard. The case can also accommodate a pair of 3.5in and one 5.25in drives, and Panrix has installed two extra cooling fans along with a 300w power supply.

The system also features an Ethernet card, an internal 56K PCI modem, and a Creative Labs SoundBlaster Live 1024 Player card; a Cambridge SoundWorks PCWorks FourPoint Surround speaker system is also included. This leaves the system as supplied with only one free PCI and an unused CNR slot but, to be fair, virtually all bases are covered.

As befits a dual-CPU system, Panrix has installed Windows 2000, and it scored an impressive 200 in SYSmark 2000 – compare this to last month's Armari dual-933 system that mustered a score of 189. Both systems featured a pair of 933MHz Pentium III processors, 256MB of RAM and GeForce 2 GTS graphics cards, but the Armari used an UltraDMA66 hard disk and 840 chipset talking to expensive PC800 RDRAM, compared to the Panrix's Ultra160 SCSI hard disk and a VIA chipset with PC133 SDRAM.

In Quake III, the Panrix won, with a score of 115fps compared to the Armari's 107fps, although its graphics card had double the memory. The Armari was fractionally faster in our 3D Studio Max test, taking 14 minutes to render our test frame compared to 14 minutes 10 seconds on the Panrix; these results demonstrate the power of dual CPUs, with a single 1,000MHz PIII taking 24 minutes. Our Seti@home test unit was also slower on the Panrix, taking just over five minutes to complete one per cent, compared to four minutes on the Armari.

Our motherboard had an evaluation ROM, so it's too early to conclude how the VIA chipset fares in dual configurations. However, as the first dual-FC-PGA system we've tested, coupled with a very high SYSmark 2000 score, it's an impressive start. By employing SDRAM, Panrix's system is cheaper than Armari's while additionally boasting Ultra160 SCSI and a 22in monitor – it may not match the build quality of Armari's workstation, but all in all it's an impressive and capable system.

GORDON LAING

DETAILS

★★★★★

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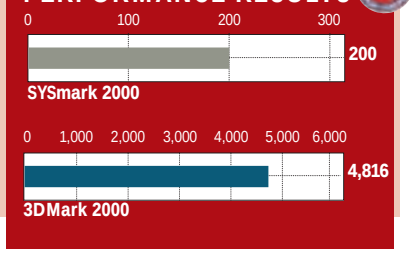
www.panrix.com
PROS Very quick. First dual FC-PGA system
CONS None to speak of
OVERALL A very impressive performer, proving you don't need RDRAM

PERFORMANCE RESULTS



Mesh Matrix GT Ultra

If you need a 1GHz Athlon system this PC has the speed you need but check the motherboard.

AMD beat Intel to a 1GHz processor by a whisker, but the processor had slower, off-die cache. This gave the old Athlon a large performance bottleneck compared to the 1GHz Pentium III with full speed, on-die cache. Last month we took a look at the new Athlon (codenamed Thunderbird) designed to address this problem, and this month Mesh has submitted a system with that processor clocked at 1GHz. This features 256KB of on-die Level 2 cache, and with the Athlon's impressive architecture, should be able to give the equivalent Pentium III (still in short supply) a run for its money.

The 1GHz processor inside this machine is Socket A, and is produced using 0.18micron process technology – there can be no doubting that this is AMD's flagship product at the moment. There is a problem with this form factor, though – motherboards. It's the same problem that has dogged the company for years – there are simply not enough Socket A boards out there at the moment. They will come, sure, but for now end users and system integrators have a severely limited choice.

This explains why Mesh has given us a seemingly crazy choice of board – an MSI 6340, which is a Micro ATX model. There is no way a system costing over £2,000 should come with a Micro ATX board, especially as it is mounted in a full-size ATX case. Mesh knows this, and promises to have a full-size ATX board available when the system ships. Given the current situation, it is unable to commit to a certain model, except to say that it will be based on VIA's KT133 chipset. This means the board will have support for PC133 SDRAM, AGP 4x and UltraDMA 66. On the machine sent in for review, only one PCI and one memory slot are free, together with the solitary CNR.

A whopping 256MB of PC133 SDRAM is supplied, all on one stick. If you are paying for the extra processing speed, you might as well opt for more than 128MB of memory, so it's good to see it here. A huge 60GB hard drive sits in one of the internal bays – it is one of the 7,200rpm drives from IBM's new Deskstar range (see page109). The bay it is housed in has been turned sideways and by pinching a clip, you can quickly and easily pull it out.

A Philips eight-speed write, four-speed rewrite, 32-speed read CD-RW drive is supplied, together with Nero Burning ROM version 5, to help you create your CDs. Should you wish to copy on the fly, you can use the Pioneer DVD drive, a DVD115. InterVideo DVD is provided so that you can watch films. A 56K PCI modem is present too.

Sound comes from an OEM version of Creative's SoundBlaster Live 1024, with coloured connectors as opposed to the golden ones sported by the retail version. This card did not have a CD-SPDIF connector, which is something of a cheap omission for a machine of this price. You can listen to the sound it generates using the Labtec LCS-2514 speakers, which consist of four satellite speakers and a subwoofer.

The monitor is the excellent Mitsubishi Diamond Plus 91. This 19in model uses a Diamondtron NF screen to generate an excellent image, and is a good choice for a machine in this price range.

The amazingly fast Hercules 3D Prophet II, with 64MB of DDR memory, provides the image and 3D acceleration. This GeForce II GTS card is reviewed on page 99, and it really give this system a kick in the 3D stakes.

Speaking of performance, this machine is pretty fast, Interestingly, on our SYSmark 2000 benchmark it scored one point less than the Dell 1GHz Pentium III featured in our June issue, but in 3D it really took off. Our Quake III time demo was completed with an average frame rate per second of 104.6 – so if you have a bottomless wallet and are looking for an ultimate games machine, then this could fit the bill. We also ran our test 3D rendering scene using 3D Studio Max. This took 23 minutes 9 seconds to render, slower than the Panrix dual-Pentium III 933 PC reviewed opposite, proving that two processors are better than one when it comes to this kind of operation.

This machine shows off the potential of the 1GHz new Athlon well, and it's good to see that AMD has caught up with Intel on the performance front. Because we could not properly evaluate the motherboard this system will finally ship with, together the fact that it is a tad on the pricey side, we could not award the full five stars. If you are one of the few that needs a 1GHz processor, then this well-built PC could be the one for you, albeit with a bit of further research first.

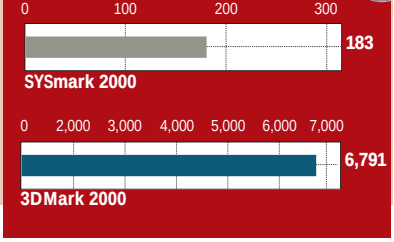
JASON JENKINS

DETAILS

★★★★

PRICE £2,583.83 (£2,199 ex VAT)
CONTACT Mesh 020 8208 4706
www.meshcomputers.com
PROS Speedy system; good monitor, hard drive and lots of memory
CONS A little pricey, no CD SPDIF connector
OVERALL Worth consideration if you check which motherboard it will ship with first

PERFORMANCE RESULTS



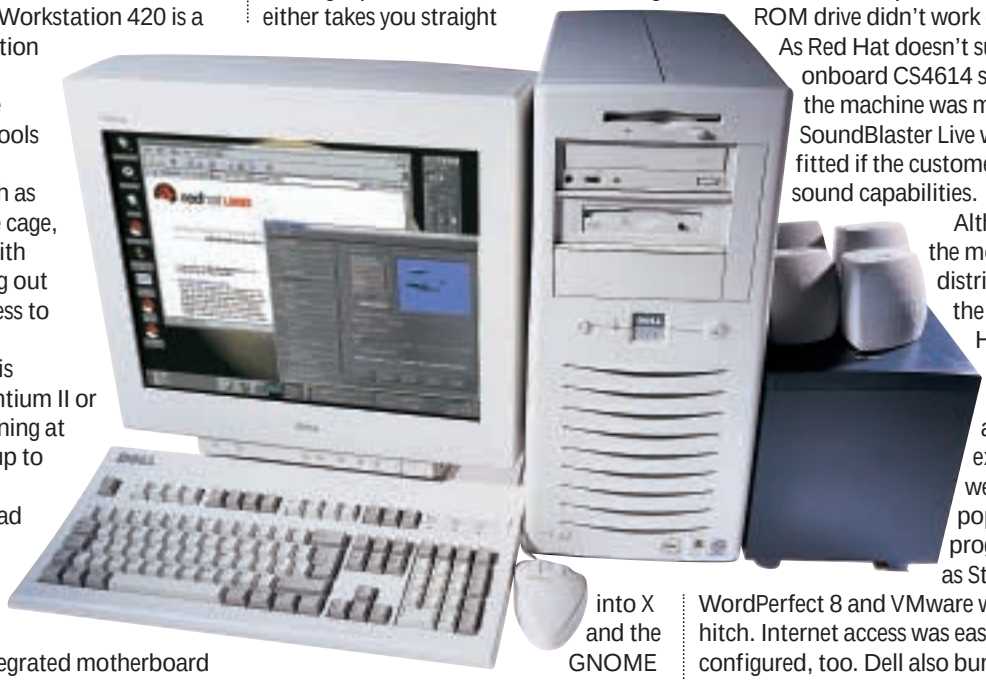
EXCLUSIVE

Dell Precision 420

Linux's growing popularity gets a boost as Dell entrusts its latest high-end workstation to the OS.

A sure sign of Linux's growing popularity is that vendors are starting to offer it as a pre-installed OS. Until recently, this has largely been confined to specialist Linux system builders such as Penguin Computing, Digital Networks UK or the large US company VA Linux Computing. Now, though, mainstream corporate vendors are starting to preload Linux and Dell is one of the first to deliver.

The Precision Workstation 420 is a high-end workstation system. The midi-tower case can be opened without tools and internal components, such as the PSU and drive cage, can be released with latches and swung out on hinges for access to the i840-based motherboard. This supports dual Pentium II or III processors running at up to 1GHz and up to four RIMMs; the review machine had two 64MB modules for 128MB of dual-channel RDRAM.



The highly-integrated motherboard includes Cirrus Logic sound, 3Com Fast Ethernet and Adaptec Ultra2 Wide LVD SCSI controllers. The only expansion card fitted is a Diamond nVidia TNT2 32MB graphics adaptor driving a flat-screen 19in Dell UltraScan Trinitron monitor, leaving the four 32bit PCI slots and one PCI/RAID port free.

Internal components include an 866MHz Pentium III with a 133MHz front-side bus (FSB) and full-core-speed 256KB secondary cache, an 18GB Quantum Atlas Ultra2 SCSI hard disk, LiteOn 48-speed ATAPI CD and an ATAPI Iomega Zip250 drive.

It is certainly a powerful and expandable high-end workstation with very few corners cut. However, all-SCSI storage might be more preferable and the 3D card, while ideal for gamers, is somewhat wasted in business use. However, the real interest lies in the operating system installed: RedHat Linux 6.1. (Since this machine was supplied, Dell has upgraded this to Red Hat 6.2.) When appropriately configured with a GUI desktop, Linux isn't much harder to use than Windows or any other graphical OS; the hardest part is often getting it installed. Buying a pre-configured system is therefore attractive, as the vendor does this for you, but what matters is how well the job is done.

The system boots into the Linux loader, LILO, offering a choice of kernels – the default multiprocessor one and one for single-processor machines. Choosing either takes you straight into X and the GNOME login screen. There's only one pre-configured user account, root, with no password. Logging in as root reveals a standard GNOME default desktop, but with Dell-logo wallpaper. The installation is largely a default Red Hat one with some minor tweaks, such as the AfterStep window manager offered as an alternative to Enlightenment.

Most of the system's hardware was correctly configured. XFree86 was correctly set up for the graphics card with a default resolution of 1,024 x 768, the SCSI controller, Ethernet, Zip and CD-ROM devices were all configured, and TCP/IP was set to auto configure itself using DHCP. Red Hat's linuxconf tool made it easy to check and adjust the various parameters, and a Dell directory of drivers and basic documentation was provided on the hard disk to accompany a slim paper manual introducing Red Hat Linux.

One area where Linux is more complex than Windows is disk partitioning. Dell has chosen sensible settings: a 20MB boot partition close to the start of the drive, a 5GB (root) partition, 2GB home and 10GB usr volumes, plus 128MB of swap space (larger for machines with more memory).

There were some niggles, though. The mount point for the Zip drive was created as a symbolic link instead of a directory, which had to be corrected before the Zip drive could be used, and the GNOME desktop icon for the CD-ROM drive didn't work correctly. As Red Hat doesn't support the onboard CS4614 sound chip, the machine was mute; a SoundBlaster Live will be fitted if the customer requests sound capabilities.

Although it's the most popular distribution in the US, Red Hat is quite spartan, with few added extras, but we tried popular programs such as StarOffice, WordPerfect 8 and VMware without a hitch. Internet access was easily configured, too. Dell also bundles 90 days' free phone and email support through LinuxCare alongside the three-year on-site warranty.

The system has some teething problems, although they aren't critical and as shipped it was usable – but they would require some Linux expertise to repair. Once these are smoothed out, though, this will be an excellent high-specification Linux workstation.

LIAM PROVEN

DETAILS

★★★★

PRICE £3,053.83 (£2,599 ex VAT)
CONTACT Dell 0870 152 4699
www.dell.co.uk
PROS Well-built, high-specification hardware; reasonable Linux configuration
CONS Some rough edges to Linux configuration; no sound support; no ISA slots
OVERALL A good first try. Dell's inexperience with Linux shows, but the problems are minor and the hardware is excellent

Sharp PC-AX10

An ultra-slim, lightweight notebook with an exceptional screen and power to die for.

The days when notebook computers were the sole domain of high-flying executives with company gold cards are long gone. That said, portable PCs still cost significantly more than their stationary counterparts and if it's a top-performing ultra-portable that takes your fancy then prepare to say goodbye to a fair wad of cash.

With a lightweight, ultra-slim design (the unit measures just 268 x 223 x 28mm) and metallic blue casing, Sharp's latest model caused quite a stir when it landed on the *PCW* testing tables. However, looks and diminutive stature alone do not a great machine make, so it's just as well it proved more than capable in our bench tests as well.

The Sharp makes good use of a 500MHz Mobile Pentium III processor coupled with 64MB of RAM, and can be further expanded to 192MB of RAM. The chip's 256KB Level 2 cache, coupled with a decent clock speed, means it can ship data around swiftly and, because the it's designed for mobile use, it does this incredibly efficiently. No wonder the machine managed to notch up a score of 90 in our SYSmark 2000 test. Although we have seen 500MHz notebooks turn in scores over 100, it's a more than respectable tally, and the unit had no problem running several office applications at once.

An onboard Rage Mobility M chip with 4MB of memory takes care of graphics, with sound handled by a chip from Crystal. Both a mono-speaker and microphone are built into the casing.

The screen is one of the most important parts of a notebook and, thankfully, TFT screens have come along in leaps and bounds in recent years. They can now be constructed more efficiently with fewer components making for thinner, brighter panels and Sharp's 12.1in screen is as good as they come. It proved capable of displaying a stable, clear image at the optimal 1,024 x 768 resolution with not a dead pixel in sight. This is one machine we'd be happy to use on a daily basis even over our desktop PC without fear of eye strain. The anti-glare, low-reflection technology (AGLR) proved effective – even in direct sunlight we could make out an image.

Unfortunately, anti-glare isn't a phrase you could easily apply to the keyboard. The decision to use purple keys and black legends isn't the wisest of design choices, however it's a minor quibble as the keyboard itself is responsive and the touchpad is equally good. Inside the machine there's a 12GB hard drive, which should be more than adequate for most users, and a 56K fax modem and network card to get you connected to the Internet or your network. Although the unit ships with Windows 98, all the relevant Windows 2000 drivers are included, so if you want the Sharp to integrate with your office environment you'll have no problems.

Expansion and connectivity are likely to be important whether you're using the notebook as your main or mobile PC. Luckily, it scores well. With two USB ports and two Mini-USB ports, connecting the latest peripherals won't be a problem and there are also connectors to hook up a monitor, plus stereo and digital audio outputs and an external microphone input. Modem and network connections are present and correct and synchronising with your PDA won't be a problem as there's an infra-red port. The unit ships with a separate floppy drive that attaches via a Mini-USB connection and there's also a separate 24-speed CD-ROM, but given the price tag we would prefer to see a DVD-ROM drive.

Battery life is crucial but, unfortunately, that's where the price for a top processor and an excellent screen is paid. A standard battery gives a rather stingy 1.3 hours of normal operation, although you can always shell out on an optional high-capacity battery or add a cell to the second battery compartment. There's a button-activated battery level indicator on the front of the case.

The Sharp is a top performer by today's standards and well worth a look for those who like the styling.

RICHARD MCPARTLAND

DETAILS

★★★★

PRICE £2,109.13 (£1,795 ex VAT)
CONTACT Sharp 0800 262 958
www.sharp.co.uk
PROS Powerful, good-looking machine; excellent quality screen
CONS Garish keyboard; no DVD-ROM drive; battery life using standard cells could be better
OVERALL If you are after a capable ultra-portable machine with an exceptional screen that will meet your needs for some time to come, the Sharp comes highly recommended but battery life seems a little low

PERFORMANCE RESULTS

SYSmark 2000

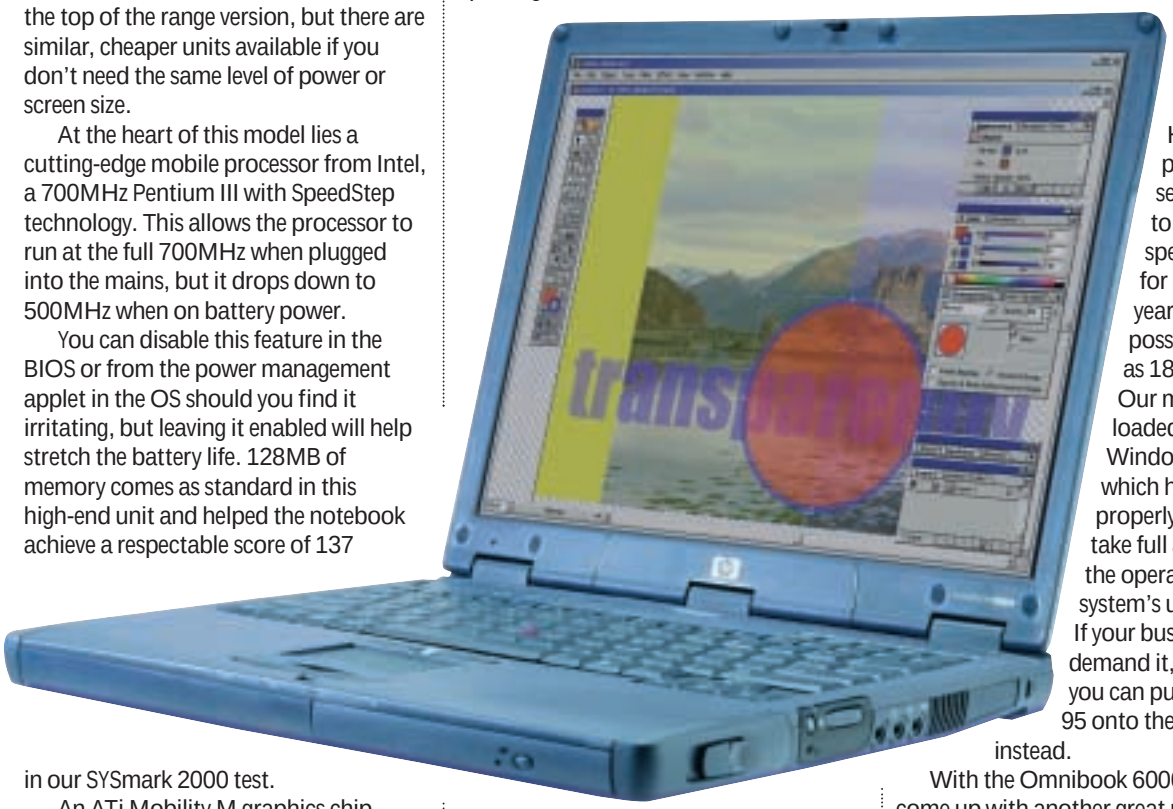
HP Omnibook 6000

Stylish corporate notebook including a V.90 modem, network card and the prospect of a long life.

The ever-present Hewlett-Packard (HP) has updated its corporate notebook range and improved on an already well-designed product. The Omnibook 6000 model reviewed here is the top of the range version, but there are similar, cheaper units available if you don't need the same level of power or screen size.

At the heart of this model lies a cutting-edge mobile processor from Intel, a 700MHz Pentium III with SpeedStep technology. This allows the processor to run at the full 700MHz when plugged into the mains, but it drops down to 500MHz when on battery power.

You can disable this feature in the BIOS or from the power management applet in the OS should you find it irritating, but leaving it enabled will help stretch the battery life. 128MB of memory comes as standard in this high-end unit and helped the notebook achieve a respectable score of 137 in our SYSmark 2000 test.



An ATi Mobility M graphics chip supplies the image on the 15in TFT display. This has 8MB of video memory and supports MPEG-2 hardware acceleration. A D-SUB output at the back means you could use the chip to drive two displays – the Omnibook's and an external monitor. The 15in TFT display itself is good – the whole thing looks bright and even, with no dark patches and the viewing angle is wider than on many notebooks we've seen.

The native resolution is 1,024 x 768 but 1,280 x 1,024 would have been better. One small drawback, though, is the fact that the screen does not fold down flat against the desk (useful for one-to-one presentations).

The keyboard is fairly good – it's very easy to type on, and HP has made sure that most of the keys are in similar positions to a standard QWERTY desktop keyboard. One thing that irritated us was the small return key – it is very easy to hit the backslash key above it instead. It's a matter of personal taste, though, and the keys are solid to use, with good travel.

As in the previous incarnation, HP has included both a trackpoint and a touchpad. Each of these has its own set of buttons, with the uppermost set sporting a new scroll button.

As this notebook is aimed at corporate users, it's good to see both a V.90 modem and network ports integrated into the chassis, with the ports placed on the left-hand side towards the screen. Next to this is the PC Card slot, with room for one Type III or two Type II cards.

On the other side is a handy rocker control to increase or decrease the speaker's volume, and there's also a mute button to silence the speaker with a single touch. The standard headphone out, microphone in and line out ports are situated next to this, together with an infra-red port. Single PS/2, USB, serial, parallel and docking connectors adorn the rear.

A single drive bay at the front can house the supplied DVD or floppy and a software decoder is provided for those who plan to watch films. Should you want to use both drives at the same time, you'll have to use a special cable that, in contrast to the previous generation of the Omnibook, HP has elected to supply. We would have preferred the DVD to be situated on the side as, when the notebook is perched on your lap, it's very easy to accidentally knock the button and trigger the opening mechanism.

On the corporate side, one of the biggest draws is the promise of a long product life. HP has promised to sell this model to the same specification for at least one year, and possibly as long as 18 months. Our model came loaded with Windows 2000, which had been properly set up to take full advantage of the operating system's use of ACPI. If your business needs demand it, however, you can put Windows 95 onto the hard drive instead.

With the Omnibook 6000, HP has come up with another great product. It's more stylish than previous incarnations, and it has a good feature set. There are a few minor points we would like to see addressed in future versions, but for corporate customers this is definitely worth a look.

JASON JENKINS

DETAILS

★★★★

PRICE £3,641.33 (£3,099 ex VAT)
CONTACT Hewlett-Packard 0990 474 747
www.hp.com/uk
PROS Fast mover; good screen and keyboard; DVD; stylish; choice of operating systems
CONS Small return key; DVD mounted at the front; only 1,024 x 768 resolution
OVERALL A great little product that will look good in the boardroom as well as appealing to IT managers

PERFORMANCE RESULTS

Gateway Solo 9300XL

This highly-specced desktop replacement is a well-priced successor to the 9300LS.

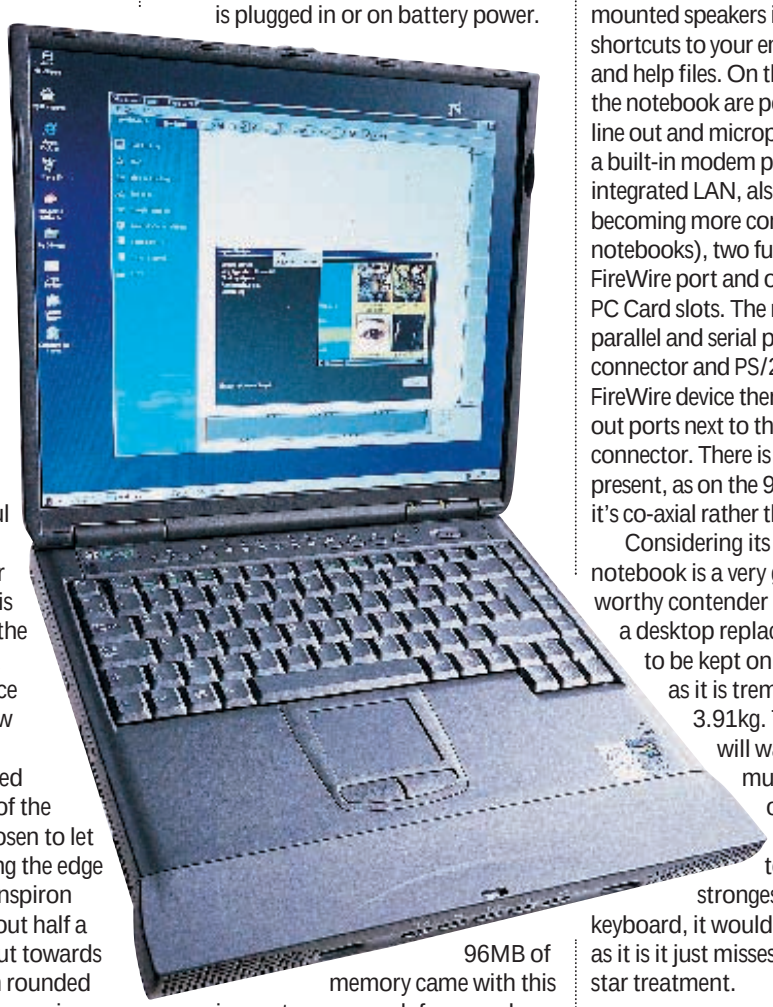
We first looked approvingly at Gateway's new 9300 solo range in our notebook group test in April, but the company hasn't sat on its laurels since then. This new desktop replacement, the Solo 9300XL, is based on our April Editor's Choice, the Solo 9300LS, but boasts improved specs.

The new feature that is most immediately apparent is the larger screen. The original has been boosted to a 15.7in TFT, with a native resolution of 1,280 x 1,024. It is exceptionally bright and clear, and there are no dead pixels evident. With this higher resolution, we were able to have multiple windows open without cluttering the screen – a useful feature, especially if you are considering abandoning your traditional desktop PC for this model. We found that using the screen at this resolution took some getting used to, but once we'd used the system for a few hours, it seemed normal.

The larger screen has forced Gateway to increase the size of the unit, and it has wisely not chosen to let the screen drastically overhang the edge of the system, as with Dell's Inspiron 7500. The screen juts out about half a centimetre along the sides, but towards the front the edges have been rounded outwards, so that when the screen is closed it lies flush. The effect of this is that you simply do not notice the small overhang.

Unfortunately, though, Gateway has not made full use of the increased form factor in the keyboard and touchpad. The keyboard is smaller than it should be. It covers just over half of the available surface area, leaving a lot of wasted space. We felt that the keyboard should have been made larger, or at least moved towards the front of the unit slightly. As it is, when typing, you have to reach over quite a lot of wasted space. This doesn't make for the most comfortable typing experience, and it is made worse by the fact that the touchpad buttons are fairly small compared to the acres of space around it.

The basic hardware specs are impressive. There is a 700MHz Pentium III inside this box. This is one of the latest processor to use Intel's SpeedStep technology, allowing it to run at two different speeds depending on whether it is plugged in or on battery power.



96MB of memory came with this review system – enough for everyday use, but as we are starting to see the arrival of 128MB as standard on new notebooks, it is beginning to look a little stingy. 32MB is soldered onto the board, and 64MB is present in one slot, leaving one free for expansion. Graphics are supplied by an 8MB ATi Mobility-P that help the screen achieve its high resolution. It also supplies good-quality hardware decoding for the Torisan DVD-U824 drive. This is located at the left-hand side of the notebook, and Gateway has been sensible enough to include a floppy drive next to it for good measure.

What this notebook lacks in ergonomic perfection, though, it more than makes up for in added features. At the front are four dedicated buttons to start, stop and skip through your DVD or CD, and there is also a lock button to prevent them being pressed accidentally. Above the keyboard are more dedicated buttons, this time for volume control (with one button reserved for muting the front-mounted speakers in one touch), and shortcuts to your email program, browser and help files. On the right-hand side of the notebook are ports for headphones, line out and microphone in. Next to this is a built-in modem port (there's no integrated LAN, also a feature that is becoming more common in other notebooks), two full-size USB ports, a mini FireWire port and one Type III/two Type II PC Card slots. The rear sees covered parallel and serial ports, a docking connector and PS/2. For those without a FireWire device there are composite in and out ports next to the standard D-SUB connector. There is still a digital out port present, as on the 9300LS, but this time it's co-axial rather than optical.

Considering its low price, this notebook is a very good effort and is a worthy contender if you are looking for a desktop replacement. It would have to be kept on a desktop, though, as it is tremendously heavy, at 3.91kg. There's no way you will want to transport this much further than from one room to the next, unless you happen to be the world's strongest man. With a larger keyboard, it would be a winner, but as it is it just misses out on the full five-star treatment.

JASON JENKINS

DETAILS

★★★★

PRICE £2,583.83 (£2,199 ex VAT)
CONTACT Gateway 0800 552 000
www.gateway.com/uk
PROS Highly specified; large high-resolution screen; keen price
CONS Keyboard could be improved; no LAN; heavy
OVERALL It could be better, but for the money this desktop replacement is certainly worth a look

PERFORMANCE RESULTS

Hi-Grade UltiNote AS8300

A notebook with room for expansion that can give some desktop systems a run for their money.

Whenever we review a PC, expandability is one of the first things we look for. When you're shelling out a lot of cash for a computer, you rightly expect your machine to grow with your needs in the months and years to come. Unfortunately, when it comes to notebooks, expandability is often sacrificed to make a smaller, lighter or cheaper machine. That's why this top-performer from Hi-Grade came as a breath of fresh air as there are more expansion opportunities than even we know what to do with.

The unit has a 650MHz SpeedStep Pentium III chip at its heart and, as its score of 122 in our SYSmark 2000 test proves, it's a very capable performer. There's also a healthy 128MB of RAM (expandable to 160MB) so running several applications at once doesn't slow the system too badly. A 12GB hard drive is included for storage.

The AS8300 doesn't fare badly when it comes to graphics either, with a Silicon Motion Lynx3DM chipset backed by 8MB of video memory. That said, you won't be able to while away hours playing Quake III.

The UltiNote definitely looks the part with its metallic finish and it isn't all that heavy either, weighing in at just 2.2kg. In fact, it's barely much taller than the six-speed DVD-ROM drive, which can be removed from the bottom of the unit, or wider than the 13.3in TFT screen. Crucially, the screen is a good one, capable of a maximum resolution of 1,024 x 768 and displaying a clear and vibrant image.

The unit's keyboard has been improved over previous offerings we've seen from Hi-Grade, with this one ranking among the better ones we have tested.

As with all portable computers its battery life is key. The unit holds a single lithium-ion battery and Hi-Grade claims a battery life of about three and a half hours in normal use – a claim we find hard to dispute. We managed about four hours of word processing from a single charge.

The notebook itself boasts a parallel, serial and USB port for expansion and if that isn't enough you can connect a break-out box to increase expandability still further. The box boasts a serial port, parallel port, two PS/2 ports, a VGA connector and two USB ports.

Although not all that practical for use on the road, for desktop use it's a valuable addition. Unfortunately there's just one Type II PC Card slot but as there's a built-in 56K modem and onboard network connection it shouldn't prove too much of a problem. There's also no FireWire connector, so if you've got your eye on the next generation of peripherals, think again.

Just in case you need more ports, the 'port dock' boasts serial, parallel, VGA and two PS/2 ports. There's also an audio jack to hook up some headphones or speakers. The dock comes with a removable floppy drive and there's a free bay for a CD-ROM, DVD-ROM or hard disk drive. There's even a set of built-in speakers and an amplifier. Using the controls on the top of the unit you can use it as a CD player although, as it draws power from the notebook, this needs to be switched on. The dock works well but the cable that connects to the notebook is a little short, which means you can't easily place the unit next to the notebook. It's also worth pointing out that you can't use the break-out box at the same time as the 'port dock'.

The UltiNote is a keenly priced machine, and you're getting a well-connected laptop with a certain degree of future proofing built-in. It would make an excellent desktop replacement and our only real qualm would be the solitary Type II PC card slot, although as there's a modem and network capability built in, it shouldn't be too much of a problem. Some people may prefer the neater solution of a removable docking bay but Hi-Grade's break-out box and 'port dock' do the job just as well.

RICHARD MCPARTLAND

DETAILS

★★★★

PRICE £1,938.75 (£1,650 ex VAT)
CONTACT Hi-Grade 0800 0740 402
www.higrade.com
PROS Good-looking, capable performer. Great screen, keyboard and touchpad. Additional expansion opportunities with the break-out box and 'port dock'
CONS You may not want to pay for ports you never use
OVERALL A good looking, capable performer with more connections than a BT switchboard

PERFORMANCE RESULTS

Bush Internet TV

A cheap way to get onto the web if you don't want to use a PC, and you can watch the footie too.

At first glance it looks just like any other television, but this one has a little surprise up its sleeve: you can use it to browse the Internet and email your friends. As a television, it is very average. The 14in screen is quite reflective, but the picture is clear and bright enough. The sound is mono, and there is a SCART socket on the rear to connect the television to other devices.

When you come to use the box's more advanced facilities, though, you can't help but be impressed, although Bush still has some way to go before people start abandoning their traditional PC for an Internet television.

There are only four buttons on the set itself – on/off, volume up and down and channel up. The rest is controlled by the television's mammoth remote control. This is about a foot long, and is heavier than a standard remote. It takes four AAA batteries. At the top is a circular pressure pad that moves your mouse pointer – but more on that in a minute. All the standard channel and volume controls are there, together with a selection of buttons help you set up the TV in the first place. Underneath the main panel, however, is a mini QWERTY keyboard, and a yellow function button that activates certain features tied to letters and numbers. The infra-red window curves around the top left of the control so you can transmit while holding it longways or sideways.

To access the Internet, you simply press the Internet button on the remote and confirm that you want to connect. The set dials the ISP, Bush Internet via Telinco, and, if it is your first time dialling, takes you through a standard sign-up procedure. Once this is complete, you don't need to remember your username and password to browse – the server uses CLI (caller line identification) to determine who you are and does the rest.

From here, you are taken to Bush's home page, which is optimised for viewing on a television. This contains links to other sites, some of which have also been optimised for this kind of browsing. As with any other browser, you can simply type in the URL to view the page. It is here, though, that one of the problems with the TV, and other products like it, shows itself. Web pages are generally not designed to be viewed on a low-resolution 14in screen. Moreover, if you want to view video, listen to MP3s, or look at Shockwave or Flash stuff, forget it.

The browser, developed by Ant, supports Javascripts, HTML 3.2 and has HTML 4.0 extensions together with SSL, so you'll be able to buy items over the Internet using your credit or debit card with confidence that the information is being encrypted. One thing that we found a bit cheeky was the fact that the Teletext facilities have been removed, on the basis that you don't need it with Internet access. We would still have liked to have seen it on the basis that Teletext is free and doesn't tie up your phone line.

Navigating web pages was slightly more difficult than with a PC and mouse, especially when it came to scrolling. Sometimes you can simply move your mouse pointer to the bottom of the page to see the rest of it, and sometimes you have to hold the select button and move the pointer. We found this a bit difficult, as our pointer kept disappearing off the side of the screen. With a bit of practice, though, we expect that you would get used to the TV's eccentricities.

The email facility allows you to have up to four separate accounts. You have to specify a username and password to log in. Once there, you can look at your stored and new messages, and there's an address book too. You can also specify a signature to round off each message. Unfortunately, the email facility is text only – you won't be able to open any attachments (except text files) that you receive. It is all very easy to use, but here another problem rears its head. The mini keyboard is simply not the best to type on – you can get a message out, sure, but it is not a very comfortable typing experience. Ideally, we would have preferred Bush to have bundled a wireless keyboard and a separate, smaller, lighter remote controller specifically for channel changing and the like. Bush will address this in September with a £29 wireless keyboard.

Although this TV is far from a perfect browser and email client, it is not half bad. There's even a printer port, although only a few printers are officially supported. What struck us was how simple it was to set up and use – just plug it in to your phone line and you are off. For someone that does not own a PC and just wants basic browsing and email facilities, this could be the answer, but you'll probably want the wireless keyboard. You certainly would not get a PC and monitor worth switching on for this price, but its limitations probably mean we won't see hoards of people flocking to abandon their PCs. Watch this space, though – with a few improvements, this could be a force to contend with.

JASON JENKINS

DETAILS

★★★

PRICE £199 (£169.36)
CONTACT Bush 01923 859777
www.bushinternet.com
PROS Very easy to use, low-cost email and Internet solution
CONS Browser and email program have comparatively limited functionality; you'll need a wireless keyboard
OVERALL If £200 is all you have, then this would be a good way to get on the Internet quickly and easily, but it can't yet compete with a PC browser and email client

EXCLUSIVE

Sony NW-MS7 Walkman

MP3 is so passé, especially when you're in possession of Sony's sleek new solid-state Walkman.

There's been a great deal of media debate about MP3 lately, especially with the legal proceedings against Napster bubbling away. It seems that what Diamond started over a year ago with its Rio portable MP3 player is coming of age.

The music on these units is stored on solid-state media, such as Smart Media, so it won't jump, no matter how active you are. Also, the lack of moving parts means the devices are both small and light.

It was only a matter of time before Sony threw its hat into the ring and turned its almost legendary design talents to this emerging market.

Before you think that Sony is just jumping on the bandwagon, there are a couple things that should be pointed out. First, the Memory Stick Walkman employs Sony's proprietary Memory Stick solid-state storage. Second, it is not an MP3 player.

Sony decided that the MP3 standard did not produce high enough quality results, so it opted for its own ATRAC (Adaptive Transform Acoustic Coding) system. ATRAC is extensively used as the compression algorithm for MiniDisc, so adapting it for the MS Walkman was not a problem. Differing amounts of compression can be applied to either increase capacity on the Memory Stick or improve the quality of the output. We were impressed by the output quality when coding a track from a CD. The depth and soundstage created were excellent and far superior to any MP3 player we had listened to. This doesn't mean you can't drop MP3 files onto the NW-MS7 – you can, although they do have to be converted to ATRAC first.

As with all things Sony, the design of the unit is superb. It's smaller and lighter than almost any other solid-state memory music device and is extremely desirable. The dimensions are only 37 x 96 x 19mm (w x h x d) and it weighs an amazing 70g. The Memory Stick used with the device is different to the versions we've seen before. Besides the obvious difference in colour (it's white instead of purple), it is called MagicGate Memory Stick and has inbuilt copy protection to stop you pirating music from it. Subsequently, any other Memory Sticks you have can't be used with the Walkman, although MagicGate sticks can be used in other devices.

The Memory Stick is a generous 64MB which will give you around two hours of playback at the lowest quality, one hour at the highest and 80 minutes at the middle setting. The middle setting of 105Kbits/sec is generally the best option, providing decent capacity while maintaining high audio quality.

The supplied software, OpenMG Jukebox, allows you to pull tracks from CD and convert them to ATRAC as well as converting MP3 files. The files you convert are stored in albums from where songs can be dragged and dropped onto the Walkman. We were disappointed that you could not drag and drop MP3 files straight to the device and have them converted on the fly. Having to convert the audio first not only takes longer, but also uses up double the space on your hard disk. That said, conversion doesn't take long, and even ripping a track from CD is incredibly quick.

When a song is taken from a CD it can be checked out three times to an external device. If after the third time the song has not been checked back into the computer, you will no longer be able to use it. This is an attempt to stop piracy, but is not very successful since, if you can no longer check a song out, the OpenMG Jukebox is happy to let you rip it from the CD again and have three more goes.

A small docking bar is supplied in the box which connects both to the PC via USB and to the mains via the supplied transformer. When the Walkman is connected to the docking bar it is ready to receive data from the PC while charging its battery at the same time. Download time is pretty speedy through the USB connection.

The device produces first-class music playback that is unaffected by what the user is doing. We ran and cycled on an exercise bike and playback was flawless.

There were, however, a couple of issues. First, was the lack of a remote control. Anyone who's used to listening to a Sony MiniDisc Walkman knows how invaluable this is. With the remote clipped to your shirt or jacket you don't have to dig around in your pocket to control the device. The second problem was the selection beep. Every time you enter the menu and select an option a beep is emitted, but the music stops momentarily when the beep is sounded. That said, the beep can be turned off.

On the whole, Sony has come up with a great product, but a couple of points stop it being the perfect solid-state music solution. The lack of a remote control is a big issue, although this was more than likely to keep costs down, but the inability to drag and drop MP3 files straight to the device is disappointing.

Ultimately, if you want a solid-state music player, then this is the best there is. It might seem pricey, but it is head and shoulders above the competition.

RIYAD EMERAN

DETAILS

★★★★

PRICE £299 (£254.46 ex VAT)
CONTACT Sony 0990 111 999
www.sony.co.uk
PROS Very small; very light; very sexy; great sound
CONS No remote; no on-the-fly MP3 conversion
OVERALL A great product that's only a step away from being perfect. It's still the best in its class by a long way, though

Compaq iPAQ H3600

Pocket PC PDA with astounding speed and good looks, but no built-in Compact Flash or PC Card.

The first thing that hits you about the iPAQ H3600 is its stylish look. It's about time someone broke away from the angular lines and boxy looks of previous PDAs. The iPAQ really does look like it has been created by a designer rather than knocked up in a CAD package by a bored engineer. However, the style isn't to everyone's taste and, while Compaq should be praised for throwing away the boxy mould, you get the impression the unit just misses the mark slightly in the cool stakes. The *PCW* office was split on this one, with half really loving the stylish look and the other half thinking the machine looked like a naff prop from a bad sci-fi movie.

The second thing that hits you, or rather smacks you around the face like a English soccer thug on the rampage, is the sheer speed of the processor. We thought the Casio E-105 was speedy, but the iPAQ is like the Casio on steroids in comparison. This is not surprising as the iPAQ uses a StrongARM SA1110 running at a whopping 206MHz compared to the Casio's MIPS clocked at 131MHz.

We loaded a copy of PocketTV from www.mpegtv.com that allows you to play MPEG files on PDA devices. The iPAQ not only handled the video playback with ease, but could also play back an MP3 file at the same time – impressive.

The TFT screen is also worthy of praise. Measuring 240 x 320 pixels, it looks fantastic with the backlight on, but even without the backlight there is enough contrast to be able to read it reasonably easily in normal office light. Not only this, but the unit has an automatic brightness sensor, visible only as a tiny hole on the front of the fascia, that checks the light level in the room and adjusts the display's brightness accordingly.

Most of the usual buttons that have appeared on previous Windows CE devices are present on the iPAQ, with quick-launch buttons for the voice recorder, calendar, contacts, program menu and one assigned to Compaq's quick-launch utility. One omission, though, is the rocker switch that's present on the Aero models, but the new dpad (that also houses the speaker) more than makes up for its absence.

Compaq is making a big hullabaloo about the expansion slot at the rear of the unit. This is a proprietary interface much like the Springboard slot on the Handspring PDAs. Modules slot over the back of the iPAQ and grip its sides to stay in place. Unfortunately, Compaq didn't have any modules available at the time of writing, so we couldn't try out this feature. However, PC Card and Compact Flash modules should be available soon, and more interesting modules such as a GPS (Global Positioning System) unit and a combination Bluetooth/Compact Flash expansion pack should follow some time in the near future.

There is an open source initiative, backed by Compaq, to put Linux on the H3600. A version of Linux can be downloaded and run on the device, but once it is installed there is currently no way to reload the Pocket PC OS. This problem should be fixed soon. Check out www.handhelds.org for more information. Despite all the plus points, there are a number of issues we have with the device. While the iPAQ doesn't skimp on memory, having 32MB of RAM and, like all new Pocket PC devices, 16MB of ROM, there are no built-in Compact Flash or PC Card slots for additional storage. This is totally unforgivable and misses the point of Pocket PC being a multimedia OS. What's the use in having multimedia capabilities such as the WMA and MP3 playback facilities when you have to use a bulky add-on to give the device the storage space to hold the multimedia files?

Secondly, no matter how much better Pocket PC is than Windows CE as an OS – and it is way ahead of its older brother – it's still not as easy to use as Palm OS. It's a bit like Windows 3 in comparison to MacOS. It looks and feels similar, but it's just more fiddly to use and still has its annoying idiosyncrasies. That said, Pocket PC has a big edge when it comes to multimedia and Internet facilities.

Also, we did manage to repeatedly crash the device while trying to delete some MP3 files from memory. The crashes were so bad that the unit wouldn't even respond to the off button. We had to repeatedly reset the iPAQ before we finally managed to free the file from the grips of the Pocket PC media player. We're not sure if this is a fault with the iPAQ or with the Pocket PC OS, but it was extremely frustrating.

That said, the iPAQ is a very cute device. It's reasonably stylish, not too bulky and has a ferociously powerful CPU, but the lack of a built-in Compact Flash or PC Card slot brings it down a notch or two.

NIALL MAGENNIS

DETAILS

★★★★

PRICE £399 (£339.60 ex VAT)
CONTACT 0845 270 4000
www.compaq.co.uk
PROS Very fast processor; great screen; distinctive design
CONS The lack of a built-in Compact Flash or PC Card slot is unforgivable
OVERALL A stylish unit with a great screen and processor, but let down by the lack of built-in support for Compact Flash and PC Cards

Sony CMD-Z5

A well-designed phone with extras including WAP, email access and answerphone capabilities.

The Sony CMD-Z5 is quite simply a stunning mobile phone, resplendent in silver and small enough to fit even the tightest of pockets. The Z5 measures only 88 x 49 x 21.5mm (h x w x d) and weighs an incredible 82.5g. The styling is rounded and it actually looks like a toy phone rather than the real thing, but it does start to grow on you after a while. The only thing that really spoils the shape is the large antenna fixed to the top right corner, but then with a device this small there probably wasn't enough room for an internal aerial.

A large active flip covers all the buttons and half of the screen, so there's little chance of accidental key activation while it's in your pocket or bag.

The display is superb with multiple shades of grey for handling graphics and full resolution for improved detail. It's usually possible to view the whole of an SMS message on the screen at once without having to scroll through it. That said, even if you do need to scroll through anything, it's the simplest of manoeuvres with the Z5. Located at the top left corner of the phone is a jog dial, but not just any jog dial. Anyone who has used a device like this will be familiar with the ability to scroll up and down by turning the wheel and selecting by pressing the wheel inward, but Sony has taken this idea a step further. As well as being able to press the wheel inwards it can also be pressed towards or away from the user, making an already versatile tool even more so.

The one gripe that we did have about the jog dial was its position. We would have preferred to have seen it at the top right-hand corner to allow for easy thumb manipulation with the phone in your right hand, although we're sure that left-handed users will be grateful for the design.

Although the Z5's size is one of its key selling points, anyone with big hands may find it hard to press the keys without unwanted keystrokes appearing at random. But then any of the very small phones on the market suffer from the same problem.

Opening the phone and pressing the jog dial inwards brings up the menus. These are displayed beautifully as 3D tabs that can be scrolled through using the dial. Navigation is simple and intuitive with the extra jog dial functions coming in very handy. Pulling the dial towards you will jump back one menu level, while pushing it away from you will give you a brief explanation of the option that's currently highlighted.

There's a memo recording facility, which is nothing new with a mobile phone, but what's interesting about this one is that you can use it as an answerphone. You can record an answerphone message and then set the phone up to play that to incoming callers and then record their message for you to listen to later. This is a great idea because you avoid the costs incurred by retrieving voicemail from your service provider.

It's not just the design of this phone that's impressive though, it's also a very advanced mobile data communication device. This is the first phone we've seen that uses the Microsoft browser that allows you to use both WAP and HTML standards. The results were impressive with faster download times than any of the other Internet phones we've seen, although setup wasn't easy and there was practically no help in the manual. You can also use the Z5 for accessing your POP3 email. Simply input the dialup and account details of your POP3 mail provider and you can read and send email from your standard POP3 account without the limitations of SMS email.

Another great design feature is the inclusion of a power cradle. This means that the phone can be placed in the cradle when you get to work where it will happily charge while you sit at your desk, and can then be simply picked up when you leave. Don't worry about having to carry the cradle with you when you travel though, since the power cable that connects to the cradle also connects to the phone.

So, is this the perfect mobile solution for the new millennium? Unfortunately, not quite; there are a couple of issues that tarnish the package. First is the lack of an infra-red modem. It may be said that a phone with features like this doesn't need to connect to a PDA or notebook, but many mobile users will still prefer to type emails on an external device. Another disappointment is the lack of GSM1900 support (it's a 900/1800 dual-band unit), rendering the phone useless if you travel to the US.

It's a shame that Sony chose to leave out two such useful mobile features that could have made the Z5 the ultimate mobile solution, although as it stands it's still a stylish and feature-packed product.

RIYAD EMERAN

DETAILS

★★★★

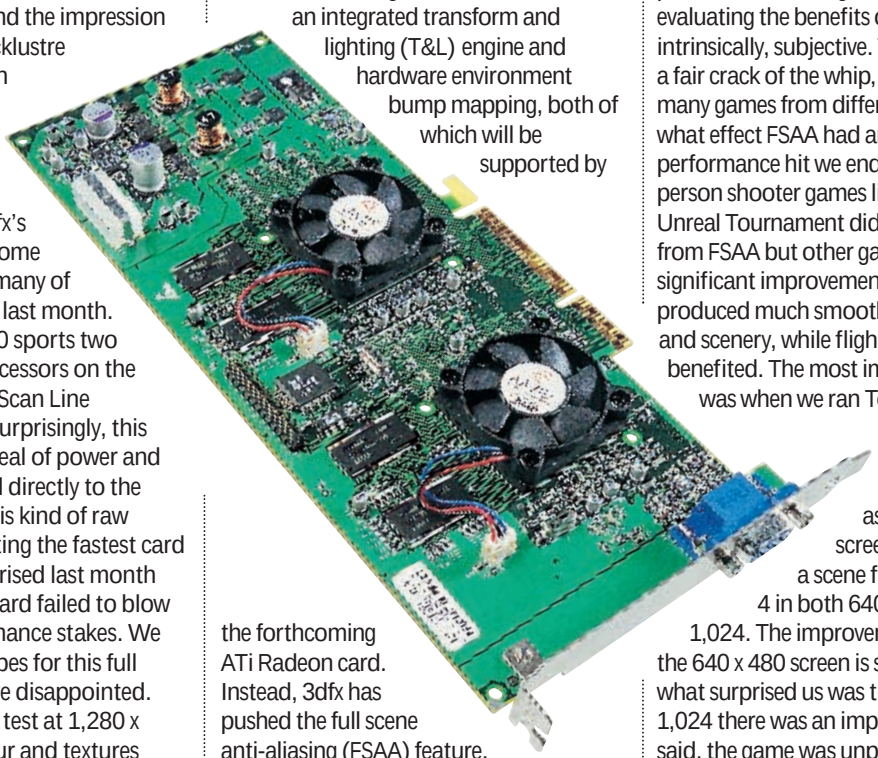
PRICE Approx £149 with a contract (£126.80 ex VAT)
CONTACT Sony 0990 111 999
www.sony.co.uk
PROS Very small; feature packed; great design
CONS No IR modem or GSM1900 support
OVERALL This could have been the perfect phone for so many users but for a couple of omissions. It's still a great product though

3dfx Voodoo5 5500

The full production graphics card still has problems, but FSAA is worth checking out for games.

We looked at a pre-production version of this board last month and the impression was of a somewhat lacklustre graphics solution when compared with the competition. However, after closer inspection of the full production board, 3dfx's new baby does show some potential, but retains many of the problems outlined last month.

The Voodoo5 5500 sports two VSA-100 graphics processors on the board running in SLI (Scan Line Interleave) mode. Unsurprisingly, this board draws a great deal of power and needs to be connected directly to the power supply. With this kind of raw power, we were expecting the fastest card around and were surprised last month when the reference board failed to blow us away in the performance stakes. We therefore had high hopes for this full retail card, but we were disappointed. Running the Quake III test at 1,280 x 1,024 with 32bit colour and textures resulted in a score of 40fps, which was comparable to last month's two GeForce2 cards that scored 41fps. The Voodoo didn't fare as well on Direct3D though. Running 3DMark in 1,280 x 1,024 with 32bit colour brought in a score of 2,277 compared with 3,084 on the Asus V770 GeForce2 card.



3dfx has also ignored features such as an integrated transform and lighting (T&L) engine and hardware environment bump mapping, both of which will be supported by the forthcoming ATi Radeon card. Instead, 3dfx has pushed the full scene anti-aliasing (FSAA) feature. This improves the image quality of a scene by smoothing the edges and eliminating 'jaggies' that surround curved and diagonal surfaces. It works very well, but the performance hit is significant, to the extent that a 3DMark score of 3,418 at 1,280 x 1,024 in 16bit colour drops to 874 with four-sample FSAA enabled. But raw performance testing isn't a fair way of evaluating the benefits of FSAA since it is, intrinsically, subjective. To give the Voodoo a fair crack of the whip, we loaded up many games from differing genres to see what effect FSAA had and how much of a performance hit we ended up with. First-person shooter games like Quake III and Unreal Tournament didn't benefit too well from FSAA but other games showed a significant improvement. Racing games produced much smoother backgrounds and scenery, while flight simulators also benefited. The most impressive example was when we ran Tomb Raider games. The difference in the image quality was astounding. The screenshots (left) show a scene from Tomb Raider 4 in both 640 x 480 and 1,280 x 1,024. The improvement with FSAA on the 640 x 480 screen is significant, but what surprised us was that even at 1,280 x 1,024 there was an improvement. That said, the game was unplayable at 1,280 x 1,024 with FSAA enabled. Games like Tomb Raider still look great even at lower resolutions with FSAA turned on, making it ideal for users with small monitors.

The Voodoo5 5500 doesn't perform as well as we'd hoped but FSAA can be applied to any game in your library without the need for native support.

RIYAD EMERAN

Top left: Tomb Raider 4 at 1,280 x 1,024 with FSAA enabled; top right with no FSAA
Bottom left: TR4 at 640 x 480 with FSAA; bottom right without FSAA

DETAILS

★★★★

PRICE £249 (£211.91 ex VAT)
CONTACT 3dfx 01753 502 800
www.3dfx.com
PROS FSAA can be applied to any game with some stunning results
CONS Lacks T&L, not as fast as a GeForce2
OVERALL The lack of features and under par performance are disappointing, but the FSAA is great when used with the right game

PERFORMANCE RESULTS

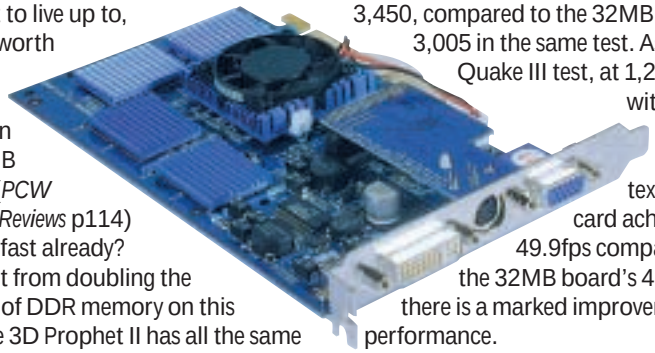
Quake III 1,280 x 1,024 32bit

3DMark 2000 1,280 x 1,024 32bit

Hercules 3D Prophet II

If you need the extra frames per second this 64MB graphics card can offer this could be for you.

The GeForce II GTS is currently the force to be reckoned with in the 3D graphics cards arena, although as last month's preview of the ATi Radeon shows, the tide may be about to turn. We got hold of the 64MB version of the Hercules 3D Prophet II to see how it performs. Billed as '3D speed beyond imagination', the card has a lot to live up to, but is it worth shelling out for this when the 32MB version (*PCW* August, *Reviews* p114) is pretty fast already?



Apart from doubling the amount of DDR memory on this card, the 3D Prophet II has all the same functions as its sibling. The board does look different as all the memory chips on this model sit on the top of the card and instead of each RAM chip having individual heatsinks, two chips share a larger heatsink between them. There is also a second PCB riser above the first to deal with the S-Video electronics as well as a DVI output.

The Prophet performed as expected, beating the scores of the 32MB variant in both 3DMark 2000 and the Quake III tests. The 64MB's 3DMark 2000 score at 1,280 x 1,024 with 32bit colour was 3,450, compared to the 32MB variant's 3,005 in the same test. As for the Quake III test, at 1,280 x 1,024 with 32bit colour and textures, the card achieved 49.9fps compared to the 32MB board's 41.1fps. So there is a marked improvement in performance.

The real issue is cost. With a street price of £319 inc VAT, it's a fair bit more expensive than the 32MB card, but if you are prepared to break the bank for slightly better performance, then at least you can be sure you have one of the fastest graphics boards on the block.

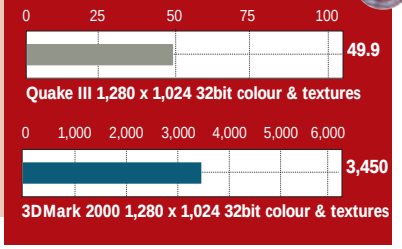
SCOTT MONTGOMERY

DETAILS

★★★★★

PRICE £319 (£271.49 ex VAT)
CONTACT Hercules 020 8686 5600
www.hercules.com
PROS Even more speed from a GeForce II GTS-based card
CONS Even more cash
OVERALL If money is no object this is the one to buy. But for the less affluent, the 32MB version will be more than adequate

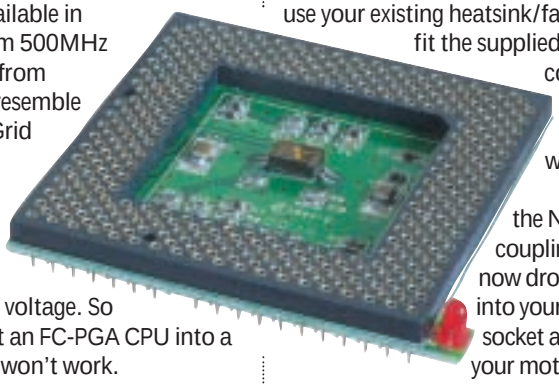
PERFORMANCE RESULTS



PowerLeap Neo-S370

A workaround for chip compatibility problems appears to have some difficulties of its own.

Upgrading your CPU is not straightforward. Intel's latest Flip Chip Pin Grid Array (FC-PGA) CPUs (available in Pentium IIIs from 500MHz and Celeron IIs from 566MHz) may resemble old Plastic Pin Grid Array (PPGA) models, but the pins are different and the CPU die requires a lower voltage. So while you can fit an FC-PGA CPU into a PPGA socket, it won't work.



Enter PowerLeap's Neo-S370, which promises to let new FC-PGA CPUs work on old PPGA motherboards, effectively letting you swap your sub-500MHz socketed Celeron for the fastest FC-PGA Pentium III on the market.

After setting two jumpers for the desired FSB (front-side bus), you must carefully insert the CPU into the adaptor – scary stuff, but not as bad as having to slide a razor blade in between to separate them again. Since the chip is now twice as thick as before, you can't use your existing heatsink/fan and must fit the supplied PowerLeap combo, which is far from the best we've seen.

In theory, the Neo/FC-PGA coupling should now drop straight into your PPGA socket and work, but your motherboard must be able to support lower 1.65 core voltages. We tried an 866MHz PIII on an Abit BP6 and, while the system started up okay, it was too flaky to run any tests.

We had, in fact, bought a pair of adaptors in the hope of dual-PIII action, but now our BP6 didn't even wake up, so it was back to the dual 366 Celerons. At the www.bp6.com enthusiast site, they'd successfully got one PIII working, but no joy with dual CPUs. Note that only FC-PGAs employing Intel's cB0 'stepping' are certified for dual operation.

Despite costing only $25 each, our pair came to £70 after postage and import tax, which is not far off a new motherboard. We're expecting to see several genuine dual-FC-PGA motherboards launched this summer which, to be honest, is a better buy.

GORDON LAING

DETAILS

★★

PRICE $25 plus postage and import tax (approx £35)
CONTACT PowerLeap
www.powerleap.com
PROS FC-PGA compatibility on legacy PPGA motherboards
CONS Ours were flaky and expensive to import
OVERALL You may be better off buying a new motherboard

Pioneer DVR-S201

DVD authors and companies that need to back up a lot of data will love this piece of kit.

A few years ago a DVD-R drive would have set you back over £13,000. Things have moved on since then, but these devices are still not cheap at £3,000 ex VAT. That said, it wasn't just the cost of DVD-R that put off potential buyers, it was also the capacity. The problem with DVD-R is that the capacity is only 3.95GB, which means that DVD discs cannot be mastered from them. Well, that's not exactly true, you could press a DVD 5 from a DVD-R disc, but you'd be wasting 800MB of capacity. However, the solution to this problem is close at hand, with the 4.7GB DVD-R standard due for implementation in September.

With 4.7GB recordable DVDs available, the process of creating DVDs for distribution has just got a lot easier.

As things stand, if you want to create a DVD you'll probably have to send your data off on DLT tape and hope that the disc comes out as you want it. However, if you could create a DVD exactly the way you want it yourself, you'd know that when your distribution discs are pressed there will be no mistakes.

The DVR-S201 is an external DVD-R drive from Pioneer. The company has been a big player in the DVD market since its inception, so it's no surprise that it's the main supplier of DVD-R devices. The drive uses the SCSI interface and the rear of the case sports two Centronics SCSI connectors, a device ID selector, a power socket and a terminator switch. At the front of the box is a power switch, an eject button and two lights indicating when a disc is loaded and when it's being read or written to.

Connecting up the device is simple, as it usually is with SCSI peripherals. There is no SCSI cable supplied, but since there's no way of knowing what SCSI card it will be connected to this makes sense.

The discs are not particularly cheap, considering they can only be written to once, but any company that needs this kind of device isn't likely to be put off by the media cost. A 3.95GB disc will set you back between £20 and £24 while a 4.7GB disc will cost between £25 and £28.

Companies that need to archive a lot of data on a regular basis will benefit greatly from a DVD-R drive, especially since only records stored on write-once media are admissible in court.

That said, the main use of a drive like this will be for video. MPEG2 encoding has dropped in price so much that anyone dealing with multimedia or video is likely to want to code their output using it. Of course, anyone with a DVD player will already have experienced the high-quality video of MPEG2 when watching movies, so distributing video and multimedia on a DVD-R disc seems like the natural choice.

Using the DVR-S201 was simple and intuitive with the drive operating like a high-capacity CD-R drive. We connected the drive to a 733MHz Intel Pentium III system with 128MB of RAM and a standard Adaptec PCI Narrow SCSI card. The burn times were long, but that's hardly surprising considering the amount of data that's being written. We wrote 3.5GB of data directly from a DVD-ROM disc to a blank 3.95GB DVD-R disc. The operation took 45 minutes and 30 seconds.

It's easy to dismiss DVD-R as being too expensive compared to a DVD-RAM drive at under £400, but they really are entirely different products. The DVD-RAM discs may be rewritable, but you can only squeeze 2.6GB on each side, although the 4.7GB per side discs have been just around the corner for several months now. Also, DVD-RAM discs can only be read by another DVD-RAM drive, whereas DVD-R discs can be read by any DVD drive.

There is some serious competition on the horizon for DVD-R, however. DVD+RW is the rewritable standard supported by Philips, Sony and HP. This alternative to DVD-RAM is due for release early next year with a 4.7GB capacity and the ability to read the discs in any DVD drive, just like DVD-R. However, whether we see DVD+RW next year remains to be seen, and in the meantime DVD-R is definitely the best solution for pre-mastering DVD discs.

The company that supplied the drive, Map 2000, is offering a bundle with the drive which includes Pioneer Crosswriter pre-mastering software as well as DVD-REP from Prassi (best known for its packet-writing CD-RW software). Rounding off the package is a box of 10 blank 3.95GB DVD-R discs to get you started.

This is a very expensive device that you either need or you don't. But if you do need it, it's well worth the money.

RIYAD EMERAN

DETAILS

★★★★

PRICE £3,525 (£3,000 ex VAT)
CONTACT Map 2000 01344 845 626
www.pioneer.co.uk
PROS Great for pre-mastering DVDs; easy to use
CONS Expensive
OVERALL A great unit if you're in the business of creating DVD discs. If you're not a DVD author, DVD-RAM may be a better option

Canon Digital Ixus

A digital camera, so compact and stylish, that the snap-happy will want to take it everywhere.

The one rule for any portable equipment is that if it's too big and heavy, you simply won't use it. This particularly applies to cameras – a big one may offer better facilities or quality, but if you can't be bothered to take it out, then you're better off buying a cardboard disposable, as at least you'll come home with some pictures.

Canon understands this philosophy perfectly and complements its higher-end SLRs with increasingly smaller compact cameras. The evolution peaked a couple of years ago with the tiny but perfectly formed Ixus camera, designed to use the new smaller APS film format. Sure, it couldn't match the quality of even some larger compacts in many circumstances, but its small size ensured it never stayed at home and missed an event. Now Canon has done what many thought would be impossible: meet the Digital Ixus.

Measuring a mere 57 x 87 x 27mm and weighing only 190g (without battery), the Digital Ixus really is the same size as the original 24-48mm zoom Ixus; suddenly Canon's earlier S10/S20 at 69 x 105 x 34mm and 270g doesn't seem so compact any more. When powered down, the only thing to protrude from the silver case is the slim zoom lever that surrounds the shutter release button on the top.

As with the S10/S20 and original Ixus, there's only room in such a small space to accommodate a 2x optical zoom lens, equivalent in focal length to 35-70mm on a 35mm camera; the actual specification is 5.4-10.8mm, f2.8~4.0 and the closest macro focusing distance is 10cm.

Before you get too excited, the Digital Ixus does not boast a 3.3megapixel CCD – after all, if it did, there'd be no point buying the more expensive S20. Instead Canon has fitted a 2.1megapixel chip, operating at 1,600 x 1,200 pixels. With most colour inkjets liking to be fed around 200 pixels per printed inch, the Digital Ixus will easily deliver 8 x 6in prints, although even at 10 x 8in, image quality was acceptable (especially with subsequent software interpolation to smooth the jaggies).

You'd be forgiven for thinking Canon had employed built-in memory but, remarkably, the company has found room for a Type I Compact Flash slot and supplied an 8MB card as standard. Understandably, the slot won't accommodate IBM's MicroDrive. Like earlier Canon Digital cameras, the Digital Ixus employs relatively light compression at its best quality setting, resulting in files measuring around 1.6MB each. You'll get around four or five of these on the 8MB card, 12 using higher compression, or 46 in 640 x 480 pixel mode. There's no uncompressed TIFF mode.

The supplied lithium-ion battery fully recharges in around 120 minutes and is good for an average day's shooting – Canon reckons it's good for around 85 shots using the LCD monitor. Speaking of which, the Digital Ixus has a 1.5in TFT display, in addition to an optical viewfinder. The 1.5in may look small alongside the 1.8 and 2in displays on other digital cameras, but it works well. About the only downside is that you have to use it to check battery life, shooting mode and number of shots left, as there's no room for the traditional mono LCD status panel on the top.

Like the S10 and S20 before it, the Digital Ixus is almost entirely automatic, with a couple of overrides thrown in for good measure. Shutter speeds range from one second to 1/500, but there's no manual control over these, the aperture or the focus beyond a basic lock.

You can however, choose a black and white mode, set the white balance and adjust exposure compensation from +/-2EV in 1/3 EV steps, which is considerably more than on an average film compact. The flash can also be forced on or off, you can reduce red-eye, or use slow-syncro to complement long exposures. There's also TV output, but no video capture mode. Finally, a neat stitch-assist mode helps you align multiple frames to create panoramic effects.

Connection is across USB only, and Canon's supplied ImageBrowser software lets you browse, manage and download images – best-quality JPEGs take around six seconds to transfer.

Image quality was pretty good, but there was a little electronic noise apparent on smooth coloured graduations such as blue skies. So saying, in our tests, the Digital Ixus panned the original film Ixus in terms of image quality, along with boasting more control.

The bottom line is that while there are certainly better quality cameras around, none are as small as the Digital Ixus and its results are more than acceptable for the environments in which it will be used. It's so small you'll take it everywhere and, because it's digital, you'll keep snapping without a care. There's even a waterproof case available, at £149, that's good to five metres. In many ways, this makes the Digital Ixus the perfect compact camera – so long as you're never more than a day away from mains electricity or additional storage, of course.

GORDON LAING

DETAILS

★★★★★

RECOMMENDED Personal COMPUTER WORLD

PRICE £599 (£509.79 ex VAT)
CONTACT Canon 0121 666 6262
www.canon.co.uk
PROS Tiny, gorgeous and more than good enough for snappy situations
CONS Not 3.3megapixel; slight noise on images; need to use main display to check status
OVERALL Small and of sufficiently good quality to replace many compacts

Epson PhotoPC 3000Z

A chunky, high-quality 3.3megapixel camera that promises to rival its competitors.

Now it's Epson's turn to join the 3.3megapixel fray with its PhotoPC 3000Z; a camera that, like its four major competitors from Canon, Sony, Olympus and Nikon, seems to have been carefully researched.

The 3000Z is a fairly chunky camera, measuring 89 x 108 x 65mm and weighing a relatively heavy 368g without batteries. Like Nikon and Olympus, Epson is sticking with four AA batteries and supplies a set of rechargeables and a charger. AAs are cheap and readily available, but they take around half a day to fully charge and rarely match the lifespan of the best lithium-ion rechargeables.

Like the earlier 850Z model, Epson has fitted the 3000Z with a 'HyPict' mode. This interpolates the standard 3.3megapixel resolution of 2,048 x 1,536 up to 2,544 x 1,904 pixels. Interpolation is where intermediate values are created by software to increase the apparent resolution of an image. It won't reveal any additional detail that wasn't originally captured, but can be quite effective at smoothing edges and hiding jaggies in big enlargements – but why build it in the camera when you can do it in software later?

We presume the answer is for situations where there's no PC, such as popping the memory card directly into a suitable photo printer. In-camera interpolation also allows you to work with raw data before it has been compressed. So saying, we took several identical compositions in both normal and HyPict modes, but when printed at A4 on Epson's Stylus Photo 1270, both looked virtually identical. At A3 there's a slight visible difference, but no-one yet produces an A3 printer with a memory card slot. Consequently we recommend you stick with the normal mode and fit more images on the memory card.

Epson supplies the 3000Z with a 16MB Compact Flash card, although the slot is not certified for the IBM MicroDrive CF hard disk. Interestingly, Epson has used the most severe standard compression out of all the 3.3megapixel cameras tested, resulting in files typically measuring only 780KB at best quality (compared to between 1 and 2MB on the others); even the interpolated HyPict mode only produces files around 1MB. There's the option of an uncompressed 9MB TIFF mode, along with a 640 x 480 and cropped 2,048 x 768 panoramic setting.

The 3x optical zoom lens is equivalent to 34-102mm on a 35mm film camera; the specification is 7-21mm, f2.0~2.5 and the closest macro focusing distance a reasonable 6cm. There's a manual focus option, but only three steps to choose from compared to seven on the Sony S70 and an impressive 50 on the Nikon 990.

Round the back is the choice of an optical viewfinder or a clear, bright 1.8in TFT display – out of all the 3.3megapixel models only the Sony S70 has a 2in screen. Seven buttons surrounding Epson's screen activate or confirm options displayed alongside, and you can zoom in by a factor of two during playback.

Flash options are particularly good, with an external hotshoe and a welcome rear-curtain mode that fires the flash at the end of a long exposure to trail the action behind. An aperture priority mode offers six steps from f2.0 to f8.0, while fully manual offers 42 shutter speeds between eight seconds and 1/750. A time lapse function can automatically snap at intervals between 10 seconds and 24 hours. Exposure compensation is available from +/-2EV in 1/3 or impressively fine 1/5 EV steps.

The now common movie mode can capture up to 25 seconds of 320 x 240 video with mono audio in the QuickTime M-JPEG format, and play back full-screen on your TV; you can also record descriptive audio clips with each picture. Epson's software lets you view and transfer images (standard JPEGs in approx three seconds), and even configure and control the camera over the USB connection.

Image quality is excellent, with sufficient pixels to make a great looking A4 inkjet print. The high level of compression even on the best-quality JPEG setting slightly softened ultimate detail, but it's nothing you'd worry about.

On the downside, the 3000Z takes 55 or 15 seconds to save a TIFF or HyPict image, and 30 or five seconds respectively to open them. A 15-second video clip takes over 20 seconds to save and the same again to buffer before playing.

The 3000Z is most comparable to Sony's S70 and Olympus' 3030. Our favourite 3.3megapixel camera remains the S70 for being slightly smaller and lighter while boasting a much longer battery life, but it's an extremely close run thing – all will do you proud.

GORDON LAING

DETAILS

★★★★

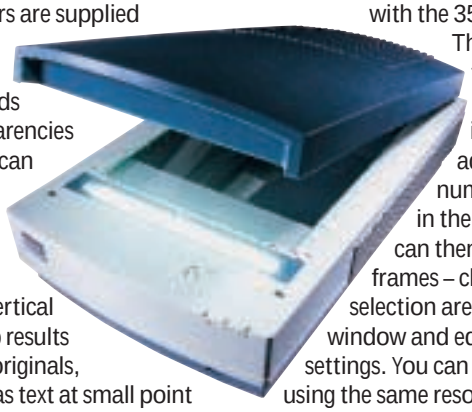
PRICE £799 (£680 ex VAT)
CONTACT Epson 0800 220546
www.epson.co.uk
PROS Good quality; PC remote control of camera; time lapse function
CONS HyPict appears to be a white elephant; slightly high compression
OVERALL Another great 3.3megapixel camera where the choice between it, the Sony S70 and Olympus 3030 is entirely personal

Umax Powerlook 1100

A FireWire scanner that will give you good results if you work with transparencies.

The Powerlook 1100 is a FireWire scanner, so data transfer to your PC will occur faster than over most SCSI links. There are two FireWire ports, so you can daisychain devices, but you'll need a FireWire card or integrated port for your PC.

Three film holders are supplied for 35mm, 120 and 5 x 4 film. The 35mm slide tray holds 12 mounted transparencies at once so you can scan lots of trannies in a short time.



The optical resolution of 1,200 horizontal x 2,400 vertical provides good sharp results and, with reflective originals, resolves detail such as text at small point sizes cleanly, though at resolutions above this the interpolation introduces a noticeable softening of edges.

The quality of scans from 35mm trannies is reasonable, with vibrant colours, but falls well short of the standard required for most print reproduction purposes. The 1100 fared better with large format trannies, though.

The batch and auto scanning features make light work of many originals and are put to effective use in combination with the 35mm slide tray. The preview scans the entire tray and selects the image areas, adding them as numbered 'frames' in the scan job list. You can then edit individual frames – changing the selection area in the preview window and editing scan settings. You can batch scan – using the same resolution and scan settings for each slide, or multiple scan with different settings. Batch scanning of a half-loaded tray with seven images all at 1,200dpi output resolution took a little over one minute, multiple scanning the same set with resolutions from 150 to 2,400dpi took just two minutes.

At this price the Powerlook is a good option for small design businesses that deal primarily with reflective originals, but occasionally need to deal with trannies in quantity, at moderate output sizes, resolution and quality.

KEN MCMAHON

DETAILS

★★★

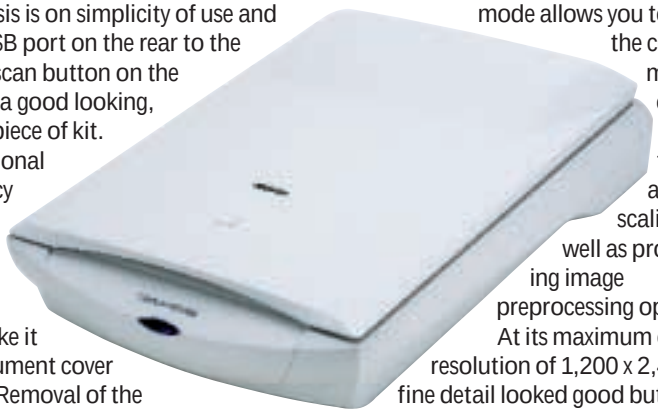
PRICE £938.82 (£799 ex VAT)
CONTACT IMC 01344 871329
www.umax.com
PROS Batch and multiple scanning; good-quality optics
CONS 35mm scan quality; poor documentation
OVERALL For almost four times the price of the Canon (below) you get a slightly bigger scan area, FireWire, noticeably higher quality, colour management and batch and multiple scanning features. Is that worth £600 to you?

CanoScan FB1210U

Sleek, simple-to-use scanner that offers one-touch processing and speedy action.

Small, light, and sleek, this is the design antithesis of the Umax Powerlook 1100 reviewed above. The emphasis is on simplicity of use and from the USB port on the rear to the one-touch scan button on the front this is a good looking, functional piece of kit.

The optional transparency adaptor is so slim and lightweight you could easily mistake it for the document cover it replaces. Removal of the protective cover, however, reveals a 5 x 4in diffuser light that illuminates the slides from above.



Scangear CS-U, a TWAIN plug-in, provides access to the scanner from your image editor.

The TWAIN module has two modes, simple and advanced. With the first you choose from a selection of document types – colour photo, line art and so on, set the paper size and image source, preview, crop and scan. Advanced mode allows you to set the colour mode, output resolution and scaling, as well as providing image preprocessing options. At its maximum optical resolution of 1,200 x 2,400, fine detail looked good but, as you'd expect from a scanner costing a quarter of the price, it was inferior to the Umax (above). Quality of transparency scans was terrific at the larger sizes, but really quite poor from 35mm originals. This might be something to do with the holder, which is fiddly to say the least.

The bundled Scangear toolbox app provides a desktop button bar that gives one-touch processing for a variety of destinations. You can set colour mode, resolution and so on in each button's preferences and nominate one to activate when the start button is pressed.

Despite the bandwidth limitations of USB, even big scans are completed fairly quickly – a slightly undersized A4 RGB page at 300dpi, producing a 22MB file, took one minute and 10 seconds.

KEN MCMAHON

DETAILS

★★★

PRICE £292.57 (£249 ex VAT) with transparency unit
CONTACT Canon 0121 666 6262
www.canon.co.uk
PROS Stylish; simple
CONS Poor-quality 35mm transparency scans; fiddly
OVERALL Good option for automated front-panel control, for 35mm transparencies in volume look elsewhere

CTX EX1300

A 21in shadow-mask monitor that offers fine quality at a budget price, but the world is going flat.

Although CTX is going flat for the majority of CRT displays, the company is also still plugging away at the top end with 21in monitors based on shadow-mask tubes. The EX1300 is the latest in the line.

Short-necked the EX1300 is not: at 540mm deep, you need plenty of desk space. And, at 30kg, unpacking and positioning is a two-person job.

Styling and control layout conforms to the usual CTX standards – three buttons on the fascia provide access to three on-screen menus for picture, colour and status information, while four others provide for navigation within them. Not the most intuitive system, but there is at least a dedicated OSD exit button, which also serves to switch between D-SUB and BNC inputs when the OSD isn't active.

The EX1300 has a USB hub, with one upstream and four downstream connectors, which are tucked away on the back panel.

Progress hasn't completely halted on improvements to shadow-mask displays: the picture is admirably sharp, although it's inevitably less beguiling than the richness and vibrancy of an aperture grille. Power regulation is rock-steady, with better resolution characteristics than we'd expect, along with a fine performance in the video bandwidth tests, which indicates good electronics. Maximum claimed resolution is 1,800 x 1,440 at 76Hz, although that's not really a practical resolution: 1,600 x 1,200 at 85Hz is the highest we'd attempt for normal use, at which it's very usable.

The EX1300 is a fine unit, but the world is moving toward flat screens, and going back to the curved surface of a shadow-mask display is a price most people upgrading from a smaller, flat-screen unit will be unwilling to pay. But, if you still prefer the look of a shadow mask, the price and quality of the EX1300 make it one to consider.

DAVID FEARON

DETAILS

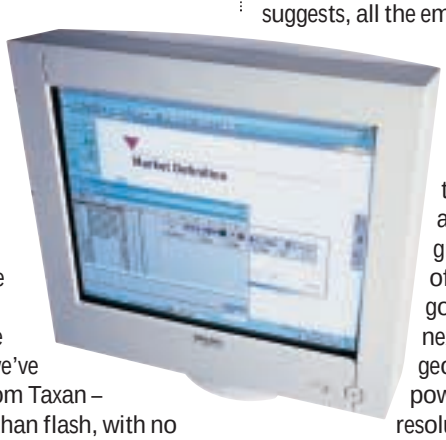
★★★★

PRICE £586 (£499 ex VAT)
CONTACT CTX 01923 810 800
www.ctxmonitors.com
PROS Fine quality for a shadow mask; comprehensive features
CONS Most don't go for curvy screens any more
OVERALL A good choice for those who need a lot of screen area on a budget

Taxan Ergovision 985

Another entrant into the 19in monitor race, this is a fine product but can it beat the competition?

The Ergovision 985 TCO99 is Taxan's latest entrant into the hotly-contested 19in monitor fray. There are no surprises as far as the tube goes: it sports a flat-screen aperture-grille unit in the form of a Mitsubishi-made Diamondtron NF, with 18in viewable diagonal



The look of the 985 is also what we've come to expect from Taxan – functional rather than flash, with no over-the-top styling. In common with most other flat-screen CRTs, the unit is fairly deep, but not unmanageable at around 475mm. The OSD menu system is the biggest departure from previous models, and it's a huge improvement. The single button and digital rotary control make finding the adjustment you want quick and simple: just twirl the knob and it'll scroll through the available adjustments page by page. As the name suggests, all the emissions, ergonomics and environmental bases are covered by the 985's TCO99 certification.

As usual, we tested the Taxan using a Matrox G400 graphics card. In terms of image quality, it's a good performer, with next to flawless image geometry and very good power regulation. At a resolution of 1,024 x 768 and a vertical refresh of 75Hz, focus and sharpness are adequate, but it doesn't possess the superb clarity and contrast of CTX's excellent, and cheaper, PR960F (*PCW* April 2000). This may be down to the variable 0.25-0.27mm aperture-grille pitch of the Diamondtron NF, compared to the constant 0.24mm pitch of the CTX's Sony FD Trinitron tube. There's no USB facility, which the CTX has as standard. Quality is good enough for the display to remain usable if you want to switch up to 1,280 x 1,024, but go over 75Hz refresh at this resolution and the drop-off in clarity becomes obvious.

We have no major complaints about the 985 – it's a fine monitor with good controls and image quality. But at this price, the competition from CTX and Mitsubishi is a little too stiff.

DAVID FEARON

DETAILS

★★★★

PRICE £390 (£331 ex VAT)
CONTACT Taxan 01344 484 646
www.taxan.co.uk
PROS Great OSD; good quality
CONS Not as sharp or as cheap as some of the competition; no USB
OVERALL It's good, but not good enough to break clear of the pack

Kodak V600 Zoom

Mobile presenters on a budget should focus in on this LCD projector for its vivid reproduction.

This LCD projector from the imaging giant Kodak is a lot more affordable than Infocus' DLP-based LP335 we reviewed last issue, but to a certain extent you get what you pay for. Having said that, the V600 Zoom would suffice for some mobile presenters.

This 800-lumens model displays an acceptable picture at 800 x 600 with, typically of LCD models, very vibrant colour reproduction. The picture was noticeably grainy, though, but if all you are doing is showing one PowerPoint slide after another, this will not be a big issue. The image can be viewed with the lights on, although not quite to the same degree as a 1,000-lumens version. For the best performance, though, keep the lights off.

Inside the case is a healthy supply of connectors: British, European and US plugs, S-Video, Composite, D-SUB, audio and even a Mac adaptor. The projector has the appropriate ports for these cables. The control system is adequate, but could be improved slightly. Five buttons allow you to navigate through the menu. However, the positioning of the buttons is a bit confusing, and we kept mistaking the up, down and select buttons for something else. You have a fairly large degree of control over the picture, and there are a few pre-sets in Kodak's Image Manager that make the picture look a little better for photos, rich colours, spreadsheets and graphics. A remote is also provided with the same buttons as the top of the projector.

Turning the lens adjusts the focus, and there's also a manual 1.3x zoom on this model, although if you don't need this, a cheaper version comes without it. You can't adjust the keystone correction manually, which is a big minus. Overall, this projector is not as feature rich and does not have such a high-quality image as more expensive models, but it is light (3.4kg) and would suit the mobile professional on a budget.

JASON JENKINS

DETAILS

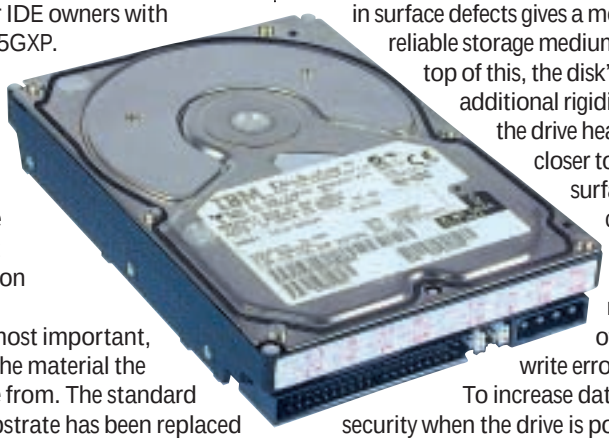
★★★

PRICE £1,996.33 (£1,699 ex VAT)
CONTACT Kodak 0870 6061031
www.kodak.co.uk
PROS Inexpensive; light; lots of ports; vivid colour reproduction
CONS No remote mouse; menu could be better; no manual keystone correction
OVERALL Not suitable for a home cinema enthusiast, but presenters could check it out

IBM Deskstar 75GXP

For IDE fans, this hard drive is full of features and can store 75GB in its high-capacity body.

The grass was always greener on the SCSI owner's side of the fence, but IBM is about to change this for IDE owners with the Deskstar 75GXP. It's a drive that manages to squeeze 75GB into a 1in high form factor. Despite this, though, it doesn't skimp on features.



First, and most important, is a change in the material the disks are made from. The standard aluminium substrate has been replaced with a more rigid glass version. Combined with fifth-generation GMR (Giant Magneto Resistive) heads, higher areal densities can be reached. This gives the 75GXP a density with a very impressive 11GB/sq in. This means that the 75GB capacity is spread across five disks, and 10 sides.

The glass substrate also undergoes a manufacturing process to create a smoother disk. The subsequent reduction in surface defects gives a more reliable storage medium. On top of this, the disk's additional rigidity allows the drive heads to fly closer to the surface, cutting down the number of read/write errors.

To increase data security when the drive is powered down, the load/unload technology is built in. Previously only seen in IBM's mobile drives, it moves the heads off the surface of the disk, and onto a safe area, when the drive powers down.

From the technical specs - a spindle speed of 7,200rpm, a 2MB data buffer, a UltraDMA100 interface, and an average seek time of 8.5ms – everything looks good in terms of performance.

We put the drive to the test with a 1GB file copy, and a random file read/write test using Iometer version 1998.10.01. It took 73 seconds to do the file copy, while the read/write test gave a result of 0.78Mbytes/second. The seek time was slightly slower than the 36GB IBM hard drive featured in our April group test. So, it's not the fastest drive, but for the price you get an awful lot of storage.

DAVID LUDLOW

DETAILS

★★★★

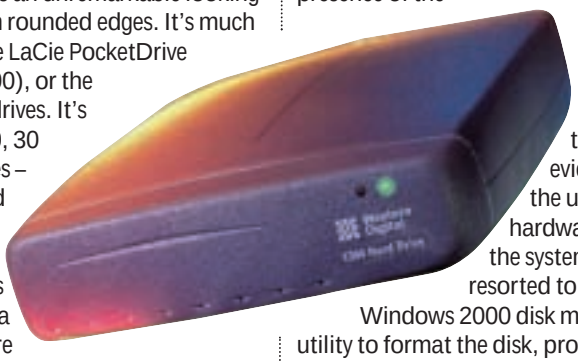
PRICE £499.38 (£425 ex VAT)
CONTACT IBM 01475 898125
www.storage.ibm.com
PROS Massive capacity; reliability should be better
CONS Average seek time is a little slow
OVERALL If you're looking for a lot of storage at a reasonable price then this is a great drive

Western Digital 1394

An external FireWire drive that performs well – even when the cable was removed!

External FireWire drives are now becoming more commonplace and the market is approaching the level at which there is a real choice. For portable video storage and indeed any other activity that requires unfussy large-capacity drives these units are ideal.

This drive is an unremarkable looking black box with rounded edges. It's much larger than the LaCie PocketDrive (*PCW* July 2000), or the popular VST drives. It's available in 20, 30 and 45GB sizes – we've reviewed the entry-level option.



The drive is supplied with a six-pin FireWire cable and power supply that we didn't expect to have to use. The unit was connected to an ADS pyro 1394 card – a space previously happily occupied by a 16GB VST drive that took its power from the card. The WD drive, however, would not function without the power cable. If you don't already have a 1394 card Western Digital sells one for £69 inc VAT.

Setup software for Windows and MacOS, which installs 1394 driver updates and formats the disk, is provided on CD, but refused to acknowledge the presence of the drive. Windows 2000 knew it was there though – as evidenced by the unplug hardware icon in the system tray. We resorted to the Windows 2000 disk management utility to format the disk, providing 19.1GB of formatted space.

In use the drive operated reliably. Given the much-vaunted hot plugability of FireWire devices it's irresistible, if a little foolhardy, to see what will happen if you pull the cable during a read operation and the drive's performance in this respect was impressive. Playback of an AVI file in Widows Media Player stopped when the cable was removed – and resumed when plugged back in!

Despite the ease with which you can plug and unplug these products, manufacturers seem to be cagey about their resilience and Western Digital is no exception. All the same, the case is robust and should easily stand up to transit in a well-padded computer bag.

KEN MCMAHON

DETAILS

★★★

PRICE £299 (£254.47 ex VAT)
CONTACT Western Digital 01372 360 055
www.westerndigital.com
PROS Reliable; quiet; good value
CONS Needs a power cable; difficult setup
OVERALL There are smaller, better looking FireWire drives on the market, but this does the job and is competitively priced

HP DeskJet 350C Series

If you need to print on the move, this mobile printer could be just what you're looking for.

The first thing you notice about the new DeskJet 350C Series is its size – small enough to be called 'mobile'. The basic 350C comes with high-volume mono and colour cartridges while the 350CBi also includes a rechargeable battery pack and infra-red adaptor. The battery charges in a little over an hour and a half and will then go on to print up to 130 pages of standard-quality black text.

As with all things mobile, though, there's a payoff. With the 350C it's the print quality. Mono graphics aren't too bad, graininess aside. Detailed colour graphics, though, even on HP's own photo paper and at the highest quality setting are extremely grainy.

To be fair, though, if you're buying a portable printer you can't really expect photo quality output, and at least transitions and general levels of detail were good. The printer weighs in at 5.4lb with the portable sheet feeder attached, so is quite heavy for a mobile device. It is, however, robust and well made. HP claims to have drop tested it from 2.5 feet.

Text printing is sharp, with very little feathering. Holding only one cartridge at a time, though, you have to make a choice between colour or black and with the colour cartridge installed, composite text is slightly grey. That said, spot colour content is vibrant, if grainy. The print speed is good, and it managed a steady five pages a minute when we switched to draft quality. Standard quality printing of a single page of text took 38 seconds.

The 350C is an adequate mobile printer. Text quality is sharp and graphics, although not first class, are acceptable.

SCOTT MONTGOMERY

DETAILS

★★★★

PRICE £179 (£152.34 ex VAT)
CONTACT Hewlett-Packard 0990 474 747
www.hp.com
PROS Good text printing at reasonable speed; vibrant colours
CONS Graphics are very grainy; unit is heavy
OVERALL A mobile printer that adequately covers all on-the-move printing needs

HP OfficeJet G85

The multifunction device returns and this does a good job as a printer, fax and photocopier.

It may not be the most attractive printer around but it is versatile, combining four of the most common business products in one unit with a footprint about the size of the average desktop PC. Its functions are printing, scanning, copying and colour faxing.

We got off to a good start with the G85. Its driver, like all of them from HP, is well written and extensive, and when you're printing it offers an impressive range of options. There are three print qualities to choose from and the G85 deals easily with banner printing, 23 media types and 18 paper sizes, including a set of user-defined dimensions.

Cartridge installation is a little less well thought out, requiring you to reach well into the unit, but this is not as awkward as at first you might think. We liked the paper release door around the back that is fast becoming an HP trademark, practically eliminating the chance of jammed paper requiring an engineer call-out.

To test its raw print speed, we subjected it to the tests used in our July issue printers group test. A total of 50 'normal' quality pages of plain text arrived in 13 minutes 27 seconds, putting it ahead of even the fastest printer tested back then, the HP PhotoSmart P1100, and a full 20 minutes faster than Canon's ponderous BJC-8200 Photo. This impressive speed was not achieved by compromising on quality. On photocopy paper the characters were dark and firm with only minimal feathering.

A good driver feature is the ability to vary the amount of ink laid down on each pass, so if, like most of us, you use this sort of low-grade paper regardless of the printing technology, you can avoid saturation. If you're a stats junkie, black text is printed at 600 x 600dpi while colour printing achieves a respectable 2,400 x 1,200dpi.

Our vector graphic test image was well rendered with smooth curves and transitions, although the colours were slightly less vibrant than those seen from other printers, even on Hewlett-Packard's own inkjet paper. There was no such problem when it came to photo reproduction. Colours were vibrant and skin tones realistic.

Two things caught our eye here, though. In one complex area there was a rather high contrast between dark and light areas, so much so that you could be forgiven for thinking we'd enabled trapping on a publishing document, and in several other parts of the image there was visible stepping where we would have expected smooth curves. From hitting print to holding the finished photo took eight minutes 10 seconds, which would have put it somewhere around the middle of the pack in our group test.

The G85's scanning performance was fair, although it demonstrated some loss of definition in areas of shadow, recognising only 19 distinct tones of grey from a range of 22 on a test target. That said, when we used it to produce a copy of the same target using HP's proprietary photo paper we were pleased with the results. It was still easy to tell the two apart but the colours were close right across the spectrum. Maximum optical scanning resolution is 600 x 3,600dpi, although this can be upped to 9,600dpi through interpolation trickery.

Copying a full A4 page at 'normal' quality took 21 seconds in monochrome and 49 in colour, which makes it far slower than a photocopier, but dropping the quality a notch cut this to 17 and 21 seconds respectively without having too detrimental an effect on the results. Helping it more closely mimic a high-end photocopier, there's an automatic document feeder, so you'll not have to watch over it on long jobs.

Of course, you shouldn't feel compelled to plug the G85 into your PC. Its fascia has more than enough buttons to brag about, providing for fax speed dialling, direct copying, magnification adjustment and even manually tweaking the print margins. Even so, there are USB and parallel connection points around the back, although no inbuilt networking features. If networking is your thing it'll happily work with an external Jet Direct unit, but that's an optional extra.

Multifunction devices have been criticised in the past for being jacks of all trades but masters of none. We're pleased to see HP has borne this in mind and in the G85 has come up with something well suited to the jobs at hand. It's keenly priced but you'll need to take into consideration that running an inkjet is a little more pricey than a laser, especially if you mainly print black text.

NIK RAWLINSON

DETAILS

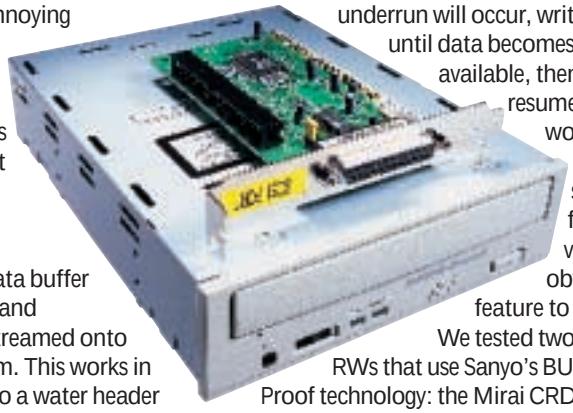
★★★★

PRICE £499 (£424.68 ex VAT)
CONTACT Hewlett-Packard 0990 474 747
www.hp.com
PROS All-in-one unit, so good for the home office; fast text printing
CONS Photo printing could be slightly better, but it's nothing serious
OVERALL The multifunction device has been reborn and the G85 should do much to give the family a good name

BURN-Proof CD-RWs

Sanyo's technology boasts more efficient CD burning, so we put Plextor and Mirai drives to the test.

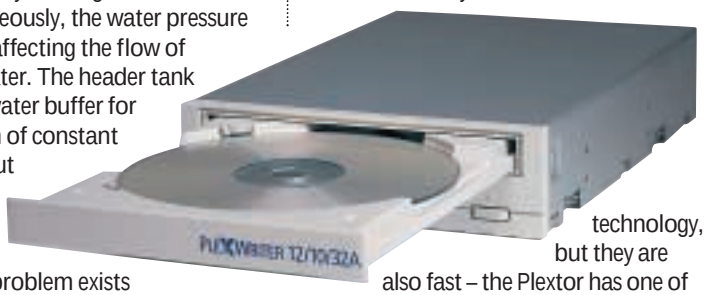
Hands up who's thrown away a CD-R because the CD writer suddenly stopped writing only part way through the operation? This is one of the most annoying problems with CD writers, and is caused by Buffer Underrun, which is where data cannot be delivered fast enough to the CD writer. The writer therefore uses a data buffer to ensure smooth and constant data is streamed onto the writing medium. This works in a similar manner to a water header tank in a house, which fills up, regulating in-house water flow, regardless of how many people on your street are running their taps. If the header tank were not in place, when all your neighbours ran their taps simultaneously, the water pressure would drop, affecting the flow of everyone's water. The header tank is in effect a water buffer for the regulation of constant water flow. But how does this relate to CD writers?



A similar problem exists with a PC. Each application and peripheral utilises the processor for operations; and, as one application is using it another cannot. So the processor shares its cycles between operations to keep everything moving. This is problematic for CD writing which needs constant data flow; so a CD writer uses the aforementioned buffer to smooth the data fluctuation, allowing constant rate writing. What is incredible is that if during the writing operation the buffer has less data in it than the writer requires for writing, the writer will stop and the disc being written will become unusable.

BURN-Proof drives stop the writing process before an underrun occurs. So when the buffer level drops to within 10 per cent of the point where an underrun will occur, writing stops until data becomes available, then writing resumes. You wonder why it's taken so long for this very obvious feature to appear.

We tested two CD-RWs that use Sanyo's BURN-Proof technology: the Mirai CRD-BP2-M, a 12-speed write, four-speed rewrite, 32-speed read SCSI drive, and the Plextor PX-W1210TA, a 12-speed write, 10-speed rewrite, 32-speed read EIDE unit. Not only do both drives use the



technology, but they are also fast – the Plextor has one of the fastest rewrite speeds around. We compared the AOpen CRW-9624 (a six-speed write, four-speed rewrite, 24-speed read drive), and the Sony CRX 145E-RP (10-speed write, four-speed rewrite, 32-speed read) to the two BURN-Proof units.

Their performance was impressive, although the Sony unit is still champion of CD-RW formatting, which took a mere five minutes 49 seconds, compared to the Mirai's 20 minutes and two seconds, and the Plextor's more respectable eight minutes 13 seconds. Copying mixed files to a CD-R (490MB), both BURN-Proof drives managed to complete the task in five minutes 33 seconds, compared to the Sony's six minutes 27 seconds and the AOpen's 10 minutes 21 seconds. As for drag and drop to a CD-RW, the Plextor managed to blow the competition out of the water with scores for copying a cover CD (490MB) in six minutes 59 seconds, and for the video CD (495MB), seven minutes nine seconds. The Mirai managed only 19 minutes 56 seconds and 17 minutes 41 seconds respectively, with the Sony and AOpen drives achieving times similar to the Mirai.

The performance is at least equal, and sometimes far better, than other fast CD-RW drives. But more importantly, the BURN-Proof technology makes CD burning more efficient and less prone to media destruction. It may finally be time to say goodbye to the bad old days, and hello to the joys of BURN-Proof.

SCOTT MONTGOMERY

DETAILS

★★★★

MIRAI CDR-BP2-M

PRICE £269.08 (£229 ex VAT)
CONTACT Armari 020 8993 4111
www.mirai-technologies.com
PROS BURN-Proof technology
CONS Rewriting is not as fast as the Plextor
OVERALL A SCSI unit comparable in speed to others on the market, but the BURN-Proof technology means writing is easier than ever

★★★★★

PLEXTOR PX-W1210TA

PRICE £210.33 (£179 ex VAT)
CONTACT Dabs Direct 0800 674 467
www.plextor.com
PROS Fast rewriting with BURN-Proof
CONS The latest technology comes with a small price premium
OVERALL With the BURN-Proof technology, and the fast read and write times, CD burning has never been as much fun

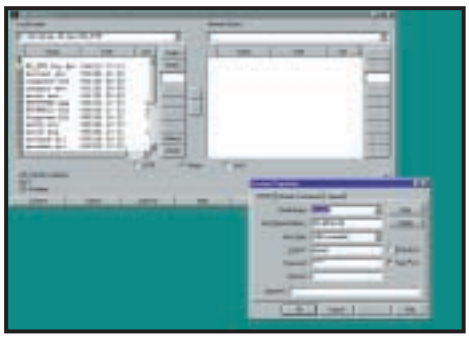
Ipswitch WS_FTP Pro 6.5

A suite offering greater flexibility and Windows Explorer integration to web authoring.

Ipswitch proudly proclaims its new suite to be the world's most popular FTP client for Windows, which is quite an assertion considering the easy availability of competitors such as Cute FTP through magazine cover discs and library downloads.

If your file transfer requirements run to nothing more than monthly changes to your website, then you'll probably not have a great need for a standalone product like WS_FTP Pro. However, unlike the FTP capabilities of your authoring software, WS_FTP Pro will integrate with Windows Explorer, making it possible to drag and drop files between the server and local PC.

As with previous releases, WS_FTP will store your settings for a range of sites so logging on becomes a simple matter of selecting the appropriate server from a drop-down list and clicking to connect. If you regularly check a range of sites for updates and patches this can quickly become a real time saver.



WS_FTP Pro can be extensively customised

The Properties dialog is extensive, allowing you to customise virtually every aspect of the package, including file sorting order and how status information should be displayed. WS_FTP Pro will intelligently switch between binary and ASCII transfer modes by referring to a user-defined list of ASCII file type extensions. It will also generate a log of all transfers in either direction, although this tends to litter every directory you touch.

Most users will have little need for FTP software, being happy with that offered by their browser and web authoring software, but if you need something a little more flexible, WS_FTP Pro remains one of the best.

NIK RAWLINSON

DETAILS

★★★★★

PRICE £33 (£28.09 ex VAT)
CONTACT Unosoft 01483 888 150
www.ipswitch.co.uk
SYSTEM REQUIREMENTS Windows 3.1/95/98/NT/2000, 16MB of RAM (32MB for Windows NT/2000), 3MB of hard drive space
PROS Flexible; good integration with Windows Explorer
CONS None to speak of
OVERALL Easy to use and customise; a good choice if you need standalone FTP utilities

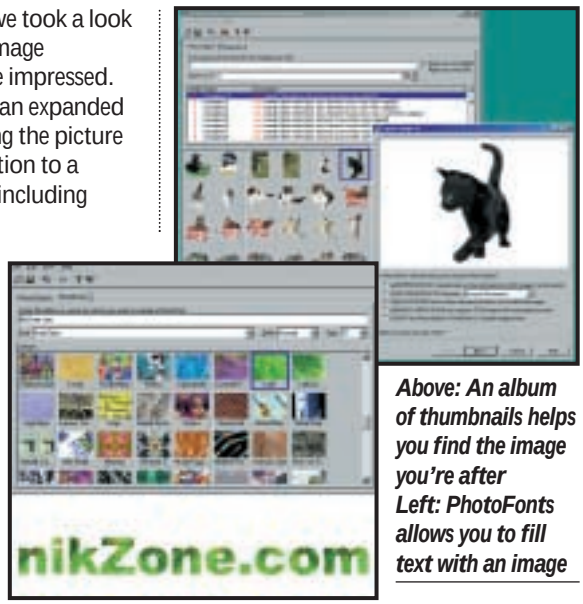
Hemera Photo Objects

A library of 50,000 pictures with a simple approach to give your web page a professional look.

It's about a year since we took a look at Hemera's original image collection and we were impressed. The company has released an expanded version, more than doubling the picture count of the original collection to a whopping 50,000 images, including 30,000 brand new ones.

Split into over 80 categories, the package uses a customised search tool. This includes an input box for entering keywords, but you'll probably find it just as easy to scroll through the categories and the images within each. There's also an accompanying book showing a thumbnail of each image so you can browse the collection without having to stare at the screen for hours.

This tool also takes care of retrieving the images from the library. It keeps track of which of the six CD-ROMs your chosen image calls home and prompts you to insert the appropriate disc. You then specify its use – web, word processing, on-screen presentation and so forth – and it gives you options for resizing and flipping the image before saving it to your chosen destination. Image quality is first class, easily matching that found in 'professional' photo libraries.



Above: An album of thumbnails helps you find the image you're after
Left: PhotoFonts allows you to fill text with an image

A bonus is the added PhotoFonts function that will use photos as the fill texture of characters. It was once necessary to resort to Photoshop to achieve this sort of effect, but here it's simple, quick and cheap.

NIK RAWLINSON

DETAILS

★★★★★

PRICE £59.99 (£51.06 ex VAT)
CONTACT Koch Distribution 01256 707 767
www.hemera.com
SYSTEM REQUIREMENTS 486 processor, 16MB of RAM, Windows 95 and above, 20MB of free hard drive space, CD-ROM drive, 256 colour display
PROS So many photos; high quality; affordable
CONS None
OVERALL A must-have product for the amateur web designer

FileMaker Pro 5

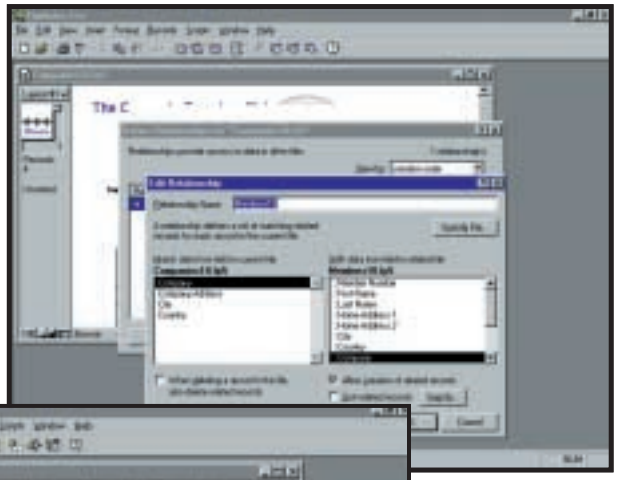
This user-friendly database management system bridges the Windows/Mac divide.

Over the years, FileMaker Pro has developed into a competent database management system (DBMS) with a good range of features. One of its greatest strengths is support for both Windows and Mac operating systems. It's one of those rare products with which you can develop cross-platform applications. This alone is reason enough to choose it if you work with both environments.

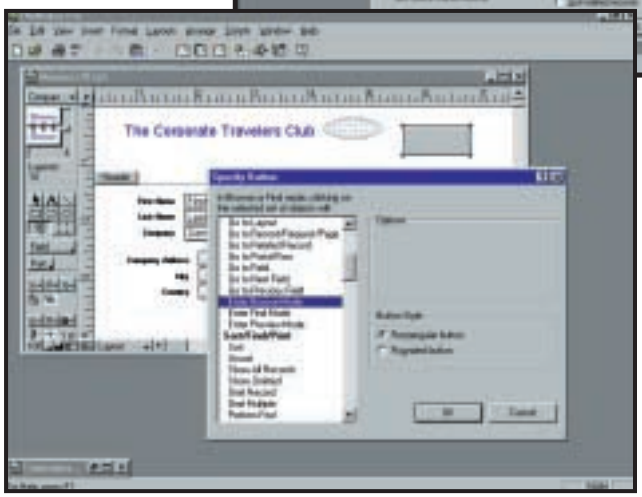
FileMaker has made great strides towards being intuitive and user-friendly so that designing your first single-table database is a doddle. There are 16 predefined database templates to get both home and business users off to a quick start: for example, Recipes, Collections, Personnel Records and Purchase Orders. Alternatively, starting from a blank database is straightforward.

Each FileMaker Pro table inhabits a file with the .fp5 extension and once a table is defined, you work with various layouts to determine what appears on the screen. Layouts take the place of the objects often known as forms and reports in other DBMSs. FileMaker can run in one of four modes: Browse, for inspecting existing records and adding new ones; Find, for locating a record or a subset thereof; Layout, for creating new views of your data; and Preview, for checking the appearance of printed output.

When creating a database, eight field types are at your disposal. Four of these are the familiar text, number, date and time types, and four are slightly more exotic. The container field type can hold image, audio or video files, OLE objects (such as spreadsheets or documents from other applications) and QuickTime file types are also supported. A calculation field holds values calculated from data in the current record or from other records, and a summary field holds summarised data from records in the current file. Finally, there's a global field for values to be used in all records in the current file, for example the rate of VAT to be used in price calculations.

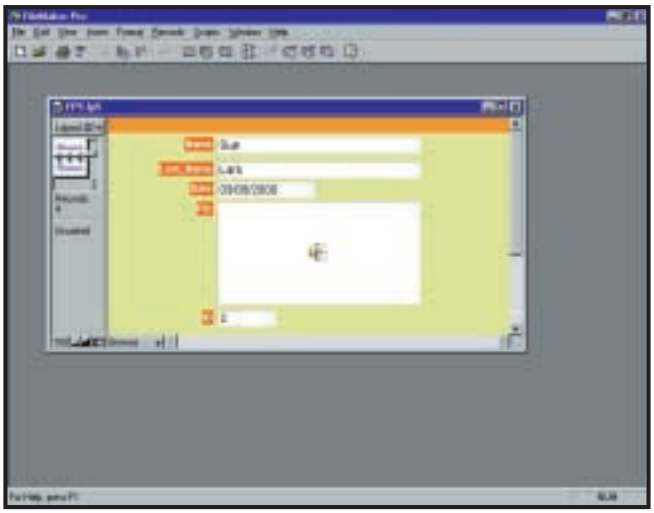


Left: Editing a relationship between two tables in FileMaker Pro. Screen handling is not always as tidy as it could be: moving the dialog box chews away part of the text of the underlying layout



ScriptMaker scripts are built by making selections from a list of available actions

Entering records requires only a click on the New Record button. Pasting .wav and .avi files into a container field is easy, and in Browse mode double clicking on the icon or thumbnail that's placed into the container field plays the sound bite or video. Container fields cannot be searched so you have to add a text field by which to identify them.



A layout with an icon indicating that a sound bite is stored – double clicking will play it

Once fields have been defined, a standard layout is generated automatically, showing all fields. The New Layout/Report assistant eases the production of further layouts for viewing data, for printing as a report and for 'mailmerge' form letters. Buttons can be added to layouts for application control; steps are selected from the ScriptMaker macro-writing tool to navigate between layouts, modes or fields and control structures such as If, Else and Loop are also available.

FileMaker Pro started life as a flat-file DBMS and has since acquired some degree of relational capabilities in response to the universal acceptance of the relational model as a means of storing all but the simplest sets of data. That's the good news. Unfortunately, instead of embracing the recognised RDBMS (relational DBMS) terminology, for reasons never made clear, FileMaker has invented its own. Terms like 'master file', 'related file', 'related record' and 'related field' seem destined to cause confusion, and when introducing the 'match field', it's simply perverse for the manual to say 'sometimes called the key field or primary key'.

Lookups cause confusion too, because defining a lookup causes data to be copied into the 'master file' from a 'related file'. No link is maintained between the two, so if data is updated in the related file, these changes are not reflected in the master.

Apart from terminology and implementation idiosyncrasies, the adherence to the relational model is somewhat tenuous. There is no easy way of employing the checks and constraints for ensuring referential integrity of data nor of dealing with null values – incomplete records can be entered into the sample database provided so that incomplete and mis-interpretable data can be retrieved.

FileMaker databases can be published on the web using the Web Companion plug-in that comes as part of version 5, though some features, notably scripts, are not available in a published database.

Existing users will find that version 5 arrives with widespread changes, especially to the interface that has been redesigned with Microsoft Office users in mind.

There's now a New Layout/Report assistant, a table view of your data, improved ODBC support for sharing data with other ODBC-enabled applications, improved conversion from Excel spreadsheets and a range of styles to apply to your web pages.

MARK WHITEHORN

DETAILS

★★★

PRICE £205.63(£175 ex VAT)
CONTACT FileMaker 0845 603 9100
www.filemaker.co.uk
SYSTEM REQUIREMENTS 486 processor, 16MB of RAM, Windows 95, 98 or NT4 (SP3)
PROS Dual Mac/Windows support is invaluable to those in a mixed environment. Ease of use for simple databases and for handling media
CONS The product makes a poor fist of implementing the relational method of data handling
OVERALL Existing users will be delighted with this latest version and new users are likely to find it great for single-table databases. If you need multi-table data to be held securely with full use made of the data integrity constraints offered by an RDBMS, look elsewhere

Elsa AirLancer

Wireless LANs have come of age and this is simpler and cheaper to install than traditional wire.

Wireless LANs aren't new: the very first systems were proprietary and, at 1.5Mbits/sec, offered painfully slow network links. The new 802.11b IEEE standard and the Wireless Ethernet Compatibility Alliance (aka WECA), a manufacturing consortium, have created products that break the speed barrier, guarantee interoperability among vendors and carry lower prices. Wireless networking is now a practical way to extend the wired network. IEEE 802.11b is an extension to the original 802.11 standard that supported only 2Mbits/sec data rates. The 802.11b spec calls for a data rate of 11Mbits/sec, with fallback rates of 5.5Mbits/sec, 2Mbits/sec and 1Mbit/sec as distance from the access point increases. Kit supporting 22Mbits/sec is in the pipeline.

Multimedia specialist Elsa is one of a handful of vendors that have launched wireless LAN products on the back of the new 802.11b standard. The product consists of a LANCOM base station or 'access point' and the AirLancer client LAN adaptor. This is in fact a PC Card network transceiver, with a rubbery aerial that juts out about an inch from a PC Card slot. As well as plugging into notebooks, it also plugs in to the LANCOM access point or into a PCI adaptor for desktop PCs.

The access point is a device about the size of a largish modem that connects to the wired LAN and translates between the cabled Ethernet LAN and the radio link. It contains a 10BaseT port that connects to the LAN's hub, communications and encryption software and a radio transceiver. The front is adorned with a series of status LEDs indicating LAN and WLAN connectivity. We were supplied with the ISDN router version of the LANCOM, so there were two additional LEDs for each ISDN B channel.

The coverage afforded by the LANCOM access point varies with the type of building – if you want your wireless LAN to cover more than a few thousand square feet, you'll need more than one access point. As a rule of thumb, expect to achieve transmission distances of 100m in fresh air but no more than 20m indoors.

As the client moves, its radio connection transfers to another access point, a process called roaming. A software utility monitors the broadcast quality and, as reception worsens, the bandwidth is progressively throttled back. Throughput at 11Mbits/sec is comparable to a conventionally cabled 10BaseT network.

Wireless LANs have several unique advantages. For a start, they allow roaming in a building, for example letting you take a notebook into a meeting while remaining logged onto your network. Wiring costs form a significant proportion of network installation costs and a wireless LAN needs very little. This makes networking feasible in many buildings that can't take a conventionally cabled LAN, such as historic or listed buildings, those with thick concrete floors or very large buildings. It's also easy to link buildings without recourse to ducting or wires. Wireless also makes it easy to set up *ad hoc* networks in schools or universities.

However, the freedom brought about by wireless comes at a price: it has a high per-node cost, (between £250 to £300), while access points (the server's transmitters and receivers) are double this. And at a time when networks are shifting to 100Mbits/sec, the 11Mbits/sec offered by the latest WLANs looks a little meagre. There's also a risk of interference from other devices – it's even possible to disrupt transmissions by using a microwave oven or a cordless phone. Bluetooth devices share the same 2.4GHz waveband and this may cause problems – this band is limited to only 60 to 80 discrete channels at 1Mbit/sec, dropping to only three channels at 11Mbits/sec. Security is another issue since anyone with a scanner can eavesdrop. But most wireless LANs incorporate 128bit WEP encryption.

Installing the LANCOM and AirLancer ought to have been straightforward but turned out to be a bit fraught, with the complicated configuration software clearly being aimed at the technically competent network techie rather than a home user. Nevertheless once we'd swapped over the PC Cards and cold booted our notebook a couple of times, all the requisite LEDs lit up and we were able to surf away to our heart's content completely wire-less.

At long last wireless LANs have come of age. However, there remain some issues to be resolved, such as inter-operability and security. But for the most part it worked very well. So long as you source all your wireless LAN kit from the same vendor you should be OK.

ROGER GANN

DETAILS

★★★★

PRICE LANCOM base station £525 (£446.80 ex VAT), with ISDN router £625 (£531.91 ex VAT), PC Card £150 (£127.66 ex VAT)

CONTACT Elsa 08000 563445

www.elsa.co.uk

PROS Cheaper and easier to install than traditional wire; secure

CONS Throughput varies; product is for Windows environments only; physical obstacles affect transmission; configuration software overly technical

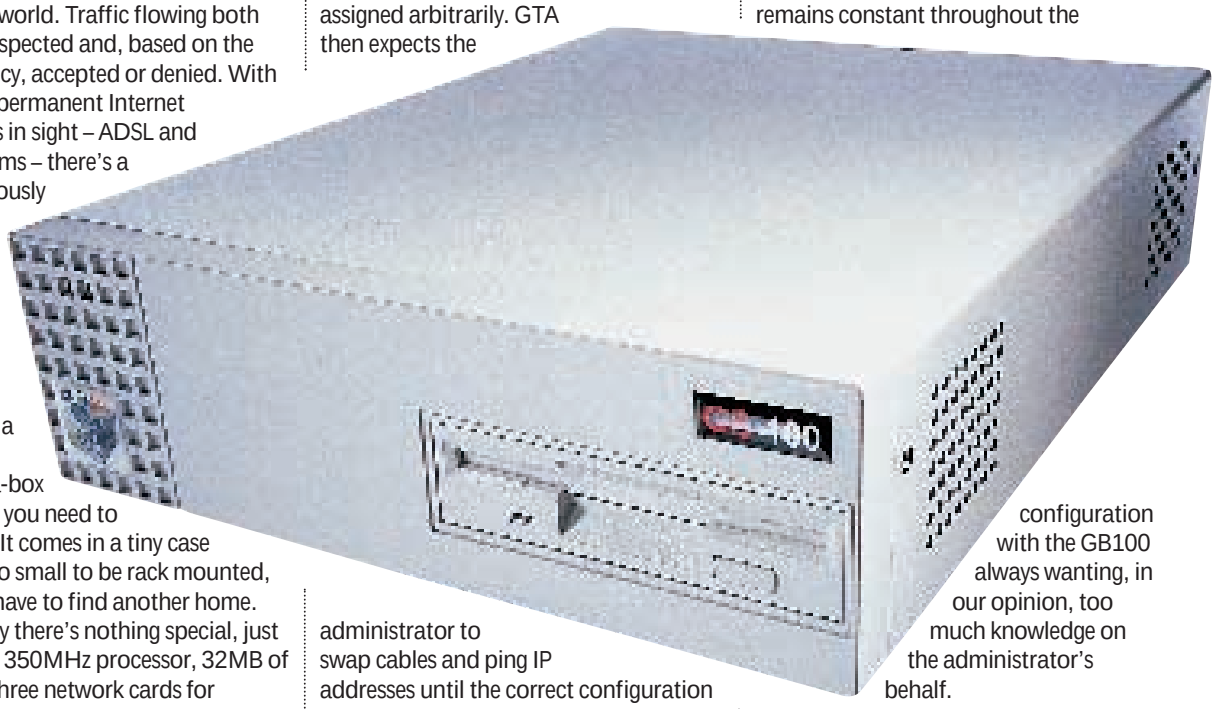
OVERALL A good product with a few niggles, but a sound option for those that need it

GNAT Box GB100

If security is getting you hot under the collar, let this firewall in a box cool you down.

A network without a firewall is the digital equivalent of leaving your house unlocked; anybody can get in and do what they like. Installation of a firewall effectively helps put access control on the network. Firewalls work by sitting between the internal network and the outside world. Traffic flowing both ways gets inspected and, based on the security policy, accepted or denied. With high-speed permanent Internet connections in sight – ADSL and cable modems – there's a need to seriously consider security.

Global Technology Associates' GNAT Box GB100 is designed as a complete firewall-in-a-box – everything you need to get started. It comes in a tiny case that's far too small to be rack mounted, and so will have to find another home.



Internally there's nothing special, just an AMD K6 350MHz processor, 32MB of RAM, and three network cards for internal, external, and demilitarised zone (DMZ) networks. The DMZ is a special case that, while protected by the firewall, is also blocked from the internal network. Typically externally accessible machines, such as web servers, should sit on the DMZ. If they're breached the rest of the network remains protected.

The appliance runs a modified version of Linux, on top of which runs the GNAT Box software. Version 3.0, in addition to firewall facilities, offers Virtual Private Networking (VPN). This allows encrypted links to be made to the firewall, enabling secure remote access across the Internet to take place. This tends to be a better, cheaper, way of letting remote users gain access to the local network.

The GB100 has its roots in PC land, and so it is no surprise that the initial configuration is achieved by plugging in a mouse, keyboard – strangely the old five-pin DIN AT – and a monitor. After typing in one of the longest authorisation codes that we've ever seen, we were taken to a set of screens designed to get the GB100 onto the network. These included assigning IP addresses to each of the network cards, and deciding which ones should act as the internal, external and DMZ.

This procedure should have been a lot easier than it was. None of the cards were labelled, and the on-screen notation didn't make a lot of sense. The setup screens suggested that IP addresses be assigned arbitrarily. GTA then expects the administrator to swap cables and ping IP addresses until the correct configuration is found. Then the cards can be manually labelled in the correct way. This is a lot of hassle and really should not be done this way.

With installation completed we had to set up the firewall policy. Two methods can be used: direct control of the GB100, or a web-based management interface. We prefer the web management as it offers a better interface.

Connection through an ordinary web browser displays a tree structure of management tasks that allowed us to drill down to the task that we wanted to perform, for example changing network settings.

The main task is likely to be to define rules stating which traffic is allowed and denied. Rules operate in list order, so it's important to get it right. For example, creating a rule to deny all traffic, and then creating a rule to allow outbound web traffic, would mean that no traffic would be allowed to pass through. Annoyingly there's no way of moving a rule's position, although it's possible to choose positioning at creation.

By default the firewall is configured to allow all outbound traffic, but to deny all inbound traffic. However, this isn't likely to be suitable as it blocks incoming email. Unfortunately, the configuration software requires that you know on which TCP port that email – SMTP – works before a suitable filter can be written. This problem remains constant throughout the configuration with the GB100 always wanting, in our opinion, too much knowledge on the administrator's behalf.

There is a better system in the Gauntlet firewall from Axent. This has a configuration wizard that creates a policy for outgoing email, FTP, and web traffic, and for incoming email. This firewall does not rely on the administrator knowing port numbers.

Overall the GNAT Box GB100 is a fairly good device for the money. If the company sorted out the initial configuration and made the interface more user-friendly, this would be a top-notch product.

DAVID LUDLOW

DETAILS

★★★

PRICE £2,344.13 (£1,995 ex VAT)
CONTACT Global Technology Associates 01903 205 151 **www.globaltech.co.uk**
PROS VPN as well as firewall; large range of functions
CONS Annoying initial setup; can require too much information for defining rules
OVERALL A well-priced product with a large range of features, but beware that it can be tricky to use

PERSONAL COMPUTER WORLD

BEST BUYS

YOUR GUIDE TO TODAY'S TOP PRODUCTS

ENTRY-LEVEL PC

Atlas
Meridian A750T

Based around AMD's Socket A 750MHz processor, an MSI K7T Pro motherboard and 128MB of PC133 memory, this machine makes use of the latest technology. You get a 20.5GB IBM hard drive and a 32MB Hercules 3D Prophet DDR-DVI. Bonuses are the 17in CTX Trinitron monitor, eight-speed DVD and Mitsumi CD-RW. A killer price for a killer system.

Review *August 2000, p78* **Price** *£1,173.83 (£999 ex VAT)*
Contact *Atlas 07000 285 275* *www.atlasplc.com*

MID-RANGE PC

Mesh
Matrix 850T

At the heart of the system beats AMD's Athlon 850MHz with on-die cache. You also get 128MB of PC100 memory and a large 30.7GB Maxtor DiamondMax hard drive. The excellent Hercules 3D Prophet II graphics card drives a 19in Mitsubishi Diamond Plus 91. Mesh has produced a fantastic package for any user after the latest technology at a bargain price.

Review *August 2000, p76* **Price** *£1,761.33 (£1,499 ex VAT)*
Contact *Mesh 020 8208 4706* *www.meshcomputers.com*

HIGH-END PC

Dell **Dimension XPS B1000 Special Edition**

The first in the new wave of 1GHz Pentium III-equipped systems, the B1000 Special Edition, partners the power of the 1GHz PIII with 128MB of RAMBUS RDRAM and Dell's custom GeForce 256 graphics card with 64MB of DDR memory. You also get a spacious 30GB EIDE hard drive that can be backed up using the eight-speed CD-RW. A scorcher.

Review *June 2000, p75* **Price** *£2,348.83 (£1,999 ex VAT)*
Contact *Dell 0870 152 4850* *www.dell.co.uk*

FULLY-FEATURED NOTEBOOK

Gateway
Solo 9300 LS

Making use of Intel's 650MHz SpeedStep processor this notebook has blistering performance. The screen and keyboard are both excellent, and the notebook enables you to do some basic video editing using the composite in and out ports at the back through the ATi mobility video card, or for digital video there's a FireWire port.

Review *April 2000, p158* **Price** *£2,113.82 (£1,799 ex VAT)*
Contact *Gateway 0800 55 2000* *www.gateway.com/uk*

ULTRA-PORTABLE NOTEBOOK

Sony
Vaio PCG-Z600RE

Sony has taken the ultra-portable genre a step further with this slim, sexy, Pentium III, 500MHz machine with 128MB of RAM and a 12GB hard disk. You also get a 56K PC Card modem and a built-in Ethernet adaptor. With a 12.1in TFT screen sporting a 1,024 x 768 resolution and a Memory Stick slot for Sony's own solid state media, this is the coolest notebook around.

Review *June 2000, p76* **Price** *£2,301.82 (£1,959 ex VAT)*
Contact *Sony 08705 424 424* *www.sony.co.uk*

PDA

Ericsson
MC218

Based on the Psion Series 5mx, the MC218 has 16MB of memory and a processor speed of 37MHz. The email software is built into the ROM and supports UUEncoded attachments and MIME. Frames and Java 1.1.4 are supported by the web browser. Ericsson has even bundled an IrDA modem for connecting the device to its range of mobile phones.

Review *May 2000, p204* **Price** *£379 (£322 ex VAT)*
Contact *Ericsson 0990 237 237* *www.ericsson.com*

DIGITAL CAMERA

Sony
Cyber-shot DSC-S70

Sony's S70 uses the latest battery technology to provide around 120-150 minutes of usage and is Sony's first genuine 3.3megapixel camera. Image quality is superb. All in all, the S70 is the best all-round 3.3megapixel camera out there.

Review *August 2000, p97* **Price** *£750 (£638.30 ex VAT)*
Contact *Sony 0990 111 999* *www.sony.co.uk*

WEBCAM

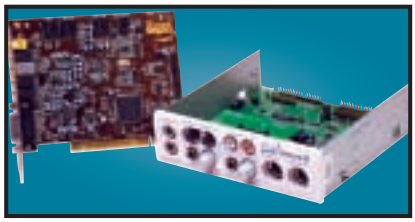
Philips
Vesta Pro

This is a very well designed unit with built-in USB microphone. The 640 x 480 pixel CCD can deliver up to 15fps at VGA resolution or smooth 30fps at lower resolutions down to 128 x 96. An excellent package at a remarkably cheap price.

Review *July 2000, p224* **Price** *£52.87 (£45 ex VAT)*
Contact *Dabs Direct 0800 138 5240* *www.pcstuff.philips.com*

SOUND CARD

Creative Labs
SB Live! Platinum



This is exactly what gamers and budding PC musicians have been asking for – great sound quality and excellent bundled software make it a winner. We think it's the best sound product ever.

Review *February 2000, p83* **Price** *£179 (£152 ex VAT)*
Contact *Creative Labs 0800 973 069* *www.soundblaster.com*

COLOUR INKJET

Hewlett-Packard
DeskJet 930C

This uses the same engine as the higher spec P1100 and is a breeze to setup. Connection is via the parallel or USB interface and drivers allow you to adjust the printed page drying time.

Review *July 2000, p201* **Price** *£149 (£126.81 ex VAT)*
Contact *HP 0990 47 47 47* *www.europe.hp.com*

BUDGET LASER PRINTER

Brother
HL-1250

This compact machine has everything you could reasonably ask for at the price, but Brother has gone one step further with the inclusion of both parallel and USB ports.

Review *February 2000, p165* **Price** *£245.58 (£209 ex VAT)*
Contact *Simply 020 8523 4020* *www.brother.com*

COLOUR PHOTO PRINTER

Epson
Stylus Photo 870

Aimed at the professional imaging user, our test photo was beautifully rendered, there was no evidence of undesirable banding and skin tones were accurately reproduced.

Review *July 2000, p206* **Price** *£207.98 (£177 ex VAT)*
Contact *Simply 020 8523 4020* *www.simply.co.uk*

BUSINESS LASER PRINTER

Hewlett-Packard
LaserJet 4050TN

The 4050TN's 1,200dpi resolution is outstanding, and with a 133MHz NEC processor and 16MB of RAM it can turn out 16ppm. It also comes network-ready as standard.

Review *September 1999, p96* **Price** *£1,580.38 (£1,345 ex VAT)*
Contact *HP 0990 474747* *www.europe.hp.com*

MULTI-FUNCTION DEVICE

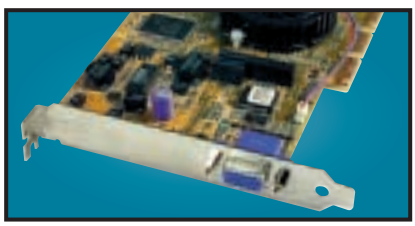
Hewlett-Packard
Office Jet G85

A scanner, photocopier and colour printer in one, that produces vibrant colours and realistic skin tones. Well suited to home or office work – and it's keenly priced.

Review *September 2000, p112* **Price** *£499 (£424.68 ex VAT)*
Contact *Hewlett-Packard 0990 474747* *www.europe.hp.com*

GRAPHICS CARD

Asus
V7700



The Asus V7700 uses nVidia's GeForce 2 chip. The core clock speed has been increased to 200MHz and memory frequency boosted to 333MHz, making this card great for gaming.

Review *August 2000, p114* **Price** *£269.07 (£229 ex VAT)*
Contact *Dabs Direct* *www.asus.com*

EXTERNAL STORAGE

LaCie
PocketDrive

This tiny external 6GB hard drive has two FireWire ports and a single USB connector. The FireWire ports mean the drive can be daisy chained to other FireWire peripherals.

Review *July 2000, p108* **Price** *£351.33 (£299 ex VAT)*
Contact *LaCie 020 7872 8000* *www.elacie.com*

EIDE HARD DRIVE

Seagate
Barracuda ATA 28GB

This 28GB beast's spin speed of 7,200rpm helped it achieve 0.89Mbytes/sec in our random read and write test. It's a breeze to install and the £5.10 cost per GB makes it a bargain.

Review *April 2000, p197* **Price** *£157.45 (£134 ex VAT)*
Contact *Simply 020 8523 4020* *www.seagate.com*

SCSI HARD DRIVE

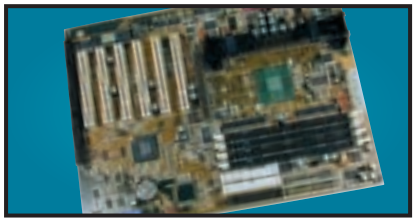
Quantum
Atlas V

Increased areal density makes this 36GB drive impressive. It may not be as fast as 10,000rpm drives, but with seek times around 6.3ms and a spin rate of 7,200rpm, it's good value.

Review *July 2000, p100* **Price** *£399.50 (£340 ex VAT)*
Contact *Quantum 01344 353 500* *www.quantum.com*

SLOT A MOTHERBOARD

Abit
KA7

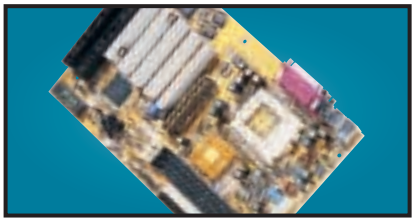


This uses VIA's Apollo KX133 chipset with the capability to run the memory at 133MHz plus support for AGP 4x. There are two Ultra DMA 66 channels plus the standard floppy connector and four DIMM banks.

Review *July 2000, p108* **Price** *£111 (£95 ex VAT)*
Contact *Dabs Direct 0800 138 5240* www.dabs.com

FC-PGA MOTHERBOARD

Gigabyte
GA-6BX7



If you are going to use one of the latest Pentium IIIs you're going to need a FC-PGA (Flip Chip Pin Grid Array) compatible board. The GA-6BX7 uses the 440BX chipset and has one AGP, four PCI and one ISA slot. It also uses cheap SDRAM.

Review *June 2000, p98* **Price** *£97.40 (£82.90 ex VAT)*
Contact *Watford 0870 729 5600* www.gbt-tech.co.uk

PROJECTOR

InFocus
LP335

A fantastic unit that uses the latest DLP chip. It even allows you to view slides with the lights on. It is expensive, but if you need something this small and light then the LP335 gives an extremely sharp, crisp image.

Review *August 2000, p118* **Price** *£4,876.23 (£4,150 ex VAT)*
Contact *InFocus 0800 028 6470* www.infocus.com

17IN MONITOR

CTX
PR711F

Using a Sony FD Trinitron tube, this monitor's slim casing somehow makes the display seem larger. Image quality is superb and a USB hub is built in to the base as standard.

Review *January 2000, p79* **Price** *£222 (£189 ex VAT)*
Contact *Simply 0800 035 2100* www.ctxeurope.com

19IN MONITOR

CTX
PR960F

Equipped with an FD Trinitron tube this has a constant 0.24mm pitch across the screen. It also has an additional BNC input and a built-in USB hub as standard.

Review *June 2000, p91* **Price** *£363.08 (£309 ex VAT)*
Contact *Simply 0800 035 2100* www.ctxmonitors.com

21IN MONITOR

Sony
Multiscan G500

The name Sony is synonymous with high-quality displays and this 21in FD Trinitron monitor is no exception. It has dual-input connectors and remains crisp even up to 1,800 x 1,440 at 75Hz.

Review *May 2000, p226* **Price** *£911 (£775 ex VAT)*
Contact *Sony 0990 424 424* www.sony-cp.com

LCD MONITOR

Sony
Sony SDM-N50

This TFT display is a svelte 1.3cm thick and the screen is easy to position with its multi-pivoted stand. The display quality is first rate and it even has built-in speakers and a headphone socket.

Review *April 2000, p96* **Price** *£1,291.32 (£1,099 ex VAT)*
Contact *Sony 0990 424 424* www.sony.co.uk

SOUND SYSTEM

VideoLogic
DigiTheatre

This set includes five speakers, a subwoofer and an integrated six-channel amplifier plus a decoder. Excellent sound quality at a fair price make the DigiTheatre a must-have.

Review *January 2000, p81* **Price** *£249 (£211.91 ex VAT)*
Contact *Videologic 01923 277 488* www.videologic.co.uk

CD-RW

Creative **CD-RW Blaster CD-Studio**

This 8 x 4 x 32 EIDE CDRW package has everything you need to get started. Not only is there an EIDE cable and screws to mount the drive, but also a CD-RW disc and 10 CD-R discs.

Review *June 2000, p192* **Price** *£164 (£140 ex VAT)*
Contact *Dabs Direct 0800 138 5114* www.europe.creative.com

ISDN TA

Eicon
DIVA USB

Weighing in at 70g and no larger than a mouse, this USB ISDN TA opens up 128Kbits/sec bandwidth and supports G3 and G4 faxing as well as a variety of voicemail and file transfer facilities.

Review *March 2000, p87* **Price** *£99 (£84.35 ex VAT)*
Contact *Eicon Technology 020 8967 8000* www.eicon.com

BACKUP

OnStream
SC30

The SC30 has a 30GB compressed data capacity and using Backup Exec it achieved over 70Mbytes/min. Echo software provides drive-letter access so you can treat it like a hard drive.

Review *September 1999, p102* **Price** *£386.58 (£329 ex VAT)*
Contact *Simply 020 8523 4020* www.onstream.com

DVD DRIVE

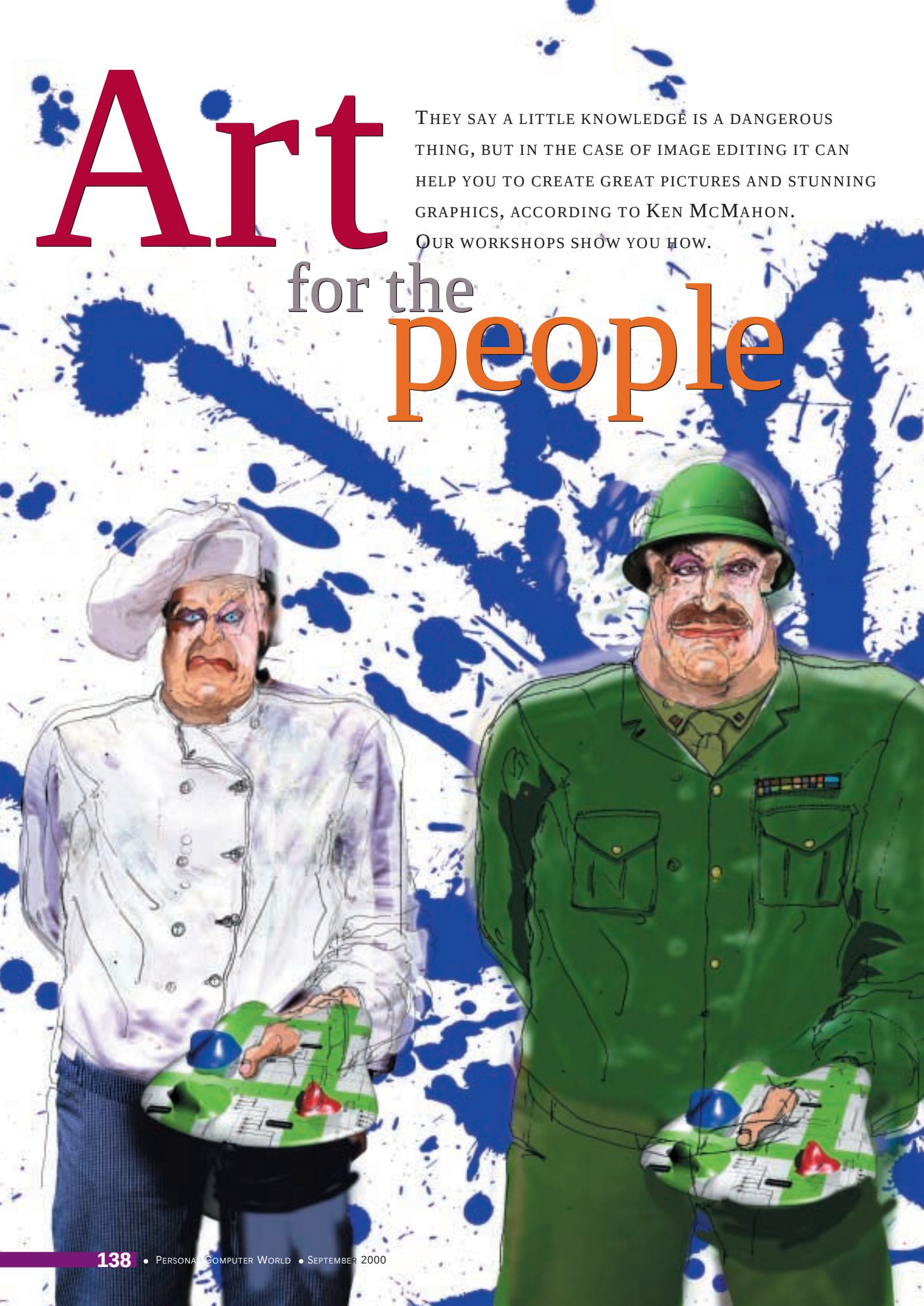
Pioneer
DVD-115

This 16-speed Pioneer drive is one of a few drives available at this speed. The unit uses a traditional tray loading design and also has a headphone jack and volume wheel on the front.

Review *August 2000, p197* **Price** *£141 (£120 ex VAT)*
Contact *Dabs.com 0800 129 3120* www.pioneer.co.uk

Art for the people

THEY SAY A LITTLE KNOWLEDGE IS A DANGEROUS THING, BUT IN THE CASE OF IMAGE EDITING IT CAN HELP YOU TO CREATE GREAT PICTURES AND STUNNING GRAPHICS, ACCORDING TO KEN MCMAHON. OUR WORKSHOPS SHOW YOU HOW.



It's no secret that photography has come a long way in the past few years. In fact it's probably no exaggeration to say that the past decade has produced more technological change than since WH Fox Talbot discovered the amazing things you could accomplish with silver-coated paper. Evidence of the impact of digital technology on photography is all around you. On the advertising hoardings you pass on your way to work, the pictures in your daily newspaper, the images on the websites you browse and the graphics displayed behind the presenter on the early evening news.

Digital image editing makes it possible for professionals to quickly produce effects that previously would have taken a lot of time and cost a great deal of money. It also makes possible things that would never have been achieved, regardless of the time and money available.

Images frequently undergo all kinds of digital processing. The art of montage – producing a new image from bits of several others – has blossomed in the digital age and we now take for granted unlikely photographic images of elephants on roller skates, cars driving on water, and mythical beasts. Not to mention less noticeable digital tweaking that gives us blemish-free models with startling eyes, sleek cars with reflection-free bodywork and holiday resorts with emerald seas, azure skies and beaches digitally denuded of their occupants.

The software tools used to accomplish all this are available to anyone with a modest PC. Adobe Photoshop is the industry standard application responsible for most of it. But even the most basic of packages aimed at the home user is now capable of many of Photoshop's tricks. Photoshop 5 LE and Paint Shop Pro 5.1, on which the following workshops are based, both have advanced features like layers, alpha channels, layer masks, sophisticated colour balancing and web-optimised output.

Plug-in filters provide image-enhancing tools like unsharp masking or other special effects and a vast range of third-party plug-ins provide additional effects and features.

ILLUSTRATION DANIEL MACKIE

Take a trip to plug-in city

If there is something your image-editing application can't do, the chances are there's a plug-in that will fill the gap. Plug-ins will work with Photoshop and any other application that conforms to Photoshop's plug-in architecture. Paint Shop Pro, for example, seems happy with most third-party plug-ins. While there were compatibility problems with early plug-ins, nowadays if application developers say their products are plug-in compatible they are probably telling the truth.

Of course, the only way to be 100 per cent sure is to try it, and many plug-ins are shareware or available as demos or trials.

Plug-ins come in two flavours. Most commonly they add one or a suite of special effects to your filters menu. Good examples include Human Software's Squizz, Xaos Tools Terrazzo and Alien Skin's Xenofex.

Squizz, is a Goo-style filter which offers brush-based, grid-based and envelope distortion effects. Terrazzo is useful for generating kaleidoscope-style tessellated background patterns and Xenoflex is the latest product from alien Skin – producers of the Black Box and Eye Candy effects suites.

Less fun, but perhaps more useful are the production tools which offer everything from image-enhancement tools to database facilities for keeping track of all your digital camera pictures. This category includes packages like Intellihance, Corel Knockout (not really a plug-in, but a standalone app), Imagebook, and Pantone's Hexwrench.

If it's productivity tools you want, an upgrade to Photoshop 5.5 might be a better option. Version 5.5 includes many of the advanced masking features that used to only be available via plug-ins; it also provides good-quality text effects.

Plug-in suites like Extensis Phototools and Kai's Power Tools (KPT) provide lots of functionality and a stunning array of effects that it would be difficult and less fun to produce in any other way. If you want to try out plug-ins online, including Intellihance and Photoframe, go to www.creativepro.com.

There's a lot of shareware and demos just waiting to be experimented with. So there's no excuse not to take a few plug-ins for a test run.

Here are some sites with worthwhile downloads: www.andromeda.com; www.alienskin.com; www.altamira-group.com; www.gamutimaging.com; www.autofx.com; www.creativepro.com; www.vertigo3d.com; www.corel.com; http://shareware.cnet.com.

As our workshops show, you don't have to be a professional to achieve professional results. A little knowledge can go a long way to improving your pictures and helping you create stunning graphics. An understanding of the workings of certain features, together with a basic operational knowledge of a few key tools will enable you to get great results quickly.

All these workshops were all produced on a 350MHz PII machine with 64MB of RAM and a 10GB hard drive. No matter what your system, a quick check of your hardware configuration will speed your work up and avoid crashes.

Image-editing applications eat memory and hard disk space. Generally, the image you are working on is stored in RAM. Memory is also required for layers, alpha channels, undos and the clipboard, in addition to the operating system and any other applications you might be running. When your application runs out of RAM it turns to the hard disk for help, making use of it as virtual memory to store image data.

So, the first rule of fast working is to install as much RAM as you can afford, because once you start to make use of virtual memory, things will start to slow down appreciably. Typically you'll need five times the size of your image file, so if your pictures are 1,024 x 768 resolution – just under 4MB, 24MB of spare RAM would be adequate. But if you are working on A4 300ppi (pixels per inch) scans, you'll need 10 times that amount. It's not essential, it just speeds things up.

If you do have to make use of virtual memory, it helps if you have one contiguous block – either allocate a partition on your hard drive exclusively for you image-editing application, or optimise your drive frequently.

While you are working you can help to keep memory and disk usage down by frequently purging the undo buffer and deleting unused layers and channels. After copying large amounts of data to the clipboard, once you have pasted, purge the clipboard by selecting a few pixels from the current layer and performing another copy.

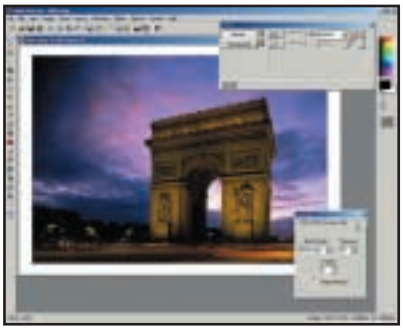
Layer upon layer

One of the biggest advances in image editing, layers, first appeared in vector graphics applications like Freehand and Illustrator and made the crossover when they were introduced in version 3 of Photoshop.

Like many new features of bitmap image-editing packages, the primary function of layers is to overcome the destructive nature of pixel

Picture framing in Paint Shop Pro 5

Straight edges can be a bit, well, straight, and photos often look more interesting with a less exacting border. In this walkthrough we'll produce an art border that you can use to give your photos a more attractive edge. We're going to make use of alpha channels and layer masks to create borders so they'll be non-destructive – your original image will still be intact, viewed through the frame mask. So, if you change your mind you can choose a different frame, or remove it.



1 Open up your image and make sure the layer and controls palettes are visible. Add a new layer and call it Frame 1. Don't worry about the mask options at this stage. Select Image/Canvas size and add about 10 per cent to the image dimensions to give a white border, then, in the background layer, select the border using the magic wand, invert it (Shift & Ctrl & I) and switch to the Frame 1 layer.

2 Modify/Contract by about 12 pixels then Press Ctrl & H and feather the selection by 12 pixels to get a soft edge, then switch to the Frame 1 layer, flood-fill the selection with black. This is our basic frame. Select Mask/New/From image and check Create mask from source opacity, then click OK. Next select Masks/Save to alpha channel, click OK in the Save to Alpha dialog and call the channel Frame 1.

3 Make the Frame 1 layer invisible and activate the background layer. Select Mask/Load from alpha channel and choose the Frame 1 alpha. Toggle the Enable layer mask button on the background layer to see what it looks like with and without the frame. Now we're going to create new frame masks using the paintbrush and spraycan.

4 Duplicate the Frame 1 layer and call it Frame 2, make the other layers invisible so you can see what you're doing. Select the paintbrush tool and in the controls palette set the paper texture and choose a brush tip. Paint around the edges of the black rectangle until you're happy with the result.

5 As in step 2, create a new mask from the image and save it as an alpha channel (call it Frame 2), then make the background layer active and load the new mask. You can continue making as many frames as you like in this way. Several of the paper textures including canvas, dark weave and asphalt produce good results. Experiment with brush tip settings and combinations. You can use the same settings with the eraser tool to remove mask as well as add it.

processing. Once you do something to the pixels in your image it's done for good – almost. You get one chance to undo it if it doesn't turn out right.

These days, there are sophisticated history features that provide multiple undos, but even these work in a linear fashion; you can undo any number of actions, but only in reverse order. Layers provide the opportunity to carry out non-destructive editing that you can undo without affecting work you did after the original edit.

One way this can be used to good effect is in combination with the clone tool, much favoured for taking out unwanted image details like lampposts, trees, washing lines and ex-partners. Cloning requires careful setting of the tool options and repeated strokes with the right brush settings to achieve a seamless, invisible result. Often it's a question of trial and error, but it's not always obvious something's not right until way down the line, and if you clone on the background layer there's nothing to do but start again.

You can avoid having to rework by duplicat-

QUICK TIP

If you need more screen room in Photoshop, click on the centre button at the bottom of the tool palette to select Full screen mode with menubar, or press f to toggle between screen modes. Press tab to toggle all floating palettes.

Making the most of digital pictures with Photoshop LE

You can download images from your digital camera and view or print them as they come. But with just a little effort you can transform them into pictures you can be proud of. How far you go is up to you. Here we've started with three simple steps – cropping, levels adjustment and unsharp masking – which all your pictures will benefit from, before graduating to some advanced tinkering with colour and tone.

1 Open your image and choose Save As, using a new filename and format. Most digital cameras store images as compressed JPEG s. Using the best-quality camera setting will save you effort. Don't resave images in JPEG format as the compression will reduce image quality. Choose Photoshop .psd format to preserve quality and keep all your layer and channel information. You can save to a flattened, compressed format when you're finished.

2 To drastically improve the impact of your photos, click on the marquee tool and hold until the flyout appears, then select the crop tool. Drag a box around the area you want to keep, then press Return. Shoot at the highest resolution setting on your camera, because once you've cropped the picture, there are far fewer pixels in the image. But this also works to our advantage, speeding up all the work we've yet to do – which is why we cropped the image first.

6 The variations default tends to ladle on the colour in bucketloads, so first adjust the slider to the fine end of the scale, that way you can add small increments. The radio buttons are set to add the colour in the midtones, which is on the beach where we want it, but depending on the image you might want to change this to add colour in the shadows or highlights. If you add too much of a colour, just add its complementary, or Alt-click on the cancel button to reset.

7 Incidentally, the sharp eyed among you may have noticed that before altering the colour balance with variations we introduced a new layer by dragging the background layer onto the new layer button in the layers palette. Creating a new layer on which to make changes is always a good idea because, by adjusting the opacity slider you can blend the adjusted layer with the original one, varying the degree of the original effect.

8 All this warming up hasn't done our sky any favours. It wasn't too blue to begin with and now the clouds have a creamy tinge. Select the magic wand tool and set a tolerance of about 32 in the tool options palette. Use Select/Grow to catch adjacent sky pixels you didn't get first time then press Ctrl & C followed by Ctrl & V to copy and paste the sky into a new layer. Click on the eye icon next to the existing layers to turn them off and you can see your sky layer in isolation.

QUICK TIP

In Photoshop, click the preview checkbox on and off to see a before and after preview in the main editing window.

ing the background layer and cloning on a duplicate image above it. That way, you always have the untouched background layer to fall back on. You can simply copy the messed up bit from the background back into your retouching layer and start again, or make use of the opacity and blend modes to merge the two to better effect.

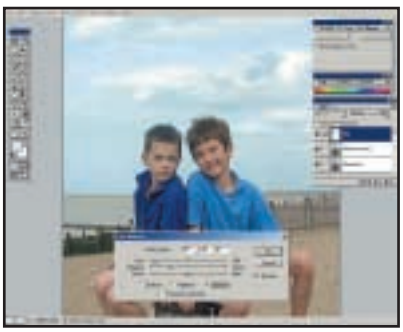
Once we had layers, the obvious thing to do was play around with how they interacted by varying the opacity – making topmost layers transparent, revealing layers underneath. You can also get a lot of mileage out of blend modes that determine how pixels on the upper layer interact with those below. Lighten and darken can be used for subtle retouching and modes like multiply, dissolve and colour burn and colour dodge can be used to great effect.

From opacity and blend modes it was but a short step to adjustment layers. These are image adjustments that sit on a separate layer above the image layer and can be edited themselves in isolation from the layer to which they apply. For

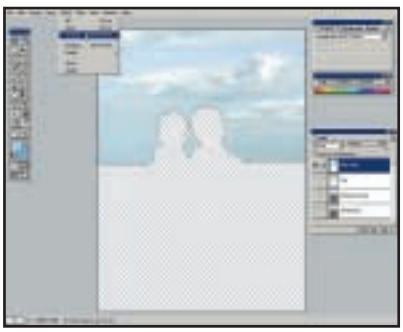
3 There aren't many images that don't benefit from unsharp masking, particularly if you're using a budget camera with a less than sparkling lens. The trick is not to overdo it. Choose an amount between 100 and 200 per cent, a radius between 0.5 and two pixels and a threshold of 0. Experiment with the sliders to see which settings give the best results and watch out for JPEG artifacts – blocky pixels and halos – which can be exaggerated by unsharp masking.

4 Press Ctrl to bring up the levels dialog. The histogram shows the frequency of pixels across the tonal range from black (0) to white (255). You'll often find this clipped at either end where there are no or few areas of highlight or shadow detail. Our photo has a pretty good tonal range, but there are no whites and the contrast can be improved by dragging the input level slider down to 240. Or you can click the Auto button to map the darkest pixel to black and the lightest to white.

5 For a seaside shot, our image looks a little cool, so we'll make a colour adjustment to warm things up. From the Image menu select Adjust/Variations to add red, green and blue (Additive Primaries) and yellow, magenta and cyan (Subtractive Primaries). Yellow and blue are complementary; adding one has the opposite effect to adding the other, so if you add equal amounts of each you get back to where you started. Magenta is the complementary of green and cyan of red.



9 Select Rename Layer from the layer palette menu and call the new layer sky, then select Image/Adjust/Colour balance. Trial and error will help you achieve a realistic looking sky, but you will need plenty of cyan and a little magenta, all in the highlight area. If you check Preserve Luminosity the tonal values in the sky won't get darker, even though you're adding colour, though this can give an unrealistic day-glo effect. If your sky is over the top use the opacity slider to tone it down.



10 Better, but still a bit gloomy. Why not replace the cloudy sky with something altogether more summery. Let's face it, on an English beach this is about the only way you're going to get the desired effect! Duplicate the sky layer by dragging it onto the new layer icon. Using the magic wand click in the transparent area below the sky (turn the other layers of if you like) and then Select/Inverse.

11 Using the eyedropper select an area of the sky close to the horizon then click the background colour swatch and pick a deeper sky blue. Using the gradient tool, drag from the bottom to the top of the sky selection. This looks thoroughly strange because there's a clear blue sky, but no shadows. However, by experimenting with opacity and layer modes (overlay works particularly well) you can achieve a natural-looking compromise.

example, you can colour balance an image using an adjustment layer and then later reduce the opacity of the layer to lessen the degree of adjustment, or remove it altogether. Again, the underlying pixels are untouched.

If you want to work quickly and efficiently, two features of image-editing applications you should get to know well are alpha channels and layer masks. RGB colour images are made up of three channels: one stores the pixels for the red image data, another the green, and the third the blue. You can view the separate channels in Photoshop LE by pressing Ctrl & 1, 2, or 3 (press Ctrl & ~ to get all three back together again).

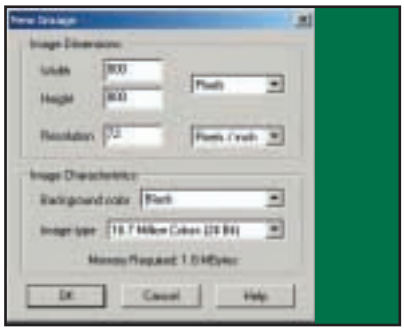
Additional channels can be used to save selections. Once you have saved a selection to an alpha channel it's available for you to load back in at any time, so you don't have to bother making the same selection over and over. What's more, you can edit the alpha channel, filling areas, applying effects filters and transformations to alter the way it works.

QUICK TIP

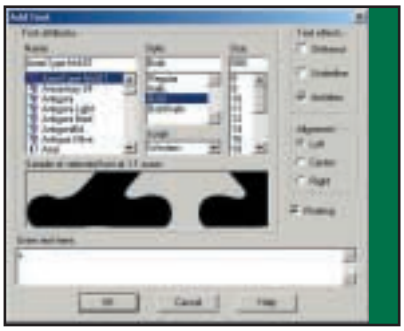
Unless you're actually making use of plug-ins, remove them from the plug-ins folder. Your image-editing application will launch more quickly and use less memory without them.

Text effects and animations in Paint Shop Pro 5

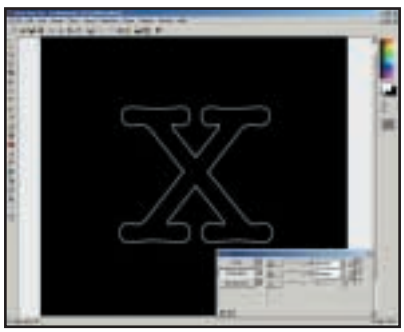
We're going create some glowing text from scratch. It doesn't require any plug-ins, filters, complicated channel juggling or blend modes – the soft edge effect is achieved using the feather command. Our glow is made up of three colours, each of which occupies its own layer. A layer mask is used to define the shape of the glow. You can use this as a button, a navbar, or just for display type. We'll also show you how to use Animation Shop to give life to the image.



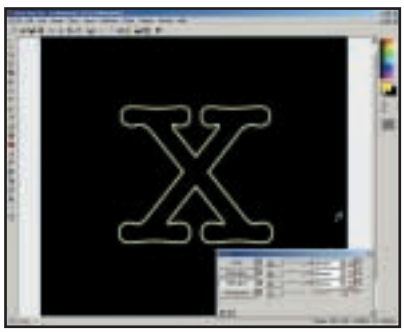
1 Select File/New and enter the image dimensions in pixels. I've chosen 800 x 800 so you can see what's going on in the screenshots. You can always work big and sample down before creating a GIF file. Select 16.7 million colours (layers won't work in 8bit mode) and make the background colour black. Activate the layers palette by clicking the toggle layers palette button on the top toolbar.



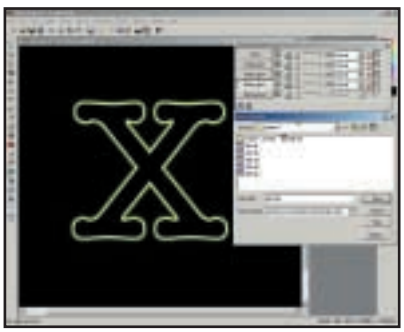
2 Click the Add new layer button on the layer palette. In the layer properties dialog call the layer TYPE. Make sure the 'Mask is enabled for this layer' and 'Mask is locked with layer' checkboxes are checked and click OK. Click the Layer visibility toggle on the background layer to turn it off. Select the text tool and click in the centre of the layer. Enter your text (experiment to get the size right), but leave edge room for the glow. Make sure the antialias and floating boxes are checked.



6 Incidentally, as we are not making use of the layer masks, other than to save selections, you can turn them off (last button from the right in the layers palette). Interestingly, if you leave them on, they will dim your glow slightly because the feather command works both sides of the selection border, so your flood fill will be two pixels wider than the selection. We may be able to make use of this 'accident' when it comes to animating the graphic.



7 Now for the yellow glow. Duplicate the White glow layer, rename it Yellow glow and reposition it below the White glow layer. Create a selection from the layer mask, expand and feather it in the same way as for the White glow layer. Remake the layer mask from the expanded and feathered selection. Double click on the foreground colour swatch, select a yellow from the basic colours, and use flood fill. Select a green and repeat this step to produce a Green glow layer.



8 We are going to save seven cells to import into Animation Shop. First make only the background layer visible and save a copy as cell1.gif. Next make the TYPE and White glow layers visible, with the layer mask turned on and save a copy as cell2.gif. Turn the layer mask off to increase the White glow and save a copy as cell3.gif. Save two GIF cells for each of the Yellow and Green glow layers (the first with mask on, the second with it off) and you will have seven animation cells.

QUICK TIP

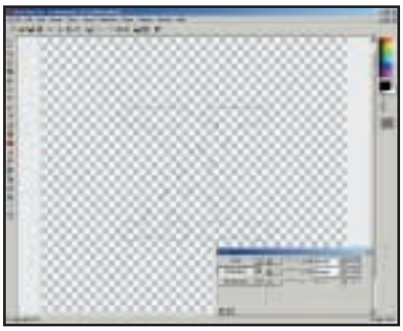
Use the arrow keys to shift selections one pixel at a time. In Paint Shop Pro you need to press Shift too, in Photoshop this moves 10 pixels at a time.

Layer masks are a lot like alpha channels, only they are linked to a particular layer. Masks control which parts of an image are displayed and which are hidden. In Paint Shop Pro the solid black areas show 100 per cent of the layer and the white areas nothing, in Photoshop it's the other way around, though you can invert the default setting. For example, if you used the gradient fill tool to fill a layer mask from solid black at the bottom to white at the top, the layer would show solid at the bottom, fading to transparent at the top.

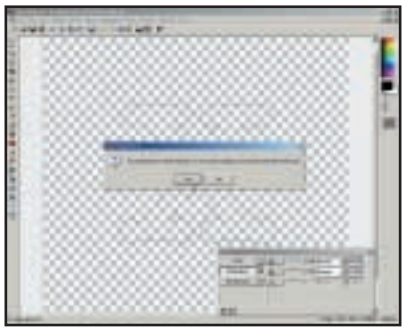
Layer masking is used a lot in photomontage work to blend images together with a soft edge. It gives absolute control over which parts of the image are revealed and hidden and it's non-destructive – the original image is unaltered.

Next come selection tools, which have become increasingly effective in recent years and now any image editor worth its salt provides a number of ways to sort the pixels you want from those you don't. As ever, Photoshop has the best selection, though even the most budget packages will offer

3 Right click on the topmost 'Floating Selection' layer and select Defloat from the popup menu. Then create a layer mask from the current selection using Masks/New/Show selection. To view the mask select Masks/View Mask (if you turn off the TYPE layer you can see it more clearly). Now you can select none (Ctrl & D) – you can get back your selection at any time with Shift & Ctrl & S.

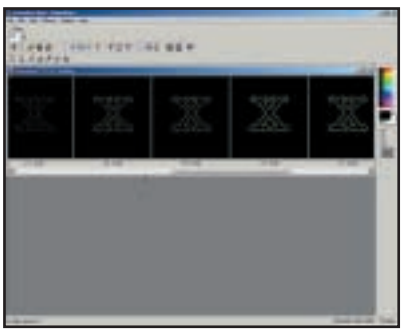


4 We now have a black X on a black background! Don't worry, it's the backlit glow that will make the type visible. Duplicate the TYPE layer by dragging it onto the new layer button in the layers palette. Double click on Copy of TYPE and rename it White glow, then close the layer properties dialog box and drag the new layer below the TYPE layer. Press Ctrl & A, followed by del to clear the layer, then Shift & Ctrl & S to make a selection from the layer mask.

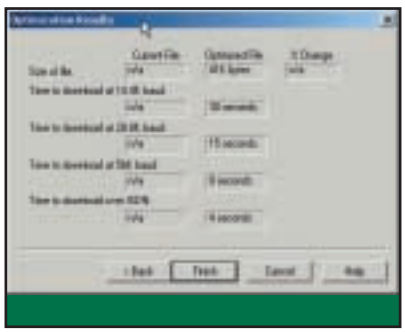


5 We need to expand and feather the selection. From the Selections menu select Modify/Expand and enter a value in the number of pixels box. I've chosen two, but the effect will depend on the size of your image. Next Modify/Feather, this time we've gone for four. Remake the layer mask from this new selection – click yes to replace the existing mask. Fill the selection with white by clicking the background/foreground toggle and using the flood-fill tool, then select None.

9 Open Animation Shop (File/Run Animation Shop) and run the animation wizard from the file menu. The wizard is fairly self-explanatory. The default frame delay is one-tenth of a second, so unless you have lots of frames you will need to lengthen this or your animation will be over in the blink of an eye. As I don't want the animation to loop I've unchecked this option.



10 Click Add Image to include all of your cell files and use the move up and move down buttons to put them in the correct order. Click Finish to build the animation and you can now see each of the frames in a filmstrip format. Select View/Animation to see how it looks in motion.



11 Lastly, you need to ensure that your animation is optimised for the web. The optimisation wizard does this for you, making appropriate colour depth and palette decisions, removing redundant frames and compressing the file so it will download quicker. You have to be careful with this and some tweaking may be necessary to achieve the best results. The optimisation wizard also provides a handy report that tells you how long your file will take to download.

some variation of the magic wand tool that picks up pixels of similar value based on an initial sample and a tolerance value.

Recent new additions to Photoshop 5.5's selection box include a magnetic lasso and pen tools, magic and background eraser tools (see this issue's *Hands On Graphics & DTP*) and an extract command. All these are designed to make the job of removing the main subject of a photograph from its background much easier. To do this kind of thing manually requires tricky tedious, time-consuming tracing.

Whether you want to produce complex multi-image montages, sophisticated titles for a home video, or graphics for your website, today's image-editing applications provide all the tools you're likely to need. Improvement of your digital photos is within quick and easy reach. Basic knowledge of the way image-editing tools work can make the difference between a professional-looking result and a dog's breakfast. So, what are you waiting for?

QUICK TIP

Use websafe colour palettes if producing images for the web. In Paint Shop Pro choose Colors/Load palette and safety.pal in palettes folder. In Photoshop 5 LE select replace swatches from swatches palette menu and use Web Safe Colors.aco.

50 hardware tips

KEEPING YOUR PC IN TIP TOP CONDITION OFTEN COSTS MONEY, BUT GORDON LAING HAS COME UP WITH A MULTITUDE OF SUGGESTIONS, MOST OF WHICH YOU CAN IMPLEMENT WITHOUT DIPPING INTO YOUR WALLET.

ILLUSTRATION ANDY BAKER

MAYBE YOUR PC ISN'T working as well as it used to. Perhaps you can't help thinking that a little tweak here and there will have your system once again firing on all thrusters. The truth is that a PC is just like any other piece of machinery, and requires regular maintenance to keep it in the best of health. But where do you start?

The answer is right here! Over the following pages we've got no fewer than 50 top tips to keep your PC hardware happy, and possibly running better than ever. Better yet, the vast majority of them are absolutely free! That's right, the best performance from your PC with no costly upgrades. So don't grind your PC into the ground. With our tips you'll have the smoothest system on the block!

Let's get physical

1 Screwed up
Before you start digging into the innards of your PC, you should note that the hardware enthusiast's best friend is the Philips-head screwdriver. Virtually everything in a PC can be loosened or tightened using this. So get hold of a good one that preferably has a magnetic head to prevent those pesky screws from falling into your case and becoming forever lost. If you find yourself regularly crawling under desks to perform PC surgery, then a small Maglite torch can also prove invaluable.

2 Static electricity
The hardware enthusiast's worst enemy is static electricity, which can destroy a precious internal component in a flash. The particularly wary (or sparky) should always use an anti-static wrist strap, while the carefree may be content by regularly grounding themselves with a tap of the internal power supply. Certainly upgrading components on a highly charged carpet, or after rubbing a balloon against a furry jumper is not recommended (Although we're not sure why you would want to do that in the first place!).

3 Motherboard installation
When fitting a new motherboard, there's no need to lean into your case and struggle with screws. The side panel of most PC cases can be unscrewed and removed from the main chassis, allowing you to mount your motherboard in comfort. Make sure you use all the motherboard's mounting holes to prevent it from flexing when you insert cards.

4 Jumper settings
It's a good idea to set the jumpers on the back of drives before you screw them into your case. Believe us, it's a lot less fiddly than trying to do it when they're properly mounted. And speaking of which, don't skimp on screws when mounting drives, as otherwise you could experience irritating vibrations.

5 More power
Most PC cases are supplied with 230w power supplies. While this is adequate for a basic system, once you start adding more and more drives, fans to keep them cool, not to mention power-hungry CPUs and graphics cards, then perhaps it's time for an upgrade. Consider swapping your power supply for a higher-rated 300w version.

Brave BIOS

6 Quick warning!
Almost every PC user will have to enter their BIOS at some time, but you should always act with caution, as an incorrect setting could render your system unstartable. While enthusiasts may tweak BIOS settings for the best performance, less experienced users should only go in when they absolutely have to.

7 Easy OS install
In the old days, we installed everything from a floppy disk – indeed, most operating system installations still require a start-up floppy disk to load CD-ROM drivers in order to continue any further. A modern BIOS, however, may have the option to boot directly from an appropriate 'bootable' CD. If your BIOS supports this option, it's well worth activating, as a bootable OS CD makes installation a breeze, particularly for Windows 2000, which, like NT, otherwise requires three floppies before it'll talk to your CD-ROM drive.

8 Parallel peripheral problems?
Before the advent of USB, the PC's venerable parallel printer port won many new friends, including numerous scanners and even a handful of MP3 players. However, almost every new device demanded that the parallel port was working in the enhanced EPP or ECP modes. Sadly it's not enough that your parallel port is EPP- and ECP-compliant – it has to be set as EPP or ECP in the BIOS, so if you're experiencing trouble with a parallel port scanner, your BIOS is the place to look.

9 Don't interrupt me!
The BIOS is responsible for snatching most of your PC's precious resources, such as IRQ interrupts. If you've run out of IRQs and are experiencing device conflicts, consider disabling unused devices or ports in your BIOS. Exclusively SCSI users could disable their onboard IDE controller, while anyone with a USB keyboard or mouse could disable their PS/2 ports. Make sure the BIOS is set up for supporting a USB keyboard at boot, though.

10 BIOS updates
Sometimes an update to your BIOS is necessary to support new CPUs, bigger hard disks, or even modern OSs – Windows 2000, for instance, requires BIOS updates on many systems. Updating or 'flashing' your BIOS normally entails downloading the required data image file and a suitable flashing utility from your motherboard maker's website, copying it onto a bootable floppy, and starting your system with it. The updating process takes about a minute. If everything's working fine on your system there's no need to update your BIOS.

11 SCSI BIOS updates
There's also a BIOS in decent SCSI cards, such as most of those supplied by Adaptec. Believe it or not, this BIOS, too, can sometimes need updating, as advised on Adaptec's website. For example, the popular 2940U2W card may require a BIOS update to work with several Intel 820 and 840 chipset motherboards.

12 Load default settings
It can be easy to change a setting in your BIOS that will render your PC unstartable. Sometimes you can re-enter the BIOS, and change the offending setting, or if in doubt, just load the default BIOS settings and start again. However, you may not be able to get into the BIOS to change the settings back. But as the BIOS uses a battery to remember its new settings, removing it should return it to its default state (it's usually the flat circular battery on the motherboard). The BIOS can remain quite faithful to its user settings, though, so you may have to remove the battery for a good few minutes, or even longer to be sure.

Full recovery

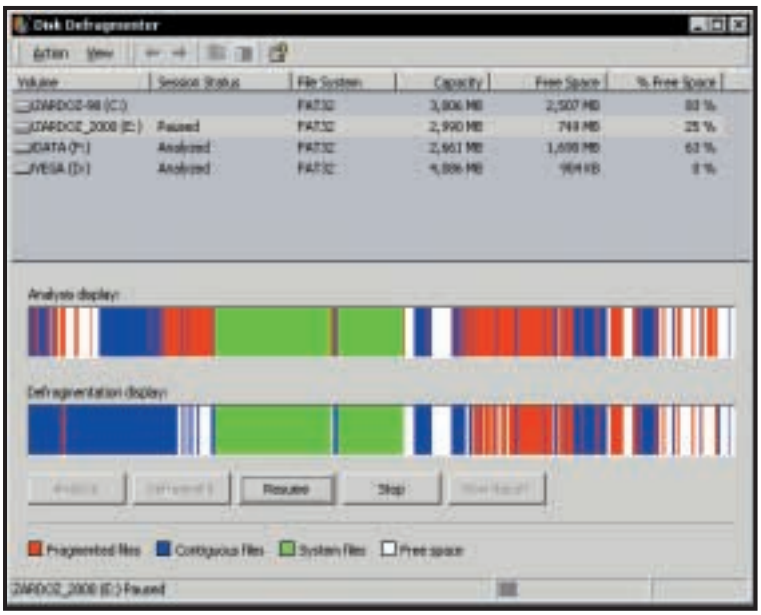
13 Okay, so the battery trick didn't work. Or perhaps your system lost power half-way through the BIOS flashing process. Either way, it's time to get really serious. Modern motherboards have a boot-block BIOS that doesn't get overwritten during flashing. This tiny amount of non-corruptible data has support for a floppy drive only, allowing you to boot and attempt to reflash the BIOS again. Sadly, there's no support for PCI graphics cards, so you'll either need to find an old ISA card, or instruct the Autoexec.bat file to fire up the flash utility and keep your fingers crossed. If this doesn't work, you're looking at physically swapping your BIOS chip for one that works. However, some boards have two BIOS chipsets to protect against this problem.

14 Updates and installers

Driver updates
Manufacturers of peripherals and devices are rarely satisfied with their drivers and usually work on improving their compatibility and performance. It's always worth checking for driver updates, particularly if you own a graphics card or Windows 2000. Amazing as it seems, we even saw improved games performance after updating a driver for a sound card. So saying, don't take the manufacturer's word as gospel. If you're experiencing problems or reduced performance with a new driver, then revert to an older one.

15 Order a CAB
Recent versions of Windows store their installation files and standard drivers as compressed files with a CAB extension. When you're asked to insert the Windows CD, you're in fact being prompted to supply the appropriate CAB files. If your hard disk has plenty of free space, consider copying the CAB files from the Windows CD and pointing the request at this location instead – very convenient if you don't always have your Windows CD to hand. There's no need to copy the entire CD though: for Windows 98, just copy the 173MB Win98 folder from the CD.

16 Already installed?
Often a newly installed device will ask for the Windows CD to be inserted for some extra files. You may, however, find that you've already got the required files present in your system. If the Windows CD is not to hand and you've not copied the CAB files across, then browse the following folders: Windows/system, Windows/system/iosubsys, and Windows/system32/drivers. In many cases the installer will find the files it's looking for in these locations.

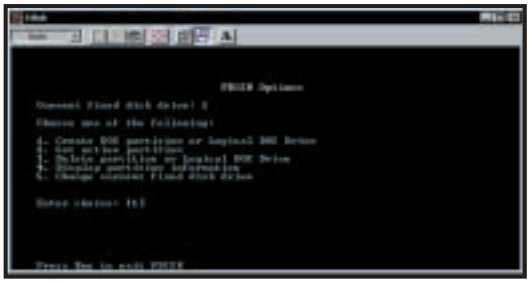


Bring all your files back together again with Windows' defrag tool

Drive tips

17 Defrag your disk
As you spring clean your hard disk, files are removed from all over the place, leaving lots of little gaps. To group them back together into one big useful area, use Windows' defrag tool. Simply bring up the properties of a drive in My Computer and choose Defragment from the Tools tab.

18 Formatting is not enough
It's well worth reinstalling your entire operating system and applications at least every year, especially if you install and remove lots of software and



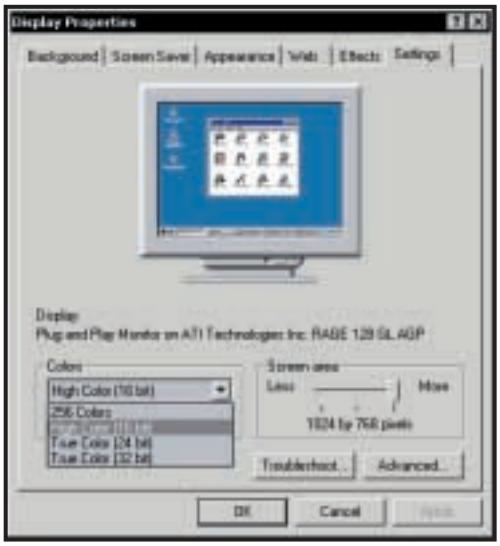
Exorcise the ghosts and create new partitions with Fdisk

devices. While the classic Format C: command may seem to get rid of everything, many OSs still leave bits behind. The only way to really exorcise the ghost is to restart in DOS, use Fdisk to delete your pesky partition and create a new active partition. You'll still need to format it afterwards of course.

19 Keep up with the IDE
The IDE interface that's standard on almost every PC motherboard typically features two connectors: one for the Primary channel and the other for the Secondary. Each channel can support two devices as Master and Slave, but it's not advisable to mix drives of very different performance. A CD or DVD-ROM drive will slow a hard disk if placed on the same channel, so keep them apart. Put hard disks on your Primary, and CD/DVD/Zip/LS-120 drives on your Secondary.

20 Choices, choices: 66 and 33
Following on from the point above, try not to mix UltraDMA66 drives with UltraDMA33 drives on the same channel, or the bandwidth on that channel will be fixed at 33Mbytes/sec. While this is still sufficient for most pairs of drives, disks are getting steadily faster. A new IBM model already delivers 35Mbytes/sec.

21 LVD, yeah, you know me!
The latest two SCSI interfaces, U2W and U160 use a Low Voltage Differential (LVD) connection. U2W and U160 SCSI cards normally feature at least two channel connectors: one labelled LVD and the other as SE. In order not to compromise the performance of high-speed LVD hard disks, you should keep them on the LVD channel and all other non-LVD peripherals on the SE channel.



Try 16bit colour mode if you're looking for speed

22 The terminator
SCSI offers great performance and flexibility so long as you obey some simple rules. One of the most important is to terminate each end of the SCSI chain, be it on an internal drive, an external scanner, or even on the SCSI card itself. Incorrect or missing termination can cause all sorts of problems.

23 Stay on the same bus
SCSI and IDE each have their pros and cons, but for the best performance, try to stick to just one or the other in your PC. Data transfer is much faster if it doesn't have to cross from IDE to SCSI or vice versa.

Graphics and display

24 Free of flicker
A flickering display will give you eye fatigue and headaches. To avoid this, make sure your graphics card refresh rate is at least 70Hz, and ideally nearer 85Hz. If you change your refresh rate and your monitor can't handle it, wait for a few seconds and Windows will switch it back to your old setting. Note LCD monitors can get away with lower refresh rates as they have their pixels illuminated at all times.

25 Crop top?
If you don't like the black borders around your picture, then use the monitor controls to stretch or reposition the image on screen. Similarly, if it's cropped, then shrink the picture or shift it back again. Adjustments are frequently necessary when you switch resolutions or refresh rates.

Pushing components to the limit

Overclocking is the process of forcing something to go faster than it was originally intended to go. While this is most commonly performed on CPUs, overclocking is now popular with some chipsets and even graphics cards. Remember, however, that if you artificially run a component beyond specification, you may damage it and probably invalidate your warranty.

A CPU's speed is dictated by two numbers multiplied together: the clock multiplier and the front-side bus (FSB), so a PIII 750 is 7.5 times 100MHz. In recent years, Intel has locked the clock multiplier on its CPUs, which means overclockers have been forced to increase the FSB instead.

Apart from ensuring the resulting speed is still within the CPU's manufacturing tolerances, increasing the FSB has many other impacts.

First is that the PCI and AGP buses are only guaranteed to work at 33 and 66MHz respectively and these speeds are calculated as a fraction of the FSB. Consequently, you'll have to ensure your motherboard offers appropriate dividers, or you may be running these often sensitive buses beyond their specification.

In BX chipset systems, the memory is also driven at the same speed as the FSB, so a 133MHz FSB will require PC133 memory.

For more details on the practicalities of overclocking, check out *Hands On Hardware* in *PCW* every month.

26 **Go for 16bit: the ideal compromise!**
While 24 and 32bit colour modes may reproduce photographic images the best, 16bit looks pretty good, and is a lot quicker for your system to handle.

27 **Quick games boost**
To immediately improve your frame rate in games, consider playing them at a lower resolution. A setting of 640 x 480 may not be anywhere as detailed as 1,024 x 768, but it's a darned sight faster, and cheaper than buying a new graphics card.

28 **Save the environment**
Power-saving modes will reduce electricity use and prolong the life of your display. Don't forget to switch off your display at the end of the day, though, as most PC power supplies will no longer do it for you.

Sound advice

29 **Magnetic shielding**
Loudspeakers use big magnets to drive those cones and produce the sound. There's nothing wrong with that, of course, unless they're placed too close to your monitor. The magnets will interfere and produce undesirable coloured interference and distortion on screen. The solution is to move them further away or, better still, to buy a magnetically shielded pair.

30 **Boo, hiss!**
To minimise background hiss when recording audio on your sound card's line or CD inputs, make sure you mute the microphone input. If you have a pre-amp option, known as 'boost' on Creative cards, then mute this too.

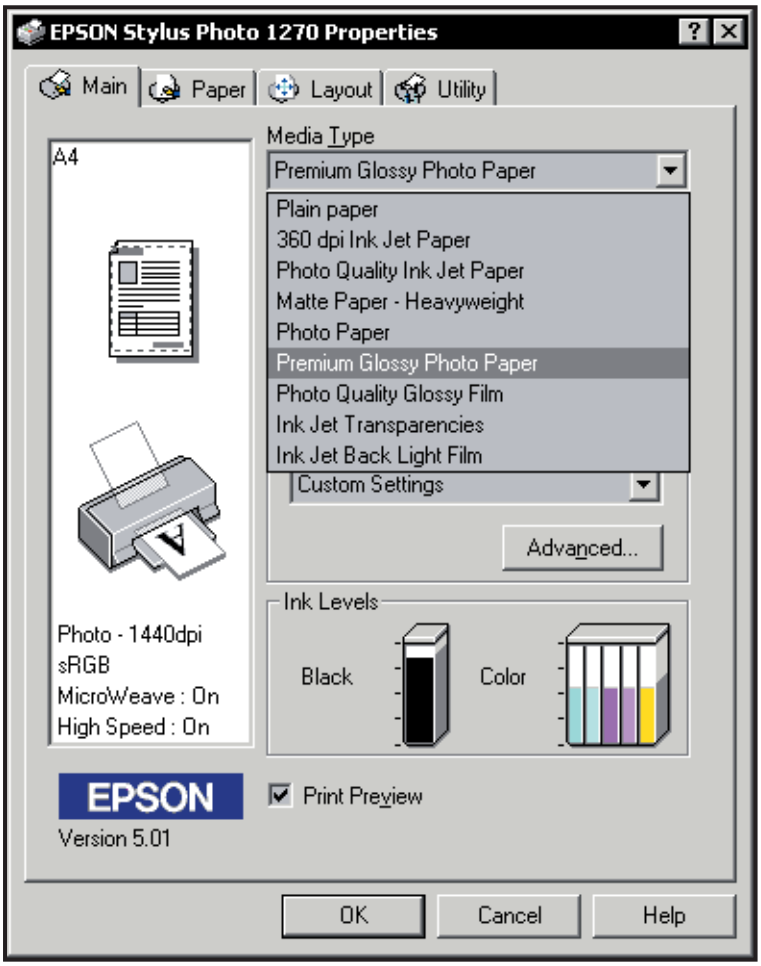
31 **Digital dream**
Most modern sound cards feature SPDIF ports, which squirt out digital audio through either an optical or coaxial phono connection. If your hi-fi pre-amp or processor features a spare SPDIF input, consider connecting it to your PC for the best quality. Note that many software DVD players can now redirect the raw Dolby Digital or DTS bitstream out of your sound card's SPDIF port, allowing you to connect it to an external Dolby Digital/DTS decoder.

Imaging and printing

32 **Blocky digital camera photos?**
The general rule for printing photos on colour inkjets is to supply them with 200-300 dots per printed inch. If you've got a 2.1megapixel digital camera, that means you'll begin to see the blocky pixels on prints larger than 6 x 8in. To eliminate these jaggies, consider interpolating your image by two times in a package like Photoshop. This won't reveal any new detail in the picture, but will let you print to A3 without seeing any nasty blocks.

33 **Matched paper**
Colour inkjet printers have an enormously wide range of different papers available – some are matt, some are glossy, some are thick and some are thin. The crucial thing is to know which paper you're using, and to instruct your printer driver. It will then know how much or how little ink to put on the page, striking the right balance between a soggy print and one which is lacking in the vibrancy department.

Cut down that background hiss



Tell your printer driver what sort of paper you are using

34 **Soft scans?**
When scanning photographs, the results can sometimes look a little soft. Consider sharpening them using software, either from the TWAIN driver if available, or from an image manipulation package. The sharpener of choice is the curiously titled Unsharp Mask, which normally lets you adjust settings and preview their effect before applying.

35 SCSI scanner not talking?
SCSI can be a superb interface for connecting drives and peripherals, but sometimes devices other than hard disks can give you trouble. The culprit is normally a missing Advanced SCSI Protocol Interface (ASPI) layer. Without ASPI loaded in Windows, you'll be lucky to get anything other than SCSI hard disks and CD-ROM drives working. Adaptec SCSI card users should get hold of a copy of EZ-SCSI 5 for Windows 95, 98 and NT, while Windows 2000 users should instead update their Microsoft SCSI card driver with one of Adaptec's own. This seems to do the trick for talking to SCSI scanners and other moody devices.

36 Cabling and cleaning

Cable compromise
Most of us use extension cables and splitters to get our phone points to our modems, but these may be deteriorating the line quality and compromising your Internet performance. Remember that a 56K modem will rarely achieve its theoretical limit, but if you're consistently getting below 30K, then it may be time to check your cabling.

37 Simple networking
While LapLink's special USB cable is a neat way of quickly transferring files between two PCs at up to 12Mbits/sec, you can't beat the flexibility of a proper network. You'll need to fit a 10/100 PCI Ethernet card into each PC, and use CAT-5 quality cabling to support the faster 100Mbit speeds. If both PCs are connected directly to each other in a peer-to-peer configuration, then you'll need to use a Crossover Ethernet cable.

38 Clean living
It's remarkable how much dust and dirt your PC accumulates over time. Try turning your keyboard upside down and shaking out all the sandwich crumbs. If your mouse has become unresponsive, remove the ball and brush any dirt and fluff from the rollers – cotton wool buds and compressed air can prove invaluable. Also check for fluff in your fan intake round the back of your PC case.

Keeping your cool

39 Biggest fan
Fast graphics cards, high-speed hard disks and quick CPUs all generate a lot of undesirable heat, and it's a good idea to get rid of it if you want to prolong their life. Most PC cases feature mountings for one or two additional fans to pull clean air in and suck it back out the other end – costing less than £10 each, additional case fans will help your PC keep its cool.

40 Thermal paste
Heatsinks may keep processors cool, but will only work at their best if there's decent contact between them. Help them by removing the heatsink, getting rid of any redundant pads, and applying a very thin layer of heat transfer compound instead (£1.99 from Maplins, www.maplin.co.uk).

41 CPU heatsinks
Overclockers often have to pump higher voltages through their CPUs in order to get them to work reliably at faster speeds. This in turn generates more heat, so bigger heatsinks and fans are a must. Remember that PPGA processors need different heatsinks to FC-PGA processors, as they're slightly different heights. Hills Components (www.hillscomponents.co.uk) has a good range of Titan fans.

Chipsets under the spotlight

In recent months, the chipset (which co-ordinates activities on your motherboard) has come to the forefront of attention. Intel's issues with its RDRAM-to-SDRAM protocol converters on 820 and 840-based motherboards have forced many users to look more closely at chipsets when they are looking to buy a new system.

Intel's old BX chipset still cuts the mustard, particularly when overclocked from 100 to 133MHz, but this pushes the AGP bus beyond spec, and supplies of the chipset are now almost non-existent.

Natively supporting PC133 memory, Intel's brand new 815 and 815E chipsets are set to do good business in mainstream products.

Many enthusiasts are, however, waiting for VIA's forthcoming chipsets that will support new DDR SDRAM, effectively running at 266MHz. We hope to see DDR motherboards for both Intel and AMD CPUs before Christmas.

42 Monitor temperatures
Wary users or overclockers should always keep an eye on the various temperatures in their systems, especially when they've been on for the best part of a day. Most BIOSs will indicate the CPU temperature, and some motherboards come with utilities to check this from Windows. Intel lists thermal guidelines in the developer sections of its website, but if your CPU is approaching 70 degrees Celsius, it's definitely time to cool down.

43 Do your research
If you want to check out overclocking or upgrade options, then the bible is your motherboard manual. If you've mislaid yours, identify your board and download a copy from the manufacturer's website – it's essential.

Media care

44 Fragile CDs
Tomorrow's World may have introduced compact discs as indestructible, but they're more fragile than we first thought. CD-R discs are particularly sensitive to scrapes and scratches, so keep them in their cases when not in use.

45 Uncertain backup?
When is a backup not a backup? When it's not been verified. It's no good studiously backing up your data if you don't check to see it was stored without a problem. All backup software offers a verification option, which simply checks to make sure everything went to plan – make sure you use it!

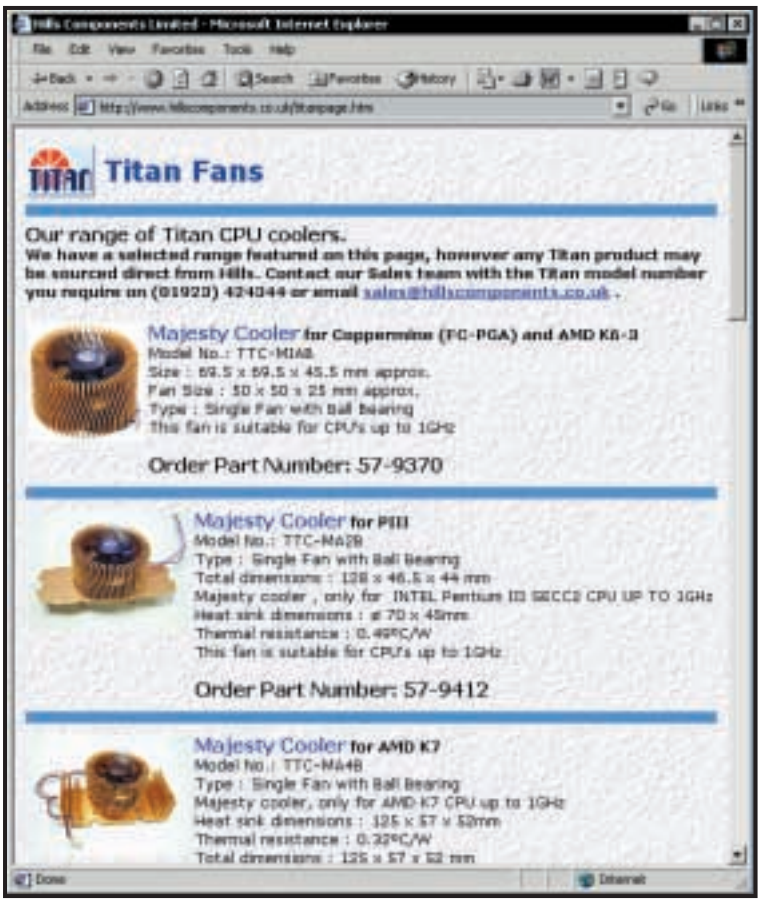
46 Backup for backup
You may be happily backing up and even verifying, but then one day your backup media fails, or is lost, burnt or nicked. If you really care about your data, back up twice each time, onto different media, and cycle it from time to time. Where possible, try to keep your backup media separate from your PC in case your system is stolen or damaged. A fireproof safe or off-site location could end up being the securest place for your precious backup media.

47 Scary magnets
Tapes and floppy disks store and identify their data using magnet properties of the media. Clever stuff, but easily distracted by a bigger magnet, like the ones they use inside your monitor and in loudspeakers. To avoid the chance of accidentally erasing your tape or floppy, do not leave it on top of your monitor or speaker.

It's dead Jim!

48 New drive won't appear?
A new hard drive may be connected up correctly, but if your BIOS hasn't been informed, then it may as well be in Timbuktu. If it's an IDE drive, ensure the first page in your BIOS has the appropriate channel set to AUTO, and that the channel itself is enabled. If you want to boot from a SCSI drive, make sure your BIOS knows to boot from SCSI and not IDE.

49 Machine won't start up?
There's a reason most technical support people ask you to check your cables and connections – they're often at fault in a system which mysteriously won't start up. If your PC fans are whirring, but there's no beeping, nothing on your display or anything else at start-up, then switch off and make sure your CPU, memory and cards are correctly seated in their respective slots. It's often worth removing them and re-inserting to be sure. AGP graphics cards are notoriously troublesome, and often pop out from their slots almost invisibly, but sufficiently to halt a system. After much cursing and head scratching, we've discovered most mysterious non-boots are due to a badly seated component.



Clash of the Titans: try Hills Components for a wide range of fans

50 Machine won't switch off?
The power button on PC systems with ATX power supplies isn't simply an on/off affair; instead it works in states. If your machine won't physically switch off when you press the button, try holding it in for a few seconds. Also remember to enable ACPI in your BIOS so that Windows can switch off your PC when you shut down.

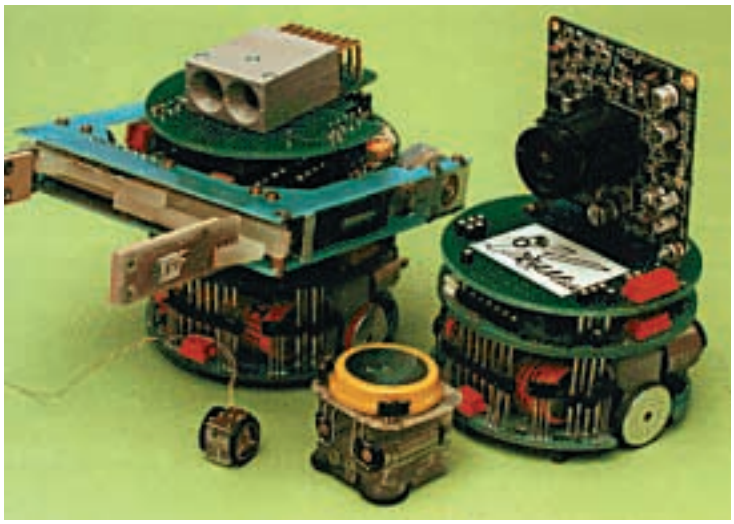
THE DAY IS COMING WHEN ROBOTS WILL BUILD, DESIGN AND REPRODUCE THEMSELVES.

Mating robots

IT ALWAYS USED TO BE THAT robots were the fruit of human imagination. Now researchers are promising a new generation of robots that can design themselves, build themselves and program themselves. Not to mention reproduce.

Richard Watson and Sevan Ficici of Brandeis University in Massachusetts are working on what they call 'Embodied Evolution' (http://demo.cs.brandeis.edu/pr/ee/). Their idea is to set up a population of robots in some environment and – wait for it – let them mate with each other.

For their experiments they've been using little home-made robots they call 'tupperbots'. Each robot is about the size of an ashtray, and inside the plastic casing are two light sensors, a simple microprocessor, a motor, and an infra-red comms link. The robots draw power directly from a floor ruled with stainless steel power strips, engaging with contacts in the base of the robot between the wheels. Each robot's task is to move towards a light at the centre of the environment, finding its way around all the other robots who are trying to do the same thing.



Snap happy: some of Khepera's robots with cameras

Each robot starts off pre-programmed with a simple behaviour algorithm – its 'genetic code' – and when two robots come within flirting distance, they transmit their genes to each other, via their infra-red links. A random mutation is introduced into the sets of transmitted genes, and each robot incorporates the genes it receives into its own genome. The effect after several generations of evolution is that the robots gradually get better at finding the light and, surprisingly, their performance even beats that of a behaviour program hand-crafted by the researchers. You can try a Java simulation of the tupperbot experiments at www.demo.cs.brandeis.edu/~miguel/cgi-bin/Bots/.

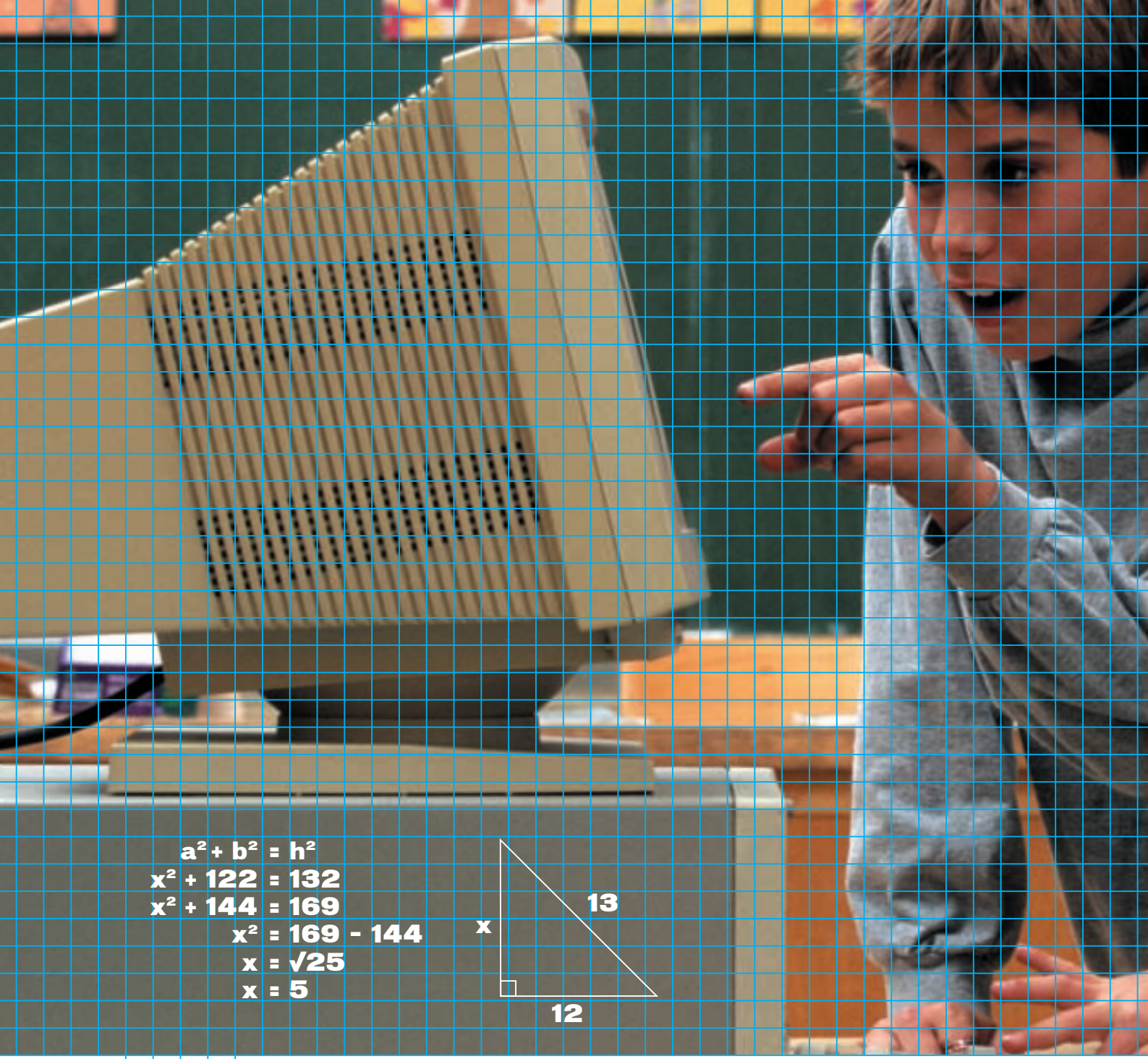
Hod Lipson, also at Brandeis University, is taking the idea of robot evolution one stage further, and wants to build robots that change their shape on the fly, according to their given task (www.demo.cs.brandeis.edu/golem/). Currently Lipson and his colleagues are running evolutionary algorithms on a computer connected to a '3D printer', which deposits layers of thermoplastic to build up a 3D structure – and out pops a simple robot. In the future, miniaturised 3D printers could be incorporated directly in a robot's body, so it could sprout extra limbs on demand, and even give birth to new robots.

At the other end of the evolutionary scale, Mark Tildon of Solarbotics (www.solarbotics.com) builds bug-like robots he calls 'junkbots', that are cobbled together from whatever spare parts he has lying around. His prototype junkbots are made from old Walkman mechanisms, bits of printers, and solar cells that once powered calculators. One of Tildon's creations is a junkbot built from disk-eject motors that wriggles like the primitive, fish-like lamprey. Strangely, a team based at the University of Genoa, led by Vittorio Sanguineti, is also interested in lampreys and robots, but in a quite different, not to say chilling, way.

They've dissected out the brainstem and spinal cord from a living lamprey (presumably living no longer) and wired it to a standard Khepera lab robot – rather like a jam jar on wheels (http://diwww.epfl.ch/Khepera/). In the lamprey's brain are some large neurons whose function is to process signals from its sensory organs and relay them to its motor cells. Sanguineti and his colleagues have attached the Khepera's light sensors to the lamprey's neurons, and connected their outputs to the servo motors used to steer the robot. As grotesque as it may sound, it works – the fish's brain steers the robot to the light.

As Isaac Asimov once said: the robots are coming – but some of them are likely to be beyond even his imagination.

TOBY HOWARD



For those making the most of their university years, or last-minute crammers with exams at stake, your own PC can be a godsend. We asked 16 manufacturers to put together a system within a student budget of £999 and with a student's needs (academic, not alcoholic) in mind.

$a^2 + b^2 = h^2$

As summer draws to a close, the school and university terms will soon be upon us once again. For some, this will mark a return to the freedom of living away from their parents, while for others it will be the first step towards the bigger life of university socialising, with its drinking, end of term starvation and a workload that few really understand until the night before their first-term exams. It is a traumatic, but strangely wonderful time.

For those of us who have travelled

contents

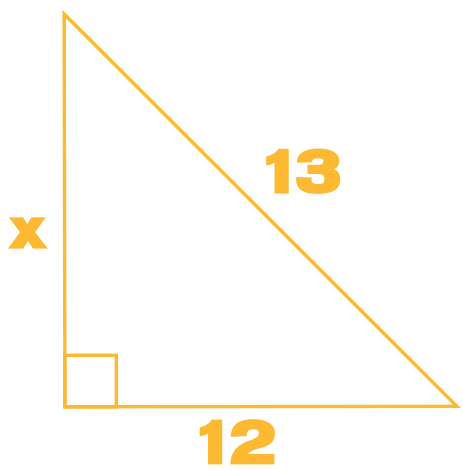
• *PCs reviewed by Scott Montgomery and Jalal Werfalli, tested by Lars Goran-Nilsson*

Education systems

this path, there was one thing we envied others for – their own computer. The benefits of having one are many and varied. You no longer have to book yourself time on a university computer; you don't have to stop writing when the library closes; and perhaps most relevant, you can involve your flatmates in alarming minesweeper competitions, the enthusiasm for which can quickly grow out of control. The especially lucky students even have a printer, which allows them to print out their flatmates' names and stick them on their doors.

This month we asked 16 manufacturers to meet the challenge of putting together a competitive system that would suit school/university study. The guidelines we gave were: at least 128MB of RAM, a minimum 10GB hard drive, 17in monitor, modem, sound card and speakers, some form of removable storage, Windows 98 Second Edition, three-year warranty and software suitable for producing illustrated reports. The system should cost no more than £999 ex VAT, but including delivery and any credit card surcharges.

Read on to see what the manufacturers recommend you use in today's education system.



Carrera Octan M750

CARRERA HAS SUPPLIED a machine that boasts the largest monitor – a 19in LG CS990DC. With a tube that isn't flat in any direction, this shadow-mask unit doesn't stand up to some of the vibrant and sharper aperture-grille models on test here. It may also be on the bulky side, if your desk is small. However, if image manipulation is a priority in your studies, you'll like the extra screen space.

Hooked up to the monitor is a 32MB TNT2 M64-based graphics card occupying the AGP slot of the Biostar motherboard. This graphics solution is nothing to write home about, with the card under-performing in both of our 3DMark and Quake III tests.

At the Octan's heart, we find a 750MHz AMD Athlon processor, supported by a single module of 128MB PC100 SDRAM in one of three DIMM slots. The innards are tidy with the cables neatly clamped to the side of the case. There's also an extra case fan to keep everything cool.

Storage is catered for by a 20.5GB Quantum Fireball hard drive which should provide more than enough room for most users, although media students capturing their video projects may find it fills up at an alarming rate. However, you can also burn data to CD using the Ricoh MP9060A CD-RW drive – winner of our Highly Commended award in June's group test – which doubles up as a four-speed DVD-ROM drive. This has allowed Carrera to forego a separate DVD or CD drive, but at the expense of on-the-fly CD copying. A blank CD-R and a CD-RW disc are included. If you want to watch DVD movies, playback is reasonable but the audio suffers from background noise. A SoundBlaster PCI 128 sound card powers the budget Altec Lansing ACS22 speakers.

Lotus SmartSuite Millennium is included for producing illustrated reports, together with IBM ViaVoice, and a basic entertainment pack. On the whole, the Carrera offers little to make it really stand out. Performance is below par while other manufacturers have submitted more tailored bundles.

DETAILS

PRICE £1,173.83 (£999 ex VAT)
CONTACT Carrera 020 8307 2800
www.carrera.co.uk
PROS 19in monitor; combo drive
CONS No separate CD/DVD-ROM; poor sound on DVD playback
OVERALL A basic PC, without enough focus on the educational theme to make an impact

FEATURES	★★★
PERFORMANCE	★★★
VALUE FOR MONEY	★★★
OVERALL RATING	★★★

Dan Home Plus S

ABSENT FROM OUR group tests for seven issues, Dan Technology returns with a machine that features Intel's Flip Chip. This FC-PGA (Flip Chip Pin Grid Array) Pentium III is clocked at a respectable 700MHz, with 256KB of full-speed Level 2 cache squeezed on the die. With 128MB of PC100 memory leaving two DIMM slots free, the Dan is a mid-range performer sitting in the middle of the SYSmark 2000 results.

Lifting the lid off the large tower reveals an orderly layout that allows easy access to the motherboard for upgrades. DVD playback is smooth, while sound is handled capably by a retail Creative SoundBlaster Live! 1024 connected to two large speakers. A DualHead 16MB Matrox Millennium G400 graphics card resides in the AGP slot. The card's reputation for great 2D performance should be welcomed in an environment where writing illustrated reports is a priority. As for 3D performance, it failed the Quake III test, causing the machine to hang.

Showing off the Matrox graphics card is a Dan-badged 17in CTX VL700. This is a budget shadow-mask monitor producing a flicker-free vertical refresh rate of 75Hz at a resolution of 1,152 x 864 pixels. However, focus is far from perfect at the corners of the tube.

The backup device comes in the form of a Panasonic LS-120 that replaces the standard floppy drive. Although handy as a storage medium, an LS120 disk is far more expensive than a CD-R, making this a costly solution for backing up files. We would have rather seen a Zip or CD-RW, as both have gained a wider acceptance in academic institutions.

Lotus SmartSuite Millennium is the office suite of choice, bundled with a selection of games. Unlike Carrera, Dan has also included a Lexmark Z32 printer, together with a cable to get you up and spooling straight away.

The Dan Home Plus S is a standard machine that makes use of Intel's latest chip technology. Problems with 3D applications and expensive backup media keep it from achieving an award.

DETAILS

PRICE £1,168 (£994 ex VAT)
CONTACT Dan Technology 020 8830 1100
www.dan.co.uk
PROS Printer; good DVD playback and sound
CONS Below-par monitor; no CD-RW capability; 3D graphics problems
OVERALL A fair attempt at an educational PC, but backing up costs could mount up

FEATURES	★★★
PERFORMANCE	★★
VALUE FOR MONEY	★★★
OVERALL RATING	★★★

Dell Dimension XPS T700r

WITH THE DIMENSION XPS T700r, Dell has opted for a well-rounded system and has provided us with a machine that includes an HP 610C printer and a Sony CRX 140E CD-RW with CD-R and CD-RW discs bundled.

As for software, Dell has chosen Microsoft Works Suite 2000. This usefully includes Word 2000, a program that is common in many schools and universities.

The rest of the setup is based on the tried and tested Intel 440BX chipset, ensuring long-term stability. The motherboard is a Dell/Intel effort featuring a Slot 1 Intel Pentium III clocked at 700MHz. Over this is a fan duct ensuring that it remains cool. The Maxtor hard drive isn't the biggest on test but you would be hard pushed to fill all 15GB. This is housed vertically at the front of the sturdy case.

The 16MB ATi Rage Pro 128 may not be at the high end of the graphics card scale but, for the task, it doesn't have to be. It will still handle most 3D games comfortably. Connected to this is a 17in Samtron monitor from Samsung. Although this is a shadow-mask unit with a curved screen, the geometry and focus is commendable. It also benefits from a splendid OSD menu system that is both clear and intuitive. The same company also makes the 12-speed DVD-ROM drive that performed admirably in last month's DVD-ROM drive bonanza. Working well with the Pro 128's ATi chipset, DVD playback was good and audio was clearly reproduced through the older SoundBlaster 64V. The separate drive also brings with it the option of CD-to-CD burning. The only thing that irritated us was the untidy cabling.

Overall, Dell has hit the right blend of components, being the only manufacturer to bundle a printer, an economical CD-RW and an appropriate office suite, all topped off with decent DVD playback and audio. A worthy winner of the Editor's Choice accolade.

DETAILS

PRICE £1,173.83 (£999 ex VAT)
CONTACT Dell Computers 0870 907 5664
www.dell.co.uk
PROS A printer together with a good office suite and robust case
CONS Untidy cable routing
OVERALL Dell has gathered together a range of components that work well together and best fit the criteria set for this group test

FEATURES	★★★★★
PERFORMANCE	★★★
VALUE FOR MONEY	★★★★★
OVERALL RATING	★★★★★

evesham.com Athlon E-Special

EVESHAM.COM'S entry this month is built around the popular 700MHz Athlon processor, mounted on an MSI K7 Pro motherboard. The MSI board is based on AMD's own 750 chipset and backed up by 128MB of PC100 SDRAM in the form of a single DIMM module, with two DIMM slots free. A Diamond 56i Pro modem and SoundBlaster 128 sound card occupy two of the PCI slots, leaving two. Access to these is unhindered, as evesham.com's engineers have neatly routed all cabling.

Storage is taken care of with a roomy 20.5GB Maxtor hard disk and the Samsung SM-304B DVD/CD-RW combo drive, but no blank discs are provided. Although the inclusion of this drive leaves two 5.25in bays unoccupied, we would have favoured a separate ROM drive as well, so that you can copy CDs directly.

In terms of performance, the TNT M64-based graphics card lets down the rest of the system. The E-Special scored badly in our 3D tests, only managing 28.8fps and a score of 2,113 in Quake III and 3DMark respectively.

The graphics card is linked up to a Mitsubishi V70 monitor, a standard 17in shadow-mask model that suffered from a focusing problem, especially at the screen's centre and corners. This gave text an uncomfortably blurry appearance. Regarding input devices, the keyboard felt a bit lifeless and the evesham.com-badged wheel-mouse just doesn't feel as good as Microsoft's.

evesham.com has supplied the functional Lotus SmartSuite Millennium office suite, which means you can be productive from your first day. However, the Lotus package is not as popular as the Microsoft Works Suite 2000 software supplied with other machines.

Although the E-Special is £50 cheaper than the best of this month's group, the money could have been spent on other areas – such as better graphics or a printer. Despite the three-year on-site warranty, the poor performance and lack of peripherals make the Athlon E-Special difficult to recommend.

DETAILS

PRICE £1,115.08 (£949 ex VAT)
CONTACT evesham.com 0800 038 0800
www.evesham.com
PROS 700MHz processor; decent-sized hard disk
CONS Poor graphics, short on features
OVERALL A rather uninspiring machine. Better value can be found elsewhere

FEATURES	★★★
PERFORMANCE	★★
VALUE FOR MONEY	★★★
OVERALL RATING	★★★

Gateway Select 750

AT £940 EX VAT, the Gateway Select 750 is the cheapest system in this month's group test. Having said that, the specification is comparable with most of the other machines we tested, so you're not losing out on features.

The motherboard is one of Gateway's own brand Kodoka AMD 750 chipset-based boards. Beating at the heart of the motherboard is an Athlon running at 750MHz. Memory is covered by a single 128MB SDRAM module, leaving two slots free for upgrade.

Storage is taken care of by a 14.7GB Western Digital hard disk, giving adequate space for essays, projects and presentations. For removable storage, Gateway has opted for a Panasonic LS-120. The 120MB size of this removable storage makes it ideal for the student's needs. However, the media is expensive at over £10 per disk, and the performance is slower than a Zip drive.

Dealing with sound, the Gateway has a SoundBlaster PCI 128 and Cambridge Soundworks GCS 200 speakers. A 32MB nVidia TNT2-based card from Creative deals with graphics and, although it is not a cutting-edge graphics solution, it performs adequately. Completing the display set is a Gateway EV700 monitor, producing a quality image, with a rotary selector allowing easy navigation of the OSD.

The Select 750's SYSmark results placed it in the lower half of the group, with an overall score of 118. Compared to the other 750MHz processors in the test, the Gateway's performance was somewhat disappointing. DVD playback was also troubled, with decompression artefacts visible on plain coloured backgrounds.

The software bundle supplied was Microsoft Works Suite 2000, which includes Word 2000.

Overall, the Select 750 is not the best system in this month's test, but it's the cheapest. The inclusion of Word 2000 is a good choice and the saving of £60 can be put towards a budget printer.

DETAILS

PRICE £1,104.50 (£940 ex VAT)
CONTACT Gateway, 0800 55 2000
www.gateway.com/uk
PROS Lower cost helps for printer purchase; good software
CONS There are better performing PCs out there
OVERALL The price makes this an attractive system, but this doesn't quite offset the disappointing performance

FEATURES	★★★★
PERFORMANCE	★★
VALUE FOR MONEY	★★★★
OVERALL RATING	★★★

Hi-Grade Ultis PV3733

HI-GRADE'S SYSTEM employs one of the first motherboards with the new 815E chipset: the Asus CUSL 2. Apart from system performance improvements, the most noticeable aspect of this motherboard is the multitude of USB sockets it can support. In the configuration Hi-Grade will ship, five USB connectors come as standard. However, the board can support a massive seven USB ports in total.

The board runs with a 133MHz FSB, which the Ultis PV3 uses to run its 733MHz Pentium III processor. Filling one of the memory slots is a 128MB of PC133 SDRAM, with two slots free.

Performance on the Hi-Grade was good in the SYSmark 2000 benchmarks, scoring 134. This shows the 815E chipset is capable of showing off the Pentium III to its full potential without the need for expensive RAMBUS memory. It was in the SYSmark Internet content creation scores that it shone most, with a score of 155.

Storage on the Hi-Grade is covered by a spacious 13.5GB hard drive from Fujitsu. Removable storage comes in the form of a Mitsumi CD-RW, although no blank CD-RW media is bundled.

Dealing with the issue of graphics, a Hercules 3D Prophet is installed, based on nVidia's GeForce 256 chipset. The card has 32MB of SDR memory. However, as the results show, the Hi-Grade's performance in both 2D and 3D is not to be sniffed at. The monitor is an excellent CTX PR705F aperture-grille model, while a SoundBlaster Live! 1024 with Diamond Promedia 2010 speakers cover sound. DVD playback on the Ultis fared no better than most, suffering from poor-quality sound.

As for software, Hi-Grade has gone with Lotus SmartSuite Millennium. This will provide for the student's word processing needs, as well as providing a spreadsheet package in 1-2-3 plus an organiser. Overall this is a good system with cutting-edge motherboard that can cater for the needs of today's student.

DETAILS

PRICE £1,173.83 (£999 ex VAT)
CONTACT Hi-Grade 020 8532 6100
www.higrade.com
PROS Lots of USB sockets; strong system performance; good monitor
CONS Stronger software packages are available
OVERALL A very up-to-date machine that will deal with the student workload with no problems

FEATURES	★★★★
PERFORMANCE	★★★★
VALUE FOR MONEY	★★★★
OVERALL RATING	★★★★

Mesh Matrix Duron 700T

MESH IS THE ONLY manufacturer to opt for the newly released AMD Duron processor to power its offering. This processor has 64KB of on-die Level 2 cache running at full processor speed, which makes it a relatively fast machine coming in at fifth place in the overall SYSmark results.

The Duron is plugged into the Gigabyte GA7ZM motherboard, based on VIA's KT133 chipset. This means that the Duron not only has a 200MHz front-side bus to the chipset, but can also take PC133 SDRAM. Mesh has opted for 128MB of PC100 SDRAM.

Located in the 4X AGP slot is the Guillemot 3D Prophet GeForce with 32MB of SDRAM. nVidia's Graphics Processing Unit helps the Mesh yield impressive figures in both the 3DMark and Quake III tests. Attached to this is Mitsubishi's Diamond Pro 720 – a quality 17in aperture-grille monitor and one of the best found here. It has excellent image sharpness and colours. The only gripe is the fiddly OSD and poor power regulation.

Under the hood, the build quality is solid, with all the cables carefully secured around the case. This allows easy access for future upgrades or additions. There is also a decent-sized 20.5GB Seagate Barracuda hard drive, occupying a 3.5in bay. This should provide plenty of data storage for several years of study. For backing up and transporting those important assignments, a Teac CD-RW is present, but no free CD-RW discs are bundled. Nevertheless, the Teac is complemented by a Pioneer 10-speed DVD-ROM. Thoughtfully, Mesh has also fitted an ATi TV tuner for added versatility.

In terms of software, the student is provided with a full copy of Works Suite 2000 offering all the programs they're likely to need.

Overall, the Mesh is a quality machine that fulfils most of the criteria we set for the group test. Only the lack of a printer lets the package down.

DETAILS

HIGHLY COMMENDED Recommended by Computer World

PRICE £1,173.83 (£999 ex VAT)
CONTACT Mesh Computers 020 8208 4706
www.meshcomputers.com
PROS Good monitor; TV option; powerful graphics
CONS No printer
OVERALL A good performer with a solid set of components

FEATURES	★★★★★
PERFORMANCE	★★★★
VALUE FOR MONEY	★★★★
OVERALL RATING	★★★★

Multivision Vision Education A700

THE VISION EDUCATION A700 is the first machine we've seen from Multivision and, as the name suggests, its Athlon processor is running at 700MHz. The motherboard is a K7 Pro from MSI. The modem and the SoundBlaster PCI 128 fill two of the five available PCI slots on the board (with the sound being pumped out to Labtec speakers), which leaves three free PCI slots for upgrading. Memory comes in the form of a single 128MB PC133 memory module, fitted into one of the three available slots.

A 20GB Seagate hard disk deals with storage, providing plenty of room for saving your work and storing applications. Addressing removable storage is a Samsung SM-304B CD-RW/DVD combo drive. This is a good solution providing versatility to the package.

The performance of the Multivision wasn't spectacular, coming fourth from last in the overall SYSmark scores with 116. That said, the average student probably wouldn't notice this in real-world use. As for DVD playback performance, the A700 had sound quality that at best would make DVD viewing a little irritating.

A 3D Prophet from Guillemot tackles the graphics, although it's the 16MB version with SDR memory instead of DDR. That said, the 3D performance results show this card still performs well.

The LG 775FT Flatron monitor supplied with the Multivision was one of the best in the test, giving a sharp image on the flat screen.

As for software, the Multivision comes with Lotus SmartSuite Millennium, which includes Word Pro for word processing, 1-2-3 for spreadsheet work and Lotus organiser. The bundle also includes an Epson 670 and printer cable.

Overall, the Multivision is a well-balanced machine for study, meeting all the software and hardware requirements the student will require. The performance wasn't the best in the group, but would be adequate for most students.

DETAILS

PRICE £1,173.83 (£999 ex VAT)
CONTACT Multivision 0121 550 8000
www.multivision.co.uk
PROS Package includes a printer; good monitor
CONS Poor sound quality in DVD playback
OVERALL A good all-round package for production of student work

FEATURES	★★★★
PERFORMANCE	★★★
VALUE FOR MONEY	★★★★
OVERALL RATING	★★★★

NEC Direction SM-667VP

NEC'S MACHINE COVERS all the software requirements that the student needs, including Microsoft Word 2000. Corel Draw 7 is also included for artistic users. Parents will also be glad to see Money 2000 included.

Performance-wise, the Direction hovers around the middle to bottom of the SYSmark 2000 tables although it still copes with most applications. Handling the graphics on the NEC is a 32MB card based on the nVidia GeForce 256 chipset. Unfortunately, the memory is SDR rather than DDR, although the results in both the graphics-intensive benchmarks show this doesn't have much effect on the overall performance. It scored 68.2fps in Quake III and a 3DMark of 4,009.

As a means of watching movies, the Direction didn't perform as well as some of the other entrants. When playing DVD movies, the picture was fine but the sound quality wasn't wonderful, with a lot of background noise. Watching DVDs could quickly become tiresome; so bear this in mind if it is important to you.

The motherboard is an MSI 6309 based on the VIA 694X chipset and the processor, although having one of the lowest clock frequencies in the test at 667MHz, is a Pentium III with the full-speed on-die cache. This lets it compete with, and beat in many operations, faster processors. The system also includes 128MB of PC133 SDRAM. The sound card is an Aureal advantage connected to Labtec speakers.

NEC's own 17in monitor, was adequate, although the image quality was a little fuzzy and couldn't maintain an adequate refresh rate at 1,280 x 1,024. The 20.5GB Maxtor hard drive will more than suffice for fixed storage, and a CED-8080B CD-RW from LG covers the issue of removable storage.

NEC has got the balance right, making sure the correct software for studying is included, while still making the machine capable of gaming.

DETAILS

PRICE £1,173.83 (£999 ex VAT)
CONTACT NEC 0870 010 6322
www.nec-online.co.uk
PROS Good software package; good graphics performance
CONS Background noise in DVD playback; disappointing monitor
OVERALL A good all-round PC, only let down by the sound in DVD playback and the quality of the monitor

FEATURES	★★★★
PERFORMANCE	★★★
VALUE FOR MONEY	★★★
OVERALL RATING	★★★

PC World Advent 3047 BTO

AT THE HEART of the Advent system from retailer PC World beats a Pentium III 650MHz mounted on a Gigabyte GA6 BX7 motherboard. The system also comes with a single 128MB PC100 SDRAM module residing in one of the three available DIMM slots.

The hard disk is a 10.2GB model from Seagate, which will be able to handle all the information a student is likely to produce. Dealing with removable storage, the Advent has an internal Iomega 100MB Zip drive. First impressions are that this is not as good as a CD-RW. However, the size of the disks and the Zip drive's ease of use make it an ideal storage device for a student PC.

A Creative SoundBlaster PCI 128 deals with the sound, with SBS20 speakers from Creative to pump it out. As for the display, an nVidia TNT2 Model 64-based card drives a Proview PK-770 17in monitor. The image quality on the monitor was poor, with streaking occurring across the screen. This was especially noticeable in any application displaying text where the streak lines were most pronounced – which is unfortunate in a student PC, where text display will be paramount.

A Toshiba SD-M1402 DVD-ROM drive is included, so a bit of after-hours movie watching is an option.

In terms of performance, the Advent produced a SYSmark 2000 score of 118, which was just below average. As for 3DMark and Quake III, the results show that the Advent is not a gaming machine, due to the graphics card.

The peripherals bundled with the machine include a Mustek 1200UB scanner and a Canon BJC-2100 colour printer. The software productivity pack includes Microsoft Works 2000, Excel 2000, Money 2000 and Home Publisher 2000.

The Advent is a well-rounded student computer, with all the peripherals needed to produce and print a student's work. It's a pity the monitor is so poor.

DETAILS

PRICE £1,173.83 (£999 ex VAT)
CONTACT PC World 08705 464 464
www.pcworld.co.uk
PROS Printer and scanner included; good DVD playback
CONS Poor-quality monitor and graphics card
OVERALL Great peripherals allow the student to do everything. However, the monitor quality has been sacrificed to achieve this end

FEATURES	★★★★★
PERFORMANCE	★★
VALUE FOR MONEY	★★★
OVERALL RATING	★★★

Polar Technology **Phoenix**

THE PROCESSOR DRIVING Polar Technology's entry for this group test is a 700MHz Athlon. This, along with 128MB of PC100 SDRAM and the MSI K7 Pro motherboard, saw the machine lodge itself in the performance tables as an all-round good performer, with the Phoenix placing third or fourth in nearly all of the categories.

The software bundled with the system is Microsoft's Works Suite 2000, which includes Word 2000, as well as Money 2000 to help tackle the inevitable student financial problems, and a copy of the Encarta Encyclopaedia.

The graphics duties are dealt with by a Creative 3D Blaster Annihilator Pro. This nVidia GeForce 256-based card has 32MB of DDR memory and its performance is highlighted by the Phoenix's position in the top five in both the Quake III test where it achieved 64.9fps, and the 3DMark test where it scored a respectable 3,728, sitting fifth on the table. The sound card is a Creative PCI128, which feeds Labtec speakers.

The Mitsubishi Diamond Pro 720 monitor performed well, achieving a maximum resolution of 1,600 x 1,200 at 75Hz, with a crisp, clear image. DVD playback performance was similar to many of the machines, with a clear and smooth picture, but unfortunately with background hiss affecting the sound.

To meet storage requirements, a 25GB IBM hard drive is installed giving plenty of space; and to address the requirement for removable storage, there's a Creative CD-RW.

One point to note is that Polar is one of the only machines on test to ship with a blank CD-RW disc to go with the drive. It's a small point, but inclusion of the disc means you are ready to go as soon as you plug it in, rather than having to run to the shops to get some media.

The Polar Phoenix is a fine all-round machine that admirably handles office tasks needed for study, yet still offers reasonable gaming performance. As with many of the machines, though, DVD playback wasn't up to scratch.

DETAILS

PRICE £1,173.83 (£999 ex VAT)
CONTACT Polar Technology 0161 482 7000
www.polartechnology.com
PROS CD-RW included; good-quality monitor
CONS Background noise in DVD playback
OVERALL A versatile machine for work and play, but let down by poor DVD performance

FEATURES	★★★★
PERFORMANCE	★★★★
VALUE FOR MONEY	★★★★
OVERALL RATING	★★★★

Quantex Microsystems **M677SX**

THE QUANTEX M677SX comes with more software on it than any other system in this month's group test, but you only get the most important original software discs with it: namely Windows 98SE, Corel WordPerfect Office 2000 and the Grolier Encyclopaedia (on DVD). Quantex has opted for a solution where the bulk of the software installed on the system is stored on a drive image on a D:\ partition on the hard drive. If your system becomes unstable you restore the stable system from the image to return your PC to its former glory.

Included with the Quantex is a Canon FB630P scanner along with a Canon BJC-2100 colour Bubble Jet printer, complete with cable. This and the addition of the scanner makes the Quantex an attractive system.

The performance of the Quantex wasn't as good as machines of similar specifications, languishing in last place in the SYSmark table and placed in the middle in the Quake III and 3DMark 2000 tests. The processor, complemented by the Biostar motherboard, is a 667MHz Pentium III, supported by 128MB of PC133 SDRAM. The graphics card is a 3dfx Voodoo 3 3000 with TV out, which is long in the tooth and doesn't support 32bit colour in 3D. A Creative PCI 128 and Altec Lansing ACS22 speakers cover sound.

Optical storage is well catered for with a Toshiba 12-speed DVD-ROM drive and a Sony CD-RW drive. There are also 10 blank CD-R discs supplied to get you started.

Considering the performance issues, the Quantex's DVD playback exhibited surprisingly good audio and video quality. The 17in Quantex-badged monitor was not up to the level of some of the competition, however.

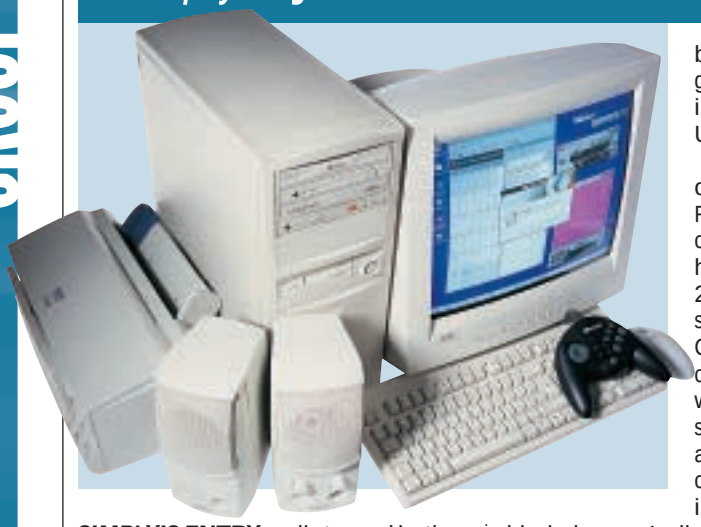
Ultimately, the Quantex fits a niche. It has all the peripherals the student will need and, although the overall performance isn't earth shattering, its DVD playback is one of the best.

DETAILS

PRICE £1,173.83 (£999 ex VAT)
CONTACT Quantex Microsystems 01438 224 444 **www.qtx.co.uk**
PROS Printer and scanner included; good DVD playback; CD-RW with 10 discs
CONS General performance wasn't wonderful; some software discs aren't included
OVERALL This system has everything the student will need to prepare and print all of their work and the impressive DVD playback is a bonus

FEATURES	★★★★★
PERFORMANCE	★★
VALUE FOR MONEY	★★★★
OVERALL RATING	★★★★

Simply Systemax A750 RV Pro



SIMPLY'S ENTRY easily topped both the Quake III and 3DMark tables. Bearing in mind that the system employs the same Creative 3D Blaster Annihilator Pro with 32MB of DDR memory as some of the other machines, the results cannot be ascribed purely to the graphics card. Although in combination with the Athlon 750MHz, the AOpen AK72 motherboard and the 128MB of PC133 SDRAM, the system performs extremely well. For the student with a gaming interest, Simply has also bundled its standard games pack, which includes Driver and Unreal Tournament.

Taking care of optical storage is a Ricoh DVD/CD-RW combo drive. The hard disk is a Maxtor 20GB unit and the system employs a Creative V128 sound card in combination with SBS52 speakers. Included is an ATi TV tuner card, turning the PC into a television, ideal when you're living in one room.

High scoring in the SYSmark tests shows the Systemax to be an all-round good performer. Only in the Internet content creation, where it came fifth, did it slip outside its position as one of the top two scorers. In contrast to its generally outstanding performance, the DVD playback was the poorest of all this month's systems, with the picture occasionally jerky and the sound quality unacceptably low.

Included with the system is an Epson Stylus 460 inkjet colour printer for printing essays and diagrams. The CTX monitor performs adequately, exhibiting sharp image quality.

As for application software, Corel WordPerfect Suite 8 is included, catering for the word processing and spreadsheet needs of the student. For the younger students there is also an educational software pack, which deals with various subjects to GCSE level.

The Simply Systemax will be more suited to the gamer than the serious scholar. Inclusion of games will appeal to some, but for others, bundling of Word 2000 may have appealed more.

DETAILS

PRICE £1,173.83 (£999 ex VAT)
CONTACT Simply Computers 08707 297 366
www.simply.co.uk
PROS Comes with a printer; exceptional gaming performance
CONS Software could be better; awful DVD playback
OVERALL A system more in tune with the gamer than the scholar, although the printer is a good addition

FEATURES	★★★★
PERFORMANCE	★★★★★
VALUE FOR MONEY	★★★★
OVERALL RATING	★★★★

Time Machine 750-7 QV Pro

TIME'S ENTRY boasts a 750MHz Athlon processor. Although other manufacturers employed a similar processor, it was the Time system that bludgeoned its way to the top of the SYSmark 2000 overall table. For the student who is looking for a powerful work machine, the Time may well be worth a look. Although the raw power may not make such a difference in real-world application use, it does make the machine more versatile and the extra power increases the longevity.

Built around an MSI K7 Pro motherboard, the Time Machine sports a SoundBlaster Live! 1024 that is piped to Screenbeat Pro 50 speakers. A 16MB Voodoo 3 3000 that also supports TV in/out feeds a Samtron monitor, which is not wonderfully sharp. A 20GB Fujitsu hard disk deals with storage and should be adequate for saving essays and dissertations, while still leaving enough room for any other applications that may be required.

The system comes complete with an Epson 460 colour printer to print essays, along with a microphone, gamepad and joystick. The inclusion of the latter peripherals gives gamers their necessary hardware – although, as the 3DMark and Quake III results show, the Time Machine isn't the best gamer's choice.

A Samsung DVD/CD-RW combo drive caters for both removable storage (through the combo's CD-RW capabilities) and reading of CD-ROM and DVD media. As for DVD playback, the Time Machine suffered, as so many of the systems did, with poor sound quality that curtails the use of this machine for enjoyable DVD viewing.

Software includes Microsoft Works and Time's standard software pack, which includes Lotus Millennium. Through both of these packages all the software needs of the student are adequately met.

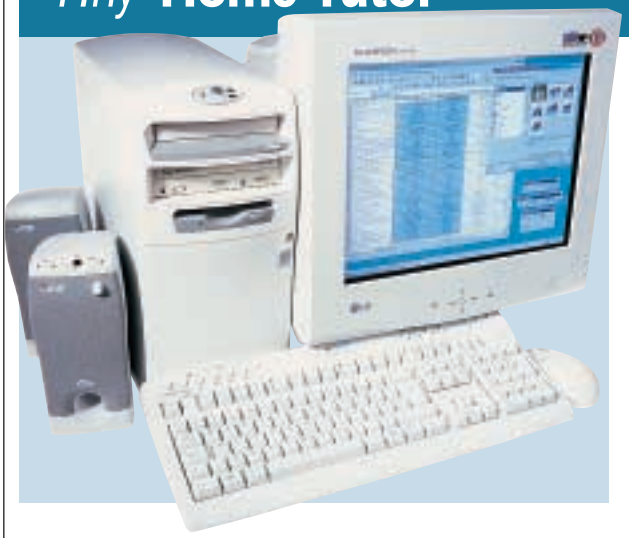
The Time system would suit the serious student, although inclusion of gaming peripherals gives versatility.

DETAILS

PRICE £1,173.83 (£999 ex VAT)
CONTACT Time Computers 01282 777 555
www.timecomputers.com
PROS Printer included; excellent performance with office applications
CONS Bundled software could have been better; DVD sound was poor
OVERALL A good system for the serious scholar, complete with a printer

FEATURES	★★★★
PERFORMANCE	★★★★
VALUE FOR MONEY	★★★★
OVERALL RATING	★★★★

Tiny Home Tutor



THE TINY HOME Tutor gears itself more to school level than university. It ships with an educational software bundle of various study aids for students at GCSE level. For students in higher education, Tiny has opted for Microsoft Office Professional 2000 with a student licence. This is therefore one of the best software bundles in this month's test, as it is directly aimed at our target audience and gives them access to one of the best office packages.

Driven by a 733MHz Pentium III processor, the Tiny has an MSI 6154 motherboard, supplied with one of the three RAM slots filled by a 128MB PC133 SDRAM module. The hard disk is a Western Digital 20GB unit, giving adequate storage space, and for removable storage a CD-RW drive is included. A single CD-R is bundled with the system, although a CD-RW would have been more useful.

An onboard Creative PCI 128 deals with sound requirements, with the sound piped to CPR50 speakers. For graphics and display, a TNT2 Model 64 card is included and a 17in LG Flatron monitor completes the ensemble. The screen image is sharp, with the monitor achieving an astounding maximum resolution of 1,600 x 1,200 at 75Hz. A Matshita SR 8585 deals with DVD.

The Home Tutor is near the bottom of all of the tables, highlighting the poor performance of this machine. Considering the power of the processor, we expected higher scores, but the Home Tutor fails to deliver. DVD playback was no worse than the others, with good visuals, but poor sound.

One problem overshadows the Tiny system, and that is the case. All the drives are recessed into the machine, which, for the DVD means the tray catches on part of the casing, stopping the tray ejecting. Inserting a floppy is also made difficult by the case design.

The Tiny performs poorly and, at least on the system we received, suffers from a questionable design. That said, the software bundle is excellent.

DETAILS

PRICE £1,173.83 (£999 ex VAT)
CONTACT Tiny 01293 821 555
www.tiny.com
PROS Microsoft Office Professional (student licence) included; good monitor
CONS CD ejection jams on case; poor performance overall
OVERALL The system case is poorly designed. Other systems are better value

FEATURES	★★★★
PERFORMANCE	★★
VALUE FOR MONEY	★★
OVERALL RATING	★★

Viglen Homepro P3 800 SWR

FITTED ONTO AN MSI MS6119 motherboard is the most powerful processor in this month's group test: an 800MHz Pentium III. Using this raw power, the Viglen sits comfortably at the number one spot in the SYSmark Internet content creation table. The Homepro's weakest area was 3D, where it slipped towards the bottom end of the tables. But even taking this into account, its overall performance can only be considered to be impressive.

The Viglen was one of the few systems that excelled in DVD playback. The image coming from the Pioneer DVD-ROM was smooth, with no decompression artefacts, and the sound was hiss-free. The 32MB ATi graphics card (with video in/out) may go some way to explaining this, due to its superior motion compensation, showing that Viglen has got the combination just right. In the same vein, the system also includes cables to allow you to connect the PC to a television. S-Video, composite and SCART cables are all supplied. The bottom line: if DVD is important to you, this machine is well worth a look.

As for software, the Viglen system comes with Microsoft Works Suite 2000, which covers most student needs. The suite includes Word 2000, Money 2000, and the Encarta encyclopaedia.

The supplied 17in ADi E55 monitor produces a decent image, although it's not as sharp as some seen elsewhere in the group. The hard disk is a 13.5GB Western Digital model, which should be more than ample for internal storage. As for removable storage, Viglen has opted for a 100MB Zip drive (an internal or external option is available). However, the cost of Zip disks should be considered (£5–£6 each).

Overall, the Viglen is a first-rate system that both performs well for work and has good DVD playback for movie watching. The software bundle covers all the bases and there's a Saitek Cyborg joystick! Shame there isn't a printer.

DETAILS

PRICE £1,173.83 (£999 ex VAT)
CONTACT Viglen 020 8758 7000
www.viglen.co.uk
PROS Generally good performance; excellent DVD playback; TV cabling included
CONS No printer; uninspiring monitor
OVERALL This is a good machine, powerful enough to cope with most applications, and with watchable DVD playback. Inclusion of a printer would have made it the overall winner

FEATURES	★★★★
PERFORMANCE	★★★★★
VALUE FOR MONEY	★★★★
OVERALL RATING	★★★★

How we did the tests

SYSmark 2000

This comprises 12 application workloads and a management program. The workloads are divided into two categories: office productivity and Internet content creation. We run the benchmark at a resolution of 1,024 x 768 in 16bit colour. It loops three times, rebooting between each workload.

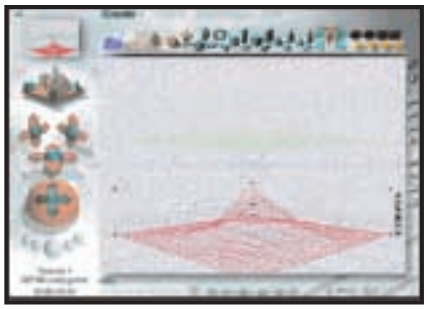
It then assigns the system a performance rating for each application, based on a comparison of workload runtimes between the system being tested and a fixed calibration platform. A rating of 100 indicates the test system has performance equal to that of the calibration platform, 200 indicates twice the performance and so on. The calibration platform is based on a Pentium III 450MHz processor, an Intel 440BX chipset motherboard, 128MB of SDRAM, a 32MB Diamond Viper V770 Ultra graphics card, an IBM DJNA 371800 and Windows 98 SE.

Each category rating is a geometric mean of the workload ratings in that category. The overall rating is a weighted geometric mean of the category ratings.

Office productivity

Corel CorelDraw 9.0
This script first takes an abstract design, applies an Art Stroke to it and runs various filter effects. It creates and manipulates a scene composed of vector graphics. Next, it takes a raster image and applies effects. It creates several 3D objects and performs 3D manipulations.

Corel Paradox 9.0
This performs SQL-style queries on a database table and runs a 'find duplicates' query. It imports other text files, formatting and exporting each to HTML. Then it opens up query forms, enters additional data and produces reports based on queries.



Bryce 4 script manipulates a wire frame scene and renders it

Microsoft Word 2000
This workload invokes word processing functions, including editing, spell checking, search and replace, font change, copy and paste, print preview, mail merge fields, insert hyperlinks, background and table formatting plus opening and viewing HTML pages.

Microsoft Excel 2000
Operations include closing and opening spreadsheets, HTML pages and data in text files, spell checks, formula calculation, plotting data, formatting charts and cells, analysing data in pivot tables, naming a cell and inserting hyperlinks.

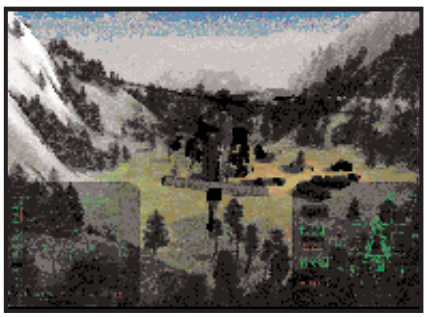
Microsoft PowerPoint 2000
Operations include spell checks, editing, formatting and moving pictures, applying templates, formatting tables in slides, inserting hyperlinks, applying header and footer data formatting charts, applying graphics and sound effects, and adding movie files.

Dragon NaturallySpeaking Preferred 4.0
The script plays a pre-recorded WAV file into Naturally-Speaking, which then converts the WAV file to text.

Netscape Communicator 4.61
This opens a website of plays by Shakespeare and selects and loads the texts several times. Then it loads a page consisting of large tables, thumbnails and images and cycles through viewing the images.

Internet content creation

Adobe Premiere 5.1
This creates an animation of about 16 BMP files and other AVI clips and puts transitions between them. It superimposes two audio tracks and runs the audio through filters.



3DMark 2000 tests each system's DirectX performance (above) and OpenGL performance is tested via Quake III: Arena (below)

Adobe Photoshop 5.5
The script loads, resizes, zooms out of images, applies filters to the images, changes mode and colour settings, adjusts image brightness and contrast and saves the image to a JPEG file.

Avid Elastic Reality 3.1
The workload sets up and renders a morph between two MPEG2-sized images (720 x 480 pixels, roughly 750KB).

MetaCreations Bryce 4
This script opens an assembled wire frame scene and renders it to the final image. Then a new image is opened and saved in Metastream format. Another image is opened and saved in an HTML-compatible format.

Microsoft Windows Media Encoder 4.0
The input file is an AVI clip that is encoded using the MPEG-4 Video Codec.

3DMark 2000

Remedy Entertainment's MAX-FX is used to test the DirectX performance of a system. It runs two specially coded games at low, medium and high resolutions. We ran the benchmark at 1,024 x 768 in 16bit colour, with each game set to loop three times. The 3DMark is calculated by adding the frames per second for each game together and multiplying the result by 12.

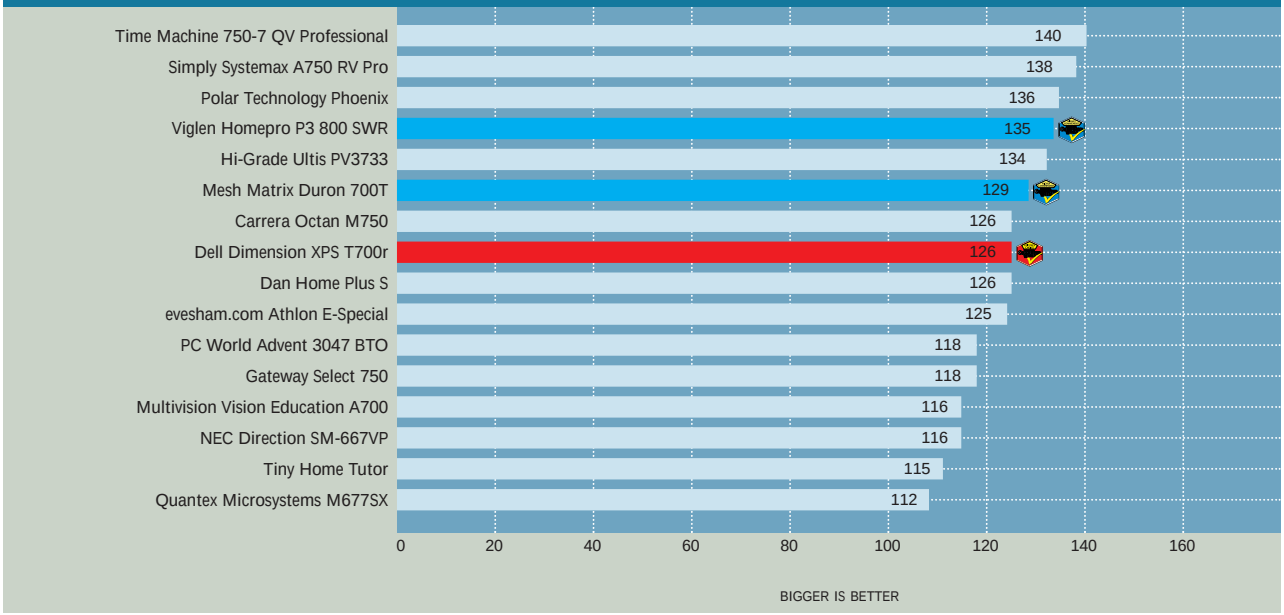
Quake III

We tested each system's OpenGL performance with Quake III: Arena (1.11). The settings were:
video mode – 1,024 × 768,
colour depth – 16bit, full screen, highest texture detail,
texture quality – 16bit,
texture filter – bilinear, lighting and lightmap.
At command prompt we typed:

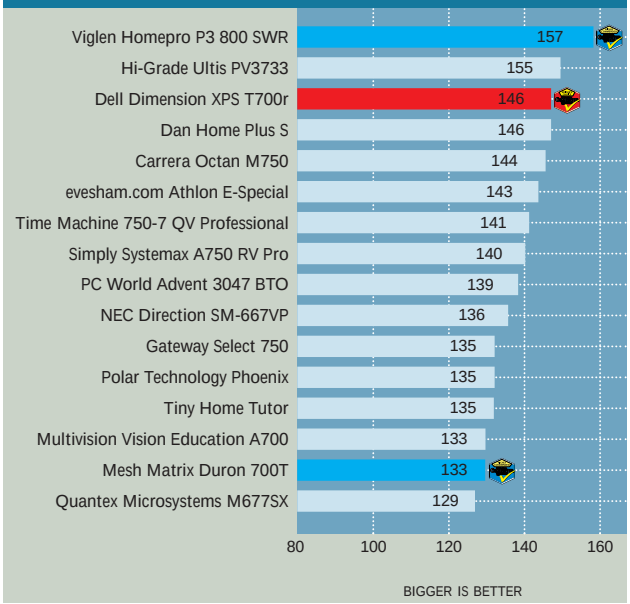
```
timedemo 1
demo demo001
```

This runs demo 1 and records the frames per second.

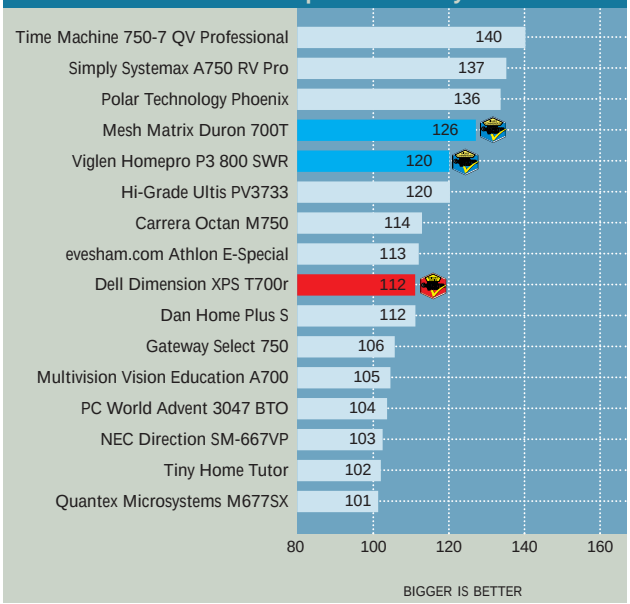
SYSmark 2000 overall



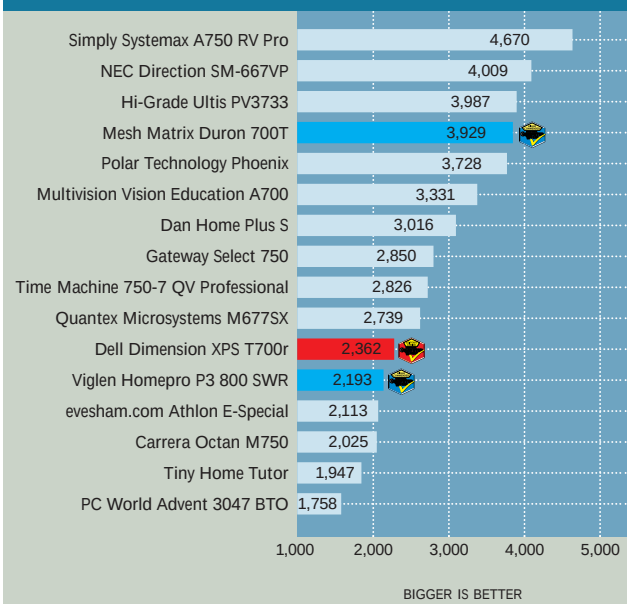
SYSmark 2000 Internet content creation



SYSmark 2000 office productivity



3DMark 2000



Quake III (fps)

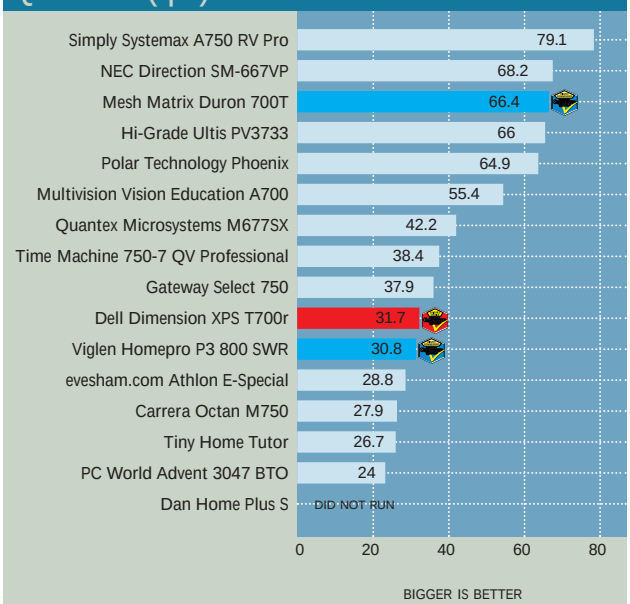


Table of features





Manufacturer	Carrera	Dan Technology	Dell Computers	evesham.com	Gateway
Model name	**Octan M750**	**Home Plus S**	**Dimension XPS T700r**	**Athlon E-Special**	**Select 750**
Price inc VAT (ex VAT)	£1,173.83 (£999)	£1,168 (£994)	£1,173.83 (£999)	£1,115.08 (£949)	£1,104.50 (£940)
Telephone	020 8307 2800	020 8830 1100	0870 907 5664	0800 038 0800	0800 55 2000
Hardware specs					
Processor	Athlon 750MHz	Pentium III 700MHz	Pentium III 700MHz	Athlon 700MHz	AMD 750MHz
RAM/type	128MB/PC100	128MB/PC100	128MB/PC100	128MB/PC100	128MB/PC100
Occupied/spare RAM slots	1/2	1/2	1/3	1/2	1/2
Max memory in this configuration	640MB	1.1GB	640MB	640MB	640MB
Maximum memory	768MB	1.5GB	768MB	768MB	768MB
Hard disk (manufacturer + model)	Quantum Fireball Plus LM	Maxtor 52049U4	Maxtor 51536U3	Maxtor 52049U4	Western Digital
HD size/interface	20.5GB/EIDE	20.5GB/EIDE	15GB/EIDE	20.5GB/EIDE	14.7GB/EIDE
Storage drive model and maker	Ricoh MP9060A	Panasonic LS120	Sony CRX 140E	Samsung SM-304B	Panasonic LS120
Size of storage drive media	650MB (1 CD-R and 1 CD-RW inc)	120MB (1 disk inc)	650MB (1 CD-R and 1 CD-RW inc)	650MB	120MB
Storage drive interface	EIDE	EIDE	EIDE	EIDE	EIDE
Motherboard components					
Motherboard manufacturer	Biostar	Gigabyte	Dell/Intel	MSI 6195	Gateway
Model/chipset	M7MKA/AMD 750	VIA GA-6VX7/694X	Northstar/440BX	K7 Pro/AMD 750	Kodoka/AMD 750
Expansion and I/O					
No of 3.5/5.25in bays	3/4	4/3	5/2	2/3	5/3
No of free 3.5/5.25in bays	1/3	2/2	3/0	0/2	3/2
No of PCI/ISA/shared slots	4/1/1	4/0/1	4/0/1	5/0/1	5/0/0
No of free PCI/ISA/shared slots	2/1/1	2/0/1	2/0/1	3/0/1	3/0/0
No of USB/serial/parallel/PS2	2/2/1/2	2/2/1/2	2/1/1/2	2/2/1/2	3/2/1/2
Multimedia					
DVD manufacturer/model	Ricoh MP9060A	Panasonic SR8585B	Samsung SD-612	Samsung SM-304B	Toshiba SD-M1402
DVD speed/interface	4x/EIDE	8x/EIDE	12x/EIDE	4x/EIDE	12x/EIDE
Sound card manufacturer	Creative	Creative	Creative	Creative	Creative
Sound card model	SB PCI 128	SB Live! 1024	SB PCI 64V	SB PCI 128	SB PCI 128
Speakers (manufacturer + model)	Altec Lansing ACS22	Dan Hi-Fi Speakers	Harmon Kardon HK195	Cambridge Soundworks SBS52	Cambridge Soundworks GCS200
Graphics card maker and model	Generic TNT2 M64	Matrox Millennium G400 DualHead	ATi Rage Pro 128	Generic TNT2 M64	Creative TNT2
Chipset	nVidia TNT2 M64	Matrox G400	ATi Rage Pro 128	nVidia TNT2 M64	nVidia TNT2
RAM and type	32MB SDRAM	16MB SGRAM	16MB SGRAM	32MB SDRAM	32MB SDRAM
Graphics card interface	AGP	AGP	AGP	AGP	AGP
Monitor manufacturer/model	LG CS990DC	CTX VL700	Samtron 75E	Mitsubishi V70	Gateway EV700
Monitor size/ max viewable diagonal	19in/18in	17in/16in	17in/16in	17in/16in	17in/15.9in
Maximum resolution at 75Hz	1,600 x 1,200	1,152 x 864	1,152 x 864	1,280 x 720	1,024 x 768
Other information					
Modem manufacturer and model	PCI internal 56K	PCI internal 56K	Aztech MDP 3900 V.90	Diamond SupraSST 56i Pro DFV	PCI internal 56K
Misc hardware		Lexmark Z32 printer	HP 610C printer		
Bundled software	Lotus SmartSuite Millennium, IBM ViaVoice, Entertainment bundle	Lotus SmartSuite Millennium, 3D games bundle	MS Works Suite 2000, Dell Home Advantage Software	Lotus SmartSuite Millennium	MS Works Suite 2000

						
	Hi-Grade	**Mesh Computers**	**Multivision Computers**	**NEC**	**PC World**	**Polar Technology**
	Ultis PV3733	**Matrix Duron 700T**	**Vision Education A700**	**Direction SM-667VP**	**Advent 3047 BTO**	**Phoenix**
	£1,173.83 (£999)	£1,173.83 (£999)	£1,173.83 (£999)	£1,173.83 (£999)	£1,173.83 (£999)	£1,173.83 (£999)
	020 8532 6100	020 8208 4706	0121 550 8000	0870 010 6322	08705 464 464	0161 482 7000
	Pentium III 733MHz	AMD Duron 700MHz	Athlon 700MHz	Pentium III 667MHz	Pentium III 650MHz	Athlon 700MHz
	128MB/PC133	128MB/PC100	128MB/PC133	128MB/PC133	128MB/PC100	128MB/PC100
	1/2	1/2	1/2	1/2	1/2	1/2
	512MB	1.1GB	640MB	1.1GB	640MB	640MB
	512MB	1.5GB	768MB	1.5GB	768MB	768MB
	Fujitsu 3136AH	Seagate Barracuda	Seagate Barracuda	Maxtor	Seagate U10	IBM
	13.5GB/EIDE	20.5GB/EIDE	20.5GB/EIDE	20.5GB/EIDE	10.2GB/EIDE	25GB/EIDE
	Mitsumi CR-4804JE	Teac CD-W 54E	Samsung SM-304B	LG CED8080B	Iomega Internal Zip 100	Creative CD-RW
	650MB	650MB	650MB	650MB	100MB	650MB (1 CD-RW inc)
	EIDE	EIDE	EIDE	EIDE	EIDE	EIDE
	Asus	Gigabyte	MSI 6195	MSI	Gigabyte	MSI
	CUSL 2/Intel 815E	GA7ZM/VIA KT133	K7 Pro/AMD 750	6309/VIA 694X (133A)	GA6 BX7/Intel 440 BX	K7 Pro/AMD 750
	4/3	3/3	4/3	5/2	4/3	5/2
	2/1	1/1	2/2	3/0	1/2	3/0
	6/0/0	3/0/0/1	5/0/1	5/0/0	4/1/1	5/0/1
	4/0/0	0/0/0	3/0/1	3/0/0	2/1/1	3/0/1
	5/1/1/2	2/2/1/2	2/2/1/2	3/2/1/2	2/2/1/2	2/2/1/2
	Asus E608	Pioneer DVD-114	Samsung SM-304B	Pioneer 115	Toshiba SD-M1402	Pioneer DVD 104
	8x/EIDE	10x/EIDE	4x/EIDE	16x/EIDE	12x/EIDE	10x/EIDE
	Creative	Creative	Creative	Aureal	Creative	Creative
	SB Live! 1024	SB Live! 1024	SB PCI 128	Advantage	SB PCI 128	SB PCI 128
	Diamond Promedia 2010	Labtec 1070	Labtec LCS-2514	Labtec LCS 2414	Creative SB S20	Labtec LCS-2414
	Guillemot 3D Prophet	Guillemot 3D Prophet GeForce SE	Guillemot 3D Prophet GeForce SE	nVidia GeForce	nVidia Riva TNT2 Model 64	Creative 3D Blaster Annihilator Pro
	nVidia GeForce 256	nVidia GeForce 256	nVidia GeForce 256	nVidia GeForce 256	nVidia TNT2	nVidia GeForce 256
	32MB SDRAM	32MB SDRAM	16MB SDRAM	32MB SDRAM	32MB SDRAM	32MB DDR
	AGP	AGP	AGP	AGP	AGP	AGP
	CTX PR705F	Mitsubishi Diamond Pro 720	LG Flatron 775FT	NEC VR17	Proview PK-770	Mitsubishi Diamond Pro 720
	17in/16in	17in/16in	17in/16in	17in/16in	17in/15.7in	17in/16in
	1,600 x 900	1,600 x 1,200	1,152 x 864	1,152 x 864	1,024 x 768	1,600 x 1,200
	Diamond Supra SST 56i Pro DF	Diamond SupraSST 56i Pro DFV	PcTel HSP micromodem 56	3Com 56K V.90 PCI Win Modem	US Robotics PCI Win Modem 56K V.90	Diamond Supra SST 56i ProDF
		ATi TV Wonder	Epson 670		Mustek 1200UB scanner, Canon BJC-2100 printer	
	Lotus SmartSuite 9.5	MS Works Suite 2000	Lotus SmartSuite Millennium IBM ViaVoice	MS Word 2000, Works 2000, Money 2000, Corel Draw 7, IBM ViaVoice, Encarta, Route Express	MS Works 2000, Excel 2000, Money 2000 Standard, Home Publisher 2000, MapPoint 2000 UK	Microsoft Works Suite 2000

Table of features





Manufacturer	Quantex	Simply	Time	Tiny	Viglen
Model name	M677SX	Systemax A750 RV Pro	Time Machine 750-7 QV Pro	Home Tutor	Homepro P3 800 SWR
Price inc VAT (ex VAT)	£1,173.83 (£999)	£1,173.83 (£999)	£1,173.83 (£999)	£1,173.83 (£999)	£1,173.83 (£999)
Telephone	01438 224 444	08707 297 366	01282 777 555	01293 821 555	020 8758 7000
Hardware specs					
Processor	Pentium III 667MHz	Athlon 750MHz	Athlon 750MHz	Pentium III 733MHz	Pentium III 800MHz
RAM/type	128MB/PC133	128MB/PC133	128MB/PC100	128MB/PC133	128MB/PC100
Occupied/spare RAM slots	1/2	1/2	1/2	1/2	1/2
Max memory in this configuration	1.1GB	1.1GB	640MB	1.1GB	640MB
Maximum memory	1.5GB	1.5GB	768MB	1.5GB	768MB
Hard disk (manufacturer + model)	Seagate ST328040A	Maxtor VL20	Fujitsu MDF3204AH	Western Digital	Western Digital
HD size/interface	28.5GB/EIDE	20GB/EIDE	20GB/EIDE	20GB/EIDE	20GB/EIDE
Storage drive model and maker	Sony CD-R 140E	Ricoh combo MP9060A	Samsung SM-304 combo	4 x 4 x 32 CD-writer	Iomega Zip 100 (int or ext)
Size of storage drive media	650MB (10 CD-Rs inc)	650MB	650MB	650MB (1 CD-R inc)	100MB (1 Zip disk inc)
Storage drive interface	EIDE	EIDE	EIDE	EIDE	Parallel
Motherboard components					
Motherboard manufacturer	Biostar	AOpen	MSI	MSI	MSI
Model/chipset	M6VCG/VIA 694	AK72/KX133	K7 Pro/AMD 750	MS 6154/VIA 693A	MS6119/Intel 440 BX
Expansion and I/O					
No of 3.5/5.25in bays	4/3	3/3	4/3	3/2	4/2
No of free 3.5/5.25in bays	2/1	1/1	2/2	1/0	2/1
No of PCI/ISA/shared slots	4/0/1	4/0/1	5/0/1	2/0/1	3/2/1
No of free PCI/ISA/shared slots	2/0/1	1/0/1	3/0/1	2/0/0	1/2/1
No of USB/serial/parallel/PS2	2/2/1/2	4/2/1/2	2/2/1/2	2/2/1/2	2/2/1/2
Multimedia					
DVD manufacturer/model	Toshiba DVD SD-M1402	Ricoh combo MP9060A	Samsung SM-304 combo	Matshita DVD-ROM SR 8585	Pioneer DVD-ROM DVD-115
DVD speed/interface	12x/EIDE	4x/EIDE	4x/EIDE	8x/EIDE	16x/EIDE
Sound card manufacturer	Creative	Creative	Creative	Creative	Creative
Sound card model	SB PCI 64V	SB V128	SB Live! 1024	SB PCI 128 (onboard)	SB PCI 128
Speakers (manufacturer + model)	Altec Lansing ACS 22	Creative SBS52	Screenbeat Pro 50	CPR50	Altec Lansing ACS33
Graphics card manufacturer and model	3dfx Voodoo 3 3000 TV out	Creative 3D Blaster Annihilator Pro	3dfx Voodoo 3 3000 TV out	nVidia Riva TNT2 Model 64	ATi Rage Fury Pro ViVo
Chipset	3dfx Voodoo 3	nVidia GeForce 256	3dfx Voodoo 3	nVidia TNT2	Rage 128 Pro
RAM and type	16MB SDRAM	32MB DDR	16MB SDRAM	32MB SDRAM	32MB SDRAM
Graphics card interface	AGP	AGP	AGP	AGP	AGP
Monitor manufacturer/model	Quantex XP1727DP	CTX PL7	Samtron 75e Plus	LG Flatron 795FT Plus	ADI E55
Monitor size/ max viewable diagonal	17in/16in	17in/16in	17in/16in	17in/16in	17in/16in
Maximum resolution at 75Hz	1,152 x 864	1,152 x 864	1,152 x 864	1,600 x 1,200	1,024 x 768
Other information					
Modem manufacturer and model	Accord I56LVP	Systemax 56K V.90	Etech PCI 56K PVP+	HSP56 Micromodem	Diamond SupraSST 56K (software)
Misc hardware	Canon FB630P scanner and BJC-2100 printer	Epson Stylus 460, ATI TV tuner, MS Sidewinder GamePad	Gamepad, joystick, microphone, Epson 460 printer		Saitek Cyborg 2000 joystick
Bundled software	Corel WordPerfect Office 2000, Grolier Multimedia Encyclopedia, Email Voicelink, Drive Image SE, RingCentral, Cybersnoop 3.0 SE, Webferret, Enfish, Tracker Pro	MS Works 2000, Systemax games & education bundle, ACID Music Software (limited) WordPerfect Suite 8 (limited)	MS Works, Time standard software pack inc Lotus SmartSuite Millennium	MS Office Pro 2000 student licence, education software pack	Microsoft Works Suite 2000

Editor's **Choice**

It's not easy to build a PC for a student and the manufacturers' varied approaches to the problem show how open to interpretation the possibilities can be. We considered that there are really three issues that a good student PC should be able to encompass: first, and most important, the PC must have the correct software and specification for doing work. It was therefore a necessity that the package should include a good word processor. We consider the preferred option to be Word 2000, although WordPerfect and Word Pro are products that are also up to the task.

The second criterion is that the machine should be versatile for entertainment purposes. Our thoughts on this were that a system with a DVD-ROM drive in one of its bays should be good enough to be able to watch DVD movies on – giving the student the option of watching films in their room. The performance of DVD playback was therefore a factor. Also falling into this category was the presence of a TV card to allow terrestrial TV to be tuned into the PC.

The final and least important aspect was the PC's ability to deal with games. So a system specification that was capable of handling games was noted, as were relevant peripherals.

One other aspect was considered to be of great value, and that was the inclusion of a printer, or money left out of the budget to buy one. The quality of the printer was not specified, although all the printers included were colour, despite being entry-level products. The versatility of a printer saves untold amounts of time for a student. Trips to the university's printing facilities can become tedious, whereas with a printer tucked in the corner of a student's room, the odd page can be printed out as needed. That said, the lack of a printer didn't hold back two of our winners.

In general, the overall quality and performance of all the machines was impressively high, with few of them failing to be relevant at least at some level.

The winners

Considering all of the above, the **Editor's Choice** this month goes to the Dell Dimension XPS T700r. With its 700MHz Pentium III processor and 128MB of PC100 RAM, this machine is more than adequate for all the office applications that a student will need to produce essays and projects. The Maxtor hard drive, although not the largest in the test, is a decent-sized 15GB unit and considering the size of the average word processor document file size, it will still take the student some time to fill. Also included is a Sony CD-RW, which with the inclusion of both CD-R and CD-RW media, promotes good backup habits from day one.

On the entertainment front, the quality of the DVD sound and video playback means the Dimension will allow the student to watch movies on their PC when they are not working. As for software, the inclusion of Word 2000 in the Works Suite 2000 package is ideal for producing essays and reports. This, along with the inclusion of the HP printer (complete with cable), makes this an ideal work machine.

The competition was fierce, though, and the Viglen Homepro P3 800 SWR receives our first **Highly Commended** award, only failing to beat the Dell because the package didn't include a printer. The speed of the processor on the Viglen was not a factor in this decision, as the performance gained from it was not really significant. Instead the Viglen is commended because it has the right software in Works Suite 2000 (including Word 2000); it had the best DVD playback of all of the systems tested; and it included a Saitek Cyborg joystick for anyone interested in gaming. The balance was good all round and the cables for connecting the DVD to a TV make this a versatile entertainment PC as well as a good work system.

The final **Highly Commended** award goes to the Mesh Matrix Duron 700T. This machine may not have come with a bundled printer, but it offered a superb mix of components. Based on AMD's latest chip, the performance of this machine was impressive. The display setup was first rate, with a nVidia GeForce-based graphics card coupled with a Mitsubishi NF aperture-grille screen. Both a DVD-ROM drive and CD-RW drive are bundled so disc-to-disc copying can be performed. Rounding things off is a TV tuner card, to give students a bit of extra entertainment during their down time.

Dell's system will be a positive boon to the student, with its printer and backup drive

The HomePro offers great performance, plus some decent entertainment options

Mesh's machine uses the latest chip from AMD and a good display set

The big picture

A good monitor is a vital ingredient of your PC system, so knowing the good from the bad is important. We invited 13 suppliers of 17in screens to let us test their mettle.

One element of your computer is actively used more than any other: the monitor. Yet you rarely hear people boast about their monitor, it's always how fast their processor is or how much memory their graphics card has. The monitor, though, is the one part of your computer you interact with the most simply because the screen is where your PC interfaces with you. Yet how many of us are seduced by the magic numbers of the diagonal? That extra inch or two on the diagonal becomes the most important thing as we doggedly follow the 'bigger is better' maxim that applies to so many other aspects of computing.

But, and there is a but, should such an arbitrary method of monitor selection really be in force? Would you buy wallpaper for your living room based on how wide the roll was? Unlikely. The variation in monitors is as diverse as any other part of your PC, and considering you are actively looking at a monitor, rather than merely observing its performance, we thought it would be a good idea to test some 17in models that now represent the norm in PC use.

The monitor manufacturers that submitted screens for this group test were given only a couple of guidelines. The monitor was to be as flat as possible, while still being good value for money; and as the reviews on the following pages show, there is a great deal of variation within the 17in market.

contents

• Monitors tested and reviewed by Scott Montgomery and Jalal Werfalli

PHOTOGRAPH DAVID WHYTE

ADI Microscan G710

LITTLE BROTHER TO the model that featured in our May issue's 21in monitor group test, the ADI Microscan G710 has the same brightness and contrast wheels under the front fascia as its sibling. These wheels offer easier and more accurate manipulation of settings than the standard button-driven digital on-screen display (OSD) method.

This unit is one of the few in the test with a built-in microphone, situated in the fascia above the screen, with output at the rear. The G710's bezel is quite big, making the screen appear slightly smaller than some of the competing units. The included USB hub has four downstream ports and plugs into the back of the unit, extending on a short cable for easy access to the ports.

Setting up this FD Trinitron screen was both simple and quick – although with the brightness set to give the correct black level, the contrast could not be driven up high enough to give the required white level. This made the screen appear slightly dimmer than we would have liked. The OSD allows easy navigation for setup of the monitor's geometry, with the unit working at optimal levels within a couple of minutes.

On the DisplayMate image quality tests (see How we did the tests box later in the group test), the G710 performed well. The geometry was good, with no distortion or pincushioning. Power regulation was good, although focus at the corners of the image deteriorated noticeably. Colour was well represented, with regular colour purity across the screen. There was no streaking or ghosting in the image and colour-fading consistency was excellent. However, the general dimness of the screen may have affected all the results because at lower contrast levels distortion is less likely to occur.

Overall, apart from the poor focus at the edges, this Trinitron screen performs well. However, the overall dimness of the display may cause a bit of eye strain with long-term use. The unit conforms to TCO99 standards, so emissions are not an issue, and at its mid-range price it's not a bad unit. Although for £20 more you could get the all-round better performing ViewSonic PF775 (see later).

DETAILS

PRICE £260 (£229 ex VAT)
CONTACT ADI 020 8327 1900
www.adimicroscan.com
PROS OSD easy to navigate
CONS Very dim screen
OVERALL The dimness of the screen pulls this unit down. Although performance appears good, this may be entirely due to low overall contrast. Eye strain may also pose a problem

IMAGE QUALITY	★★★
CONTROLS	★★★★
VALUE FOR MONEY	★★★
OVERALL RATING	★★★

Belinea 10 30 50

ONE OF FOUR entrants in this month's test with a shadow-mask tube, the Belinea 10 30 50 had one of the best images based on initial impression at power-up. The colours were vibrant, and the image was sharp and focused – all-round, an excellent first impression.

The fascia surrounding the screen is narrow and gives the screen area a virtual boost. It also sports what at first appears to be three buttons and, tucked underneath, a wheel for adjustment. After pressing the left and right buttons, though, we discovered they were merely adornment for the fascia. Using the centre button in combination with the wheel, the brightness, contrast and screen geometry can be set up. The OSD was simple to navigate: you just select the required option and then manipulate the settings by rotating the wheel.

Running the DisplayMate tests, the Belinea did not perform as well as we initially thought it would. This serves to highlight how an overall impression of a monitor can be just as valid a means of assessment as a program like DisplayMate.

Focus on the Belinea was excellent, and fine focus testing further reinforced the quality of the tube, with minimal deterioration towards the edges. Screen regulation was impressive, while pincushion and barrel distortion, plus other geometric features were not as good as the flatter aperture-grille models. Video bandwidth was excellent, with lines of varying thickness appearing at consistent intensity. The image also experienced very little streaking and ghosting, only suffering mildly from the former on grey backgrounds. The anti-glare coating wasn't particularly good and colour representation in the tests wasn't wonderful, with patchiness in pure colours and irregular fading. The Belinea is TCO99 certified, so ergonomics and emissions are assured.

Overall, the working image on this monitor is great, with its failings in DisplayMate by no means affecting this. For general Windows purposes it is a fine monitor, even if the screen is a little curvy. However, its £304.33 price tag means it's eclipsed by cheaper models.

DETAILS

PRICE £304.33 (£260 ex VAT)
CONTACT Belinea 01344 788 920
www.belinea.co.uk
PROS Excellent image quality for general use, with striking colour and focus
CONS One of the most expensive 17in monitors we tested
OVERALL Apart from the price, this is a good monitor. Unfortunately, similar quality can be bought for less

IMAGE QUALITY	★★★★
CONTROLS	★★★★
VALUE FOR MONEY	★★
OVERALL RATING	★★★

CTX PR705F

THE PR705F IS A 17in member of CTX's ProFlat series, all of which sport an 'absolutely flat screen'. Not only is it flat, but the fascia is constructed to highlight this, with sharp edges and barely a curved surface in sight. The only curves visible from the front are where the OSD control buttons are situated. At the back of the unit, along with the D-SUB input are BNC connectors for RGB input. The unit also conforms to the TCO99 standard.

Four buttons allow access to the OSD and navigation was clearly set out and easy to use. Unfortunately, the CTX proved to be one of the most difficult units to set up correctly. The main problem was getting the geometry correct. Every time one geometric aspect was changed, it seemed that another had to be reset or altered to compensate for a new error. The setup took a long time in comparison to other monitors.

There was one problem we were unable to resolve through the OSD: the top edge of the screen was not straight. As none of the OSD geometry controls address top and bottom curvature on any monitor, this problem unfortunately had to stay, and the straight lines of the fascia only served to highlight the imperfection.

DisplayMate reinforced our thoughts on this monitor's good points and the performance showed it to be a quality unit. Text focus was fairly sharp across the image, although the ViewSonic was sharper in the corners. The flatness of the FD Trinitron screen meant that distortion and curvature were minimal, except for the top edge problem, which obviously let it down. Screen regulation was overall very good, as was colour purity, although there was some minimal streaking from colours and greys. As for desktop resolution, it managed 81Hz at 1,280 x 1,024 while 85Hz would have been preferable.

Leaving the DisplayMate tests and looking at the CTX in normal use, the PR705F had a good overall image quality – assuming the curvature problem with the top edge was an idiosyncrasy of our test unit. You could do a lot worse for £222 inc VAT.

DETAILS

PRICE £222 (£189 ex VAT)
CONTACT CTX 01923 810 800
www.ctxmonitors.com
PROS BNC as well as D-SUB input gives some versatility
CONS The curve on the top edge of the screen; general setup difficulties
OVERALL Setup was lengthy, but image quality was OK apart from the curve at the top of the screen

IMAGE QUALITY	★★★
CONTROLS	★★★
VALUE FOR MONEY	★★★
OVERALL RATING	★★★

Hansol 710D

HANSOL ELECTRONICS started manufacturing displays in 1995 with the introduction of its first 17in monitor, the Mazellan 700P. Since then, it has built up a reputation for monitors with good picture quality at equally attractive prices. The Hansol 710D, one of four monitors in Hansol's current professional series, is no exception. The unit encases a Samsung-designed DynaFlat shadow-mask tube that has a virtually flat screen.

The first thing that strikes you when you switch it on is the overall sharpness and liveliness of the screen. This is comparable to some high-end models on test here. Both the dot pitch and maximum resolution are decent at 0.25mm and 1,600 x 1,200 at 75Hz, respectively. However, using this resolution will leave you squinting. Nevertheless, it does comfortably handle 1,024 x 768 at 85Hz – the more appropriate screen resolution for a 17in monitor.

Starting up DisplayMate, the 710D showed little evidence of blooming, while text is finely resolved right across the screen and into the corners. Moving on to power regulation, the Hansol performed better than the other two budget models from Mitsubishi and Taxan, but it's not perfect. When compared directly to other models it was obvious that a small displacement existed in the top left-hand corner, revealing that beam control needs fine-tuning.

Basic geometry is acceptable, although when the monitor arrived we needed to make some adjustment to rectify a skewed tilt. The slightly awkward four-button OSD has most of the necessary options to set the picture squarely within the bezel. Vertical and horizontal convergence tests were passed with flying colours, but if the three beams decide to migrate off their factory settings then you're pretty much stuck, as no colour convergence controls exist. At the back of the unit is a captive D-SUB connection – something we expect to see on a lower-priced model.

All in all, the picture quality offered by the 710D is very respectable. If you're looking for a vibrant and bright picture but don't want to overstretch your budget, the 710D is ideal.

DETAILS

PRICE £210 (£179 ex VAT)
CONTACT Hansol 01276 418 213
www.hansol-uk.com
PROS Fine overall quality from the DynaFlat tube
CONS No horizontal or vertical convergence controls
OVERALL An excellent screen for an attractive price

IMAGE QUALITY	★★★★
CONTROLS	★★★
VALUE FOR MONEY	★★★★★
OVERALL RATING	★★★★

Iiyama VisionMaster Pro 410

ANYONE WHO IS familiar with the name Iiyama will know that this Japanese company has a reputation for producing high-quality display units. However, you may also know that its monitors have been criticised in the past for their power regulation. Thankfully, it would seem that Iiyama has addressed this problem as the VisionMaster Pro 410 put in a fine performance in our regulation tests.

The tube comes in the form of a Mitsubishi 17in Natural Flat model, with a 0.25mm aperture-grille pitch. The viewable area is 15.9in and the screen reflectivity is thankfully low. As with all aperture-grille monitors this one exhibits the ubiquitous damping wires that some users may find distracting. This aside, the tube provides excellent image quality and its ability to display images with vibrant colours and in sharp focus is very commendable, only being eclipsed by Sony's Multiscan E200. The resolution specifications are decent too, managing a comfortable 1,280 x 1,024 at 85Hz, and an eye-straining 1,600 x 1,200 at 75Hz.

The styling is characteristic of all Iiyama monitors, with clean lines and a fascia that bears its old three-button OSD controls. These are not the most intuitive and can only be navigated in a long-winded manner because the buttons have multiple functions. That said, the four menus do include geometry controls, horizontal convergence correction, moiré reduction and a colour control with three pre-set options and one user-defined option where only the red and blue levels can be adjusted.

BNC inputs are provided at the rear, however, you'll have to use the clumsy OSD to switch between them. On the plus side, these connections along with the power lead are recessed and allow the unit to be pushed up against a wall.

Although the design is perhaps looking a little outdated now, it is difficult to fault the VisionMaster Pro 410 especially in terms of the overall visual result. With the added bonus of BNC connectivity and a non-captive D-SUB lead – which the Sony display lacks – the Iiyama VisionMaster Pro 410 is undoubtedly one of the best 17in monitors around.

DETAILS

PRICE £276.12 (£235 ex VAT)
CONTACT Iiyama 01438 314 417
www.iiyama.co.uk
PROS Excellent image quality and colour vibrancy
CONS That awkward OSD
OVERALL The 17in CRT of choice at an attractive price

IMAGE QUALITY	★★★★★
CONTROLS	★★★★
VALUE FOR MONEY	★★★★★
OVERALL RATING	★★★★★

Glossary of monitor terms

Aperture grille Instead of fine holes like a shadow mask, this display uses a mask of very fine vertical wires held in place by two just visible horizontal damping wires. No masking in the vertical direction leads to a brighter and more vivid picture.

Barrel distortion Defines the straightness of the sides of the image area – called barrel, because of the convex appearance of the image area.

Bezel The part of the monitor casing that surrounds the edges of the screen, effectively framing the picture.

BNC connectors The five separate connections around the back of some monitors. These are in place to separate the video signals into red, green, blue, and horizontal and vertical synchronisation signals. This decreases interference as the signals are shielded from each other.

Cathode-Ray Tube (CRT) A partially evacuated tube, whereby electrons striking an internal phosphorescent coating form a picture.

Convergence Describes how well the three colour guns (red, green and blue) intersect at each pixel. The better the guns converge, the more closely the colours overlap, creating a sharper image.

Degaussing The removal of magnetic fields that have built up within the display. These fields cause image or colour distortion and are either degaussed by an internal coil when the computer is turned on, or by manually selecting a degauss option.

D-SUB connector Standard video cable that may already be connected internally to the monitor (known as captive), or it may plug independently into the monitor's D-SUB port.

OSD (on-screen display) Graphical interface in which the user selects screen adjustment options usually using the buttons on the front of the monitor.

Pincushion distortion Inverse of barrel where the distortion resembles a pincushion, in that the sides of the image area have a concave appearance.

Refresh rate The rate at which the screen is redrawn, measured in cycles per second or Hertz (Hz). If the rate is not high enough the human eye will detect the decay in screen brightness between refresh cycles – known as flicker. Flicker is noticeable below a refresh rate of 75Hz.

Screen regulation How well the screen can control the electron beam between areas of high-beam intensity and low-beam intensity. Determined by flashing white areas against a black background.

Shadow mask A sheet of alloy – usually the iron-nickel alloy invar, used because of its low thermal expansion properties – perforated with many small holes into which the beams from the three guns converge. This sits in front of the phosphor layer.

Streaking and ghosting Another indicator of the quality of the beam intensity electronics. When the beam is scanned from a high-intensity area (white) to a low-intensity area (black) the beam has to switch from on to off. If this is not precise then the white area will appear to streak or ghost into the black area.

VESA (Video Electronics Standards Association) An association of companies that co-operate in establishing common standards for video display systems.

LG Flatron 795FT Plus

CONVENTIONAL CRTS are still based on a screen that is formed from part of a glass sphere – or a cylinder for Sony's Trintron displays. However, some screens are designed with a completely flat front surface such as Mitsubishi's Diamondtron NF and FD Trinitrons. Although these tubes can produce wonderful results, the internal surface remains curved to compensate for beam diffraction. This is where the LG Flatron differs as both sides of its tube are flat. This produces a screen that has excellent non-reflective properties.

The 795FT Plus borrows technology from both aperture-grille and shadow-mask designs, in that it uses a 'slot mask' whereby a mask with slots rather than holes is used in front of the phosphor. The stripe-pitch is rated at 0.24mm, equivalent to a 0.25mm dot-pitch tube. The Flatron 795FT has a 16in viewable diagonal and reaches an unusable maximum resolution of 1,600 x 1,200 at 77Hz. It handles all other VESA resolutions with ease.

Considering tube performance, the image is not as bright as other aperture grilles. Focus is slightly lost in the corners of the screen and vertical resolution is not the finest.

Geometry, however, cannot be faulted. The only area where the LG really trips up is in regulating the screen's power and electron beams. It was nevertheless a little more stable than the Mitsubishi and Taxan offerings.

The OSD is one of the simplest to navigate because the touch-sensitive controls are a pleasure to use, as well as being laid out on the fascia in the same fashion as the icons in the OSD menus.

Colour convergence is adjustable in both planes, while there are settings for moiré correction and overall colour purity, together with a couple of extra pincushion geometry options.

Connectivity is dealt with by a non-captive D-SUB lead along with one upstream and four downstream ports at the expense of BNC connections. Two USB cables are included.

The LG Flatron 795FT Plus employs different technologies, but this comes at a price as this is the most expensive model in the group test.

DETAILS

PRICE £340.75 (£290 ex VAT)
CONTACT LG Electronics 01753 500 400
www.lge.com
PROS Touch-sensitive controls; self-explanatory OSD; non-reflective screen
CONS Expensive; poor power regulation
OVERALL An innovative display but with a premium price to match

IMAGE QUALITY	★★★
CONTROLS	★★★★★
VALUE FOR MONEY	★★
OVERALL RATING	★★★★

Mitsubishi Diamond Plus 73

JOINING MITSUBISHI'S expanding line-up of Diamondtron NF (Natural Flat) colour monitors, the Diamond Plus 73 sports a vibrant aperture-grille display, housed in a case that lacks some of the design *finesse* seen elsewhere. That said the bezel does frame the tube with enhancing narrow borders.

For this price the grille pitch is an admirable 0.25mm, and it does not vary from the screen's centre to the corners. Indeed the resolution was good in all areas of the display, passing every sharpness and resolution test. As for maximum resolution, your graphics card need not worry as the Diamond Plus 73 can only handle 1,280 x 1,024 at a flickery 66Hz, but it comfortably achieves the standard 1,024 x 768 at 85Hz. Anti-glare was fine, while colour fading was constant and colour purity rich and even.

By far the worst results were obtained when testing the Diamond Plus 73's power regulation. This revealed a gun untamed by its electronics, failing all of DisplayMate's regulation tests with the entire screen expanding in bright areas and contracting in dim areas.

On the front are three buttons that give you simple access to the basic OSD. Most of the usual display controls are present but to keep costs down Mitsubishi has left out advanced controls such as moiré, and colour convergence – a shame because the colour registration was off in both directions. Nevertheless, the available settings can be adjusted very finely and not in jerky steps as with other displays. Still, this didn't help us with geometry correction as we had difficulty centring the display within the bezel and removing an intrinsic vertical and horizontal curvature to the picture.

The only thing that's around the back is a captive D-SUB lead.

Even though the Mitsubishi Diamond Plus 73 uses a Diamondtron Natural Flat tube it didn't perform to the standards we are used to seeing from Mitsubishi. The best thing about this 17in is the price, but the Diamond Plus 73 will struggle to compete with the Hansol offering.

DETAILS

PRICE £222.07 (£189 ex VAT)
CONTACT Mitsubishi 01707 278 684
www.mitsubishi.com
PROS User-friendly OSD; vibrant flat screen; attractive price
CONS Basic controls; poor power regulation and colour convergence
OVERALL A budget monitor that suffers from flaws that will be noticeable to the discerning end user

IMAGE QUALITY	★★★
CONTROLS	★★★
VALUE FOR MONEY	★★★
OVERALL RATING	★★★

NEC MultiSync FE750

WITH ITS NATURAL FLAT aperture-grille tube and a narrow fascia, this is a fine looking monitor. It does, however, have one unusual aesthetic feature. At the bottom of the screen where the OSD controls are situated is a small piece of clear plastic displaying the MultiSync logo. The orange/green LED signalling the monitor's standby/on status is behind this so the logo changes colour with the light. Whether you like this feature is a matter of personal taste, but at least it looks different from the rest of the pack.

The OSD is menu driven and navigation is simple, with the monitor quick and easy to set up. The overall impression at this stage was that the image was reasonably focused across the screen, with well-represented vibrant colours.

As with the Belinea screen, the DisplayMate testing revealed a different side to NEC's entrant – again, both the testing and the general feel of the monitor should be borne in mind.

DisplayMate highlighted a degree of blooming and some defocusing towards the periphery of the monitor. Screen regulation and general resolution across the image were also not up to the same standard as some of the other units. However, the anti-glare coating was excellent and colour fading was pretty much uniform across the spectrum, the geometry was outstanding, with no pincushion or barrel distortion and no evident horizontal or vertical curvature.

The MultiSync's lack of gun control was highlighted by the display being prone to mid-range streaking. This weakness was further exemplified with problems in both a white-level and black-level shift. Basically this manifests itself in a slight change in what should be a uniform colour, due to the presence of other colours on the screen. Green colour purity was also not what it should have been, with the screen becoming slightly faded towards the corners.

At a price of £304.32 some of these performance issues should not have arisen. Having said that, for Windows use this is a perfectly adequate display, though you can get better quality for less cash.

DETAILS

PRICE £304.32 (£259 ex VAT)
CONTACT NEC 0645 404 020
www.nec.co.uk
PROS Good colour representation and screen geometry
CONS Regulation and streaking proved to be a problem
OVERALL This display is adequate for general use, although there are monitors with better images for the money

IMAGE QUALITY	★★★
CONTROLS	★★★★
VALUE FOR MONEY	★★★
OVERALL RATING	★★★

Philips 107P

ON PULLING THE Philips 107P out of its box, the first thing that strikes you is the styling of the unit. With limited desk space in mind, the 107P is designed with a narrow back and sweeping flanks that curve to the front of the chassis. The bezel is also quite narrow making the screen look much bigger than it really is. On the front are some unusual silver OSD controls comprising four arrow keys and an 'OK' button. Even the flimsy on/off switch has had the silver paint treatment. Around the back is an independent D-SUB socket and BNC connectors. No internal USB ports exist, although a USB base is available as an optional extra.

The tube is an aperture grille with a pitch of 0.25mm and a maximum resolution of 1,920 x 1,440 at a refresh of 60Hz – pointless considering that the only time you will ever use this setting would be out of curiosity. 1,280 x 1,024 at 85Hz is the highest practical resolution for this screen.

Our tests produced mediocre results pretty much across the board. Nowhere did the 107P excel, but there are areas where it didn't do well, for example it faltered over blooming. This had a blurring effect on text and gave the whole screen a slightly soft feel. Geometry is another problem because the picture has an intrinsic curve to the left-hand side of the screen. The display was also sensitive to vibrations, wobbling when the bench was tapped. However, power regulation is adequate.

The OSD is intuitive, helping you along with clear prompts, and the range of options is impressive with extra controls for precise purity adjustment. An 'Auto Calibrate' option regularly readjusts the luminance and black level with the colour settings to maintain their original relative values. The 107P is also the only monitor in this test to offer direct switching between the D-SUB and BNC inputs, albeit through a simultaneous press of the 'OK' and 'UP' buttons on the control panel.

On the whole, the Philips 107P isn't a bad monitor, but we expect better image quality from a company with a history in electron beam technology.

DETAILS

PRICE £311.37 (£265 ex VAT)
CONTACT Philips 020 8665 6350
www.pcstuff.philips.com
PROS Space-saving design; BNC/D-SUB direct switching; range of controls
CONS Blooming; geometrical imperfection; vibration-sensitive
OVERALL A monitor with an excellent set of controls, but a disappointingly average performance

IMAGE QUALITY	★★★
CONTROLS	★★★★★
VALUE FOR MONEY	★★★
OVERALL RATING	★★★

Samsung SyncMaster 700IFT

ALTHOUGH APERTURE-grille technology appears to be the preference in 17in monitors, with most of this month's entrants using it, the Samsung SyncMaster 700FT has an Infinitely Flat Tube (IFT) shadow-mask screen.

The SyncMaster's fascia is quite plain and generally uninspiring. However, pressing the bottom of the fascia releases the OSD control buttons that swing out on a small block – a nifty feature indeed. The OSD is intuitive and easy to navigate and covers all the usual geometry setup requirements, as well as allowing the input to be selected – so that two computers could be connected at the same time via the D-SUB and BNC connectors. Not included in this though are the contrast and brightness control wheels, which are situated under the front fascia. The accuracy of wheels for these settings is always preferable, despite the fact that they are no longer in vogue. Between the OSD and the wheels, the monitor was easily set up.

Putting the SyncMaster to the test with DisplayMate we found it was not too bad, but certainly not groundbreaking. The screen was fairly well in focus across the display and the anti-glare coating functioned adequately. As for geometry, although it passed all the tests, it excelled in none. There was minimal pincushion and barrel distortion, while vertical and horizontal curvature, although present, was minimal. Resolution was not the worst in the group, but a general focus problem in the bottom left of the screen let the unit down. The Samsung did, however, pass the screen regulation tests with flying colours.

One of the biggest problems was colour. Colour scale fading consistency was fine, but there were general problems of colour streaking. This may have been partly due to the red gun's inability to give an even colour in the red colour purity test. There was also some black-level shifting, although it wasn't awful.

At £280.82 inc VAT, this monitor isn't too bad, but unfortunately other units of a very similar price outperform it and look better in general terms.

DETAILS

PRICE £280.82 (£239 ex VAT)
CONTACT Samsung 020 8391 0168
www.samsung.com
PROS BNC input, good screen regulation
CONS Mediocre performance
OVERALL The input options give this unit versatility. But for a similar fee, a better and equally versatile monitor is available from Iiyama

IMAGE QUALITY	★★★
CONTROLS	★★★
VALUE FOR MONEY	★★★
OVERALL RATING	★★★

Sony Multiscan E200

SONY REQUIRES little introduction when it comes to CRTs. Having invented the vertically flat Trinitron tube, it has also brought us a truly flat display in the form of the FD Trinitron. Built around this technology, the Sony Multiscan E200 is an entry-level model and, as such, its specifications are not the highest. Lacking any BNC inputs, the E200 also has a captive D-SUB lead so if this goes wrong, the whole unit will have to be returned. The maximum supported resolution is also limited to 1,280 x 1,024 refreshing at 81Hz. However, a setting above this will rarely be needed on a monitor of this size.

As for image quality, the E200 delivers the wonderfully rich colours that we have come to expect from this type of aperture-grille tube. Colour fading is uniform while contrast is particularly good, covering a wide intensity range from the darkest black to a brilliant white. This gives rise to excellent greyscale performance attributable to a near perfect balance that Sony has struck between the E200's darkly tinted glass and beam intensity. The E200 did show some evidence of streaking and ghosting, but this was minimal. Text appears very sharp in all corners of the screen, while reflections are hardly noticeable. Geometry is praiseworthy, but, surprisingly, vertical colour registration was not quite as spot on as the Iiyama screen. However, Sony does give you both horizontal and vertical convergence controls.

Styling is of a typical Sony standard with the screen surrounded by a narrow and shallow bezel that enhances its apparent size. At first glance, the only control seems to be a power switch, but on closer inspection, you'll find a small four-way joystick facing downwards from the base of the bezel. Moving it will navigate you through the OSD and pressing it makes selections. This is a bit tricky at first due to its light operation, but you soon get used to it.

The Sony Multiscan E200 achieved a slightly higher score in our tests than the Iiyama VisionMaster Pro 410, but not by much. Restrictions to connectivity means that the Multiscan E200 just misses out on our Editor's Choice.

DETAILS

PRICE £276.12 (£235 ex VAT)
CONTACT Sony 0990 424 424
www.sony-cp.com
PROS Image vibrancy and colour purity
CONS Captive D-SUB lead and lack of BNC connectivity
OVERALL A very competent tube; with a vast heritage behind it. Although it's let down by limited connectivity it's still worth a look

IMAGE QUALITY	★★★★★
CONTROLS	★★★★
VALUE FOR MONEY	★★★★★
OVERALL RATING	★★★★★

Taxan Valuevision 1710 TCO99

THE TAXAN VALUEVISION range of monitors, as the name suggests, target the value-oriented monitor buyer. However, having the word value in the name of a monitor makes one think that the quality isn't up to scratch even if that isn't the case. Unfortunately, in this instance the quality was disappointing. As the cheapest monitor in the group test, though, value is perhaps apt.

The unit is TCO99 certified, so there's no scrimping on emissions issues. But apart from this, and the overall aesthetically pleasing shape of the fascia, there is little to recommend this monitor.

The first problem we encountered involved the setup. The OSD is accessed through four buttons unobtrusively situated on the front of the monitor, and proved easy to navigate. However, when the OSD is used there are problems: first, its presence on the screen causes the image to expand due to the intensity of the OSD; and second, when the brightness and contrast are set correctly and the OSD is switched off, the dynamic of the image (minus the OSD) changes, making the brightness and contrast settings incorrect. In other words, setup can only be done by best guess rather than accurately.

DisplayMate only served to further prove the weaknesses of the Valuevision. The display was prone to defocus and blooming. The geometry was adequate, but not nearly as accurate as some of the other models. The biggest failure was, of course, regulation; its failings on all the regulation tests sheds some light on the OSD setup problems. Also troubled was horizontal line and corner resolution. At 1,280 x 1,024, maximum refresh was 67Hz making the VESA maximum viewable screen resolution only 1,024 x 768.

There were things the Valuevision did well, namely a general lack of streaking and ghosting and relatively pure colour representation, but overall this unit did not represent good value for money. We were unable to set up the display correctly, so it's impossible to recommend the 1710, which is a shame when you consider Taxan's usually high-quality displays.

DETAILS

PRICE £163.32 (£139 ex VAT)
CONTACT Taxan 01344 484 646
www.taxan.co.uk
PROS Aesthetically pleasing fascia; and good OSD navigation
CONS Appalling regulation reduced setup to guesswork
OVERALL With an OSD that hindered an effective setup, there is little about this monitor to recommend it

IMAGE QUALITY	★★★
CONTROLS	★
VALUE FOR MONEY	★
OVERALL RATING	★★

ViewSonic PF775

EMPLOYING A SONICTRON aperture-grille absolute flat tube, the ViewSonic PF775 image was pretty impressive from the moment it was turned on. The colours were bright, the image sharp and that was before we had even set it up optimally.

The minimal recessing of the screen from the fascia increases the overall flat look of the screen, although the bezel is quite big and square, giving the illusion of a smaller screen size than some units.

The OSD was not the most intuitive system, with two of the four buttons situated below the screen used to select features, rather than one. Frequent pressing of the wrong select button was a little irritating, but once this aspect was mastered, setting up this display was a simple operation. The OSD has all the necessary options for manipulation to an optimal image – although a curve existed on the top edge of the screen that could not be removed.

Intrigued by some of the results on other screens with DisplayMate, we found the ViewSonic to perform fairly well across the tests. The anti-glare coating was good and text was in focus across the screen. The geometry was fine, with minimal pincushion and barrel distortion, although there was some horizontal curvature. The bane of the Taxan, screen regulation, was very good on the ViewSonic, with only minimal movement of the pixel-thick lines that were edging a white flashing image. Overall resolution was good, although horizontal lines were better resolved than the vertical lines, which were also not wonderfully sharp in the corners. A high degree of gun control was evident in the video bandwidth test, as well as in colour registration tests. Colour purity was commendable, with regular colour across the whole display from each gun. But no monitor is perfect, and the ViewSonic suffered from slight streaking problems, specifically coming from pure white, which streaked in almost every instance.

Despite this, though, at £280.82 inc VAT, TCO99 certification, good colours and a fine image, the PF775 is a good-quality monitor.

DETAILS

PRICE £280.82 (£239 ex VAT)
CONTACT ViewSonic 01293 643 900
www.viewsonic.co.uk
PROS Good focus, regulation and colours
CONS Square bezel gives the impression of a smaller screen
OVERALL A good-quality monitor, only a whisker behind this month's winners. Certainly worth checking out if you're in the market for a 17in monitor

IMAGE QUALITY	★★★★
CONTROLS	★★★
VALUE FOR MONEY	★★★★
OVERALL RATING	★★★★

Table of features

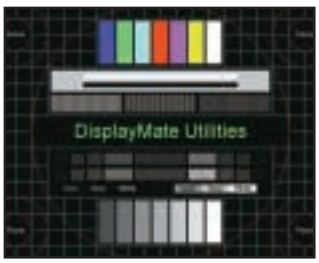



Manufacturer	ADI	Belinea	CTX	Hansol	Iiyama
Model	Microscan G710	10 30 50	PR705F	710D	VisionMaster Pro 410
Price (ex VAT)	£229	£260	£189	£179	£235
Price (inc VAT)	£260	£304.33	£222	£210	£276.12
URL	www.adimicroscan.com	www.belinea.co.uk	www.ctxmonitors.com	www.hansol-uk.com	www.iiyama.co.uk
Tube type	FD Trinitron aperture grille	CRT shadow mask	FD Trinitron aperture grille	FST shadow mask	Diamondtron NF aperture grille
Nominal tube size	17in	17in	17in	17in	17in
Actual viewable diagonal	16in	16in	16in	16in	15.9in
Dot/grille pitch	0.24mm	0.26mm	0.24mm-0.25mm	0.25mm	0.25mm
Power consumption					
Power consumption (max)	130w	95w	125w	85w	110w
Power consumption (standby)	15w	Less than 15w	15w	Less than 65w	10w max
Power consumption (suspend)	5w	Less than 3w	5w	Less than 15w	10w max
Power consumption (off)	N/A	N/A	N/A	Less than 5w	5w max
Available connections					
USB hub (upstream ports, downstream ports)	1 x U, 4 x D	✗	✗	✗	✗
Integrated microphone	✓	✗	✗	✗	✗
Video outputs	Captive D-SUB	Captive D-SUB	Captive D-SUB	Captive D-SUB	D-SUB, BNC
Refresh rates					
Maximum VESA refresh rate at 1,024 x 768 (Hz)	85	85	85	85	85
Maximum VESA refresh rate at 1,280 x 1,024 (Hz)	85	85	81	85	85
Maximum VESA refresh rate at 1,600 x 1,200 (Hz)	79	77	N/A	75	75
Manufacturer's proposed maximum resolution/refresh rate (Hz)	1,600 x 1,200/75	1,600 x 1,200/64	1,600 x 1,200/67	1,600 x 1,200/75	1,600 x 1,200/75
Other information					
Dedicated front-panel input select	✗	✗	✗	✗	✗
Highest emissions compliance	TCO99	TCO99	TCO99	TCO99	TCO99
Dimensions (mm) (w x h x d)	439 x 441 x 441	420 x 428 x 454	418 x 448 x 447	418 x 417 x 419	412 x 424 x 420
Net weight	21kg	18.1kg	20kg	17kg	21kg

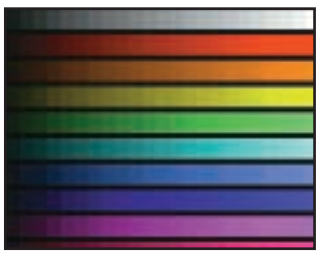
How we did the tests

Monitors need a carefully controlled environment for accurate and fair testing. For this group test we used a dual setup of two identical PCs, both equipped with Matrox Millennium G400 graphics cards as they are considered to give the best 2D display performance. The choice of graphics card is important, since if the monitor isn't being fed with a high-quality signal it can never give its best. We used two systems in testing so that we were able to make instant and accurate A-B comparisons without having to mess about with disconnecting and reconnecting cables, or using signal-degrading splitters.

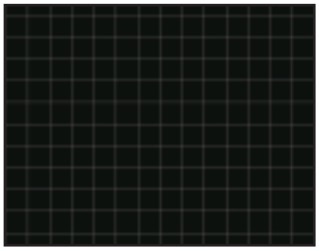
As important as the graphics card driving a monitor, or the software used in testing, is the physical testing environment. A monitor relies on magnetic fields to steer its electron beams and produce a picture. Consequently, any monitor is susceptible to external magnetic fields, and these can both distort geometry and affect colour. Although this is more pronounced in larger screens, 17in



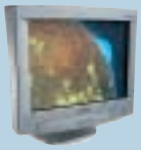
DisplayMate Master test

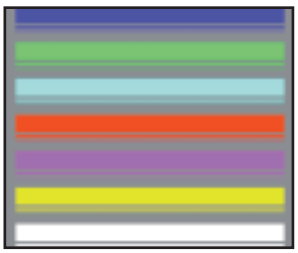


Colour fading consistancy test



Geometric linearity test screen

	LG	Mitsubishi	NEC	Philips	Samsung	Sony	Taxan	ViewSonic
								
	Flatron 795FT Plus	Diamond Plus 73	MultiSync FE750	107P	SyncMaster 700IFT	Multiscan E200	Valuevision 1710 TCO 99	PF775
	£290	£189	£259	£265	£239	£235	£139	£239
	£340.75	£222.07	£304.32	£311.37	£280.82	£276.12	£163.32	£280.82
	www.lge.com	www.mitsubishi.com	www.nec.co.uk	www.pcstuff.philips.com	www.samsung.com	www.sony-cp.com	www.taxan.co.uk	www.viewsonic.com
	FST 'slot mask'	Diamondtron NF Aperture grille	NF aperture grille	Flat aperture grille	IFT shadow mask	FD Trinitron aperture grille	FST shadow mask	PerfectFlat aperture-grille
	17in	17in	17in	17in	17in	17in	17in	17in
	16in	16in	16in	16in	16in	16in	16in	16in
	0.24mm	0.25mm	0.25mm	0.25mm	0.24mm (diag)	0.24-0.25mm	0.27mm	0.25mm
	130w	100w	75w	92w	120w	120w	Less than 100w	130w
	8w	N/A	N/A	Less than 11w	60w	15w	Less than 15w	N/A
	8w	Less than 15w	Less than 15w	Less than 11w	Less than 15w	15w	Less than 5w	15w
	3w	Less than 5w	Less than 5w	Less than 2.4w	Less than 3w	3w	Less than 5w	3w
	1 x U, 4 x D	✘	✘	✘	✘	✘	✘	✘
	✘	✘	✘	✘	✘	✘	✘	✘
	D-SUB	Captive D-SUB	Captive D-SUB	D-SUB, BNC	D-SUB, BNC	Captive D-SUB	Captive D-SUB	D-SUB
	85	85	85	85	85	85	85	85
	85	N/A	85	85	85	81	N/A	85
	77	N/A	77	79	79	N/A	N/A	77
	1,600 x 1,200/75	1,280 x 1,024/66	1,600 x 1,200/65	1,920 x 1,440/60	1,600 x 1,200/75	1,280 x 1,024/81	1,280 x 1,024/65	1,600 x 1,200/77
	✘	✘	✘	✔	✘	✘	✘	✘
	TCO99	TCO99	TCO95	TCO99	TCO99	TCO99	TCO99	TCO99
	415 x 439 x 435	403 x 420 x 420	403 x 427 x 440	399 x 410 x 419	415 x 438 x 418	404 x 414 x 420	408 x 377 x 425	417 x 430 x 450
	21kg	18.8kg	16.5kg	19kg	18.8kg	20kg	15.5kg	20kg



Colour streaking test screen

Video bandwidth test screen

monitors are also affected.

Even the earth's own magnetic field can have a subtle effect, so when testing, all the monitors were set up facing in exactly the same direction. We also made sure that each display on test was at least one metre away from any others, to avoid the possibility of any magnetic or electromagnetic interference (EMI): the same went for any other electrical equipment in the vicinity that might give off significant levels of EMI.

The units were all tested under constant, artificial light. Each monitor was given a warm-up period of one hour before we commenced testing, which is vitally important for

White-level shift test screen

any monitor, as both shadow masks and aperture grilles tend to expand as they are bombarded with electrons from the guns.

This variation is taken into account when monitors are factory-calibrated and image quality can be noticeably superior once a unit has properly warmed up.

Testing itself was done using the industry-standard DisplayMate utility by Sonera. Utilising a series of test screens (see examples left) each monitor undergoes an exhaustive set of tests and every aspect of image quality is examined, including geometry performance, focus, resolution, corner-to-corner consistency, power regulation, colour purity and linearity.

All the formal testing was performed at a resolution of 1,024 x 768 with a 75Hz refresh rate. As well as formal testing, however, we also looked at how subjectively usable the units were at higher resolutions where this was appropriate.

Editor's **Choice**

As the previous pages show, not only are there a lot of monitors to choose from, but there are also a number of factors that will affect that choice. The monitors we tested ranged from the not-so-good to the excellent and the prices ranged from £163.32 to £340.75 inc VAT – a differential that we think you will agree is pretty big: meaning that the cheapest is less than half the price of the most expensive monitor.

The trap is to assume that, because all of the units are the same size, price is a convenient way to help you to choose the monitor you need. Unfortunately, it is not such a simple equation. If only it were the case that the most expensive was the best and the cheapest the worst – although in this case the cheapest definitely came off worst in the group.

What it ultimately comes down to is value for money. Some of the most interesting comparisons were between units of a similar price. Evaluating these was difficult, as we were aware that on a limited budget, performance and features would be the deciding factors.

There are four aspects to each monitor: image quality, controls, value for money, and an overall rating. Image quality was marked on test performance, image sharpness, colour representation, as well as overall impression of the display for general use. The controls score is based on the ease of use of the input method to access the OSD, as well as the navigation of the OSD and general ease of setup. Value for money reflects the price versus the performance, while the overall score is based on all the criteria.

One thing to bear in mind when purchasing a monitor is that personal preference will obviously sway your choice. We had disagreements about a number of issues with the monitors in the group test: some of us preferred certain fascias and controls, and others were hated and found to be totally unintuitive. However, despite our personal tastes, the DisplayMate tests ensure that there is as much objectivity projected onto the scoring as is possible, with anything clearly failing a test being marked accordingly. Exemplary performance was a little harder to gauge, although we managed to thrash it out between ourselves to pick the winners.

One final thing should be borne in mind if you are looking to buy a monitor. Try to see it in the flesh so you know you are happy with it. After all, you'll be looking at it for a long time, so it's worth getting it right.

The winners

For the ultimate prize of **Editor's Choice**, the eventual decision came right down to the wire. The final contenders battling it out were the Iiyama VisionMaster Pro 410 and the Sony Multiscan E200. Both units performed excellently, although the Sony did achieve a slightly higher overall DisplayMate score than the Iiyama. In addition to very similar ratings, both monitors occupy the same price bracket, which left us with no option other than to base our final decision upon features. Both units employ aperture-grille screens, the Sony with its FD Trinitron screen and the Iiyama using a Mitsubishi Natural Flat screen; and both are excellent, with colour, focus and overall image quality first-rate.

Showing greater versatility than the Sony as regards input, the Iiyama entrant comes with BNC input as well as a non-captive D-SUB. The Sony, by comparison, only has a captive D-SUB cable for input from the PC. This may seem a small point to note, but in the event of a cable failure on a monitor with a captive D-SUB, the whole unit has to be returned to the manufacturer, with all the inconvenience that is likely to cause. In the end, therefore, the Iiyama VisionMaster Pro 410 is this month's Editor's Choice, with the Sony Multiscan E200 coming a close second, and winning this test's first **Highly Commended** award.

For the second **Highly Commended** award we looked to the budget end of the group. In general, we found the lowest-priced units did not represent good value for money, due to screen geometry issues, regulation problems and poor overall image quality. One monitor that did not suffer from these problems was the Hansol 710D, with its reasonable performance and sharp, lively screen image. The DynaFlat shadow-mask screen is virtually flat and geometry on the unit is overall quite good. It's certainly not as good a monitor as our first two winners, but at £210 inc VAT, this is the best value for money in the lower price bracket.

Iiyama's VisionMaster Pro 410 scoops Editor's Choice – an aperture-grille to thrill

Sony's Multiscan E200, with its excellent image quality, was pipped at the post

At the budget end, the Hansol 710D proved that the shadow mask isn't dead

Server city

Many small businesses are looking to client/server environments to satisfy their networking needs, so we challenged 10 server manufacturers to come up with products to suit this growing market.

Many small businesses are now realising the benefits networking can bring to their productivity. SMEs (small to medium enterprises) represent a huge proportion of UK businesses and an extremely lucrative and rapidly growing market to manufacturers.

While some small businesses are still content with a simple peer-to-peer network, the majority are looking to the benefits of a client/server environment where they can centralise all their major applications such as email, databases or intranets. With all your shared resources now in one location, everyone suffers if the system fails, so it's no longer enough to be content with just using a PC as a server. Continued business operations depend on total reliability so nothing less than a purpose-built machine will do.

The small-business market will be split between those looking for their first server and companies wanting to upgrade to something more substantial. With this in mind we invited 10 manufacturers to submit a server that had the muscle to cope with up to 100 users and a maximum price limit of £2,000 ex VAT. To spice things up we made no requests for particular specifications, but left it entirely up to each vendor to decide what they thought would be suitable for the target market. The tight price restriction would require some juggling with components – would faster processors or more memory be a better bet than a RAID controller or more hard-disk storage? It was their call. Our challenge produced some interesting results, so turn the page to find out more.

contents

• PCs tested and reviewed by Dave Mitchell

Compaq ML350

FOR MANY YEARS Compaq has been content to use the same chassis for its small-business and workgroup ProLiant servers that, although offering a unique modular assembly and excellent build quality, are looking somewhat dated. The ML350 is one of a new range of servers from Compaq that heralds a completely new design. Gone are the separate boards for processors and memory, replaced by a single main board, which produces a much tidier interior.

The ML350 on review came equipped with a single PIII 600EB processor but it does support dual processors up to 866MHz. The processor slots are located at the top of the motherboard with four DIMM sockets below them. The basic configuration comes with a single 128MB PC133 module that can be upgraded to 2GB. Compaq is yet another server vendor that has handed the job of core logic duties to ServerWorks. So the 'Intel inside' sticker literally only refers to the processors.

SCSI services plus network and graphics adaptors are all integrated, although the arrangement is most peculiar as Compaq has placed them all on a single, full-length daughterboard occupying the top PCI slot. Here, you have a Compaq NC3163 dual-speed network adaptor sitting alongside an ATi 3D Rage IIC PCI graphics chipset, so both monitor and network ports are on the same backplate. The hard disk subsystem is handled by a Symbios 53C896 chipset that provides dual Wide-Ultra2 SCSI channels with support for up to 15 devices each and both connectors are located on the edge of the daughterboard. Coined a 'Server Feature Board' by Compaq, it's not the most elegant solution, but this arrangement does have its advantages, as it would be a simple job to upgrade network, graphics and SCSI services in one fell swoop by installing new cards as Compaq makes them available.

HARDWARE SPECIFICATIONS
Motherboard: Compaq
Chipset: ServerWorks Entry ServerSet III LE
FSB speed (MHz): 133
Processor type/speed: Pentium III 600EB
No of processors: 1
Max processors: 2
STORAGE
Hard disk: 2 x Fujitsu MAE3091LP
Total capacity (unformatted): 18.2GB
Controller type: Symbios 53C896
Software: Compaq SmartStart, Insight Manager, ASR

Although the ML350 uses a similar internal design to HP's LC2000 it offers far fewer features. Cooling is limited to a single fan mounted on the rear panel, whereas the LC2000 uses no fewer than four in a single hot-swap assembly. Furthermore, the ML350 only comes with a single power unit, while many other vendors offer multiple redundant supplies. Storage capabilities are more modest than most, with the ML350 using a small cage mounted at the front with room for four fixed hard disks. Two 9.1GB Compaq-branded Fujitsu hard disks were supplied but total storage can be increased to a healthy 72.8GB using four 18.2GB versions instead. Compaq also offers an optional hot-plug bay as well.

Operating system installation is helped along by Compaq's SmartStart utility, supplied on a bootable CD-ROM. The process kicks off by storing some basic configuration details on a server profile disk and then offers a choice of operating systems. We found this was fully up to date with options, not only for Windows 2000 Server and Advanced Server, but also for NetWare 5.1. A fair amount of CD-ROM swapping is required but we had the ML350 up and running inside a couple of hours.

Server management comes courtesy of Compaq's Insight Manager. This provides plenty of information about processors, memory and disk drives, as well as detailed information on operating temperatures and voltages. In addition, the XE version now supports web-based management. The information gathered can be linked to an alert log so that any error messages detected will cause the software to send out warnings to support staff by network broadcast, email or pager. Compaq's ASR2 (automatic server recovery) can also be called into play as it will automatically reboot the server and activate a pager number if a critical failure is detected.

With the review system costing a reasonable £1,724, the ML350 looks good value. The arrangement for gathering graphics, network and SCSI services on a separate board may not appeal to everyone, but this server impressed in the performance stakes taking fourth place in both Ethernet and Fast Ethernet tests.

DETAILS

PRICE £2,026 (£1,724 ex VAT)
CONTACT Compaq 0845 270 4000
www.compaq.com
PROS Combines top performance and value with good management facilities and innovative design
CONS Minimal internal cooling and no support for redundant power supplies
OVERALL A fine specification for the price that delivers good performance. Quality management features, but look elsewhere if you want hot-swap power supplies and cooling fans

BUILD QUALITY	★★★
PERFORMANCE	★★★★
VALUE FOR MONEY	★★★
OVERALL RATING	★★★

Dan Dantum RAID/PP Server

WITH THE DANTUM RAID/PP Server, Dan has taken the same approach as Viglen by fitting a non-server-specific motherboard. However, the company has taken a bigger risk with the SuperMicro PIIIDME because this uses an Intel 840 chipset, which has had more than its fair share of troubles recently. Originally designed for expensive Rambus memory, the 840 was modified by Intel with a Memory Repeater Hub (MRH-S) allowing it to accept less costly SDRAM.

The PIIIDME offers a 133MHz FSB (front-side bus), but thanks to this modification it only has a 100MHz memory bus. Also, dual memory channels are designed to improve performance by interleaving, so memory modules must be installed in pairs. For the Dantum, Dan plumped for a pair of 128MB DIMMs leaving a couple of sockets spare for upgrades. Another point of note is that the MRH-S on 840 motherboards has had problems with ECC memory and a quick check in the Dantum's BIOS revealed this feature was disabled.

The PIIIDME is one of a family of four 840-based motherboards and, in terms of features, this is the weakest because it is the only one with no onboard SCSI. Instead you get two UltraDMA66 IDE channels that are not suited to server applications, purely because of the limited number of devices they can support. To overcome this, Dan has selected an Adaptec AAA-131U2 single-channel PCI RAID controller card. This was linked to a triplet of 9.1GB Quantum Ultra160 hard disks and configured as RAID 1 mirror array with one of the drives standing in as a spare in case of failure. RAID 1 is designed for data protection, although with three drives up for grabs Dan could just as easily have configured them for RAID 5, which combines increased performance and fault tolerance.

Array creation requires the server to be booted from Adaptec's configuration floppy, after which it can be managed and monitored from the operating system using the bundled CI/O software. We tested the array by cutting the power to one of the mirrored pair and, sure enough, the server started squawking loudly. The CI/O software then cut in and rebuilt the array in nine minutes using the spare drive, during which time the server continued to function normally.

HARDWARE SPECIFICATIONS
Motherboard: SuperMicro
Chipset: Intel 840
FSB speed (MHz): 133
Processor type/speed: Pentium III 700
No of processors: 1
Max processors: 2
STORAGE
Hard disk: 3 x Quantum Atlas IV
Total capacity (unformatted): 9.1GB (mirror + spare)
Controller type: Adaptec AAA-130U2
Software: Veritas Backup Exec

The Genie chassis looks a good choice as it's well built and offers plenty of room for expansion. Dan filled all four front 5.25in bays with three holding lockable UniStor hot-swap disk carriers, each with dedicated cooling fans and status indicators. A Toshiba IDE CD-ROM drive fills the fourth bay, but the Seagate TapeStor SCSI tape drive in the spare 3.5in bay looks more of a token gesture as its low backup speeds and native 4GB capacity are really only suited to PC backup.

The interior is reasonably tidy, with only the ribbon cables for the disk drives running across the motherboard. Up above is a massive internal disk cage with its own cooling fan and room for five more hard disks. Dual processors are supported and the Dantum is supplied with a single PIII 700MHz chip. Combining this with the healthy portion of memory undoubtedly gave Dan second place in both Ethernet benchtests (see performance results graphs later in the group test) although we would have expected it to be much closer on the heels of the Mesh 700L.

The only PCI slot in use is taken up by the RAID controller leaving two 64bit and three 32bit PCI slots free. One integrated component that has no place on a server is the sound chip linked to audio and MIDI ports on the rear panel. This is rather a waste but, as long as Dan is not charging you for the privilege, you can always ignore it.

The Dantum does offer a good specification for the price, but it comes in for the same criticisms as Viglen's system, mainly due to the choice of motherboard. The PIIIDME is not designed for servers, there are still issues surrounding the 840 chipset and general server management and monitoring tools are also particularly weak.

DETAILS

PRICE £2,148 (£1,828 ex VAT)
CONTACT Dan 0870 444 7020
www.dan.co.uk
PROS Quality Adaptec RAID controller with three hard disks and plenty of memory
CONS Motherboard not designed specifically for servers; lack of integrated SCSI controller; and tape drive has insufficient capacity and speed for server backup
OVERALL Although the RAID controller provides excellent levels of fault tolerance, this system would benefit hugely from a server-specific motherboard. The chassis offers good expansion potential, but management tools are almost non-existent

BUILD QUALITY	★
PERFORMANCE	★★★
VALUE FOR MONEY	★★
OVERALL RATING	★★

Dell PowerEdge 2400

THE POWEREDGE 2400 is Dell's top server product for small to medium-sized businesses and took over from the highly successful PowerEdge 2300 last year. The 2400 still uses the same large black chassis borne by its predecessor, but offers a greatly improved specification. Dell was one of the first server companies to drop Intel in favour of ServerWorks for core logic duties. The 2400 uses an Entry ServerSet III LE chipset that allowed Dell to claim it as the very first server on the market to offer a 133MHz front-side bus (FSB). This move was obviously a smart one as many other vendors including Hewlett-Packard and Compaq have followed suit. One of the main reasons for not implementing Intel's 840 chipset at the time was that it supported the more expensive Rambus memory that Dell didn't think the server market was ready for. The ServerWorks chipset allows vendors to implement less costly PC133 SDRAM.

Dell also pioneered the tool-free design, so maintenance and upgrades can be carried out without needing a screwdriver. Thumbscrews are used throughout the 2400 and expansion cards are held in place using small plastic clips. With the side cover removed, you'll find a well-designed interior allowing upgrades to be carried out swiftly, so reducing server downtime. Dual-processor slots are mounted at the top of the motherboard and covered with a large plastic duct to direct the air flow where it's needed most. The review model came fitted with a single 600MHz chip teamed up with 128MB of memory occupying one of the four DIMM slots alongside.

A unique feature is Dell's integrated PERC/2i RAID controller built around an embedded 100MHz Intel 80960RX processor. A separate DIMM socket sits alongside for cache memory and the controller is activated by purchasing a special hardware key and inserting it in a slot next to the memory modules. The RAID option was enabled on the review system and supported by 64MB of cache memory. For non-RAID operations, two SCSI chipsets are provided with an embedded Adaptec AIC-7880H servicing the 40-speed CD-ROM drive and two spare 5.25in bays. An AIC-7890 Ultra2 chipset looks after storage and is placed in a large cage, accessible from the front, which supports six 1in or four 1.6in hard disks. Dell only offers active backplanes for the storage cage and these are fitted with their own Adaptec SCSI chipset and support hot-plug drives. Note that installing the RAID key will automatically disable the 7890 chipset. A pair of 9.1GB Quantum Atlas V drives were fitted and configured in a RAID 1 mirrored array, although these Ultra160 drives will be of limited value as the RAID controller cannot utilise the higher speeds.

The 2400 offers the best expansion slot options with no fewer than five 33MHz, 64bit PCI slots. A single ISA slot shares a mounting plate with one of them while an extra 32bit PCI slot is located at the base. Standard systems come with a single power supply but an optional distribution board can be fitted, allowing a pair of hot-swap supplies to be added to the recipe.

Dell offers a comprehensive range of server management and monitoring tools. A full array of sensors on the motherboard means administrators can keep in touch with operating voltages, temperatures and fan activity. An optional Dell Remote Assistant card equipped with its own processor and modem allows the server to be monitored and managed remotely. The RAID controller comes with its own array management utility that can also be used to look after remote systems. Local diagnostics are dealt with by Dell's OpenManage Resolution Assistant and a bootable Server Assistant CD-ROM ensures your chosen OS is installed without any problems.

Performance results for the 2400 were average, although faster processors and more memory would have remedied this. Even so, the 2400 does offer a lot of server for your money, and the integrated RAID controller is particularly impressive.

HARDWARE SPECIFICATIONS
Motherboard: Dell
Chipset: ServerWorks Entry ServerSet III LE
FSB speed (MHz): 133
Processor type/speed: Pentium III 600
No of processors: 1
Max processors: 2
STORAGE
Hard disk: 2 x Quantum Atlas V
Total capacity (unformatted): 9.1GB (mirrored pair)
Controller type: Dell PERC 2/Si
Software: Server & Resolution Assistant

DETAILS

EDITOR'S CHOICE PCW COMPUTER WORLD

PRICE £2,349 (£1,999 ex VAT)
CONTACT Dell 0870 152 4850
www.dell.co.uk
PROS Very well designed and built with plenty of management and monitoring tools. Good fault tolerance provided by integrated RAID controller and hot-swap drive bay
CONS Average performance and supplied Ultra160 drives of limited value
OVERALL Easy to install and manage with a fine specification for the price. Good levels of fault tolerance on offer and the high levels of component integration leave plenty of room for expansion

BUILD QUALITY	★★★★★
PERFORMANCE	★★★
VALUE FOR MONEY	★★★★
OVERALL RATING	★★★★

evesham.com SE3200

ALONG WITH TOSHIBA and Mesh, evesham.com is sufficiently impressed with Intel's L440GX+ server motherboard that it has included it in its small-business server range. However, instead of using an Intel chassis as well it has opted to clothe the board in a box from Tiawanese-based In Win Developments. No, we haven't heard of this company either, but suffice to say that the IW-2000 chassis actually looks a better bet than the Intel alternative that is used by Mesh.

Build quality is as good as the Astor II but the extra depth of the SE3200 allows it to offer a better designed and laid out interior. A large hot-swap disk cage at the front has room for up to six 1in hard disks and evesham.com generously supplied a pair of 18.2GB Fujitsu Ultra2 drives held in sturdy metal carriers. Up above are three 5.25in bays with two home to an LG 40-speed IDE CD-ROM drive and a very useful OnStream ID30 tape drive. This is a better backup option than the HP T20 and DAT DDS-3 drives supplied elsewhere because, although it only offers a modest backup transfer rate of 60Mbytes/min, the sturdy cartridges have a high native capacity of 15GB, making the ID30 more suitable for high-capacity backup.

Physical security is better than on the Mesh server, since the front door can be locked to deny access to the hard disks, 5.25in bays and power and reset buttons. Dual power supplies provide limited fault tolerance as they are fitted in a special carrier that uses a single plug socket so there's nothing to stop the server being unplugged and shut down accidentally.

There's more room to manoeuvre inside because the disk cage doesn't foul the motherboard, so all components are in the clear. Normal SCSI services are looked after by an Adaptec AIC-7896N chipset, but evesham.com has fitted an Adaptec ARO-1130 RAID controller card. This uses the special RAIDport III slot and effectively upgrades the embedded SCSI chipset to perform as a RAID controller.

A single slot supports up to 64MB of EDO cache memory, although evesham.com only supplied the minimum 2MB. With the RAID card linked to the disk cage backplane, the review system had the Fujitsu drives configured as a RAID 1 mirrored pair. As they're perfect copies of each other, if one fails the system will continue uninterrupted using the other drive.

Monitoring is provided by Intel's Server Control, which gathers plenty of information about operating temperatures, cooling fan status and voltages from the motherboard sensors and displays it in an intuitive interface. Alert notification is extensive so you can configure Server Control to send a broadcast message if it spots a problem. In the event of a severe error or failure you can, for example, set it to close down the operating system and initiate a hardware reset or switch the server off completely.

Both the Adaptec RAID controller and embedded Intel network adaptor can be monitored and you can also keep an eye on other servers on the same network with the agent software installed. Adaptec provides a dedicated utility for managing the RAID controller as well, which offers an email option for notification of errors. The L440GX+ motherboard also offers a useful feature called PEP (Platform Event Paging) that is implemented in the BIOS. Should any significant system events occur frequently, the server can be configured to automatically call a pager using an external modem connected to one of the COM ports.

The SE3200 impressed in the benchtest stakes with SYSmark recording a respectable third place overall. Clearly, the L440GX+ motherboard is a speedy performer, although the differences between all the PIII 600MHz-endowed systems was relatively small. Even though the Mesh 700L stands out from the crowd for its higher specification, evesham.com's SE3200 looks a smarter long-term bet as the chassis is better designed and the RAID controller will pay dividends if you're running mission-critical applications.

HARDWARE SPECIFICATIONS
Motherboard: Intel
Chipset: Intel 440GX
FSB speed (MHz): 100
Processor type/speed: Pentium III 600E
No of processors: 1
Max processors: 2
STORAGE
Hard disk: 2 x Fujitsu MAE3182LC
Total capacity (unformatted): 18.2GB (mirrored pair)
Controller type: Adaptec ARO-1130
Software: Intel Server Control, OnStream Echo

DETAILS

PRICE £2,349 (£1,999 ex VAT)
CONTACT evesham.com
0800 038 0800 **www.evesham.com**
PROS A solid server-specific Intel motherboard teamed up with a substantially better chassis than the Mesh's Astor. Good overall performance; tape drive included; and the Adaptec RAID controller is a worthy addition
CONS Local management and monitoring not as good as some
OVERALL A balanced specification that provides good performance and plenty of fault tolerance. Good choice of backup tape drive and all housed in a well-designed chassis

BUILD QUALITY	★★★★
PERFORMANCE	★★★★
VALUE FOR MONEY	★★★★
OVERALL RATING	★★★★

Hewlett-Packard NetServer LC2000

LAUNCHED AT THE beginning of this year, the LC2000 is firmly aimed at small to medium-sized businesses, being as it is a replacement for HP's aging NetServer LC3. It's one of the largest servers on review and offers superb build quality and a completely revamped design. Dell may have pioneered the tool-free design, but HP caught on quickly as you can tell from this server. You don't need a screwdriver to remove or add any components because everything is secured using thumbscrews.

Three 5.25in bays sit behind the lockable front panel and are partnered by a large hot-swap disk cage beneath with room for up to six 1in hard disks. HP offers the least amount of storage for your money, though, as the review system only came supplied with a single 9.1GB HP-branded Seagate hard disk.

Internally, the LC2000 displays some excellent design concepts. Behind the disk cage is a full-height assembly holding no fewer than four cooling fans. In the event of a failure the entire module can be released with a single thumbscrew and pulled out for swift replacement without having to power down the server. The only downside is the LC2000 is easily the noisiest server here.

HP's mother-board occupies the main part of the chassis and the processor slots are mounted next to the lower two fans for maximum cooling and are protected by a large metal cage. Both connectors for the Symbios Ultra2 SCSI chipset, along with floppy and IDE channels, are located at the top of the board, so the ribbon cables can be routed underneath the top cover and kept well away from the motherboard. One power supply comes as standard, but this can be teamed up with an optional second supply for increased fault tolerance, and the units are easily removed from the rear of the chassis.

HARDWARE SPECIFICATIONS
Motherboard: Hewlett-Packard
Chipset: ServerWorks Entry ServerSet III LE
FSB speed (MHz): 133
Processor type/speed: Pentium III 533
No of processors: 1
Max processors: 2
STORAGE
Hard disk: Seagate ST39102LC
Total capacity (unformatted): 9.1GB
Controller type: Symbios 53C897
Software: NetServer Navigator, HP TopTools

Alas, the asking price for the review model we received only includes a single PIII 533MHz processor but the LC2000 does support speeds up to 800MHz. The poorer processing power undoubtedly had an impact in the benchtest, as a glance at the performance charts later in this group test shows HP lurking down in the basement for both tests. However, the tests show clearly the effects different components have on network performance, so a faster processor would undoubtedly have made an improvement. HP is another vendor that has dropped Intel in favour of ServerWorks with the LC2000 sporting the Entry ServerSet III LE core logic chipset which supports up to 4GB of PC133 SDRAM memory. Four DIMM sockets sit above the processors, with one holding a 128MB module.

Supplied on a bootable CD-ROM, HP's NetServer Navigator provides plenty of installation assistance while HP's Local TopTools for Servers offers a web-based interface for viewing server status and configuration. It provides a tidy row of tabbed folders so you can easily browse through CPU, memory and storage utilisation, view an event log and print reports on system status and configuration changes.

A new feature is Remote Administration (RA), which uses a dedicated serial port link for monitoring hardware on the motherboard. Local access to the server is via a null-modem cable or you can call in from a remote location using a modem link. RA allows the server to be controlled independently of the operating system and you can view statistics such as operating temperatures and voltages. If a fault is identified, RA can be configured to call a pager number from a predefined list.

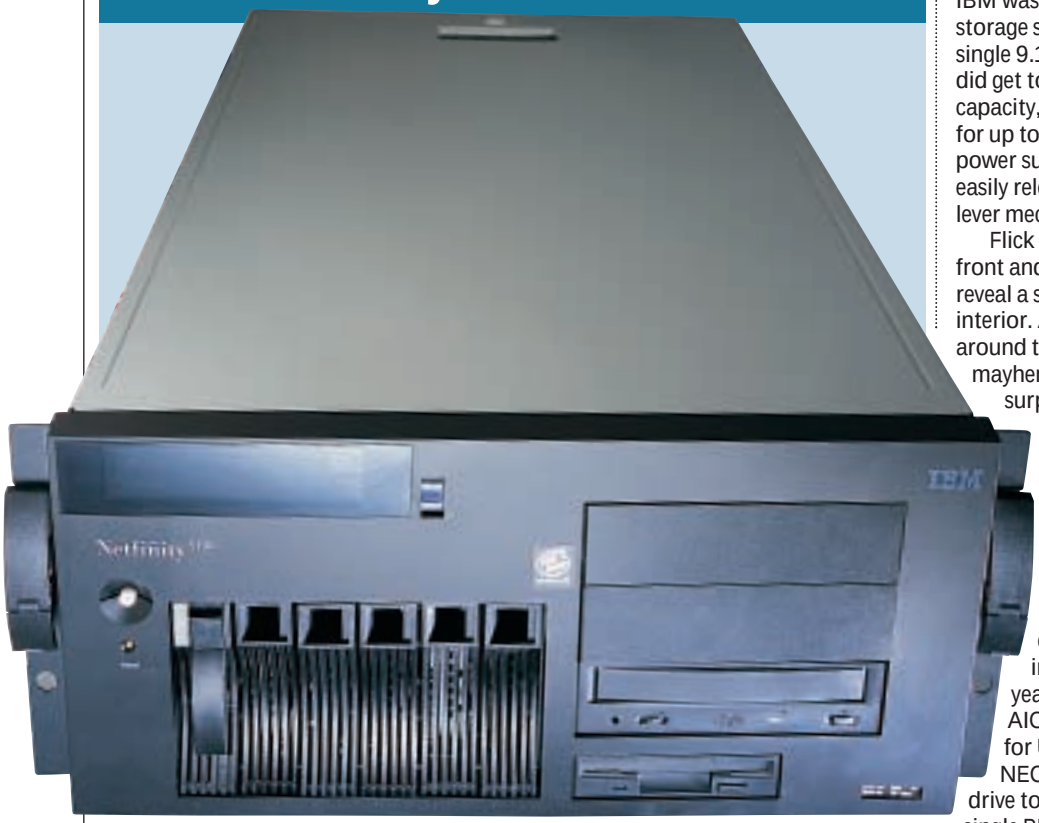
Although Hewlett-Packard's LC2000 server offers less hardware for your money, in terms of build quality and design the machine is nothing less than a standard setter. Management tools are also particularly good, while redundancy and expansion potential are excellent. The performance issues mentioned in the review can easily be remedied with a higher specification so, if these features are important to you, then this system should definitely be on your shopping list.

DETAILS

PRICE £2,089 (£1,777 ex VAT)
CONTACT Hewlett-Packard
0990 474747 **www.hp.com**
PROS Exemplary build quality and internal design; good expansion and fault tolerance, plus a host of remote management tools
CONS Weak specification resulting in low performance; very noisy cooling fans; only one year on-site warranty
OVERALL A modest specification for the price but superb build and expansion potential makes the LC2000 a good choice as a long-term investment

BUILD QUALITY	★★★★★
PERFORMANCE	★★
VALUE FOR MONEY	★★★★
OVERALL RATING	★★★★

IBM NetFinity 5100



THE NETFINITY 5100 is one of a range of four servers from IBM that are aimed at budget-conscious businesses looking for a good combination of price and performance. Clothed in IBM's trademark black chassis, the 5100 is available in standard tower or rack-mount versions – we looked at the latter for this review. Standing at 5U, or 8.75in high, up to eight units can be placed in an industry-standard 42U high rack assembly. As we've come to expect from IBM, build quality is among the best and its tool-free design enables swift upgrades and maintenance.

HARDWARE SPECIFICATIONS
Motherboard: IBM
Chipset: ServerWorks Entry ServerSet III LE
FSB speed (MHz): 133
Processor type/speed: Pentium III 667
No of processors: 1
Max processors: 2
STORAGE
Hard disk: IBM DNES-309170Y
Total capacity (unformatted): 9.1GB
Controller type: Adaptec AIC-7899G
Software: ServerGuide, NetFinity Manager

For first-time installation, IBM provides its ServerGuide bootable CD-ROM. No operating system had been installed prior to delivery so we called upon this utility for assistance and found it very easy to use. It begins with a system scan and then loads the most appropriate drivers before installing your chosen network operating system.

You also get plenty of other utilities including a driver disk and book factory, online help and a System Information Tool that gives you the lowdown on installed hardware. IBM's NetFinity Manager software links up with an integrated Advanced System Management processor on the motherboard to provide detailed management and monitoring facilities. Although we found the Service Manager interface rather clunky, it does provide plenty of useful information. You can monitor system health, run hardware and software inventories and stay ahead of hard-disk failures with a Predictive Failure Analysis tool. Many of these features can be extended to remote systems running the NetFinity Client. Full alerting is provided, although this was complex to set up. However, if a problem is detected, the software can send a warning message, dial a pager or execute a program.

The front panel is endowed with a useful LED status display showing power and system status, the number of processors installed, network speed and activity, plus fault notification. The latter indicator ties in neatly with an LED panel on the motherboard called a 'light path indicator'. This shows any error conditions identified with the various system components, making it easy to locate the problem area. Below this is a large hot-swap disk cage with room for up to six 1in hard disks. Along with HP, IBM was the least generous in the storage stakes as it only supplied a single 9.1GB IBM Ultra2 hard disk. It did get top marks for power redundancy capacity, though, as the 5100 has room for up to three compact hot-swappable power supplies at the rear that are easily released with a simple clip and lever mechanism.

Flick down the small lever at the front and the top panel slides back to reveal a spacious and well-designed interior. All connectors are arranged around the edge keeping cable-related mayhem to a minimum. There are no surprises in the core logic department as ServerWorks (formerly Reliance Computer Corporation) gets the job with its Entry ServerSet III LE offering a 133MHz FSB and full support for PC133 SDRAM. IBM is a long-time supporter of the ServerWorks chipsets, having implemented it in its servers for a number of years now. An integrated Adaptec AIC-7899G chipset offers support for Ultra160 drives but, as with NEC, IBM chose to fit an Ultra2 drive to keep within our price limit. A single PIII 667MHz module fills one of the processor slots but Intel doesn't get the networking job as this is handled by an integrated AMD PCnet server adaptor. Add the 128MB of PC133 memory and you would expect a reasonable performance from the 5100. However, we were disappointed to see it lounging down in ninth place for the Ethernet test, although this did improve noticeably for the Fast Ethernet test. The network card can often be a bottleneck when under heavy load, so we added an Intel Pro100+ PCI server adaptor and re-ran the Fast Ethernet test. This clawed back only a few seconds but enough to raise the 5100 to fifth place.

DETAILS

PRICE £2,290 (£1,949 ex VAT)
CONTACT IBM 0990 727 272
www.ibm.com
PROS Exemplary build quality and design. A wide array of management and monitoring software, plus a good specification that includes an Ultra160 SCSI chipset
CONS Single 9.1GB Ultra2 hard disk; average performance. Management software is not the easiest to use and could do with updating
OVERALL A quality rack-mount server with good internal design and specification. Performance was not the best, but the 5100 can be easily upgraded with a wide range of options

BUILD QUALITY	★★★★★
PERFORMANCE	★★
VALUE FOR MONEY	★★★
OVERALL RATING	★★★

Mesh 700L

INSTEAD OF producing a server using a variety of off-the shelf components, Mesh has taken the simple expedient of sourcing not only the motherboard, but also the entire chassis from Intel. The 700L comes clothed in Intel's Astor II server chassis, equipped with the same L440GX+ server motherboard as found in Toshiba's Magnia 3030. Since both components are specifically designed for servers, the 700L is very much up to the task at hand.

HARDWARE SPECIFICATIONS
Motherboard: Intel
Chipset: Intel 440GX
FSB speed (MHz): 100
Processor type/speed: Pentium III 700
No of processors: 2
Max processors: 2
STORAGE
Hard disk: Quantum Atlas 10K
Total capacity (unformatted): 18.2GB
Controller type: Adaptec AIC-7896N
Software: Intel Server Control, Stac Replica Backup

The Astor has a comparatively small chassis but offers plenty of room for expansion as it has a large hot-swap drive bay at the front, with room for five 1in high hard disks. One carrier was fitted with an 18.2GB Quantum Atlas Ultra2 drive and, once more drives are added, an LED status display alongside shows when they can be safely removed without powering the server down.

As with the Magnia, one PCI slot supports a RAID controller, although in this case it'll be Adaptec's ARO range of PCI cards. Only two 5.25in. bays are provided and both were occupied by a Teac CD-ROM drive and an HP SureStore T20 tape drive. The latter offers transfer rates similar to the DAT DDS-3 tape drives supplied by NEC and Viglen, but the Travan TR-5 based cartridge's native capacity of 10GB is already being stretched by the supplied 18GB hard disk.

Chassis security is rudimentary. The side panel and hard-disk door need to be padlocked shut, although an intrusion switch can be fitted and linked to the management software. If the chassis is breached for any reason, the software can be configured to lock the keyboard or even power the server down.

Internally, Mesh's 700L offers far less room than the Magnia 3030, mainly due to the depth the hard-disk cage extends into the chassis. A pair of large cooling fans are fitted to the rear and the entire assembly completely obscures access to the IDE connectors. The single Ultra2 channel offered by the embedded Adaptec AIC-7896N chipset looks after the hard-disk cage while the Ultra Wide channel is linked to the tape drive.

Installation assistance is not provided by Mesh because the company's servers are generally configured with the required network operating system before they are dispatched to the customer. However, benchtesting the 700L got off to a poor start as we were unable to network the server. The diagnostics tab on Intel's ProSet utility showed the adaptor drivers for the embedded Pro100+ chipset had failed to load and it was only after some extensive investigation that we found networking had been disabled in the Windows NT hardware profile. A bad slip-up on Mesh's part but, with this tick-box unchecked, the server proceeded to behave itself and promptly posted the best scores for the entire performance test. The 700L may only have a 100MHz FSB and PC100 memory, but the pair of PIII 700MHz processors and 256MB of memory clearly had a significant impact.

As you'd expect, management is well catered for with Intel's Server Control software, although Mesh forgot to include this so we had to borrow the copy supplied by Toshiba. Software agents can be installed to other Intel-based servers on the network allowing them to be monitored and controlled remotely from a single console. The server can also be accessed independently of the operating system as the 440GX+ board allows COM2 to act as an emergency management port (EMP). Console software for Windows 95/98 provides access either via a direct serial cable link or remotely over a modem and with this in action you can reset the server, power it off and on or view the motherboard sensor data.

There's no doubt that Mesh is offering a lot for your money, making the 700L a good choice for small businesses that happen to be on a tight budget. However, if you're prepared to sacrifice some memory and the second processor, you could choose HP's LC2000, for example, which offers far superior build, design and expansion potential.

DETAILS

PRICE £2,231 (£1,899 ex VAT)
CONTACT Mesh 020 8208 4706
www.meshplc.co.uk
PROS Top performance for a low price; dual processors; 256MB of memory and plenty of storage
CONS Restrictive internal design; sloppy configuration prior to delivery
OVERALL A budget-priced server with a fine specification that delivers excellent network performance. Room for future expansion although internal design is cluttered

BUILD QUALITY	★★
PERFORMANCE	★★★★★
VALUE FOR MONEY	★★★★
OVERALL RATING	★★★

NEC Direct Express5800/120Ld

ALTHOUGH NEC IS a comparative newcomer to the server marketplace, the company has managed to build up an impressive range of products. However, earlier entry-level server products from NEC failed to impress because they were built around non-server-specific motherboards and had more in common with PCs. Not so with the Express5800/120Ld, though, as it offers a fine list of features for the price and they're all housed in a purpose-built chassis.

Physical security is good as the lockable front door bars access to the power switch, front bays and thumbscrews for the side panels. Three 5.25in bays are available with one occupied by an LG 40-speed IDE CD-ROM drive and a second is home to an Archive Python DAT DDS-3 drive offering native transfer rates of around 60Mbytes/min. However, considering the server's storage potential the 12GB, native capacity of the DDS-3 format will be insufficient for all but the most basic of backups. You have two choices for hard-disk storage: you either use the basic fixed disk cage underneath the expansion bays with room for four 1.6in drives, or the hot-swap cage supplied with the review model, which has room for six 1in drives. Our review unit had two slots filled holding a pair of 9.1GB Seagate Ultra2 drives enclosed in solid carriers. NEC also offers optional Mylex RAID controllers should you wish to add fault tolerance to your storage options.

Good build quality doesn't extend to the side panels as these are comparatively flimsy and difficult to replace once removed. Internal design is more impressive, though, as the 120Ld uses a similar layout to HP's LC2000. The drive bay assembly is positioned in a dedicated section at the front and partnered by a pair of large cooling fans. These are held in position by a single screw so they are relatively easy to remove and replace in the event of a failure but, unlike the LC2000, the server must be powered down first. NEC's well-designed motherboard takes up the lion's share of the interior, with the pair of processor slots mounted at the top next to another large cooling fan. The review model came supplied with a single PIII 600EB module, but the 120Ld supports dual processors at speeds up to 733MHz. No surprises in the core logic department as ServerWorks makes yet another appearance with its Entry ServerSet III LE chipset. Along with a 133MHz FSB it offers support for up to 4GB of SDRAM. Four DIMM sockets are sited alongside the processor slots, of which one is fitted with a 128MB module. Integrated graphics and network adaptors keep all the expansion slots free, so you have a choice of three 64bit PCI, three 32bit PCI slots and a single ISA slot.

SCSI services are particularly well catered for with the integrated Ultra160 Adaptec AIC-7899G chipset. One channel is connected to the disk cage backplane while the second is routed through to the rear panel for external devices. Alas, the high SCSI transfer rates on tap had no impact in the performance tests as NEC could only supply 80Mbytes/sec Ultra2 drives for the price. Of all the servers equipped with 600MHz processors, the 120Ld came out as the slowest in both Ethernet and Fast Ethernet tests (see performance graphs).

Server configuration and NOS (network operating system) installation is aided by NEC's Express Builder utility supplied on a bootable CD-ROM. This provides an intuitive menu system to get your server up and running with the minimum of fuss. Plenty of quality management tools are provided by the EsmPro Suite, which uses the embedded sensors on the motherboard to keep track of voltages, temperatures and fan operation. Other servers and workstations can be monitored remotely with the appropriate agent software installed and the server's COM2 serial port doubles up as an EMP (emergency management port) allowing the server to be controlled directly from another system or remotely via a modem connection.

HARDWARE SPECIFICATIONS
Motherboard: NEC
Chipset: ServerWorks Entry ServerSet III LE
FSB speed (MHz): 133
Processor type/speed: Pentium III 600EB
No of processors: 1
Max processors: 2
STORAGE
Hard disk: 2 x Seagate ST39175LC
Total capacity (unformatted): 18.2GB
Controller type: Adaptec AIC-7899G
Software: Express Builder, EsmPro Suite

DETAILS

PRICE £2,349 (£1,999 ex VAT)
CONTACT NEC 0870 010 6322
www.neccomp.com
PROS Good internal design with high expansion potential; Ultra160 SCSI chipset and an abundance of management tools
CONS Comparatively poor performance; build quality not as good as many other manufacturers; supplied tape drive of limited value
OVERALL A good choice as a first server with plenty of room to grow with demand, although it's let down by a below par performance

BUILD QUALITY	★★★
PERFORMANCE	★★
VALUE FOR MONEY	★★★
OVERALL RATING	★★★

Toshiba Magnia 3030

TOSHIBA STARTED producing servers at the beginning of 1999, but it was only at the end of the year that it decided the time was right to make an assault on the UK market. The 3030 is the latest member of the Magnia family and is aimed directly at the workgroup and small to medium enterprises business sector. Initial impressions are good as the Magnia 3030 looks well built and offers plenty of expansion potential, allowing the system to grow with your business.

HARDWARE SPECIFICATIONS
Motherboard: Intel
Chipset: Intel 440GX
FSB speed (MHz): 100
Processor type/speed: Pentium III 600E
No of processors: 1
Max processors: 2
STORAGE
Hard disk: 2 x IBM DNES 309170Y
Total capacity (unformatted): 18.2GB
Controller type: Adaptec AIC-7896N
Software: Server Setup, Intel Server Control

A hot-swap disk cage with room for six 1in hard disks is located at the front. The review model came equipped with a brace of 9.1GB Ultra2 IBM hard disks, but filling the unit with 18.2GB drives would provide a huge 109GB of storage capacity. The drives are held in sturdy metal carriers that are kept in place by a simple plastic locking panel on the front of the unit. The front door is separated into two parts so you can secure the drive bays and leave the three 5.25in bays open or, alternatively, lock the whole lot away from wandering fingers. Power redundancy is also an option as the chassis has room for a second hot-swap supply at the rear.

When we removed the side panel the first thing we noted was that Toshiba doesn't actually manufacture its own mother-boards, but uses the same Intel L440GX+ server board as Mesh and evesham.com. Although it only provides a 100MHz FSB and support for 2GB of PC100 SDRAM, it's clear that choosing the right hardware specification will deliver good network performance. Even though the Magnia 3030 only came equipped with a single PIII 600 processor and 128MB of memory, it still put in a very creditable performance in both the SYSmark tests we carried out (see performance results later in the group test).

Processor cooling is high on the agenda as both slots are hidden behind a large metal fan cage that pulls air directly across the modules and shunts it out the back. Upgrade manoeuvres won't be hindered for long, though, because the unit is only held in place by two thumbscrews and can be removed within seconds.

Both the drive bay and power supply assembly are partnered with two fans each, but even so the 3030 was surprisingly quiet during operation. An integrated Adaptec AIC-7896N chipset deals with storage and provides Ultra2 and Ultra Wide channels with the former connected to the disk cage backplane. Two IDE channels are also on offer with one servicing a 40-speed CD-ROM drive.

Graphics are handled by a simple but effective Cirrus Logic chipset, while network duties are, of course, handled by an integrated Intel Pro100+ chipset. This arrangement leaves all expansion slots free and a RAID array is a distinct possibility since one of the PCI slots can support optional AMI single or dual-channel RAID controller cards.

Toshiba failed to carry out our request for a pre-installed operating system, but at least this lapse gave us an opportunity to use its Server Setup utility. Booting the server from the supplied floppy disk and CD-ROM takes you to an intuitive menu system where you can create driver disks, install a utility partition and load your chosen operating system. Once you've supplied all the necessary information, the setup utility gets on with the job, requiring little further operator intervention, but Toshiba ensures there's plenty of help to hand throughout this process if you need it. As with the Mesh server, management comes courtesy of Intel's LANdesk Server Manager Utility. This keeps an eye on areas such as processor and chassis temperatures, along with operating voltages, and can be configured to send network messages and even shut the server down automatically if a fault is detected.

Comparing the Magnia 3030 with Mesh's well-endowed 700L shows the Toshiba alternative to be a more costly choice because you get far less hardware for your money. However, overall build quality and internal design are far better and the performance is quite respectable.

DETAILS

PRICE £2,256 (£1,920 ex VAT)
CONTACT Toshiba 01932 828 828
www.toshiba.co.uk
PROS Good build quality; plenty of internal cooling; big-name brand
CONS Intel motherboard only has a 100MHz FSB and the Mesh alternative offers more hardware for less cash
OVERALL Comparatively expensive, but a promising entry into the server market from Toshiba. Uses the same motherboard as Mesh, but has a far better internal design with tool-free maintenance

BUILD QUALITY	★★★
PERFORMANCE	★★★
VALUE FOR MONEY	★★
OVERALL RATING	★★★

Viglen CX1

PRIOR TO THE RELEASE of the CX-1 in 1999, Viglen had always insisted on using Intel motherboards in its servers, but this time around it has opted for a SuperMicro board. The P6DBU motherboard does offer plenty of useful features, but it's getting on a bit now and is not specifically designed for server applications. Consequently this server's expansion potential, internal design and management options are somewhat restricted. The unit comes bundled with Intel's LANdesk Client Manager software that is aimed at administering other networked PCs. However, to see what's going on locally you need to install the client software, which cannot co-exist with the administrator utility. The LANdesk client can access some of the motherboard sensors, but it pales into insignificance when compared with the software supplied by companies such as Dell, Compaq and Hewlett-Packard. Viglen also pre-installed Computer Associates' UniCenter TNG management software, but this is a complex product that's pitched more at enterprises than the small-business market.

The CX-1 comes enclosed in a compact chassis but inside you'll find that the poor design and limited space will severely hamper upgrades and maintenance. Two processor sockets are provided with one holding a PIII 650MHz chip. The server comes with 128MB of SDRAM memory and three DIMM sockets are left free for further expansion, but reaching them will be difficult as the hard disk and floppy drive cage is mounted directly in front of the sockets and blocks access completely. In fact, it is so close it's actually resting against the installed memory module. Inside the cage you'll find a single 9.1GB Fujitsu Ultra2 hard disk with room for two more drives. Up above are three 5.25in bays with one holding a 40-speed CD-ROM drive and the second home to an HP DAT DDS-3 SCSI tape drive. The tape drive is partnered by a copy of Veritas' Backup Exec for Windows NT/2000/NetWare that includes the intelligent disaster recovery option.

Access to the interior of the server requires the entire shell to be removed. You cannot secure the shell in place, so physical security is at a minimum. However, an intrusion detection microswitch is located inside and this will notify you if the case has been removed – provided you have loaded up the supplied Super Doctor and LANdesk Client Manager software utilities. Also, there's no protection for the power and re-set switches at the front.

Integration is another casualty on the SuperMicro board as the only embedded chipsets are an Adaptec AIC-7890AB and AIC-3860Q which, between them, offer Ultra2, Ultra Wide and Narrow SCSI connectors. It's also worth noting that these are all located behind the hard-disk cage as well. However, Viglen does get a pat on the back for fitting a pair of Intel Pro100+ PCI network adaptor cards. Using the latest onboard 82559 chipset these cards support adaptor teaming and adaptive load balancing, so you can add fault tolerance to your network connection – if one card fails, all network traffic will be switched to the other. Using only one network card for the benchtest delivered an average performance with the CX-1 taking sixth place in the Fast Ethernet benchtests. Adaptor teaming should improve performance and we tried running the Fast Ethernet benchtest with both cards connected to the dual-speed switch, but saw no significant improvements.

Communications are well catered for as you can take advantage of fast Internet access using the Eicon Diva Pro PCI ISDN card that comes with a copy of RVS-COM Lite for fax and voicemail applications. Viglen also included an external 3Com 56K voice modem as well. Two PCI slots are still available with one supporting Adaptec's ARO1130 RAID controller cards, but the two ISA slots at the base will be of limited value.

The CX1 is let down mainly by its use of a non-server-specific motherboard and a chassis that is more suited to a desktop PC. Viglen does bundle plenty of extras but, at £1,999, the CX1 still doesn't offer great value.

HARDWARE SPECIFICATIONS
Motherboard: Supermicro
Chipset: Intel 440BX
FSB speed (MHz): 100
Processor type/speed: Pentium III 650
No of processors: 1
Max processors: 2
STORAGE
Hard disk: Fujitsu MAE3091LP
Total capacity (unformatted): 9.1GB
Controller type: Adaptec AIC-7890AB
Software: Intel Client Manager, Veritas Backup ExecHard disk: Fujitsu MAE3091LP

DETAILS

PRICE £2,349 (£1,999 ex VAT)
CONTACT Viglen 020 8758 7000
www.viglen.co.uk
PROS Plenty of useful extras including dual network adaptors, a tape drive partnered with good backup software and an ISDN card
CONS Limited expansion potential and awful internal design will make upgrades and maintenance a nightmare
OVERALL A PC-based motherboard and chassis masquerading as a server. The CX1 will do the job and Viglen does include plenty of extras, but there are far better bargains on offer elsewhere in this group test

BUILD QUALITY	★
PERFORMANCE	★★
VALUE FOR MONEY	★★
OVERALL RATING	★★

Choosing the right network infrastructure

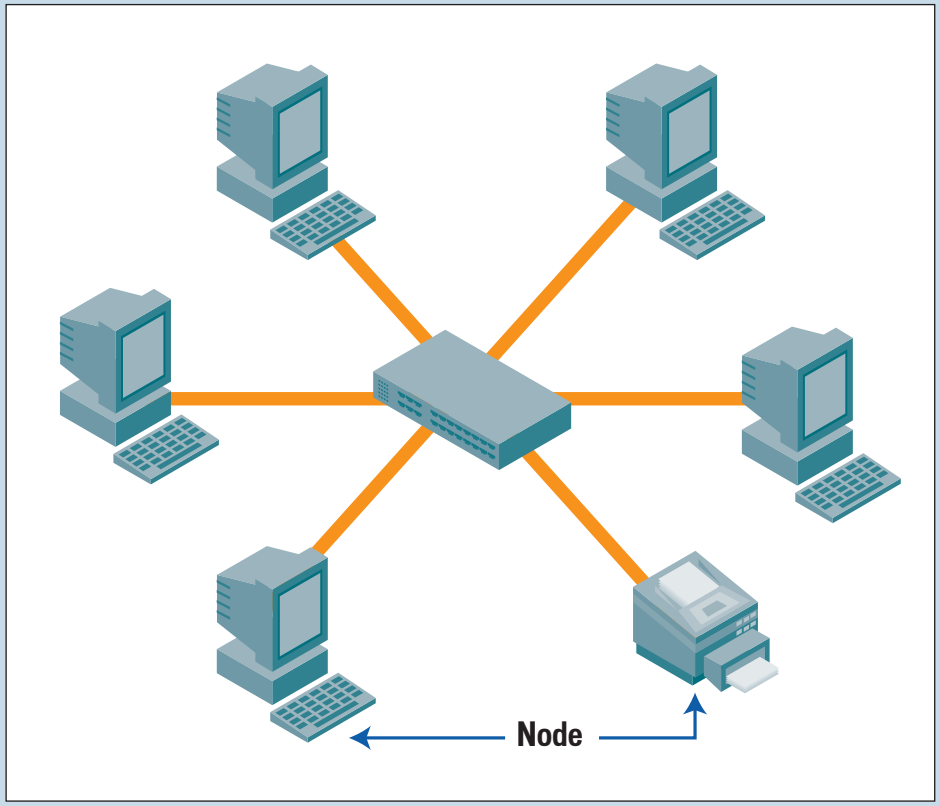
Getting your new server up and running and on the network is only a small part of the big picture – you also need to consider carefully what type of networking infrastructure will suit your company best. It goes without saying that all users will be connected over Ethernet, but the key to choosing the right networking products is understanding the needs of your business and its potential for expansion.

The most common form of network connection is over UTP (unshielded twisted pair) cable or 10BaseT with each user linked to a hub. This device creates a star topology where the hub is the central point with all connections radiating outwards. If a cable fails, only that link is affected and all others continue to function normally. The specifications of 10BaseT dictate that cable lengths are limited to 100m, but you can go beyond this by adding more hubs. Called cascading, one port on each hub is used to connect two devices together, although this also has a limit as end-stations cannot be separated by more than four hubs or five wiring segments.

Most small businesses indulging mainly in file and printer sharing will find 10Mbits/sec Ethernet provides all the bandwidth they need. However, the amount and variety of data being shunted around many of today's networks can easily soak this up so the next option is Fast Ethernet.

Fundamentally, this is no different to standard Ethernet and uses the same method of collision detection, although bit timings – the time taken for each bit of information to be transmitted – are reduced by a factor of 10 for a 10-fold increase in performance to 100Mbits/sec.

One of the biggest issues with Ethernet networks is that maximum throughput will never be reached. Ethernet is a connectionless service over shared media – when data is transmitted it is sent to every other node on the network and only one packet of data can be on the wire at any one time. If two packets are transmitted at the same time they will collide so each station must back off for a random period and re-transmit. Unfortunately, as more data is transmitted, collisions increase and eventually the network reaches a stage called thrashing where no data is actually reaching its destination.



Top: An Ethernet network using a star topology
Left: Gigabit switches are still very expensive

An Ethernet switch can reduce these effects as it reads the addresses contained in each data frame's header and only sends them to the port where that device is connected. By creating a virtual connection between the stations the switch is segmenting the network into smaller collision domains. Implementing a switch doesn't mean your hubs have to go as they can be linked directly to the switch ports allowing groups of users to receive a dedicated 10 or 100Mbits/sec pipeline from the switch.

Switches also support full duplex mode which transmits and receives data on separate wire pairs so collisions on this cable length won't occur. All the servers on review have dual-speed network adaptors that support this so you could easily create a high-speed 200Mbits/sec pipeline for improved user access. You'll also need a switch if you want to use multiple network cards in your server to take advantage of adaptor teaming and fault-tolerant links.

Network speed can be increased further, but the next step is not suited to small businesses due to high costs. Gigabit Ethernet offers a massive speed increase to 1000Mbits/sec and is aimed at backbone or large server farm connections. Originally designed to run over long-distance fibre-optic links, the latest Gigabit specification now allows it to utilise standard Category 5 copper cabling making it ideal for high-speed server links.

There are plenty of dual-speed switches on the market now with optional Gigabit uplink modules and vendors such as 3Com and Intel offer Gigabit PCI server cards, although you can expect to pay upwards of £500 for a single fibre-based card – around a quarter the cost of your new server.

Intel 01793 431155
3Com 0800 225252

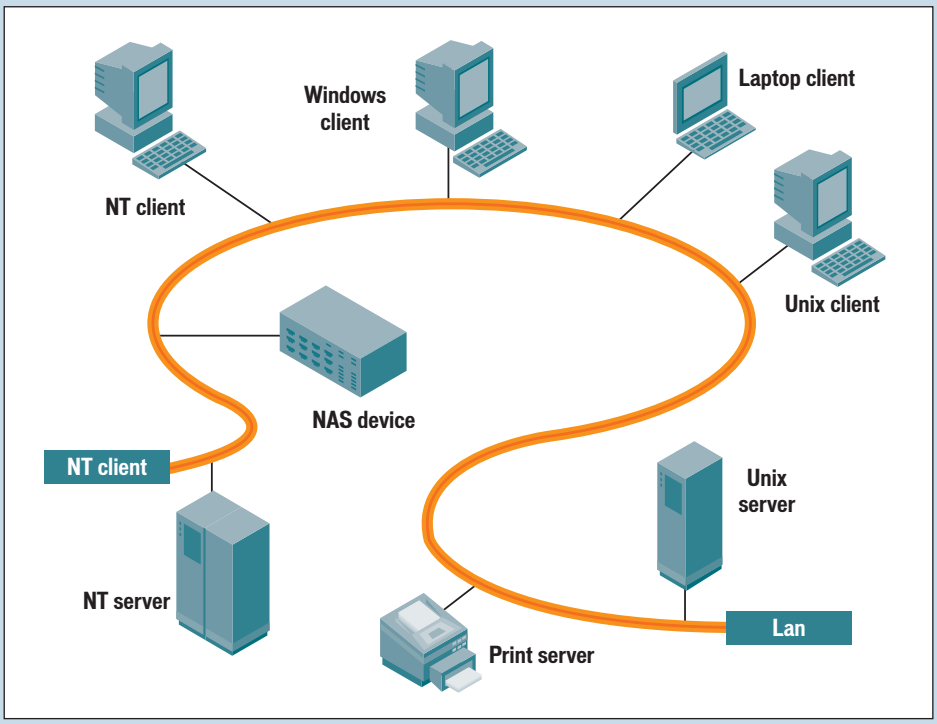
NAS and SAN: what's the difference?

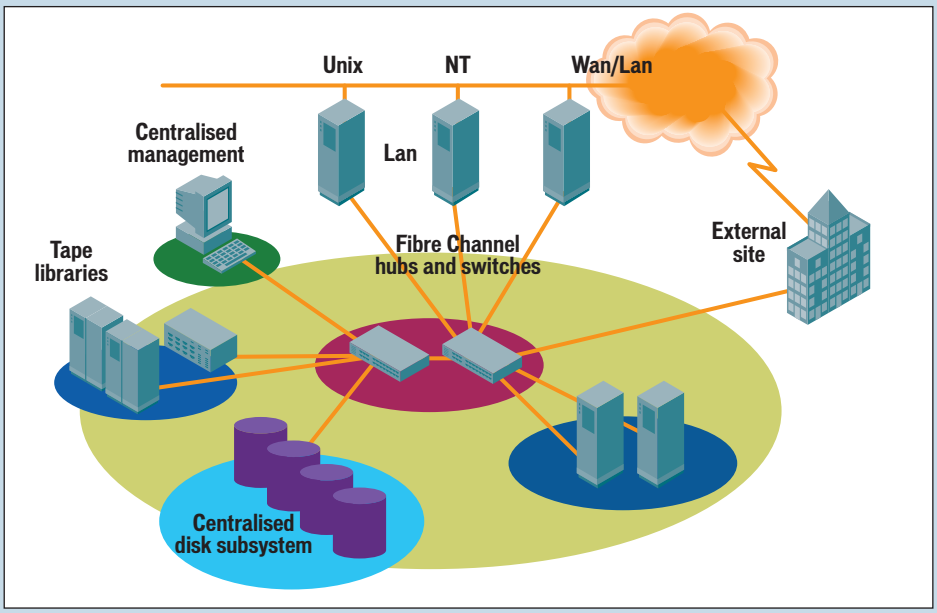
The increasing number and variety of network applications is fuelling a data explosion. To keep up with this demand, administrators must upgrade server storage, which will involve scheduling out-of-hours maintenance periods, powering down the server, installing and configuring new disks and then hoping it all comes back up safely. Both SAN (Storage Area Networks) and NAS (Network Attached Storage) are architectures aimed at relieving this pressure on servers. However, although they may sound similar they are totally different technologies. A small business is more likely to be interested in the NAS appliance so we'll look at this first.

NAS comprises drive arrays that connect directly to the network and appear to users as large hard disks. The array is contained within a dedicated system box that has its own control hardware and OS and generally has a web browser interface for management and configuration from a networked workstation. NAS appliances are designed to overcome the storage crisis as they can be plugged straight into the network as required without affecting servers and key services – as storage demands increase you just add more boxes.

Hard disk manufacturers, Quantum and Maxtor, have their own solutions with the Snap! Server and MaxAttach devices. The Snap! Server comes in 15GB, 30GB, 60GB, and 120GB models with the two- and four-drive 2000 and 4000 versions offering RAID 0 and 1 mirroring and striping. Maxtor's alternatives are the MaxAttach 3000 and 4000, with the latter offering up to 160GB of storage and both support RAID levels 0 and 1. In both cases you just plug the appliances in, connect them to the network and configure them using a web browser.

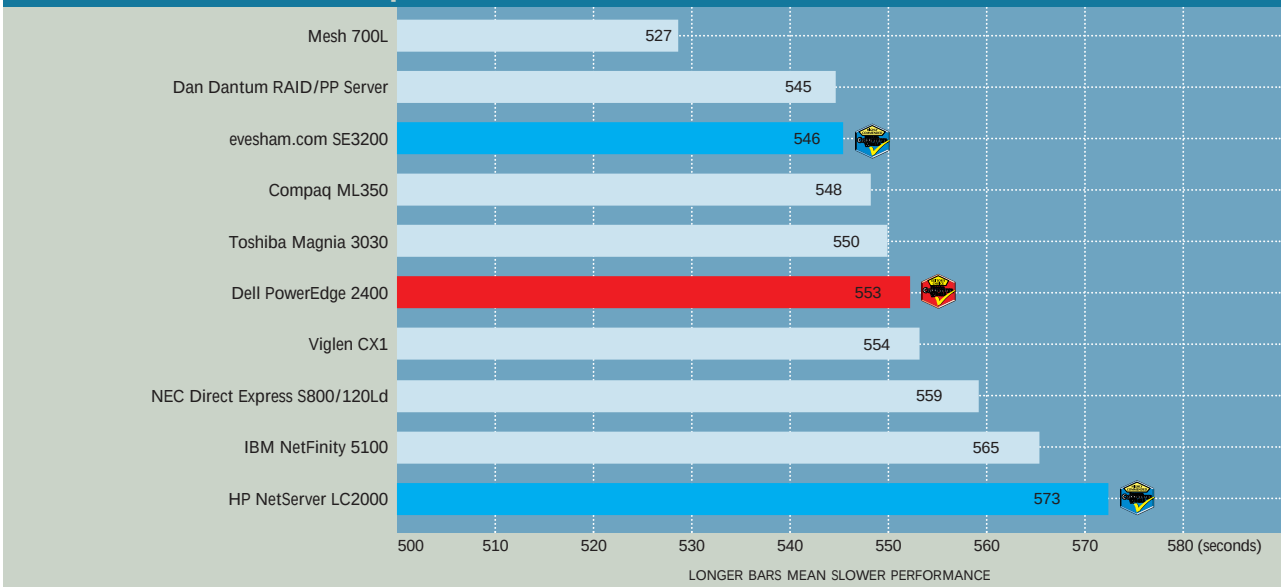
The SAN concept aims to place all storage devices on a separate, dedicated network. Taking hard-disk arrays and tape libraries away from servers and placing them on the SAN frees up resources as the servers no longer need to control them. SAN devices become a shared resource accessible to all servers on the main network. This allows data to be managed more efficiently and, as with NAS appliances, more storage can be added without impacting general operations. A big advantage of the SAN is that storage devices can be placed in separate data centres away from the main building. Mirroring of mission-critical data to a secondary site can easily be done too, so in the event of a failure at the primary site, data recovery is virtually instantaneous. Fibre Channel is an increasingly popular method of connecting SAN devices together. It supports up to 127 devices with 100Mbytes/sec transfer rates and distances of up to 30m for copper and 10km for fibre. The SAN network is controlled by Fibre Channel switches that are, in turn, linked to the network servers using SCSI-to-Fibre Channel adaptors. The SAN is an ideal solution for large networks as it scales easily and frees up vital server resources for increased performance.



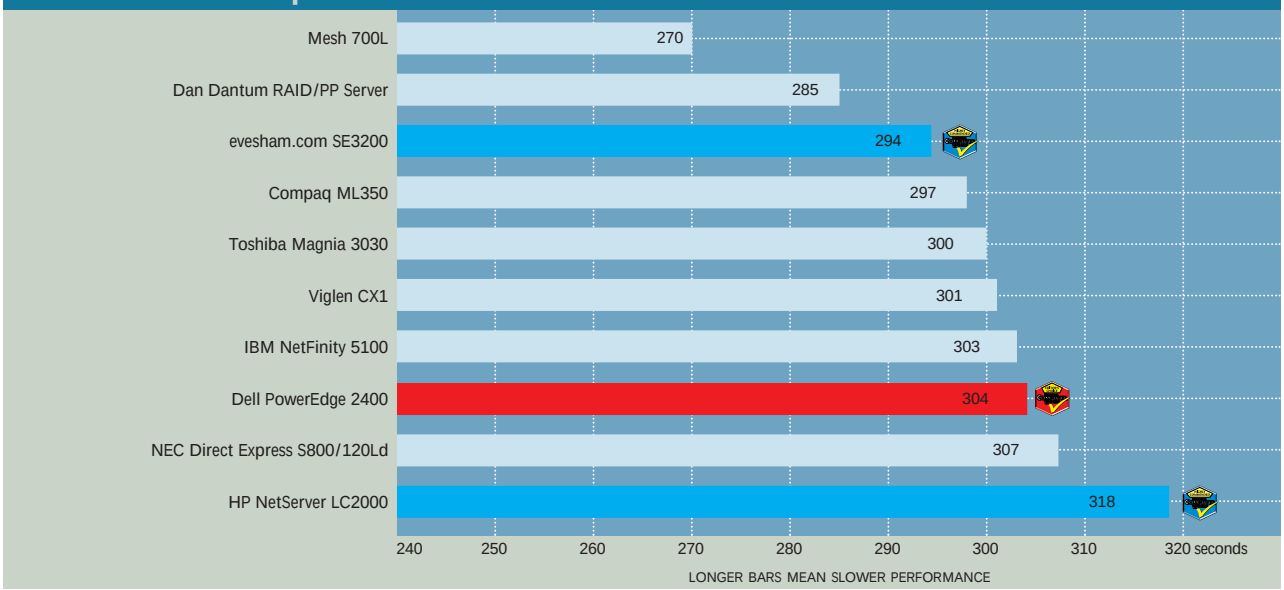


Top: NAS appliances can be easily added directly onto the network as required
Above: The SAN separates all storage devices from servers and places them on a dedicated network

Standard Ethernet performance



Fast Ethernet performance



How we did the tests

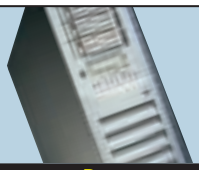
In an average office a server will be dealing with many different types of requests, from file and printer sharing through to complex database queries. BAPCo's SYSmark for File Servers measures network performance by loading a suite of nine applications on the server and running them simultaneously from multiple client PCs attached over a network. The suite is designed to cover a wide range of business activities such as email, word processing, graphics design and database queries. Each server had Windows NT Server 4 installed with Service Pack 6a applied. SYSmark includes tools for creating user names for each client and setting up network shares on the server's hard disk.

The client workstations do not require any software other than DOS and Microsoft's client re-director, as each application in the test suite is loaded from the server before being run locally. A small batch file is also created on each client that assigns a unique number to each workstation. This determines which application in the suite it will start first and creates a more realistic test scenario as the server will be forced to cope with multiple requests for different applications and their associated data. A control workstation monitors each client and notifies the tester when all workstations are logged in and synchronised. It then issues simultaneous 'go' commands to each client causing them to start running the benchtest.

As each application loads onto the client it runs predefined instructions from a macro or a script created with Microsoft's Test utility. A complete report is then produced showing the times each client took to complete the test suite.

As all clients and servers had dual-speed network cards we ran SYSmark across standard 10Mbits/sec Ethernet and 100Mbits/sec Fast Ethernet to give a clear indication of the benefits of the higher network speeds. After these tests the clients and test server were reconnected to an Intel Express 510T dual-speed Ethernet switch so each had a 200Mbits/sec full duplex link. The run times were reduced by almost 50 per cent in some cases.

Table of features

Manufacturer	Compaq	Dan	Dell	evesham.com
Product	**ML350**	**Dantum RAID/PP Server**	**PowerEdge 2400**	**SE3200**
Price inc VAT (ex VAT)	£2,026 (£1,724)	£2,148 (£1,828)	£2,349 (£1,999)	£2,349 (£1,999)
Telephone	0845 270 4000	0870 444 7020	0870 152 4850	0800 038 0800
Chassis				
h x w x d (mm)	467 x 212 x 670	541 x 225 x 464	442 x 260 x 600	425 x 220 x 570
PSU rating (Watts)	300	250	330	337
Standard/max PSUs	1/1	1/1	1/2	2/2
Hardware specs				
Motherboard	Compaq	SuperMicro	Dell	Intel
Chipset	ServerWorks Entry ServerSet III LE	Intel 840	ServerWorks Entry ServerSet III LE	Intel 440GX
FSB speed (MHz)	133	133	133	100
Processor type/speed	Pentium III 600EB	Pentium III 700	Pentium III 600	Pentium III 600E
No of processors/max processors	1/2	1/2	1/2	1/2
Memory				
RAM ftted/maximum RAM	128MB/2GB	256MB/4GB	128MB/2GB	128MB/2GB
Free/total sockets	3/4	2/4	3/4	3/4
Storage				
Hard disk(s)	2 x Fujitsu MAE3091LP	3 x Quantum Atlas IV	2 x Quantum Atlas V	2 x Fujitsu MAE3182LC
Total capacity (unformatted)	18.2GB	9.1GB (mirror + spare)	9.1GB (mirrored pair)	18.2GB (mirrored pair)
Controller type	Symbios 53C896	Adaptec AAA-130U2	Dell PERC 2/Si	Adaptec ARO-1130
Controller location	PCI Card	PCI Card	Motherboard	PCI Card
Other controllers	IDE (2)	IDE (2)	Adaptec AIC-7890 (disabled) Adaptec AIC-7880	Adaptec AIC-7896N IDE (2)
Network interfaces				
Model	Compaq NC3163	Intel Pro100+	Intel Pro100+	Intel Pro100+
Location	PCI Card	Motherboard	Motherboard	Motherboard
Slots free/total				
64bit PCI	2/2	2/2	5/5	2/2
32bit PCI	3/4	3/4	1/1	3/4
ISA	1/1	0/1	1/1	1/1
AGP	0	0	0	0
Drive bays free/total				
Front 5.25in	2/3	0/4	2/3	1/3
Front 3.25in	2/4	0/2	4/6	4/6
Internal 5.25in	0/0	0	0/0	0
Internal 3.25in	0/0	5/5	0/0	0
Additional peripherals				
CD-ROM	Compaq CDR-8435	Toshiba XM-6502B	NEC 466	LG CRD-8400
Tape device	✗	Seagate TapeStor 8GB	✗	OnStream DI30
Other	✗	✗	✗	✗
Graphics adaptor	ATi 3D Rage IIC PCI	ATi Xpert XL	ATi 3D Rage IIC AGP	Cirrus Logic GD5480
Location	PCI Card	AGP Card	Motherboard	Motherboard
Video memory	4MB	8MB	4MB	2MB
Monitor included	✗	✗	✗	✓
Keyboard/mouse	✓/✓	✓/✓	✓/✓	✓/✓
Software supplied	Compaq SmartStart Insight Manager, ASR	Veritas Backup Exec	Server Assistant Resolution Assistant	Intel Server Control OnStream Echo

						
	Hewlett-Packard	**IBM**	**Mesh**	**NEC Direct**	**Toshiba**	**Viglen**
	NetServer LC2000	**NetFinity 5100**	**700L**	**Express 5800/120Ld**	**Magnia 3030**	**CX1**
	£2,089 (£1,777)	£2,290 (£1,949)	£2.231 (£1,899)	£2,349 (£1,999)	£2,256 (£1,920)	£2,349 (£1,999)
	0990 474 747	0990 727 272	020 8208 4706	0870 010 6322	01932 828 828	020 8758 7000
	453 x 215 x 695	215 x 426 x 627	488 x 210 x 455	450 x 220 x 650	440 x 220 x 620	493 x 195 x 430
	349	250	300	300	300	300
	1/2	1/3	1/1	1/1	1/2	1/1
	Hewlett-Packard	IBM	Intel	NEC	Intel	Supermicro
	ServerWorks Entry	ServerWorks Entry	Intel 440GX	ServerWorks Entry	Intel 440GX	Intel 440BX
	ServerSet III LE	ServerSet III LE		ServerSet III LE		
	133	133	100	133	100	100
	Pentium III 533	Pentium III 667	Pentium III 700	Pentium III 600EB	Pentium III 600E	Pentium III 650
	1/2	1/2	2/2	1/2	1/2	1/2
	128MB/4GB	128MB/4GB	256MB/2GB	128MB/4GB	128MB/2GB	128MB/1GB
	3/4	3/4	3/4	3/4	3/4	3/4
	Seagate ST39102LC	IBM DNES-309170Y	Quantum Atlas 10K	2 x Seagate ST39175LC	2 x IBM DNES 309170Y	Fujitsu MAE3091LP
	9.1GB	9.1GB	18.2GB	18.2GB	18.2GB	9.1GB
	Symbios 53C897	Adaptec AIC-7899G	Adaptec AIC-7896N	Adaptec AIC-7899G	Adaptec AIC-7896N	Adaptec AIC-7890AB
	Motherboard	Motherboard	Motherboard	Motherboard	Motherboard	Motherboard
	IDE (1)	IDE (1)	IDE (2)	IDE (1)	IDE (2)	IDE (2)
	HP NetServer 10/100TX	AMD PCnet Server Adaptor	Intel Pro100+	Intel Pro100+	Intel Pro100+	2 x Intel Pro100+ Server Adaptor
	Motherboard	Motherboard	Motherboard	Motherboard	Motherboard	PCI Cards
	2/2	3/3	2/2	3/3	2/2	0
	4/4	2/2	4/4	4/4	4/4	2/5
	0	0	1/1	1//1	1/1	2/2
	0	0	0	0	0	0/1
	2/3	2/3	4/5	2/3	2/3	1/3
	5/6	5/6	0/2	4/6	4/6	1/2
	0	0	0	0	0	0
	0	0	2/2	0	0	2/3
	Hitachi CDR-8435	LG CRD-8400B	Teac CD-532E	LG CRD-8401B	ON Technology LTN-403L	Sony CDU4811
	✗	✗	HP SureStore T20	Archive Python DAT DDS-3	✗	HP DAT DDS-3
	✗	✗	✗	✗	✗	Eicon Diva ISDN card 3Com 56K modem
	ATi 3D Rage IIC AGP	S3 Savage4 Pro	Cirrus Logic GD5480	ATi 3D Rage IIC PCI	Cirrus Logic GD5480	ATi Xpert98 Pro
	Motherboard	Motherboard	Motherboard	Motherboard	Motherboard	AGP Card
	2MB	8MB	2MB	4MB	2MB	8MB
	✗	✗	✗	✗	✗	✓
	✓/✓	✓/✓	✓/✓	✓/✓	✓/✓	✓/✓
	NetServer Navigator HP TopTools	ServerGuide NetFinity Manager	Intel Server Control Stac Replica Backup	Express Builder EsmPro	Server Setup Intel Server Control	Intel Client Manager Veritas Backup Exec

Editor's **Choice**

The ideal small-business server needs to satisfy a wide range of requirements. Performance is always an important consideration, but there are many other factors that need to be taken into account. A server can represent a considerable financial outlay to companies on a strict budget, so it should be designed with high levels of upgrade potential. The average PC may only last a couple of years, but servers can, and should, last well beyond this to maximise your investment. Increasing online storage or adding extra processors and more memory to improve performance must be simple tasks that can be carried out easily to reduce downtime.

With your company depending on one system to provide all its networked services, reliability is paramount. Redundant power supplies, RAID arrays – even adequate cooling – all play their part in ensuring the server does its job without interruption. You need to keep a close eye on general operations and have advance warning of impending doom, so decent management software is a must, while good security keeps the curious, or worse, at bay.

The winners

Choosing the best was a tough decision as there were a lot of very high-quality servers in this group test. There has to be a winner though so, after considerable debate, the **Editor's Choice** award goes to Dell's PowerEdge 2400 as it delivered on all counts. It came in for review with a reasonably beefy Pentium III 600MHz processor, but there's still potential to add a second processor thanks to its dual motherboard. More memory can easily be added and, when the time comes, the totally tool-free design will ensure the server is back in business with the minimum of delay.

The server's internal design is exemplary and it's worth noting that Dell has had a big influence in this crucial area, with many other manufacturers now using similar concepts in their servers. Placing all the connectors on the edge of the motherboard right next to the devices they're servicing makes for a tidy interior and keeps ribbon cable clutter to a minimum.

Hard-disk storage is well-catered for with a six-disk capacity drive cage and a hot-swap backplane now a standard feature in the 2400. The drives are fitted in sturdy carriers that are easy to remove and replace as required. Power redundancy is an option, while server management and monitoring tools are in abundance. The icing on the cake was the integrated RAID controller chipset providing extra storage fault tolerance, ensuring the server won't let your business down. Overall, the PowerEdge 2400 is a well-focused system that fitted our requirements perfectly.

The first of our **Highly Commended** awards goes to Hewlett-Packard's mighty NetServer LC2000. Some may see this as a strange choice as the single Pentium III 533MHz processor was the slowest of the lot, resulting in a less than impressive performance. However, the price of the LC2000 was one of the lowest, so HP could have added more hardware and still stayed within our price limit. What impressed us most was the build quality, as this was easily the best of the rest. Clearly, a lot of thought has gone into the design as the chassis and its internal layout is superb. HP has gone with the flow and fitted the ServerSet III LE chipset that offers a 133MHz FSB and support for up to 4GB of SDRAM memory. There's plenty of room to grow with demand as the LC2000 also has a hard-disk cage with capacity for up to six drives and an optional hot-swap backplane can be fitted as well.

Our second **Highly Commended** award goes to evesham.com with its SE3200. Intel's 440GX+ motherboard gets the system off to a good start as it's specifically designed for servers and comes with plenty of management and monitoring facilities. Performance was particularly good, with evesham.com securing a solid third place overall and yet there is still plenty of room for expansion. The large six-drive disk bay can keep up with future storage demands and evesham.com even managed to supply a pair of 18.2GB Ultra2 hard disks and team them up with an Adaptec PCI RAID controller card. Creating a server from off-the-shelf components can be tough as it's easy to get the recipe wrong. However, the SE3200 shows how it can be done with a fine balance of components brought together in a decent chassis.

Dell's PowerEdge delivered on all counts, including extra storage fault tolerance

The low price of HP's NetServer impressed, as did its internal design

evesham.com's server offered good performance and room for expansion

pcwexpert

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PHOTOGRAPH PATRICK LLEWELYN-DAVIES

scanners

Welcome to the first pcwexpert. Each month we're dedicating 16 pages to an in-depth look at one subject. This month Gordon Laing delves into the world of scanners, their origins, how they work and how you can get the best out of them. Read on to find out more and become a PCW expert on scanners.

From a swinging pendulum to electrical signals

When a French physicist couldn't find a use for his discovery, a Scot developed the idea and set the scanner ball rolling

A scanner is a device that captures something for later use. In the context of this feature, the subjects under capture are images, whether photographic prints, transparencies, documents, or real-life 3D objects. From this point on, unless otherwise stated, we'll use the term scanner to refer to image capture only.

The basic principle of a scanner is similar to that of a facsimile system, except that the scanner integrates the transmitter and receiver into one unit, whereas the facsimile transmitter and receiver may be on opposite sides of the planet.

The first scanners captured and processed originals, while reproducing them onto film almost simultaneously. For modern desktop scanners, the processor is the PC and the final receiver is usually a printer, or some kind of electronic media.

Where it all began

Arguably the father of scanners was Scottish physicist and clock maker Alexander Bain (1818-1903). In 1843 Bain proposed a facsimile telegraph transmission system based on discoveries made by French physicist Edmond Becquerel a few years earlier. Becquerel discovered that when two pieces of metal were immersed in an electrolyte, an electrical charge was developed when one of the pieces was illuminated. He couldn't think of a practical use for his discovery.

Bain, however, proposed that this could allow metallic characters to be chemically transmitted. Later, his transmitting machine used a detector mounted on the end of a swinging pendulum to sweep over the subject and scan it line by line. As the detector passed over areas of ink, it emitted a different electrical signal to when it passed over areas of no ink. This signal contained the original image, broken into small portions for transmission. The signals were transmitted over a telegraph wire to the receiving device, which applied them to chemically treated paper, recreating the image.

The problem of synchronising the two devices was solved by using large metronomes set off at the same time. The Italian Giovanni Caselli constructed an enormous version of Bain's facsimile machine called the Pantelagraph in 1856. Four years later, Caselli used this to transmit the first long-distance fax between Paris and Amiens – an impressive 70-mile distance, but one that required the use of eight-feet tall pendulums.

First scanner

Modern fax machines and scanners are based on photo-sensitive elements, and the first practical transmission using photo-electric cells was developed by German physicist Arthur Korn in 1902. By 1925, the American Telephone and Telegraph company (AT&T) had invented the first wire photo service.

In 1929, Bavarian electronic engineer Dr Rudolf Hell formed a company in his own name and applied to patent a 'device for the electronic transmission of written characters' – he called this electronic fax machine the Hell Recorder.

The first prototype drum scanner was constructed from a modified engineering lathe by Alexander Murray and Richard Morse in 1937 – at the time, Murray was working for Eastman Kodak. In 1946, Time took the Kodak prototype and continued its development until, in 1949, the Austin Company built it into the first workable scanner, known as the Austin Scanner.

In 1947 John F Crosfield founded Crosfield Electronics. In 1955 he invented the first colour scanner, the Scanatron MK1, which used a cathode-ray tube and flying spot, similar to the technology behind TV sets; the first model was installed at Sun Printers in Watford in 1959. Crosfield's subsequent inventions included the first commercial drum scanner in 1964.

Returning to the early 1950s, Hell entered the world of reproduction with his invention of the Klischograph, which could convert continuous tone and line images directly into Klishees, or printing blocks. In 1950 Hell introduced the Colorgraph, an experimental flatbed scanner. Many innovations followed, but one of the biggest landmarks was the 1970 launch of the Hell DC 300, an enlarging and reducing scanner using digital technology.

Crosfield beat Hell to the first enlarging and reducing drum scanner (MagnaScan 450) a year earlier. Until now, scanners had captured and reproduced images the same size as the original. In 1975 Crosfield released the MagnaScan 550 drum scanner

pcwexpert timeline™

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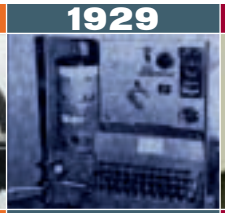
The date and origin are arguable, but no-one can dispute that the benchmark image capture and processing system is the human eye and brain. The best scanner in the world!

1843

Fax machine invented by Alexander Bain, who proposes a facsimile telegraph transmission system, built in 1856 using eight-feet pendulums and called the Pantelagraph (above).

1929



Dr Rudolf Hell invents graphic transmission concept used by almost all fax machines today. Hell later merged with Linotype and both were recently swallowed up by Heidelberg.

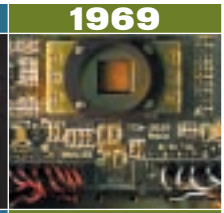
1950

The first experimental flatbed scanner, the Hell Colorgraph, invented by Dr Hell (above). In 1970, Hell launched the DC 300, the first digital enlarging and reducing drum scanner.

1955

First colour scanner, the Crosfield Scanatron MK1, invented by John F Crosfield, using cathode-ray tube and flying spot. Crosfield invented first drum scanner in 1964.

1969



Charge Coupled Device (CCD) invented by George Smith and Willard Boyle at Bell Labs. Stores electrical charge proportional to the amount of light that falls on it.

that, for the first time, exposed four colour separations simultaneously under the control of an integrated digital computer.

Drum scanners are still used in professional reprographic environments. They enjoy a higher tonal dynamic range and suffer from less noise than Charge Coupled Device (CCD)-based scanners.

The image is mounted on a spinning transparent cylinder – the drum. A high-pressure Xenon lamp illuminates the subject and the reflected or transmitted light is detected by Photo Multiplier Tubes (PMTs). Four PMTs are used: three with red, green and blue filters, and the fourth for an Unsharp mask channel. In the early days the electrical signal from the PMTs could be adjusted to control brightness and colour correction in real time, before driving a lamp to expose photographic film for colour separations. Now, the signal is converted into digital data and manipulated by a PC, before being used to output colour film separations.

The silicon revolution

A silicon chip sits at the heart of almost every modern imaging device. Invented in 1969 by George Smith and Willard Boyle at Bell Labs, the light-sensitive CCD revolutionised digital imaging.

Microtek claims it was the first to produce a 300dpi (dots per inch) CCD-based sheet-fed black and white scanner in 1986. Agfa produced the first scanner for the Mac market in 1987. Microtek was also first with a 300dpi 24bit colour flatbed in 1989. However, until the early 1990s, flatbed scanners were still expensive. Users on a budget who wanted to capture images had to rely on a short-lived breed of handheld scanners. Resembling small car vacuum cleaners, these had a 4in wide scanning window, and the user dragged the unit over the image. AMS was first with a handheld scanner in 1988, but was soon after bought by Swiss mouse-giant Logitech. The latter dominated the handheld market, which peaked with the £399 ScanMan Colour in 1992.

In the mid to late 1990s, the dedicated document scanner made a comeback. Previously an attachment for a flatbed device, this new breed was little larger than a half-finished roll of kitchen paper and fed papers through with rubber rollers. Visioneer was the undisputed king of these document scanners.

However, many unknown Taiwanese companies were building scanners for the big boys, but toward the end of the 1990s they realised they could competitively market themselves. Within a couple of years, the average price of a flatbed scanner plummeted. Flatbed prices seem to have bottomed out today, but have just about eliminated every other type of budget scanner. The CCD is also gradually approaching the quality of high-end drum scanners, with innovative 'XY-Stitch' flatbeds moving their CCD heads both vertically and horizontally over the image to produce extremely high-resolution scans.

It is, however, refreshing to remember that the best quality imaging device is also the oldest. Coupled with the advanced processing, recognition and storage features of the human brain, our very own eyes are the best scanners in the world.

Scanners explained

Flatbed **Pros** - Flexibility of scanning photos, film, documents, card, books, small objects; **Cons** - Occupies lots of desk space and you shouldn't put anything on the lid

Drum **Pros** - Highest quality scans make drums the choice for high-end reproduction; **Cons** - Very expensive, large and require expertise to operate

Handheld **Pros** - Smallest desktop scanner, and cheap too; **Cons** - Small scanning area, average quality, increasingly rare

Document **Pros** - Small and dedicated to document scanning, management and OCR (optical character recognition); **Cons** - Not suitable for thicker originals, typically poor colour quality, also rare

Network **Pros** - High-speed document scanning and server support - ideal for large offices; **Cons** - Large, expensive and not on your desk. Requires network expertise

Film **Pros** - Concentrates high optical resolution into small area to capture small frames; **Cons** - Low flexibility - only scan film, and some only do 35mm

Digital camera **Pros** - Portable, captures small and large objects, pretty flexible; **Cons** - Quality only sufficiently good for A4 prints with 3.3megapixel models

1973

The barcode standard, a linear design used to label and identify products, is chosen as the Universal Product Code symbology. Checkouts are never the same again.

1981

Heinrich Rohrer and Gerd Karl Binning invent the Scanning Tunnelling Microscope, a scanner that can image tiny atomic details. Scary insect photos follow.

1988

AMS launches first handheld scanner, and soon after is bought by Logitech. In 1992 Logitech releases ScanMan Colour for £399. Handhelds are almost extinct today.

1989

Microtek launches the world's first affordable 300dpi three-pass 24bit colour flatbed. By the mid-1990s, the Taiwanese dominate the budget flatbed market.

1989

Adobe Photoshop is launched and becomes the killer application that revolutionised digital photo retouching and sold millions of scanners in the process.

1999

Stanford and University of Washington complete project to scan the sculptures and architecture of Michelangelo in 3D using custom laser rangefinder and gantry.

The power behind digital imaging devices

We take an in-depth tour around the technology that makes a scanner work and explain how you can get the best results

All digital imaging devices work on the same principle of reflection or transmission. The subject is placed before the imaging device, consisting of a light source, optics and a sensor. The amount of light reflected by or transmitted through the subject is gathered by the optics and focused onto the sensor, then converted to a voltage proportional to the light intensity – the brighter the image, the more light is reflected or transmitted, resulting in a higher voltage. This voltage is changed by an analog-to-digital converter into bits of information the computer can understand.

The subject

In practice the range of subjects we want to capture digitally is varied, so many different imaging devices have been developed. Flatbed scanners are currently the most widespread, although digital cameras are increasing in popularity. While scanners and cameras seem, on the surface, to be very different, their purpose is the same: to capture a subject and present a computer with a bitmapped digital image file.

In the case of the camera, you simply point it at your subject and expose the entire sensor in one go, using natural or man-made light sources. The scanner, on the other hand, operates in an almost clinical environment, encompassing the subject and using its own light source for consistent illumination.

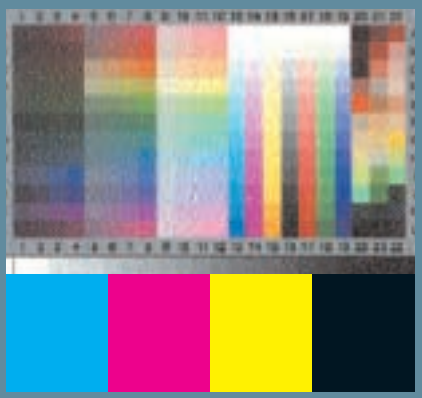
While a camera is forced to expose its entire sensor in one go to capture fast-moving subjects, scanners operate at a quite leisurely pace. Whether in a drum, on a flatbed, or dragged past by hand or rubber rollers, the scanner slowly passes its sensor over the subject (or vice versa) in a capture process that typically takes between 10 seconds and two minutes depending on the technology. For more detail see the *History* section of this *pcwexpert*.

The sensor

The most common sensor in digital imaging is the Charge Coupled Device (CCD), which is at the heart of most scanners, digital still cameras and camcorders. A CCD consists of many tiny photo-sensitive elements arranged in a rectangular grid in the case of a video or digital camera, or in a long, thin line in desktop scanners; the more photo-sensitive elements per unit length, the higher its resolution, and greater its capability of resolving fine details in the subject. The CCD in a scanner may be 2-3in long, while one in a digital camera may only measure 0.5in across its diagonal. The number of genuine photo-sensitive elements in a CCD used to capture the subject is its optical resolution.

The energy associated with the photons of light that strike a photo-sensitive element during an exposure are absorbed by the silicon and converted into electrical charge. At the end of the exposure, the amount of charge in the element is directly proportional to the number of photons that struck it, and to the relative brightness of the subject at that point. By converting the charge from a load of photo-sensitive elements placed closely together, it's possible to capture and recreate the subject. It's like placing transparent graph paper over the subject and measuring the brightness in every square, the smaller the squares the more accurate the reproduction will be.

Colour correction



Ever had one of those conversations where you're describing something as rusty orange coloured, but are then stopped and told it's clearly pillarbox red, or worse still, lime green? Yes, we all have very different ideas about colour and computers are no different.

The trouble is that monitors and scanners work with red, green and blue (RGB) light in an additive process, whereas printers work in a subtractive process using cyan, magenta, yellow and black (CMYK) inks. Not only do you have to convert between colour spaces when printing a scan, but the CMYK model cannot reproduce the same range of colours as RGB.

Just because your monitor and scanner both work with RGB doesn't mean they won't give you colour headaches. Your scanner has no idea what the brightness, contrast, or colour temperature settings of your monitor are. It's crucial to ensure your monitor is correctly set up before you start making tonal and colour adjustments on scanned images. TFT monitors are not capable of displaying the same levels of detail in shadows and highlights as a CRT.

The solution is to employ a Colour Management System (CMS) that will calibrate each component so what you scan should look the same on screen and the printed page – or at least close enough to work confidently. These systems will also warn you if you're trying to reproduce a colour that's clearly out of the printer's capabilities.

Fortunately, the International Colour Consortium (ICC) has gone to the trouble of developing a standard to describe the colour characteristics of any device, be it a scanner, monitor or printer. Called ICC profiles, they effectively plug into colour management software that can make the required corrections and compensations. ICC profiles are available for many popular imaging devices, but you can make your own by measuring how your device handles standard test targets packed with tricky coloured squares. Many decent printer drivers can be fed an ICC profile for a scanner and the printer itself, in order to produce calibrated output. If you fancy a quick, easy, yet effective means of colour matching, check out Colorific, available to order online for around £35, or bundled with some monitors and graphics cards.

Colorific: www.ecolor.com

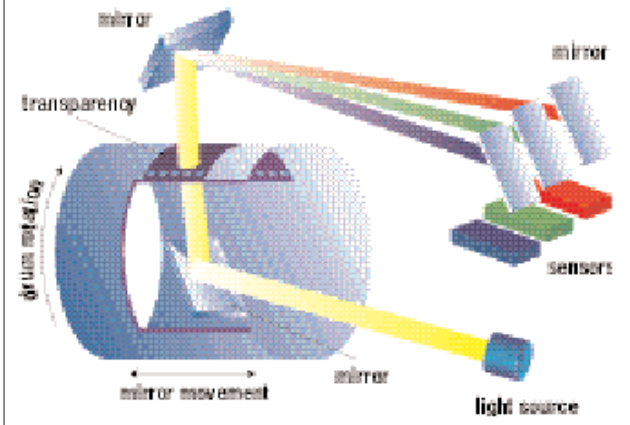
Modern budget scanners are increasingly using an array of illumniating LEDs and contact image sensors instead of a fluorescent tube and CCD for capturing images. Unlike flatbed CCD arrays that measure only a couple of inches across and use a lens to capture the full A4 width, an LED system evenly spreads its elements across the entire 8in document width. This allows them to produce images that are as sharp at the edges as they are in the middle and not rely on optical lens quality for edge performance as CCD units do.

Brightness alone doesn't, however, contain any colour information. To capture full colour, you need to place suitable filters in front of the CCD. Since mixing different amounts of red, green and blue light can make up the entire visual spectrum, digital imaging devices place red, green and blue filters in front of their CCDs – like a cathode-ray tube in reverse. Normally there are three separate CCDs, each with a different filter, while on older scanners a single CCD builds a full-colour image in three passes.

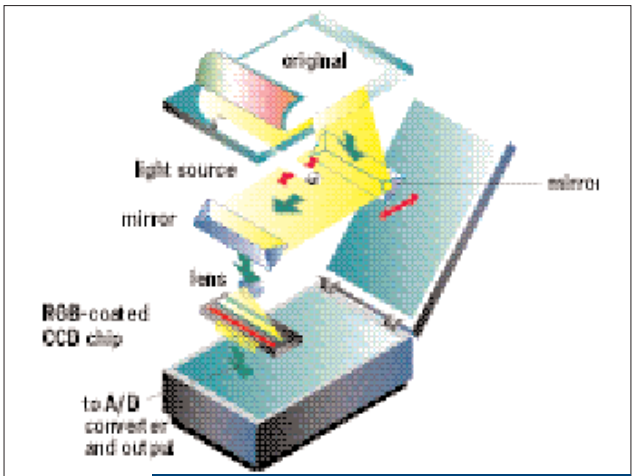
Pixels and resolutions

Once the exposure is complete, there will be three brightness values representing a tiny section of the subject: one each for red, green and blue. When combined, the result is a single full-coloured dot, often called a pixel. Since most digital imaging devices are used to capture colour subjects, their resolution is described in full colour. Cameras, webcams and camcorders are described by the number of effective colour pixels used to capture the whole subject in one go. Hence a camera with 1,600 x 1,200 colour pixels is described as having 2.1 million pixels (2.1megapixels).

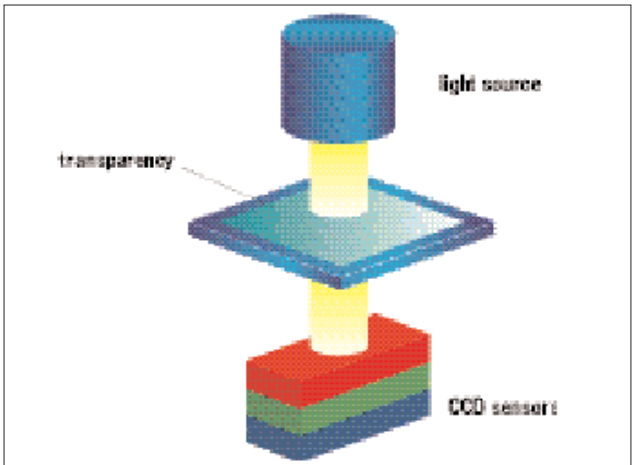
Since scanners capture subjects of different sizes, their resolving power is more fairly described as a number of dots or pixels per inch (dpi or ppi). The important figure is the optical resolution, since this refers to the number of effective photo-sensitive elements in the CCD, as opposed to extra dots invented by software later in the process.



Drum scanners: high quality but expensive



Flatbed scanners: flexible but take up space



Film scanner: can capture small frames

Unlike a camera's rectangular CCD with hundreds of dots horizontally and vertically, the CCDs used by most scanners consist of a single line of elements in a row. While the scanning CCD may only be a few inches long, it captures a much wider area using special lenses and mirrors.

A scanner claiming a horizontal *optical* resolution of 600dpi and a maximum capture width of 8in will have 8 x 600, that's 4,800 light-sensitive elements on its CCD. Most colour scanning heads contain a fluorescent tube light source with three such CCDs, filtered for red, green and blue light, plus optics to focus the subject onto the CCDs. These allow the scanner to capture a full-colour image in a single pass in around 30 seconds.

A scanner's vertical resolution is dictated by the degree of fineness by which the imaging head can be directed over the image. The first affordable PC scanners were built into handheld devices that the user dragged across the subject. Document scanners or fax machines use motor-driven rollers to drag the subject through the device and over the CCD. In the case of a flatbed scanner, the head is driven by a stepper motor, a device that turns a predefined amount every time it is fed an electrical pulse. The maximum vertical resolution may exceed the horizontal one thanks to the stepper motor being highly geared; an optical resolution of 600 x 1,200dpi is not unusual, but the important number is the (normally smaller) horizontal one referring to the actual CCD.

The optical resolution describes the maximum amount of genuine detail the device can capture. But if you look too closely, you'll see the steps originally used to chop up your subject during the digitising process. In the case of image capture, you'll begin to see the pixels as small solid squares of colour that get more obvious the greater you enlarge the picture. The closer you want to look at or enlarge a digital image, the more pixels you'll need to capture it with in the first place. This is why optical resolution is such a crucial specification of any digital imaging device. However, short of buying a higher-resolution device, what can be done to eliminate these jagged edges?

Interpolation

The apparent resolution of a digital image can be increased by interpolation, which under software or hardware control guesses intermediate values and inserts them between real ones.

In theory, if your image has a red pixel next to a yellow pixel, it may be fair to assume that if there were an additional one in between, it would be orange. Interpolation would add that orange pixel in the appropriate place, effectively doubling the apparent resolution of the image.

In practice, interpolation can be more sophisticated. To create just one new pixel, normally all its surrounding neighbours are considered, and in some cases, the interpolator looks further outwards in the attempt to predict a trend. Of course, if you've gone to all the trouble of creating one new pixel, why not go the whole hog and insert several more between your 'real' pixels. This is exactly what's offered by just about every scanner on the market, with some 600dpi optical devices boasting interpolated resolutions up to 9,600dpi. It doesn't take a trained eye to treat such figures with at least a little scepticism, and it's certainly true that most of the time they're used purely in a marketing numbers game. So is interpolation all bad?

In the negative camp, interpolation cannot invent detail that was never captured. Consider a car number plate, where the characters are just beyond the resolving power of the imaging device and haven't appeared on the final picture. While a higher-resolution optical device would capture the characters, no amount of interpolation on the lower-resolution image will make them appear.

On the positive side, interpolation will increase your number of pixels to a point where the jagged edges will be smoothed away. Sure, there won't be any additional detail in your picture, but at least you won't be plagued by a blocky image. Interpolation can really help when it comes to making an acceptable-looking big enlargement from a modest-resolution digital camera.

It's worth pointing out that some original subjects are very simple and can be successfully predicted. While the car number plate is a tough subject, consider a simple circle as part of lettering or a logo. When captured with low resolution, the stepped edges of the circle will be painfully apparent, but interpolation could be used very successfully to fill in the gaps with smaller dots, producing a considerably smoother result. As with so many aspects of digital imaging, the results depend on your particular subject, device, additional processing and personal expectations. Consequently, you may find interpolation to be a winner on one day, but a pointless loser on another.

You'd be forgiven for thinking that raw resolution is the be-all and end-all of digital imaging

Dynamic range

At this point you'd be forgiven for thinking that raw resolution is the be-all and end-all of digital imaging. While it is the single most important specification of an imaging device, one that follows very closely behind is dynamic range.

So far we've discussed brightness and colour as simple abstract values but, in the world of digital imaging, real numbers are required for everything. In the same way that optical resolution physically chops a subject into a grid of manageable pixels, so must each brightness value be assigned a number. The difference between the lightest and darkest value that can be captured is known as the dynamic range, and it's this range that's also divided up during the digitising process. Like optical resolution, the more steps that can be assigned to describe a level of brightness, the more accurate the result.

The assigning of a nearest number to describe a brightness value is the job of the analog-to-digital converter within the device. Normally these are described as operating with a certain number of bits. Just like graphics cards, 8bits give you 256 levels, 16bits offer 65,536 and 24bits boast just under 16.8 million levels. It's generally accepted that the human eye cannot distinguish between adjacent grey levels when 256

File formats

There is a wealth of graphics file formats to choose from, which can make a huge impact on the quality of your image and the amount of storage space it occupies on your PC. It's crucial to consider where you're going to use your image before making any file format decisions that could permanently compromise its quality.

Before the days of web dominance, the most common graphics file format was the Tagged Image File Format (TIFF), which stores the contents of a bitmap image in the required number of colours and nothing more. The only problem was that file sizes could become unmanageable – a 10 x 8in 300dpi TIFF in 24bit colour measures over 20MB.

As exchanging images became increasingly common online, CompuServe developed the Graphics Interchange Format (GIF). This format reduced the total colour palette to 8bit, then looked for identical coloured pixels in a row. By describing rows of identical pixels in one go, simple images could be highly compressed without any loss of quality. This technique is known as Lemple-Zif-Welch (LZW) compression and is used by WinZIP, as well as being offered as an option when saving TIFFs from some applications. LZW is not particularly efficient at compressing full-colour images, but since the process operates without any loss of quality, you may as well use it where available. Beware of saving photos as GIF files though, as in almost all cases it will permanently reduce your total colour depth to only 8bit.

Undisputed king of Internet image formats is the JPEG from the Joint Photographic Experts Group. Unlike LZW, JPEG employs so-called lossy compression, which permanently throws away information it deems unnecessary. The level of compression is set by the user, with higher compressed images occupying less space, but looking worse for it. Finding out how much compression is tolerable is a case of experimenting, and you'll find some images look better than others. Photoshop 5.5 offers an invaluable preview of how the compression will look compared to the original. While perfect for delivering full-colour images online, we recommend important pictures are archived in the TIFF format as backup. Although using the best-quality JPEG settings may not produce the smallest file in the world, but the resulting image will be almost indistinguishable from the original.

levels are used. So basic colour scanners employ 8bit analog-to-digital conversion for each of the three colour filters, red, green and blue, making a total of 24bits per full-colour pixel.

Unfortunately, a few of the least significant bits are lost in electronic noise, while any post-scanning tonal corrections reduce the range further still. It's for this reason that superior scanners boast not 24bits per pixel, but often 30 or 36bits, or sometimes more still. These offer a much higher dynamic range with finer steps between adjacent levels, resulting in greater tonal detail, particularly in dark shadows or bright highlights. Most applications, and especially printers, cannot handle this tonal range, but once your device has captured it, you can shift these subtle details into tonal ranges that can be finally reproduced. Capturing an increased dynamic range also gives you more room to breathe when making other tonal corrections, after which you should still have a great set of 24 most significant bits to output.

Sadly, dynamic range has also become a marketing numbers game of late, with many bargain-basement scanners described as offering 36bits per pixel. While it's remarkable what cheap scanners can deliver, don't kid yourself that their final tonal performance will be anywhere near that of a high-end scanner. Tonal performance separates the men from the boys in the digital imaging world, with those that talk the talk, but not walk the walk suffering from undesirable noise and lack of detail in shadows and highlights, regardless of the number on the box. Even as high-end CCDs improve, ultimate tonal dynamic range still requires the photo-multiplier tubes used in drum scanners.

Configuration tips

Adobe Photoshop dominates the high-end photo retouching and image-manipulation market. Much of its success is down to licensing deals where Photoshop or a cut-down version is bundled with many scanners as standard. Buying a scanner is a great way of getting hold of a copy of Photoshop, as even the limited versions come with attractive upgrade offers. The current version is 5.5, which includes a copy of ImageReady 2.0, designed for getting images optimised for web use. Online graphics manipulation is an increasing business for Photoshop, which started life as the professional printer's best friend.

Manipulating images can be thirsty work for a PC, but there are ways you can lighten the load. What follows are some configuration tips applicable to all photo retouching applications, and a few just for Photoshop.

Ultimately, memory is key. The instant you run out of memory, your hard disk is enlisted to pretend, but it's absolutely nowhere near as fast. Consequently, if image manipulation is your thing, ensure you have sufficient memory to handle your common files entirely out of RAM, and remember your applications and operating systems will want a fair portion too. When it comes to printing images, a large amount of memory also comes in handy. We recommend at least 128MB to get started with digital imaging, with 256MB and above advised for serious work.

As far as Photoshop is concerned, Adobe recommends three to five times the amount of system RAM as the size of the image you're working on. If that isn't possible, remember to purge the cache from time to time – you'll lose your 'undos', but free up memory. Also, in Photoshop's preferences, devote all available RAM to Photoshop, and when working on heavy images, quit all other applications.

The speed of your hard disk is also paramount as it defines how long you have to wait to open and save images and prepare pictures for printing, along with being a big factor in virtual memory performance when you run out of RAM. Bigger and faster drives are always better, but consider using a pair of hard disks, as both drives firing simultaneously can effectively double your bandwidth. Try installing your OS and application on one disk, but keeping, say, files on the other.

Photoshop uses its own virtual memory system called a Scratch Disk. Decent performance increases can be enjoyed by devoting your second hard disk to the Scratch Disk. It's also useful to check the efficiency and scratch ratings in the corner of Photoshop to measure available system resources.

Tonal density

Density is the degree of opacity of a photographic image on paper or film, and is usually described as a number between 0 and 4.0D. It's a description of tonal range, calculated as the Log10 of the number of grey levels – hence in theory, 8bit 256 grey level has 2.4D, 10bit 1024 grey level has 3.0D, while 12bit 4096 grey level achieves 3.6D. Scanners are often described as capturing a certain density, but marketeers of cheap products often quote theoretical figures, without taking noise and surface reflection into account. The highest density ranges are still in the realm of drum scanners which may genuinely deliver as much as 4.0D (approaching 16bit greyscale).

Getting the image out

At this point in the capture process, the subject has been exposed to and measured by the imaging sensor, and a massive amount of data generated. It's this data that's processed by the scanner's built-in firmware, often under user instruction via the software driver mentioned in a moment. In the meantime, the data has to be transferred from the imaging device into the PC for subsequent use.

In the past, the dominant interface for connecting all types of scanners to computers was SCSI, which still boasts high performance along with broad device connectivity options. SCSI was the most common scanner interface since it used to be a standard fitting on Apple Macs that previously dominated the digital imaging market and are still the most popular platform in many high-end facilities.

As PCs entered the digital imaging arena, SCSI cards were fitted to allow them to communicate with scanners. However, as many Taiwanese manufacturers moved into the market and drove scanner prices down at the entry level, a new cheaper interface was required. For a short period, the enhanced capabilities of the PC's ever-evolving parallel port were employed, but with variable

success usually depending on the age of the motherboard. Today the dominant interface at the low to mid-range is USB, allowing reasonably quick data transfer, but more importantly for most users, easy connectivity.

At the high end, SCSI still holds on to much of the market, although several devices now have IEEE-1394 FireWire interfaces. These mostly cater for modern Macs that have dumped SCSI in favour of FireWire, although, ironically, many high-end Mac users fit third-party SCSI cards to retain compatibility with older peripherals.

Never the TWAIN

We take many PC technologies and innovations for granted. One of the most useful, but often ignored, was the Windows printer driver, which installs just one driver for a particular printer, that can then be used to output from every Windows application. Sounds obvious, but in the old days, a different printer driver was required by each application. Believe it or not, a similar situation existed with scanners for much longer.

Until quite recently, a scanner was supplied with a standalone piece of software that was launched each time you wanted to scan. Once your image was scanned, you had to save the often large file before launching your image-editing application and laboriously opening the file again – hardly ideal.

The solution for Windows was developed by Hewlett-Packard, Kodak, Aldus (since merged with Adobe), Logitech and Caere. Called TWAIN, but not standing for anything, it's a single scanner driver available for control from any TWAIN-compliant application.

TWAIN-compliant applications usually have two options on their File menus to select between multiple imaging devices, then to acquire the image from the chosen device. During acquisition, the scanner's unique set of drivers and controls are presented, without having to leave the host application. Once scanning is complete, the driver window closes, leaving the scanned image open in the host application. No unnecessary quitting, launching, or saving of potentially large or useless files.

TWAIN can be used to control almost any imaging device and, while in the early days it was occasionally used for digital cameras, today it's almost exclusively used for scanners.

All TWAIN drivers have much in common. Dominating the proceedings is a preview window that presents a low-resolution picture of the subject. Once previewed, the TWAIN driver lets you crop the subject to capture the area you desire, along with adjusting brightness, contrast and, in more sophisticated drivers, the colour and tonal curves.

Generally, the TWAIN driver will take the most significant 24bits that remain after correction and deliver these to the host application. However, since the TWAIN driver is talking directly to the scanner, this is the place to make tonal corrections, as here you're dealing with the maximum dynamic range of the device. Some scanner/TWAIN combinations can output more than 24bits to your PC, but you'll need a suitable application to deal with them. Photoshop's 48bit RGB mode can handle colour depths greater than 24bit, but almost all the options are greyed-out, and you'll be dealing with file sizes double that of 24bit.

Within the TWAIN driver you also set the operating resolution and optional interpolation. Next to these are normally the colour settings, for capturing different types of subjects. While full 24bit (or higher) colour is suitable for colour photographic work, black and white photos need only 8bit greyscale modes, and pages of text for OCR work may only require basic mono 'line-art' capture – note that some OCR packages can make use of greyscale information for better recognising text. A CMYK option may also be available for delivering an image optimised for a specific printer, normally using standard ICC colour profiles (see Colour correction box). Epson's scanner drivers have optional settings optimised for its range of Stylus Photo printers.

What resolution?

The biggest question facing all scanner users is deciding which resolution to use. Popular misconceptions include using the highest available simply because you've paid for it, or matching the scanner's dpi with that of your printer. The real answer is to consider the size of your subject and the size and environment in which you'd like it reproduced. For starters, we'll consider colour inkjet printers.

First, forget the resolution of your printer, as this normally refers to drops of ink and not the number of full-colour scanner pixels that can be reproduced. Virtually every colour inkjet printer is happy being fed around 200 full-colour dots of information per printed inch. Lesser models may be happy with 150, while top-of-the-range ones may be able to make use of up to 300, but any additional information will be ignored and just slow down the image handling process.

Consequently if you have a 6 x 4in photo that you want reproducing same size on your inkjet printer, scan it at 200dpi. If you want it reproducing half the actual size, then halve the resolution to 100dpi. If you want it double the size, then double the resolution to 400dpi.

High resolutions are only required when significantly enlarging small subjects. Photographic film is a prime example, where a 35mm frame measures only 1in tall. Scan this at 200dpi and you'd only get a 1in tall print. To enlarge it to 4in tall, you'd need to scan at 800dpi. To make a 10 x 8in print, you'd need to scan at 1,600dpi. While you can fit a transparency adaptor to a flatbed scanner that shines light through the film, the sad fact is that most flatbeds just don't have sufficient optical resolution to handle 35mm film. Instead, you should use a dedicated film scanner. Typical models may only handle 35mm subjects, but boast optical resolutions of 2,700dpi, sufficient to produce a good-looking A3 print.

Scanning for the web is the other way around. The target viewing device is a monitor, which, depending on the display mode, will be operating between 70 and 100dpi, with each on-screen pixel directly handling one colour scanner pixel. So for a display running at 70dpi, scan at 70dpi for same-size reproduction, 35dpi for half-size, 140dpi for double-size and so on.

See the workshops later for some more advice on scanning for print, the web and film.

Scanning terminology

Scanner technology is full of acronyms and specialist words, but the pcwexpert Glossary reveals all

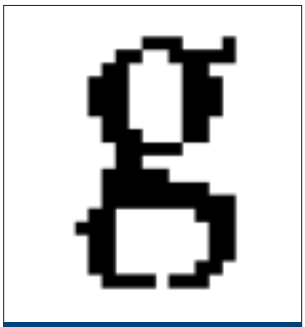
Artefacts: Undesirable elements on an image introduced through limitations of a digital device, processing or compression system. Typically they show up as snow-like noise, speckles, blocks or banding.
CCD: Charge Coupled Device. A type of silicon chip used in many imaging devices. Uses a grid of light-sensitive elements that store electrical charge proportional to the amount of light falling on them. The charge is converted into digital data for processing.
CMYK: Cyan, Magenta, Yellow and Black. The four colours used by almost every printing process. By printing these four inks in different sized dots, the eye is fooled into perceiving full colour. CMYK is often offered as a scanning mode that is optimised for a specific printer. (The letter K is used for Black to distinguish it from the B for Blue in RGB.)
CMS: Colour Management System. Ensures colours you scan are the same that you see on-screen and on the printed page. Limitations in various devices mean some colours can never be perfectly matched, but a CMS can help prevent nasty surprises.
Compression: Mathematical formulas used to identify redundant information in a digital file and remove it to save storage space or transmission time. Compression can either operate in a lossless form where there is no loss of quality, or lossy which reduces quality, but can significantly decrease file sizes.
Density: Degree of opacity in an image, usually between 0 and 4.0D. A description of tonal range, it's often quoted as a scanner specification, but there is a difference between theoretical density and the tonal range a device can deliver.
Drum scanner: Lathe-like device that mounts image on a transparent spinning cylinder. Large, expensive, requires trained operators, but offer best quality.
DPI: Dots per inch, often used to describe the resolution of a scanner or printer. Since a printer needs to drop lots of dots to recreate one full-colour scanner dot, many scanners now describe their resolution in the more accurate pixels per inch (PPI).
Dynamic range: The range of measurable tones in an image, ie the difference between the lightest and darkest portions.
Flatbed: A scanner in which the original is placed on a glass plate under a lid. Resembling a slim photocopier, flatbeds are the most flexible scanners available.

GIF: Graphics Interchange Format. Graphics format developed by CompuServe for online use. Reduces colour depth to 8bit (so not as suitable as JPEG for photographs) then uses LZW lossless compression.
Halftone: Technique used to reproduce a continuous-tone photograph as a mosaic of tiny dots. Halftoning gives the perception of full colour, when in fact only four different inks are typically used – see CMYK.
Histogram: A graph that indicates the tonal distribution of an image and the relative number of times each tone is present. Typically presented from 0 (black) to 255 (white), with shades of grey between. Histograms are very useful for evaluating the quality of a digital image and tonally correcting it.
Interpolation: Mathematical process of increasing apparent image resolution by averaging adjacent pixels and inserting new ones. It will never create new detail but can smooth edges.
JPEG: Joint Photographic Experts Group. Most common image file format used by digital cameras and on the web. Uses permanently lossy compression, but at a user-variable level.
Line art: Black and white, monochrome mode offered by some scanners to capture text.
Lossy: Type of digital compression that permanently throws away information in an attempt to reduce file sizes. Used by JPEG format – see above.
LZW: Lemple-Zif-Welch. Lossless compression used in WinZIP format, and several graphics formats such as TIFF and GIF.
Moiré: Undesirable patterns produced as a result of scanning an image that has already appeared in a book or magazine, ie halftoned. De-screening options on some scanners can reduce the effect.
Newton's Rings: Undesirable artefact that can occur when light shines though glass in the scanning process. Flatbeds sometimes suffer, where dedicated film scanners may not.
OCR: Optical Character Recognition. Software that attempts to recognise shapes as characters from a scanned document, and output the result as an editable text file. It is rarely 100 per cent accurate but will save time retyping documents.
Optical: As in optical resolution, the genuine resolving capabilities of a scanner. Many unscrupulous marketeers prefer to highlight the 'invented' interpolated figures.
PMT: Photo Multiplier Tubes. Sensors used in drum scanners, which boast much higher tonal dynamic ranges than CCDs.
PPI: Pixels per inch. Used to describe resolution of scanners – see also DPI.
RGB: Red, Green and Blue. The three lights used by displays or filters used by scanners to handle the full visible spectrum of colour.
TIFF: Tagged Image File Format. A popular uncompressed graphics file format. Sometimes offers 'LZW' option.
Transparency Adaptor: Replacement lid for flatbed scanners. Contains own light source to shine through transparent originals onto the imaging CCD. A driver lets you convert negatives to positives, but relatively low optical resolutions mean small enlargements from tiny 35mm frames.
TWAIN: PC standard for scanner drivers. Activated using the Acquire option on an imaging application's File menu, the TWAIN driver presents all the scanner's capture options. Doesn't actually stand for anything. Macintosh scanner drivers are normally supplied as Adobe Photoshop plug-ins.
Unsharp mask: A traditional film compositing technique used to sharpen image edges. Now offered digitally by many apps, it can correct blurring introduced during photographing, scanning, resampling or printing.

ILLUSTRATION TOM GREEN

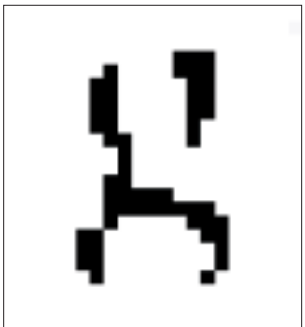
Unravelling the numbers game

The numbers quoted by scanner manufacturers often bear no relation to the actual resolution or tonal dynamic range

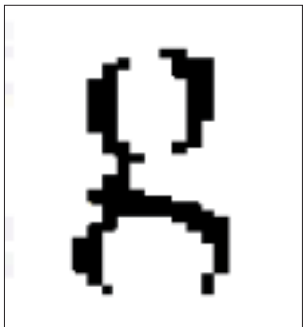

Scanner 1 - 300dpi optical


Scanner 1 - 300dpi RGB optical


Scanner 1 - 2,400dpi interpolated


Scanner 2 - 600dpi optical

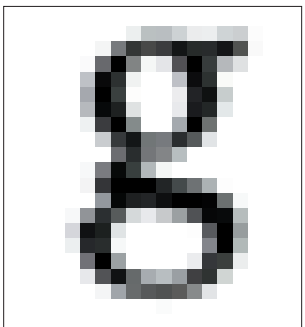

Scanner 2 - 600dpi RGB optical

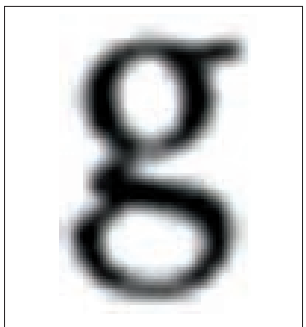

Scanner 2 - 9,600dpi interpolated

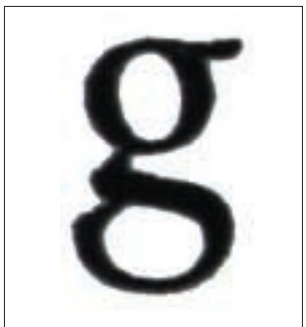

Scanner 3 - 300dpi optical


Scanner 3 - 300dpi RGB optical


Scanner 3 - 9,600dpi interpolated


Digital camera 200dpi A4 optical


Digital camera 1,000dpi interpolated


Digital camera 2,500dpi macro optical

The most important scanner specifications are genuine resolution and tonal dynamic range, both of which have been described in detail earlier. Sadly, scanner marketing has a severe case of number-itus, where bigger is always perceived as better. In truth, the figures quoted are frequently misleading and in many cases bear no relation to the actual results. We devised two tests in order to find out how truthful various specification claims are in reality. On the left are the results of our resolving power and interpolation tests, while the histograms on the right reveal true tonal capabilities. In each of the two tests we took different sets of budget flatbeds to illustrate our points.

Resolving power

The images on the left show the results of our resolution test for three different budget flatbeds and one digital camera; we'll discuss the flatbeds first. We took an A4 page of text and scanned it at the highest optical resolution in both mono and colour modes – this was typically at either 300 or 600dpi (dots per inch). Then we scanned the same page at the highest interpolated resolution, which claimed to be from 2,400dpi to as much as 9,600dpi in some cases. As we discovered, the numbers are often meaningless.

Each scan was cropped to reveal a single character: a letter g measuring a mere six points, or 1mm tall. From left to right is the optical resolution in mono, optical in colour and interpolated in mono.

Taking the three mono optical results in the first vertical column, our third budget scanner delivered the best result, even though it was rated at 300dpi. Note the worst result from scanner two, despite claiming 600dpi optical resolution.

The colour results are interesting if only to illustrate the

convergent problems facing a budget flatbed. Each of these letters in the middle vertical column should be pure black with the minimum of colour fringes. Again, scanner three delivers the best result, but none of them can really be described as great.

Interpolation

The interpolated results are particularly revealing. Remember, each of the three results down the far right-hand vertical column were generated by the scanner from the results down the first vertical column. Given this as a starting block, scanners one and three have produced remarkable results, but note the claimed resolutions of each model. Scanner one has the best interpolated result, but only describes it as 2,400dpi, compared to scanners two and three claiming 9,600dpi. While scanner three's result is good, clearly the 9,600dpi result of scanner two leaves much to be desired.

Digital camera

At the bottom are some results from the Nikon CoolPIX 990 3.3megapixel digital camera. We photographed the same A4 page of text in uncompressed TIFF mode to avoid JPEG artefacts. With 2,048 pixels for the entire height of the page, the camera was effectively working at around 200dpi, and the result on the far left is understandably blocky. The middle image shows the result after we took it into Adobe Photoshop and interpolated it up to 1,000dpi. It has significantly smoothed the edges. Out of interest we set the Nikon to macro and got as close as we could to the page (right-hand image), capturing just over one inch across, it was effectively working at around 2,500dpi, and the result is, of course, very smooth. With modest-sized text, digital cameras of 3.3megapixel resolution can now clearly be used for OCR work. Compared to the flatbeds, the Nikon's colour convergence is very good too – remember each of the three test images was taken and reproduced in colour.

Tonal range

To measure and compare tonal and colour capabilities, we scanned a standard IT-8 test target, pictured at the bottom of this page, using three different budget flatbeds (not the same models as in the resolving test). The IT-8 consists of a grid of colours and a strip with 21 distinct greyscales.

Using Adobe Photoshop's histogram tool we analysed the coloured and greyscale sections separately. The top graph represents the range of colours captured, which should ideally slope off smoothly at the extreme ends. Where it falls short at the left or right sides, shadow or highlight details respectively are being lost. The lower graph should ideally show 21 sharp, thin and evenly spaced peaks; the reality indicates the number of greyscales resolved and the inability to separate adjacent grey levels in some cases.

Consider the upper graphs of figures 1, 2 and 3 for the colour results first. All three scanners are failing to capture any detail in the darkest areas using automatic settings. Figure 1 is clipping at the bright right-hand end rather than falling smoothly off as the scanner in figure 3 is doing. The one in figure 2 is simply not capturing any detail in either the dark or bright areas using automatic settings.

In contrast, the scanner in figure 2 has the best defined peaks in the lower greyscale graphs. All three models are having difficulty separating the darkest greyscales from each other, but the scanners in figures 1 and 3 are also blurring the distinctions between adjacent grey levels.

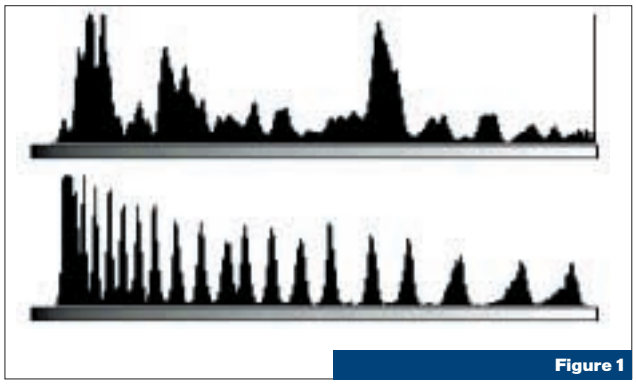


Figure 1

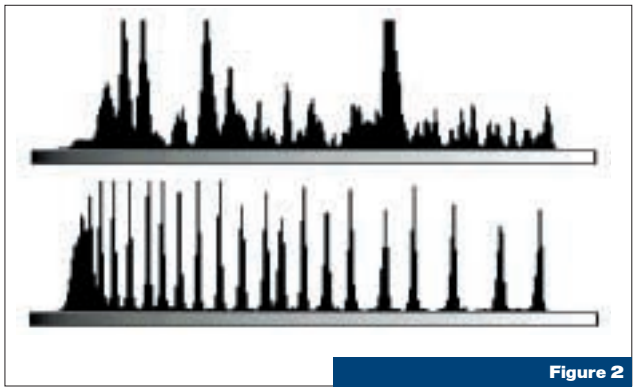


Figure 2

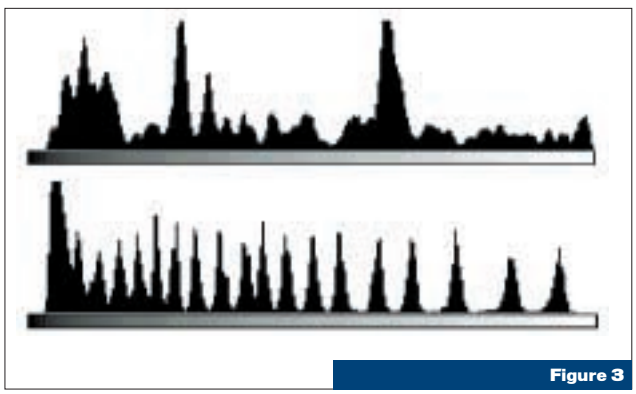
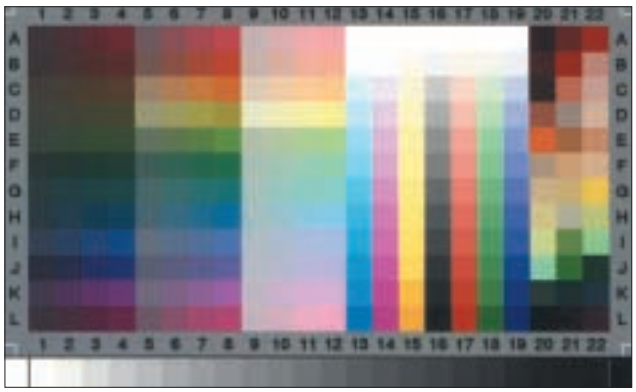


Figure 3



Moving towards another dimension

Technology is moving so fast that it won't be long before we will be able to touch and feel 3D digital objects

What does the future hold for image acquisition? In terms of capturing two-dimensional objects, there's not a great deal left to achieve. Since the late 1990s, the Taiwanese have forced down the price of entry-level flatbed scanners to a point that has reduced many established companies to tears. Certainly, higher optical resolutions and improved tonal density will become ever more affordable, but the physical side of the flatbed scanner is unlikely to change all that much. Companies like Canon have done a great job in recent years of slimming down their flatbeds to sylph-like proportions, but most still have at least an A4 footprint and don't like anything resting on their lids.

While flatbeds offer high flexibility and decent quality at low prices, other technologies are fast catching up. A digital camera is essentially a portable scanner that doesn't need a permanent connection to your PC – many can capture moving video too. When you consider that all digital cameras feature built-in power and storage facilities, capture their images in split seconds and are pocket sized, you've got to ask why you're using a flatbed.

The answer is that the controlled environment of a flatbed offers better capturing of flat originals, such as documents and photographs. As time goes on, though, the resolution of digital cameras will increase to a point where they'll match flatbeds, while cunning post-processing will ensure that 2D flat-capture is a snap. Proper document management and OCR facilities can't be far away on digital cameras.

Times are slowly changing at the high end of image capture. The PMT technology of drum scanners may still claim the top-dog position, but how much longer can these dinosaurs fend off steadily maturing CCD-based solutions? Flatbeds may seem large in the desktop world, but compared to floor-standing drum scanners, they're tiny and highly desirable in cramped reprographic environments.

Resolution on CCD scanners is no longer an issue, with switchable lenses concentrating resources onto specific areas, and new high-end XY-Stitch flatbeds moving their imaging heads both vertically and horizontally across the image. You can bet that the tonal dynamic range will also improve in the near future and PMTs will shuffle off into retirement. Particularly innovative designs from companies like Imacon (www.imacon.dk) are changing the way high-end professionals think of CCD scanners.

Software won't be standing still either. As image files increase in quality, they'll inevitably need more of your precious storage space.

In the world of consumer audio and video, the days of uncompressed digital formats are now just about over. DVD didn't get where it is today by not compressing its data and forthcoming high-end audio standards are also likely to use plenty of the squeezing stuff.

The JPEG file format can preserve image quality in a reduced space, but programmers and developers the world over are working on more effective means of compression that offer better quality yet ever smaller storage requirements. As devices sport faster processors, the intensive compressing and decompressing stages will be significantly reduced, allowing new formats to infiltrate the mainstream.

The real breakthroughs, however, will be in the realm of 3D scanning and we're not talking about using a digital camera to make a 2D image of a 3D object. Instead we mean capturing three-dimensional co-ordinates of an object, then being able to move around it or zoom in and out. With improvements in human interfaces, we'll be able to pick up and feel purely digital, non-existent objects.

We'll be able to pick up and feel purely digital, non-existent objects

Far-fetched? Not really. 3D scanning has been with us for many years in fields as diverse as movie special effects and the automotive industry. Both have real-life objects they wish to capture in every detail (be it an actor's head or a car), for later testing and processing.

In the same way that a digitally captured image can be emailed across the world and printed out, a 3D scan can be transported electronically, and manipulated on screen or reproduced in three dimensions. Stereo-lithography uses a laser to draw thin sections of a model, one sliver at a time, in liquid plastic. The plastic hardens and the shape is recreated.

The trouble with 3D scanners today is that they are large, bulky, fixed devices. This is necessary in order to precisely place the scanning head in relation to the object and collect accurate co-ordinates. Far better would be a handheld portable 3D scanner, which could capture an object in a process not dissimilar to filming it with a camcorder.

3D scanner in action mapping a Merc A Class

While simple for the operator, the compensation and reconstruction algorithms would be horrifically complicated. For a handheld 3D scanner to work, the processing would have to be carried out in real time and, while that isn't commercially possible for small-scale users today, the never-ending increases in processor performance should make such devices a reality in the future. Pie in the sky? No way – Canon has already demonstrated such a unit at its research centre in the UK, and *PCW* featured a similar device from 3D Scanners on p25 of the June 2000 issue.

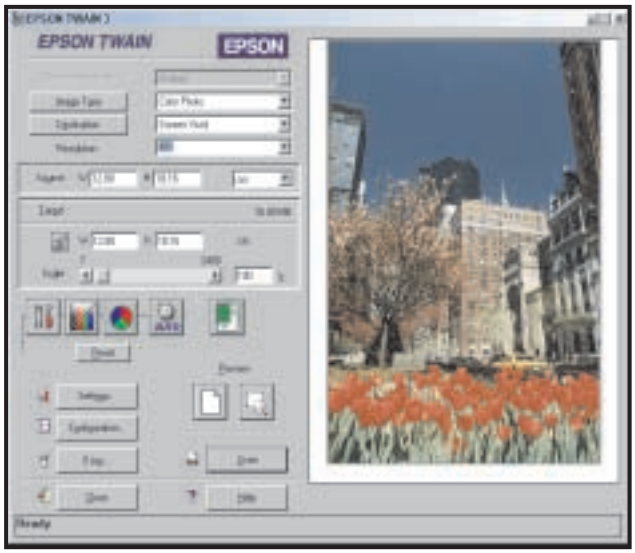
One thing is certain: image acquisition devices are getting smaller, more portable and offering ever better quality. One wonders what Alexander Bain, inventor of the fax machine, would say to a handheld 3D scanner... he'd probably ask where the pendulums were.

PHOTOGRAPH 3D SCANNERS (UK)

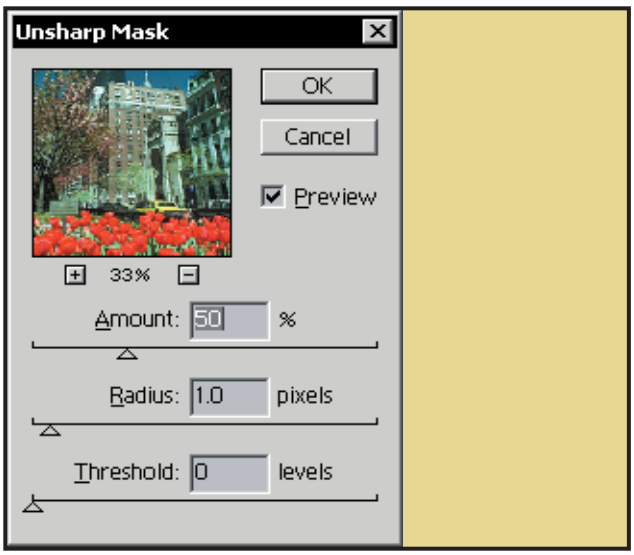
Scanning for printing

If you want to create a colour printout of a holiday snap, our first workshop shows you how to get the best results

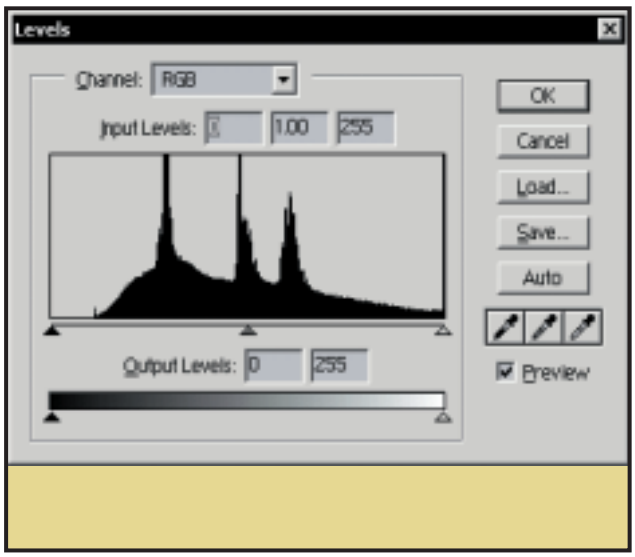
1 The trick with scanning is to know the limits of your output device. Most colour inkjets are happy to be fed between 150 and 300 full-colour scanner pixels per printed inch. Try out different settings to see if you can tell the difference, but we find that around 200dpi is sufficient for most photos. Here we've set the scanner TWAIN driver to scan at 200dpi, and have made a preview of our photo. We've selected the picture and zoomed in – it's a 5 x 7in photo, hence the driver is stating a source of 12.80 x 18.16cm. The file size in 24bit will be 4.12MB.



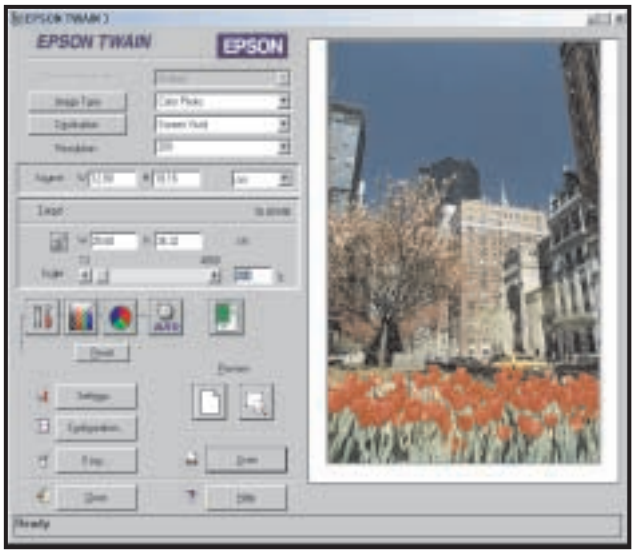
2 If you want to resize the picture, then you'll need to change the resolution. It's a simple equation: double the size means double the resolution, whereas half the size means half the resolution. Since we've discovered that 200dpi is sufficient for same-size reproduction, then a double-size enlargement will require scanning at 400dpi, and a half-size reduction will require only 100dpi. Note that in the above screenshot at 400dpi, that the target file size has increased from 4.12MB to 16.49MB, reflecting the increase in image data.



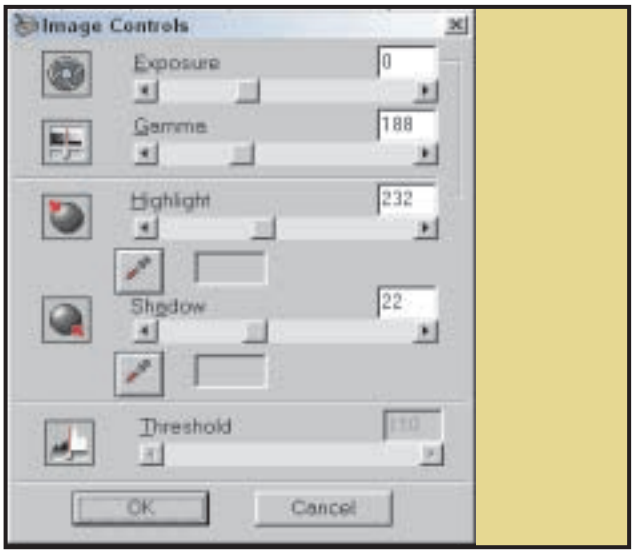
5 Once you've made your final scan, it's time to make any corrections or enhancements. We've scanned into Photoshop 5.5, but the picture is looking a little soft. Many scanner drivers offer a sharpening control, but if that doesn't work try the sharpening controls in most photo retouching packages. Photoshop boasts no fewer than four different types of sharpening, including the strangely-named but sophisticated and preferred Unsharp Mask pictured above. A preview shows what impact the Unsharp Mask filter will have on your image.



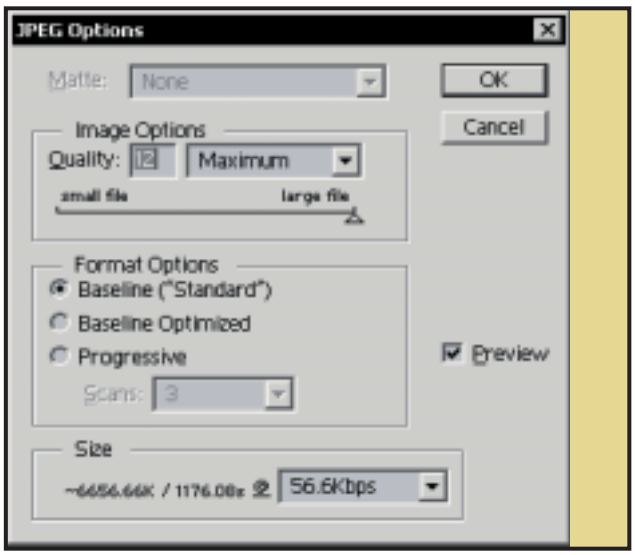
6 Check the histogram of a digital image to see the range of tones in the picture. Histograms are offered by most photo retouching packages and some sophisticated TWAIN drivers. This histogram shows the tonal information petering off before it hits the darkest shadows on the far left. If there are supposed to be dark areas, consider stretching the tonal information across the entire range of light and dark. Photoshop's Levels control, above, lets you do this automatically or manually by dragging the input level's triangles to the limits of the captured range.



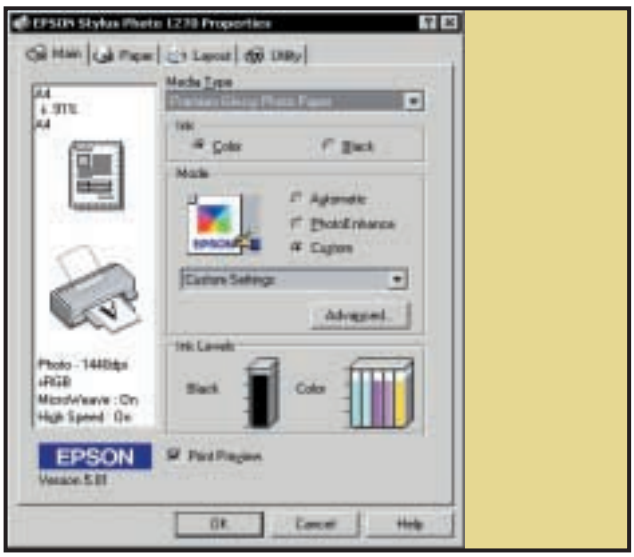
3 Previously we doubled the resolution, but as far as the scanner was concerned, we were still going to print it the same size at 12.80 x 18.16cm. To make the enlargement, we would change the resolution to 200dpi without altering the file size in Photoshop, forcing the physical printing dimensions to increase. However, it's easier to use the scaling function. Above we have left the resolution at 200dpi, but changed the scale from 100 to 200 per cent. The file size is 16.49MB, but the physical dimensions (used to instruct a printer) have doubled to 25.60 x 36.32cm.



4 If possible, the TWAIN driver is the best place to make tonal or colour corrections, before doing the final scan. At this point, most drivers will be working with the most possible image data, such as an increased tonal dynamic range, before normally delivering the most significant 24bits to your application. If you make brightness, contrast and colour adjustments after scanning, you may increase the level of noise or reduce the tonal dynamic range. This pre-scan stage is also where you should activate any de-screening options to eliminate moiré.



7 Once you've got this far you'll want to save your image. The big question is whether to compress or not. The JPEG format permanently throws away information, so is not suitable for archive. Try saving as a TIFF with LZW compression – this is lossless, so may not be as effective as JPEG, but you'll still save a little space without losing quality. Then again, try using JPEG compression at its mildest setting. Above we've set the slider to maximum quality, which has reduced the file size from 16.49MB to 6.66MB without any perceptible loss in quality.

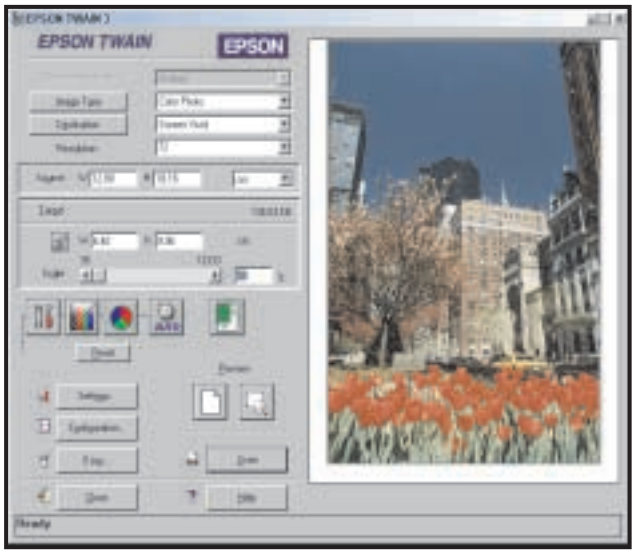


8 Above is the printer driver for the Epson Stylus Photo 1270, which can hold your hand or let you tweak to your heart's delight. Most crucially, make sure your printer driver knows what kind of paper it's using, or you may end up with too much or not enough ink on the page. We've chosen custom colour settings in an attempt to match the colour properties of our scanner without messing around with ICC profiles. We've opted for sRGB (standard RGB), which is used by many devices to match scanner settings in order to get an accurate printout.

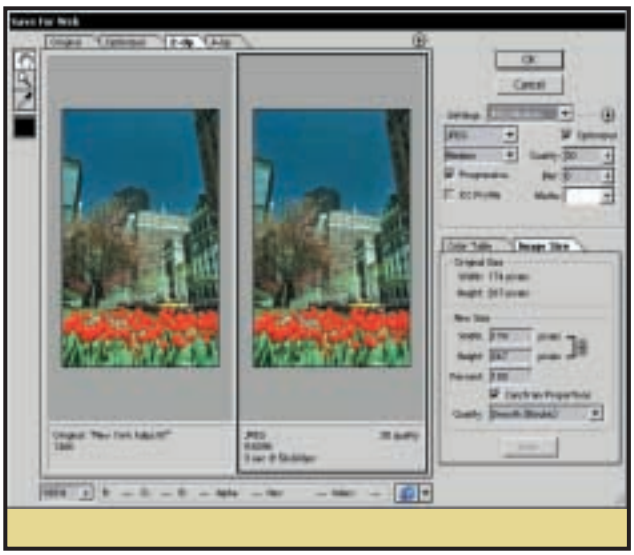
Scanning for the web

Size does matter when you put pictures on the Internet, so to avoid excessive download times, follow our advice

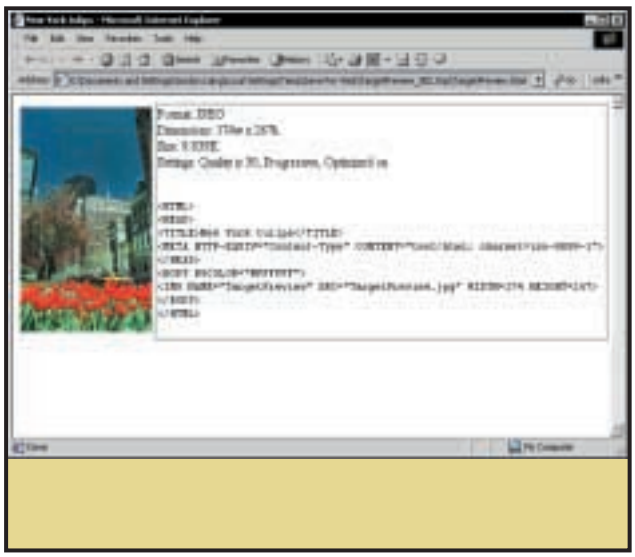
1 Scanning images for the web is pretty simple, with just two main considerations concerning image size. First, how big would you like the picture to appear on a monitor? Most monitors operate between 70 and 100dpi, depending on the desktop setting and the physical screen size. A typical 17in monitor measures about 13in across, and if it's running at 1,024 pixels, will have a display resolution of about 79dpi. Since each monitor pixel can perfectly display each scanner pixel, use this display resolution as a base. Above we've chosen 72dpi, with a file size of 547KB.



2 Since our original photo measures 5 x 7in, scanning it at 72dpi will reproduce it on screen at 5 x 7in. This is a bit big, so above we've halved its size using the scale to 50 per cent control. The new target size physically measures 6.4 x 9cm, and the corresponding file size has been reduced to 136KB. While you may think this is a bit small on screen, a picture 9cm tall is considered pretty big in website terms. Choosing the correct size for online publication takes a bit of practice, but generally, you'd be surprised how small most web pictures really are.



3 A file size of 136KB may sound small compared to the tens of megabytes mentioned in the printing workshop, but it's still too big for most websites. The trick is to use JPEG compression to reduce the file size without overly compromising image quality. Photoshop 5.5 has a superb Save for Web facility (above) that displays the original image next to one or three compressed versions for direct comparison. Going for medium quality, we've reduced the file size to just 9.8KB, which Photoshop estimates will take three seconds to download using a 56K modem.

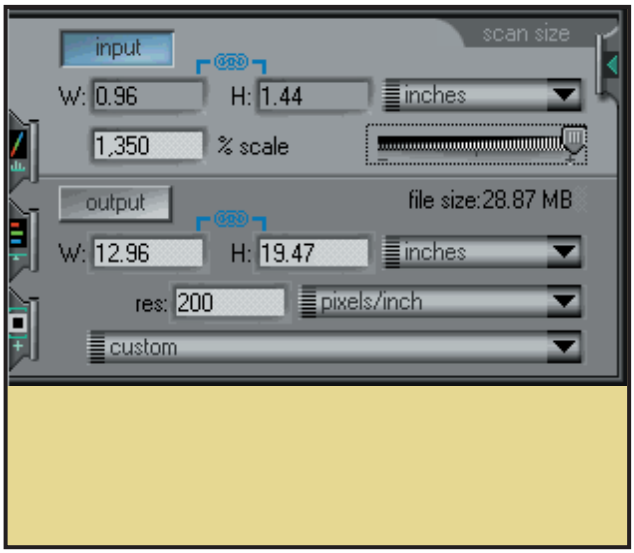


4 Remember what we were saying about how big images can look when viewed in a web browser? The final step in preparing any image for web use is to preview it in a browser. You can either open your JPEG directly into a browser using its File menu, or you could go for a special preview mode in your image manipulation package. Above we've gone for Photoshop 5.5's Save for Web browser preview, which also shows the settings used, and even lists the HTML code used to display it. If the image is too large, consider reducing its physical size further.

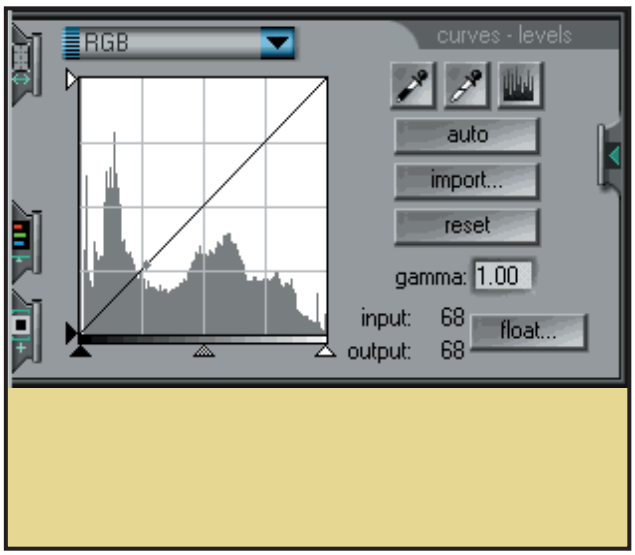
Film scanning

What if your favourite picture is in 35mm transparency format? Well, with a high-quality scanner you can get great results

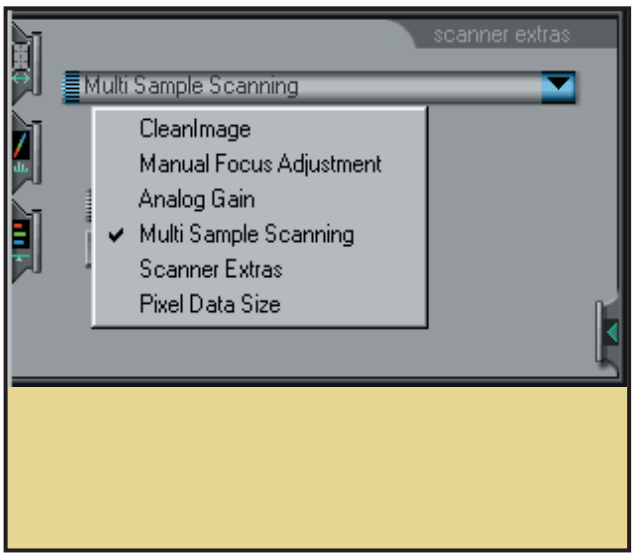
1 Scanning tiny frames of film can be a specialist business. Flatbed scanners can have transparency adaptors, but all they do is shine a light from above and do nothing to improve the unit's relatively low resolving power. Even with 1,200dpi of genuine horizontal optical resolution, you're only looking at a 6 x 9in 200dpi print from a 35mm frame and 3 x 4.5in from a 600dpi scanner. Consider a dedicated unit such as Nikon's compact but high-quality LS-2000 SCSI-2 model. The TWAIN driver v2.5 is sophisticated with many options for advanced users.



2 The first of the four main pull-out tabs sets the scanning resolution and image output size. The 'input' size reveals the small 0.96 x 1.44in size of a 35mm frame. By entering a desired output resolution of 200dpi for our colour inkjet, the driver calculates that a maximum 1,350 per cent scale increase will result in a print measuring 12.96 x 19.47in – A3 to you and me. At standard 24bit, the maximum file sizes from the LS-2000 are 28MB. Obviously you can go for smaller enlargements, or lower resolutions for more modest prints or online use.



3 The second of the four tabs reveals a fully-featured histogram facility. This indicates the range of tones present in the image and lets you automatically stretch them, or manually choose bright and dark points on the preview window. This histogram is for the photo in Step 1. The Nikon's default auto-exposure settings have produced a scan with a good range of tones, so no correction is urgent. The third settings tab offers sliders to adjust brightness, contrast and colour – the TWAIN driver is the place to make these adjustments for the best quality.



4 The fourth tab presents the advanced options. CleanImage spots specks of dust, small hairs and scratches – the banes of film scanning – and automatically retouches them. The results are excellent, but the final image is often a little soft, so there's also a Sharpen option. Pixel Data Size lets you switch from 8bit grey levels to genuine 12bit, although Photoshop will round this up to 16bit in its 48bit RGB mode. Multiple sample scanning makes four or 16 extra passes on the original, significantly increasing signal-to-noise ratio.

hands on

We're all guilty of paying too much attention to all things new and not enough to things we already know. Playing around with new toys is fun, whereas mastering those that you already own can be hard work.

Well, in this month's **Workshop** (p250) Stephen Wells is on hand to show you how to get the most out of that old workhorse Excel. He guides you through some of the more advanced features and time-saving short cuts you may have missed out on if you're a casual user of the package.

Meanwhile, over at **Graphics and DTP** (p274) Ken McMahon shows you how to be a master at cutouts using Photoshop 5.5 LE's eraser tools.

In **Web Development** (p282) Tim Anderson has a step-by-step guide to creating a guestbook for your website using PHP and MySQL. And as Tim says, the humble guestbook is a real interactive web application that can be easily adapted for other purposes.

Benjamin Woolley in **3D** (p276) gets to grips with Blender and looks at Toon3D, an authoring environment for animating simple models.

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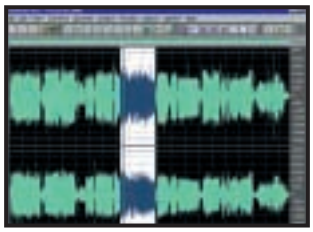
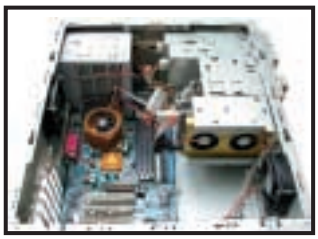




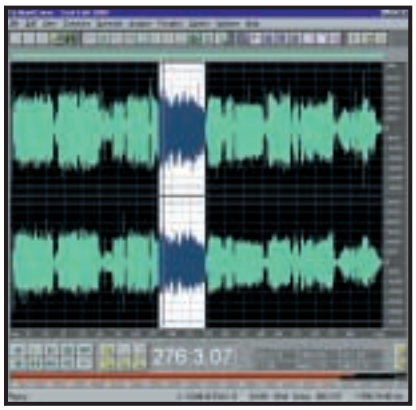
Advice from our experts

Got a problem? Our *Hands On* columnists answer questions and solve your problems.

Windows

Q *I want to make a CD of a 20-minute music tape, but the software that comes with my CD-writer has no provision for recording sound, so I am trying to create a .wav file on my hard disk before using this to create an audio CD. If I try to record using the Windows 95 Sound Recorder, I'm limited to 15 seconds of recording time. How can I increase this?*

Ian McPherson via email



Cooledit is better than Windows Sound Recorder

A One way round this is to record the 15 seconds, then use the Edit, Copy, and Edit, Paste Insert, commands repeatedly. This will double the length at each round. When you have sufficient length, rewind and record over it. To record at CD quality, you'll need around 200MB. A better solution is to find some decent recording software. Cooledit 2000 is available on a 30-day trial from www.syntrillium.com, will do what you want, and will also remove extraneous noise, such as tape hiss.

Q *When I boot up, I seem to have lost the Windows logo – do you know how I could get it back?*

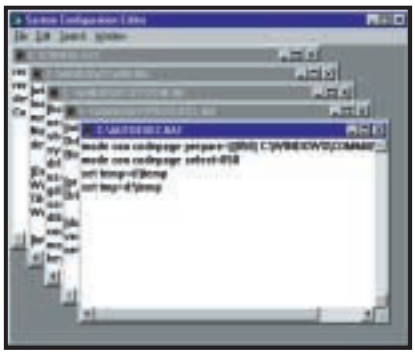
Nick Bearman via email

A First, delete (or rename) any file named LOGO.SYS in the root of C:\ (assuming your PC boots from the C: drive). Also, make sure in the file C:\MSDOS.SYS that the entry logo=0 is not present in the [options] section. You will probably have to clear the Read-only attribute from MSDOS.SYS in order to edit it. If Windows won't let you do this then open an MS-DOS box and type: attrib -s -h -r C:\msdos.sys (you have to remove the system and hidden attributes as well this way). Don't forget to reinstate the attributes (using the plus sign instead of a minus) afterwards.

Q *How can I change the Temp directory that Windows uses? I tried adding the line SET TEMP="D:\TEMP" to Autoexec.bat but this had no effect. Nor did using Winset.exe in the RUN section of the System Policy Editor.*

Nick Lee via email

A You lost me with the Winset stuff, but your initial approach is along the right lines. First, you don't need the quotes. Second, you also need the line SET TMP=D:\TEMP in Autoexec.bat. This should do the trick.



You need two entries to change Temp folder

Q *I keep setting my default signature in Outlook Express to my own text file. After reboots or restarts, Windows often – but not always – discards my signature file and replaces it with some empty KAK.HTM file. I then have to reset my signature. Any idea what is going on or where this appropriately named KAK is coming from?*

Harry Collier via email

A This, I'm sorry to say, sounds like the Kakworm virus, which spreads itself in this way. It's specially insidious as it doesn't rely on the victim opening an attachment. You can get rid of it by finding and deleting the file KAK.HTA (use Windows Find, Files, All hard drives, Include subfolders). Having done that, run REGEDIT and find and delete the following Registry key: HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion\Run\ cAgOu.

There's also an Outlook patch to protect against Kakworm available at www.microsoft.com/technet/security/bulletin/ms99-032.asp.

Spreadsheets

Q *How can I quickly weed out the duplicates in an Excel 97 list?*

Eve Tibbles via email

A Make sure the list has column-heading labels. Then click anywhere in the list and choose Data, Filter and Advanced Filter. Click the Copy to another location radio button, and check the Unique records only box. The range of your list should appear in the top box, but check that it is correct. Leave the Criteria range box empty. Click in the Copy to box and then a cell several rows below your list. Click OK to close this dialog box and a revised version of your list will be displayed that will omit any duplicates.

Weeding out Excel 97 duplicates

Q *Using Excel, how can I enter a series of consecutive dates leaving out the weekends?*

David Smith via email

A Enter the first date, then point to the Fill Handle, which is the small black square in the corner of the cell. Press the right mouse button and draw

the dates down the column or along the row. When you first let go, you'll be offered a whole bunch of options. Choose Fill Weekdays (see *Workshop*.)

Q *How can I enter a fraction in the Works spreadsheet module?*

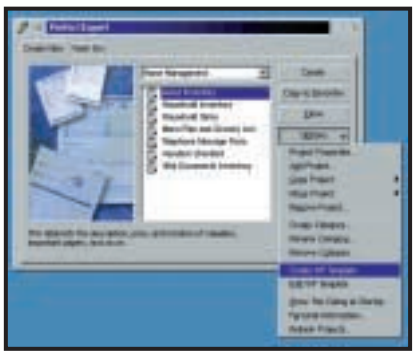
Lynda Long via email

A In either Excel or Works all you have to do is type a space between the number and the fraction. For example, enter 23, space, 1/4. Both spreadsheets will display 23 1/4, although they'll store the number as 23.25, so you can add or multiply this number in other cells. If you just want a fraction by itself, enter a zero, then a space and then the fraction.

Word Processing

Q *How do I create a new template in WordPerfect 9?*

Jeremy Doyle via email



Hardly intuitive, but easy: creating a new template in WordPerfect 9

A This is easy, but somewhat counter-intuitive, as you first have to go to File, New from Project. In the dialog that appears, click on the Options button and choose 'Create WP Template'. Add whatever text, prompts, other macros and toolbars you want, then save; you will be prompted for a name, description and category.

Q *Can you explain why I can't use Word 97 text boxes properly. It will only create large boxes whose size won't adjust. What am doing wrong?*

Ian Sugarman via email

A It sounds as if you have the 'Snap to grid' option enabled, together with a large grid size. You can turn this off by clicking on the Draw menu on the Drawing toolbar, selecting Grid, then clearing the snap settings or changing the grid size.

Q *I am using Word 97 and would like to check spelling in more than one language – in particular, Swedish. I've searched the Microsoft website, but all I have got is frustrated. If I don't have to pay, so much the better.*

Scott Ballentyne via email

A The good news is that you can get a Swedish spelling checker, thesaurus and hyphenation dictionary (but not a grammar checker, unfortunately) online from www.alki.com.

The bad news is that it will cost you about £48. An alternative is to upgrade to Word 2000, which includes English, French and Spanish proofing tools as standard. Unfortunately, Swedish isn't included as standard, but a Proofing Tools pack, comprising 40-odd languages is available from Microsoft dealers in the UK for around £75.

Hardware

Q *I have a PIII 600E Flip Chip Pin Grid Array (FC-PGA) that I would like to fit into an Asus P2B-S motherboard Rev 1.02 using the Iwill Slocket II. How do you set the CPU core voltage to the appropriate 1.65v?*

Howard Barnfather via email

A First the bad news – according to Asus' website, you need Rev 1.04 of the P2B-S to support Coppermine CPUs. However, also according to Asus, you need Rev 1.12 of the P2B to do the same and we've had our Rev 1.10 work fine with the help of Iwill's Slocket. Simply set the core voltage to 1.65v on the Slocket and the correct clock multiplier on your P2B-S (6 x 100MHz) and everything should be fine – you should, however, also flash your BIOS to the latest version.

The 600E may also overclock to 800MHz using a 133MHz FSB (front-side bus), but you may need to increase the Slocket voltage to 1.75v, use additional cooling, switch your PCI bus to one-quarter and ensure your memory is 133 compliant – your AGP graphics card may complain, but it's worth a shot!

Q *I have a Chaintech 6ltm motherboard with an LX chipset, running a Pentium II 233. Would it be possible, with the aid of a slocket, to upgrade to a Celeron 500 processor?*

Kevin Martin via email

A Intel's website says the LX can support Celerons and your motherboard will already be running at the right voltage and FSB for Plastic Pin Grid Array (PPGA) Celerons up to and including the 500MHz model. All you need to do is to make sure your motherboard supports sufficiently high clock multipliers, which for a 500MHz Celeron is 7.5 times. Almost any slocket will do too, as you don't need compatibility with the newer FC-PGA Celerons or PIIIs which demand lower core voltages.

Q *Can I mix an Ultra160 SCSI hard disk and a SCSI CD-R without dropping the performance of the disk? I already attach two scanners to my Adaptec 19160's legacy SCSI connector and fear they may drop the performance of the CD-R if attached to the same channel, too.*

Peter M Pascoe via email

A Keep the hard disk and any other U160 or U2W LVD drives by themselves on the LVD channel, as any non-LVD drives, such as the CD-R, will compromise the bandwidth. The CD-R will work perfectly well with the scanners on the legacy channel.

Q *In July's* Hands On, Hardware, *you stated that the SuperMicro PIIIDME 840 chipset motherboard uses Intel's MTH. After hearing about the MTH problems on the 820 chipset I ran Intel's MTH ID utility and it did not detect an MTH on my motherboard – what's going on?*

Stany Thibaut via email

A Hands up, you caught us out! Both the 820 and 840 chipsets were designed for RDRAM memory, but Intel developed a chip that would translate the protocol so that SDRAM could be used instead. This chip on the 820 is the ill-fated MTH, which is now in a process of refund or replace. The higher-end 840 chipset instead uses the different MRH-S chip which, while recently revealed not to get on with ECC SDRAM, appears to be in the clear – for now.

Databases

Q *In Access I created a query which worked fine, so I saved it as Query1. Later I renamed it and now when I run the query it asks me for a 'parameter' which it then ignores! This problem disappears when I rename the query back to Query1.*

Andrew Walker via email

A Our guess is that, after saving it as Query1, you used the Sort button while looking at the answer table generated by the query and then saved the query again under the same name. Then you later renamed the query and hit the problem.

When you use the Sort button on an answer table and then close the table, Access will ask if you want to save the query. If you agree, it writes something like Query1.ColumnName into the properties of the query. Renaming the query doesn't cause this parameter to be rewritten, hence the problem. Rename the parameter to: NewQueryName. ColumnName and all should be well.

Unix

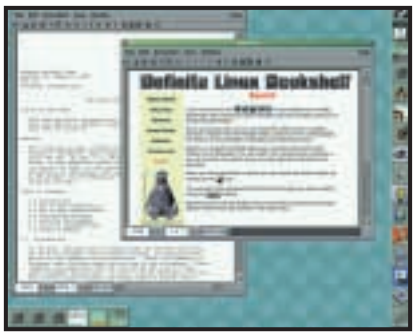
Q *Your Unix column sweet-talked me into installing Linux, but I'm fed up with having no modem, no printer, no scanner, no sound and that's just for starters. I've zapped Linux, but I'm still left with Lilo and can't get rid of it. I bet you'll try persuading me to give Linux another try.*

David Berry via email

A To solve your problem, boot from a DOS floppy and use fdisk/mbr to overwrite the Lilo code with the standard DOS master boot record.

As for persuading you to try again, we've no intention of doing that. It's up to you. It happens that millions of Linux users out there modem happily through to their ISPs; they have printers that print and scanners that scan as their sound cards chortle out their MP3s. And their CDs automount if and when they want them to (which incidentally isn't always – this is an operating system where the user calls the shots).

Most modern Linux distros sort all these things out automatically at install time and if there are glitches, Linux users are proactive types who read the docs and ask around, fix the problems and learn a lot in the process.



These days you don't need to be a rocket scientist to run Linux. But it helps a lot if you have a healthy curiosity about how things work, and are prepared to put in the time maintaining that curiosity and sharing your discoveries with others.

For starters there is a ton of documentation out on the Internet. Phone-bill conscious Linux newbies may prefer something such as the Definite Linux Bookshelf, described as 'A gigantic collection of Linux reference material on one CD-ROM'. It contains copious PDFs relating to every facet of Linux use and you can get it from www.definitesoftware.com for around £10

Graphics and DTP

Q *I have a video-capture card (Motion Picture) that refuses to work with a new motherboard/processor combination I had fitted recently. Can you suggest any video cards that I can use for capturing stills from a Hi-8 video camcorder: I haven't got around to needing editing – yet – so that feature would be helpful, but my primary requirement is to capture stills.*

Mike Gerynant via email

A Matrox, Pinnacle and ATi all produce reasonably priced cards that will allow you to capture and output analog video stills and movie clips. Cards such as the ATi All-in-Wonder 128 Pro also provide MPEG-1 and MPEG-2 digital video compression as well as a TV tuner and DVD player all for under £150.

Q *I am a professional photographer specialising in sports photography. I have a problem with regard to re-sizing photographic scans. At the start of each football and basketball season I attend as many games as possible, shooting stock action of the players. I use a Polaroid Sprintscan Plus and always scan at maximum optical resolution (2,700dpi) which results in JPEGs of around 3-6MB each, 14-24MB uncompressed. This is an ideal size for my main uses but NOT for distribution to newspapers, which usually stipulate a maximum uncompressed file size of 6-8MB.*

I wish to batch convert several hundred pictures to match this specification but cannot do it in Photoshop – or any other program I have tried (including DeBabaliser). You can set the width, height, etc, but not the resulting finished file size. Any ideas?

Pete Murphy via email

A The reason you cannot set the file size is that it depends on the nature of the image. Pictures with large areas of flattish colour will compress more efficiently than those with lots of detail. You can demonstrate this by creating a 1,000 x 1,000 pixel RGB image filling it with flat colour and saving it as a medium quality (5) JPEG file. Then apply 50 per cent gaussian noise and resave

The top image is 18KB in size... whereas the one below is 626KB

with the same settings. When I did this the first file was 18KB, the second 626KB. So, even if it were possible to make all your files the same (compressed) size, it might not be desirable as the quality would vary widely.

As the newspapers stipulate a maximum uncompressed file size, why not save the files as uncompressed TIFFs, you can work out arithmetically, or by trial and error the pixel resolution that will generate a 6MB file. Then you can zip the files before sending, which has the added advantage that you need only send one file, rather than any number of images.

CONTACTS

All of our experts welcome your queries: simply respond to the appropriate address at the end of their *Hands On* columns.

Balancing act

Uncovering Excel's hidden depths Stephen Wells finds shortcuts to keep your accounts in order.

The spreadsheet was the killer application that got Apple started. In 1978, Dan Bricklin, a Harvard Business School student with some experience of computers from summer jobs with Wang, worked with Bob Franckston, a programmer friend, to simulate the accountant's worksheet on screen. That's where the columns and rows came from. The really clever bit, though, was that they allowed hidden formulas to be embedded within the worksheet that could perform calculations on the visible data.

This is how VisiCalc for the Apple II personal computer was born. More than 700,000 copies of VisiCalc were sold and Apple sales boomed. The VisiCalc program that ran on the IBM PC in 1981 still runs on today's PCs. It is only 27KB long and can be downloaded from www.bricklin.com/history/vcexecutable.htm and run under Windows or DOS.

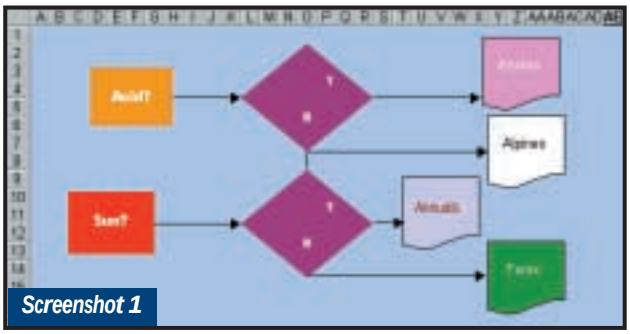
By 1984 VisiCalc had disappeared, though vestiges of it live on in Lotus 1-2-3. For years 1-2-3 was the dominant spreadsheet, but Lotus was slow to move on from its DOS-based versions. Microsoft stepped in with Excel, the first Windows spreadsheet and, after a slow start, took the market by storm.

Since the boom in the Internet, PCs have almost become household appliances and many businesses and families have acquired Excel, Lotus 1-2-3, Corel Quattro Pro, or the Works spreadsheet module as part of a software bundle with their machines.

The problem is that most people never get the best out of their spreadsheet package. So we're going to take a look at Excel in this workshop and help you understand some of its more useful features that you may have initially missed. Becoming familiar with these can save a lot of time.

First steps

You may not have realised that Excel includes several templates for producing invoices or purchase orders. To access these just choose File, New, Spreadsheet solutions. If the selection presented doesn't appeal to you, there is also a link from here to the Village Software website where you can order many more – although, as the company is in Boston, Massachusetts, you will have to anglicise these forms for use on these shores.



Excel will create simple flowcharts using just the Drawing and Formatting toolbars

But time-saving isn't just about templates and shortcuts. Often a graphic representation of tabular data enables it to be quickly understood. Stock prices are a good example of this. Excel can make a chart instantly. All you have to do is highlight the whole table, including row and column labels and press F11. Excel will open a new sheet and put a bar chart on it with both axes labelled. If you want to change the chart type, just click on the Chart wizard tool and choose another one. To reformat any part of the chart, right-click on that element and make the changes.

Instead of bar charts, you might want to draw flowcharts. You can draw these with Excel using the tools on the Drawing toolbar. On a new sheet, click the Select All button – the grey area where the row and column headings meet. Draw the join between column headings A and B slowly to the left until the column width is reduced to 2.00. The cell borders now offer a grid for aligning AutoShapes.

For a decision shape, hit AutoShapes, Flowchart, Flowchart:Decision. Drag the mouse on the sheet, holding down Alt to snap to grid. Click on the edge of the AutoShape, right-click and choose Colors and Line, Fill Color. Then select a new colour for the decision diamond.

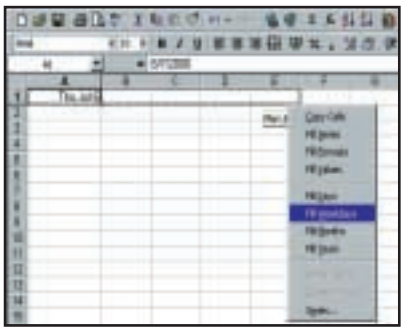
To draw connecting lines, click on AutoShapes, Connectors and choose one. To eliminate the conventional spreadsheet gridlines, choose Tools, Options and uncheck the Gridlines box. For a colour background, click the Select All button and click the Fill Color button on the Drawing toolbar. With a little practice you can create flowcharts like screenshot 1 in no time.

Perhaps the biggest time-saving feature of Excel is its support for macros. Many users don't realise Excel offers listings for a number of useful macros in the file, Samples.xls. There is code that will start a macro when someone enters data in a worksheet, a macro for looping through an array, one for retrieving data from a database and one for copying an Excel chart into a Word document.

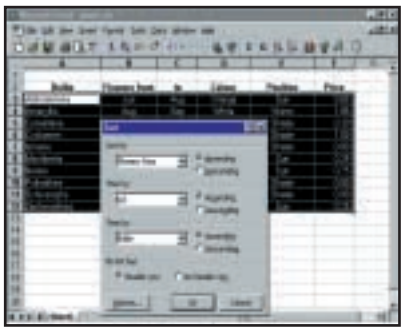
To enter a macro listing in Excel just press Alt & F11 to open the VBA for Excel editor. Double-click on Sheet 1 (if that's your current worksheet name). If there is already a macro listed there in the right-hand box, you can still add another one after it. Either way, carefully type or paste in the macro code. Press Alt & Q to return to your workbook. Press Alt & F8 to open the Macro dialog box. Click on Options and you can assign a keyboard shortcut which will run your new macro. The job's done.

Excel can do a lot more than you may have thought a spreadsheet was capable of. For example, the file Mapstats.xls, included with Excel, offers you a look into the world of mapping. The root software for Excel's mapping facility is provided by MapInfo. Its British affiliates offer datasets on everything from all the parishes of Britain to the postcode boundaries of Switzerland. You can buy lists of 13,000 UK estate agents, or 10,000 pubs, which are instantly mappable in Excel. Subscribers to a

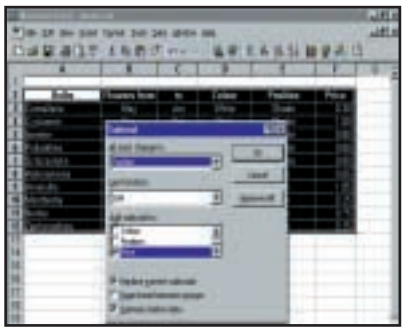
Six helpful built-in Excel features



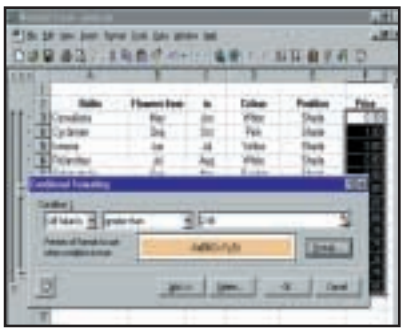
1 To enter a series of consecutive dates down a column or across a row, you can drag the Fill Handle at the bottom right of the cell. But supposing you want to skip the weekends? Simply hold down the right mouse button before you drag and you're offered lots of options, including skipping Saturdays and Sundays. Or you could have a series of dates 10, 15, 30, 60 or 90 days apart. Just fill in the Step value box.



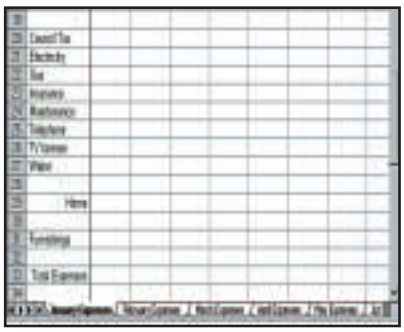
2 To leave space around your list or format the heading labels bold, click on any cell within the list. Choose Sort on the Data menu. Your labels will appear in the drop-down boxes. Pick Ascending if the list is to be sorted in alphabetical or growing order. Here the flowering months were entered as 1/1/00 and so on, and then given a Custom Date format of mmm. The sort order is: month flowering starts; then when it ends; then by name.



3 Here a sort has first been made based on the Position column. Choose Subtotals on the Data menu. From the drop-down boxes choose Position as the main key, Sum as the function to enter and Price as the column in which to subtotal. When you click OK, subtotals will be added for the Shade plants, and the Sun plants, with a grand total at the bottom. You can display all the list, or just the subtotals, or just the total.



4 Excel can automatically change formatting by recognition of a specified condition. Highlight the full range of cells for which you wish the condition to apply and choose Conditional Formatting on the Format menu. Here we have chosen to make any cell in the prices column have an ochre background if the cell's value is more than £2.99, but the range of options is enormous. In this particular case it produces that colour in the subtotal and grand total cells.



5 To make entries apply throughout a workbook, you can Group the worksheets. Click on the tab of the first worksheet, then hold down the Shift key and click on the last tab and the whole group of sheets will react as one. For just particular sheets, click them holding Ctrl. You can enter any labels, formulas or formatting on one sheet and they will appear on all the others. To separate them, right-click on a tab and choose Ungroup sheets.

6 To ensure all your data appears on the printed page, highlight the range you expect to print and choose File, Print Area, Set Print Area. Then choose File, Page Setup. In this dialog box, under the Page tab, check the paper size is correct, and the portrait (vertical) or landscape (horizontal) orientation of the paper. Click the Scaling radio button which specifies one page wide by one page tall. This automatically adjusts the image size so your table will fit.

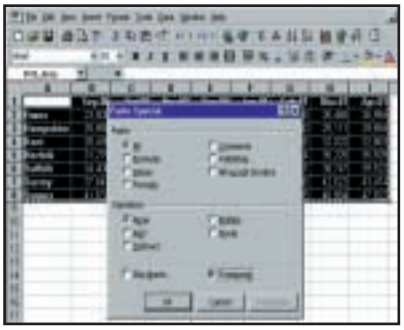
service can even track ambulances and delivery vans on a map live, using a GPS (global positioning system). See the MapInfo site at www.datasets.com.

If you're interested in other specialist spreadsheet applications, you can invest in an Excel Add-In, such as those from Eastern Software Publishing in Essex. Run by spreadsheet lecturer Grenville Croll, Eastern distributes programs on risk analysis, neural networks, staff scheduling, diagramming, cost modelling, genetics, customer valuation and many more. Check out its site at www.eastern-software.com.

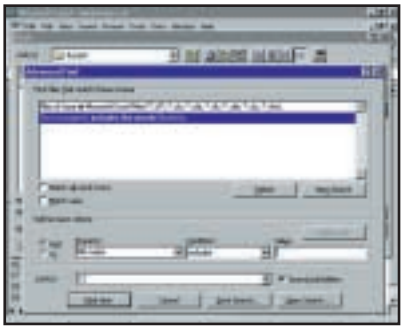
If it's Excel utilities you're after, then your first port of call should be Edwin's Power Tools at http://users.vol.net/edwintam/EPT.HTM. Edwin offers Excel Add-Ins for Excel 2000, 97 and 95 for Windows, and Excel 98 and Excel 5 for the Mac.

Another useful Excel site run by an enthusiast is Alan R Barasch's site at www.barasch.com/excel/. But the most widely appreciated non-commercial site has been maintained for some years by

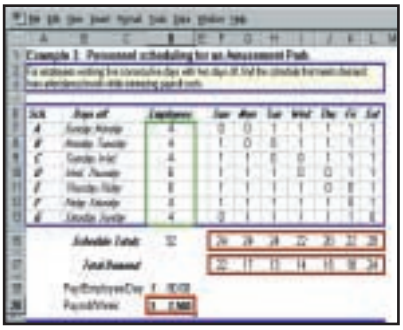
Six more advanced Excel features



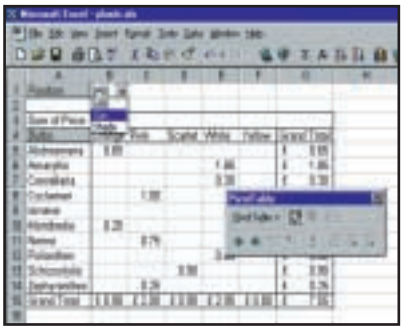
1 If you would like to switch a table around, moving the column headings to become row labels and the row labels to become column headings, it's no problem. Highlight all of the table, right-click and choose Copy. Click on a cell at the top-left corner of a clear range which is away from the table. Choose Edit, Paste Special. In the dialog box that appears, choose All under Paste, None under Operation, check the Transpose box and then click OK.



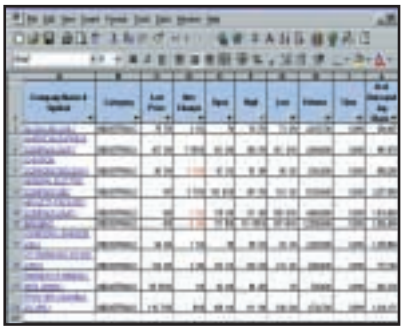
2 Can't remember the name of a file? If you can recall a word in it, choose File, Open and enter the word in the 'Text or Property:' box. This only works for files in the specified directory. If the workbook is in some other directory, click the Advanced button. Now you'll see there is an important box at the bottom named 'Search subfolders'. Check that and change the 'Look in:' box to C:\ – if that's your main hard drive.



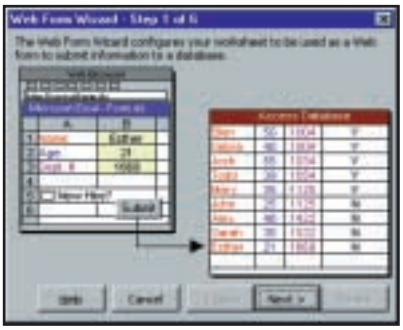
3 When you have a problem to calculate based on a set of rules, lay out the basic table and use Excel's Solver Add-In to work out the answer. Choose Tools, Add-Ins and check the Solver box. Then it's available under Tools, Solver. For a quick tour of Solver, and four examples of its use, first find and open the file Solvsamp.xls. The example illustrated here is for scheduling staff to meet customer demand at maximum efficiency.



4 You can view a list in numerous ways by presenting it in a Pivot Table. Click in the list and choose Data, Pivot Table Report. In the ensuing Wizard, you can move the labels of your list with the mouse into boxes representing Column, Row, Data or Page. In this example, using the plants list, we moved the label, Position, into the Page box, Colour into the Columns box, Bulbs into the Row box and Price into the Data box.



5 Many websites offer information for downloading straight into a spreadsheet. Often this is simply in CSV (Comma Separated Values) but some sites provide special templates called Web Queries. To try out an example choose Data, Get External Data, Run Web Query. Then select Dow Jones and connect to the Internet. As shown in this example, the template includes drop-down boxes so you can pick the top 10 stocks in price rise, or volume of sales.



6 If you have a website and there's an appropriate Access database on your web server with CGI (the Common Gateway Interface), you can display an Excel form that visitors can use to send you information. Choose Tools, Add-ins, and confirm that the Web Form Wizard box is checked. Then choose Tools, Wizard, Web Form. Step five lets you enter a thank-you message for visitors. Step six will create the .xls, .idc, .htx and .mdb files needed.

Californian John Walkenbach at www.j-walk.com/ss/. John is also the author of a number of spreadsheet books.

With so many users of Excel sharing their problems with Microsoft, the first place to look for an answer to any question is the Microsoft Knowledge Base. To get Excel-specific information, go to http://support.microsoft.com/search/default.asp. Then, in the 'My search is about:' box, pick your version of Excel. You can search by keywords, a KB article ID number if you know it, or see what's been added in the past few days.

Finally, for more articles and sample applications for Excel, see The Microsoft Excel Developers' Forum at www.microsoft.com/exceldev/e-a&sa.htm.

CONTACTS

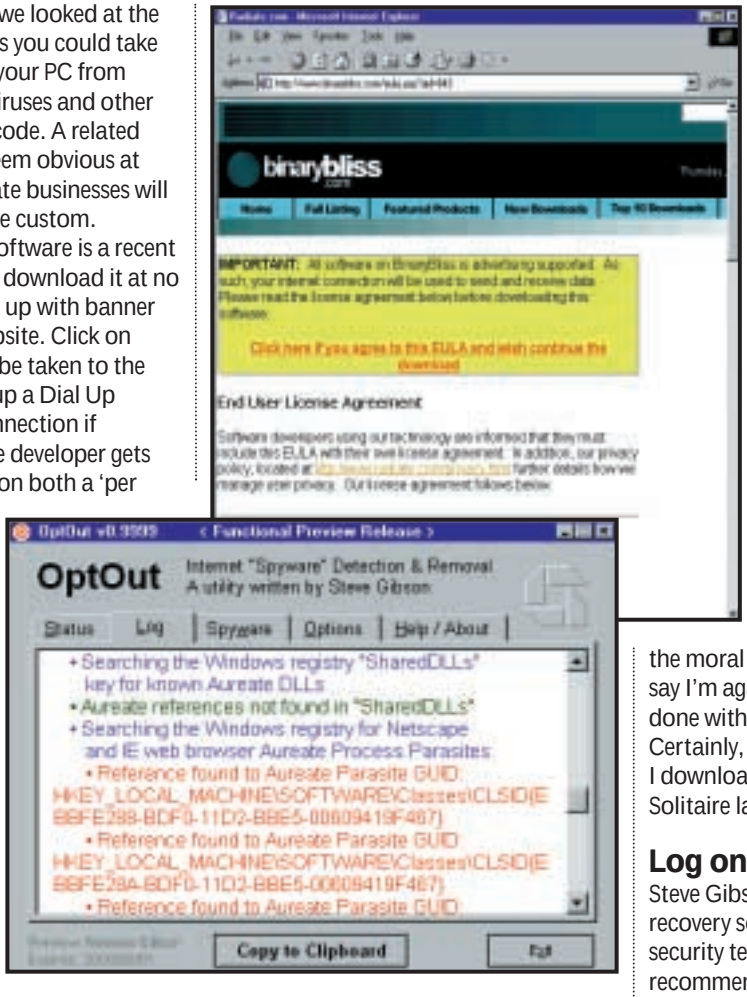
Stephen Wells welcomes your comments on the subject of spreadsheets. Contact him via the *PCW* editorial office or email **spreadsheets@pcw.co.uk**.
Please don't send any attached files until requested.

Beware of spyware

A lot of 'free' software does more harm than just send you the odd advert, warns Tim Nott.

Last month we looked at the precautions you could take to protect your PC from attack by viruses and other malicious code. A related issue, which may not seem obvious at first, is how far legitimate businesses will go to attract your online custom.

Advert-supported software is a recent development – you can download it at no charge, but have to put up with banner ads, exactly as on a website. Click on one of these and you'll be taken to the advertiser's site, firing up a Dial Up Networking (DUN) connection if necessary. The software developer gets paid by the advertisers on both a 'per display' and 'per click-through' basis; one of the first operators in this field was Aureate, which provides advertising content in freeware such as Go!Zilla and the Free Solitaire game mentioned last month.



Left: You have been warned, but not all sites supplying adware are this forthright Below: Gibson's OptOut shows what you may not be aware of

However, there is rather more to this than meets the ad-fatigued eye. Scare stories posted earlier this year claimed that the Aureate software posted software inventories of users' PCs, details of users' surfing habits and other personal information back to the company's site. This was denied by Aureate – which is also known as Radiate – and independent analysis appears to confirm that those scary rumours were, indeed, false. But, remember, just because you're paranoid, it doesn't mean they are not out to get you, so read on.

Typically, when you download one of these freeware packages, you'll be prompted to fill in a lengthy questionnaire. This – according to Radiate – helps tailor the ads you will see. Note that the questionnaire is voluntary, and if you are happy to answer it then you can't really complain about invasion of privacy.

Fresh adverts are delivered to your PC, even when you are not using the software

However, fresh adverts are delivered to your PC, even when you are not using the software, and stored on your hard disk. Information regarding which ads you have seen – and more importantly, those you have clicked on – is transmitted back to Radiate. This, in turn, provides the information to pay the software authors and further 'tune' your advert profile.

All this can happen without your knowledge and can continue even after you have removed the original ad-bearing software. Individual profiling in this way opens a can of particularly juicy and wriggly worms. Now I'm not going to go on at length about the moral pros and cons: suffice it to say I'm against it, especially when this is done without the user's knowledge. Certainly, I had no idea of this when I downloaded and wrote about Free Solitaire last month.

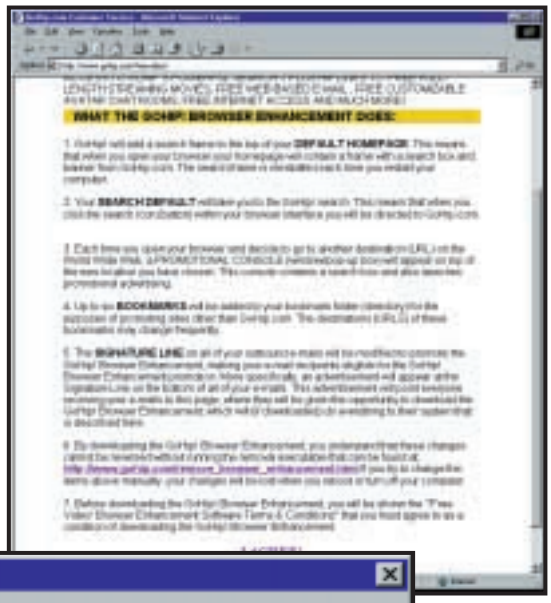
Log on, click in, opt out

Steve Gibson, author of the Spinrite disk-recovery software and the ShieldsUP security testing website (both highly recommended), has taken the matter of 'spyware' very seriously. His website (http://grc.com/optout.htm) contains a detailed explanation of how Radiate and similar systems work and you can get a copy of OptOut, which will detect and/or remove spyware from your system. Steve points out that privacy is not the only issue: other problems can also include security problems and browser crashes.

I ran Steve's OptOut on my system and it found several Registry entries and files belonging to Radiate. Having decided that the Free Solitaire was too expensive, I removed it with Control Panel, Add/Remove programs. This took out the Free Solitaire program, and the store of adverts (which I'd never realised I had), but left behind the Radiate Registry entries and two DLLs –

ADVERT.DLL and AMCIS.DLL. This can't be excused as sloppy housekeeping, as the next day I did a bit of spying myself, with the Windows System Information tool. As soon as I ran Internet Explorer, both DLLs were loaded into memory, and the WINDOWS\AMC folder (used to store the adverts) was recreated. I ran OptOut again and this time chose the option to remove these parasites – as Steve Gibson aptly calls them – from my system.

In the interests of fairness and accuracy, I went to download Buddyphone from www.binarybliss.com (a site apparently owned by Aureate Media, shown left). Here the download screen stated clearly that the software was advertising-supported and that you should read the End User Licence Agreement below – which, in turn, stated: 'understand that this software will connect to the Internet UBIQUITOUSLY to download advertisements and/or to provide software updates. You also accept responsibility for any network usage costs or any other costs incurred by using this software'. Reasonably frank, but mysterious in the use of UBIQUITOUS (its capitals): does this mean it connects everywhere or often? After download, the installation offered no further information until the application was started, when the optional questionnaire appeared – and was dismissed unfilled. Once again, OptOut reported the presence of ADVERT.DLL and AMCIS.DLL and once again these managed to survive an uninstall of Buddyphone before I let OptOut deep-six them.



Left: No – this is not a joke Below: That's odd – I'm sure I said 'Copy'. Your shortcut keys may lead to unexpected places when using WinPopup

Not all sites and applications are this candid – I downloaded Aureate Go!Zilla from Tucows and received no warning at download, on installation or on use, although the same advert software was installed. However, this time uninstalling removed the DLLs – but not the Registry entries nor the advert files, so once again OptOut was asked to do its stuff.

At the time of writing, OptOut was free of charge, (and a mere 31KB download) but it only dealt with the Aureate/Radiate system – others, such as the Conducent Tsadbot that gets installed by the trial version of CuteFTP, weren't detected. By the time you read this, however, OptOut will be a commercial product and expanded to detect and remove Tsadbot and other systems. Aureate/Radiate also claims to supply a remover for its DLLs: to find this you need to go to the (again very small print) 'privacy policy' link on the home page. The contents of this page openly states what Radiate does and makes the sensible suggestion that 'if you don't want your personal information collected, please do not submit it'. I found a link on this page to 'Aureate/Radiate DLL Remover', but clicking on this produced a '404 – not found' message.

If you don't want your personal information collected, please do not submit it

The obvious defence is to read the small print carefully and avoid ad-supported software (unless you like that sort of thing). However, there is another defence – although the Radiate DLLs hook into Internet Explorer and Netscape Navigator, they won't affect some other browsers, such as the fast and lightweight Opera.

In fairness, Radiate is by no means the only player in this arena and I'll be keeping a beady eye on other intrusive advertising technologies that take liberties with your operating system. One I'll mention now, as it deserves a prize for bare-faced cheek, is the search'n'shop portal www.gohip.com.

Download the 'Browser Enhancement' and it changes both your home page and your search engine to Gohip's. It adds 'up to six' changing bookmarks to your favourites folder. It opens a 'Promotional Console' each time you open your browser or go to another URL, which contains advertising and a search box.

The final, horrifying, touch is that it adds an advertisement for itself to your Outlook Express signature. This will point recipients of your mail to the Gohip site, where they, too, can have the opportunity to download and help bring a new meaning to the word 'enhancement'. Fortunately, you are told about this before you can download the file and have to click on an 'I am a complete idiot' button to continue. All right, I made up the last bit – it's 'I agree', but the rest is true.

If, by some inexplicable oversight you have fallen for this, then here's what to do. First, don't send any email messages, especially to me. Next delete 'Windows Startup' (winstartup.exe) from Windows\Start Menu\Programs\Startup. This is essential, otherwise all of the other reparations will be in vain.

Now you can reset your home page and your search engine: if you're using Internet Explorer you can reset these to the defaults by going to Internet Properties, Programs and Reset Web Settings. You can then change the home page from the General tab. Next, reset your Outlook Express signature from Tools, Options, Signature. Alternatively,

Gohip offers its own remover on its Customer Service page.

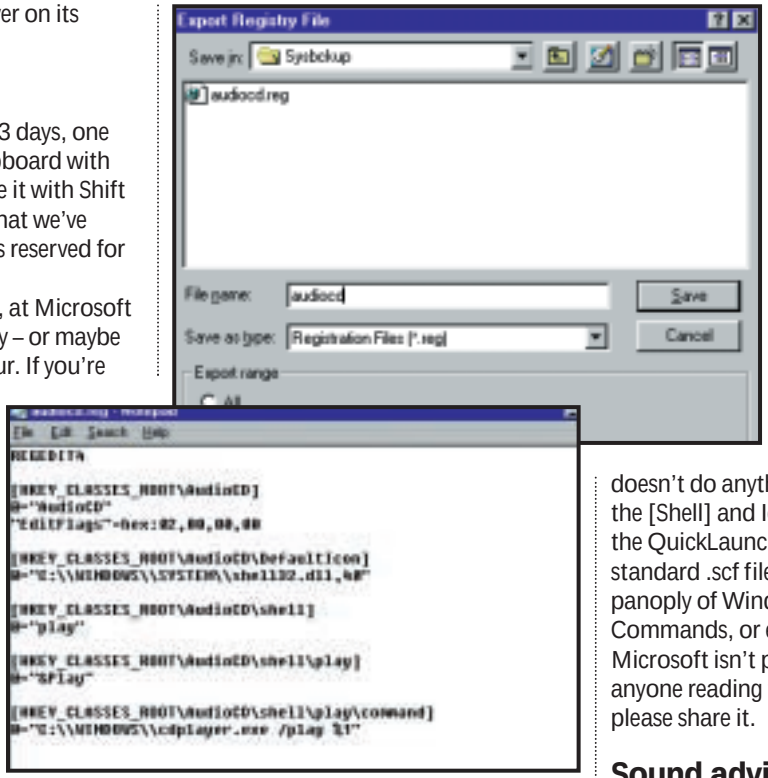
Copy or kill?

Way back in pre-Windows 3 days, one would copy stuff to the clipboard with Control & Insert, then paste it with Shift & Insert. The Control & C that we've come to know and love was reserved for aborting DOS commands.

Somebody, somewhere, at Microsoft must have a sense of history – or maybe just a weird sense of humour. If you're not connected to a network, you probably haven't experienced the joys of WinPopup, which is a utility designed to send short text messages to other members of your workgroup.

Apart from important tasks such as announcing the lunchtime pub venue, it's quite useful for sending information such as 'Here's that email address/phone number/URL you wanted...' So, bingo, you highlight the relevant part of the message, hit Control & C and it isn't copied to the clipboard.

Instead, you are asked if you want to delete all your messages (see screenshot on previous page). Admittedly, you can copy with a right mouse click, but if you're a habitual keystroke copier, you may find this irksome. Take heart that, amazingly enough, Control & Insert still works in WinPopup – as it seems to do in Windows generally.



Top: Backing up the Audio CD default behaviour...
Bottom: ...and what the standard settings should look like

The shortcut to SCF

Windows 98 brought us the mysterious Windows Explorer Command files. These, which have the .scf extension, are plain text files that act as shortcuts. Two come as standard on the QuickLaunch toolbar. The first opens Explorer, but as this defaults to a view with the C: drive expanded, I long since replaced it with a standard shortcut that has the command line C:\WINDOWS \EXPLORER.EXE /n,/e,/select, C:\ which, as regular readers will doubtless recognise, opens Explorer without expanding any drives in the left-hand pane. The other is the very useful 'Show Desktop' command. This has a similar effect to the Minimize All command available from a right-click on the Taskbar, but it's one less click, and applies to objects (such as file, shortcut, and Control Panel property boxes) that the latter can't reach.

If you've removed this useful little icon, here's how to restore it. Open Notepad and type the following:

```
[Shell]
Command=2
Icon File= explorer. exe,3

[Taskbar]
Command= ToggleDesktop
```

Save this in C:\Windows\Application Data\Microsoft\Internet Explorer\Quick Launch as 'Show Desktop.scf'. The third SCF file is the View Channels button, which I am not going to dwell upon, but all this gave me a healthy curiosity as to what else could be done with .scf files. After a search of first the Microsoft website and then, with a variety of technology, the Internet, I found absolutely nothing, save a rather lame tip on using a button that doesn't do anything (ie, just consists of the [Shell] and IconFile= lines) to divide the QuickLaunch bar. So either the three standard .scf files encompass the full panoply of Windows Explorer Commands, or else there is more that Microsoft isn't prepared to tell us. If anyone reading this knows any more, do please share it.

I still like to be able to stick an audio CD in the drive and have the plain old player pop up

Sound advice

Over the past few months I've played with a variety of music players and these seem to sever the connection between Audio CDs and the Windows CD Player – even after they are uninstalled.

Wonderful though the various juke boxes are (see July's *Hands On*, *Windows*), I still like to be able to stick an audio CD in the drive and have the plain old player pop up automatically. So, given that the CD player is working properly, a quick piece of pre-emptive prudence is to run Regedit, go to HKEY_CLASSES_ ROOT and select the AudioCD entry. Now, go to the Registry Menu and Export Registry File: choose a name and destination and make sure the 'Selected branch' option is chosen. You'll then have a small text file with the .reg extension: double clicking on this will merge it back into the Registry, restoring the original settings. Note that you'll still need to make sure 'Auto Insert Notification' is enabled for the CD drive in Device Manager.

CONTACTS

Tim Nott welcomes your comments on the Windows column. You can contact him via the *PCW* editorial office or email: **win@pcw.co.uk**. Please do not send unsolicited file attachments or queries concerning the *PCW* CD-ROM or website.

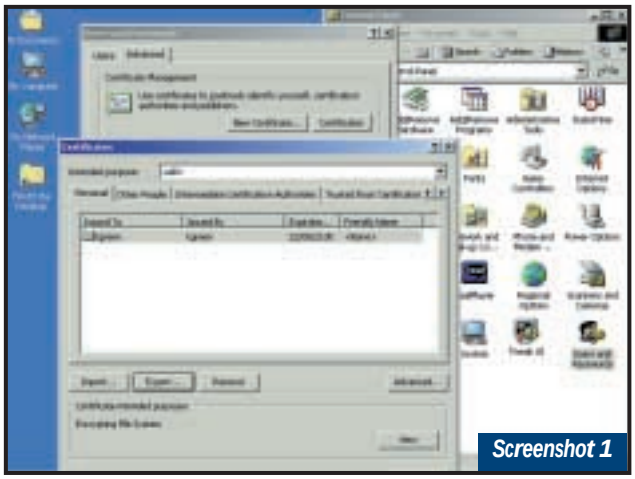
Permission granted

NTFS is key to a secure Windows environment, Terence Green unlocks the resilient file system.

When Windows NT first shipped in 1993 it sported an all-new file system, the NT File System – known as NTFS – which proved to be far more resilient than the File Allocation Table (FAT aka FAT16 and FAT32) file systems of Windows 9x. However, NTFS was revamped with added features, such as file encryption, for Windows 2000.

Although Windows 2000 supports FAT for backwards compatibility, using NTFS has advantages for performance, reliability and security. But there are also traps for the unwary. Security measures protect your data from unauthorised access, but can also prevent you from accessing your own data if you forget your passwords or fail to back up your encryption key.

NTFS is resilient. It can recover from errors, such as sudden power cuts, that can destroy FAT-formatted disks. This is because it keeps a transaction log of disk writes that enables NTFS to roll back to a pre-disaster consistent state. NTFS can't do magic. Data held in memory or that has only been partially written to the disk can't be recovered. NTFS also keeps multiple copies of file system data in case of physical problems, such as bad sectors which can spell disaster for FAT-formatted disks.



When using EFS, always export and save your certificate and private keys in a safe place

The file system provides enhanced data security to protect your sensitive data. It maintains Access Control Lists (ACLs) of security permissions (read, write, execute, etc) that can be applied to files and folders. As of Windows 2000, NTFS also provides encryption for files. Windows 2000 ACLs and encryption are only available on NTFS. We don't have space here to fully explain ACLs and encryption, so we'll concentrate on the important gotchas. (The 'Security' section in the Contents of Windows 2000 online Help has more information if you want some more background knowledge on the subject.)

Permissions allow several people to share a Windows 2000 computer without exposing their files to other users, except for administrative users, who can take ownership of any file and reassign the security permissions. Used sensibly, this is a security measure enabling access to the files of a user who has forgotten their password or has left the company. Ideally, a single responsible person holds administrative rights and everyone else has a regular user account.

NTFS was revamped with added features, such as file encryption, for Windows 2000

ACLs can also control program execution. With eborne viruses a growing threat, this can be really useful. An administrator can deny the right to execute a file or group of files. One way to tackle the ILOVEYOU virus problem might be to deny execute permission for Windows Scripting Host (WSH) to everyone except the operating system itself. This will prevent a VB script virus from activating, even if the attachment is opened. This method also bypasses Windows 2000 System File Protection (SFP), which prevents you from deleting system files.

Encryption

In an ideal world, security permissions would secure our data, but unfortunately, in real life, they're not impregnable. In particular, a couple of free programs from www.sysinternals. com – NTFS for DOS and NTFS for Windows 98 – can read NTFS disks regardless of security permissions. To use either you must have physical access to the computer and be able to boot it. Paid-for versions of these utilities can write to NTFS from DOS and Windows 98. Seemingly a huge security hole, these tools can in fact be very beneficial in recovering data from crashed systems, allowing users with dual-boot systems to read their NTFS files from Windows 95/98.

Oddly enough, because they can only be used to read NTFS drives by someone with physical access to the computer, they help security by highlighting an aspect which is often overlooked. If you can't secure physical access to your computer you can at least use the BIOS passwords to control who can boot it and to disable booting from floppy. On some computers, IBM ThinkPads for example, BIOS passwords cannot be circumvented, but on many desktops password security can be disabled on the motherboard. Password boot security also won't provide much of a defence against someone in possession of the passwords or with the opportunity to move the hard disk into another system.

Enter the Windows 2000 encrypting file system (EFS), which scrambles files or folders so that only you can open them.

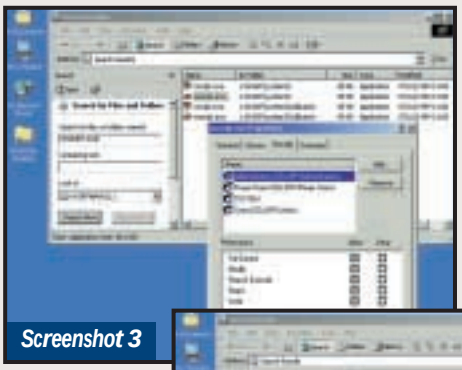
Security permissions

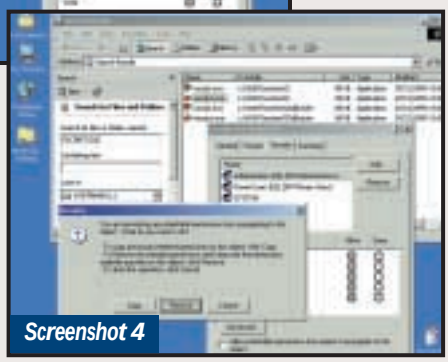
To change the default permissions for Windows Scripting Host, log in with the Administrator account and locate WSCRIPT.EXE and CSCRIPT.EXE (the console version of WSH) by using Start/Search/For Files or Folders to search for ?SCRIPT.EXE on the Windows 2000 system drive (see screenshot 3). You'll find four entries. The duplicates in DLLCACHE folder are the copies that the System File Protection copies back into the SYSTEM32 folder if WSCRIPT.EXE or CSCRIPT.EXE are ever deleted. Try deleting WSCRIPT from SYSTEM32 if you like. It will reappear within minutes. There's no need to alter the permissions on the DLLCACHE versions.

Change permissions for the two system files. Right-click on WSCRIPT.EXE to open Properties/Security. You can't change permissions here as the file has inherited them from the folder hierarchy. This is represented by the grey backgrounds of the ticked boxes. Untick 'Allow Inheritable permission' A warning message pops up because you are trying to alter these inherited permissions (see screenshot 4). Click on Remove and both the Name and Permission lists will be cleared. (Note: the defaults can be restored by ticking 'Allow' and clicking on 'Apply'.)

Now give SYSTEM complete rights to the executable. Click on Add, select SYSTEM from the list and click on Add. Click on OK to return to Properties/Security and tick the Full Control box. Click on Apply to confirm the changes, and OK to exit. Repeat the procedure for CSCRIPT.EXE. Now, whenever anyone attempts to run a script file such as a VBS script embedded in an email attachment they'll be refused access. Test by creating a Notepad file on the desktop, naming it TEST.VBS, and double-clicking it.

This is the briefest run-through of one of the many uses of permissions. Experiment with care, as you can easily prevent yourself from running applications, or even from accessing your own system. Should this happen, log in as Administrator and take ownership of the file from the Advanced window of the Security Properties page.


Screenshot 3


Screenshot 4

Right: Restricting the use of Windows Script Host can prevent VBS viruses from running Below: Remove the inherited permissions for all users to fully disable WSH

This is great for laptops and shared computers holding sensitive files. This being Microsoft, you can't share encrypted files or folders, but we are assured that this feature will be added in due course. View the online Help (search on EFS) for more detail and also search the KnowledgeBase for 'EFS' for tips (www.microsoft.com/technet/).

The big gotcha with EFS is what to do when things go wrong. EFS is enabled via digital certificates and it's possible to lose your digital certificate – as the result of a computer crash for instance – in which eventuality you won't be able to access your files. A corporate network will have recovery measures in place, but standalone users need to take three steps to cover for this eventuality: back up; export and save a copy of your digital certificate and keys (see screenshot 1, opposite); and lastly, export and save a copy of the default recovery agent's certificate and keys.

These keys should be kept in a secure location on floppy or on another drive. The recovery agent keys and certificates can be used to decrypt any encrypted file on a standalone system. An individual's certificate and keys can be used to decrypt files which have been relocated to another system using NT Backup.


Screenshot 2

The step-by-step guide to EFS has invaluable advice on the use of the Encrypting File System

Copying an encrypted file to an unencrypted location converts it to text, whereas NT Backup keeps encryption.

To understand the export process, have a look at the information in the Knowledge Base, including a step-by-step guide to EFS, at www.microsoft.com/windows2000/library/planning/security/efssteps.asp (see screenshot 2). Standalone systems should adopt the procedures described under 'User Scenarios' in the guide.

EFS offers extra cover for Windows 2000 systems, especially for mobile users, but it must be used with care. As the first cut also has deficiencies, you'll have to forego sharing on encrypted files, including off-line folders. Hopefully these omissions will be rectified before long.

CONTACTS

Terence Green welcomes your comments on the Windows 2000 column. Contact him via the *PCW* editorial office or email: **win2000@pcw.co.uk**

Get on the bus

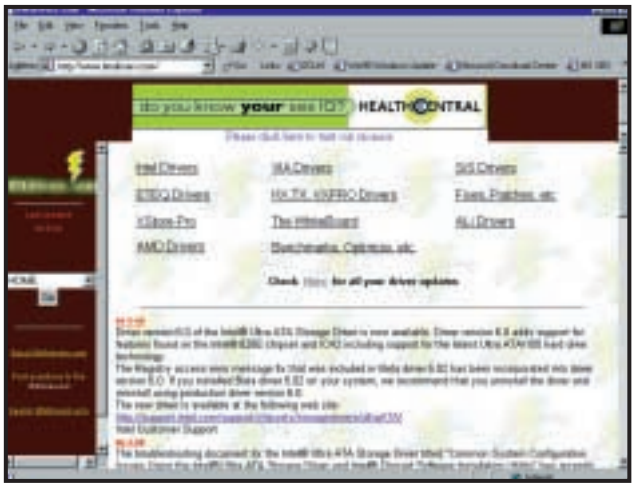
Roger Gann makes a return trip to the subject of bus mastering for improving performance.

Back in July I waxed lyrical about the possible performance gains you can achieve with IDE hard disk subsystems by the simple task of turning on DMA using the simple (and free) DMACHECK.EXE download from Microsoft's website.

Now, I know that Windows NT4 and SCSI were simply made for each other and that to run IDE drives on an NT rig is heresy, but the fact remains that IDE offers tremendous bangs per buck – it's cheap and pretty damn fast, providing you've got it configured properly under NT4. It's often said by SCSI proponents that IDE (aka ATA) drives cannot touch the miniscule CPU utilisation posted by SCSI drives. This is untrue if DMA is used. The problem is, as we've seen, that DMA operation is, by default, switched off in a standard NT4 installation.

Now we know how to turn on DMA support, courtesy of DMACHECK.EXE, what can you expect in the way of performance gains? Quite a lot, is the short answer. With the right IDE device driver, turning DMA (aka bus mastering) on you can cut CPU utilisation from as high as 75 per cent down to less than two per cent. Not only that, the data transfer rate is also significantly improved as well – gains of 33 per cent are not exceptional. Check out www.9-muses.com/freak/viewpoint/nt/nt_busmastering_3.shtml for some interesting benchmarks.

For day-to-day use, you may not notice much improvement, but if you multitask and run many programs that access the hard drive, you'll probably notice less lag, especially during heavy disk accesses. You'll also be doing your other peripherals a favour. For example, if your IDE CD-R is bus-master capable, then you should be able to do other things while it's burning CDs, since the CPU doesn't have to watch over the entire process.



BMdrivers.com will happily supply you with DMACHECK.EXE

Back of the bus

The transfer model for IDE devices has traditionally been PIO (programmed I/O) where data is transferred to and from IDE devices explicitly via CPU instructions. This is a straightforward and simple technique, but requires a relatively large amount of dedicated CPU time, especially when transferring large amounts of data to and from hard disk drives. If your PC's chipset includes support for bus mastering, then the burden on your CPU can be seriously reduced. A bus master is a chunk of microcode that controls traffic on the computer bus or input/output paths. The bus master is the 'master' to the I/O devices on the bus, which are its 'slaves'. Once these paths are set up, the flow of data bits goes directly between the I/O device and the microprocessor.

For example, the common Intel 430 and 440 chipset series contain a PIIXn IDE controller function. The PIIXn IDE controller acts as a PCI bus master on behalf of IDE DMA slave devices, performing DMA transfers to and from devices on either primary or secondary IDE channels. More modern chipsets can also increase bandwidth via the UltraDMA33 hardware interface.

The table below maps Intel chipsets to PIIXn devices and notes each chipset's IDE hardware interface.

Chipset	PIIXn Device	IDE h/w interface
Intel(r) 430FX PCIset	82371FB (PIIX)	ATA16
Intel(r) 430VX PCIset	82371SB (PIIX3)	ATA16
Intel(r) 430HX PCIset	82371SB (PIIX3)	ATA16
Intel(r) 430TX PCIset	82371AB (PIIX4)	UltraDMA33
Intel(r) 440FX PCIset	82371SB (PIIX3)	ATA16
Intel(r) 440LX AGPset	82371AB (PIIX4)	UltraDMA33
Intel(r) 440EX AGPset	82371EB (PIIX4E)	UltraDMA33
Intel(r) 440BX AGPset	82371AB/EB (PIIX4/4E)	UltraDMA33
Intel(r) 440GX AGPset	82371EB (PIIX4E)	UltraDMA33

Bus mastering

The original version of NT4 shipped with an IDE driver that didn't permit bus mastering. Consequently, the maximum transfer rate was limited to PIO Mode 2 or 8.33Mbytes/sec. For NT4 Service Packs 3 and above, Microsoft includes an UltraDMA-capable bus-mastering IDE driver. It's the 'IDE CD-ROM (ATAPI 1.2)/Dual Channel PCI IDE Controller' you see in the SCSI Adapters applet in the Control Panel. However, by default, it is not enabled for compatibility reasons. To enable it, use the DMACHECK.EXE utility described in the July NT column – you can get it from http://support.microsoft.com/support/kb/articles/Q191/7/74.ASP. Or look out for BMNT4.ZIP at www.bmdrivers.com.

Other bus-mastering IDE/ATAPI drivers are available, principally from Intel, and these offer slight advantages

over the current Microsoft bus master IDE driver – you might want to experiment here and find out for yourself. For example, Intel's Bus Master Driver version 2.05 has been popular. They were designed for the Intel 82371AB/EB controller found in the 430TX and 440 family chipsets.

There are several different versions to be found floating around the Internet, some originating from the Hewlett-Packard website. For 800 series Intel chipsets, you'll need Intel's Ultra ATA Storage Driver 5.0. This does actually work with most BX chipset boards, but results will vary. An interesting thing about this driver is that it does not show up in the SCSI Adapters section in the Control Panels. For instance, it shows up in the Devices, but does not show up in the Drivers tab. However, it does come with its own utility that lets you see how your devices are configured. It looks like the SCSI Adapter Control Panel, but with a lot more detail.

Left and below: There are plenty of resources out on the Internet and you can get the latest Ultra ATA drivers from Intel's site

Don't forget that it's a good idea to keep similar ATAPI devices on the same chains. For instance, don't connect a CD-ROM drive to your UltraDMA-2 hard disk because it will force your hard disk to operate at the lowest common denominator, ie CD-ROM data transfer rates. For example, on my Compaq PWS-5000, there's only one IDE channel. Connecting the CD-ROM and an IDE drive on the same channel disables DMA. Also, some ATAPI devices may or may not function correctly using bus mastering. In that case you should keep them on a separate chain to prevent them from causing problems.

Driver sources

A good source of info and drivers is BMDrivers.com at www.bmdrivers.com/. Intel's very latest Ultra ATA drivers can be picked up from the Intel website at http://support.intel.com/support/chipsets/storagedrivers/ultraATA/. For previous releases, see the Intel Chipset Software Installation Utility Archive page: http://support.intel.com/design/software/drivers/platform/archived_inf.htm.

Power management

Back in the July column I also alluded to the availability of power management software for the Windows OS. NT4 has no inherent support for any form of power management, which made it unpopular as an operating system for battery-powered notebooks simply because of the poor battery life it returned. However, for the past couple of years most major notebook vendors, eg Compaq, IBM, Toshiba and even Dell, have been offering their notebooks with Windows NT4 pre-installed, complete with power management software and hot-swappable PC Card support.

There are a fair few third-party vendors offering drivers and software that bestow a reasonable degree of power management onto Windows NT4, mainly for laptops, but one is available for desktop PCs.

SystemSoft makes a number of Windows NT4 'mobile' utilities, including PowerProfiler/SE for about £30, which is perhaps the best-known APM add-on. It provides extended suspend/resume controls and battery-status information on APM 1.x systems. PowerProfiler/SE lacks features found in PowerProfiler, but the latter only comes preinstalled on a laptop. The software will run on any notebook with a BIOS that supports the APM (Advanced Power Management) 1.1 or 1.2 specification.

Phoenix Technologies sells Desktop APM for NT www.ptltd.com/platform/power.html, although this appears to be an OEM product, not retail. TouchStone Software, www.touchstonesoftware.com/, sells a retail version of CardWare 6.0 (£70) that, as well as offering APM power management, additionally includes full PC Card support.

Finally, Softex (www.softexinc.com/deskmktg.html) sells DeskPower Controller for around £25. This package is specifically aimed at desktop PCs and offers BIOS-independent power management. It features an APM-like user interface, support for CPU Idle, display time-out settings, hard disk spin down settings and it updates the system time on a resume from suspend. It supports the Win32 Power Management API, so that power-management-aware applications under Windows 95 will now also be power-management-aware under Windows NT.

CONTACTS

Roger Gann welcomes your comments on the Windows NT column. Contact us via the *PCW* editorial office or email **nt@pcw.co.uk**

More routing around

Adding PPP software is the finishing touch to Chris Bidmead's Apricot Xen II ADSL-router project.

We're now on the last stage of building the Linux-based ADSL router on my old Apricot Xen II 486 machine, based on the download from www.coyotelinux.com. Last month we got the floppy disk image, intended to route between a pair of Ethernet cards, back onto the hard disk so we could do some surgery on it. We need to add PPP software to drive the serial interface to the HomeChoice set-top box, and bring that up at boot time instead of the Internet-facing Ethernet card.

I'm not going to venture too deep into the details of the changes I made because at the time of writing the current free version of Coyote (version 1.13) now includes a script for creating a PPP dialup version of the router, which would cut out a fair bit of the fiddling I had to do. But I want to cover some of the principles involved in peeking inside the disk image and the tarballs it contains. The operation throws up some generally useful Unix and Linux techniques that are worth exploring even if you're not trying to build a router. And you can always email me if you need help with specifics.

FIG 1 **Using df. to display space usage within a filesystem**

```
df .
Filesystem           Size  Used  Avail Use% Mounted on
/tmp/apricot/coyote.xen.image
                     1.4M  1.2M  158k  89%  /tmp/apricot/mp
```

To access the entrails of the floppy disk image we've mounted it using the Linux loop device, with the command line:

```
mount -o loop -t msdos ↙
coyote.image mp
```

(*Key: ↙ code string continues*)

...which means we can now duck inside the mp/ directory to find the tarballs (here called .lrp rather than the more usual .tgz or tar.gz) that the SysLinux boot system automatically untars when the floppy is booted.

With a little tweaking, recent versions of the Midnight Commander filemanager might be a good way of inspecting the contents of these tarballs (drop me a line if you know more about this), but I went straight for an old-fashioned pipeline. For example, tar tvzf config.lrp reveals a file named var/lib/lrpkg/config.help. One shortcut to reading its contents might be:

```
tar xvzOf config.lrp ↙
var/lib/lrpkg/config.help ↙
| less
```

...remembering that the O switch redirects tar's output to stdout.

After some research it turns out that the tarballs I needed to edit were etc.lrp, config.lrp and modules.lrp. I also needed to add a ppp.lrp tarball as well as modify a couple of setup files.

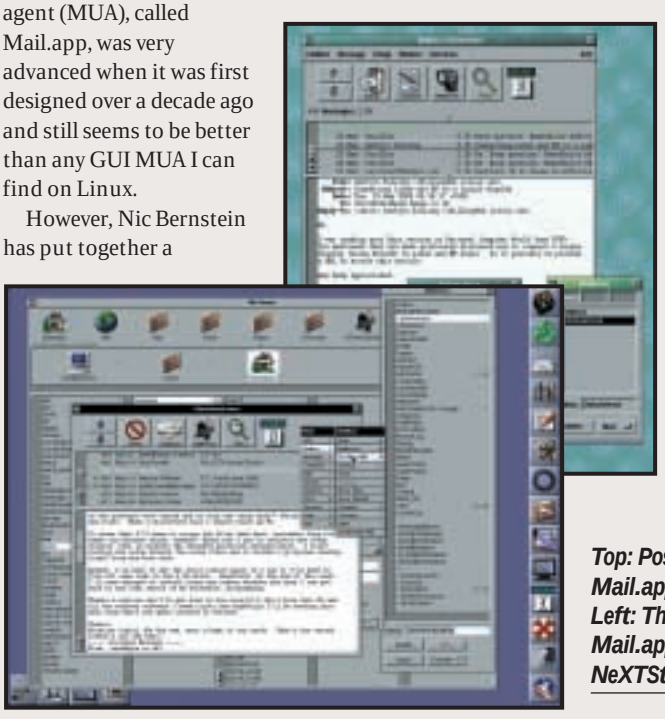
It wouldn't be too smart to try to expand any of these tarballs directly inside the mp directory (eg tar xvzf modules.lrp), because mp is a separate floppy-sized filesystem (within coyote.image) and it'll fill up. The command df is used to display the space usage within filesystems and I get the result as shown in figure 1 above.

So I added the C switch to make sure the expanded files end up outside mp in a pre-established empty directory (so

Mail user agents

I still handle all my email from a NeXTStep system running on a 486-based Canon object.station. NeXTStep's mail user agent (MUA), called Mail.app, was very advanced when it was first designed over a decade ago and still seems to be better than any GUI MUA I can find on Linux.

However, Nic Bernstein has put together a NeXTStep Mail.app lookalike for Linux called Postilion (www.postilion.org). It's based on Martin Forssén's TkRat MUA (www.dtek.chalmers.se/~maf/ratatosk) and is aimed at eventual inclusion in the GNUStep project (www.gnustep.org). It's written in C and Tcl/Tk, so should be portable across most Unix-like operating systems. Currently, I'm running it on Linux Mandrake side by side with the Real Thing on my faithful NeXT machine.



Top: Postilion mimics Mail.app under Linux Left: The genuine Mail.app running under NeXTStep

that it's easy to retar the files back into a .lrp file).

```
tar xvzfC modules.lrp ↙
/tmp/working
```

(If you're new to tar the 'modem-noise' string of command-line switches reads 'expand (x) verbosely (v) while decompressing (z) the file (f) into the switched directory (C)'. The values for f and C follow as modules.lrp and /tmp/working, and have to be in the same order as the relevant command-line switches.)

The modules package inside the disk image didn't include the necessary ppp.o module in the /lib/modules directory, but it was there in the Coyote distribution under ../packages. I discovered that ppp.o also needs slhc.o to run, so I added that too. It's also necessary to add these names (without the .o) to the /etc/modules config file. Having done that I retarred the contents of my /tmp/working directory back into a new modules.lrp tarball to replace the original.

I used the same technique to open up etc.lrp and looked at the startup script in there called /etc/rc.d/rc.inet to work out the best way to get the pppd daemon up and running. Because Coyote is adapted from existing work done by the Linux Router Project (www.linuxrouter.org), the start-up script was already set up to look for a file called /etc/rc.d/rc.ppp and include it if it existed.

```
elif [ "${USEPPP}" = "YES" ↙
]; then
        # Dialup PPP Sharing
        [ -x /etc/rc.d/rc.↙
ppp ] && . /etc/rc.d/rc.ppp
```

All I needed to do was write this script, based on the single workstation PPP connection to HomeChoice I'd already figured out (see July issue):

```
echo "Attempting to start ↙
pppd"
/usr/sbin/pppd /dev/ttyS0 ↙
115200 local receive-all ↙
noauth defaultroute
```

You'll notice that the elif stanza above depends on a variable called $USEPPP. I could have simply snipped this out, but it seemed better not to depart unnecessarily from the existing architecture, so I looked to see where this variable gets set. Early on in the rc.inet script is the line:

```
# Read in the Coyote ↙
configuration script
. /etc/coyote /coyote.conf
```

This led me to investigate the config.lrp tarball, where cat /etc/coyote/coyote.conf produced:

```
LOCAL_IPADDR= 192.168.1.50
LOCAL_NETMASK= 255.255.255.0
LOCAL_BROADCAST ↙
=192.168.1.255
LOCAL_NETWORK =192.168.1.0
USERRM=NO
USEDHCP=NO
IPADDR=
NETMASK=255.255.255.0
GATEWAY=
DNS1=
DNS2=
DOMAINNAME=
DHCPSERVER=NO
DHCPD_START_IP=
DHCPD_END_IP=
```

The IP addresses come from values I'd supplied in running the original script to create the floppy disk image. I added a line:

```
USEPPP=YES
```

...and recreated the config.lrp tarball. Last month I mentioned that although the running version of Coyote uses RAM disks exclusively (so mods to files like /etc/coyote/coyote.conf are volatile) there is a script for saving such changes back to the floppy. Happily this means that the management of the disk image I'm discussing here doesn't have to get all these values exactly right – they can be tuned on the fly.

At first I cheated by disabling the built-in Ethernet and plugging in an EtherLink card

To cut a long story short, the rewarding result – after writing the diskette image back to a diskette with

```
|dd if=coyote.image ↙
of=/dev/fd0|
```

was a working ADSL router for the price of an obsolete, diskless 486 box and a few hours' industrious exploration at the very edges of my competence (and where better to spend a few hours?).

I could have saved the time. An alternative, if you happen to have a few bob to spare, is GnatBox (see www.globaltech.co.uk, where you can download a demo version of a very similar commercial single floppy disk router that times out after 180 minutes). The full working version costs £995. GnatBox is sold and supported in the UK, and the UK sales director Kate Vidgeon tells me you can buy a dedicated hardware version for £1,995.

The GnatBox licence says I've agreed not to 'modify or adapt' the software, or 'attempt to discover the source code'. This may be great for a small business that needs a commercially supported router-cum-firewall, but I think I'll stick with Coyote, which encourages modification and access to the source code and so makes it very easy for me to change the pppd options and add features such as remote logging whenever I want.

Driver reviver

The Apricot Xen II 486 machine's built-in Ethernet connection is based on the i82596 Ethernet controller chip and last month I mentioned that the Linux driver for this (apricot.o) stopped working a few years ago with newer versions of the Linux kernel. It was originally written by Mark Evans, who I ran into again recently at the Linux 2000 Conference.

Mark told me that he'd stopped maintaining the driver when he parted company with his old Apricot. The new maintainer, Richard Hirst, generalised the driver to work with other network hardware based on the same i82596 Ethernet controller chip. Unfortunately, under its new name, 82596.o, it still no longer worked with the Apricot Xen II.

So, how did I handle the Ethernet side of the router operation? At first I cheated by disabling the built-in Ethernet and plugging in a 3Com EtherLink card, but this struck me as inelegant and wasteful. Obviously, it would be worth taking a look at the code for 82596.o and fixing it. So I did.

Well, I don't deserve all the credit. In fact, narrow-minded commentators might be inclined to ignore my contribution altogether. But, hey, I blew the whistle. I ran the driver and found it didn't work. I didn't whinge (well, I didn't just whinge), I damn well sought out the source code and ran my expert eye over it. I don't write C and I

don't understand much about C, but I do recognise an author's email address when I see one.

I dropped a line to Richard and he wrote back saying that he was interested in restoring Apricot Xen compatibility for the next official release of the Linux kernel. He didn't have a Xen, but he sent me some revised code to test on mine. The revision didn't work either, but I returned the diagnostics to him and within a couple of days we had a working driver.

I say 'we'... well, yes, I do say 'we'. The moral is that even if you're not a codester, there's still a proactive role to play in all this. This is what being a Linux user is all about, and it's one reason that Linux is the fastest-growing, fastest-improving operating system in the history of the world.

Administry over the web

Jon Hawkesworth (jon@unity.demon.co.uk) writes: 'I haven't seen mention of Webmin in your column. In case you haven't heard of it, have a look at www.webmin.com/webmin.

'It's a system administration tool for Unix, which can be handy, since it supports lots of distributions, but gives you the same web-based interface to all of them. As with any useful admin tool it is not a substitute for understanding what you are trying to achieve, but it can speed up repetitive administrative tasks and let you concentrate on sorting out the more tricky stuff.

'I'm sure someone that you have never met raving about a piece of software you haven't used isn't the most riveting read, so I'll stop here and let you draw your own conclusions. Hope you find it worthy of a mention in a future column.'

Well, thanks, Jon, for drawing my attention to a great piece of software. Can't think how I missed this. Webmin is now owned by Caldera, but is BSD-licensed, and – as you say – runs across many Unix platforms. There's an RPM package that installs directly onto RedHat and Mandrake Linux systems (I haven't tried it with SuSE), and source code is available for pretty much every Linux distribution you've ever heard of, as well as Solaris, FreeBSD, OpenBSD, HP/UX, SGI Irix, SCO UnixWare and even MacOS X.

Webmin is impressive, consisting of a simple web server and a number of CGI programs that directly update system files such as /etc/inetd.conf and /etc/passwd. So, unlike Linuxconf and SuSE's YaST there are no intermediate special configuration files to add to the complexity. The web server and all the CGI programs are written in Perl version 5, and use no external modules. So, if Perl 5 is available for a platform, Webmin will run on it without compilation.

Left: Webmin conceals the complexity of system administration behind a tab notebook-style interface with distinctive icons. But don't think of it as 'Admin for Dummies'. I agree 100 per cent with Jon's warning: 'As with any useful admin tool it is not a substitute for understanding what you are trying to achieve'

Setting up cron jobs traditionally involves understanding the crontab conventions, where, for example, a line such as:

```
42 4 1 * * root run-parts /etc/cron.monthly
```

...means 'run the script called 'run-parts' with the parameter '/etc/cron.monthly' as user 'root' at 42 minutes past four am on the first of each month'. Webmin's GUI-ified cron editor takes the pain out of this, although it's still worth getting to grips with man crontab so you know what's going on underneath

As Jon says, this gives you a uniform overview of every system on the network. But Webmin can also administer down to the minutest level of detail, such as editing ../rc.init scripts and cron scripts. It's also easy to add your own individual administrative elements by writing your own Webmin modules, or, more directly, simply by setting up arbitrary utilities to be run through the web interface. Several third-party Webmin modules are available from the website (including one written by Jon).

CONTACTS

Chris Bidmead welcomes your comments on the Unix column. Contact him via the *PCW* editorial office or email: **unix@pcw.co.uk**

Asus deals an ace

Triumphant Gordon Laing assembles a plus-1GHz BX solution that out-SYSmarks RDRAM.

Last month I had great fun getting my old Asus P2B motherboard to overclock a poor 866MHz Flip Chip to the heady heights of 1GHz, and actually outperform brand new 1GHz systems with expensive RDRAM! The trick was to overclock the aging BX chipset from 100MHz to 133MHz – it's a project which seems to have caught the imagination of hardware enthusiasts the world over, in a way only matched by the dual-Celeron Abit BP6 a few months back.

Of course, no self-respecting tweaker can leave anything alone for long, so this month I took my overclocked 1GHz system one step further, along with trying out new BX solutions. All that performance generates a fair amount of heat though, so I got myself down to the local computer fairs and bought the cream of case coolers.

Finally, FedEx delivered a pair of PowerLeap Neo370s that promise to let legacy PPGA motherboards accept new FC-PGA processors – could this mean dual-PIII action on an Abit BP6? Grab your anti-static wrist bands and read on!

BX – nearing retirement?

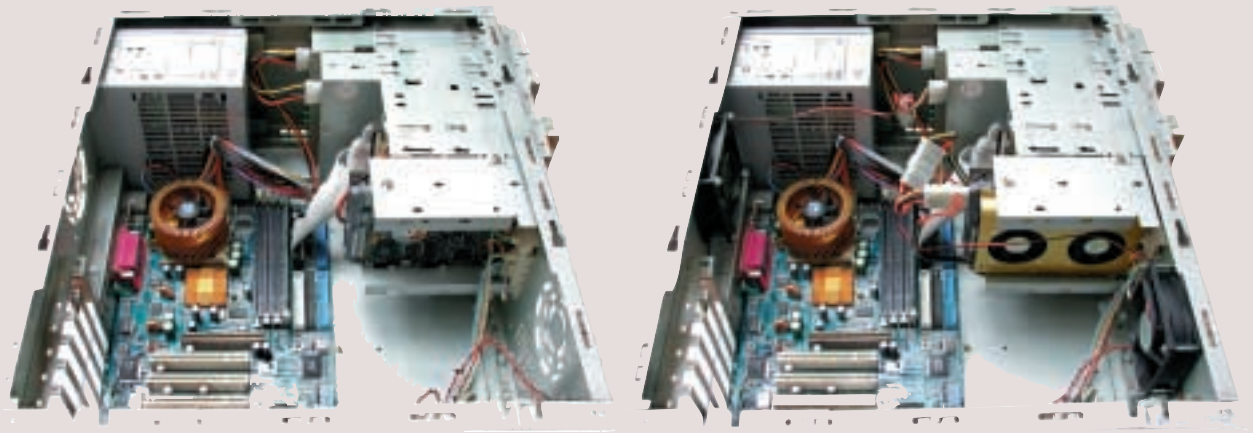
It's funny to remember that the Intel 440BX chipset is now over two years old – funny since most chipsets have a considerably shorter lifespan of around six months. It was the first chipset to support front-side bus frequencies up to 100MHz and AGP transfers of 2X. Time, of course, stands still for no chipset, so the i820 was introduced as a replacement, supporting higher 133MHz FSB frequencies, AGP 4X and doubling the bandwidth of the onboard IDE controller from 33Mbytes/sec to 66Mbytes/sec.

The problems started when Intel designed the 820 to use only RDRAM, which still costs around three times the price of SDRAM today. Component manufacturers and system integrators the world over demanded an SDRAM solution, so Intel built the Memory Translater Hub (MTH) chip and thought everyone would be happy.

Sadly, as most people know by now, the 820 with MTH suffered from poor SDRAM performance and recently was revealed to even spontaneously reboot under certain circumstances, forcing Intel to offer a refund or replacement program. In the meantime, the BX chipset has enjoyed a comeback, at first as enthusiasts demonstrated old boards were quicker with SDRAM than the 820/MTH solution, then second, as genuinely new products arrived from innovative Taiwanese motherboard manufacturers singing 'better the devil you know'.

I've got some cracking results from my old Asus P2B BX motherboard, with a little encouragement here and there. First, I got around incompatibilities with Coppermine CPUs (PIIIs above 600MHz and Celerons above 566MHz), by using a Slocket convertor, which boasted an FC-PGA compatible socket and manual core voltage adjustment. Second, to get the really high CPU frequencies, I needed to run the FSB at 133MHz. Consequently, I bought 133MHz SDRAM, set my PCI divider to one quarter and kept my fingers crossed that my AGP card didn't mind being run at 89 instead of 66MHz.

It all worked beautifully, but I felt there may be a better motherboard solution – one based around a BX chipset, but which was happy to accept Coppermine FC-PGA CPUs as standard.



Can't stand the heat? This overclocking and high-performance I/O is all very well, but things can get pretty hot inside your PC case. I recently noticed disturbing hot-wafts coming from mine, so I decided to do something about it. I headed down to the Tottenham Court Road computer fair and bought a variety of case fans for between £5 and £10 each. Along with conventional case fans, I found ones designed to cool high-speed hard disks and others to suck out nasty hot air through a spare blanking plate. If your case has two fan mountings, place one to suck air in at the bottom and the other to blow it out at the top. I've done this on mine, along with mounting another to cool my new Ultra160 hard disk

Back in June's *PCW* we tested and recommended a Gigabyte GA-BX7 motherboard that did just that, but shortly afterwards, the GA-BX7+ arrived, just begging for a spin!

The GA-BX7+ boasts several advantages over its predecessor. Instead of three, it features four DIMM slots which support up to 1GB of SDRAM. Lack of native UltraDMA66 support on the BX chipset is remedied by the inclusion of an onboard Promise UltraDMA66 controller, with its own pair of channels. The Abit BP6 offered something similar from HighPoint, both with the advantage that instead of the traditional pair of IDE channels, you now have four to play with, doubling the number of supported IDE devices from four to eight. Finally, the GA-BX7+ features a unique Dual-BIOS facility for backup purposes and a 'Magic Booster', which increases CPU core voltage by 10, 20, 30, 40 or 50 per cent. Sadly, there are several capacitors located very close to the Socket 370, which made fitting a large heatsink like my Titan Majesty a bit of a squeeze.

I built a system using an 866MHz FC-PGA PIII, 128MB of PC133 SDRAM, a 13.6GB UltraDMA66 Quantum Fireball Plus KX and an ATi Rage Fury Maxx graphics card. Last month I built an identical system using an Asus P2B and an Iwill Slocket II CPU convertor, which scored an impressive 173 in SYSmark 2000 under Windows 98 SE. The same configuration on the new Gigabyte board scored 176, which isn't bad when you consider both boards use the same chipset and had the same components installed.

You won't be surprised that I next attempted to overclock my 866 CPU, but even with the help of the Magic Booster, the GA-BX7+ wasn't having any of it. This was a shame considering I'd got the same CPU to run reliably at 1,000MHz on my P2B/Slocket combo, scoring a huge 187 in SYSmark 2000. I guess that proves overclocking isn't an exact science, it sometimes works, but not always. I would, however, expect the GA-BX7+ to score slightly higher than 187 with a genuine 1GHz CPU in the same configuration described above.

Powerleap NeoS370

I couldn't leave this column without mentioning the pair of PowerLeap Neo-S370s that I recently bought over the Internet at an end-cost of £35 each.

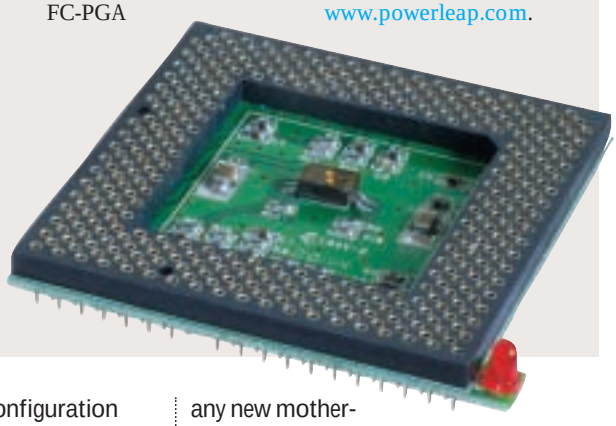
They're supposed to allow you to fit new FC-PGA CPUs into old PPGA sockets. I tried an 866MHz PIII in my Abit BP6 and, while it did boot, the system was rather unreliable.

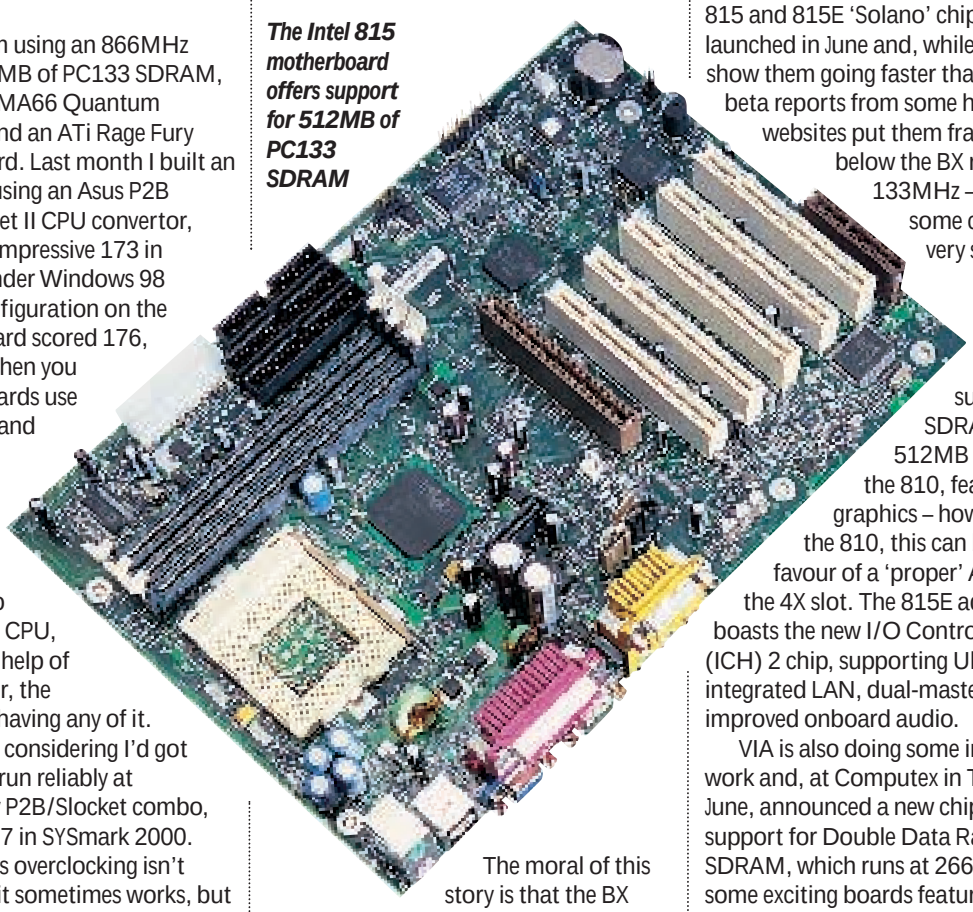
When I tried a pair of 866s, with stepping certified by Intel for SMP use, the system wouldn't even start.

Do I need an updated BIOS? Do I need different CPUs? Do I need a bit more patience? Instead, how about more sensibly spending the £70, plus a tad more, on a new dual-FC-PGA motherboard, such as those launched at Computex in June – far more sensible.

Price: $25 plus postage and import tax (approximately £35)

Contact: PowerLeap, www.powerleap.com.





The Intel 815 motherboard offers support for 512MB of PC133 SDRAM

The moral of this story is that the BX chipset still cuts it. The sad news, however, is that they're now in seriously short supply and you're unlikely to see any new motherboards released with them. Intel's new 815 and 815E 'Solano' chipsets were launched in June and, while early results show them going faster than 820 boards, beta reports from some hardware websites put them fractionally below the BX running at 133MHz – I'll run some comparisons very soon.

For the record, both 815s officially support PC133 SDRAM (but only 512MB of it) and, like the 810, feature onboard graphics – however, unlike the 810, this can be disabled in favour of a 'proper' AGP card in the 4X slot. The 815E additionally boasts the new I/O Controller Hub (ICH) 2 chip, supporting UltraDMA100, integrated LAN, dual-master USB and improved onboard audio.

VIA is also doing some interesting work and, at Computex in Taiwan during June, announced a new chipset with support for Double Data Rate (DDR) SDRAM, which runs at 266MHz. Expect some exciting boards featuring DDR later this year, but in the meantime it looks like supply will soon dry up on the BX. We at *PCW* salute it and wish it the

best of luck in chipset retirement – it'll certainly not have any bother from the doddering 820.

SCSI versus IDE

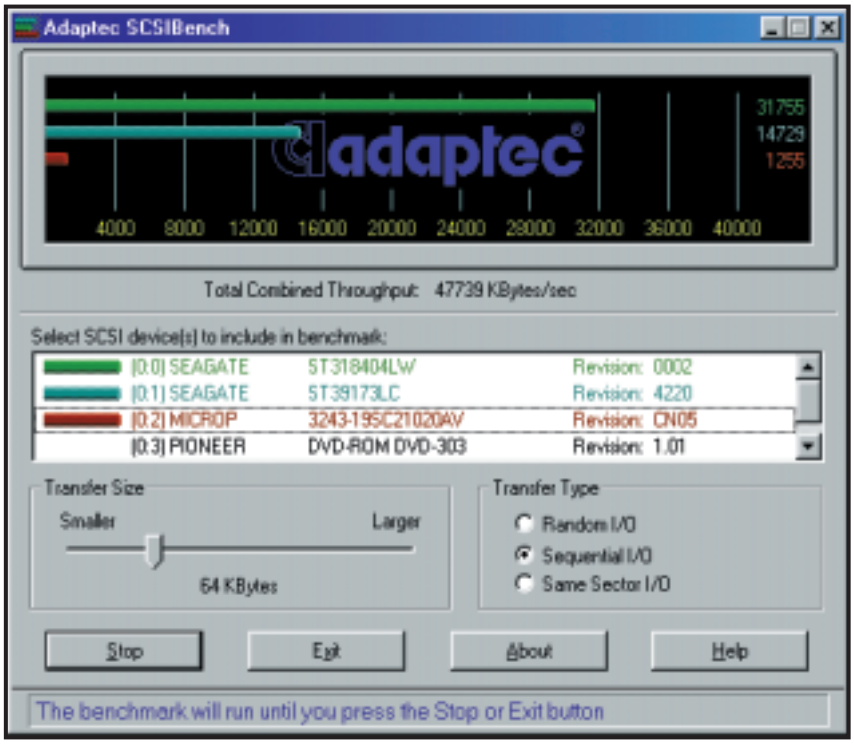
I've been accused of being an I/O snob. You see, over the years I've come to prefer SCSI as the interface of choice for high-performance peripherals, not to mention the broadest flexibility – IDE in its various guises just never cut it for me. It all started with my photographic interests and the absolute need in the early days of scanning to have a SCSI card in your PC. I noticed very early on that the data transferred much quicker from one SCSI peripheral to another, than if it had to get off the SCSI bus and catch the IDE one instead; one SCSI hard disk later and my destiny was set.

Today I have all-SCSI DVD-ROM drive, Iomega ZIP and Jaz, two hard disks and still have plenty of opportunity to connect external SCSI peripherals, something IDE has never been able to do. However, over the years, IDE (in terms of interface and devices) has begun to catch up in terms of raw performance. Out of curiosity, I decided to try out my SCSI card and drive on the Asus P2B system described above, with 866MHz CPU, ATi Rage Fury Maxx and 128MB of PC133 SDRAM. My hard disk was a Seagate ST39173 9GB Ultra2 drive and my controller an Adaptec 2940U2W.

Much to my surprise, my SCSI system actually went a tad slower in SYSmark 2000 than the IDE Quantum one described earlier – 168 on SCSI versus 172 in IDE. While the SCSI subsystem still suited me overall in terms of better connectivity, I admit I felt a bit miffed.

In last month's *Reviews*, I tested an Armari R8-2000E workstation, which featured IBM's brand new 75GXP UltraDMA66 hard disk. Armari is normally a big SCSI fan, but reckoned this new drive really cut the mustard. IBM claims it sustains a whopping 37Mbytes/sec, which, for once, actually demands the bandwidth of the UltraDMA66 interface. In our tests it certainly did fly, so the challenge really was on for SCSI to regain some ground.

Taking no prisoners, I decided to go for a new Seagate Cheetah 18XL 18GB Ultra160 hard disk, spinning at 10,000rpm. While this would work on the 80Mbytes/sec LVD channel of my Adaptec 2940U2W card, I opted for a new controller: the Adaptec 29160,



Adaptec's SCSI-bench shows the relative performance of sequential data transfers on three disks on my system – note the Ultra160 drive is sustaining more than double the throughput of my older U2W drive, while an ancient SCSI-2 drive has virtually given up the ghost

which as its name implies, supports the latest Ultra160 SCSI specification.

I set up the same configuration once more, ran SYSmark 2000 and was delighted to score 180, compared to 168 with the old SCSI hard disk. Out of sheer greed, I overclocked my CPU to 1,000MHz, ran the tests again and achieved a whopping 198! Suddenly, the mid-180s scored by production RDRAM 1GHz systems seemed relatively slow.

Out of curiosity I fired up Adaptec's EZ-SCSI tests and set the Seagate Ultra160, Seagate U2W and an old Micropolis SCSI-2 sequentially firing at the same time. My U2W drive sustained just under 15Mbytes/sec, but the new Ultra160 drive delivered over 35Mbytes/sec. The old SCSI-2 disk plodded along at just over 1Mbyte/sec, albeit slightly slowing itself and the Ultra160 in the process. The moral of this story is that a fast disk can make all the difference. I'd recommend a new Ultra160 SCSI subsystem any day, while the new IBM 75GXP will do wonders for an UltraDMA66 system.

Thanks!

After all that excitement, I'd like to thank several readers for doing my job for me and tracking down some tricky suppliers! In reference to Richard Pankhurst's request for some DOS CD-writing software, Alistair Cunningham and Andrew Gratton both suggested DAO from www.golden hawk.com. James Pearson suggests looking up www.fadden. com/cdrfaq for a list of DOS CD-R apps, while Ross Rundle uses a home-made DOS batch file employing XCOPY to write to CD-RWs that have been formatted as removable drives using Adaptec's DirectCD.

I may have gone all the way to Japan to find an Iwill Slocket II and Titan Majesty fan, but Howard Barnfather and Cyril Holmes beat me by finding UK suppliers that were cheaper to boot!

The Iwill is available from Vision Multimedia Systems: www.vmsystems.co.uk, 01274 403040, and the Titan Majesty from Hills Components: www.hillscomponents.co.uk, 01923 424344.

CONTACTS

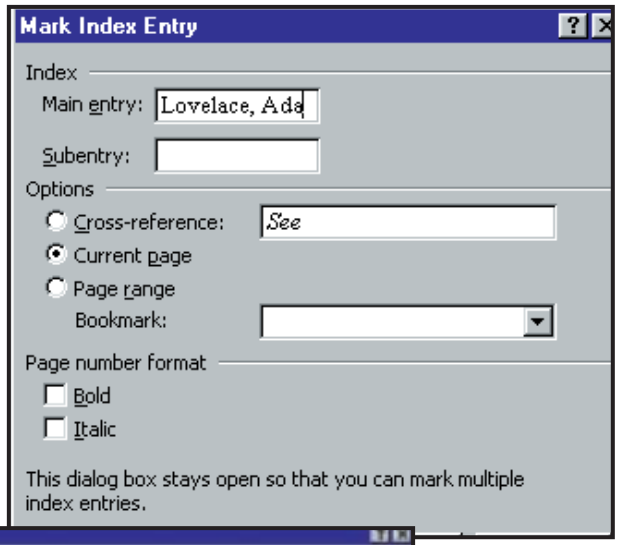
Gordon Laing welcomes your comments on the Hardware column. Contact him via the *PCW* editorial office or email: **hardware@pcw.co.uk**

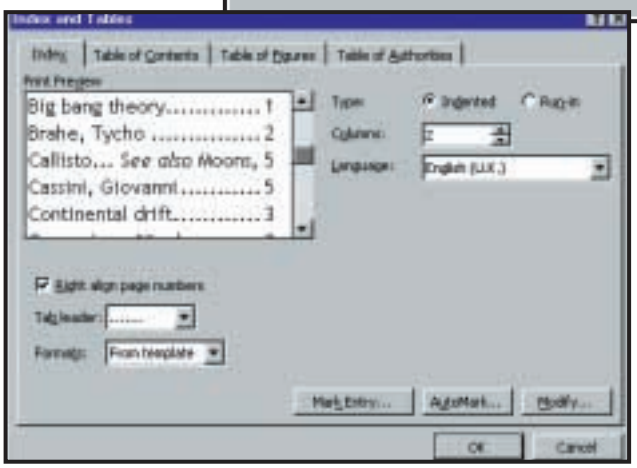
Index-linked

You don't appreciate a good index until you need one, so Tim Nott tells you how to make your own.

One of the great things about electronic documents is that you can search through them easily. You don't have to fumble about in an index or thumb through the pages. However, if you are writing, say, a history of computing or a study on the wines of the Quercy that is destined for the printed page, then you are going to need a conventional index.

Using Word, this doesn't pose too much of a problem. Start reading your opus on screen. When you come to a word or phrase you want to index, you select it, then mark it as an index entry. You can get at the necessary dialog through the Insert, Index and Tables command, but since you'll be doing rather a lot of this it pays to learn the keyboard shortcut – Alt & Shift & X. There are several options here, but we'll keep it simple.





Left: Marking some text for indexing Below: Creating the index itself

Type the main entry you want to index under, as it will appear in the index. Then hit Mark. This inserts an XE field in the appropriate place: normally this is hidden, but Word will obligingly turn on the view of non-printing symbols and text. A better strategy than hitting Mark (who might hit you back) is to click the Mark All button instead, which does exactly as it says – all occurrences of the word or phrase will be tagged.

To be absolutely accurate, only the first occurrence of a word in the paragraph is flagged and multiple instances on the same page will only be referenced once in the actual index. You need to be careful when creating an index entry – usually you'll want to capitalise it, and you need to do this at the time of creation, as the text in the index itself will not retain directly-applied formatting.

Having marked the text to be indexed, creating the actual index is a doddle. Place the cursor where you want the index to appear and Insert, Index and Tables, Index, OK. You have a few options here, such as the number of columns and aligning the page numbers. The index itself is another Word field, so if you want to add entries after it has been created, select the index (it should turn grey) and press F9 to update it. If you add text that contains words already indexed to your book, then you will need to refresh the tags by repeating the Mark All process.

You may want to index a different word to an existing entry – your computing history may refer to Augusta Byron, Ada Byron King and the Countess of Lovelace, who are all the same person. You can do this by typing in the title of an existing entry when indexing the other forms. Be careful though, as the index is case sensitive: if you type in 'drink' when there's an existing 'Drink' entry, you'll create a second index entry.

A better way of dealing with this, using formatting and reusability, is to create a concordance file. This wonderfully biblical-sounding device is actually nothing more than a two-column word table. The left-hand column contains the words as mentioned in the text, the right-hand column the index entry. This makes it easy to create different texts in the left-hand cells that refer to identical entries in the right-hand column.

You can also use this to harness different word forms or synonyms – drinking, drunk, boozing – to the same entry. Note that, like the index entry titles, the tagged text is case sensitive – you'll need to enter both Wine and wine to get both forms tagged. Creating the index is again a two-stage process. First you go to Insert, Index and Tables... Index and click the Automark... button. This brings up a standard file open dialog and you choose your concordance file. This closes all the dialogs and marks the entries. You then need to go back and Insert, Index and Tables... Index, OK.

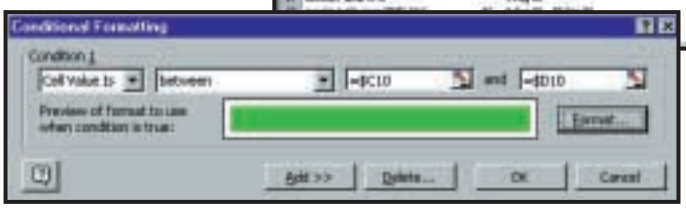
CONTACTS

Tim Nott welcomes your comments on the Word Processing column. Contact him via the *PCW* editorial office or email: **wp@pcw.co.uk**. Please do not send unsolicited file attachments.

Task masters

With project management, time is of the essence, so Stephen Wells shows you how to save it.

Every now and then I receive a request to solve the problem of having Excel change the formatting in one cell, based on an entry in another. Those readers will be interested in this excellent example (right) contributed by Simon J Warren. Earning himself a well-deserved £25 book token for his contribution, it is a worksheet Simon uses for project management and simulates the type of planning and progress chart devised by American, Henry L Gantt.



Top: Simon J Warren's home-made Gantt chart created by using Excel's built-in conditional formatting facility
Above: A typical format instruction used to make the Gantt chart

Task descriptions are entered in column A with the number of days each task takes entered in column B. Columns C and D are the start and end dates of each task. Except for the first in the list, they are calculated from the preceding one.

All cells in column E equal the value in the start date cell and cells in column F onwards equal the previous cell plus seven. The columns are made quite narrow and formatted with the font in white on a white background, so they don't display by default.

Here's where the Conditional Formatting comes in. In Excel 97, find it on the Format menu. It is used to display a green font on a green background only if the date in the cell is between the start and end dates. The stored value never displays but the cell becomes a block of green and part of a chart bar. For example, cell L10 has, as shown in the screenshot above, the conditional format that it shows green if the cell value is between C10 and D10. The formula it holds is K10+7. As the result of this formula is not between 28 Apr (C10) and 5 May (D10) the cell shows white.

This Gantt chart works perfectly. If you find a task is going to take longer than originally planned, you just change the number of days in column B. The end date of the task, and all the other end dates, automatically change in column D. The adjacent bar lengthens to reflect the change and all of the following chart bars shift to the right as they should.

Simon admits that his creation doesn't have the sophistication of, say, Microsoft Project 98, but it does the job and may be something you could adapt.

With books first editions are the most valuable. With software the opposite is true

Old timers

In the July column I mentioned that Excel doesn't recognise dates prior to 1900 and pointed reader Rod Strong toward Corel Quattro Pro 8. This led Matthew Inns to email me and suggest an Excel add-in available for downloading from John Walkenbach's excellent spreadsheet site. You can read all about this series of XDATE custom functions first at www.j-walk.com/ss/excel /files/xdate.htm. The add-in only works with Excel 97 or 2000, not Excel 95, nor Excel for Macintosh, and is not guaranteed to be accurate prior to 1752. Still, it's fully functional and free. Just download and execute the xdate.exe file and it installs eight XDATE functions including XDATE, to give a date for a year, month, and day; XDATEDIF which returns the number of days between two dates; and XDATEDOW which gives the day of the week of a date.

Excel 2000 fixes

With books, first editions are the most valuable. With software the opposite is often true as you are often best advised waiting until the publisher has responded to initial customer complaints. To see a list of the changes made to Excel 2000 so far, download the 326KB file at www.microsoft .com/office/ork/2000/download/ SR1Changes.xls. It includes all 620 changes to the different applications in Office 2000, including over 80 for Excel. The actual SR1a file is much too large for most people to download but you can order the patch CD using www.microsoft.com/uk/office/update/sr1order.htm, or phone Microsoft Connection on 0345 002 000 in the UK or 01 450 2113 in Ireland.

CONTACTS

Stephen Wells welcomes your comments on the Spreadsheets column. Contact him via the *PCW* editorial office or email **spreadsheets@pcw.co.uk**. Please don't send attached files until requested.

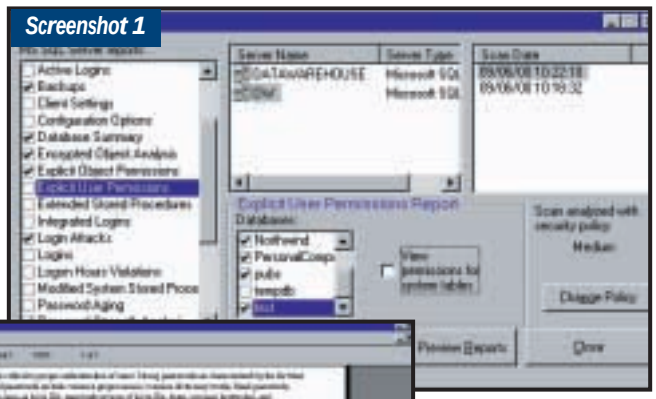
A secure base

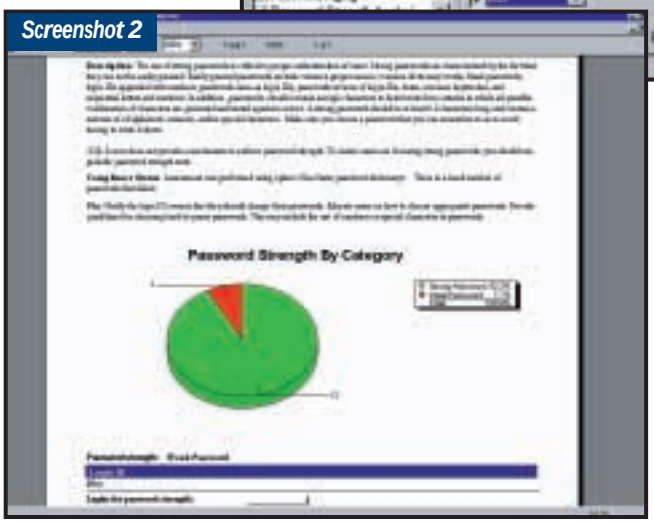
Database security is in question as Mark Whitehorn looks at password-checking software.

Now I like to think I run a tight ship, database-wise; I didn't get where I am today by running loose databases. Client-server databases such as SQL Server and Oracle provide high levels of security, but it is up to the Database Administrator (DBA) to ensure that they are used and I certainly do that. Absolutely.

But how can I really be sure that I haven't missed anything? And how can I be sure that the users are playing the game? After all, I tell all my users to use non-guessable passwords, but since I can't make sense of the password file, I can't tell if they are following my instructions.

The answer is to use a product such as ISS Database Scanner. This intriguing piece of software runs entirely on a client and simply requires a Systems Administrator login to the database server in question. From the client you can initiate a scan of the database security. This takes some time to run (the time depends on the size of the database, number of users, level of security check required etc), but your patience is rewarded by an extremely comprehensive report on a host of security aspects (see screenshot 1). From this you can choose to print it all or simply focus on one aspect. In this case I have chosen to look at password strength and I am pleased to report that 11 of the 12 users are using strong passwords. (This is a real operational database, incidentally, and these are real users). The twelfth person is new to the database and I had forgotten to suggest that she scatter numbers in among the letters – so this one is my fault.





Top: Some of the report components from Database Scanner
Bottom: Oops, there's a weak password in there

For this particular test Database Scanner has a huge file of known passwords which it throws at the password encryption algorithm and then checks to see if the products match the entry in the password file. It also checks to see if the password is the same as the login name, the reverse of the login name etc.

One of the joys of this product is that the printed reports not only give you bold information about the state of your database, they also try to put the information in context. For example, in the report on passwords, not only does it provide general information about what makes a strong password, it also includes SQL Server specific information (the fact that it has no mechanism to enforce strong passwords). If I had run this against an Oracle database, the report would be tailored for that platform.

If you select all the options, the complete report runs to over 120 pages. The software itself has an unpolished feel, not in terms of the functionality, which is excellent, but in terms of the interface. It feels clunky and unhelpful, which is at odds with the highly polished and helpful reports that it ultimately produces.

The cost of Database Scanner is the non-trivial amount of circa £650 for SQL Server and £1,200 for Oracle. On the other hand, how much does a security breach cost? You can find out more information at www.iss.net.

Teaser tables

In the July issue I posed an SQL teaser from Paul Edwards (pedwards@e-promotions.co.uk).

He has two tables, which are tblSubject: SubjectID, SubjectName, ShowCount and tblArticle: ArticleID, ArticleTitle, ArticleText, WhenCreated, SubjectID.

He wants a list of recent articles, but wanted to see the 10 most recent articles on SQL,

```
SubjectName = "SQL", ↙
ShowCount = 10;
```

the five most recent on Windows NT,

```
SubjectName = "Windows NT", ↙
ShowCount = 5
```

and only the two most recent on DOS,

```
SubjectName = "DOS", ↙
ShowCount = 2
```

(*Key: ↙ code string continues*)

I was deluged with replies and thanks are due to all who responded. Check my website (www.penguinsoft.co.uk) for the file DBCSEP00.MDB. In this are solutions from Neil Sunderland (neilsunderland@freeuk.com) and David Portas (dportas@acm.org) and in AC.MDB is a solution from Andrew

Cumming (andrew@dcs. napier.ac.uk).

So, how do they work? There are various approaches and I strongly advise having a look at the three solutions provided and performing your own 'compare and contrast' exercise. However, let's consider Andrew's variation. This solves the problem using:

```
SELECT A.ArticleTitle
FROM tblArticle AS A, ↙
tblArticle AS B, ↙
tblSubject  AS S
WHERE A.WhenCreated <= ↙
B.WhenCreated
AND A.SubjectID = ↙
B.SubjectID
AND A.SubjectID = ↙
S.SubjectID
GROUP BY A.ArticleTitle, ↙
S.ShowCount
HAVING Count(B. ArticleID)↙
<=S.ShowCount;
```

To explain this he breaks it down into two stages. The first is:

```
SELECT A.ArticleID, ↙
A.WhenCreated, B.ArticleID, ↙
B.WhenCreated
FROM tblArticle AS A, ↙
tblArticle AS B
WHERE A.WhenCreated <= ↙
B.WhenCreated
ORDER BY 2 DESC;
```

This generates an answer table in which every article in the table appears a number of times. The number of times each one appears is related to the number of articles that have an equal or more recent date.

In Andrew's example, Article 21 – the most recent – shows up just once, linked with itself. Article 20 shows up twice, linked once with 21 and once with itself. Article 19 shows up three times – with 19, 20 and 21.

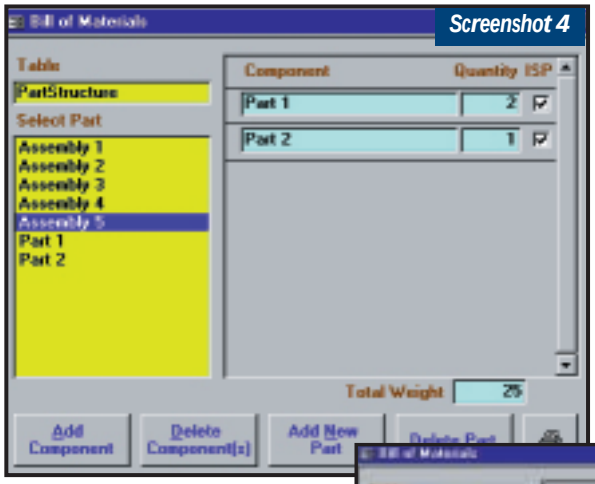
This becomes even more relevant if we expand the WHERE clause:

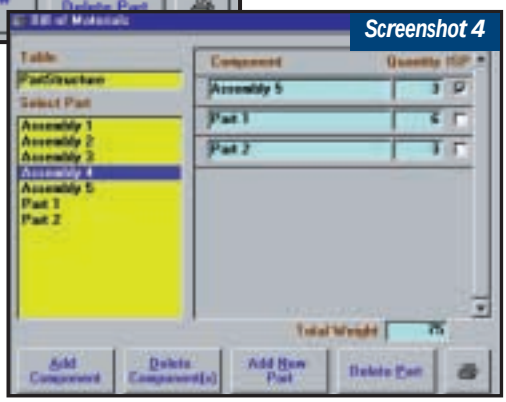
```
WHERE (A.WhenCreated<=B.↙
WhenCreated) AND ↙
(A.SubjectID=B.SubjectID)
```

that ensures that only the articles on the same subject are counted together.

Clearly, the number of times that an article appears in this answer table gives us information about how recent it is, so all we have to do is to count the number of times each article appears, for example:

```
SELECT A.ArticleTitle, ↙
Count(B.ArticleID) AS ↙
CountOfArticleID
FROM tblArticle AS A, ↙
tblArticle AS B
WHERE (((A.When↙
Created)<=[B].↙
[WhenCreated]))
AND (A.SubjectID=B.↙
SubjectID)
GROUP BY A.ArticleTitle
ORDER BY 2;
```





Left: The shin part's connected to the knee part...
Below: ...and the knee part's connected to the thigh part...

Several people warned, quite correctly, that there are three things to bear in mind here. One is that these solutions work fine on small data sets and poorly on large ones; in other words, this is not an 'Order n' solution. Second, there are problems with articles having identical dates. Andrew's example demonstrates this with two of the DOS articles having the same date. Thirdly, in reality, articles are likely to have relevance for more than one subject, so an intermediate joining table may be required.

For people interested in further information on this classic problem, see *SQL for Smarties: Advanced SQL Programming* by Joe Celko (ISBN 1558605762).

Sounds like...

Mechanisms for calculating how alike two words sound to the human ear have been mentioned in two issues recently (June and August) so I don't want to spend more time on it here (unlikely as it sounds, there may be some people for whom the subject is beginning to pall). However, I'm still interested and mail keeps arriving so check out the file SOUNDEX.TXT on my website for the latest.

Explosive parts

Imagine that you run a company that puts together parts into assemblies (which in turn can be used to create more complex assemblies). The parts have properties such as weight and, given that you know which parts go into which assemblies, you can calculate the weight of the final product. Well, that's exactly the problem facing reader Ken Sheridan.

For example, part one weighs 10 units and part two weighs five. So, assembly five, which is composed of (two * part one) and (one * part two) weighs a total of 25 units (screenshot 3). Assembly four is composed of (three * assembly five) which makes a total of (six * part one) and (three * part two) giving a total weight of 75 units (screenshot 4).

All of this is fine and dandy and perfectly logical. The problem isn't the logic, the problem is how you model all of this in a database. If you have been pondering a similar problem, read Ken's email in the Soundex.txt text file and take a look at BOM.MDB (Bill of Materials) on my website.

CONTACTS

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Living on a player

Ian Waugh sounds out the new Windows Media Player and finds it adapting to market needs.

You can imagine the call coming down from somewhere on high at Microsoft: 'Time to revamp the Media Player, fellows.' That useful one-stop app for playing MIDI, audio and movie files is looking a bit long in the tooth and doesn't support any of the neat media, CD audio or Internet-related stuff we now take for granted.

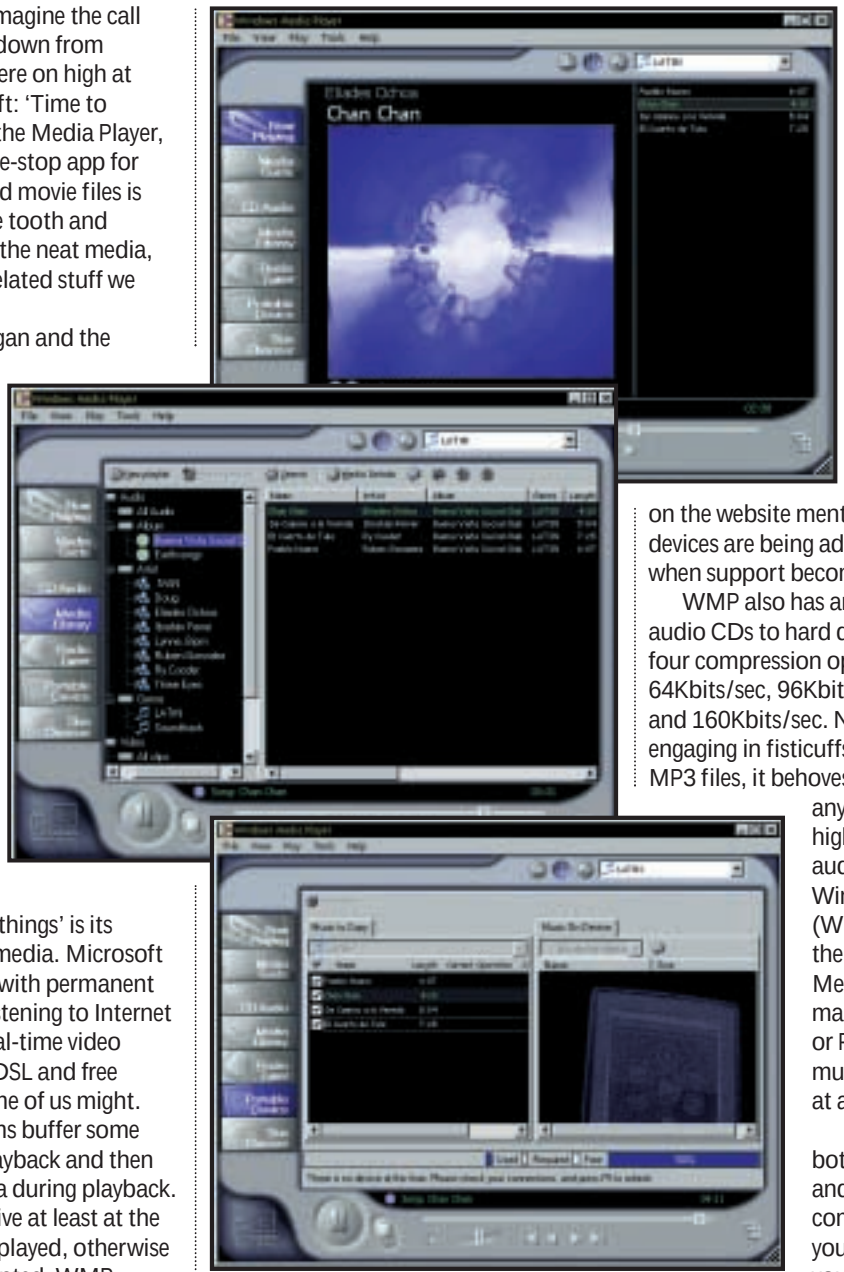
So development began and the Windows Media Player (WMP), although still in beta, is now into version 7. It has had so many changes it is now a totally new program. There are seven main options on tabs down the left of the window: Now Playing, Media Guide, CD Audio, Media Library, Radio Tuner, Portable Device and Skin Chooser. Here, we're going to concentrate on the audio stuff.

One of WMP's 'big things' is its support for streaming media. Microsoft expects us to be sitting with permanent Internet connections listening to Internet Radio and watching real-time video broadcasts. Roll out ADSL and free Internet access and some of us might.

All streaming systems buffer some data before starting playback and then continue to receive data during playback. Hopefully, data will arrive at least at the same rate as it is being played, otherwise playback will be interrupted. WMP incorporates intelligent streaming, which attempts to detect network conditions and adjusts the properties of the stream to maximise playback quality. The object is to deliver the highest quality playback whatever the conditions, although this requires the media to have been encoded at multiple bit rates, which not all media is. At least not at the moment.

WMP supports a whole range of media file formats, but of prime interest to audiophiles is support for Windows Media (.wma and .asf), Wave (.wav) and MP3 (.mp3). These can be copied to a portable device for playback. Three levels of compression are offered – 32Kbits/sec, 64Kbits/sec and 128Kbits/sec.

The software supports what Microsoft calls portable devices, but by this it really means PDAs supporting its new Pocket PC OS. There's a list of compatible models on the website mentioned later and new devices are being added to the list as and when support becomes available.



Left: Windows Media Player can display groovy graphics as it plays your music
Middle: The Media Library keeps track of all your audio and video files
Below: You can copy files from the Media Player to a portable device

WMP also has an option to copy audio CDs to hard disk and there are four compression options here – 64Kbits/sec, 96Kbits/sec, 128Kbits/sec and 160Kbits/sec. Now, without engaging in fisticuffs about the quality of MP3 files, it behoves one to suggest that anyone interested in high-quality compressed audio should try Windows Media Audio (WMA) and compare the file quality. Windows Media can pack twice as many tunes into a player or PDA as MP3 so it must be worth looking at and listening to.

Considering that both Windows Media and MP3 are lossy compression formats, you will do well to let your ears suggest which formats you're happy using.

However, it's the audio CD copying process where it gets interesting with WMP version 7. The ripping process is straightforward, but it copies the files in .wma format, so you may not be able to import them into every music program. There is no option to save such files as Wave files: a veritable missed opportunity, but doubtless an intended miss.

Part of the logic behind this may have something to do with WMA's support for licensed files. Such files may be downloaded from the Internet, perhaps after payment of a fee, and the licence restricts where and how the file can be played. Now, in itself, that's not a problem; the labourer is worthy of his hire and all that.

But these licences can restrict playback to the computer onto which the file is downloaded. It's like buying a CD and only being allowed to play it on your sister's My Little Pony player. You may not even be allowed to copy it to a portable device. Of course, this begs many questions that the record companies love to ask – such as, when you buy a 'song', do you buy the right to listen to it anywhere and play it on any system capable of playing the media? The licence system says: 'absolutely not'.

How well this and other restrictive licensing systems succeed depends entirely upon the take-up by the great unwashed – you, the music-buying public. If lots of people think it's a good idea and buy into it, the freedom we take for granted of being able to play our music collection where and when, and how we want, could be curtailed.

Above: The CD Audio function copies audio files from CD to hard disk in Windows Media format
Below: Get online with the Media Guide and find the latest cool stuff to look at and listen to

It's like buying a CD and only being allowed to play it on your sister's My Little Pony player

What is also interesting is that the CD audio preferences in WMP have a Personal Rights Management option. If this is enabled, when you rip an audio CD, a licence is generated preventing the files from being played on any other computer. Yes, I tried it and it works! However, if you don't enable this during copying, you may then be prevented from copying the file to a portable device if that device supports SDMI (Secure Digital Musical Initiative). You don't suppose anyone has realised that it's possible to make two copies with and without the option enabled?

The main message would seem to be, that if you want to put your CD collection onto a portable player, stick with MP3. Lest the odd reader or two gets the idea that this is promoting music piracy – far from it. What it does advocate is freedom to listen to music that you have paid for in different locations. Just like we used to be able to do in the good old days.

Back with WMP, it can look up CD information on the Internet to save you typing in the names – and this worked just fine, albeit after a bit of a slow start.

The Media Library section is used to organise your media collection. A CD track can be added simply by clicking a button and you can add URL links as well as physical media files. Collections of files are stored in a playlist and you can create any number of playlists containing any combinations of files.

The program will search your PC for both music and video files – you may even discover a few you had forgotten about or never knew you had – and it can search the web for files, too. This feature links to a website which appears in the middle of WMP and from which location you're supposed to navigate. This is a real pain. The address is actually http://windowsmedia.com (www.windowsmedia.com doesn't work) so use this instead as it makes navigation far easier.

Using the Media Library options, you can set rights for the contents of your Library for applications and Internet sites. You can prevent them accessing your playlists, or allow them to read and edit the files.

One of the main problems with the WMP is that it is currently very slow. The term 'wading through treacle' comes to mind. This isn't just when it's doing anything clever; it can take an age to switch from one option to another when you click on the tabs. Oh, and it does crash sometimes.

So, WMP has some good ideas, even if some are severely limited and not everyone will welcome them. It also still needs several tweaks to make it of 'merchantable quality' – yes, even though it's free! But it certainly shows how Microsoft sees the music, media and Internet markets developing.

The latest beta of Windows Media Player can be downloaded from www.microsoft.com/windowsmedia. It's a hefty file, weighing in at 7MB, so if you're on a slow connection, you may be better off waiting for the final version.

CONTACTS

Ian Waugh welcomes your comments on the Sound column. Contact him via the *PCW* editorial office or email: **sound@pcw.co.uk**

Digital scissors at work

Ken McMahon rubs shoulders with Photoshop's erasers to create flawless cutouts.

Some of the most fun to be had with image editing involves cutting out images. Whether you want to create a montage, or just remove an ugly background, producing cutouts can be a rewarding, though difficult business. When it's done well, you'd never know the digital scissors had been at work, but poor technique is visible a mile off, fringing, messy edges, stray background pixels and cut-off foreground detail are all evidence of tampering which will destroy the illusion of reality in an instant.

There was a time when the only way to produce flawless cutouts was to apply a great deal of concentration, time and effort with the pen tool and even then soft and wispy stuff like hair, fur and out-of-focus detail was extremely difficult to deal with.

Then along came Photoshop 5.5 with a batch of eraser tools that make producing cutouts an altogether much simpler, less tedious task.

There are three eraser tools that between them are up to the task of removing virtually any subject from its background. The good news for anyone who bought a scanner bundled with Photoshop 5.5 LE is that this cut-down version contains all the same eraser tools as the full version.

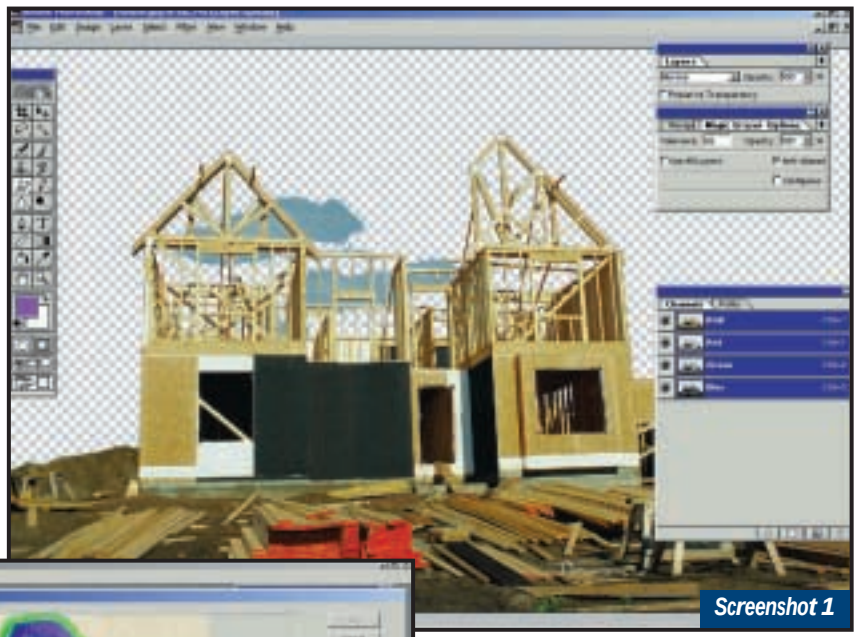
The magic eraser is the simplest to use, though the least effective of all. It works in the same way as the magic wand – deleting, rather than simply selecting pixels. The pixels are selected on the basis of proximity to the first pixel clicked and the tolerance value set in the magic eraser palette. In contiguous mode the magic eraser deletes only adjacent pixels, anything that is surrounded by pixels outside the tolerance remains.

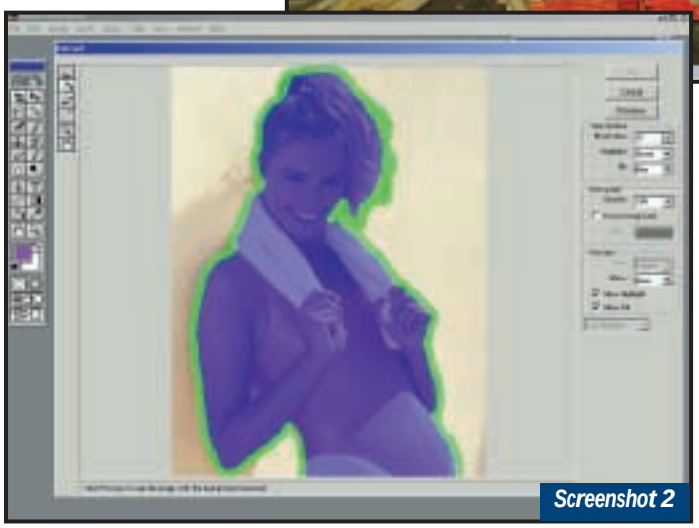
Unless you are fortunate and your background consists of pixels of a similar colour all within the tolerance value, you'll need to click in several different areas to remove all the unwanted detail and this is likely to have the undesirable result of taking out some of the foreground detail too. But with certain kinds of images the magic eraser works like, well, magic.

Screenshot 1 shows a good example of what you can do with the magic eraser on a background of broadly similar colour. First, I've unchecked the contiguous mode so that the fiddly sky detail in between the roof rafters will be erased, even though it's separated from the main block of sky by the roof timbers. Then, clicking on the blue sky detail in the top right quarter of the image with a tolerance setting of 100 has removed all but the lighter blue areas where the clouds are. Clicking on this remaining detail with the tolerance reset to 32 gives a perfect result.

The Background eraser is a sophisticated tool. Drag it along the edge of your foreground image and watch it erase the background as you go. The key to success with the background eraser is in optimising the parameters for the particular subject you're dealing with.

Sampling mode can be set to once, continuous or background swatch. Set to once, you'll need to erase in short strokes, otherwise, when you begin to move away from your starting point the background may no longer match the original pixel. You need to be precise with the background eraser and make sure


Screenshot 1


Screenshot 2

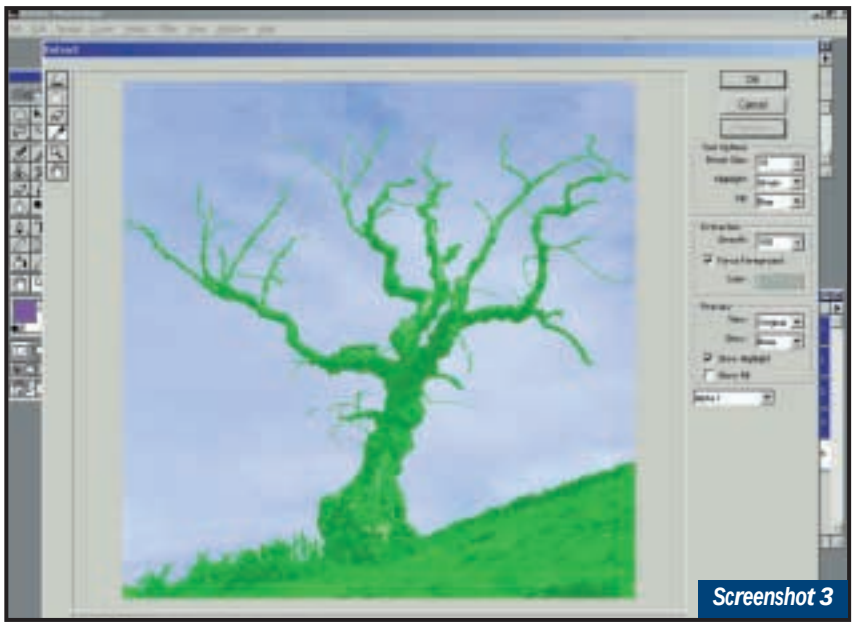
Above: The magic eraser works its spell removing the sky in two stages
Left: Make sure wispy hair and other fine detail is well covered with the highlighter

that you start on the background and don't accidentally start erasing foreground, though this can easily be undone. You can also guard against accidental foreground erasure by checking the 'Protect Foreground Colour' box in tool, options, palette and sampling a prevalent foreground colour with the eyedropper (Alt & click).

In continuous mode, the background eraser samples as you go, so if the background is complex – say brightly coloured flowers – you'll get a much better result.

Photoshop's extract command is the most powerful of the eraser tools, but the power comes at the price of complexity. Extract uses its own dialog box that you access using image, extract or Ctrl & Shift & X. The process is quite simple – it's the options that give extract its power and complexity.

First select the highlighter tool from the toolbar on the left of the preview window and trace the edge of your foreground subject. It's important that there is no break in the outline and that you completely cover the boundary between the foreground object and background – you can change the brush size in the tool options palette, or even adjust it while you trace using the left and right square bracket keys. Holding down either of these keys accelerates the rate of change of the brush, so you can go from tiny to big very quickly.



For complicated outlines use an alpha channel to create the highlight and force foreground colour to keep subject detail

the highlighter tool to draw straight-edged lines.

When you're satisfied that you've done a reasonable job on the outline and fill, click on the preview button. If the results look good click OK to apply the extraction.

If you don't get good results first time you may need to adjust the smoothness setting above its default of zero. High smoothness settings are particularly effective for dealing with wispy hair. Make sure all of the hair is covered with the highlighter before filling (screenshot 2).

High smoothness settings are particularly effective for dealing with wispy hair

Next select the fill bucket and click inside the outlined object. If the fill colour bleeds out into the background it means there is a hole in your outline. Select view original from the preview palette and plug the hole using the highlighter before refilling. Unfortunately there is no undo, so if you make a mess with the highlighter you'll have to erase the problem area with the eraser tool and have another go.

The trick with the highlighter is to use a narrow brush for areas of precise detail and a broader brush to cover softer, less well defined borders. It's much easier to do this using a tablet, but if you're using a mouse, or just find it hard work, you can make life easier by Shift clicking with

For objects that are hideously difficult to trace, you can sometimes convert one of the colour channels into an alpha channel and use this as the basis for your selection in the extract dialog.

First check which of the colour channels provides the best contrast between subject and background detail by pressing Ctrl & 1, 2 and 3 to view the R, G, and B channels. Duplicate your chosen channel by dragging it to the new channel button in the channels palette and open the extract dialog. You can use the levels or curves command to further adjust the channel, increasing the contrast between the areas you want to keep (black) and background detail you want to lose (white). Select Alpha1 from the load highlight pulldown, click the force foreground button, select the eyedropper and click on the most generally representative colour in the body of your subject (screenshot 3).

If you duplicate the layer you are working on before starting the extraction process you can clean up any scrappy edges using the history brush and background eraser tool. To reinstate lost foreground detail click the state in the history palette prior to the extraction and use the history brush to paint back in the missing subject detail.

Don't worry if you also paint in some unwanted background as you can remove it easily using the background eraser set to sample once.

You can also use this technique when compositing images by placing the layer containing your foreground subject on top of the new background before extracting it from the old one.

See also this month's image-editing workshop earlier in the issue.

CONTACTS

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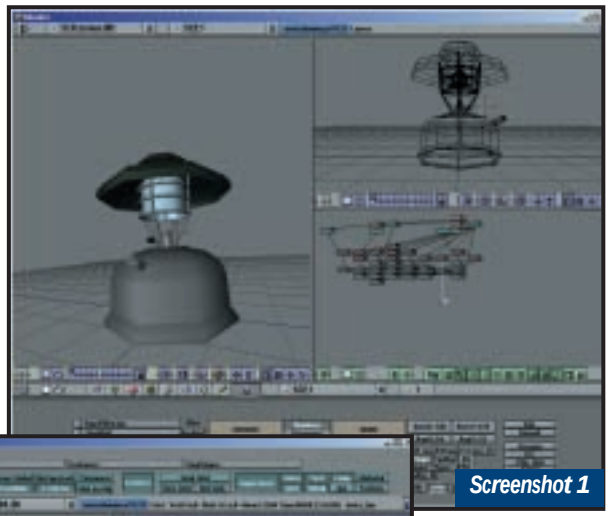
Getting into the mix

Benjamin Woolley casts intuition aside in order to make sense of Blender's idiosyncrasies.

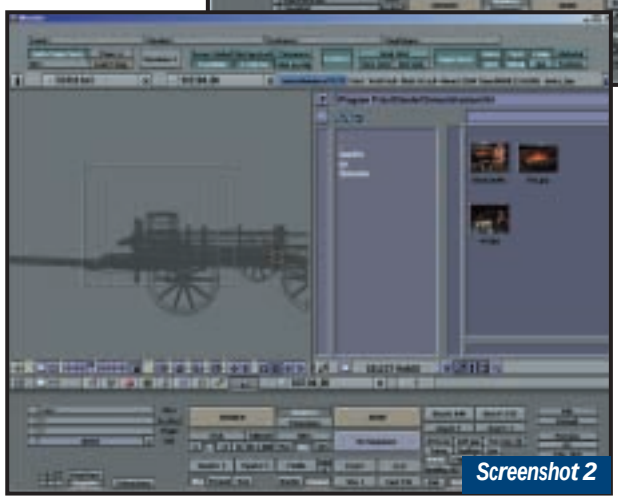
Following the inclusion of Blender for Windows and BeOS on *PCW*'s July cover CD, reader John Wellbelove sent me the following email:

'I've been writing software and using computers since the early 1980s and I'm usually pretty quick at figuring out how to use the basic features of a program without having to look at the manual, but Blender is beyond belief. I spent 15 minutes fiddling about, pressing buttons, selecting menus etc, which usually gives me an idea of the basics, but this program was almost completely incomprehensible. I got nowhere!

'Can I put this program forward as a candidate for "The most unintuitive program of the year" award. If there isn't such an award at *PCW*, can we start one?'



Screenshot 1



Screenshot 2

Left and below: Mind Blender – the interface that sent John Wellbelove over the edge is, to say the least, complicated, but will yield its secrets to those who persist

Blender has become the Linux of 3D. Created by Ton Roosendaal while he was at the Dutch animation studio NeoGeo, he decided to offer it as a 'freeware gift to the worldwide computer graphics community'. It now boasts a global user base of 65,000 and is available as a free download from the Blender website (www.blender.nl), in versions for virtually every platform (BeOS being the latest).

A glance at its interface (screenshots 1 and 2) shows how the free thinking behind its marketing extends to its interface. As John so succinctly put it, to anyone brought up in the world of Windows or the Mac, or even of Linux, it is completely incomprehensible. And if you try to explore it blind, as John and many of us did, you quickly become unstuck.

To make matters worse, Blender does not offer any sort of context-sensitive help, nor a comprehensive manual, although there is a rather basic version available online and a more professional printed version, published by NaN, that you can buy for around £25.

Other 3D software tends to be almost exclusively mouse driven. Blender is not

Even practised Blender users can find it flummoxing. Blender forums are packed with cries of bewilderment. One of the FAQs on the Blender website begins with the plea 'Help! The "Add menu" gets stuck!'.

However, with Blender, as with so many things in life, first impressions are misleading. No-one could claim that the interface is an example of software design at its best. It is cluttered and the feedback you get from mouse or keyboard actions is often perplexing, sometimes downright perverse. Nevertheless, once its strange ways become familiar to you, it begins to reveal some virtues as well.

To master Blender, you have to first follow the piece of advice you see repeated over and over again in the Blender forums and FAQs: you need to have a hand on the keyboard and one on the mouse. Other 3D software tends to be almost exclusively mouse driven. Blender is not. Theoretically, you could probably do most things with the mouse, but it would become laborious and awkward. For example, you toggle in and out of 'EditMode' (the mode for editing an individual object's geometry) by pressing Tab; you invoke the toolbox by pressing space; you exit by pressing 'Q'.

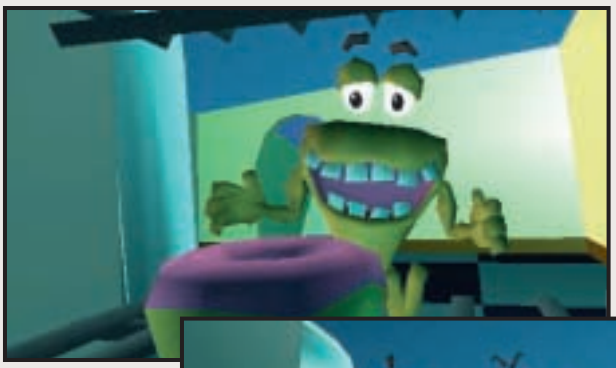
One other strange quirk of Blender is that it relies on a three-button mouse, with an option for simulating the third button if you haven't got one by using Alt-LeftButton.

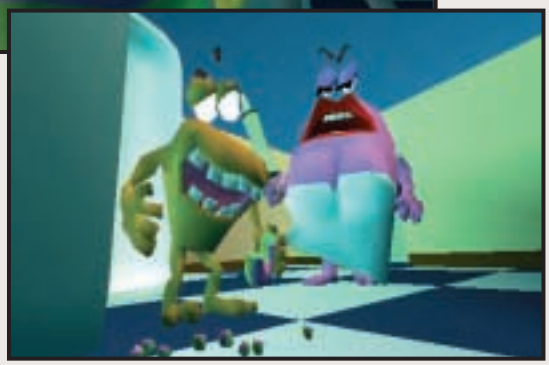
The workspace is, as with more conventional packages, split into windows, but there comforting familiarity once again ends. There is no menu along the top – the nearest equivalent is the popup toolbox. You can change the number and position of all the windows, although none can float: they are always 'tiled' to fill the

Stay tooned – The Shags are coming

The prize for the least promising name for a family of cartoon characters has to go to Toon 3D's 'The Shags'. These grisly little monsters do not, thankfully, live up to their name. In fact, their role is more prosaic: to demonstrate the latest tool for delivering 3D animations over the Internet.

Toon3D is an authoring environment for animating simple models and publishing the resulting movies. There is a range of keyframe animation tools as well as a facility for adding 'Toons'. These are used to control objects, allowing you to assign them such behaviours as those of the inimitable 'Dad Shag', featured in the demo, who likes to snaffle doughnuts from the fridge.





Above and right:Scenes from 'The Shags', demonstrating some of the animation possibilities offered by Toon3D

However, there are problems with the technology demos (which you can find on Toon3D's website at www.toon3d.com). One is that currently only Lightwave objects can be imported; another is that the movies can only be viewed with Internet Explorer, although I don't really think the repulsive 'Shags' help much, either. On the positive side, the files are very small and the animations seem to run smoothly enough, if somewhat slowly.

Version 2, or GameBlender, is geared towards gaming

workspace. Each window can be configured to be one of several types, an odd assortment that includes a 3D window, which displays the objects in the scene, an 'OopsWindow' which shows a schematic diagram of the data objects (eg the meshes, materials and so on) in the scene and their relationships to one another, a SequenceWindow, for post production, and a FileWindow, for loading and saving files. You can identify which type of window you are in by an icon/button displayed in the left-hand corner of its 'header' (which, confusingly, is sometimes displayed at the foot of the window). If you point and press on this icon and slide the mouse to the right or left, you can scroll through the different window types.

By exploiting such features, you have an infinite number of ways of both arranging the workspace and messing it up. One of the most common experiences I found with Blender was getting stuck in a window with no obvious way out.

Another cause of confusion is the mouse. Double clicking apparently has no effect, but you will find the middle mouse button often and unexpectedly does. For example, suppose you manage to find your way to the file window and navigate through to the file you want to open. If you click on its name, nothing happens. It turns out you need to click on its name using the middle button, or select its name using the left button and then press Enter.

Of course, committed Blender users would say this is all part of the charm of the package. Critics might say that it is a blatant attempt to make it unusable without the manual, for which you have to pay. However, even if the latter was true, you would still be getting a very useful 3D package for less than £30 and that is money you can be sure is going to the good cause of future development. Furthermore, by judicious use of the free resources available on the web, both from the Blender site itself and from a growing number of third-party sites, such as www.blendermania.com, you can get enough information to get to know this fascinating, frustrating package.

At the time of writing, Blender was facing a number of radical changes. Version 2, to be called GameBlender and aimed at being a combined authoring and publishing package for games developers, was about to be released, and the practice of selling 'keys' to unlock some of Blender's more advanced facilities was about to be dropped. There were also promises of new documentation.

For those who penetrate the interface that poor Wellbelove found so perplexing, such developments, and a general enthusiasm for Blender's freeware principles, promise an exciting future and I will aim to continue bringing you news of it in these pages.

CONTACTS

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Coming clean

Tim Anderson builds a web service with Microsoft's SOAP toolkit and answers readers' queries.

According to Microsoft, the next big thing in development is web services. This is another kind of remote object invocation, as also offered by CORBA, DCOM, or Java's Remote Method Invocation. The difference is that web services use SOAP (Simple Object Access Protocol), which is based on XML and HTTP. In one sense there is nothing particularly clever about SOAP. Sending and receiving data via HTTP is basic functionality, and you do not need SOAP to call a CGI script on a remote computer, pass it arguments and read the results.

What SOAP brings to the party is standardisation. Through SOAP, your application can query a remote site to discover what services it offers, in order to invoke them correctly as required.

There are several advantages over more elaborate schemes such as COM and CORBA. The loose coupling is more suitable for frail Internet connections and the simplicity of the link means different object technologies can be easily bridged.

Full support for web services will come in the next release of Visual Studio, but in the meantime Microsoft has issued a preview SOAP toolkit that you can use now. Here is an example of how it works. The starting point is a COM DLL server such as you can easily create with Visual Basic or Delphi.

This example was produced using Visual Basic 6.0. By choosing File, New Project, ActiveX DLL you can create a skeleton Quoteserver project. The class module is named 'quoter' and it has a single method, GetQuote, which returns a random quotation. This functionality can now to be offered by SOAP.

The SOAP toolkit includes an SDLWizard. SDL stands for Service Description Language and it is an XML format that publishes the web service. The wizard asks you to select the ActiveX DLL you want to publish and next the services you want to expose. You then select a server-side web technology, either ASP or ISAPI. ASP is easier to work with, although performance is not as good. Select ASP and the wizard generates two files. Quoter.xml is the SDL file for the service (see figure 1) and Quoter.asp is a skeleton ASP page that implements the service.

While the specification of SDL may change, the essence of it will not. Note that the generated XML includes the web address of the service and a description of the interface. In this case a single method that takes no arguments and with a return type of String.

Most of the work is done by listener.asp, a supplied generic ASP page that is included in pages generated by the wizard. This is code that receives SOAP requests, calls your code to get results, and sends replies in the standardised format. To publish the web service, all you need to do is to place these files in a web directory. The web server also needs access to the ActiveX Server DLL itself.

Coding a SOAP client

A SOAP client has several tasks. First, it must read the SDL file to discover what services are available and how to call them. Next, it formats an XML request conforming to the service description,

FIG 1

Quoter.xml

```
<?xml version='1.0' ?>
<!-- Generated 15/06/2000 20:33:31 by Microsoft SOAP ↙
Toolkit Wizard, Version 1.0.204 --><serviceDescription ↙
name='Quoteserver'
   xmlns='urn:schemas-xmlsoap-org:sdl.2000-01-25'
   xmlns:dt='http://www.w3.org/1999/XMLSchema'
   xmlns:quoter='quoter'>
<import namespace='quoter' location='#quoter'/>
   <soap xmlns='urn:schemas-xmlsoap-org:soap-sdl-2000-01-↙
25'>
      <interface name='quoter'>
         <requestResponse name='GetQuote'>
            <request ref='quoter:GetQuote'/>
            <response ref='quoter:GetQuoteResponse'/>
         </requestResponse>
      </interface>
      <service>
         <addresses>
            <location ↙
url='http://youripaddress/quoter.asp'/>
         </addresses>
         <implements name='quoter'/>
      </service>
   </soap>
<quoter:schema id='quoter' targetNamespace='quoter' ↙
xmlns='http://www.w3.org/1999/XMLSchema'>
      <element name='GetQuote'>
      </element>
      <element name='GetQuoteResponse'>
         <type>
            <element name='return' type='dt:string'/>
         </type>
      </element>
   </quoter:schema>
</serviceDescription>
```

(*Key:* ↙ *code string continues*)

posts it to the service address and finally parses the XML response.

The SOAP toolkit simplifies the task with a set of objects called ROPE (Remote Object Proxy Engine). ROPE is also used by Listener.asp. It does the job of parsing and generating XML in the correct format and has methods for posting data and reading the response.

The neatest ROPE trick is its Proxy object, which lets you treat the remote web service as if it were a local COM object. Figure 2 shows minimal code for a Quoter client. It reduces the client to a couple of simple steps. First, the ROPE Proxy object loads the SDL file, before calling the GetQuote method.

How does the client know that the GetQuote method exists? This information is contained in the SDL file, but clearly the code in the example relies on advance knowledge that GetQuote will work. It would be possible to write a generic client that retrieved the available methods dynamically. More likely, you would use the SDL at design time and write code accordingly. In this scenario, the application will work provided that the SDL remains compatible. As with COM objects, the onus is on the web-service provider to continue supporting a published SDL.

Although COM is used in this example, there is no necessity for it either on the client or the server. For example, you could instead use a Java servlet at one end and a VB client at the other.

The concept works best where there is a permanent Internet connection. For example, send a postcode and get back a map, or a weather or traffic report. Ecommerce is another natural use for this technology. There is no need to view a web page, so it is ideal for PDAs or other visually-challenged devices.

How visual is visual?

Mark McKeachan asks: 'What is the difference between C++ and Visual C++? Is visual a "drag and drop" environment as opposed to typing out code?'

The difference between C++ and Visual C++ is that one is the name of a programming language, and the other the name of a product. To create applications with C++ all you need is a text editor and a compiler, such as GNU C++ or Borland C++, both of which you can download without charge.

The purist view of visual programming is that you should be able to construct both the interface and the logic of an application by drag-and-drop. The most widely used example of this is IBM's VisualAge series, particularly VisualAge for Java.

More often, supposedly visual tools let you create an interface by drawing it on the screen, but resort to text-based code for the program logic. Visual Basic, Delphi, JBuilder and C++ Builder all fall into this category.

Surprisingly, Visual C++ is one of the least visual of programming tools. There is a visual dialog editor, but in other respects you have to rely on code to design your interface. By contrast, C++ Builder is similar to Delphi. Whichever product you use, the bulk of a developer's time is likely to be spent writing code rather than messing with dialogs and drawing objects.

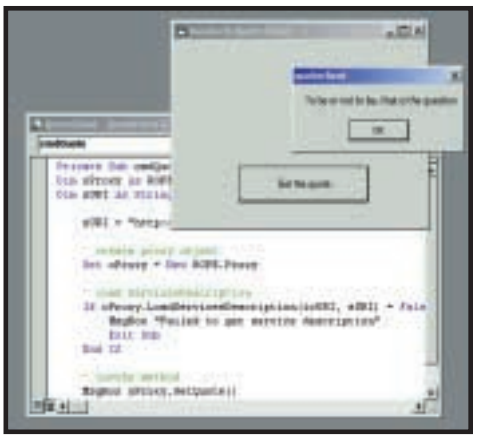
The rest of the code is in class libraries and, in theory, fully debugged. Delphi and C++ Builder use the Visual Component Library, while Visual C++ uses the Microsoft Foundation Classes and the Active Template Library. Visual Basic is more of a black box, although the objects presented by Visual Basic, such as Forms and CommandButtons, are the equivalent of a class library. Java has its own extensive class library.

So, when choosing a programming tool, consider what class library you want to work with, and which development environment you like the look of. You can mix and match to some extent, such as using C++ Builder to work with MFC, or using Visual C++ with the cross-platform Standard Template Library, but you lose the benefit of many of the supplied tools.

FIG 2 **A basic Quoter client (code adapted from the SOAP toolkit)**

```
Private Sub cmdQuote_Click()
Dim oProxy As ROPE.Proxy
Dim sURI As String

    sURI = "http://youripaddress/quoter.xml"

    ' create proxy object
    Set oProxy = New ROPE.Proxy

    ' load ServicesDescription
    If oProxy.LoadServicesDescription(icURI, sURI) = False ↙
Then
        MsgBox "Failed to get service description"
        Exit Sub
    End If

    ' invoke method
    MsgBox oProxy.GetQuote()

End Sub
```

(*Key:* ↙ *code string continues*)



The Quote client in action. Using the ROPE proxy reduces the amount of code needed

CONTACTS

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visual@pcw.co.uk
To find the SOAP toolkit and other online resources, visit http://msdn.microsoft.com/xml/general/soaptemplate.asp
Also try www.w3c.org/tr/soap/

Sign on the dot-com line

Tim Anderson looks at how PHP and MySQL are the bricks and mortar to the online guestbook.

The difference between static and data-driven websites is the difference between online publishing on the one hand and web applications on the other. What follows is an explanation of how to create an online guestbook using PHP (Hypertext Preprocessor) and MySQL, an open-source database server. The humble guestbook is a real interactive web application and this example can be easily adapted.

Despite its simplicity, designing a guestbook involves a number of tasks. These include database administration, web server configuration, page design and coding. This tutorial assumes you have successfully installed PHP and MySQL, or that your friendly ISP has done this for you. PHP and MySQL run on Linux and other Unix-like operating systems as well as Windows. One of the best ways to proceed is to design and test on a local intranet, before deploying it live. This is also excellent technology for use on an intranet.

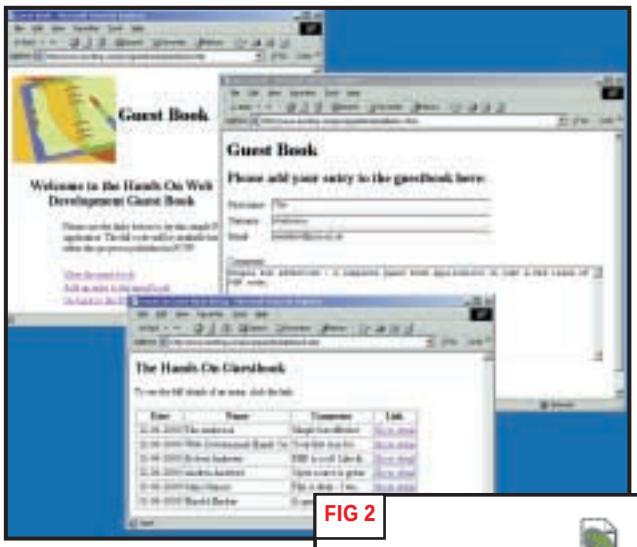
1 Create the database

MySQL lacks the user-friendly visual IDE with which Windows developers may already be familiar. Instead, it is driven through SQL commands. The MySQL client is an SQL shell that lets you type commands interactively and has a batch mode so that you can run scripts.

FIG 1 **Script to create the guestbook database table**

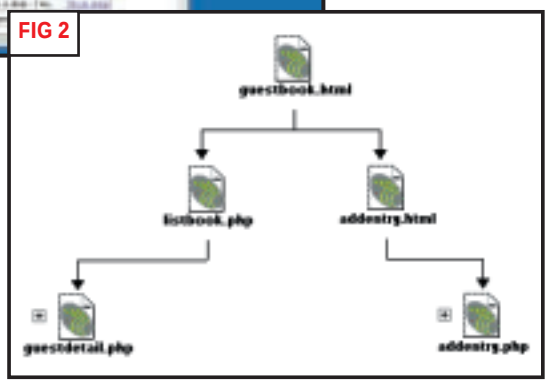
```
USE guestbook;
CREATE TABLE thebook (id ↙
INT UNSIGNED NOT NULL ↙
AUTO_INCREMENT, firstname ↙
CHAR(60) NOT NULL, ↙
lastname CHAR(60) NOT ↙
NULL, email CHAR(60), ↙
regdate DATE NOT
NULL,
comment BLOB, PRIMARY KEY ↙
(id), KEY name ↙
(lastname,firstname), KEY ↙
regdate
(regdate)
);
```

(*Key: ↙ code string continues*)



Left: The pages that make up the Guest Book web application Below: Figure 2 shows the layout of Guest Book

FIG 2



The guestbook database needs only a single table called 'thebook'. At a minimum, the fields must include a primary key, name fields, date of entry and a comment field. Here is the structure:

ID: primary key, auto-increment field
Firstname: 60-character field
Lastname: 60-character field
Email: 60-character field
Regdate: date field
Comment: Memo or blob field for comments.

Typing a long Create Table command interactively is error-prone, so the best way to get this into MySQL is with a script such as that in figure 1. To use this script you need to have first created the guestbook database. Then you can run the script with the following command:

```
mysql < thescript.txt
```

You will probably need to give MySQL a valid hostname, username and password, in which case the syntax is:

```
mysql -h host -u user -p < ↙
thescript.txt
```

(*Key: ↙ code string continues*)

If you make a mistake and need to recreate the table, simply run the MySQL client, use the guestbook database and enter the command: drop table thebook;. You can then recreate the table as needed.

2 Design the app

Like most database applications, the guestbook interface must allow for the searching, viewing and updating of data. A delete facility is not included, but could be easily added, although you would probably want to add security to prevent users deleting other people's entries. Figure 2 shows the site layout. From the guestbook.html page users can either view the existing entries, or add a new one. The link for viewing the guestbook is listbook.php, which generates a table showing each existing entry in one-line summary form. Comments are presented as a few words with an ellipsis. To see the full detail, a generated link on each line takes you to guestdetail.php. The form for adding a new entry is held in

addentry.html, and when the form is submitted it calls addentry.php to verify the data and add the record.

The pages with .php extensions are pre-processed by PHP before being sent to the web browser. Therefore, the input to the PHP scripts is contained in the HTTP request that calls the page. The output is the HTML surrounding the scripts along with whatever you choose to generate from the script itself.

A flaw in this initial design is that the entire guestbook is returned on a single page. This is fine for a few hundred entries, but would not suit a large database. An obvious enhancement would be to return only a limited number of lines, while also providing a 'More results' link or other search options.

3 View the guestbook

The simplest script to start with is listbook.php, most of which is shown in figure 3. Note that PHP variables always begin with a $ character. The function mysql_connect() makes a database connection, the hostname, username and password parameters should be substituted as required. The connection is closed when the script ends, so there is often no need to call mysql_close(). The die() function is a handy way to check for errors. It simply outputs a message and terminates the script. The following construct exits the script if the function returns false:

```
$var = func() or die("error message ");
```

After making the connection and selecting the database, the script sends an SQL query to the database. Assuming success, the results are read row by row with mysql_fetch_array, which stores the data in an array, where each field name is an index into the array. The date field is returned in standard SQL format, which is yyyy-mm-dd, although you may want to reformat this for display.

This script returns an HTML table. Each row includes a hyperlink to another PHP page, including the ID field as part of the URL. This is a simple and effective technique for providing a detail page.

The detail page itself is similar, except that it only retrieves a single record. The other difference is that the PHP script needs to read the value of an argument in the URL. This is simplicity itself. If the URL is like this:

```
href= "guestdetail.php?id=123"
```

PHP then creates a variable $id containing the value. Therefore, the script in guestdetail.php begins like this:

```
if ($id==0) {
die "No entry specified ";
}
```

4 Add a new entry

The starting point for adding a new entry is an HTML form. The form tag itself begins like this:

```
<form method= "post" action = "addentry.php">
```

The 'post' method means that the form's data is sent separately from the URL, unlike 'get' which tags it onto the URL itself. This is the W3C (World Wide Web Consortium) recommendation and avoids the length limitation of get. Each field in the form has a name attribute, using text boxes and a textarea to hold the data. There is no need for the form to provide the date or ID fields, since the date is taken from the system date while the ID is generated by MySQL.

The script for adding data is shown in figure 4. PHP automatically creates a variable for each control in the form ($controlname), or you can read the values from the $HTTP_POST_VARS() array. For the date, PHP has a gmdate() function which gets the Greenwich Mean

FIG 3

Script to list the guestbook entries

```
<table width="75%" border="1">
  <tr>
   <th><b>Date</b></th>
   <th><b>Name</b></th>
   <th><b>Comments</b></th>
   <th><b>Link</b></th>
 </tr>
<?
$conn = mysql_connect("hostname","username","password")
or die("Database connection failed");
$db = mysql_select_db("guestbook",$conn) or die("Failed
to use database");

//construct SQL query
$sql = "SELECT id, firstname, lastname, regdate, comment
FROM thebook
ORDER BY regdate ASC;";

$result = mysql_query($sql,$conn) or die("Error retrieving
data");

//add results to table
while ($record = mysql_fetch_array($result)) {
$id = $record["id"];
$firstname = $record["firstname"];
$lastname = $record["lastname"];
$regdate = $record["regdate"];
$year = substr($regdate,0,4);
$month = substr($regdate,5,2);
$day = substr($regdate,8,2);
$comment = substr($record["comment"],0,20);
$comment .= "...";

echo "<tr><td>$day-$month-$year</td><td>$firstname
$lastname</td><td>$comment</td>";
echo "<td><a href=\"guestdetail.php?id=$id\">Show
detail</a></td></tr>";

}
?>
</table>
```

PHP tips

If you find that .php files are not running at all, check the configuration of the web server. Sometimes PHP is configured so that a .php3 extension is required. For Apache, check the AddType directive or the mime.types files.

PHP's mail command is a handy way to keep in touch with users of your website. Simply use:

```
mail("me@myisp.com",↙
"subject","content");
```

For example, you could have PHP mail you every time an entry is added to the guestbook.

The database support in PHP is determined by compilation options. Thus, MySQL support may not always be available and other databases such as SQL Server, ODBC and Oracle may be supported. For maximum flexibility, do your own PHP build.

FIG 4

Script to add a new entry

```
<?php
//Get the form values
$firstname = $HTTP_POST_VARS["edFirstName"];
$lastname = $HTTP_POST_VARS["edLastName"];
$email = $HTTP_POST_VARS["edEmail"];
$comment = $HTTP_POST_VARS["txtComments"];

$regdate = gmdate("Y-m-d"); //use SQL format

//Check for no surname
($lastname != "") or die("You must enter a surname. Go back ↙
and try again");

$conn = mysql_connect("hostname","username","password") or
die("Database connection failed");
$db = mysql_select_db("guestbook",$conn) or die("Failed to ↙
use database");

//construct SQL query
$sql = "INSERT INTO thebook (firstname, lastname, email, ↙
regdate, comment)
values ('$firstname','$lastname','$email',↙
'$regdate','$comment')";

$result = mysql_query($sql,$conn) or die("Error ↙
inserting data");

echo("<p>Thank you for adding your entry to the guest ↙
book</p>");

?>
```

(*Key:* ↙ *code string continues*)

Time date, which is useful if you run a UK site that may be hosted on a server in a different time zone.

After getting the data, you can do any validation that is required. The script shown checks that a surname has been supplied. PHP has a full range of string and arithmetic functions for additional validation. You might also want to check for duplicate entries with a SELECT query, restrict the length of the comment data, or run other sanity checks.

Valid data is appended to the database with an SQL INSERT INTO command. To work seriously with MySQL you will want to get hold of an SQL tutorial, as the supplied documentation does not cover this well. After inserting the data the script returns a confirmation message to the browser. Next time the user views the guestbook the new entry will be included.

Why PHP/MySQL?

The PHP/MySQL combination is popular and with good reason. It is reliable, easy to use and its performance is excellent. PHP version 4 introduces some sophisticated new features including a session management scheme similar to that used by Active Server Pages (ASPs). Both products are open source and you can generally run PHP and MySQL on the web without paying licence fees. If you run MySQL on Windows a fee is payable.

You can extend PHP with your own C code, but PHP is not as clever as Microsoft's ASPs with its COM support. MySQL is a simple affair alongside the major commercial database servers and lacks support for transactions along with other SQL functions such as sub-queries. Even so, many web developers find MySQL does all they need and makes a fast and cost-effective solution.

Getting a count

Debs Eppie asks: 'You published an example music database using ASP. Any idea how to get a record count?'

There are several ways to get a record count in a web application. If you are looping through a series of records to create formatted output, you can simply maintain your own counter variable. Alternatively, the SQL COUNT function is useful. A query like:

```
SELECT COUNT (*) FROM mytable;
```

returns a one-row, one-field result set which contains the count. COUNT DISTINCT gives you the number of unique values. You can use this with a WHERE clause to count records in a subset of the data. If you are using Microsoft's ADO (ActiveX Data Objects), you can also inspect the RecordCount property of any recordset, although this may return -1 if the database driver or cursor (result set) type doesn't support it.

CONTACTS

Tim Anderson welcomes your comments on the Web Development column. Contact him via the PCW editorial office or email: **webdev@pcw.co.uk**

Guest Book can be found at www.itwriting.com/pcw/guestbook/guestbook.html. For more information on PHP see *PCW* April 2000. The home pages for PHP and MySQL are at www.php.net and www.mysql.com respectively, and these sites have further links to web resources. Reader Richard Thomas mentions PHPmyAdmin at www.phpwizard.net, a freeware product for web administering a MySOL database

Slot machines

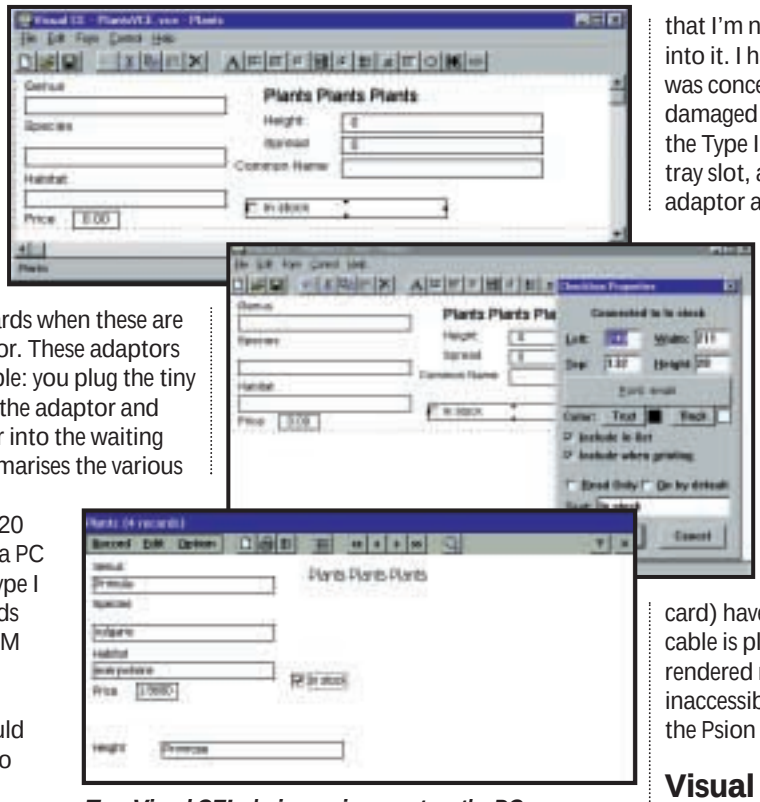
Mark Whitehorn sorts out what slots and what's not, delves into CE apps and scribbles on-screen.

I've recently been asked a lot about the slots in various Psion models and what follows is a brief résumé of the card-carrying members of the Psion clan, namely the Series 5s and the Series 7s.

The story starts comparatively simply. There are CF (Compact Flash) Type I slots which take CF Type I cards – these are roughly matchbook-sized but very thin. CF Type II slots take the marginally deeper CF Type II cards but will also accept Type I cards. Then there's the PC slot which will accept a PC Card (the credit-card sized ones) and also CF Type I or CF Type II cards when these are slotted into an adaptor. These adaptors are fairly freely available: you plug the tiny Type I or II cards into the adaptor and then slide the adaptor into the waiting PC slot. Figure 1 summarises the various options available.

FIG 1

Card type	Slot type: PC	CF Type I	CF Type II
CF Type I	✘	✓	✓
CF Type II	✘	✘	✓
PC	✓	✘	✘
CF Type I + adaptor	✓	✘	✘
CF Type II + adaptor	✓	✘	✘



Top: Visual CE's design environment on the PC
Middle: Objects on a Visual CE form have properties that are accessible by double clicking; these are for a check box control
Bottom: A Visual CE form as viewed on the PDA

I have a Jornada 820 with a CF Type II and a PC slot as well as three Type I cards, two Type II cards (one of which is an IBM Microdrive) and an adaptor. Every combination you would expect to work does so without drama.

And now the Psion story. Series 5s have one 'memory disk' (Psion's term) slot into which CF Type I cards fit. My Series 5 happily detects each of the Type I cards, although my 5mx detects only the Kodak Digital Science 8MB card and not the Kingston Technology 8MB cards, consistently giving the error message 'Drive not present'.

My guess is that this is a glitch in my machine, but if you have the same problem and decide to send the machine back to Psion, it might be worth sending the undetectable card back as well, so it can be seen not to work. Otherwise there's the danger of it checking out fine when Psion tests it and opening the door to endless wrangling over the problem.

The Series 7 has, on the left of the machine, a slide-out CF card tray that will accept either a CF Type I or Type II card. On the 7's right is a PC Card slot.

A Type II card is a very tight fit in the card tray; the clearance is so minimal that I'm not happy fitting the Microdrive into it. I have done so and it works, but I was concerned that something might be damaged in the process. That aside, all the Type I cards worked from the card tray slot, as they did when fitted into the adaptor and then into the PC slot. The bewildering thing is that the Microdrive, fitted to its own adaptor and placed in the PC slot, doesn't work.

The CF card tray is a strange 'innovation'. It has a vertical plate that forms the leading edge of the tray when it's pulled out and shuts off the slot neatly and completely when it's closed. Modem and network cards (such as the Xircom Ethernet card) have a connector into which a cable is plugged. This connector is rendered neatly and completely inaccessible when the card slotted into the Psion 7. Great design feature, guys.

Visual CE and Report CE

I've been playing with Visual CE and Report CE from Syware (www.syware.com) and have been impressed by both, especially by the strong database bias of Visual CE.

With Visual CE, you can build form-based applications for Windows CE devices, that is, applications with a form or a collection of forms that make up the interface.

The software is installed on a PC while the CE device is connected and thereafter the design stage takes place on the PC with the completed form being downloaded onto the CE device. This is the method I used, although if you have

an HPC Pro you can perform the whole process from there.

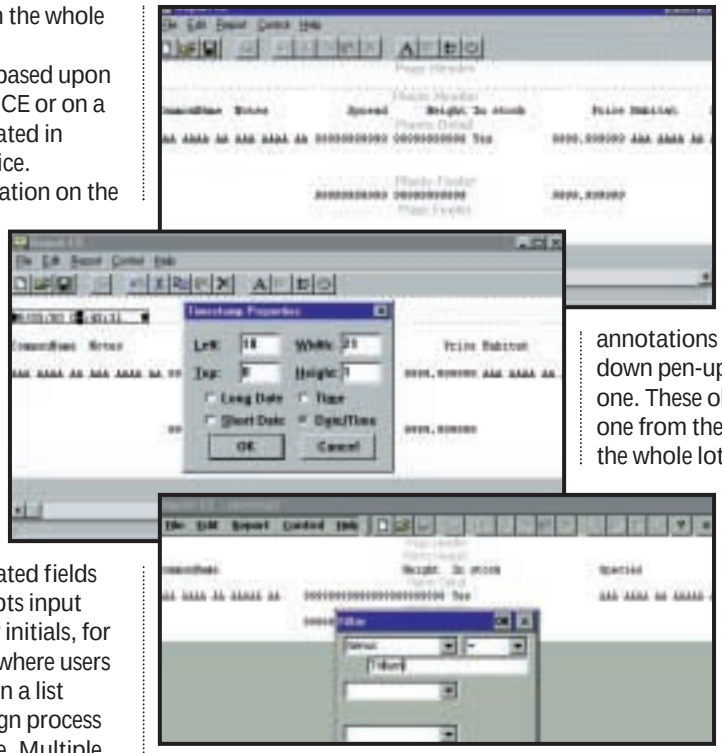
A Visual CE form can be based upon a table created within Visual CE or on a table that's already been created in Pocket Access on the CE device. Alternatively, given an application on the PC that supports ODBC, data from this can be used to create a Visual CE table. This lets you work with an existing Access table from the PC, without having to convert it to a Pocket Access table.

There are 12 types of control that can be placed on a form: edit, note and check boxes, labels, radio buttons, timestamps, calculated fields and a scribble box that accepts input from a stylus – a signature or initials, for example. Drop-down boxes where users choose input can be based on a list created during the form design process or from data in another table. Multiple objects on a form can be selected for speedy alignment and there's a snap-to-grid option too.

Downloading forms and reports to the CE device was quick, although opening a small Pocket Access table took about 19 seconds despite the fact that I'd only been experimenting with small data sets.

Report CE is, as you've probably guessed, a reporting tool for data from a Visual CE application, Pocket Access, any application that uses its .cdb format or any table held in the Windows CE Database Object Store.

Reports are of the ubiquitous banded type and easy enough to set up. Given the iterative nature of report design, the lack of a Print Preview button is a pain: you have to go to the File menu and select it. Timestamp, calculated controls, labels and 'column controls' (the data from the underlying field) are at the designer's disposal. Data from several tables can be combined in a report and records can be filtered to show a subset of records either when you run the report or as part of its definition.



Top: The Report CE design environment on the PC. The A and 9 placeholders give it a somewhat crude appearance
Middle: Adding a timestamp control to a report
Bottom: Here a filter is being set up before the report is run on the PDA

These are seriously useful tools for developing CE applications. The only bugbear is the price, which ranges from about £50 to £400 for the Enterprise Edition – check out the website for further details of versions and downloading.

Annotation's what you need

Sometimes electronic editing of documents just isn't expressive enough. Have you ever yearned, when staring at a Word document that you've been asked to comment upon, to pick up a fat red marker and scrawl 'NO!' across an offending paragraph? Happily for Palm users, you can now do just this with enotate from Informal Software.

Imagine the scene: a Word document is on your PC's screen. Your Palm is plugged into the PC which also shows the Word document on its screen. Pick up the stylus. Scribble a comment on the Palm's screen across the reviled paragraph and circle it – magically these annotations appear on the PC. You can add freehand annotations to your heart's content and then save the document. Cleverly, enotate saves the annotations as Word objects, each pen-down pen-up action creating a separate one. These objects can be deleted one by one from the document as it's revised, or the whole lot can be removed at once.

You can also annotate PowerPoint presentations or .jpg images in the same way.

You can also start from a blank screen on the Palm and attach your artwork to an email, or you can load up an image from your digital camera, add an arrow to show exactly where you fell into the river, save it (in this case annotations will be embedded into the JPEG) and email it to those unfortunate enough to miss the event.

One of enotate's great strengths is keeping everything digital: the annotated fax is an anachronism in the paperless age. Serious applications might include annotated images of archaeological evidence, damage reports from insurance assessors – imaginative uses abound.

Check out www.informal.com for details: it costs about £30 and is great fun, has all manner of uses and is clever too.

These are seriously useful tools for developing CE apps. The only bugbear is the price

Club Palm

Jon Alsbury sent me details of the North London Palm User Group (NLPUG). Founded early last year and now boasting over 70 members from all over the UK (despite the name) and Europe, the group held its first meeting in May with others in the pipeline. Check out www.nlpug.org for the latest.

CONTACTS

Mark Whitehorn welcomes your comments on the PDA column. Contact him via the *PCW* editorial office or email **pda@pcw.co.uk**

Selling made simple

Spam is a very cheap marketing ploy, but making your site simple is the key, says Nigel Whitfield.

While this is only the second of our ecommerce columns, over the past few months *PCW* has covered a number of topics that touch on the subject and some of those have prompted readers to write in to me.

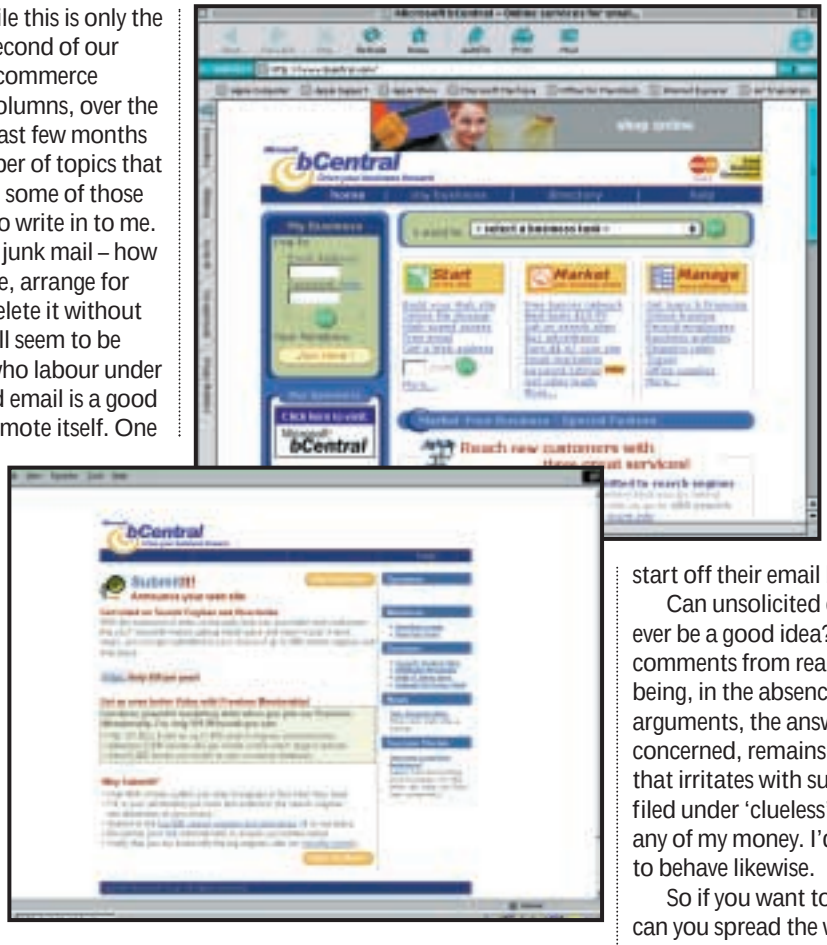
One recent topic was junk mail – how to avoid it and, if possible, arrange for your email program to delete it without prompting you. There still seem to be some people, however, who labour under the belief that unsolicited email is a good way for a business to promote itself. One reader wrote: 'Now we must not use unsolicited email to promote ourselves and we must not start with an empty site. How the hell do you think Yahoo started?

'I might have hoped that you would be more encouraging of those who would give it a go. But instead you are positively discouraging. In your article you make no mention of those of us who might like to make genuine and sensible use of spam. You do not consider the problems you are creating for those who might like to try and get started.'

I'd welcome comments from other people who have businesses online. And doubtless someone will correct me if I'm wrong, but Yahoo never sent unsolicited email promoting its site. And yes, I will continue to be positively discouraging to people – there is no 'genuine and sensible use' for junk email.

My correspondent, I fear, has not considered the problems he'd be creating for himself by setting out to give his business a bad reputation online. His view is that sending a single email to selected addresses, saying at the top of it that people won't get any more messages, is acceptable.

I'm afraid I disagree; junk email is unacceptable however you do it. My Demon Internet account is virtually unusable for email, receiving dozens of pieces of junk each week. Many of those promise that they're just going to send the one message. A distressingly large number now say that I'm a subscriber to an 'opt-in' list, giving the impression that I somehow asked to receive their junk. I didn't and I certainly won't do business with companies that start off their email by lying to me.



Left: Microsoft's bCentral is a good place to find out about promoting your business online, without resorting to spam Below: Submit-It enables you to have your site listed on a popular search engine

Can unsolicited commercial email ever be a good idea? I'd welcome comments from readers. For the time being, in the absence of any compelling arguments, the answer, as far as I'm concerned, remains 'no'. Any business that irritates with such tactics is mentally filed under 'clueless' and won't be seeing any of my money. I'd urge other people to behave likewise.

So if you want to do ecommerce, how can you spread the word? As my correspondent pointed out, many avenues of promotion may be out of the reach of small businesses – but that's no excuse for annoying potential customers.

Building your business

The first rule of building up a customer base has to be to make sure your site works well to begin with – you can spend as much as you like on promoting a website, but if visitors have a bad experience when they try to find out about you and your products, they're unlikely to come back. Perhaps one of the best examples is the late Boo.com – a slow site packed with the latest technology resulted in frustration for many users.

Similarly, make sure key information is easy to find. If I want to check a price, I want to do it without registering, or downloading an obscure plug-in. And if I

Any business that irritates with such tactics is mentally filed under 'clueless'

Setting out your virtual stall

Over the next few issues, I'll be looking at some of the practical issues involved in setting up a site, using a variety of different systems to provide online shopping facilities, ranging from the 'drag and drop' type of catalogue-building program, to systems that provide you with much more customised control over how your site will look. As well as setting up the site itself, we'll be looking in more detail at some of the other aspects – including arranging the payment mechanisms, which can be the trickiest thing to sort out for many, especially if they're starting a business from scratch, with the aim of putting it on the Internet.

There are many different packages available to help create online shops. The first two that we'll be looking at are Shop@ssistant (www.floyd.co.uk), and MiniVend (www.minivend.com), which is a full-featured package written in Perl.

Before you choose a system for your own site, you'll need to check a number of different things.

First, what are the requirements for the web server that will host your site? Does the shopping package you've chosen need special programs running on the server?

Next, what payment services are supported by the shopping system? You'll need to decide if you want realtime processing of transactions and whether or not the card-processing service you use is compatible with the software.

And finally, do you need to make special arrangements with your ISP to provide a secure server, or have it run software to connect to card services? Some ISPs will offer this as part of a business package, or you can arrange to have your ordering page hosted by some of the payment services on the Internet.

The two systems we'll be looking at initially take a completely different approach to setting up your online store.

Shop@ssistant handles most of the work, with the exception of the final processing of secure credit card transactions, in the user's own web browser. It uses JavaScript, which you can add to your web pages via cut and paste – or using the supplied objects for popular web design tools – to control movement around the site and calculate prices and things such as postage. Aside from the secure credit card processing, you could run a complete online shop using the free web space given by many ISPs – all you need on the server is a script for sending email. A single-currency version of Shop@ssistant costs £199.

MiniVend runs as a script on the web server, so it's compatible with more browsers, but installation is much more difficult. Like Shop@ssistant, it relies on adding information to your existing pages, but in this case, they're in the form of special tags, which are converted on the fly by the MiniVend server program. It's also extendable – you can link it to SQL databases, for example, to integrate with the rest of your in-house systems. It's a free program – which has implications for support, as well as the startup cost.

We'll return to both of these programs next month, in more detail.

Shop@ssistant makes life easier for ecommerce businesses

can't find a price for a product on a site, then I'll go somewhere where I can.

Email can be a way of informing people about your site – but make sure that you only email people who have requested that you do so; make it quite clear when you collect email addresses that you intend to send out information, and give people the option of declining.

You can increase the likelihood of your site appearing in search engines by ensuring that you use META tags to supply keyword and description information for web robots – but you'll also need to make sure there are links to your site from others. Ask companies you do business with, or other appropriate pages, to link to you.

Tools such as Submit-It (www.submit-it.com) can have your site listed on popular search engines – with costs starting from around £40, it's well within the reach of small companies. Advertising can be surprisingly cheap too, with Microsoft's bCentral (www.bcentral.com) offering 5,000 adverts a month from around £12.50.

Of course, a small business can't expect to build a brand quickly overnight – but even if you did, could you cope with a massive increase in orders? For most firms, building slowly is the best way – and word of mouth will help more than just about anything else.

Rather than dream about how many people you could reach with junk mail, remember instead the damage you can do by sending it out. There are other ways to promote your business – not least of which is offering good service.

CONTACTS

Nigel Whitfield welcomes your comments on the Ecommerce column. Contact him via the *PCW* editorial office or email **ecommerce@pcw.co.uk**

Ever-ready Ethernets

Troubleshooter Roger Gann shows you how to effectively detect and locate cabling problems.

Modern Ethernet CAT 5 twisted pair network cabling is pretty robust these days, certainly a heck of a lot more reliable than coaxial cable. You fit it and forget it, it's that simple. But even so, problems can crop up from time to time and this month's column is devoted to basic network cabling troubleshooting.

OK, let's say a server has disappeared from the browse list. As far as the system is concerned, you have a network, but no server. You've tried downing it and rebooting: it comes up seemingly OK, but it still remains invisible to the workstation clients. How do you track down the cause of this break in the network chain? The basic technique is simple – you methodically substitute every link in the chain with a replacement you know to work 100 per cent.

Most 10BaseT and 100BaseT networks consist of a trio of hardware components: a network interface card (NIC) in a client or server computer, a port in a hub, switch, router, or other device and the cable connecting the first two components. Problems at the NIC typically involve faulty drivers, network configuration settings within the operating system and, rarely, jumper or DIP-switch settings on the card itself.

At the hub end, the port rarely causes problems, although if it is a switch or a router, there could be complex configuration issues, such as VLAN definitions or policy settings. The cabling comprises several elements, typically twisted pair cable with an RJ-45 plug. There'll be a drop cable to the wall socket, internal cabling to a punch-down block in a patch panel and, finally, a patch cable that runs to the hub, switch, or router port. Once the cable segment is correctly installed, it will rarely cause problems.

The first thing to check is that the link light is on, at the rear of the NIC. Older coaxial-based 10Base2 and 10Base5 NICs usually don't have link indicators, but practically every 10BaseT and 100BaseT NIC sold these days has two or three status LEDs. These lights help indicate whether a problem exists with the connector, cable or hub. The Link or LNK LED lights up whenever the interface receives link pulses from the hub at the other end. 10BaseT interfaces generate link pulses about 60 times each second when there is no data on the cable.

The Activity or ACT LED illuminates (or blinks) when the NIC detects read or write activity on the network, even when there is no activity on the adaptor. If the ACT LED is not on, make sure that the hub and network are operating and that the correct drivers are loaded.

You may also find a third indicator: the 100 LED illuminates when a 100Mbits/sec connection is established.

There is a corresponding Link LED back at the hub port as well. If the Link LEDs at both ends of a questionable link are lit (and if they go off when you unplug the cable), you can be confident that the cable is wired and connected correctly, that the NIC and the hub are powered up and capable of receiving data, and that the most likely source of the problem is the configuration of the computer or the network interface.

If only one Link LED is on, the cable segment is almost certainly bad; the interface at the lit-up end is successfully receiving link pulses, while the interface at the other end is sending them but not receiving them. If possible, plug the computer into another cable that supports a working system. If the computer works on the other cable, you know the computer is configured properly. If a computer known to be

Above: Unlike hubs, switches can cause problems due to their configuration
Below: The LEDs on the back of NICs indicate the source of a cabling problem

working properly shows the one-link-light-out symptom on the original cable, you have added reason to suspect the cable segment.

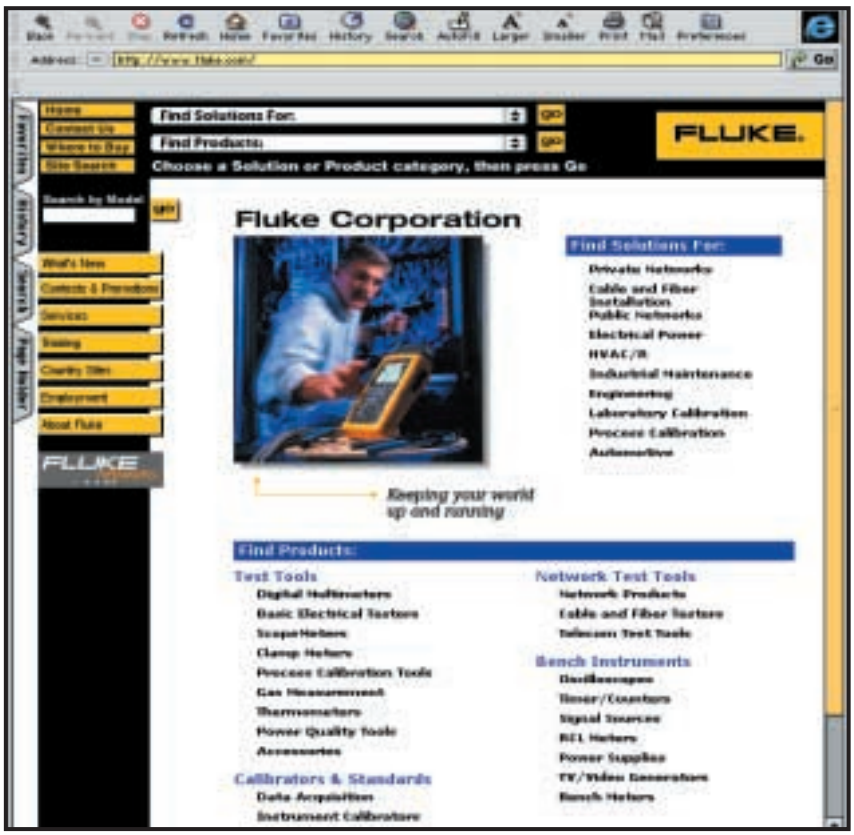
If both Link LEDs are OFF, there might be a bad connection or cable or a problem with the hub. For example, you might have the cable plugged into the wrong wall socket or the port itself might be faulty. The easiest way to test this problem is to see if another Ethernet-capable computer can connect using the port. Check that the patch cable to the hub is actually plugged in!

Another possibility is dud cabling. Make sure both ends of the cable are firmly plugged in and are in good shape (ie there are no cracks in the plastic, no bent pins, etc). The easiest way to test this problem is to swap in another Ethernet cable and see if this solves the problem. If you have a cable tester, use it to pinpoint the problem to a particular length of cable or to a connector along the path. It's useful in situations such as this to use a working networked laptop as a diagnostics tool – it allows you to rapidly substitute the suspect computer for a known 'runner'.

If you installed your own Ethernet hardware, you also may not be getting a Link LED because the Ethernet hardware isn't installed correctly. Try reinstalling the network drivers that came with the NIC. Or check the manufacturer's website and download the latest drivers.

Rarely, you'll come across a problem where the Link LED is on, but there's still no connection. The Link LED tells you that your computer can see the link pulse from the network, but a complete connection is a two-way street, so it's necessary for the network to see the link pulse from the computer as well. If you can, swap in an Ethernet cable you know is working. Try swapping the card as well.

If both Link LEDs are off, it could be down to a 'smart' hub: they're designed to automatically 'partition' or isolate faulty ports, so a malfunctioning port might be behind the absence of Link LEDs. To check this, plug the cable into a different port on the hub and see if the Link lights come on. If a known 'good' hub port doesn't light up the Link lights at both ends, you should connect a known 'good' computer, such as your laptop, to the computer end of the cable segment. If the lights stay out at this point, then something along the cable path is definitely the culprit.



Investing in a cable tester from specialists such as Fluke can save you a lot of time rather than resorting to trial and error

The other indicator LED you'll see on hubs is the 'collisions' LED. A flicker of the collisions light every few seconds is to be expected on a normal network, but anything resembling a constantly lit collision indicator is likely to indicate serious problems. The most common reasons for excessive collisions are violations of the 10BaseT rules: no links longer than 100 metres and no more than five repeated segments, with no more than three of the segments populated and no more than four repeaters (hubs) between any two nodes.

If everything checks out but you're still having connection problems the next step requires a slightly more analytical approach. If you can't log on to a server when others can, or if you can't ping a destination that responds to other pings, then the cable comes under suspicion again, even if the link lights are on. Particularly at 100Mbits/sec, CAT 5 cable can be sufficiently below spec to prevent a link from working, without obvious electrical or mechanical faults. Inadequate connectors, electromagnetic interference and poor wiring techniques are three of the most common ways the cable link might fail while still letting the Link lights come on.

It might be worth investing in a cable tester. A cable tester that can measure near-end crosstalk and attenuation across the frequency band from 0Hz to 100MHz is the only way to be sure of a good cable link for 100BaseT. If you have a lot of coaxial cable-based Ethernet to troubleshoot, cable testers that estimate the distance of problems along the cable using time domain reflectometry can save a lot of trial-and-error operations.

The big names in cable testing are Fluke (www.fluke.com), Microtest (www.microtest.com), Wavetek Wandel Goltermann (www.wwgsolutions.com/), Datacom Textron (www.datacom.textron.com), and Hewlett-Packard/Agilent Technologies.

CONTACTS

Roger Gann welcomes your comments on the Networks column. Contact him via the *PCW* editorial office or email:
networks@pcw.co.uk

PERSONAL COMPUTER WORLD

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There are several steps you can take to help ensure that the buying process is smooth and trouble-free. We'd like to suggest these main guidelines:

KEEP RECORDS

When you phone a supplier, make a note of the name of the person you speak to, and when. Note down any claims they make for the product in which you are interested, or any specifications they mention. If you are unsure that what they are offering is right for the task, then ask.

GET A FULL SPEC OF THE MACHINE

Before you place an order for a machine, insist on being faxed or emailed a full specification, detailing all components and peripherals. Check what is included: for example, when buying a printer, are all cables and cartridges bundled? If you've used a review in a magazine to guide your decision, make sure that what is quoted matches what you have read. Sometimes, machine specifications can change from the model sent for review.

BE CLEAR ABOUT SUPPORT AND WARRANTIES

Make sure that you get a warranty that suits your needs and is fully detailed in the quotation. If you need swift repairs, consider paying extra for an eight-hour repair service. Also make sure you understand the level of service you can expect to receive, including who pays for couriers if your machine has to be returned for repair.

USE CREDIT CARD PROTECTION

When you place your order, use a credit card. The Consumer Credit Act ensures that credit card purchases between £100 and £30,000 are covered. Check the address to which the goods will be sent. Often, if you buy with a credit card you can only receive the goods at the address on the card. If you are buying over the Internet, make sure you are using a secure server, sometimes denoted by the prefix 'https'.

SET DELIVERY DATE AND CHECK WHAT IS DELIVERED

This gives you some comeback if the goods are not delivered on time. When the goods arrive, check the packaging before you sign for them, to guard against damage in transit.

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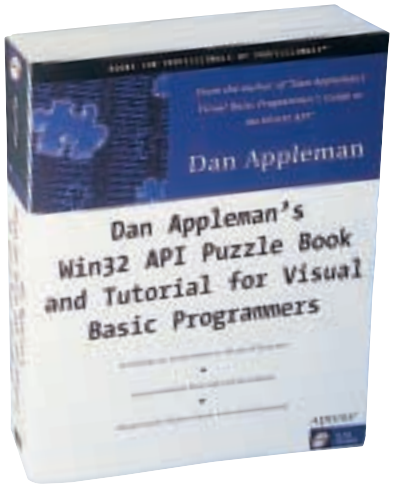

WIN32 API Puzzle Book and Tutorial for Visual Basic Programmers

This long-awaited complement to Dan Appleman's bestseller shows programmers how to turbocharge VB by describing how to control the entire Windows API. The book is primarily for VB6 programmers, but includes a VB5 source code tree as well.

Author: D Appleman; 483pp plus CD-ROM

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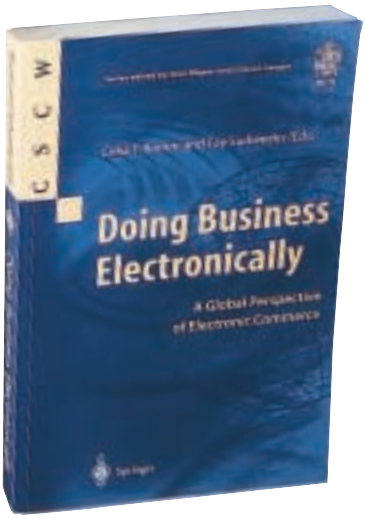

Doing Business Electronically: A Global Perspective of Ecommerce

This book covers three main areas of concern to business today: how to join, manage and benefit from the Internet revolution. It will be of interest to anyone who is interested in how to buy or sell on the Internet.

Edited by Celia T Romm & Fay Sudweeks; 208pp

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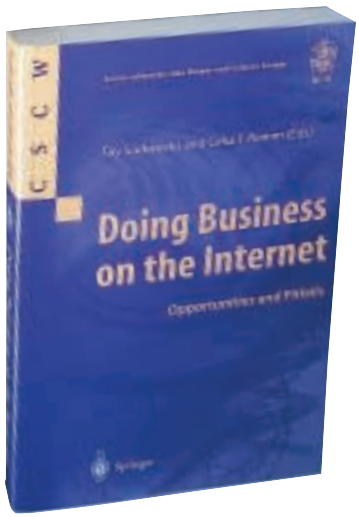

Doing Business on the Internet

This covers all the major aspects of electronic commerce – general, commercial, social and cultural – addressing issues such as the implications of real-time transactions for financial institutions; integrity and security; and how networked communities can benefit from global collaborative systems.

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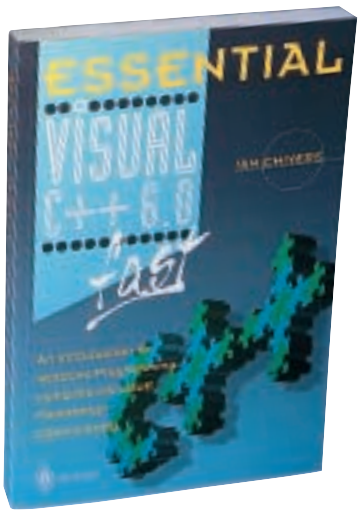

Essential C++ 6.0 Fast

Microsoft's Visual C++ 6.0 contains lots of new features designed to help developers build high-performance applications. This book gives a quick introduction to Windows programming using C++ and the Microsoft Foundation Class (MFC) library. Essential Visual C++ 6.0 Fast will help you create your own applications quickly and effectively.

Author: Ian Chivers; 224pp

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Essential Java 2 Fast

A complete introduction to Java 2, this book will show you how to take advantage of Java 2's new features (such as the abstract windowing toolkit and the swing classes) for creating graphical user interfaces. It is designed for professional developers or students who need to learn the maximum in the minimum time.

Author: John Cowell; 256pp

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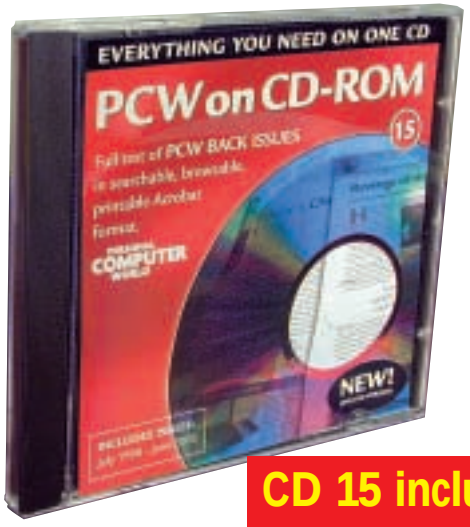

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LEISURE LINES

contents

Max Payne

Usually, when talk turns to third-person games, a vision of Lara Croft clad in tight tops and hotpants springs to mind. Enter Max Payne, protagonist in a title from developers Remedy and 3D Realms, to be published in the UK by Take 2. Taking its lead from film noir, Max Payne brings third-person gameplay kicking and screaming into a darker, more modern era.

In development for three years and with no fixed release date as yet, Max Payne is powered by Remedy's in-house MAX-FX 3D engine, which allows spectacular levels of graphical realism. With both skeletal and skinning animation, the models and their textures present an incredibly accurate representation of movement. This, along with the 'radiosity' lighting system, which uses surface reflection of light instead of ambient lighting, makes for a very realistic environment indeed.

Set in a bleak present-day New York, you play the eponymous Max, a DEA agent by trade, although he has recently been framed for the murder of his boss and has just had his family brutally murdered by junkies. Needless to say, he's not a happy man. So he's on the run and out for revenge. Certainly not kids' stuff, but then the developers are going for an adult audience with this title.

Reminiscent of *The Matrix*, Max Payne also sports an interesting replay feature that allows you to watch your more stylish kills in camera-revolving slow motion. With a bullet cam, for that added bit of macabre cinematic fun, Max Payne promises to be spectacular.

www.maxpayne.com

SCOTT MONTGOMERY

Republic: The Revolution

The Revolution will be televised! Well at least played out on your PC with Elixir Studios' title Republic: The Revolution, due for release some time next year. Republic is one of the most ambitious titles currently in the pipeline and so far looks to be a ground-breaking leap for the simulation/strategy genre.

The game uses the most advanced graphics engine ever seen: 'Totality'. This engine seems too good to be true, as it is capable of rendering scenes comprising an unlimited number of polygons and in real time. This throws the door open for buildings and characters of unprecedented detail, creating a living,

breathing cityscape. The graphics engine also allows incredible versatility, such as zooming from a satellite-like image right down to a window box on a building, where even the petals on a flower are rendered in immaculate detail.

Elixir also plans to create a rich simulation environment by using revolutionary AI techniques to allow up to one million non-player characters, with their own beliefs, emotions and loyalties, to inhabit the city.

The synopsis of the plot is that you are a powerful faction leader who is charged with 'ousting the President of the Republic of Novistrana... by any means'. You must build up nationwide support for your faction in order to complete your task. If Elixir can deliver the goods, Republic: The Revolution will be stunning.

www.elixir-studios.co.uk

SCOTT MONTGOMERY

Diablo II

The next episode of the Diablo epic is ready for your delectation and it's a class act.

Just as the games industry was settling in for the summer slump, Diablo II has finally arrived. The long-awaited sequel to Blizzard's best-selling, multi-player, fantasy adventure looks set to send sales spiralling, as role-playing game fans are asked to tackle evil once again.

The original Diablo cast you as a wandering warrior, rogue or sorcerer with a mission to destroy the evil deity Diablo. Unfortunately, he proved to be stronger than anyone imagined.

Diablo II continues the story with the wanderer, now possessed by Diablo, on a mission to free the demon's brothers Baal and Mephisto. The evil has returned to Tristram and a new hero is needed to deal with things once and for all. This time you can choose to be a holy Paladin, a seductive Sorceress, an athletic Amazonian, a nefarious Necromancer or a beefy Barbarian.

As before, each character has a different set of skills available and the role you choose greatly determines the way the game unfolds. The Paladin, for example, is a holy knight who can call on the power of his god to help strike down his enemies. The Barbarian is the only character who can wield two weapons at once, while the Sorceress has more than a few tricks up her sleeve. Perhaps the most interesting is the Necromancer, who can raise the souls of the dead to do his bidding for him.

As before, each adventurer starts out at a basic level and, as their experience grows through battle and quests, so does their power. That said, changes have been made to the way you learn new skills. Instead of reading books to gain magical knowledge, this time you are given a point to invest in skills for every experience level. There are 30 levels in all, so you get a maximum of 30 points throughout the game to invest. The great thing here is that, because of this, two players can choose the same class of character and have completely different abilities, depending on what they choose to master.

There are a raft of new skills and spells to be learned, thousands of items to collect and plenty of nasties to defeat. You'll see some old faces, too, with the return of blacksmith Griswald, although he's not quite the man he used to be. The world in Diablo II has grown. Whereas the first game had a single town and its underground catacombs, Diablo II has four realms to explore.

Another nice twist is that you can hire other people to join you on your quest, increasing your chances of success. And some skills – such as the Paladin's ability to heal himself – can benefit everybody in the party.

Not all the improvements are as obvious. For a start, while the mouse-controlled interface has been refined and the graphic engine updated to include support for 3D accelerators and some amazing parallax perspective scrolling, you are limited to running at a resolution of 640 x 480. Yes, the graphics look good, but they would look much better at higher resolutions. Stranger is the fact that the game switches to 800 x 600 for menu screens. Limiting the resolution may make it easier to port the game to other platforms, but it seems plain daft on today's PCs.

However, it's easy to overlook things like this once you get into the action and especially the multi-player games. These can be played over a network or via Blizzard's Battle.Net over the Internet and they add a whole new dimension to the game. The only downside is that you still need a copy of the game per player. Allowing two players to use the same disc would be good. You also need to type in the host's TCP/IP address on network games, which is a tad annoying.

With detailed graphics and atmospheric audio complete with Dolby Surround sound, Diablo II looks set to be the role-playing adventure of the year.

CHRIS CAIN

DETAILS

★★★★★

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www.blizzard.com

SYSTEM REQUIREMENTS Pentium 233MHz, 32MB of RAM, Windows 95, 650MB of hard disk space, four-speed CD-ROM, Direct X-compatible video card

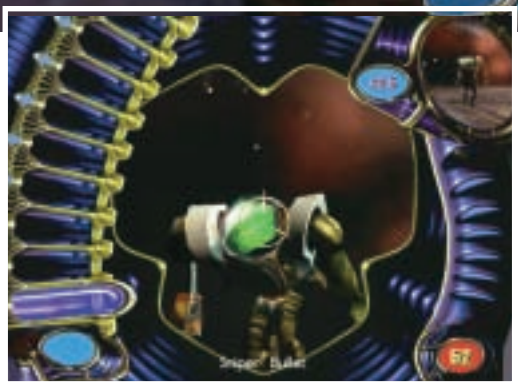
MDK 2

Janitor turned superhero Kurt Hectic returns in this deranged third-person shoot 'em up.

MDK was a surprise success a couple of years back, combining terrifically violent gun-toting with comic-book characters and oddball humour. So MDK 2 has been a much-anticipated release. The wait has been well worth it.

In MDK 2 the character of Kurt Hectic, transformed from a simple janitor to sniper superhero by Doctor Fluke Hawkins, is back to save the world when news reaches him of an alien invasion. Kurt's mentor and guru, Doctor Hawkins, has built him a coil suit, complete with ribbon chute, enabling him to float large distances. He's also got a chain gun and a sniper scope that lets him pick off his enemies from a mile off.

You get to play both characters, as well as Max, another of Doctor Hawkins' inventions. Max is a robotic dog with four arms, so you can use multiple weapons, and a jet-pack. Hawkins is the weakest of the player characters and has an extremely limited and ostensibly useless arsenal, consisting of household items such as a toaster, a loaf of bread, or a pile of dirty towels. Beware, though, when you're playing the inventive Doctor you can try different combinations of items in his left and right hands to varying effect.



Gameplay itself feels a bit staggered. Although there is a linear plot that holds the whole thing together, each stage is like a challenge in the Crystal Maze. All the pieces are there and you just have to locate them and use them in the right manner to pass on to the next. The game does, however, retain the humour of the original, with your alien opponents pulling faces while you're training your sniper rifle on them, or laughing callously as they slice you in two. Even so, when you finish one of them off they collapse and die with a suitable gurgle of slime.

Movement is great in this game. As with all third-person shooters, the viewpoint is vital, both in order to see your own character and to get a good view of his surroundings.

Hitting the enemy with your gun is also more difficult because of this, as there is no cross-hair through which to aim. Having said that, most of the target work with Kurt is done through the sniper scope. When you enter sniper mode, a whole new arsenal of powerful and accurate weapons becomes available and you can zoom in and out effectively. Kurt also has a few other tricks up his sleeve, such as a dummy decoy, a bouncing bullet and an invisible cloak.

Max, on the other hand, has a pure killer instinct. No special weapons here, but you start off with double the health, get to use multiple weapons and play a robotic four-armed canine, so who's complaining?

The AI of the aliens isn't really an issue either. They may prefer shooting the dummy and don't take the game seriously, but they'll still whip you if you're not careful.

The environments you explore are magnificent, with vast swirling organic arenas and deep twisting vaults. Truly the work of the deranged.

The movies between each stage of the game are wacky to say the least, although they don't stand up to much repeated viewing. And on our 466MHz Celeron test machine, the best we could get was an 800 x 600 display, which gave these movies a blocky look at times. The rest of the game was fine, however.

In all, as Max might say, we think this game is the mutt's nuts in terms of giving the third-person shooter a new lease of life. With beautifully conceived graphics, a narrative that sweeps you along and enough mindless killing to keep diehard fraggers on their toes, this is a game that will fly off the shelves.

MATT WHIPP

DETAILS

★★★★★

RECOMMENDED Personal COMPUTER WORLD

PRICE £34.99 inc VAT
CONTACT Interplay 020 7551 0000
www.interplay.com/mdk2
SYSTEM REQUIREMENTS Pentium 233MHz (300MHz recommended), Windows 95/98, 24MB of RAM, 250MB of hard disk space, 8MB graphics card

Vampire: The Masquerade

This age-old tale of revenge and bloodsucking gives you the opportunity to play the storyteller.

Vampires have always had a big following in film and literature, and a game based around them has more scope for an intelligent storyline than zombiefests such as House of the Dead. Vampire: The Masquerade has one up on the competition, as it is based on an already popular role-playing game and has a wealth of background information to fill in the history behind the undead. The plot takes place among warring clans of bloodsuckers and follows a gory trail across the centuries and through four cities – medieval Prague and Vienna, and then modern-day London and New York.

The game mixes its styles to set the exploratory gameplay of Diablo in the 3D environment of Quake. The character is moved using the cursor to point and click in the desired direction, with the view panning around as you move the mouse. This system is a lot easier than the clunky controls of Tomb Raider. But, unlike Lara, you're not going to die by falling off the edge as the game makes you keep to the path. This makes it easier to navigate, but it also makes you feel as if you are not really in control and are just following a set route.

The narrative follows an 18-year-old soldier called Christof, who is wounded fighting an unholy war and falls in love with the nun who nurses him back to health. But dark forces and the forbidden nature of their relationship keep them apart.

It's the age-old story of boy meets nun, boy becomes vampire, vampire seeks revenge across 800 years and half the globe. The story opens with him defending Prague against the undead with swords, bows and arrows. But when it moves forward in time the weapons become more high-tech and you're more likely to be touting a flamethrower or an assault rifle.

The manual kicks off with a well-crafted tale of Christof's life in the crusades, but this isn't carried through into the game. There are also a some odd quirks: when Christof meets some fellow Knights of St John they tell him in an English accent how good it is hear another French accent. He replies in his vaguely Irish accent while standing before them in his tunic emblazoned with the red cross of St George.

As you progress through the single-player game you can pick up allies to add to your coterie (the vampire word for a group of undead working together for mutual ends). Your characters will also gain in experience and you can add to their physical attributes, such as learning new disciplines, which are vampire powers similar to magical abilities.

The most interesting aspect of the game, however, is the Storyteller mode, which allows one player to create and run an adventure of their own over the Internet or LAN. Using the tools in the Vampire software developers' kit, Embrace, storytellers will be able to manipulate the game and create their own levels, chronicles and objects. Commands include in-game manipulation to further the story, such as adding or deleting creatures, objects or props and taking control of any character, whether they are actual players or are controlled by the computer.

Overall, the game is extremely playable and even those unfamiliar with Vampire's role-playing roots should enjoy it, as there is plenty of background material in the manual. And if the storytelling aspect takes off, you could be starring in a different vampire flick every night.

MATT CHAPMAN

DETAILS

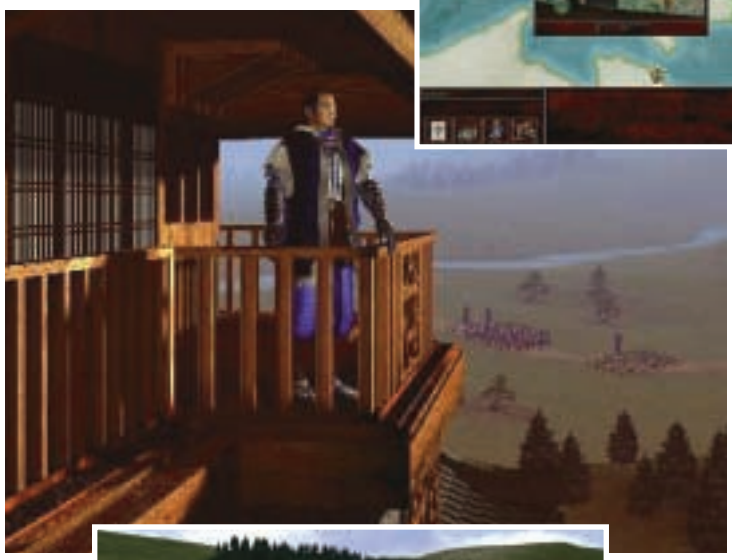
★★★★

PRICE £29.99 inc VAT
CONTACT Activision 01895 456 700
www.activision.com/games/vampire
SYSTEM REQUIREMENTS Pentium II 233MHz, 64MB of RAM, DirectX 7.0-compatible graphics card and sound card, 720MB of hard disk space plus 80MB of swap file space, Windows 95/98

Shogun – Total War

Honour, politics and war in 16th Century Japan takes 3D strategy games to new heights.

You can almost hear the melodramatic American growl of the voiceover as visions of sword and sorcery appear on the screen: 'Many years ago, in a far off land, warring clans did battle for supremacy.' Now change that voice to one with a Far Eastern accent and the place to historically accurate Japan, circa 1530. Creative Assembly's Shogun – Total War has one of the most refreshing and impressive intros we have ever witnessed, and is an apt prelude to the best of the current crop of strategy games, mixing realtime out-and-out warfare using a great 3D engine with turn-based resource management and strategic manoeuvres.



The start menu offers you several choices. It would be unwise to skip the tutorial and head straight for the campaign mode, as it's a slowish game with a lot of controls and skills to master.

If you feel like skipping the turn-based element you can play out historical conflicts using the realtime 3D engine only, or load the odds in your favour with the custom battle option.

In the campaign you begin as a Daimyo, controlling a number of provinces and with the ambition to conquer the rest. Not surprisingly there are many ways to accomplish this based on strategic alliances or battles. The turn-based element incorporates training troops and placing them on the map.

There is a huge variety of troops at your disposal. Those on the battle field brought no surprises: spearmen, cavalry, archers and such. But you can also muster some more interesting individuals, ranging from emissaries and spies to priests, Ninja and the most deadly assassin of all: the Geisha. Place these in your enemy's province and let them do their work.

To afford these troops you must pay for them in Koku, the rewards of the annual harvest. Harvests are reaped once every four turns and the rewards can be increased by irrigation or building mines and gaining more territory. One way or another, you'll want as much as you can get, so guard your harvest carefully.

To get the more advanced units you'll also need to start building such constructions as Tea Houses enabling provincial trade, watch towers, temples and Ninja Houses. You'll also need a castle, if only as a stronghold to fall back to and hold out in during a seige.

To find out the latest news or consider or propose alliances you must visit the throne room where your trusty advisor will dole out the advice from which you can make your decisions.

However, more often than not, we felt like getting stuck in there in the battle mode. The realtime strategy 3D engine opens up vistas below you of rolling hills dotted with castles and encampments, wildlife and small woods. Both the terrain and the weather affect your troops' performance, so use them wisely. Your troops can assume many formations and you can view the options by clicking on their flag.

One thing that did impress us here was the sound. As you move your viewpoint around, for example, you can hear the thunder of horses' hooves and battle cries grow louder as you pass over a troop of mounted samurai.

Honour and morale are important concepts in the game and, should you manage to take out the enemy leader, the honour and morale of his troops will droop and you'll rout or make mincemeat out of them. Similarly, if you march your troops uphill for too long they'll flag.

So to sum up, Shogun seems impervious to faults. There is a lot to learn in order to get the most out of it, but you can get by on the basics without disrupting the flow of the game. It simply exudes class, from its astounding attention to detail to its playability.

MATT WHIPP

DETAILS

★★★★★

PRICE £34.99 inc VAT

CONTACT Electronic Arts 01932 450 000

www.totalwar.com

SYSTEM REQUIREMENTS Pentium 233MHz, Windows 95/98, 500MB of hard disk space, 4MB DirectX 7-compatible graphics card, four-speed CD-ROM

Dawn chorus

This month's brainteaser is certainly not for the birdbrained among you. All you have to do is insert a letter into each of the 14 blank squares so that you can trace out the nine birds listed below. To trace out a word you may start from any square, but each move to a letter must be to an adjacent square – horizontally, vertically or diagonally. You may use a letter as many times as you like, even within the same word.

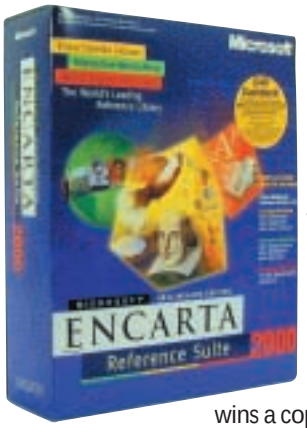
			D	

AUK
KAKA
KIWI
REDWING
SERIN
SILKTAIL
SOLAN
SWAN
WAGTAIL

Find the solution to this puzzle for a chance to win a copy of Microsoft Encarta Reference Suite 2000.

Send the answer, along with your name and an address where you would like the prize to be mailed, on a postcard to: *PCW* Prize Puzzle (September 2000), VNU House, 32-34 Broadwick Street, London W1A 2HG, or by email to: letters@pcw.co.uk.

Answers should arrive no later than 20 August 2000. Please note that we DO NOT open attachments.



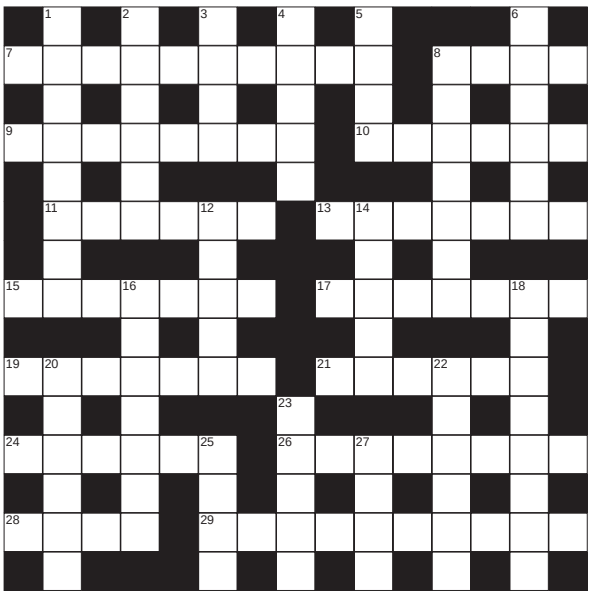
June's Prize Puzzle answer

The solution to our Once is enough puzzle in the June issue is below.

C Hodgson from Stockport was the first reader out of the hat and wins a copy of Encarta Reference Suite. Congratulations, your prize is on its way.

2	6	3	4	1	5
5	1	4	3	2	6
4	5	6	1	3	2
1	2	5	6	4	3
6	3	1	2	5	4
3	4	2	5	6	1

prize crossword

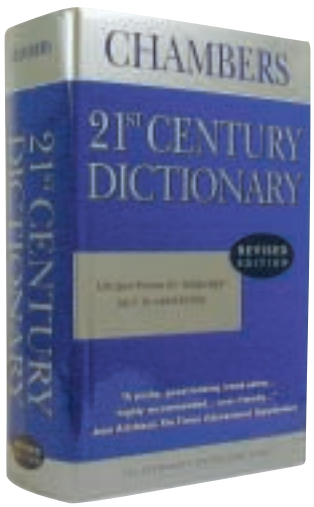


ACROSS

7 Image sharpness (10)
8 Reference lines on a graph (4)
9 Gratis software (8)
10 and 24 across Moving images for idle monitors (6, 6)
11 Packet of personal details (6)
13 Fashionable internet companies (3.4)
15 Computers served by servers (7)
17 The C of CPU (7)
19 Devices for directing data between networks (7)
21 Port that's not parallel or USB (6)
24 See 10 across
26 Computer's underlying structure (8)
28 Program's defects (4)
29 File appended to an e-mail (10)

DOWN

1 Having poetic rhythm (8)
2 Piece by Ravel (6)
3 Chrysalis (4)
4 Large stream (5)
5 Taverns (4)
6 Buy back (6)
8 Orange-coloured fruit (7)
12 Bury (5)
14 Overweight (5)
16 Respects (7)
18 Attractive (8)
20 Non-transparent (6)
22 Notoriety (6)
23 Flood (5)
25 Marine mammal (4)
27 Curved entrance (4)



Each month, one lucky *PCW* Crossword entrant wins a copy of the *Chambers 21st Century Dictionary*. The winner of July's crossword puzzle is: D Medrow from Sussex. This time, it could be you. Send your completed crossword to: '*PCW* September – Prize Crossword', VNU House, 32-34 Broadwick Street, London W1A 2HG, to arrive no later than 20 August 2000.

• Please state clearly on your entry if you do not wish to receive promotional material from other companies.

Solutions to August's crossword

ACROSS: 7 Basic 8 Font 9 Read 11 Bounce 12 Firewall 13 Demo 15 URL 16 Error 19 History 20 Retried 23 Cells 25 Exe 26 Spam 28 Protocol 30 System 32 HTML 33 User 34 Media

DOWN 1 Halo 2 Signpost 3 Norfolk 4 Stern 5 Brewer 6 Bawl 10 Require 14 Exile 17 Opera 18 Release 21 Resisted 22 Replied 24 Little 27 Scrub 29 Rate 31 Epic

WIN 3 great Philips Brilliance monitors

We have three stunning monitors to give away this month, thanks to award-winning manufacturer Philips. Three lucky *PCW* readers have the chance to win a great 17in, 19in or 21in monitor from the Philips Brilliance range. Brilliance, Philips' line of professional displays, offers high-performance products that, with the help of ICE technology, deliver excellent performance. The monitors are incredibly easy to use thanks to Customax monitor control software connected via USB.

The 17in Brilliance 107P has a VESA flicker-free display of 1,024 x 768 at a refresh rate up to 85Hz, and a maximum resolution of 1,920 x 1,440, and its dual inputs allow simultaneous connection to two computers.

Philips' 19in 109P offers a maximum resolution of 1,920 x 1,440 with a flicker-free display of 1,280 x 1,024 at up to 85Hz. An exclusive Auto Calibrate feature is included that guarantees consistent performance and extends by a third the useful life of the monitor.

Finally the Brilliance 210p has a stunning 21in display with a staggering horizontal frequency of 121KHz, a maximum resolution of 2,048 x 1,536 and a VESA flicker-free display of 1,600 x 1,200 at up to 85Hz. It also benefits from the Auto Calibrate feature mentioned above.

■ *For a chance to win one of these Philips monitors, just answer the question and follow the 'How to enter' instructions opposite.*

The Brilliance 107P's maximum resolution is:
1) 1,024 x 768
2) 1,920 x 1,440
3) 1,600 x 1,200

Packard Bell and ATi winners

Nigel Massen of Surrey is the winner of July's competition for a Packard Bell Spirit PC. The runners up, who win an ATi All-in-Wonder graphics card, are Mr Gooch of Letchworth, T Campbell of Leicester, and Alan White of Bath.

PCW September 2000 competition entry form

Name: .....

Email address: .....

Daytime telephone number: .....

Address: .....

.....

Answer: The Brilliance 107P's maximum resolution is: .....

• *Please tick here if you DO NOT want to receive information about other products and services from VNU Business Publications Ltd* ❒

• *Please tick here if you DO want your details to be passed on to other carefully selected companies for marketing purposes* ❒

How to enter

Fill in the coupon and send it to the following address by 30 August 2000:
Personal Computer World
VNU Business Publications,
32-34 Broadwick Street,
London W1A 2HG
Or email your name, address and daytime telephone number to us at pcw_competition@vnu.co.uk

Please state in your email if you DO NOT wish to receive information about other products and services from VNU Business Publications Ltd, and if you DO want your details to be passed to other carefully selected companies for marketing purposes.

◆ *Competition open to UK residents only.*

Rules of entry

This competition is open to UK readers of *Personal Computer World*, except for employees (and their families) of VNU Business Publications, and Philips. *PCW's* Editor is the sole judge of the competition, and his decision is final. No cash alternative is available in lieu of prizes.

The Micro Chess Championship, a modular PC and the imminent launch of Windows 95.

20 YEARS AGO September 1980

With chess very much flavour of the month, *PCW* asked the question, 'Who'll be World Micro Chess Champ?' This was in reference to the first official World Microcomputer Chess Championship that was to be staged at the forthcoming 3rd *PCW* Show. To set the scene, Kevin O'Donnel looked back at chess micros, including the famous late 18th Century Automaton Chess Player. This was a life-sized figure, sat behind a chest in readiness to defeat any challengers. It was all the rage, but you have to feel sorry for the tiny chess expert crammed inside the chest.

In keeping with the chess theme, Computer Games by David Levy, quoted the findings of Claude Shannon. This mathematician calculated that there are some 10,120 possible games of 40 moves (the average length in a masters game), and analysing this at the rate of one game per microsecond would take a computer 1,090 years to make its first move. These heady figures led to the development of Shannon's evaluation function – a theoretical estimate of who had the upper hand, obtained by assigning importance and positional values to each chess piece.

Up for bench testing, was the long-awaited Commodore SuperPET. With built in IEEE-488 interface and parallel port, it was aimed at the business market interested in cross-computer comms.

Finally, back in the chess world, Sargon 2.5 was a program devised by husband and wife team Dan and Kathe Spracklen. It eventually found its way into the Sargon chess console, which had 8K of ROM and could out-manoeuvre the average chess club member.

15 YEARS AGO September 1985

Inexplicably, a rather pale Charlie Chaplin graced this month's cover, draped around our lead review product: ACT's Apricot F10, priced at a humbling £2,295. Our man at the scene, Peter Bright, peeled off the flimsy casing to find the same Intel 8086 chip, driven at 4.7MHz as on the earlier Apricot F1. Significantly, though, the RAM had been doubled to 512KB and a 10MB drive had been added. The monitor impressed, too. A Sony FD Trinitron screen blazed away in four colours and, to this day, we still prefer the aperture-grille flavour of the Trinitrons over their shadow-mask brethren, as seen in our monitors group test on page 186 of this issue.

The other exciting news this month was the eighth *Personal Computer World* show at Olympia. The list of major names gracing the floor of the National Hall reads like the past few months of our Retro column: Amstrad, Acorn, BBC and Sinclair were all showing off their latest machines. And for the first time in the UK, Atari brought us its 520ST (as 'reviewed' in our Retro column overleaf). Who knows how many boffins browsing that stall turned out to be the drum 'n' bass icons of today? Finally, Psion pre-empted today's PDA-crazy world with its Organiser.

10 YEARS AGO September 1990

A decade ago, Guy Swarbrick was saying: 'The PC industry is, without doubt, going through one of its slow periods. Strangely, though, while there is little new hardware or software around, what there is is innovative.'

One of the innovations he was talking about was the Agilis System, which he described as 'a rugged, flexible, portable PC quite unlike anything else on the market'. It was a machine that could be pieced together to create a system to suit individual needs. It included packet radio capabilities, a portable handheld computer that could communicate with the PC back at base via an Ethernet network. The system was apparently used by the Morgan Hill police department in California to check suspects' details.

The criminal world was also on MP Emma Nicholson's mind with the imminent arrival of the Computer Misuse Act. Far from being a politician in the ivory towers of Westminster, Nicholson had spent 18 years as a programmer and, 'she really does think hacking is wicked and hackers are either wrong minded or criminally intentioned. And if you spend your leisure hours playing pass-the-parcel with someone else's data, she really does want to see you in the nick,' according to writer John Diamond. Strong words indeed, but faced with today's hackers and viruses, such as the Love Bug, we have to wonder whether times have really changed and if the law introduced 10 years ago has worked.

Where times have changed, however, is in the specs of notebooks. The ever-present Guy Swarbrick tested Sharp's 'power-packed' PC-6200 notebook, an 80286-based machine with a massive 20MB hard disk. And for the number-crunchers, there was a connector for a numeric keypad!

5 YEARS AGO September 1995

The imminent launch of Microsoft's Windows 95 dominated this cover, not to mention the issue. A 36-page review bared all about the new OS, as the *PCW* team separated Windows fact from fiction. Windows was compared to floor wax and dessert topping as the *PCW* team attempted to explain everything a user needed to know, including whether to make the leap. However, not everyone was convinced that Windows 95 was the future. Jez Deacon, technical director at Carrera, told *PCW* it would probably be: 'an optional purchase initially, and we'll gauge the reports and customer reception when we decide whether to make it the initial product on all systems'. Isn't hindsight a wonderful thing?

It may come as a surprise to some that it was five years ago this month that the PlayStation was originally released. It competed with Sega's Saturn and helped fuel the beginning of the games console wars. Chris Cain reviewed both machines, concluding that the PlayStation outclasses the Saturn in terms of hardware design, although Saturn might win the competition initially, because of its superior game titles. However, as Chris said: 'This is an issue Sony can do something about, and once it does, Sega will have a big problem.'

Finally, the chip of the moment, the Pentium 90, was put to the test with the review of 21 P90 PCs. Adams Accura Professional 586 WS picked up the Editor's Choice for its top-quality components, including a new Matrox Millennium with 2MB of VRAM.

THE PCW TEAM

Atari ST

A 16bit processor and graphical user interface made for a cheap and cheerful home computer.

Say Atari and great video games spring to mind, right? After all, this was the company where video games legend Nolan Bushnell created the seminal Pong arcade coin-op in 1972, then followed it up with Breakout. And who can forget the awesome Atari VCS games console in 1977, complete with fake corrugated wooden case and the first home version of Space Invaders?

While Atari was a force to be reckoned with on the games front, more serious projects were afoot. The Atari 400 and 800 ranges during the late Seventies and early Eighties proved Atari could cut the mustard on the home computer front, but better things were on the horizon.

In 1984, Atari was sold to former head of Commodore, Jack Tramiel, and from that day on, the company would focus on computers. The fruit of Atari's labours was a system employing a 16bit Motorola 68000 processor, which with 32bit internal architecture led to Atari coining the name ST – short for sixteen/thirty-two. The first model featured no less than 512KB of RAM, and hence was known as the 520ST (give or take a few kilobytes). Launched worldwide in 1985, the Atari 520ST weighed in at a not inconsiderable £750, but most crucially beat Commodore out of the 16bit gates. £750 was also sufficiently cheap for Tramiel to coin the slogan: 'Power without the price'.

In beating arch-rival the Commodore Amiga to the shops, Tramiel did, however, cut a few corners. The first ST's operating systems were not in ROM, but instead supplied on 3.5in floppies. Worse still, Jack named the OS after himself, resulting in the unfortunately acronymed Tramiel Operating System. It did, however, employ Digital Research's GEM desktop, which was the first time a graphical user interface had ever been seen on an affordable home computer.

The 520ST's 68000 CPU ran at 8MHz, backed up by 512KB of RAM and up to 192KB of ROM. The system could drive a mono monitor at 640 x 400 pixels in crisp black and white, or a colour monitor at 640 x 200 in four colours or 320 x 200 in 16 colours, each out of a palette of 512 colours. A 360KB 3.5in floppy drive was built in, and a two button mouse supplied. There was no shortage of plugs: a ROM cartridge slot, a pair of joystick ports, video, parallel, serial, floppy and hard disk connectors, but most importantly of all, a pair of MIDI ports.

Atari's 520ST beat Commodore to a 16bit machine and offered 'Power without the price'

PC owners take it for granted that their joystick port doubles up as a MIDI interface, capable of talking to and controlling all manner of musical instruments. Impressively, the ST boasted built-in MIDI 15 years ago.

On the games front the ST absolutely shone, with such classics as Jez San's 3D Starglider 1 and 2, the addictive platform action of Bubble Bobble, and the intricate adventures of The Pawn and Guild of Thieves.

Later, the 1040ST arrived with 1MB of RAM and TOS on ROM, and subsequent STs also included RF modulators for direct connection to a TV set. Much more exciting was the introduction of the Mega ST range, which separated the keyboard from the main processing box, and boasted 1, 2 or 4MB of RAM. At this point, Atari introduced the 20MB MegaFile hard disk and the SLM804 laser printer, creating a new killer application for the ST: a complete desktop publishing system for less than the price of a typical IBM laser printer.

There was even more to come. Atari released the STacy, a portable ST albeit weighing a lap-crushing 15lb. Next, the long-anticipated TT030 arrived boasting a modular case with removable hard disk, a 32MHz 68030 CPU, along with SCSI, LAN and three serial ports on top of the connections already offered on the ST.

In 1988 Atari and Inmos announced the ATW800 Transputer Workstation, which combined the power of multiple T800-20 processors (each delivering 10MIPS) running in parallel with the easy-to-use front-end of the Mega ST. However, by 1992, Atari was winding up its computer story with the Falcon 030, a 16MHz 68030 system featuring DSP and hard disk audio recording in a conventional 1040ST case.

Atari was now focused on its Jaguar games console, but the less said about that and its consequences, the better. Let's instead head over to the appropriately named Little Green Desktop website, download Paul Bates' superb WinSTon emulator (http://lgd.fatal-design.com), and remember the good times when Atari offered a true GUI powerstation at a price IBM could only dream of.

GORDON LAING