

## SPECIALIST READING

**A** Find the answers to these questions in the following text.

- 1 Name some types of devices that use 'computers on a chip'.
- 2 What uses of handheld computers are mentioned in the text?
- 3 What are the benefits of using computers with the following items?
  - a Security systems
  - b Cars
  - c Phones
- 4 What smart devices are mentioned in the text?
- 5 What are smart cards used for?
- 6 What are the advantages of multimedia?
- 7 What can medical expert systems do?
- 8 How can computers help the disabled?
- 9 What types of computing systems are made available to people in remote locations using electronic classrooms or boardrooms?
- 10 What aspects of computing can people power determine?

## Computers Make the World Smaller and Smarter

The ability of tiny computing devices to control complex operations has transformed the way many tasks are performed, ranging from scientific research to producing consumer products. Tiny 'computers on a chip' are used in medical equipment, home appliances, cars and toys. Workers use handheld computing devices to collect data at a customer site, to generate forms, to control inventory, and to serve as desktop organisers.

Not only is computing equipment getting smaller, it is getting more sophisticated. Computers are part of many machines and devices that once required continual human supervision and control. Today, computers in security systems result in safer environments, computers in cars improve energy efficiency, and computers in phones provide features such as call forwarding, call monitoring, and call answering.

These smart machines are designed to take over some of the basic tasks previously performed by people; by so doing, they make life a little easier and a little more pleasant. Smart cards store vital information such as health records, drivers' licenses, bank balances, and so on. Smart phones, cars, and appliances with built in computers can be programmed to better meet individual needs. A smart house has a built-in monitoring system that can turn lights on and off, open and close windows, operate the oven, and more.

With small computing devices available for performing smart tasks like cooking dinner, programming the VCR, and controlling the flow of information in an organization, people are able to spend more time doing what they often do best - being creative. Computers can help people work more creatively.

Multimedia systems are known for their educational and entertainment value, which we call 'edutainment'. Multimedia combines

text with sound, video, animation, and graphics, which greatly enhances the interaction between user and machine and can make information more interesting and appealing to people. Expert systems software enables computers to 'think' like experts.

Medical diagnosis expert systems, for example, can help doctors pinpoint a patient's illness, suggest further tests, and prescribe appropriate drugs.

Connectivity enables computers and software that might otherwise be incompatible to communicate and to share resources. Now that computers are proliferating in many areas and networks are available for people to access data and communicate with others, personal computers are becoming interpersonal PCs. They have the potential to significantly improve the way we relate to each other. Many people today telecommute - that is, use their computers to stay in touch with the office while they are working at home. With the proper tools, hospital staff can get a diagnosis from a medical expert hundreds or thousands of miles away.

Similarly, the disabled can communicate more effectively with others using computers.

Distance learning and videoconferencing are concepts made possible with the use of an electronic classroom or boardroom accessible to people in remote locations. Vast databases of information are currently available to users of the Internet, all of whom can send mail messages to each other. The information superhighway is designed to significantly expand this interactive connectivity so that people all over the world will have free access to all these resources.

People power is critical to ensuring that hardware, software, and connectivity are effectively integrated in a socially responsible way. People - computer users and computer professionals - are the ones who will decide which hardware, software, and networks endure and how great an impact they will have on our lives. Ultimately people power must be exercised to ensure that computers are used not only efficiently but in a socially responsible way.

## B Re-read the text to find the answers to these questions:

### 1 Match the terms in Table A with the statements in Table B.

Table A

- a Edutainment
- b Multimedia
- c Expert system
- d Telecommute
- e Information superhighway

Table B

- i Software that enables computers to 'think' like experts
- ii Use computers to stay in touch with the office while working at home
- iii Internet system designed to provide free, interactive access to vast resources for people all over the world
- iv Multimedia materials with a combination of educational and entertainment content
- v A combination of text with sound, video, animation, and graphics

### 2 Mark the following statements as True or False:

- a Desktop organisers are programs that require desktop computers.
- b Computers are sometimes used to monitor systems that previously needed human supervision.
- c Networking is a way of allowing otherwise incompatible systems to communicate and share resources.
- d The use of computers prevents people from being creative.
- e Computer users do not have much influence over the way that computing develops.

## READING

3

Now study the text below to find this information:

- 1 What is the memory size of this PC?
- 2 Which input devices are supplied?
- 3 What size is the monitor?
- 4 How fast is the processor?
- 5 What is the capacity of the hard drive?
- 6 Which operating system does it use?
- 7 What multimedia features does the computer have?

## HOW TO READ A COMPUTER AD.

- 1 Intel Pentium IV 1.7GHz Processor
- 2 Mini Tower Chassis
- 3 256MB Rambus RDRAM
- 4 60GB Hard Drive
- 5 Embedded Intel 3D Direct AGP video with 64MB SDRAM
- 6 64-voice wavetable sound
- 7 48 X CD-ROM Drive
- 8 19" (17.9" VIS) Colour SVGA monitor
- 9 Microsoft Windows XP
- 10 1.44MB 3.5" Floppy Drive
- 11 Microsoft Intellimouse
- 12 105-key keyboard



Fig 2  
Dell computer

- |  |  |   |
|--|--|---|
| <ol style="list-style-type: none"> <li>1 The main processing chip that operates at a clock speed of 1.7 thousand million cycles per second.</li> <li>2 A small size of tall and narrow style of case containing the computer system.</li> <li>3 256 megabytes of Rambus dynamic type of main memory chips that constitute the computer RAM.</li> <li>4 A hard drive internal storage device with a capacity of approx. 60 thousand million bytes.</li> </ol> | <ol style="list-style-type: none"> <li>5 A video controller for controlling the monitor screen that is built on to the computer motherboard. It can process 3D images using the AGP type of video bus interface. It also contains approx. 64 million bytes of synchronous dynamic random access memory that is used as video memory.</li> <li>6 A soundcard that has 64 voices and generates sounds using the wavetable system.</li> </ol> | <ol style="list-style-type: none"> <li>7 A CD-ROM storage device that operates at 48 times the speed of the original CD-ROM devices.</li> <li>8 A colour monitor for displaying output on a screen at resolutions determined by the SVGA standard. The diagonal measurement of the whole screen is 19 inches but the diagonal measurement of the actual viewable area of the screen is only 17.9 inches.</li> <li>9 The operating system that is used to control the system.</li> </ol> |
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## SPECIALIST READING

## A

Find the answers to these questions in the following texts.

- 1 What is one of the main causes of a PC not running at its highest potential speed?
- 2 What word in the text is used instead of 'buffer'?
- 3 What device looks after cache coherency?
- 4 What is the main alternative to 'write-through cache'?
- 5 When does a write-back cache write its contents back to main memory?
- 6 When is data marked as 'dirty' in a write-back cache?
- 7 What determines what data is replaced in a disk cache?

## CACHE MEMORY

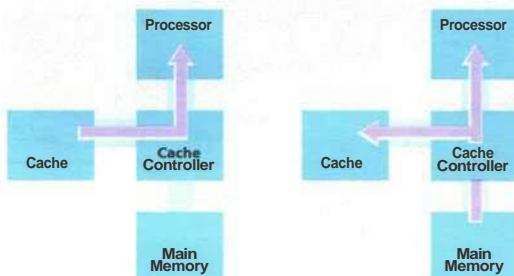
Most PCs are held back not by the speed of their main processor, but by the time it takes to move data in and out of memory. One of the most important techniques for getting around this bottleneck is the memory cache.

- The idea is to use a small number of very fast memory chips as a buffer or cache between main memory and the processor. Whenever the processor needs to read data it looks in this cache area first. If it finds the data in the cache then this counts as a 'cache hit' and the processor need not go through the more laborious process of reading data from the main memory. Only if the data is not in the cache does it need to access main memory, but in the process it copies whatever it finds into the cache so that it is there ready for the next time it is needed. The whole process is controlled by a group of logic circuits called the cache controller.
- One of the cache controller's main jobs is to look after 'cache coherency' which means ensuring that any changes written to main memory are reflected within the cache and vice versa. There are several techniques for achieving this, the most obvious

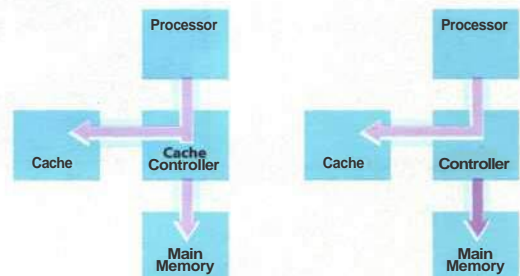
- being for the processor to write directly to both the cache and main memory at the same time. This is known as a 'write-through' cache and is the safest solution, but also the slowest.

- The main alternative is the 'write-back' cache which allows the processor to write changes only to the cache and not to main memory. Cache entries that have changed are flagged as 'dirty', telling the cache controller to write their contents back to main memory before using the space to cache new data. A write-back cache speeds up the write process, but does require a more intelligent cache controller.

- Most cache controllers move a 'line' of data rather than just a single item each time they need to transfer data between main memory and the cache. This tends to improve the chance of a cache hit as most programs spend their time stepping through instructions stored sequentially in memory, rather than jumping about from one area to another. The amount of data transferred each time is known as the 'line size'.



If there is a cache hit then the processor only needs to access the cache. If there is a miss then it needs to both fetch data from main memory and update the cache, which takes longer. With a standard write-through cache, data has to be written

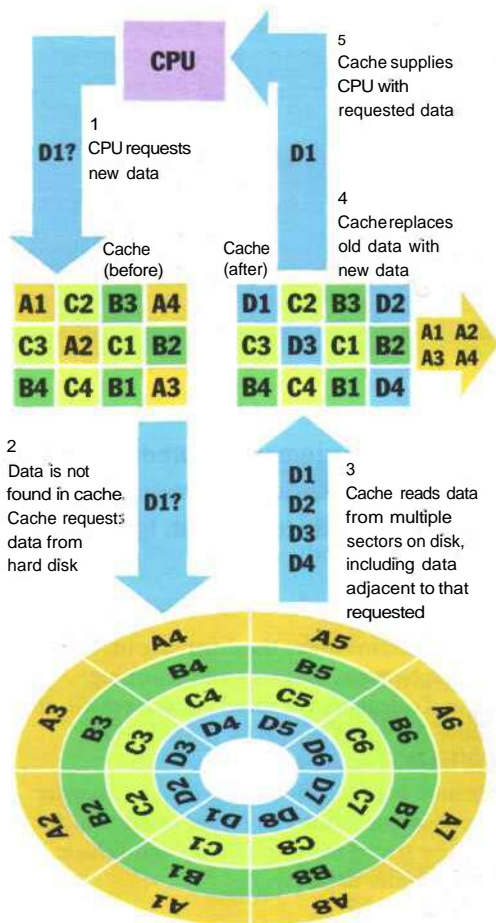


both to main memory and to the cache. With a write-back cache the processor needs only write to the cache, leaving the cache controller to write data back to main memory later on.

# How a Disk Cache Works

Disk caching works in essentially the same way whether you have a cache on your disk controller or you are using a software-based solution. The CPU requests specific data from the cache. In some cases, the information will already be there and the request can be met without accessing the hard disk.

- If the requested information isn't in the cache, the data is read from the disk along with a large chunk of adjacent information. The cache then makes room for the new data by replacing old. Depending on the algorithm that is being applied, this may be the information that has been in the cache the longest, or the information that is the least recently used. The CPU's request can then be met, and the cache already has the adjacent data loaded in anticipation of that information being requested next.



**B** Re-read the texts to find the answers to these questions.

- 1 Match the terms in Table A with the statements in Table B.

Table A

- a Cache hit
- b Cache controller
- c Cache coherency
- d Write-through cache
- e Write-back cache
- f Line size

Table B

- i The process of writing changes only to the cache and not to main memory unless the space is used to cache new data
- ii The amount of data transferred to the cache at any one time
- iii The process of writing directly to both the cache and main memory at the same time
- iv The processor is successful in finding the data in the cache
- v Ensuring that any changes written to main memory are reflected within the cache and vice versa
- vi The logic circuits used to control the cache process

- 2 Mark the following as True or False:

- a Cache memory is faster than RAM.
- b The processor looks for data in the main memory first.
- c Write-through cache is faster than write-back cache.
- d Write-back cache requires a more intelligent cache controller.
- e Most programs use instructions that are stored in sequence in memory.
- f Most cache controllers transfer one item of data at a time.
- g Hardware and software disk caches work in much the same way.

# Computer Applications

## STARTER

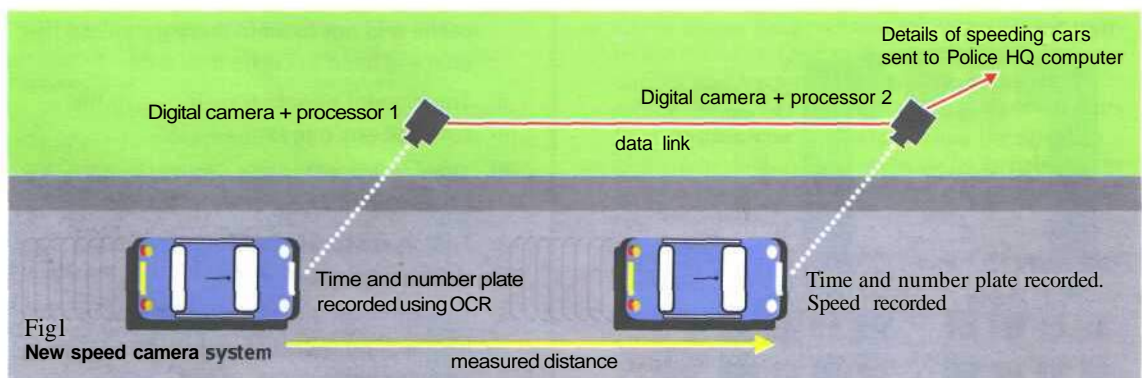
**1** Work in groups. List as many uses as you can for computers in one of these areas.

- 1 supermarkets
- 2 hospitals
- 3 airports
- 4 police headquarters

## READING

**2** Study this diagram. Using only the diagram, try to list each stage in the operation of this computerised speed trap to make an explanation of how it operates. For example:

- 1 Camera 1 records the time each vehicle passes.



## 3

Part 1 of the text describes the system which predates the one shown in Fig 1. Does it contain any information that may help complete your explanation? Read it quickly to find out. Ignore any information which is not helpful to you.

### Part 1

In the last ten years, police have installed speed trap units on many busy roads. These contain a radar set, a microprocessor and a camera equipped with a flash. The radar sends out a beam of radio waves at a frequency of 24 gigahertz. This is equivalent to a wavelength of 1.25 cms. If a car is moving towards the radar, the reflected signal will bounce back with a slightly smaller wavelength. If away from the radar, the waves will reflect with a slightly longer wavelength. The microprocessor

within the unit measures the difference in wavelength between outgoing and returning signals and calculates the speed of each vehicle. If it is above the speed pre-set by the police, the camera takes a picture of the vehicle. The information is stored on a smart card for transfer to the police computer. The owner of the vehicle can then be traced using the Driver and Vehicle Licensing Centre database.



**4** Part 2 describes the new system. Read it to complete the stages in your explanation.

Part 2

Some drivers have now got used to these traps. They slow down when they approach one to ensure that the camera is not triggered. They speed up again as soon as they have passed. This is known as 'surfing'. One way of outwitting such motorists is a new computerised system. This consists of two units equipped with digital cameras positioned at a measured distance apart. The first unit records the time each vehicle passes it and identifies each vehicle by its number plates

using optical character recognition software. This information is relayed to the second unit which repeats the exercise. The microprocessor within the second unit then calculates the time taken by each vehicle to travel between the units. The registration numbers of those vehicles exceeding the speed limit are relayed to police headquarters where a computer matches each vehicle with the DVLC database. Using mailmerge a standard letter is then printed off addressed to the vehicle owner.

## LANGUAGE WORK

### Present passive

#### Study these sentences.

- 1 The radar sends out a beam of radio waves.
- 2 The information is stored on a smart card.

**In 1 the verb is active and in 2 it is passive, the Present passive. Why is this so? What difference does it make? In 1 the agent responsible for the action is included - the radar. In 2 the agent is not included although**

**we know what it is - the microprocessor. The passive is often used to describe the steps in a process where the action is more important than the agent and where the agent is already known to the reader. If we need to add the agent, we can do so like this:**

- 3 The information is stored on a smart card *by the microprocessor.*

**5** Describe the operation of the new speed trap by converting each of these statements to the Present passive. Add information on the agent where you think it is necessary.

- 1 The first unit records the time each vehicle passes.
- 2 It identifies each vehicle by its number plates using OCR software.
- 3 It relays the information to the second unit.
- 4 The second unit also records the time each vehicle passes.
- 5 The microprocessor calculates the time taken to travel between the units.
- 6 It relays the registration numbers of speeding vehicles to police headquarters.
- 7 A computer matches each vehicle with the DVLC database.
- 8 It prints off a letter to the vehicle owners using mailmerge.

## SPECIALIST READING

**A** Find the answers to these questions in the following text.

- 1 What tool is often used in data mining?
- 2 What AI method is used for the following processes?
  - a Separate data into subsets and then analyse the subsets to divide them into further subsets for a number of levels.
  - b Continually analyse and compare data until patterns emerge.
  - c Divide data into groups based on similar features or limited data ranges.
- 3 What term is used for the patterns found by neural networks?
- 4 When are clusters used in data mining?
- 5 What types of data storage can be used in data mining?
- 6 What can an analyst do to improve the data mining results?
- 7 Name some of the ways in which data mining is currently used.

## DATAMINING

Data mining is simply filtering through large amounts of raw data for useful information that gives businesses a competitive edge. This information is made up of meaningful patterns and trends that are already in the data but were previously unseen.

The most popular tool used when mining is artificial intelligence (AI). AI technologies try to work the way the human brain works, by making intelligent guesses, learning by example, and using deductive reasoning. Some of the more popular AI methods used in data mining include neural networks, clustering, and decision trees.

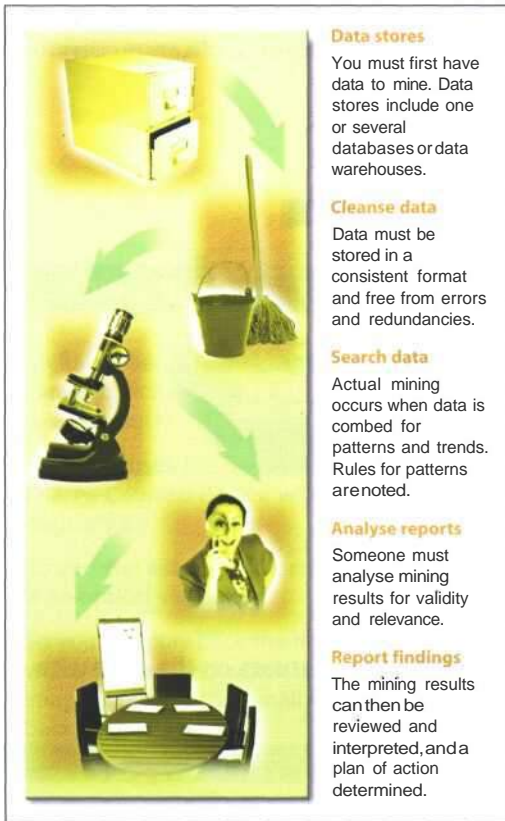
Neural networks look at the rules of using data, which are based on the connections found or on a sample set of data. As a result, the software continually analyses value and compares it to the other factors, and it compares these factors repeatedly until it finds patterns emerging. These patterns are known as rules. The software then looks for other patterns based on these rules or sends out an alarm when a trigger value is hit.

Clustering divides data into groups based on similar features or limited data ranges. Clusters are used when data isn't labelled in a way that is favourable to mining. For instance, an insurance company that wants to find instances of fraud wouldn't have its records labelled as fraudulent or not fraudulent. But after analysing patterns within clusters, the mining software can start to figure out the rules that point to which claims are likely to be false.

Decision trees, like clusters, separate the data into subsets and then analyse the subsets to divide them into further subsets, and so on (for a few more levels). The final subsets are then small enough that the mining process can find interesting patterns and relationships within the data.

Once the data to be mined is identified, it should be cleansed. Cleansing data frees it from duplicate information and erroneous data. Next, the data should be stored in a uniform format within relevant categories or fields. Mining tools can work with all types of data storage, from large data warehouses to smaller desktop databases to flat files. Data warehouses and data





50 marts are storage methods that involve archiving large amounts of data in a way that makes it easy to access when necessary.

When the process is complete, the mining software generates a report. An analyst goes over the report to see if further work needs to be done, such as refining parameters, using other data analysis tools to examine the data, or even scrapping the data if it's unusable. If no further work is required, the report proceeds to the decision makers for appropriate action.

60 The power of data mining is being used for many purposes, such as analysing Supreme Court decisions, discovering patterns in health care, pulling stories about competitors from newswires, resolving bottlenecks in production processes, and analysing sequences in the human genetic makeup. There really is no limit to the type of business or area of study where data mining can be beneficial.

**B** Re-read the text to find the answers to these questions.

**1 Match the terms in Table A with the statements in Table B.**

Table A

a Data mining	c Cleansed data
b AI	d Data warehouse

Table B

- i Storage method of archiving large amounts of data to make it easy to access
- ii Data free from duplicate and erroneous information
- iii A process of filtering through large amounts of raw data for useful information
- iv A computing tool that tries to operate in a way similar to the human brain

**2 Mark the following as True or False:**

- a Data mining is a process of analysing known patterns in data.
- b Artificial intelligence is commonly used in data mining.
- c In data mining, patterns found while analysing data are used for further analysing the data.
- d Data mining is used to detect false insurance claims.
- e Data mining is only useful for a limited range of problems.

**3 Complete the following description of the data mining process using words from the text:**

Large amounts of data stored in data ..... are often used for data ..... The data is first ..... to remove ..... information and errors. The ..... is then analysed using a tool such as ..... An analysis report is then analysed by an ..... who decides if the ..... need to be refined, other data ..... tools need to be used, or if the results need to be discarded because they are ..... The analyst passes the final results to the ..... makers who decide on the ..... action.

## SPECIALIST READING

**A** Find the answers to these questions in the following text.

- 1 What is Currie Munce's main aim?
- 2 How quickly did the possible areal density of hard disks increase in the 1990s?
- 3 How long does Munce think magnetic recording technology will continue to make rapid advances in capacity?
- 4 What problem does he predict for magnetic storage?
- 5 What is the predicted limit for discrete bit magnetic storage capacity?
- 6 What storage technologies might replace current magnetic systems?
- 7 What is the advantage of holographic storage being three-dimensional?
- 8 What improvements are predicted due to the fast access rates and transfer times of holographic storage?
- 9 What is predicted to be the most important high capacity removable storage media in the next 10 years?
- 10 What method of software distribution is likely to replace optical disks?

## Ready for the Bazillion-Byte Drive?

Thinking about writing your memoirs - putting your life story down on paper for all eternity? Why not skip the repetitive strain injury and just capture your whole life on full-motion video, putting it all in a device the size of a sugar cube? It might not be as far off as you think.

Currie Munce, director of IBM's Advanced HDD Technology Storage Systems Division, has one avowed goal: Build bigger storage. Recently Munce and his fellow Ph.Ds restored Big Blue's lead in the disk space race with a new world record for areal (bit) density: 35.3 gigabits per square inch - roughly three times as dense as any drive shipping at press time.

- 15 During the 1990s, areal density doubled every 18 months, keeping pace with the transistor density gains predicted by Moore's Law. But increasingly daunting technical challenges face those who would push the storage envelope further. 'I think magnetic recording technology has another good 5 to 10 years,' says Munce. 'After that, we'll see substantial difficulties with further advances at the pace people are accustomed to.'

- 25 From here on, a phenomenon called superparamagnetism threatens to make densely-packed bits unstable. Provided that new developments continue to thwart superparamagnetic corruption, scientists speculate that the theoretical limit for discrete bit recording is 10 terabits per square inch (1 terabit = 1,000 gigabits).

Approaching this limit will require new technologies. Two possible contenders are atomic force microscopy (AFM) and holographic storage.

- 35 AFM would use a spinning plastic disk, perhaps inside a wristwatch, and a tiny, 10-micron cantilever with a 40-angstrom tip (an angstrom represents the approximate radius of an atom) to write data. In theory, AFM will allow densities of
- 40 300 to 400 gigabits per square inch.

While AFM is still in the lab, holographic storage is closer to reality. According to Rusty Rosenberger, optical program manager for Imation, 'We are targeting a 5  $\frac{1}{4}$  -inch disk with

45 125GB of storage and a 40MB-per-second transfer rate.' Future iterations of holographic systems should improve substantially.

The three-dimensional nature of holography makes it an appealing storage medium because

50 'pages' of data can be superimposed on a single volume - imagine transferring a whole page of text at once as opposed to reading each letter in sequence. Hans Coufal, manager of IBM's New Directions in Science and Technology Research

55 division, predicts that the fast access rates and transfer times of holographic storage will lead to improved network searches, video on demand, high-end servers, enterprise computing, and supercomputing.

60 Meanwhile, also-ran technologies are thriving. Tape, first used for data storage in 1951 with the Univac I, has been revitalized by the corporate hunger for affordable archiving solutions. In the consumer arena, says Dataquest analyst Mary

65 Craig, recordable CD-ROMs and DVDs will remain the dominant high-capacity removable storage media for the next decade. Despite their failure to match the areal density gains of hard disks, optical disks are cheap to produce, making

70 them ideal for software distribution (until a mature digital rights management system facilitates online delivery). Finally, solid state options such as flash cards can't yet match the pricing of hard disks at high capacities.

75 Further out, scientists salivate over the prospect of data manipulation and storage on an atomic level. Because consumer demand for capacity is lagging behind what technology can deliver, bringing new storage options to the masses will

80 depend on seeing the need for more space.

**B** Re-read the text to find the answers to these questions.

**1 Match the terms in Table A with the statements in Table B.**

Table A

- a Big Blue
- b Areal density
- c Moore's Law
- d Superparamagnetism
- e Terabit
- f AFM
- g Angstrom

Table B

- i Atomicforce microscopy
- ii The approximate radius of an atom
- iii IBM
- iv The data capacity of a storage device measured in bits per square inch
- v Prediction that the number of transistors that can be incorporated into a processor chip will double every 18 months
- vi A phenomenon that threatens to make densely packed bits unstable in magnetic storage devices
- vii One thousand gigabits

**2 Mark the following statements as True or False:**

- a The development of AFM is more advanced than holographic storage.
- b The predicted maximum storage density of AFM is 400 gigabits per square inch.
- c Holography works in 3D.
- d Univac I was the first computer to use tape storage devices.
- e Users want higher capacity storage devices than technology can provide.



3

Study this text title. What do you think it means?

## Operating Systems: Hidden Software

Now read this text to check your answer and to find the answers to these questions:

- 1 What difference is there between applications software and operating systems?
- 2 Why is the supervisor program the most important operating system program?
- 3 What is the difference between resident and non-resident programs?
- 4 What are the main functions of an operating system?

When a brand new computer comes off the factory assembly line, it can do nothing. The hardware needs software to make it work. Are we talking about applications software such as wordprocessing or spreadsheet software? Partly. But an applications software package does not communicate directly with the hardware. Between the applications software and the hardware is a software interface - an operating system. An operating system is a set of programs that lies between applications software and the computer hardware.

The most important program in the operating system, the program that manages the operating system, is the supervisor program, most of which remains in memory and is thus referred to as resident. The supervisor controls the

entire operating system and loads into memory other operating system programs (called nonresident) from disk storage only as needed.

An operating system has three main functions: (1) manage the computer's resources, such as the central processing unit, memory, disk drives, and printers, (2) establish a user interface, and (3) execute and provide services for applications software. Keep in mind, however, that much of the work of an operating system is hidden from the user. In particular, the first listed function, managing the computer's resources, is taken care of without the user being aware of the details. Furthermore, all input and output operations, although invoked by an applications program, are actually carried out by the operating system.

## SPECIALIST READING

**A** Find the answers to these questions in the following text.

- 1 What did Linus Torvalds use to write the Linux kernel?
- 2 How was the Linux kernel first made available to the general public?
- 3 What is a programmer likely to do with source code?
- 4 Why will most software companies not sell you their source code?
- 5 What type of utilities and applications are provided in a Linux distribution?
- 6 What is X ?
- 7 What graphical user interfaces are mentioned in the text?

# LINUX

Linux has its roots in a student project. In 1992, an undergraduate called Linus Torvalds was studying computer science in Helsinki, Finland. Like most computer science courses, a big component of it was taught on (and about) Unix. Unix was the wonder operating system of the 1970s and 1980s: both a textbook example of the principles of operating system design, and sufficiently robust to be the standard OS in engineering and scientific computing. But Unix was a commercial product (licensed by AT&T to a number of resellers), and cost more than a student could pay.

Annoyed by the shortcomings of Minix (a compact Unix clone written as a teaching aid by Professor Andy Tannenbaum) Linus set out to write his own 'kernel' — the core of an operating system that handles memory allocation, talks to hardware devices, and makes sure everything keeps running. He used the GNU programming tools developed by Richard Stallman's Free Software Foundation, an organisation of volunteers dedicated to fulfilling Stallman's ideal of making good software that anyone could use without paying. When he'd written a basic kernel, he released the source code to the Linux kernel on the Internet.

Source code is important. It's the original from which compiled programs are generated. If you don't have the source code to a program, you can't modify it to fix bugs or add new features. Most software companies won't sell you their source code, or will only do so for an eye-watering price, because they believe that if they

35 make it available it will destroy their revenue stream.

What happened next was astounding, from the conventional, commercial software industry point of view — and utterly predictable to anyone who knew about the Free Software Foundation. Programmers (mostly academics and students) began using Linux. They found that it didn't do things they wanted it to do - so they fixed it. And where they improved it, they sent the improvements to Linus, who rolled them into the kernel. And Linux began to grow.

There's a term for this model of software development; it's called Open Source (see [www.opensource.org/](http://www.opensource.org/) for more information).

50 Anyone can have the source code - it's free (in the sense of free speech, not free beer). Anyone can contribute to it. If you use it heavily you may want to extend or develop or fix bugs in it — and it is so easy to give your fixes back to the community that most people do so.

An operating system kernel on its own isn't a lot of use; but Linux was purposefully designed as a near-clone of Unix, and there is a lot of software out there that is free and was designed to compile on Linux. By about 1992, the first 'distributions' appeared.

A distribution is the Linux-user term for a complete operating system kit, complete with the utilities and applications you need to make it do useful things — command interpreters, programming tools, text editors, typesetting tools, and graphical user interfaces based on the X windowing system. X is a standard in academic and scientific computing, but not hitherto common on PCs; it's a complex distributed windowing system on which people implement graphical interfaces like KDE and Gnome.

As more and more people got to know about Linux, some of them began to port the Linux kernel to run on non-standard computers. Because it's free, Linux is now the most widely-ported operating system there is.

## B Re-read the text to find the answers to these questions.

### 1 Match the terms in Table A with the statements in Table B.

Table A

- a Kernel
- b Free Software Foundation
- c Source code
- d Open Source
- e A distribution
- f X

Table B

- i A type of software development where any programmer can develop or fix bugs in the software
- ii The original systems program from which compiled programs are generated
- iii A complete operating system kit with the utilities and applications you need to make it do useful things
- iv A standard distributed windowing system on which people implement graphical interfaces
- v An organisation of volunteers dedicated to making good software that anyone could use without paying
- vi The core of an operating system that handles memory allocation, talks to hardware devices, and makes sure everything keeps running

### 2 Mark the following statements as True or False:

- a Linux was created in the 1980s.
- b Minix was created by a university student.
- c Linux is based on Unix.
- d Minix is based on Unix.
- e Linux runs on more types of computer than any other operating system.



# Graphical User Interfaces

## 2 Study this second example of a GUI.

- 1 How does it differ from Fig 1?
- 2 In what ways is it the same?

### Menu bar

Just about all programs display a menu bar across the top of the screen, including the 'Finder'. The menu bar will change, depending on the program you're running at the time.

### Document

This is a text file which tells us something about the contents of this CD-ROM. You can read it by simply double-clicking on it - your iMac will then automatically find the program needed to open it.

### Application

This is an application, or program icon. Double-clicking on it will start the program. It's not always obvious whether an icon is for a document or a program, but you soon get to be able to spot these things.

### Folder

This is a folder icon, and these all tend to look the same - like a kind of 3D view of a suspension file. Sometimes they're adorned with other graphics, but they're usually pretty easy to spot. Double-clicking on a folder icon displays that folder's contents in another window, which is what we've done here.

### Hard Disk icon

Folders, files, documents and other items are displayed as little icons like this. This one, in fact, represents your iMac's internal hard disk.

### CD-ROM icon

Your hard disk icon (and Wastebasket icon) may be the only ones you see on your desktop. If you insert a CD-ROM, though, it will appear as an icon on your desktop too. We've double-clicked on it to display its contents. To eject a CD, by the way, you have to drag its icon onto the Wastebasket - you can't just press the CD-ROM drive button. If you do, you'll be waiting an awful long time.

### Folder window

When you double-click on a folder or a disk drive, its contents are displayed in a window like this one. These contents can be documents, programs or other folders.

### Wastebasket icon

The Wastebasket is where you throw things you no longer need. It doesn't empty straight away, (though as you can see, ours is so full the lid's fallen off), so you can change your mind if you have to. When you want to eject a disk, be it a CD-ROM or a floppy disk (if you've got a floppy disk drive attached), you drag its icon on to the Wastebasket and the iMac will spit it out automatically.

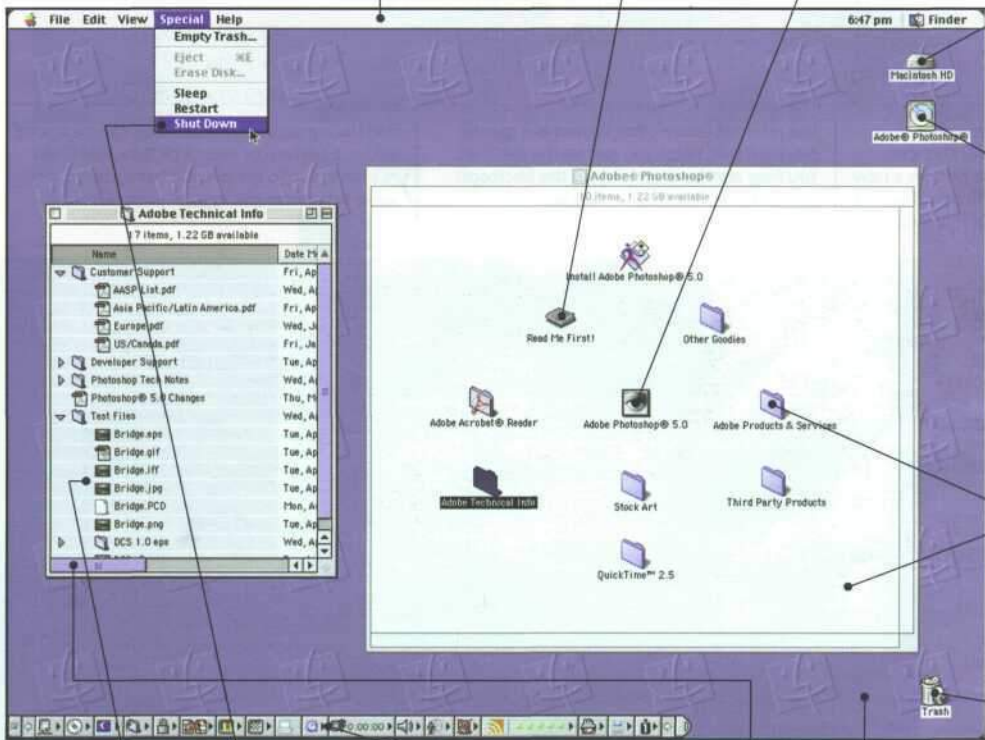


Fig 2  
Mac GUI

### List view

This is another folder window, but this time we're looking at the contents in list' view. Otherwise, it's the same as the window next to it - a 'window' on a folder, basically. You can nest folders many layers deep, in case you're wondering, and you're likely to get confused long before your iMac does - try to keep your filing system as simple as possible.

### Menu/menu option

To open a menu, click on its name in the menu bar. This displays a drop-down list like the one you see here. To choose one of the menu options, just click on it (the options are highlighted as the mouse pointer moves over them to help you get the right one). Don't forget to always shut down your iMac via this menu, NOT by simply switching the power off.

### Control Strip

The Control Strip offers quick access to many of your iMac's settings like the speaker volume, sound input and CD player controls. Until you've found out what these gadgets do, you can 'hide' it by clicking on the small ribbed area to the far right. This reduces it to a little handle in the bottom left-hand corner of the screen. Click this handle if you want to display the Control Strip again.

### Scrollbar

You'll see these gadgets whenever the contents of a folder won't fit in the window. You click on either the horizontal or vertical scroll arrows to display more of the contents - either that, or drag on the little blue 'scroll box'.

### Desktop pattern

This background image can be swapped for many more via the Appearance control panel. You can use a repeating 'pattern' like this, or a single image - a scanned photograph for example.

## SPECIALIST READING

**A** Find the answers to these questions in the following text.

- 1 What developments are driving the development of completely new interfaces?
- 2 What has inspired a whole cottage industry to develop to improve today's graphical user interface?
- 3 In what way have XML-based formats changed the user interface?
- 4 What type of computers are certain to benefit from speech technology?
- 5 Name a process where a mouse is particularly useful and a process where it is not so useful.
- 6 What facilities are multimodal interfaces likely to offer in the future?
- 7 What type of input device will be used to give vision to the user interface?
- 8 What development has led to an interest in intelligent agents?
- 9 List ways in which intelligent agents can be used.

## USER INTERFACES

Cheaper and more powerful personal computers are making it possible to perform processor-intensive tasks on the desktop. Break-throughs in technology, such as speech recognition, are enabling new ways of interacting with computers. And the convergence of personal computers and consumer electronics devices is broadening the base of computer users and placing a new emphasis on ease of use. Together, these developments will drive the industry in the next few years to build the first completely new interfaces since SRI International and Xerox's Palo Alto Research Center did their pioneering research into graphical user interfaces (GUIs) in the 1970s.

True, it's unlikely that you'll be ready to toss out the keyboard and mouse any time soon. Indeed, a whole cottage industry - inspired by the hyperlinked design of the World Wide Web - has sprung up to improve today's graphical user interface. Companies are developing products that organize information graphically in more intuitive ways. XML-based formats enable users to view content, including local and network files, within a single browser interface. But it is the more dramatic innovations such as speech recognition that are poised to shake up interface design.

Speech will become a major component of user interfaces, and applications will be completely redesigned to incorporate speech input. Palm-size and handheld PCs, with their cramped keyboards and basic handwriting recognition, will benefit from speech technology.

Though speech recognition may never be a complete replacement for other input devices, future interfaces will offer a combination of input types, a concept known as multimodal input. A mouse is a very efficient device for desktop navigation, for example, but not for



changing the style of a paragraph. By using both a mouse and speech input, a user can first point to the appropriate paragraph and then say to the computer, 'Make that bold.' Of course, multimodal interfaces will involve more than just traditional input devices and speech recognition. Eventually, most PCs will also have handwriting recognition, text to speech (TTS), the ability to recognize faces or gestures, and even the ability to observe their surroundings.

At The Intelligent Room, a project of Massachusetts Institute of Technology's Artificial Intelligence Lab, researchers have given sight to PCs running Microsoft Windows through the use of video cameras. 'Up to now, the PC hasn't cared about the world around it,' said Rodney A. Brooks, the Director of MIT's Artificial Intelligence Lab. 'When you combine computer vision with speech understanding, it liberates the user from having to sit in front of a keyboard and screen.'

It's no secret that the amount of information - both on the Internet and within intranets - at the fingertips of computer users has been expanding rapidly. This information onslaught has led to an interest in intelligent agents, software assistants that perform tasks such as retrieving and delivering information and automating repetitive tasks. Agents will make computing significantly easier. They can be used as Web browsers, help-desks, and shopping assistants. Combined with the ability to look and listen, intelligent agents will bring personal computers one step closer to behaving more like humans. This is not an accident. Researchers have long noted that users have a tendency to treat their personal computers as though they were human. By making computers more 'social,' they hope to also make them easier to use.

As these technologies enter mainstream applications, they will have a marked impact on the way we work with personal computers. Soon, the question will be not 'what does software look like' but 'how does it behave?'

## **B** Re-read the text to find the answers to these questions.

### 1 Match the terms in Table A with the statements in Table B.

Table A

- a GUI
- b Multimodal interface
- c Intelligent agent
- d TTS
- e The Intelligent Room

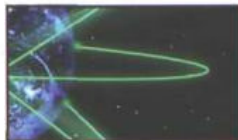
Table B

- i Software assistant that performs tasks such as retrieving and delivering information and automating repetitive tasks
- ii Text to speech
- iii Graphical user interface
- iv A project of the Massachusetts Institute of Technology's Artificial Intelligence Lab
- v A system that allows a user to interact with a computer using a combination of inputs such as speech recognition, handwriting recognition, text to speech, etc.

### 2 Mark the following statements as True or False:

- a Fewer people are using computers because computer functions are becoming integrated into other electronic devices.
- b Keyboards and mice will soon not be required for using personal computers.
- c There have been no improvements in interface design since the development of the GUI.
- d Speech recognition is likely to completely replace other input devices.
- e Computer speech and vision will free the user from having to sit in front of a keyboard and screen.
- f Intelligent agents will make computers seem more like humans.





# Applications Programs

## READING

**4** Work in groups. Read paragraph A and additional paragraphs selected by your teacher. Complete this note-taking frame for each text you read.

	B	C	D
Users			
Use			
Program types			
Data input			
Output			

**A** The system consists of 5 networked PCs, one in each of the consulting rooms, one in the Practice Manager's office and the other in Reception alongside the file server. (Each PC has its own laser printer.) There is also a dot-matrix printer in Reception for prescriptions as these are printed on special paper. All users have access to Microsoft Office.

**B** Doctors use the system to access a number of databases. The most important holds the records of all the patients in the practice. These files contain personal details and the medical history of the patient. The doctor can call up the appointments book prior to the consultation. By clicking on the patient's name, they have immediate access to that patient's records. At the end of each consultation, the doctor enters brief case notes including the diagnosis and treatment. This database can also be used to produce statistics for research and reports.

Doctors can also access a drugs database on CD-ROM which provides prescribing information on thousands of drugs including their

suitability for different categories of patients. This is updated every month. Another database is a conditions dictionary which provides information on a wide range of problems.

**C** Reception staff use specially tailored software developed from a database to enter all appointment dates and times for each doctor. The program generates daily lists of appointments and can be accessed by the doctors. Reception use the patient database to identify children and old people who are due to have vaccinations. They then use mailmerging to create letters asking for appointments to be made.

**D** The Practice Manager uses a payroll package based on a spreadsheet to calculate salaries for each employee of the health centre. She enters all income and expenditure to produce practice accounts. She uses a database to produce a monthly rota of which doctors are on call in evenings and at weekends. This rota is available over the network to all users.

**5** Exchange information with others in your group to complete notes for all the texts. Ask and answer questions like these:

- 1 How do Reception use the system?
- 2 What type of program do they use?
- 3 What kind of data do they enter?
- 4 What is the output from the program?

## SPECIALIST READING

**A** Find the answers to these questions in the text below.

- 1 How do you pay for the applications provided by an ASP?  
a no charge  
b charged according to use  
c single payment
- 2 What two main services does an ASP provide?
- 3 How does an ASP ensure that they have enough storage space for the changing needs of customers?
- 4 What types of applications are available from ASPs?
- 5 Why is it useful for a small business to be able to rent specialist tools from an ASP?
- 6 What is one of the best established areas of ASP use?

## Application Service Providers

If your hard disk is packed to bursting point, the IT department is far too busy to fix your email problems, and your business can't afford to buy the tools that you'd like to develop the company website, then it's time to think about using an application service provider (ASP). Rather than installing software on each machine or server within your organisation, you rent applications from the ASP, which provides remote access to the software and manages the hardware required to run the applications.

There are a lot of advantages to this approach. The havoc caused by viruses makes the idea of outsourcing your email and office suite services an attractive option. It also gives you more flexibility - you pay for applications as and when you need them, rather than investing in a lot of costly software which you're then tied to for years. Not having to worry about upgrading to the latest version of your office suite or about battling with the complexities of managing an email system, leaves businesses with more time. Time to focus on what they do best.

However, there are some potential pitfalls. To use applications remotely requires a lot of bandwidth, which is only really available from a broadband connection or a leased line to the ASP itself. It is also important to ensure that the ASP will be able to provide a secure, reliable service which will be available whenever you need it.

Providing applications and storage space for vast numbers of users requires some powerful technology on the part of the ASP. This includes security controls and data storage as well as providing the physical links to customers. For

the most part, ASPs don't own the data centres that store the information. Instead, they lease space from data storage specialists. In this way, they can be confident of meeting customers' increasing storage requirements by buying more space as it's needed.

There's a wide variety of applications available for use via ASPs. Office suite applications and email services are two of the most generic applications available through ASPs. Large, complex business applications such as enterprise resource planning tools like SAP are another popular candidate for delivery through an ASP. Other business services, such as payroll and accounting systems are also available. This is particularly beneficial to small businesses which are likely to grow quickly and don't want to deal with the problems caused by outgrowing their existing system and having to move to a high-end package. ASPs also offer a means of using specialist tools that would otherwise prove prohibitively expensive. Small businesses have the opportunity to use such tools for short periods of time as and when they need them, rather than having to buy the software as a permanent investment.

One of the major barriers for small businesses which want to make a start in e-commerce is ensuring that they have sufficient resources to cope with sudden large increases in customers. This means not only having adequate storage for all your customers' details, but ensuring that you have the technology in place to handle stock levels, efficient delivery and large volumes of traffic. It's very rare for an e-commerce business to handle all of these elements by itself, making this one of the best-established areas of ASP use. Being able to respond rapidly to changes in the size of your customer base and the type of product that they want to order from your business, demands more flexibility than traditional software can provide.

**B** Re-read the text to find the answers to these questions.

1 Note the advantages and disadvantages of using an ASP.

2 Match the items in Table A with the statements in Table B.

Table A

- a Website
- b ASP
- c Virus
- d Office suite
- e Bandwidth
- f Broadband
- g Data centre
- h SAP

Table B

- i Set of standard programs used in an office
- ii Facility for storing large amounts of information
- iii Capacity of a network connection
- iv High capacity Internet connection
- v Self-replicating program
- vi Common enterprise resource planning tool
- vii Application service provider
- viii Collection of related webpages

3 Using information from the text, mark the following as True or False:

- a Software from an ASP must be installed locally on a user's computer.
- b You need a high bandwidth connection to use an ASP service.
- c ASPs usually use their own storage space for customers.
- d Using an ASP gives you more flexibility.
- e An e-commerce business usually provides all of the required technology itself.



**3** Match these captions to the pictures in Fig 1. Consider again your answers to Task 2.

- a Once you've paid by credit card (unless it's one of the millions of free files), music is downloaded to your PC.
- b The original music file is stripped of anything that is inaudible to the human ear. After MP3 has done its work, the file is reduced to roughly one twelfth that of the original recording.
- c MP3 files can be listened to on your PC, a dedicated MP3 player, or your hi-fi.
- d MP3 files are put on a website, where browsers can listen to samples and buy a single track or album... or even create their own compilation.

## READING

**4**

Read this text to find the answers to these questions.

- 1 What does MP3 stand for?
- 2 What is the difference between MP3 and WAV files?
- 3 What kind of sound does MP3 strip out?
- 4 What kind of information is included in the tag?

## Understanding MP3

The name comes from MPEG (pronounced EM-peg), which stands for the Motion Picture Experts Group. MPEG develops standards for audio and video compression. MP3 is actually MPEG Audio Layer 3.

MP3 competes with another audio file format called WAV. The key difference is that MP3 files are much smaller than WAV files. An MP3 file can store a minute of sound per megabyte, while a WAV file needs 11 or 12 megabytes to hold the same amount. How does MP3 achieve this

compression? CDs and audio files don't reproduce every sound of a performance. Instead, they sample the performance and store a discrete code for each sampled note. A CD or WAV file may sample a song 44,000 times a second, creating a huge mass of information.

By stripping out sounds most people can't hear, MP3 significantly reduces the information stored. For instance, most people can't hear notes above a frequency of 16kHz, so it eliminates them from the mix. Similarly,

it eliminates quiet sounds masked by noise at the same frequency. The result is a file that sounds very similar to a CD, but which is much smaller. An MP3 file can contain spoken word performances, such as radio shows or audio books, as well as music. It can provide information about itself in a coded block called a tag. The tag may include the performer's name, a graphic such as an album cover, the song's lyrics, the musical genre, and a URL for more details.

**5** Read the rest of this text to find the answers to these questions:

- 1 How do you play MP3 files?
- 2 What does the Windows Media Player file do with an MP3 file?
- 3 What is a standalone player?
- 4 What special features can players offer?
- 5 What information can you obtain by clicking on the track info button?
- 6 What does a skin enable you to do?
- 7 How do you play music from a CD-ROM on an MP3 player?
- 8 What hardware and software do you need to make your own audio CDs?

# Play MP3 Files

**Most machines today have enough processing power and memory to play MP3s immediately. Simply download an MP3 file like any other and click on it in Windows Explorer. The Windows Media Player will decode the file and route the signals to your soundcard and then to your speakers.**

Other MP3 features include:

## Players.

Most standalone players have many features beyond Windows' default Media Player. To control what music you play, players let you group songs into playlists and randomize the selections. To control how the music sounds, they offer spectrum analyzers, graphic equalizers, and frequency displays.

## Track info.

A track info button gives you the information on the MP3 file's tag. Other buttons may take you to a music library where you can organize your MP3 files by performer or genre.

## Skins or themes.

These programs are designed to change the appearance of

the most popular players. They're akin to the wallpaper that alters the look of the Windows desktop. With a skin, a player can become a jukebox, a car dashboard, or a Star Trek tricorder. Think of them as easily interchangeable faceplates.

## Rippers and encoders.

A ripper is a program that rips songs from a CD in your CD-ROM drive and turns them into WAV files. An encoder converts WAV files into MP3 files or vice versa. Many MP3 players incorporate rippers and encoders and can do both steps in one.

## Recorders.

With a writeable CD-ROM drive, a recorder program lets you create your own audio CDs.