

# Computer Architecture

**STARTER**

- 1** Name these different types of computers. Then match the possible users below to each type. Justify your choice.



a



b



c



d



e



f



g

Fig 1

- 1 Marketing research person collecting data from the general public
- 2 large company processing payroll data
- 3 travelling salesperson giving marketing presentations
- 4 large scientific organisation processing work on nuclear research
- 5 businessperson keeping track of appointments while travelling
- 6 graphic designer
- 7 secretary doing general office work

- 2** What do these abbreviations mean? Use the Glossary if necessary.

- |          |         |
|----------|---------|
| 1 CD-ROM | 5 AGP   |
| 2 RDRAM  | 6 SDRAM |
| 3 MB     | 7 SVGA  |
| 4 GHz    |         |

**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" (1 7.9" 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

- |  |   |   |
|--|---|---|
| <p><b>1</b> The main processing chip that operates at a clock speed of 1.7 thousand million cycles per second.</p> | <p><b>5</b> 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.</p> | <p><b>7</b> A CD-ROM storage device that operates at 48 times the speed of the original CD-ROM devices.</p>   |
| <p><b>2</b> A small size of tall and narrow style of case containing the computer system.</p>                      | <p><b>6</b> A soundcard that has 64 voices and generates sounds using the wavetable system.</p>   | <p><b>8</b> 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 1 7.9 inches.</p> |
| <p><b>3</b> 256 megabytes of Rambus dynamic type of main memory chips that constitute the computer RAM.</p>        | <p><b>9</b> The operating system that is used to control the system.</p>  |   |
| <p><b>4</b> A hard drive internal storage device with a capacity of approx. 60 thousand million bytes.</p>         |   |   |

## LANGUAGE WORK

## Function of an item

We can describe the function of an item in a number of ways. Study these examples.

Using the Present simple

- 1 ROM *holds* instructions which are needed to start up the computer.

*Used to-infinitive. Used for + -ing form*

- 2 ROM is *used to hold* instructions which are needed to start up the computer.

- 3 ROM is *used for holding* instructions which are needed to start up the computer.

Emphasising the function

- 4 *The function of ROM is to hold* instructions which are needed to start up the computer.

**4** Match each item in Column A with its function in Column B. Then describe its function in two ways.

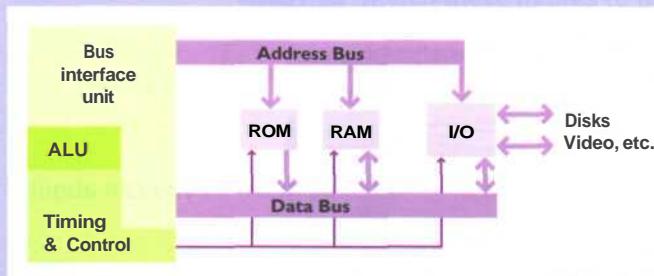
A Item	B Function
RAM	controls the cursor
processor	inputs data through keys like a typewriter
mouse	displays the output from a computer on a screen
clock	reads DVD-ROMs
3.5" floppy drive	reads and writes to removable magnetic disks
monitor	holds instructions which are needed to start up the computer
keyboard	holds data read or written to it by the processor
DVD-ROM drive	provides extremely fast access for sections of a program and its data
cache	controls the timing of signals in the computer
ROM	controls all the operations in a computer

- 5** With the help of the Glossary if necessary, describe the functions of these items.

- |                   |                      |
|-------------------|----------------------|
| 1 scanner         | 6 supercomputer      |
| 2 printer         | 7 mainframe computer |
| 3 ATM             | 8 barcodes           |
| 4 PDA             | 9 swipe cards        |
| 5 hard disk drive | 10 memory            |

**LANGUAGE WORK****Prepositions of place**

Study these examples of prepositions of place.



- 1 Data moves *between* the CPU and RAM.
- 2 Data flows *from* ROM to the CPU.
- 3 A program is read *from* disk *into* memory.
- 4 Data is transferred *along* the data bus.
- 5 The address number is put onto the address bus.

**Fig 3**  
Computer buses

**Fig 4**  
Hard disk



- 6 The hard disk drive is *inside* a sealed case.
- 7 Heads move *across* the disk.
- 8 Tracks are divided *into* sectors.

- 6** Complete each sentence using the correct preposition.

- 1 The CPU is a large chip ..... the computer.
- 2 Data always flows ..... the CPU ..... the address bus.
- 3 The CPU can be divided ..... three parts.
- 4 Dataflows ..... the CPU and memory.
- 5 Peripherals are devices ..... the computer but linked ..... it.
- 6 The signal moves ..... the VDU screen ..... one side ..... the other.
- 7 The CPU puts the address ..... the address bus.
- 8 The CPU can fetch data ..... memory ..... the data bus.

**PROBLEM-SOLVING****7**

Study these 'System upgrades and options' for the computer described in Task 3. Which upgrades and/or options would improve these aspects of this computer?

- 1 capacity
- 2 speed
- 3 protection from damage due to power failure
- 4 network connections

**Upgrades and options**

- 3Com 10/100 Ethernet controller
- CD-RW Drive
- Extra memory module
- APC 1400 Smart-UPS
- 3 Year Next-Business-Day On-site Service

**SPEAKING****8**

Work in pairs, A and B. Find out as much as you can about your partner's computer and complete this table.

**Student A** your computer details are on page 184.

**Student B** your computer details are on page 190.

Feature	A	B
processor type		
processor speed		
bus speed		
memory (RAM)		
memory type		
hard disk capacity		
hard disk type		
monitor size		
monitor resolution		
CD-ROM drive speed		

**WRITING**

**9** Put these instructions for opening a computer in the correct sequence.

- a Release the two catches underneath and lift up to remove panel.
- b Shut down your computer by choosing Shut Down from the Apple menu or the Special menu.
- c If there are security screws on the vertical plate on the back of the computer, remove them with a Philips screwdriver.
- d Unplug all the cables except the power cord from your computer.
- e Pulling gently, slide the tray out.

**10** Match these figures to the instructions.

Fig 5  
Opening a computer



i



ii



iii



iv

**11** Add these sequence words to your instructions: *first, then, next, after that, finally*.

## 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.

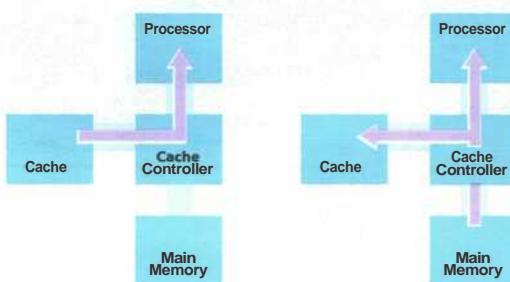
- 10 The idea is to use a small number of very fast memory chips as a buffer or cache between main memory and the processor. Whenever the processor needs to read data it looks in this cache area first. If it finds the data in the cache then this counts as a 'cache hit' and the processor need not go through 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.
- 15 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.

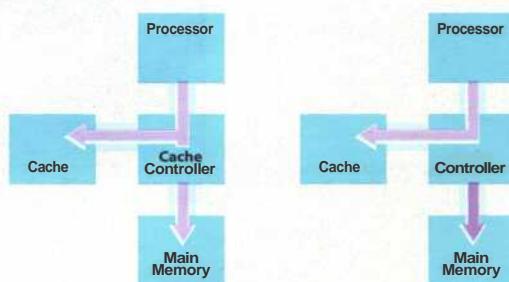
- The main alternative is the 'write-back' cache
- 20 which allows the processor to write changes only to the cache and not to main memory. Cache entries that have changed are flagged as 'dirty', telling the cache controller to write their contents back to main memory before using the space to
  - 25 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

- 30 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
- 35 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

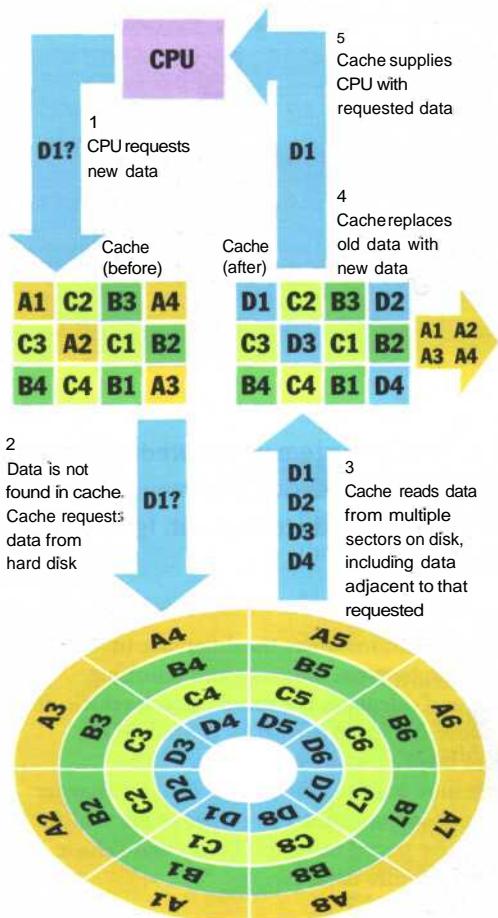


both to main memory and to the cache. With a write-back cache the processor needs only write to the cache, leaving the cache controller to write data back to main memory later on.

# 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

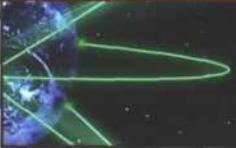
- a Cache hit
- b Cache controller
- c Cache coherency
- d Write-through cache
- e Write-back cache
- f Linesize

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**

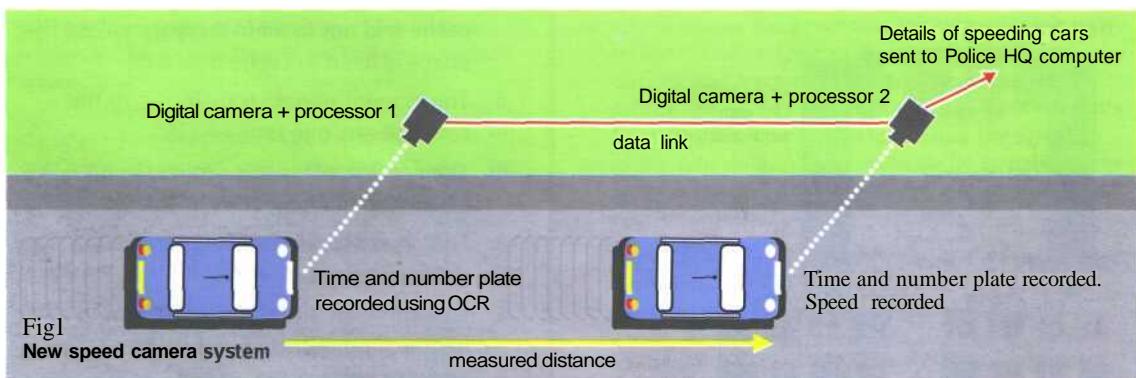
**1** Work in groups. List as many uses as you can for computers in one of these areas.

- 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.

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.

**6** With the help of this diagram, sequence these steps in the operation of an EPOS till. Then write a description of its operation in the Present passive.

- The scanner converts the barcode into electrical pulses.
- The branch computer sends the price and description of the product to the EPOS till.
- The scanner reads the barcode.
- The branch computer records the sale of the product.
- The till shows the item and price.
- The checkout operator scans the item.
- The scanner sends the pulses to the branch computer.
- The till prints the item and price on the paper receipt.
- The branch computer searches the stock file for a product matching the barcode EAN.

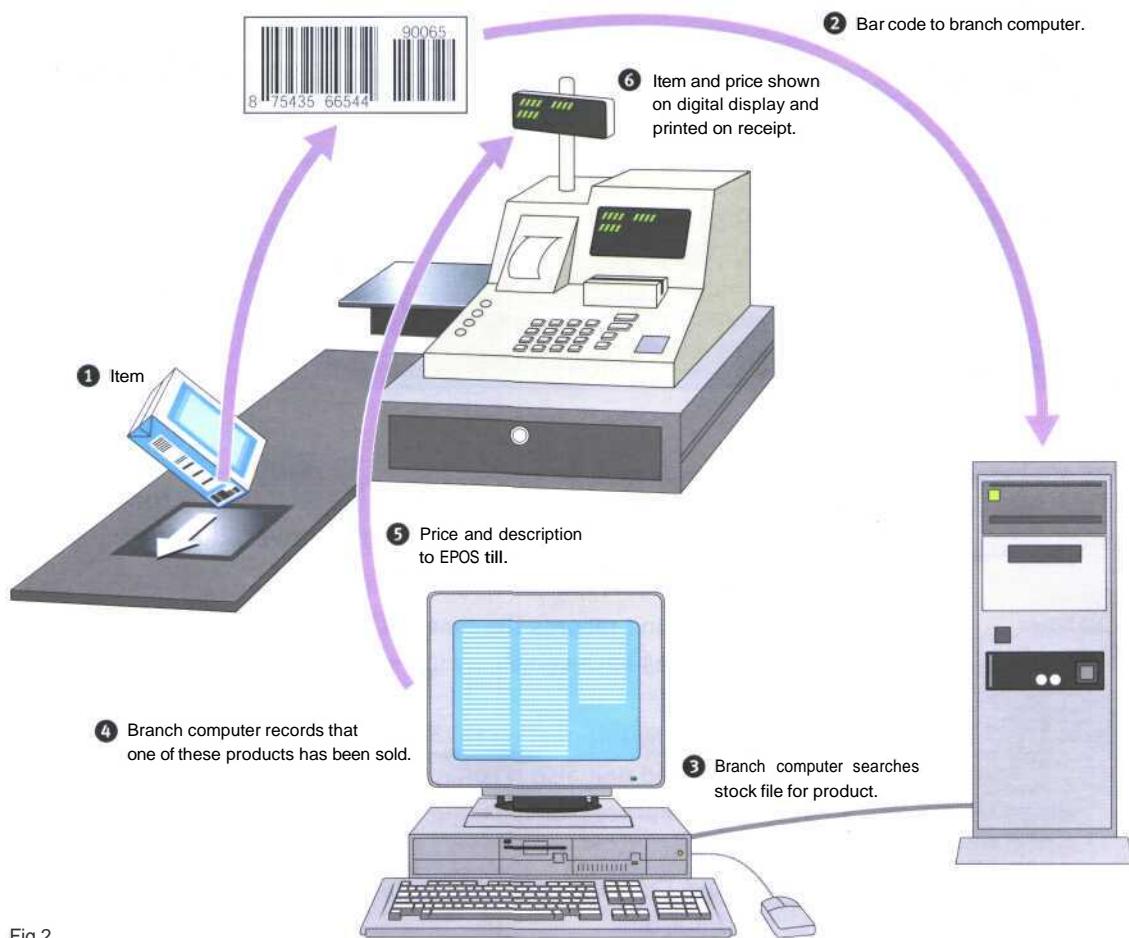


Fig 2  
Operation of EPOS till

**PROBLEM-SOLVING**

**7** Assuming cost is not a problem, what computer applications would make today's cars safer, more comfortable, more secure and more efficient? List your ideas; then compare ideas with others in your group.

**SPEAKING**

**8** Work in pairs, A and B. Be prepared to describe the process shown in your diagram to your partner. Take notes on the process described to you. Ask your partner to repeat or explain further if you do not understand any of the steps in his/her description. If you prefer, you may describe another computing process you are familiar with.

**Student A** Your process is on page 184.

**Student B** Your process is on page 190.

**WRITING**

**9** Write a description of the process you described in Task 8.

**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.

**DATA MINING**

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



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.

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.

[Adapted from 'Data Mining for Golden Opportunities', Smart Computing Guide Series Volume 8 Issue 1, January 2000]

**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:**

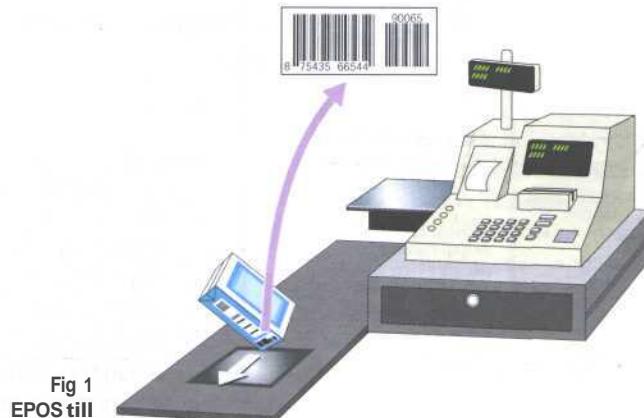
Large amounts of data stored in data ..... are often used for data ..... . The data is first ..... to remove ..... information and errors. The ..... is then analysed using a tool such as ..... . An analysis report is then analysed by an ..... who decides if the ..... need to be refined, other data ..... 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.



# Peripherals

**STARTER**

**1** Identify the peripherals in this computer application. Divide them into input and output devices.



**2** Link the inputs on the left and the outputs on the right with the appropriate peripherals in the centre.

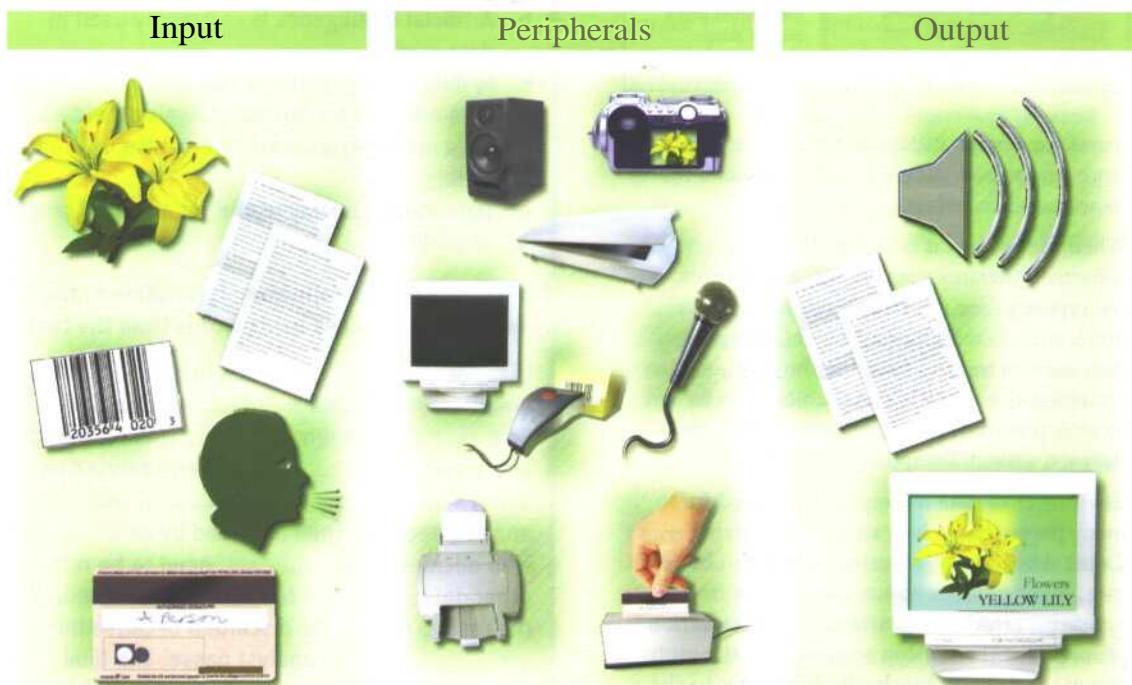


Fig 2  
Input and output devices

**LISTENING**

**3** Study this description and answer these questions.

- 1 How do digital cameras differ from conventional cameras?
- 2 How do they work?
- 3 What are their advantages and disadvantages compared to conventional cameras?

### HOW a digital camera works

Digital cameras store images on memory cards so pictures can be transferred easily to a computer.

A lens focuses the image on to a CCD unit or Charge-Coupled Device where the film would normally be.

So you can aim the camera accurately, there is an optical viewfinder.

So you can play back the images and decide which to keep and which to re-shoot, the image is passed to a small LCD screen on the back of the camera.



Fig 3  
Canon PowerShot, G1

**4** Listen to Part 1 of this discussion between A and B and complete this table of similarities and differences between conventional and digital cameras. Tick (✓) or cross (✗) the boxes.

Feature	Digital	Conventional
lens		
viewfinder		
requires chemical processing		
film		
transfer images directly to PC		
can delete unsatisfactory images		

**5** Listen to Part 2 of the dialogue to list the disadvantages of digital cameras.

**6**

Now listen to both parts again to find the answers to these questions:

- 1 What does a CCD contain?
- 2 What is a pixel?
- 3 How can you view pictures before they are downloaded to a PC?
- 4 When you have downloaded the images, what can you do with them?
- 5 Is special software required?
- 6 Why is the resolution important?
- 7 What does the capacity of a digital camera depend on?
- 8 Why is it worth getting a rechargeable battery?

**LANGUAGE WORK**

## Revision: Comparison and contrast

Study this comparison of digital and conventional cameras.

FEATURE	DIGITAL	CONVENTIONAL
lens	✓	✓
viewfinder	✓	✓
requires chemical processing	✗	✓
film	✗	✓
transfer images directly to PC	✓	✗
can delete unsatisfactory images	✓	✗

Note how we can compare and contrast these types of cameras.

Comparing features which are similar:

- 1 Both cameras have lenses.
- 2 Like the conventional camera, the digital camera has a viewfinder.

Contrasting features which are different:

- 3 The conventional camera requires chemical processing whereas the digital camera does not.
- 4 The conventional camera uses film *unlike* the digital camera.
- 5 With a digital camera you can transfer images directly to a PC *but* with a conventional camera you need to use a scanner.
- 6 With digital cameras you can delete unsatisfactory images; *however* with conventional cameras you cannot.

**7** Study this data about storage devices. Then complete the blanks in the following sentences comparing and contrasting the different types.

Device	Read/Write	Speed	Media Capacity	Media Removable	Cost
Floppy disk	Read and write	Slow	Very low	Yes	Low
Fixed hard disk	Read and write	Fast	Very high	No	Medium
Removable hard disk	Read and write	Medium to fast	High	Yes	Medium
CD-ROM	Read only	Medium	High	Yes	Low
CD-R	Recordable	Slow	High	Yes	Medium
CD-RW	Read and write	Medium	High	Yes	Medium
CD-MO	Read and write	Medium	High	Yes	High
DVD-ROM	Read only	Medium	High	Yes	Medium
DVD-RAM	Read and write	Medium	Very high	Yes	High
Magnetic Tape	Read and write	Very slow	High	Yes	Medium

- 1 You can write to hard disks ..... optical disks.
- 2 Floppy disks have a ..... capacity ..... other devices.
- 3 CD-ROMs and floppy disks are ..... low priced.
- 4 DVD-RAM has a ..... capacity ..... other optical disks.
- 5 CD-ROMs cannot be re-recorded ..... some other optical disks can be.
- 6 ..... hard disks, you can read from and write to CD-MO drives.
- 7 ..... CD-ROMs, CD-Rs are recordable.
- 8 Magnetic tape is much ..... other devices.
- 9 ..... DVD-RAM and fixed hard disks have very high media capacity.
- 10 Floppy disks are cheap ..... DVD-RAM is expensive.

**8**

Write your own comparison of printer types.

Type	Speed	Text Quality	Graphics Capability	Colour Quality	Cost
Dot-matrix	Slow to medium	Fair to good	Limited	Fair if you add a colour option	Low
Ink-Jet	Medium to fast	Good to excellent	Good to excellent	Good to Very Good	Low to high
Laser	Medium to very fast	Excellent	Good to excellent	Good in colour laser printers	Medium to high
Thermal Transfer	Medium to fast	Excellent	Good to excellent	Good to superior	Medium to high
Solid Ink	Medium to fast	Excellent	Good to excellent	Good	Medium to high
Electro-static	Slow to fast	Fair to good	Fair to good	Fair to good	Low to high

**PROBLEM-SOLVING****9**

Study this list of needs. Which type of peripheral would you advise in each case?

- 1 inputting printed graphics
- 2 building cars
- 3 controlling the screen cursor in a fast action game
- 4 making choices on a screen in a public information terminal
- 5 recording moving images
- 6 recording a book loan in a library
- 7 printing very high quality text and graphics
- 8 creating drawings
- 9 printing building plan drawings
- 10 recordingsound
- 11 listening to music without disturbing others
- 12 storing programs and data
- 13 inputting a lot of text
- 14 backing up large quantities of data

**WRITING**

**10** Describe the EPOS till shown in Fig 1. Explain the function of each peripheral using the structures studied in Unit 2.

**11** Check these websites for the latest digital cameras. Compare the newest cameras with the one described in Fig 3. You will find its specifications on [www.canon.com](http://www.canon.com).



**MINOLTA**

[www.minolta.com](http://www.minolta.com)



**FUJIFILM**



[www.fujifilm.com](http://www.fujifilm.com)

**PENTAX**



[www.pentax.com](http://www.pentax.com)

**OLYMPUS**



[www.olympus.com](http://www.olympus.com)

**SAMSUNG**



[www.samsungcamera.com](http://www.samsungcamera.com)

**ItICOH**  
Image Communication



[www.ricohcamera.com](http://www.ricohcamera.com)

**SONY**



[www.sony.com](http://www.sony.com)

**Canon**

Imaging across networks



[www.canon.com](http://www.canon.com)

## 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,

**5** 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

**10** 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 **20** 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.'

From here on, a phenomenon called

**25** 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 **30** 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 division, predicts that the fast access rates and **55** 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.



# Operating Systems

**STARTER****1**

Study this screen display and answer these questions.

- 1 How do you enter Unix commands?
- 2 Which Unix commands does it show?
- 3 What is the output of each command?
- 4 What will happen when the last command is entered?
- 5 Which other Unix commands do you know?

```
$ date
Mon Sep 24 12:45:38 BST 2001
$ passwd
passwd: Changing password for dsea03
Enter login password:
New password:
$ ls
home local mnt packages scratch
$ logout >
```

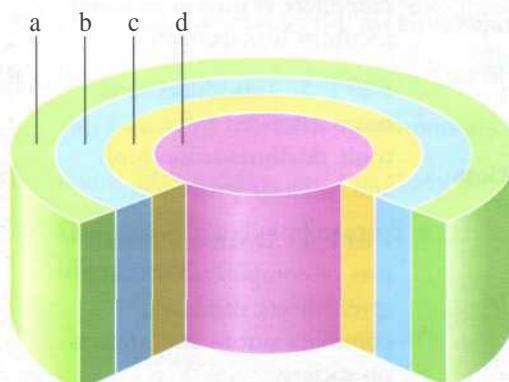
**Fig 1**  
Unix screen display

**READING****2**

Match the labels to the four layers of this diagram with the help of the diagram caption.

- 1 applications programs
- 2 user
- 3 hardware
- 4 operating system

A CONCEPTUAL DIAGRAM OF AN OPERATING SYSTEM



**Fig 2**  
Conceptual diagram of an operating system

Closest to the user are applications programs  
- software that helps a user compute a payroll or play a game or calculate the trajectory of a rocket.

The operating system is the set of programs between the applications programs and the hardware.

- 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.

**4** Complete the gaps in this summary of the text on operating systems using these linking words and phrases:

<i>although</i>	<i>in addition</i>
<i>because</i>	<i>such as</i>
<i>but</i>	<i>therefore</i>

The user is aware of the effects of different applications programs ..... operating systems are invisible to most users. They lie between applications programs, ..... wordprocessing, and the hardware. The supervisor program is the most important. It remains in memory, ..... it is referred to as resident. Others are called non-resident ..... they are loaded into memory only when needed. Operating systems manage the computer's resources, ..... the central processing unit. ...., they establish a user interface, and execute and provide services for applications software. ..... input and output operations are invoked by applications programs, they are carried out by the operating system.

**LANGUAGE WORK****-ing form (1) as a noun; after prepositions**

We can use the *-ing* form of the verb as a noun. It can be the subject, object, or complement of a sentence. For example:

- 1 *Managing* the computer's resources is an important function of the operating system.
- 2 The operating system starts *running* the user interface as soon as the PC is switched on.
- 3 Another function of the operating system is *executing* and *providing* services for applications software.

The *-ing* form is also used after prepositions. This includes *to* when it is a preposition and not part of the infinitive. For example:

- 4 *Without* the user *being* aware of the details, the operating system manages the computer's resources.
- 5 We begin *by focusing* on the interaction between a user and a PC operating system.
- 6 We look forward to *having* cheaper and faster computers.

**5** Rewrite each of these sentences like this:

An important function of the operating system is to manage the computer's resources.

*Managing the computer's resources is an important function of the operating system.*

- 1 One task of the supervisor program is to load into memory non-resident programs as required.
- 2 The role of the operating system is to communicate directly with the hardware.
- 3 One of the key functions of the operating system is to establish a user interface.
- 4 An additional role is to provide services for applications software.
- 5 Part of the work of mainframe operating systems is to support multiple programs and users.
- 6 The task in most cases is to facilitate interaction between a single user and a PC.
- 7 One of the most important functions of a computer is to process large amounts of data quickly.
- 8 The main reason for installing more memory is to allow the computer to process data faster.

**6** Complete these sentences with the correct form of the verb: infinitive or -ing form.

- 1 Don't switch off without (close down) your PC.
- 2 I want to (upgrade) my computer.
- 3 He can't get used to (log on) with a password.
- 4 You can find information on the Internet by (use) a search engine.
- 5 He objected to (pay) expensive telephone calls for Internet access.
- 6 He tried to (hack into) the system without (know) the password.
- 7 You needn't learn how to (program) in HTML before (design) webpages.
- 8 I look forward to (input) data by voice instead of (use) a keyboard.

**PROBLEM-SOLVING****7**

Try to find the commands from the lists below which will have these actions.

VMS	Unix
help	write
directory	cp
search	lpr
copy	ls
rename	mkdir
print	date
show users	rm
show time	man
create/directory	grep
phone	rwho
delete	mv

Action	VMS command	Unix command
List all the files in a directory		
Delete a file		
Rename a file		
Copy a file		
Send a file to a printer		
Obtain help		
Create a directory		
Show date and time		
Show users on system		
Talk to other users on system		
Search for a string in a file		

**SPEAKING****8**

Work in pairs, A and B. Each of you has information about some popular operating systems. Find out from the information you have and by asking each other, the answers to these questions:

**Student A** Your information is on page 184.

**Student B** Your information is on page 190.

- 1 Which operating system is used on Apple Macintosh microcomputers?
- 2 What is Penpoint designed for?

- 3 Name one system used on IBM mainframes.
- 4 Which operating system is Linux related to?
- 5 Name an IBM operating system similar to MS-DOS.
- 6 Which operating system replaced MS-DOS?
- 7 Which systems are in fact graphically orientated shells for MS-DOS?
- 8 How many versions of Windows 9X were developed?
- 9 Which operating systems are designed for networks?
- 10 Which operating system is used by DEC VAX minicomputers?

**WRITING****9**

This description of the Mac OS X is drawn from the table below. Write a similar description of Linux.

Mac OS X is a Unix-based operating system designed for use on Apple Mac computers. It includes memory-protection, pre-emptive multitasking and symmetric multiprocessing support. Graphics are provided by a graphics engine known as Quartz. It has advanced-PDF standards support, OpenGL and Quicktime integrated into the OS. The operating system features are accessed through a graphical user interface called Aqua.

	Mac OS X	Linux
type	Unix-based	Unix-based
computer features	Apple Mac memory-protection, pre-emptive multi-tasking, symmetric multiprocessing support	wide variety variety of distribution kits available
graphics engine	Quartz	XFree86
standard support	advanced-PDF, OpenGL, Quicktime	
user interface type	GUI	command line, GUI
user interface	Aqua	KDE, Gnome
source code availability	not available	freely available

## 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 **40** 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, **45** 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 **60** 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 **65** 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 **70** 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 **75** 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-supported 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:

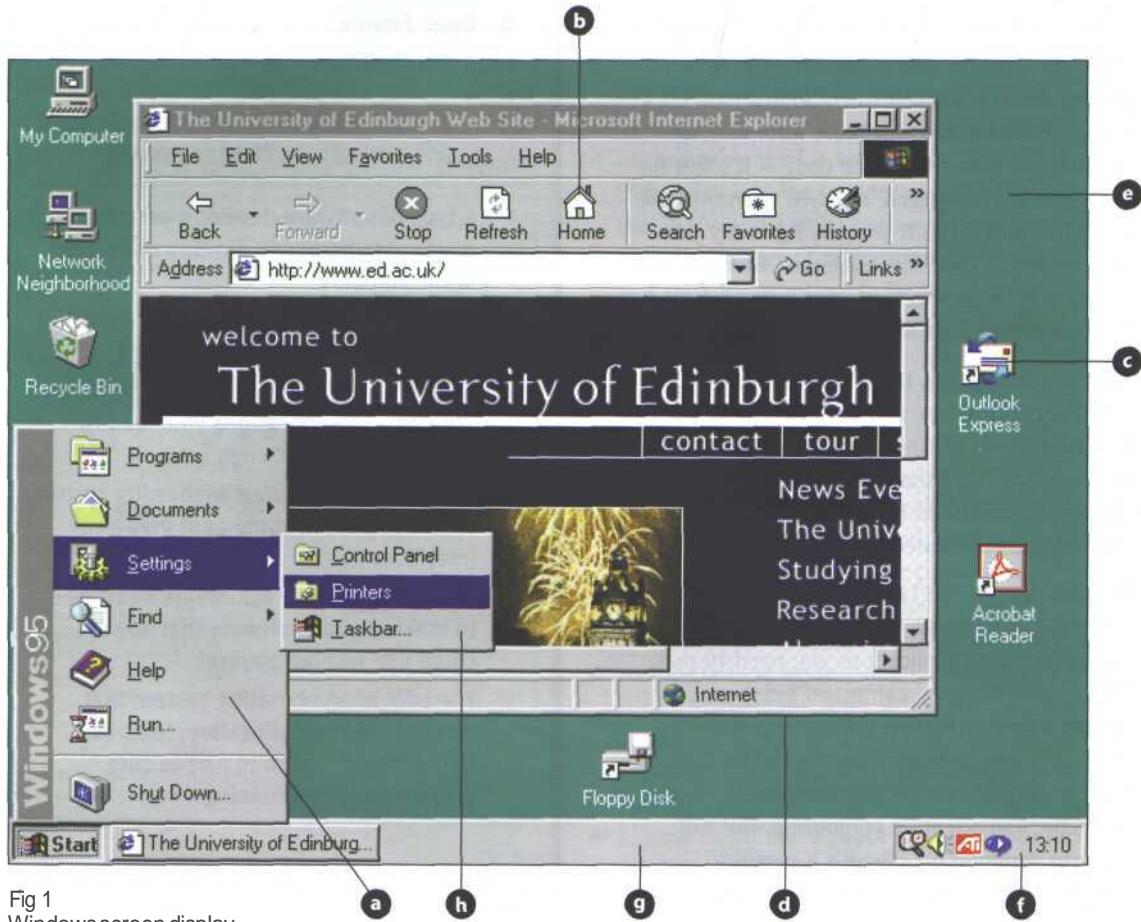
- a Linux was created in the 1980s.
- b Minix was created by a university student.
- c Linux is based on Unix.
- d Minix is based on Unix.
- e Linux runs on more types of computer than any other operating system.

# Graphical User Interfaces

**STARTER**

**1** Study this diagram of a graphical user interface (GUI). Identify these features:

- |               |           |
|---------------|-----------|
| 1 window      | 5 taskbar |
| 2 icon        | 6 submenu |
| 3 menu        | 7 desktop |
| 4 system tray | 8 button  |



## 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

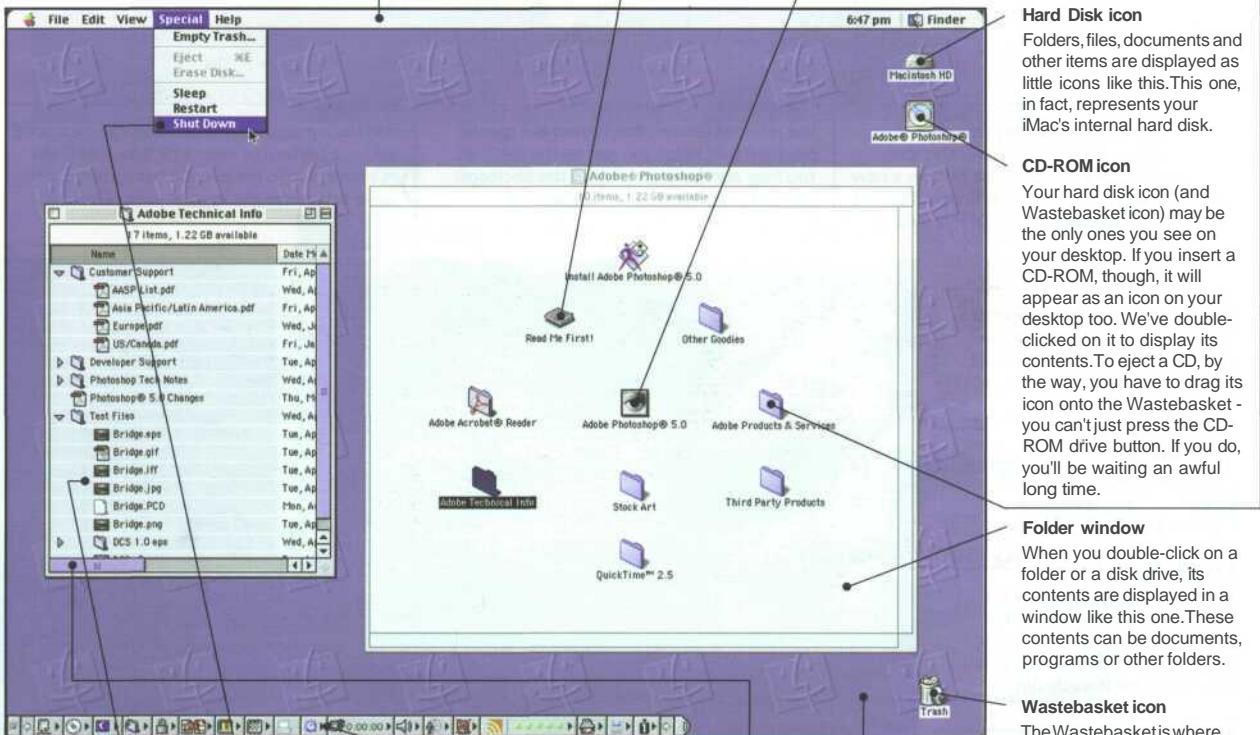
Just about all programs display a menu bar across the top of the screen, including the 'Finder'. The menu bar will change, depending on the program you're running at the time.

### 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.



**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.

### 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.

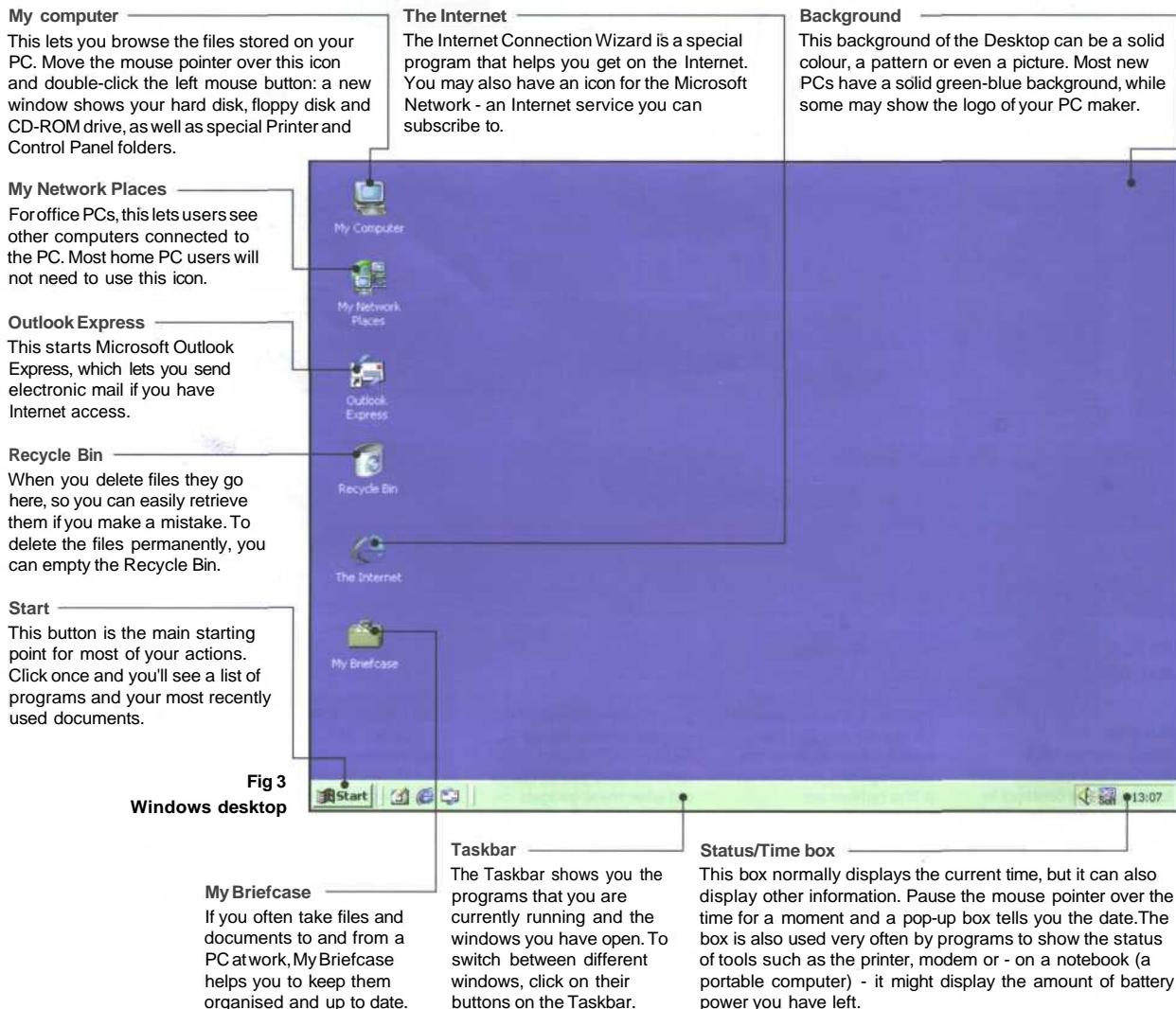
### Wastebasket icon

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.

**READING**

**3** Study this diagram of the Windows Desktop and answer these questions about its features.

- 1 What does Outlook Express let you do?
- 2 Which feature shows you current programs?
- 3 How do you read the date?
- 4 What is *My Briefcase* for?
- 5 Which background colour is most common?
- 6 Which feature shows other computers networked with yours?
- 7 Which feature lets you see which files are stored on your PC?
- 8 What is the program that helps you get on the Internet?
- 9 How do you delete files permanently?



**LANGUAGE WORK****Verbs + object + infinitive; Verbs + object + to-infinitive**

**New developments in computing are often designed to make something easier. These verbs are often used to describe such developments:**

allow	let
enable	permit
help	

**Study these examples:**

- 1 A GUI *lets you point* to icons and click a mouse button to execute a task.
- 2 A GUI *allows you to use* a computer without knowing any operating system commands.

3 The X Window System *enables Unix-based computers to have* a graphical look and feel.

4 Voice recognition software *helps disabled users (to) access* computers.

***Allow, enable and permit* are used with this structure:**

**verb + object + to-infinitive**

***Let* is used with this structure:**

**verb + object + infinitive**

***Help* can be used with either structure.**

**4** Complete the gap in each sentence with the correct form of the verb in brackets.

- 1 The Help facility enables users.....(get) advice on most problems.
- 2 Adding more memory lets your computer.....(work) faster.
- 3 Windows allows you.....(display) two different folders at the same time.
- 4 The Shift key allows you.....(type) in upper case.
- 5 The MouseKeys feature enables you.....(use) the numeric keypad to move the mouse pointer.
- 6 ALT + TAB allows you.....(switch) between programs.
- 7 The StickyKeys feature helps disabled people.....(operate) two keys simultaneously.
- 8 ALT + PRINT SCREEN lets you.....(copy) an image of an active window to the Clipboard.

**5** Describe the function of these features using 'enabling' verbs.

- 1 In a window, the vertical scroll bar
- 2 The Find command
- 3 The Undo command
- 4 Cut and paste
- 5 Print Screen
- 6 Menus
- 7 Recycle bin
- 8 Tooltips

**PROBLEM-SOLVING****6**

Study this version of a GUI. Which part of the screen would you touch if you want to:

- 1 make a phone call
- 2 send an email
- 3 access a keyboard
- 4 record an appointment
- 5 get help
- 6 write new mail

What do you think happens if you touch these areas of the screen?  
g, h, i, j, k, l

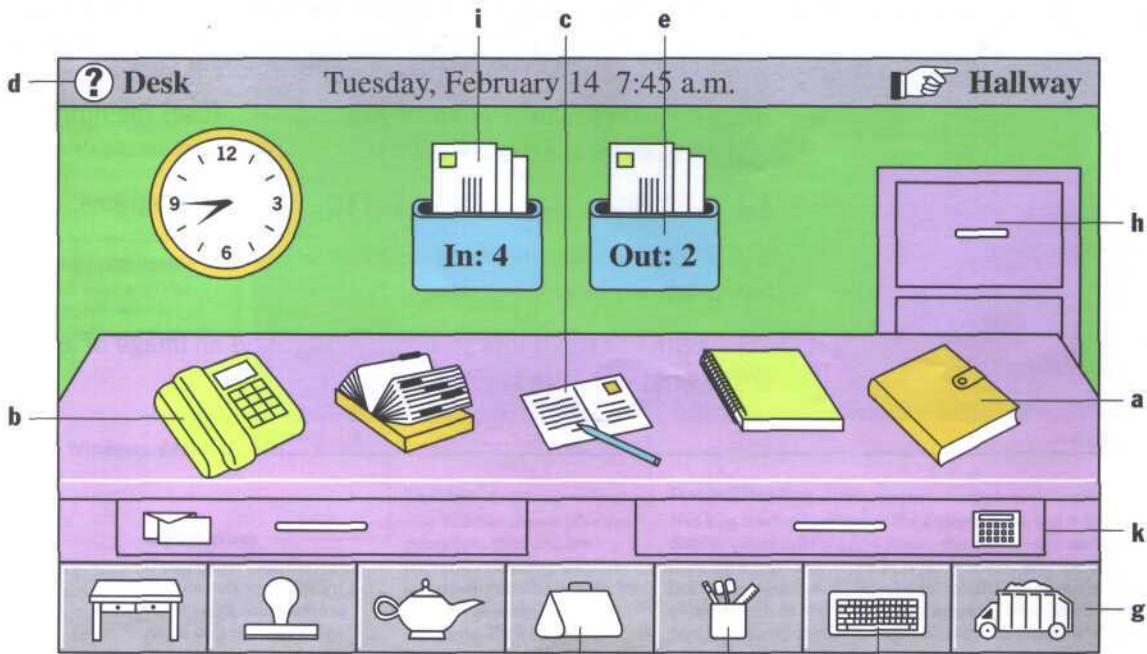


Fig 4  
Magic Cap GUI

**SPEAKING****7**

Work in groups. Complete this questionnaire for yourself. Then take turns in your group to explain how to perform each of these actions. You may need these verbs:

choose  
right/left/double-click on  
hover  
drag and drop  
select

<b>Do you know how to:</b>	<b>Yes</b>	<b>No</b>
1 create a folder?		
2 start a program?		
3 shut down the system?		
4 adjust the speaker volume?		
5 arrange the icons?		
6 display the date?		
7 in Windows, show Tooltips?		

**WRITING****8**

Study these instructions for moving a file from one folder to another using Windows Explorer. Then write your own instructions for one of the actions in Task 7. Compare your instructions with those given in the Help facility on your computer.

**TO MOVE A FILE**

- 1 If you want to move a file that was saved in a different folder, locate and open the folder.
- 2 Right-click the file you want to move; then click Cut on the shortcut menu.
- 3 Locate and open the folder where you want to put the file.
- 4 Right-click the folder; then click Paste on the shortcut menu.

**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

50 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.

55 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.'

60 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.

65 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.

70 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:**

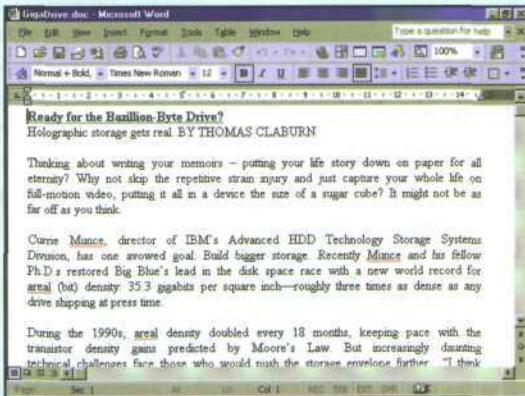
- a Fewer people are using computers because computer functions are becoming integrated into other electronic devices.
- b Keyboards and mice will soon not be required for using personal computers.
- c There have been no improvements in interface design since the development of the GUI.
- d Speech recognition 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

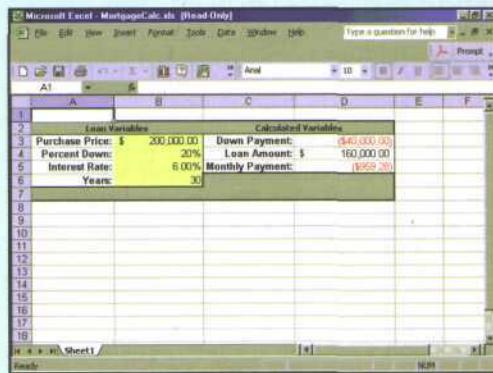
## STARTER

## 1

Identify these applications programs.



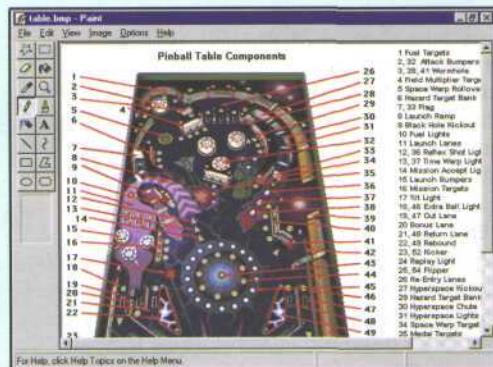
a



b

Microsoft Access [D:\mystuff\Selected Queries]		
Term	Start of Definition	User
WAV	now	9
compression (scheme)	now	9, 11
kHz	now	9
tag	now	9, 14
URL	now	9, 13, 20, 22
Windows Media Player	now	9
skin	now	9
Windows Explorer	now	9
decide	verb	9
calculator	now	9, 11
spectrum analyzer	now	9
graphic equalizer	now	9
frequency display	now	9
voltagemeter	now	9
mp3	now	9
verb	now	9
CD-ROM drive	now	9, 11
encoder	now	9
writable CD-ROM drive	now	9

c



d



e

Fig 1 Examples of common software applications  
Screen displays

**2** Conduct a survey to find out who in your class:

- 1 can name a spreadsheet program
- 2 has used a spreadsheet
- 3 can name a database program
- 4 has used a database
- 5 knows how to insert graphics into a document
- 6 can name a wordprocessing program
- 7 can centre a line of text
- 8 can disable the autocorrect

**3** Study this diagram of a medical centre. Which applications programs will be used by the following?

- 1 Reception
- 2 Practice Manager
- 3 Doctors

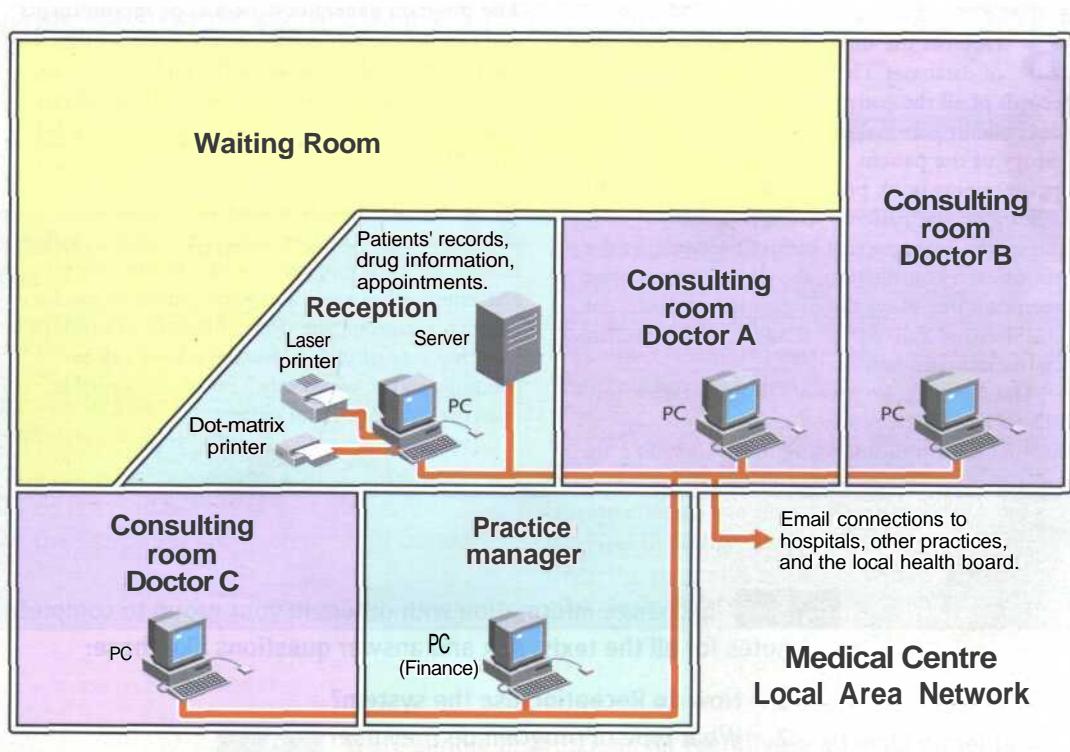


Fig 2  
Medical centre LAN

**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?

**LANGUAGE WORK****Instructions/complex instructions**

Study this extract from an instruction manual for software for doctors in a health centre.

### PATIENT BROWSER

Patient Browser allows you to find specific patients and open their records. It also allows you to identify different categories of patients.

- 1 To find patients, first click on the appropriate tab (Personal, Address or Registration).
- 2 Enter the search criteria. A combination of tabs may be used (e.g. enter a surname under the Personal tab and select a doctor in the Registration tab).
- 3 Select the Defaults button if you wish to clear the criteria boxes of any existing entries, or to search for all patients, but the list may be a long one.
- 4 Start the search by clicking on the Find button.

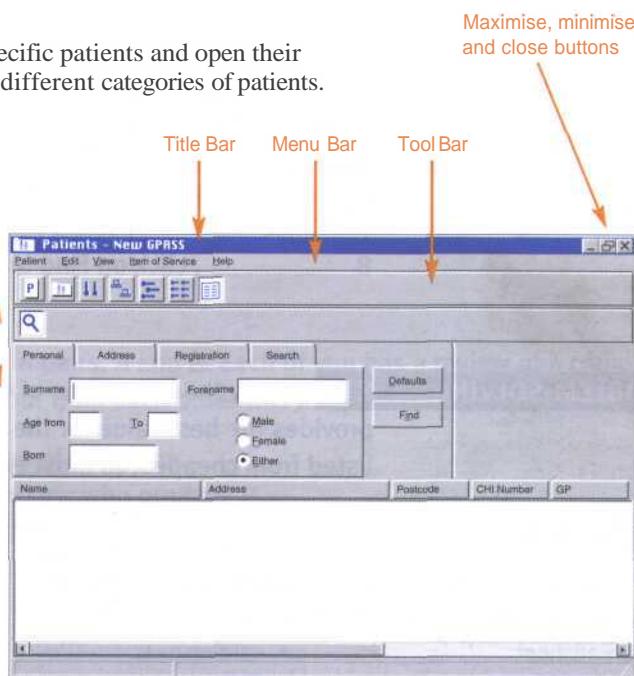


Fig 3  
GPASS

**We make simple instructions using the infinitive:**

*Click on the appropriate tab.  
Enter the search criteria.*

**We can add an explanation using the to-infinitive or *by + -ing*:**

*To find patients, click on the appropriate tab.  
Click on the Find button *to start* the search.  
Start the search *by clicking* on the Find button.*

**We can put the instructions in order using sequence words:**

*First click on the appropriate tab.  
Then enter the selection criteria.  
Finally click on the Find button.*

**We can link two instructions and emphasise their order like this:**

*Having entered the selection criteria, click on the Find button.  
Once the selection criteria *have been entered*, click on the Find button.*

- 6** Write simple instructions for identifying all male patients called Smith in the 16 to 50 age group registered with Doctors Warner and Roberts.

**7** Complete the gaps in these instructions for finding the records of all members of the Green family living in postcode WX14 3PH and registered with any doctor in the practice.

- 1 First enter the search criteria by.....
- 2 To....., enter Green in the Surname box.
- 3 Ensure both male and female members of the family are found by.....
- 4 .....select the Address tab.
- 5 Having....., enter the postcode.
- 6 .....choose the Registration tab.
- 7 Once.....select All doctors.
- 8 .....click on Find ta.....

### PROBLEM-SOLVING

**8** Study these versions of OfficeSuite and decide which version provides the best value for the following users. The versions are listed from cheapest to most expensive.

<b>OfficeSuite Standard</b>	<b>OfficeSuite Small Business Edition</b>	<b>OfficeSuite Professional</b>
<ul style="list-style-type: none"> <li>• wordprocessor</li> <li>• spreadsheet</li> <li>• presentation program</li> <li>• email</li> <li>• PIM</li> </ul>	<ul style="list-style-type: none"> <li>• wordprocessor</li> <li>• spreadsheet</li> <li>• DTP</li> <li>• email</li> <li>• PIM</li> <li>• small business tools</li> </ul>	<ul style="list-style-type: none"> <li>• wordprocessor</li> <li>• spreadsheet</li> <li>• database</li> <li>• DTP</li> <li>• presentation program</li> <li>• email</li> <li>• small business tools</li> </ul>
<b>OfficeSuite Premium</b>	<b>OfficeSuite Developer</b>	
<ul style="list-style-type: none"> <li>• wordprocessor</li> <li>• spreadsheet</li> <li>• database</li> <li>• DTP</li> <li>• presentation program</li> <li>• email</li> <li>• PIM</li> <li>• small business tools</li> <li>• website editor</li> <li>• image editor</li> </ul>	<ul style="list-style-type: none"> <li>• wordprocessor</li> <li>• spreadsheet</li> <li>• database</li> <li>• DTP</li> <li>• presentation program</li> <li>• email</li> <li>• PIM</li> <li>• small business tools</li> <li>• website editor</li> <li>• image editor</li> <li>• developer tools</li> </ul>	

- 1 A salesperson who wants to make presentations at conferences.
- 2 An administrative assistant who needs to write office correspondence and send and receive emails.
- 3 A programmer who wants to develop applications tailored to a company's needs.
- 4 A company wanting to produce its own in-house newsletter.
- 5 A company wishing to develop its own website.
- 6 A company which wants to analyse all its sales records.
- 7 A promotions person who wants to be able to edit complex graphics and incorporate them in brochures.
- 8 A company which wants to share documents on a local area network.

**SPEAKING**

- 9** Work in pairs, A and B. Each of you has a review of a computer game. Find out from each other this information:

- 1 The name of the game.
- 2 The company who produce it.
- 3 The platform on which it's played.
- 4 The bad points.
- 5 The good points.
- 6 The star rating.

**Student A** your game details are on page 185.

**Student B** your game details are on page 191.

**WRITING**

- 10** Work in groups. Decide which applications programs would be used and for what purpose, by the following:

- 1 a museum
- 2 publishers of a subscription-only magazine
- 3 police headquarters

- 11** Write your recommendations for one of the users in Task 10. Give reasons for each applications program you recommend.

**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 ASPuse?

## 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's 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,  
 40 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  
 45 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  
 50 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  
 55 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  
 60 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  
 65 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  
 70 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.  
 75

[Adapted from 'ASP and you shall receive' by Maggie Williams, PC Direct Magazine, November 2000]

**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.



# Multimedia

**STARTER**

- 1** Match the multimedia terms in Column A to the activities in Column B. More than one match is possible.

Column A	Column B
MIDI	watching movies
MP3	composing music on a PC
DVD	downloading music from the Internet
MPEG	using reference works like encyclopaedias

- 2** Study this diagram which explains MP3. Answer these questions:

- 1 How does MP3 reduce the size of music files?
- 2 What can you obtain from [www.mp3.com](http://www.mp3.com)?
- 3 How can you listen to MP3 files?

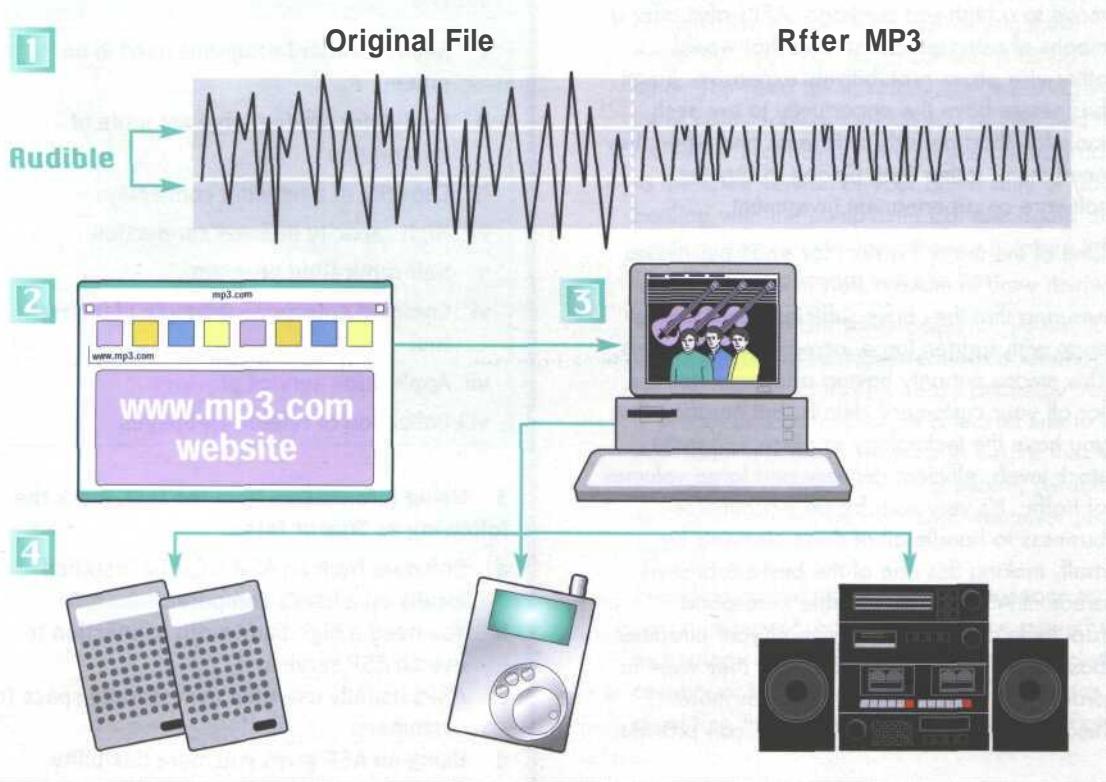


Fig 1  
How MP3 will transform music

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

- Once you've paid by credit card (unless it's one of the millions of free files), music is downloaded to your PC.
- 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.
- MP3 files can be listened to on your PC, a dedicated MP3 player, or your hi-fi.
- 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.

- What does MP3 stand for?
- What is the difference between MP3 and WAV files?
- What kind of sound does MP3 strip out?
- 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.

**LANGUAGE WORK****-ing clauses (2) cause and effect**

**Study this sentence.**

- 1 Using MIDI, computers can communicate with synthesisers.

**It contains two clauses. An -ing clause:**

*Using MIDI*

**and a main clause:**

*computers can communicate with synthesisers*

**We can use an -ing clause, as in example 1, to explain how something happens. The -ing**

**clause explanation can be placed before, or after the main clause as in example 2.**

- 2 DVD drives read DVD disks (*by*) *using blue laser light*.

**We can also use -ing clauses to link a cause and effect.**

- 3 A WAV file may sample a song 44,000 times a second, **[cause]** *creating a huge mass of information. [effect]*

**6**

Match each cause and effect. Then link them with an -ing clause.

**Cause**

- 1 Computers with MIDI interface boards can be connected to MIDI instruments.
- 2 Each side of a DVD can have two layers.
- 3 MP3 removes sounds we can't hear.
- 4 You can download single tracks.
- 5 Each MP3 file has a tag.
- 6 MP3 players contain several devices.
- 7 You can download a skin program.
- 8 You can legally download some music.

**Effect**

- a This permits extra information to be stored on the performer and other track details.
- b You can create your own compilation.
- c This allows you to sample a new group before buying their CD.
- d This gives an enormous storage capacity.
- e This allows the music being played to be stored by the computer and displayed on the monitor.
- f This enables you to change the appearance of your player.
- g These allow you to control the way the music sounds.
- h This produces much smaller files.

**7** Explain how each of these actions happen. The explanations are available in Tasks 2, 3 and 4.

- 1 MP3 reduces the information stored.
- 2 You can alter the look of your MP3 player.
- 3 You can 'rip' the audio information from a CD.
- 4 You can convert a WAV file to MP3 format.
- 5 You can view the lyrics, notes and author data.
- 6 You can control how the music sounds.
- 7 You can access many free and legal music files for downloading.
- 8 You can play MP3 files through your sound system.

**SPEAKING**

**8** Work in pairs, A and B. With the help of the notes provided, explain to your partner one aspect of multimedia.

**Student A** Your notes are on page 185.

**Student B** Your notes are on page 191.

Link your notes into a text describing one aspect of multimedia. Choose either the Student A or the Student B notes.

**WRITING**

**9** Study the diagram, Fig 2, which illustrates how MIDI operates. Then link each set of sentences into one complex sentence to form a continuous paragraph. You may add, omit and change words.

- 1 Most modern music is mixed.  
This uses computers.
- 2 Musicians record their music into a computer system.  
This system is called a Musical Instrument Digital Interface (MIDI).
- 3 MIDI was developed as a standard interface.  
MIDI is for linking music synthesisers and instruments together.
- 4 Computers can be connected to MIDI instruments.  
These computers are fitted with MIDI interface boards.  
This allows the music to be stored on computer.  
This allows the music to be displayed on the monitor.  
The music is being played.
- 5 The music can be displayed as a musical score.  
The music can be edited.  
This uses all the features of a mixing desk.

# The PC Setup

What goes where in a typical PC music set-up

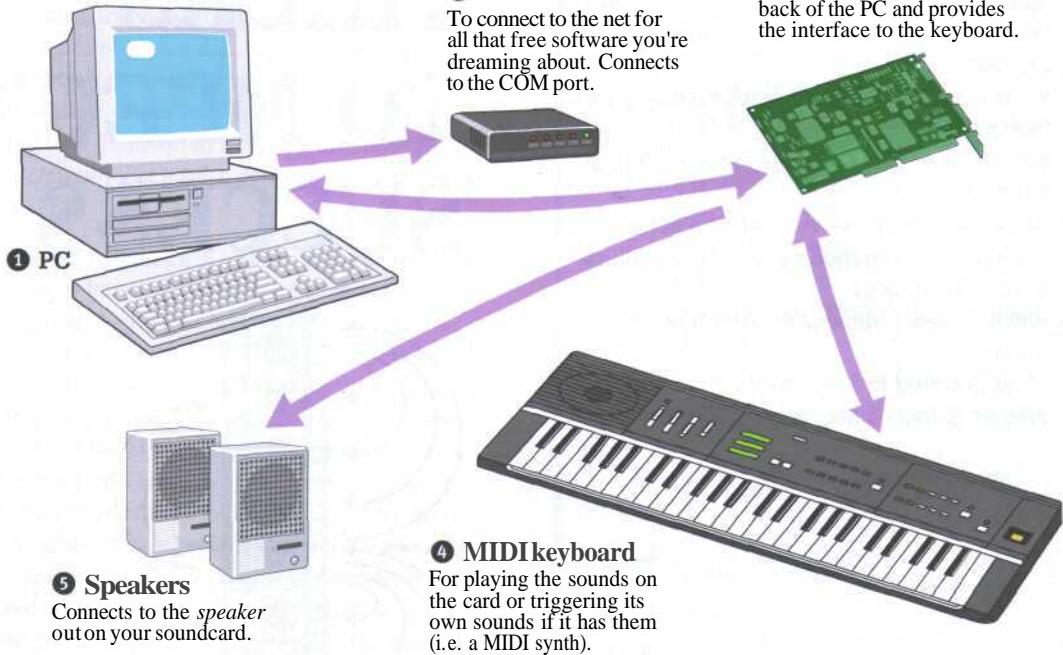


Fig 2

## What is MIDI?

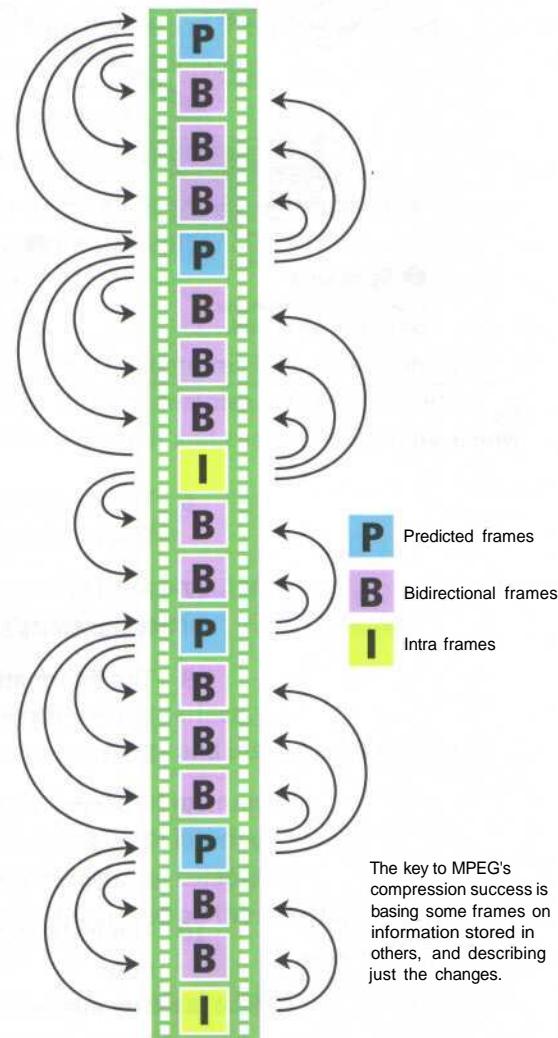
- 6 The music can also be printed out from the computer.  
The music is being played.
- 7 MIDI doesn't transmit any sound.  
It transmits simple binary information.
- 8 The information is called a MIDI message.  
The message encodes sound as 8-bit bytes of digital information.
- 9 The most common messages consist of instructions.  
These instructions tell the receiving instrument to play a note for a specific duration of time.
- 10 The instructions also contain details of how loud to play that note.  
The instructions contain a number.  
The number indicates which instrument to play.  
Number 67 is a saxophone.

## SPECIALIST READING

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

- 1 Into what two components is the data stream split?
- 2 What information does an Intra frame contain?
- 3 What is stored in the P-frames following an I-frame?
- 4 What is stored in a P-frame in the case of a bouncing ball?
- 5 What gives the massive reduction in the amount of information needed to reproduce a video sequence?
- 6 Why is a new I-frame used after a few P-frames?
- 7 What is stored in a B-frame?
- 8 Why do B-frames not propagate errors?

# THE TRICKS TO MPEG'S SUCCESS



The most common system for the compression of video is MPEG. It works like this. The single data stream off the CD-ROM is split into video and audio components, which are then decompressed using separate algorithms. The video is processed to produce individual frames as follows. Imagine a sequence of frames depicting a bouncing ball on a plain background. The very first is called an Intra Frame (I-frame). I-frames are compressed using only information in the picture itself just like conventional bitmap compression techniques like JPEG.

Following I-frames will be one or more predicted frames (P-frames). The difference between the P-frame and the I-frame it is based on is the only data that is stored for this P-frame. For example, in the case of a bouncing ball, the P picture is stored simply as a description of how the position of the ball has changed from the previous I-frame. This takes up a fraction of the space that would be used if you stored the P-frame as a picture in its own right. Shape or colour changes are also stored in the P-frame. The next P-frame may also be based on this P-frame and so on. Storing differences between the frames gives the massive reduction in the amount of information needed to reproduce the sequence. Only a few P-frames are allowed before a new I-frame is introduced into the sequence as a new reference point, since a small margin of error creeps in with each P-frame.

Between I and P-frames are bi-directional frames (B-frames), based on the nearest I or P-frames both before and after them. In our bouncing ball example, in a B-frame the picture is stored as the difference between the previous I or P-frame and the B-frame and as the difference between the B-frame and the following I or P-frame. To recreate the B-frame when playing back the sequence, the MPEG algorithm uses a combination of two references. There may be a number of B-frames between I or P-frames. No other frame is ever based on a B-frame so they don't propagate errors like P-frames.

Typically, you will have two or three Bs between Is or Ps, and perhaps three to five P-frames between Is.

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

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

- JPEG is the most common compression system used for video.
- P-frames only store the changes in the image.
- There is always at least one P-frame between two I-frames.
- B-frames store the complete picture information.
- There can only be one B-frame between each I and P-frame.
- There are typically about four P-frames between each I-frame.

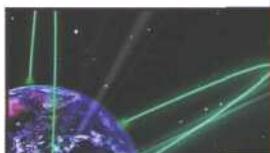
**2** Match the words in Table A with the statements in Table B.

Table A

- Algorithm
- I-frame
- JPEG
- P-frame
- B-frame
- MPEG

Table B

- A common type of compression used for video data
- A compressed video frame known as a predicted frame
- A compressed video frame that stores changes between the frame before it and the frame after it.
- A formula used for decompressing components of a data stream
- A type of compression used for bitmap images
- A compressed video frame that contains the complete image information



# Networks

**STARTER**

**1** With the help of this diagram, try to describe the function of these components of a typical network system:

- |                 |             |
|-----------------|-------------|
| 1 a file server | 5 a LAN     |
| 2 a bridge      | 6 a gateway |
| 3 a router      | 7 a modem   |
| 4 a backbone    |             |

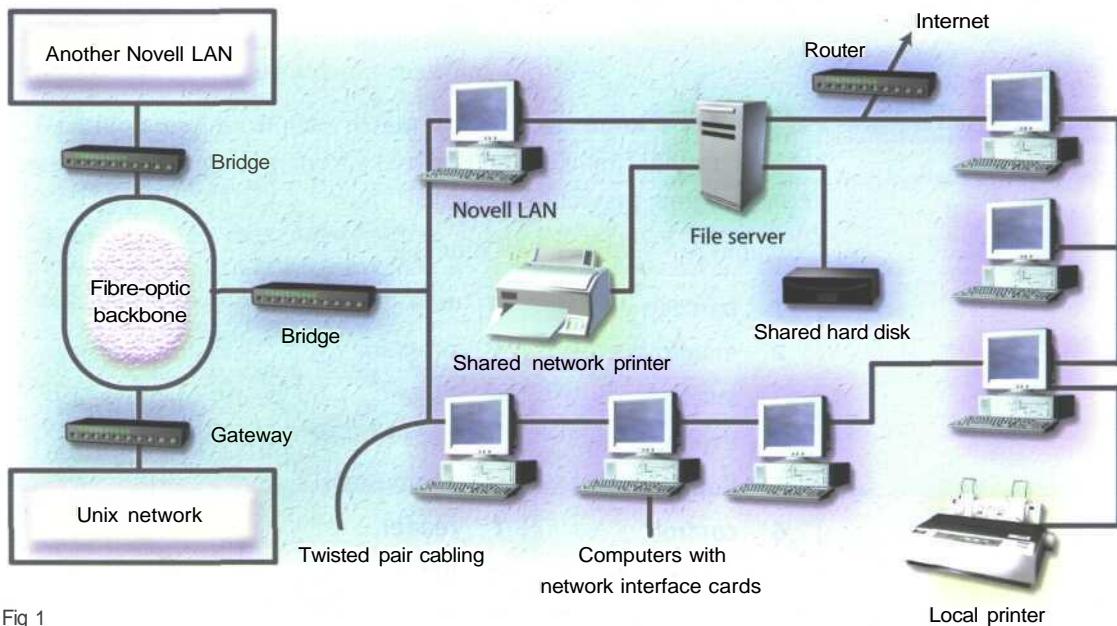


Fig 1

Components of a typical LAN

**2** Now read these definitions to check your answers. You may also refer to the Glossary.

**A bridge** is a hardware and software combination used to connect the same type of networks. Bridges can also partition a large network into two smaller ones and connect two LANs that are nearby each other.

**A router** is a special computer that directs communicating messages when several networks are connected

together. High-speed routers can serve as part of the Internet backbone.

**A gateway** is an interface that enables dissimilar networks to communicate, such as two LANs based on different topologies or network operating systems.

**A backbone** is the main transmission path, handling the major data

traffic, connecting different LANs together.

**A LAN** is a network contained within a small area, for example a company department.

**A modem** is a device for converting digital signals to analogue signals and vice versa to enable a computer to transmit and receive data using an ordinary telephone line.

## READING

## 3

Now study this text and the diagram of a simple home network setup. Match the diagram key to the components of the network.

The technology needed to set up a home network is here today. It is just a matter of connecting a number of PCs equipped with Ethernet adapters to a hub using twisted-pair cabling which uses sockets rather like phone sockets. Special isolation adapters can be fitted to allow existing mains lines to be used instead of twisted-pair cabling. Most future home networks, however, are likely to be wireless network systems, using tuned transmitter and receiver devices. The simplest networks allow basic file-sharing and multi-

player gaming as well as sharing of peripherals such as printers. Most advanced home networks are likely to have a client/server structure, with low-cost terminals, or 'thin' clients, connected to a central server which maintains the system's storage capacity and, depending on whether the terminals are dumb or processor-equipped network computers, its processing power. To make the most of such a network, it must become part of an integrated home entertainment and control system. To the user, the desktop

becomes just one of many features accessible throughout the house. Tired of working in the study? Pop down to the living room and reload it into the terminal there. Before you start work, call up the hi-fi control program and have the music of your choice pumped through the living room speakers. Computer and entertainment networks can be separate but linked by the server to allow control of the latter from the terminals. Future home networks are more likely to have the entire system based on a single loop.

## KEY TO THE DIAGRAM

- 1 Line receiver delivering home entertainment audio to speakers within the room.
- 2 TV set relaying digital TV broadcasts relayed from the receiver by the home entertainment system.
- 3 Network modem allowing clients to access the Internet simultaneously. Ideally this would be replaced by an ISDN adapter or DSL modem fitted inside the server.
- 4 Thin client comprising a display, keyboard, mouse, floppy and CD-ROM drive. If the client is NetPC-based, it will have its own processor and memory. A dumb terminal will simply act as an interface to the real computer, the server.
- 5 Network printer connected to any client.
- 6 Line driver connected to the home entertainment system; the cable TV player, DVD player, etc.
- 7 Home server. It contains roughly 5Gb of storage per terminal and one or more processors, depending on whether it is connected to network computers or to cheaper dumb terminals.
- 8 Entertainment system delivery network. This also hooks up to the server to control the system and receive digital audio and video from it.
- 9 Entertainment network control pad. While the system can be controlled by a PC, there would be one of these per connected room to ensure that the client does not need to be activated to use the system.
- 10 Data line linking clients to server.

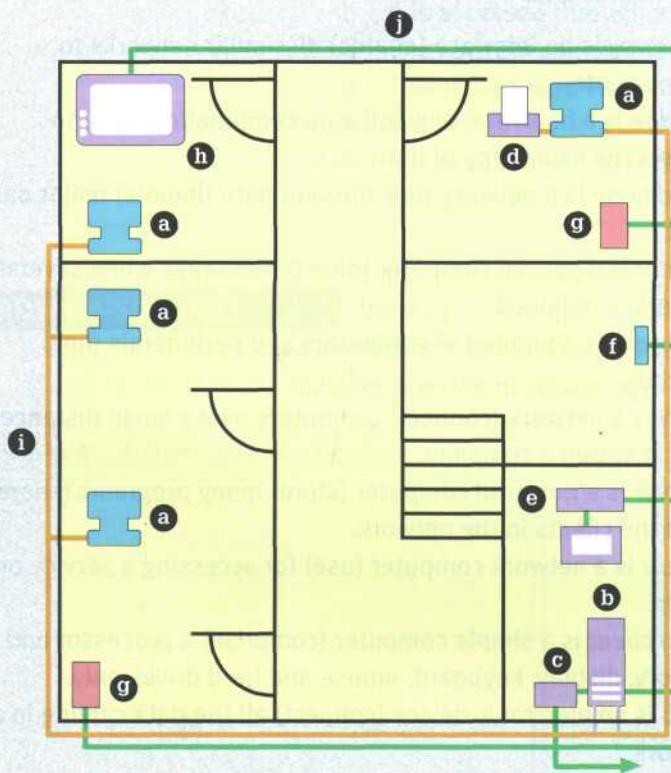


Fig 2  
Simple home network

**LANGUAGE WORK****Relative clauses with a participle**

**Relative clauses with a participle** are often used in technical descriptions. They allow you to provide a lot of information about a noun using as few words as possible.

Study these examples from the Task 3 text.

- 1 The technology *needed* to set up a home network
- 2 PCs *equipped* with Ethernet adapters
- 3 Network modem *allowing* clients to access the Internet simultaneously
- 4 Data line *linking* client to server

We can use the passive participle as in examples 1 and 2.

- 1 The technology needed to set up a home network.

= technology *which is needed*

- 2 PCs equipped with Ethernet adapters

= PCs *which are equipped*

We can use an active participle as in examples 3 and 4.

- 3 Network modem allowing clients to access the Internet simultaneously

= modem *which allows clients to access the Internet simultaneously*

- 4 Data line linking client to server

= data line *which links client to server*

**4**

Complete these definitions with the correct participle of the verb given in brackets.

- 1 A *gateway* is an interface (enable) dissimilar networks to communicate.
- 2 A *bridge* is a hardware and software combination (use) to connect the same type of networks.
- 3 A *backbone* is a network transmission path (handle) major data traffic.
- 4 A *router* is a special computer (direct) messages when several networks are linked.
- 5 A *network* is a number of computers and peripherals (link) together.
- 6 A *LAN* is a network (connect) computers over a small distance such as within a company.
- 7 A *server* is a powerful computer (store) many programs (share) by all the clients in the network.
- 8 A *client* is a network computer (use) for accessing a service on a server.
- 9 A *thin client* is a simple computer (comprise) a processor and memory, display, keyboard, mouse and hard drives only.
- 10 A *hub* is an electronic device (connect) all the data cabling in a network.

**5** Link these statements using a relative clause with a participle.

- 1 a The technology is here today.  
b It is needed to set up a home network.
- 2 a You only need one network printer.  
b It is connected to the server.
- 3 a Her house has a network.  
b It allows basic file-sharing and multi-player gaming.
- 4 a There is a line receiver in the living room.  
b It delivers home entertainment audio to speakers.
- 5 a Eve has designed a site.  
b It is dedicated to dance.
- 6 a She has built in links.  
b They connect her site to other dance sites.
- 7 a She created the site using a program called Netscape Composer.  
b It is contained in Netscape Communicator.
- 8 a At the centre of France Telecom's home of tomorrow is a network.  
b It is accessed through a Palm Pilot-style control pad.
- 9 a The network can simulate the owner's presence.  
b This makes sure vital tasks are carried out in her absence.
- 10 a The house has an electronic door-keeper.  
b It is programmed to recognise you.  
c This gives access to family only.

**PROBLEM-SOLVING****6** Work in two groups, A and B. Group A, list all the advantages of a network. Group B, list all the disadvantages. Then together consider how the disadvantages can be minimised.

Group A Advantages of a network

Group B Disadvantages of a network

**SPEAKING****7**

**Transmission modes** Work in pairs, A and B. Explain to your partner how one mode of transmission between computers operates with the help of the text provided. Your explanation should allow your partner to label his/her diagram.

**Student A**

Your text is on page 186. Your explanation should allow your partner to label this diagram.

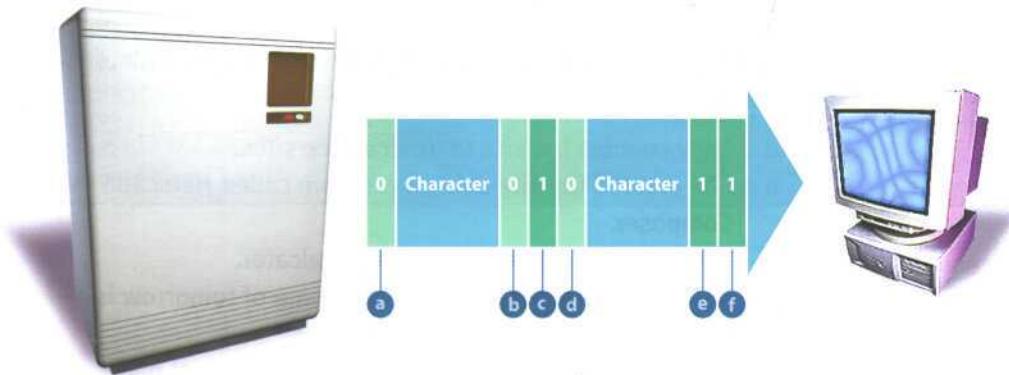


Fig 3  
Asynchronous transmission

**Student B**

Your text is on page 192. Your explanation should allow your partner to label this diagram.

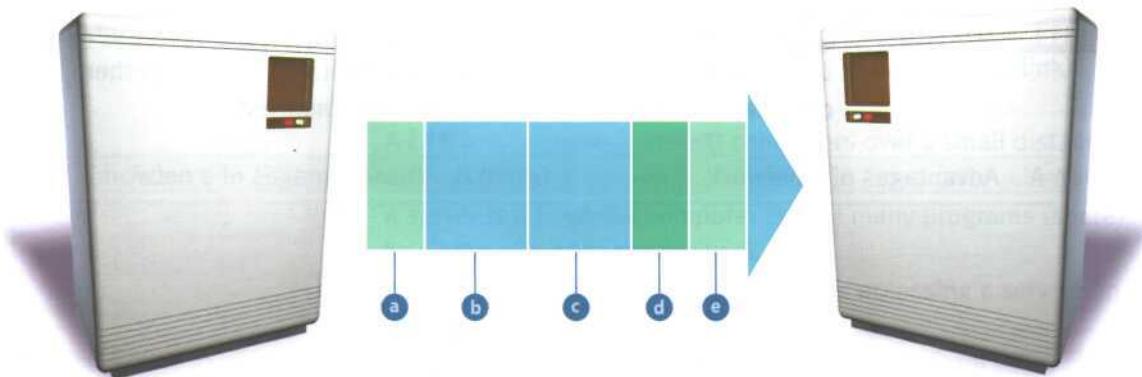


Fig 4  
Synchronous transmission

**WRITING**

**8** Using the lists you compiled in Task 6, describe the advantages and disadvantages of networks. Try to link some of the advantages and disadvantages as in these examples.

Advantages	Disadvantages
Allow data to be shared.  Users can share software on the server.	Permit viruses to spread quickly.  Server failure means no one can work.

- 1 Although networks allow data to be shared, they permit viruses to spread quickly.
- 2 Users can share software on the server; however server failure means that no one can work.

WHEN YOU HAVE FINISHED THE READING SECTION ON THE FOLLOWING PAGES,  
COME BACK TO THESE ADDITIONAL EXERCISES

**3 Identify which layer attaches the following headers to a network transmission:**

- a Specifying the language, the compression and encryption schemes
- b Identifying each segment's checksum and its position in the message
- c Containing the sequence of packets and the address of the receiving computer
- d Marking the beginning and end of the message and specifying whether the messages will be sent half-duplex or full-duplex
- e Identifying the sending and receiving computers

**4 Fill in the missing words in the following sentences then put the sentences in the correct order:**

- a The checksum is recalculated by the.....layer which also reassembles the message .....
- b The message is.....and.....by the presentation layer.
- c The message is reconverted into.....by the physical layer.
- d The session layer then sends the message to the next.....
- e The application layer converts the bits into .....characters, and directs the data to the correct.....
- f The incoming.....are recounted by the network layer for.....and billing purposes.
- g The.....layer confirms the arrival of the packets,.....them in, and calculates the .....for each packet.
- h The parts of the message are.....by the .....layer until the message is.....

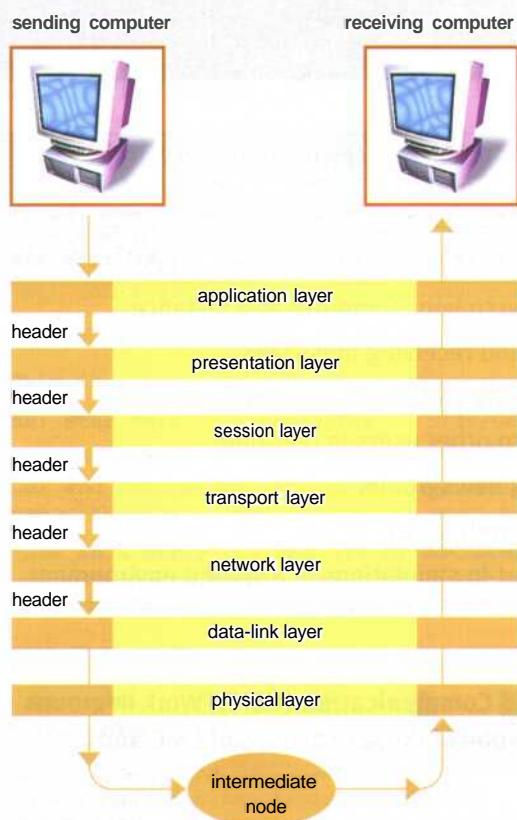
## SPECIALIST READING

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

- 1 Into what units is data subdivided by the following layers?  
 a transport layer  
 b network layer
- 2 What is the purpose of a transmission checksum test?
- 3 How long does the data-link layer keep a copy of each packet?
- 4 What processes can be carried out at intermediate nodes?
- 5 Which network communications layer is described by each of the following statements?  
 a Makes sure that the message is transmitted in a language that the receiving computer can understand  
 b Protects the data being sent  
 c Encodes and sends the packets  
 d Supervises the transmission  
 e The part of a communications process that a user sees  
 f Starts communications and looks after communications among network nodes  
 g Chooses a route for the message  
 h Makes backup copies of the data if required  
 i Confirms the checksum, then addresses and duplicates the packets

# Network Communications

- 1 The application layer is the only part of a communications process that a user sees, and even then, the user doesn't see most of the work that the application does to prepare a message for sending over a network. The layer converts a message's data from human-readable form into bits and attaches a header identifying the sending and receiving computers.
- 2 The presentation layer ensures that the message is transmitted in a language that the receiving computer can interpret (often ASCII). This layer translates the language, if necessary, and then compresses and perhaps encrypts the data. It adds another header specifying the language as well as the compression and encryption schemes.
- 3 The session layer opens communications and has the job of keeping straight the communications among all nodes on the network. It sets boundaries (called bracketing) for the beginning and end of the message, and establishes whether the messages will be sent half-duplex, with each computer taking turns sending and receiving, or full-duplex, with both computers sending and receiving at the same time. The details of these decisions are placed into a session header.
- 4 The transport layer protects the data being sent. It subdivides the data into segments, creates checksum tests - mathematical sums based on the contents of data - that can be used later to determine if the data was scrambled. It can also make backup copies of the data. The transport header identifies each segment's checksum and its position in the message.
- 5 The network layer selects a route for the message. It forms data into packets, counts them, and adds a header containing the sequence of packets and the address of the receiving computer.
- 6 The data-link layer supervises the transmission. It confirms the checksum, then addresses and duplicates the packets. This layer keeps a copy of each packet until it receives confirmation from the next point along the route that the packet has arrived undamaged.



- 7 The physical layer encodes the packets into the medium that will carry them - such as an analogue signal, if the message is going across a telephone line - and sends the packets along that medium.
- 50 8 An intermediate node calculates and verifies the checksum for each packet. It may also reroute the message to avoid congestion on the network.
- 55 9 At the receiving node, the layered process that sent the message on its way is reversed. The physical layer reconverts the message into bits. The data-link layer recalculates the checksum, confirms arrival, and logs in the packets. The network layer recounts incoming packets for security and billing purposes. The transport layer recalculates the checksum and reassembles the message segments. The session layer holds the parts of the message until the 60 message is complete and sends it to the next layer. The presentation layer expands and decrypts the message. The application layer converts the bits into readable characters, and directs the data to the correct application.
- 65

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

1 Match the term in Table A with the statement in Table B.

Table A

- a Bracketing
- b Half-duplex
- c Full-duplex
- d Checksum

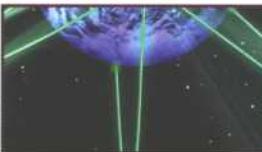
Table B

- i Transmission mode in which each computer takes turns sending and receiving
- ii Mathematical calculations based on the contents of data
- iii Set boundaries for the beginning and end of a message
- iv Transmission mode in which both computers send and receive at the same time

2 Mark the following statements as True or False:

- a Most of the work that an application does to prepare a message for sending over a network is not seen by the user.
- b ASCII is always used to transmit data.
- c The encryption layer compresses the message.
- d The network layer keeps track of how many packets are in each message.
- e The network layer keeps a copy of each packet until it arrives at the next node undamaged.
- f Analogue signals are used on ordinary telephonelines.
- g When a message arrives at its destination, it passes through the same seven network communications layers as when it was sent, but in reverse order.

► Additional exercises on page 77



# The Internet

**STARTER**

**1** Match each of the Internet services in Column A with the uses in Column B.

Column A	Column B
1 IRC	a logging on to your computer at a distance
2 MOOs	b sending and receiving messages
3 email	c downloading a file from a server
4 FTP	d chatting to other users in real-time
5 WWW	e accessing newsgroups
6 Telnet	f browsing webpages
7 Usenet	g taking part in simulations in a shared environment

**READING**

**2 Computer-Mediated Communication (CMC)** Work in groups of three, A, B, and C. Read one of these examples of CMC and complete this table.

Extract	A	B	C
Type of CMC			
Number of participants			
Topics			
Synchronous or asynchronous			
Special features of this type of CMC			

**Extract A**

Inside the lounge of the House of Language.

There is a television in the corner.

You see the following exits: east and north

Hank, Spartacus, Diana, Tony (resting)

Hank says, 'have any of you guys tried batmud?: :'

Diana says, 'no'

Spartacus says, 'what is it?'

Hank says, 'it's a virtual reality game. you'll find it at: bat.org'

Diana groans.

Diana says, 'these things are addictive. You spend \*hours\*on them. '

Rupert appears with a flash of lightning.

Spartacus says, 'we have a new participant. welcome Rupert!'

Rupert says, 'Thanks. How do you get to the kitchen?'

Hank says, 'type 'go kitchen'. You can find the instructions on 'help topics'.'

Rupert says, 'Do you use Telnet?'

Diana says, 'use tf... it's much better. '

## Extract B

**Re: Star Wars** moviebelle 3/10/00 3.25 pm

What can I say? I enjoyed the three older films but the new one was so cheesy and so un-Star Wars that it didn't seem to fit in with the others. I mean, it was so commercial and so inane. Maybe he was trying to appeal to the younger generation.

**This is a Reply to:** Msg 145 by pinkpanther

**Re: Star Wars** cinemachick 3/10/00 4.18 pm

you know, most of the star war fans I know are in their thirties. lol.

OH! and Unforgiven. that's a great western. it's so not the stereotypical western! I mean, there's no good guy. it's such a kick ass movie!

**This is a Reply to:** Msg 146 by moviebelle.

## Extract C

**From:** Allan Wind <allwind@ls.net>  
**Newsgroups:** alt.fan.elvis-presley  
**Sent:** 3 November 2000 10.51  
**Subject: Re:** Latest all-time Top 10 albums  
EG <eg@nospam.com> writes: >

>ONLINE VOTING  
><http://www.ultimatecharts.com>  
>  
>1Beatles Revolver  
>2 Beatles Sgt Pepper's Lonely Hearts Club Band  
>3 Elvis Presley The Sun Collection  
>4 Beach Boys Pet Sounds  
>5 Marvin Gaye What's Going On  
>6 Michael Jackson Thriller  
>7 Sex Pistols Never Mind The Bollocks  
>8 Nirvana Nevermind  
>9 Oasis (What's the Story) Morning Glory?  
>10 Beatles The Beatles (White Album)  
>  
>The voting is very close

I can't say what my top fave albums are but here are some artists I enjoy. ELVIS, ORION, Buddy Holly, Roy Orbison. Keep ELVIS #1 & Jimmy "ORION" Ellis king of the soundalikes, Allan.

**3** Compare results orally with the others in your group. Complete a table for each of the other extracts using the information the others provide.

## LANGUAGE WORK

## Warnings

**Where might you see these warnings?**

- 1 Never give out your home address or phone number.
- 2 This appliance must be earthed.
- 3 Avoid turning off main power while computer is running.
- 4 It is an offence to make unauthorised access to computer material.
- 5 No smoking, eating or drinking at the computer.
- 6 A machine which has been exposed to a moist atmosphere should be given time to dry out before being put into use.

**Warnings are used to ensure safety, to prevent damage to equipment and breaches of security, and to ensure the law is not broken. The simplest warnings are basic instructions NOT to do something:**

Don't do X.      Avoid Xing.  
No Xing.      Never do X.

Sometimes the warning is twinned with matching good practice:

Always do Y; never do X.

Do Y rather than doing X.

Warnings may be made stronger by using *must/must not* and in some cases *should/should not*. For example:

The wire linking a static earthing band to earth must contain a resistor of at least 1 megohm.

If there is any reason to fear the warning may not be understood, a reason for the warning may be added. For example:

Never remove ICs with a screwdriver. *The pins are very fragile.*

**4** Rewrite each of these warnings according to the prompt. Add a reason to the warning where you think it appropriate.

1

Don't give open access to PCs.

Avoid...

2

**You must not use your own  
floppies on these machines.**

Never...

3

No Coffee  
in this lab



... must not...

4

**Avoid giving financial information  
in a chat room.**

Don't ...

5

**NEVER GIVE OUT YOUR PASSWORD.**

Always...

6



Don't use out-of-date anti-virus software.

Use ...

7

Never use a computer that has been standing for a long time in a cold environment without waiting until it has reached normal room temperature.

Always...

8

Cards must not be removed from their anti-static packing until required.

Never ...

9

Use an IC extraction tool; don't use a screwdriver.

... rather than ...

10

Always ensure the power is switched off when working on a computer.

... must not...

5

Translate some of the rules for computer use in your own college or university into English. Compare your translations with others in your group and agree on the best English versions.

**PROBLEM-SOLVING****6 Choosing a free ISP** Read these hints on choosing a free ISP.

Then decide which of the options available offer the best deal to these users. Be prepared to defend your choice.

- 1 a household with a young family
- 2 a small home-based business
- 3 someone who enjoys online gaming
- 4 someone who doesn't want a lot of spam in their email

**Using a free ISP requires no new technology - all you need is a computer, a modem, a telephone line, and the appropriate software (which is available free of charge when you sign up with the service). Once installed on your PC you can access the Internet as normal, but your connection costs only the price of a local call, and you pay nothing else - not even for features such as an unlimited number of email addresses, unlimited Web space and original content.**

**Most of the services are very similar, but it is still worth looking around for a service that offers at least the following features:**

**CD-ROM or Online sign up**

Many free ISPs require you to sign up for their service online (which obviously means you already need to have an Internet connection and some experience with setting up a dial-up networking connection). If you are a complete beginner, you'll need a free ISP which can provide its sign-up software on CD-ROM that will automatically configure your computer to access the Internet.

**Local rate calls**

Although using the ISP is free, you still have to pay for your online time. Nearly all ISPs however provide local call access numbers. Any free ISP that uses a national rate number or charges an initial set up or administration fee should be avoided.

**Email**

Having several email accounts is very useful - you can separate business and personal email for example, or provide an address for each member of your family. Many free ISPs also offer only Web-based mail which is great if you need to get into your computer on the move as you can access it from any computer with Internet access. POP3 email however is faster and more efficient and can be downloaded to your PC to read offline - a combination of the two is ideal.

**Free Web space**

A decent amount of free Web space would be around 25-50Mb. This would be sufficient for most of your own personal website developments. Also check to see if there are any restrictions on your use of Web space, since some free ISPs will not let you use the space for commercial purposes.

**Newsgroups**

Newsgroups are huge discussion forums on the Internet that are an amazingly rich resource of information and a brilliant way to communicate with other Internet users. Unfortunately they are also the home to some of the most unsavoury content on the Internet (they are largely unmoderated) and as a result many free ISPs restrict access to some or all newsgroups.

**Customer Support**

Check support line charges; many free ISPs use their support lines as a source of revenue relying on your ignorance to make money from the call.

The target audience is generally Net novices and, as a result, support lines are pretty much jammed all day with queries and connection problems.

Most use premium rate telephone line charges. However, there are a few free ISPs who only charge local or national rates for their telephone helplines.

**Reliable Service**

Of course all the features in the world won't make a scrap of difference if the ISP is unreliable and you find it impossible to log on. Look out for recommendations from friends and shop around. Interestingly many of the more popular services have become saturated and seem to be in a constant 'upgrading the network' phase.

There is nothing to stop you having more than one free ISP account. Windows will even enable you to run a number of different free ISP connection set-ups on the same PC so you can easily have multiple accounts and just use the best one on the day.

**Option A****Bigwig**

- 7 POP3 email accounts each with up to 1,000 aliases
- Scans all emails for viruses before they reach you
- 15Mb free Web space
- Access to 25,000 newsgroups
- Technical support at 50p/minute
- Comprehensive online information and easy-to-follow help available

**Option B****Arsenal**

- 5 POP3 email accounts
- Access to most newsgroups
- 5Mb free Web space
- Technical support at 50p/minute

**Option C****ConnectFree**

- 5 POP3 email addresses each password-protected
- Full access to newsgroups
- Unlimited Web space
- Free online webpage design service
- Free access to online multiplayer games

**Option D****Bun**

- Unlimited email addresses
- 25Mb Web space
- Online help section
- Free access to CyberPatrol for blocking or restricting access to inappropriate content on the Web

**Option E****Free4all**

- Unlimited POP3 email accounts
- Email virus protection and junk email filters
- 25Mb of free Web space with option to increase at £1 per Mb per month
- Powerful enough to create quite advanced, functional sites
- Technical support at local call rates

For further details of ISPs try:

[www.net4nowt.com](http://www.net4nowt.com)

[www.ispa.org.uk](http://www.ispa.org.uk)

[www.ispc.org](http://www.ispc.org)

**WRITING**

**7** Write an article for a newsgroup of your choice. Keep it short and choose a meaningful reference name. Pass it to another student for a reply.

**8** If you have access to newsgroups, browse one of the groups dedicated to computing. They have the prefix *comp*. Write a reply to one of the articles posted there. You need not post your reply unless you are confident it will be helpful. Ask your fellow students to read it first.

## SPECIALIST READING

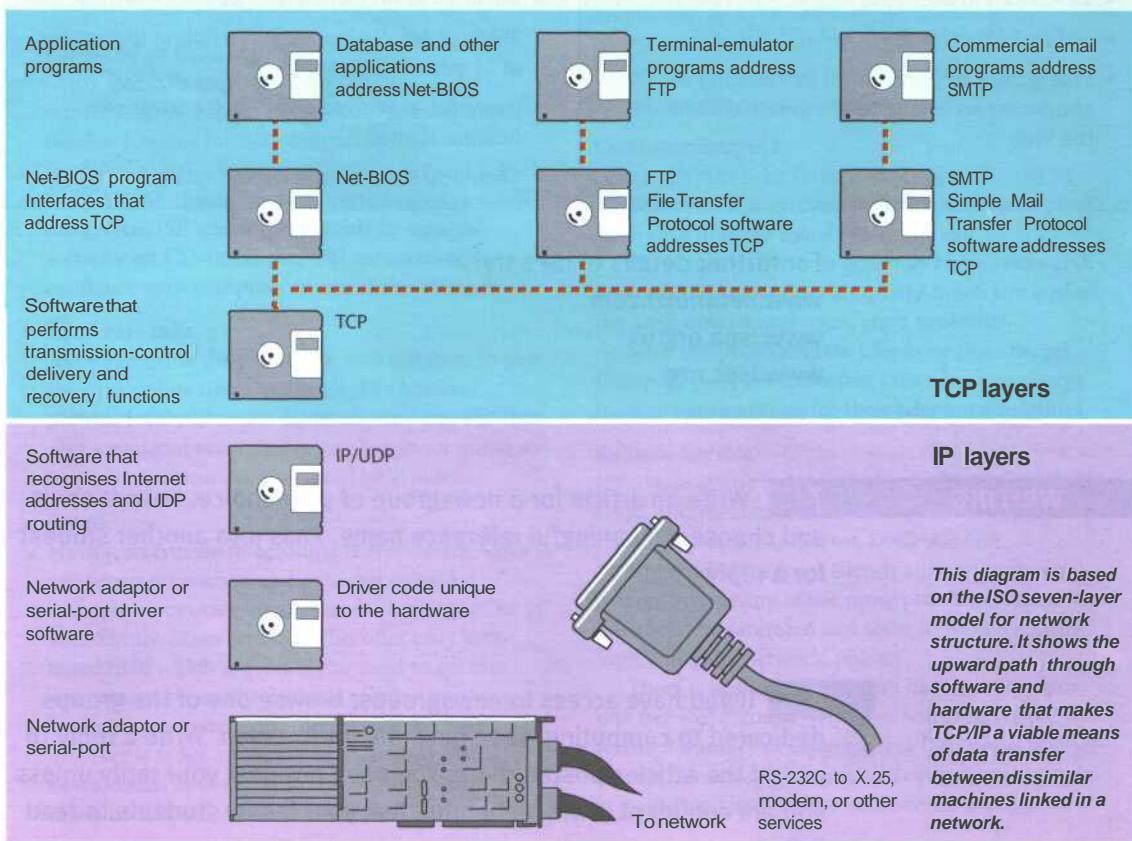
**A** Find the answers to these questions in the following text.

- What purpose does the Internet address have apart from identifying a node?
- What data-delivery systems are mentioned in the text?
- What do IP modules need to know about each other to communicate?
- How many Internet addresses does a gateway have?
- What does UDP software do?
- When does the TCP part of TCP/IP come into operation?
- What processes are performed by TCP software to provide reliable stream service?
- What standard protocols are mentioned which are used to deal with the data after TCP brings it into the computer?

## How TCP/IP Links Dissimilar Machines

At the heart of the Internet Protocol (IP) portion of TCP/IP is a concept called the Internet address. This 32-bit coding system assigns a number to every node on the network. There are various types of addresses designed for networks of different sizes, but you can write every address with a series of numbers that identify the major network and the sub-networks to which a node is attached. Besides identifying a node, the address provides a path that gateways can use to route information from one machine to another.

Although data-delivery systems like Ethernet or X.25 bring their packets to any machine electrically attached to the cable, the IP modules



- 15 must know each other's Internet addresses if they are to communicate. A machine acting as a gateway connecting different TCP/IP networks will have a different Internet address on each network. Internal look-up tables and software based on another standard - called Resolution Protocol - are used to route the data through a gateway between networks.

Another piece of software works with the IP-layer programs to move information to the right application on the receiving system. This software follows a standard called the User Datagram Protocol (UDP). You can think of the UDP software as creating a data address in the TCP/IP message that states exactly what application the data block is supposed to contact at the address the IP software has described. The UDP software provides the final routing for the data within the receiving system.

The Transmission Control Protocol (TCP) part of TCP/IP comes into operation once the packet is delivered to the correct Internet address and application port. Software packages that follow the TCP standard run on each machine, establish a connection to each other, and manage the communication exchanges. A data-delivery system like Ethernet doesn't promise to deliver a packet successfully. Neither IP nor UDP knows anything about recovering packets that aren't successfully delivered, but TCP structures and buffers the data flow, looks for responses and takes action to replace missing data blocks. This concept of data management is called reliable stream service.

After TCP brings the data packet into a computer, other high-level programs handle it. Some are enshrined in official US government standards, like the File Transfer Protocol (FTP) and the Simple Mail Transfer Protocol (SMTP). If you use these standard protocols on different kinds of computers, you will at least have ways of easily transferring files and other kinds of data.

Conceptually, software that supports the TCP protocol stands alone. It can work with data received through a serial port, over a packet-switched network, or from a network system like Ethernet. TCP software doesn't need to use IP or UDP, it doesn't even have to know they exist. But in practice TCP is an integral part of the TCP/IP picture, and it is most frequently used with those two protocols.

**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 Internet address
- b Resolution Protocol
- c Look-up table
- d Gateway
- e User Datagram Protocol
- f Transmission Control Protocol

Table B

- i Standard used for software that routes data through a gateway
- ii Standard used by software that moves information to the correct application on the receiving system of a network
- iii Standard used by software that manages communication exchanges between computers on the Internet
- iv A 32-bit number identifying a node on an IP network
- v Stored information used to route data through a gateway
- vi A device for connecting dissimilar networks

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

- a Internet addresses are an integral part of the IP protocol.
- b Internet addresses can be written as a series of numbers.
- c UDP software provides the final routing for data within the receiving system.
- d UDP recovers packets that aren't successfully delivered.
- e TCP only works with packet-switched networks.
- f TCP only works when it is combined with IP.



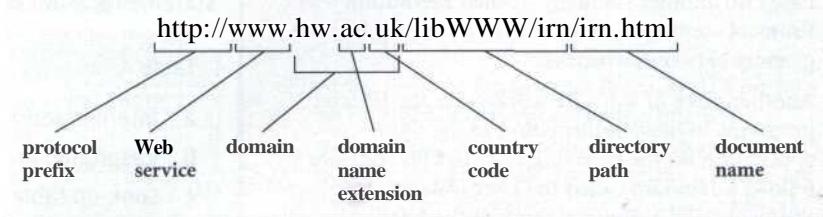
# The World Wide Web

## STARTER

**1**

Study this URL (Uniform Resource Locator).

**Fig 1**  
Uniform Resource Locator



Which part of the address tells you:

- 1 the company is in the UK
- 2 this is the webpage
- 3 the type of transmission standard your browser must use to access the data
- 4 this points to the computer where the webpage is stored
- 5 this is where the webpage is stored in the computer
- 6 this is a company
- 7 this is a Web file

- 2** Study these approved domain name extensions and their meanings. Then match these suggestions for new extensions to their meanings.

Extension	Meaning
.aero	aviation industry
.biz	businesses
.com (.co in UK)	commercial
.coop	cooperatives
.edu (.ac in UK)	educational and research
.gov	government
.info	general use
.int	international organisation
.mil	military agency
.museum	museums
.name	individuals
.net	gateway or host
.org	non-profit organisation
.pro	professionals

Suggested extension	Meaning
1 .firm	a informative
2 .store	b cultural or entertainment
3 .web	c personal
4 .arts	d firm or agency
5 .rec	e online retail shop
6 .info	f Web-related
7 .nom	g recreational

**LISTENING**

**3** Study this diagram which illustrates how your browser finds the webpage you want. Label these items:

- a Router
- b Domain Name System (DNS) server
- c Remote Web server
- d Browser PC
- e URL
- f Internet Protocol address

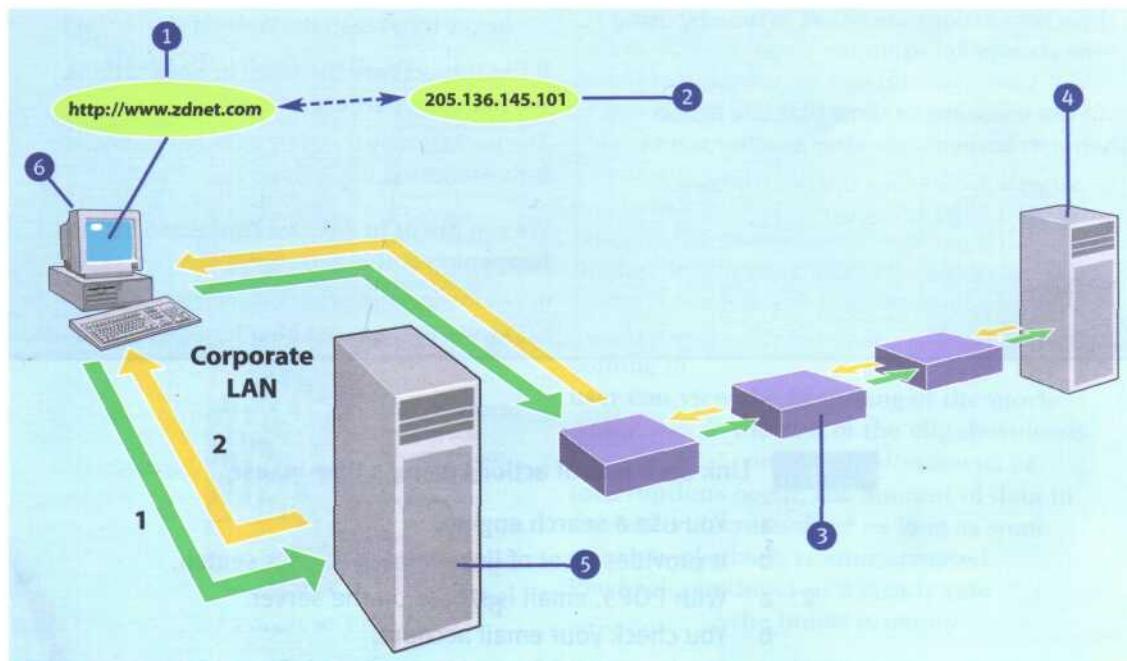


Fig 2

How your browser finds the page you want

**4** Now listen to this recording which explains how the process works and take brief notes on each stage. For example:

**Stage 1**

Click on a webpage hyperlink or URL.

The browser sends the URL to a DNS server.

**LANGUAGE WORK**

**Time clauses**

What is the relationship between each of these pairs of actions?

- 1 a You click on a URL.  
b Your browser sends it to a DNS server.
- 2 a The packets are passed from router to router.  
b They reach the Web server.
- 3 a The packets may travel by different routes.  
b They reach the Web server.
- 4 a The individual packets reach the Web server.  
b They are put back together again.

Each pair of actions is linked in time. We can show how actions are linked in time by using time clauses. For example:

We can use *when* to show that one action happens immediately after another action:

- 1 When you click on a URL, your browser sends it to a DNS server.

We can use *once* in place of *when* to emphasise the completion of the first action. It often occurs with the Present perfect. For example:

Once the DNS server has found the IP address, it sends the address back to the browser.

We can use *until* to link an action and the limit of that action:

- 2 The packets are passed from router to router until they reach the Web server.

We can use *before* to show that one action precedes another:

- 3 The packets may travel by different routes before they reach the Web server.

If the subjects are the same in both actions, we can use a participle:

The packets may travel by different routes before reaching the Web server.

We can use *as* to link two connected actions happening at the same time:

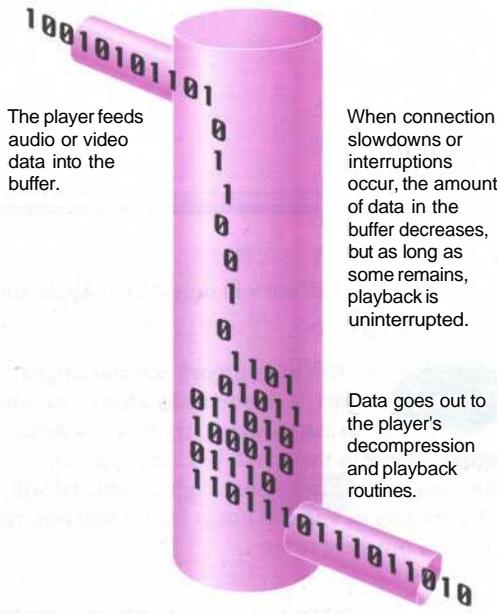
- 4 As the individual packets reach the Web server, they are put back together again.

**5** Link each pair of actions using a time clause.

- 1 a You use a search engine.  
b It provides a set of links related to your search.
- 2 a With POP3, email is stored on the server.  
b You check your email account.
- 3 a You have clicked on a hyperlink.  
b You have to wait for the webpage to be copied to your computer.

- 4 a You listen to the first part of a streamed audio file.  
b The next part is downloading.
  - 5 a The graphics can be displayed gradually.  
b The webpage is downloaded.
  - 6 a You receive an email message.  
b You can forward it to another address.
  - 7 a You click on a hyperlink.  
b The browser checks to see if the linked webpage is stored in the cache.
  - 8 a You can bookmark a webpage to make it easier to find in the future.  
b You find a webpage you like.
  - 9 a You type in a Web address.  
b You should press the Enter key.
  - 10 a You click on the Home button.  
b The browser displays your starting webpage.

**6** Fill in the gaps in this description of buffering, a way of ensuring that Web video runs smoothly.

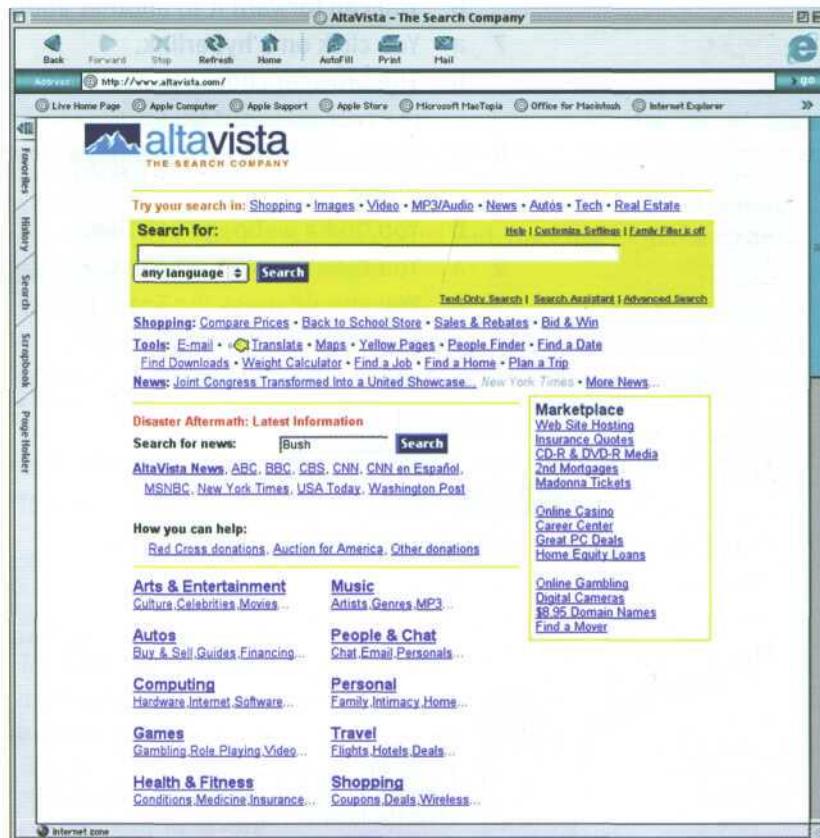


Streaming is a way of dealing with bandwidth problems.<sup>1</sup> You download video from the Internet. One key to successful streaming is the process of buffering.<sup>2</sup> When you download a movie, the video player stores part of the movie in memory.<sup>3</sup> While playing it, imagine the buffer as a container filled from the top as shown in Fig 3.<sup>4</sup> When the container is full, the player sends data on for playback from the bottom. Data keeps coming in.<sup>5</sup> While a clip plays, the user can view the beginning of the movie.<sup>6</sup> The rest of the clip downloads.<sup>7</sup> If connection slowdowns or interruptions occur, the amount of data in the buffer decreases but as long as some remains, playback is uninterrupted. Playback continues at a steady rate.<sup>8</sup> When the buffer is empty,

Fig 3  
**Video buffering**

**PROBLEM-SOLVING****7**

**Search engines** Study these tips for conducting searches using AltaVista. Then decide what you would type into the search box to find this data. Compare your answers with others in your group and together decide what would be the best search. Restrict sites to English language.

**Tip 1**

Don't use simple keywords. Typing in the word football is unlikely to help you to find information on your favourite football team. Unless special operators are included, AltaVista assumes the default operator is OR. If, for example, the search query is *American football*, AltaVista will look for documents containing either *American* or *football* although it will list higher those documents which contain both.

**Tip 2**

AltaVista is specifically case sensitive. If you specify apple as your search term, AltaVista will return matches for apple, Apple and APPLE. However, if you use

Apple or apPle, AltaVista will only match Apple and apPle respectively.

**Tip 3**

AltaVista supports natural language queries. If you really aren't sure where to start looking, try typing a natural language query in the search box. The question Where can I find pages about digital cameras? will find a number of answers but at least it will give you some idea of where to start.

**Tip 4**

Try using phrase searching. This is where you place quotation marks around your search term, e.g. 'alternative medicine'. This will search for all documents where these two words appear as a phrase.

**Tip 5**

Attaching a + to a word is a way of narrowing your search. It means that word must be included in your search. For example, if you were looking for information on cancer research, use +cancer +research instead of just cancer.

**Tip 6**

Attaching a - to a word or using NOT is another way of narrowing your search. This excludes the search item following the word NOT or the - sign. For example, science NOT fiction or science -fiction will exclude sites in which these two words occur together.

**Tip 7**

Use brackets to group complex searches, for example: (cakes AND recipes) AND (chocolate OR ginger) will find pages including cakes and recipes and either chocolate or ginger or both.

**Tip 8**

You can refine your search by doing a field search. Put the field, then a colon and then what you are looking for.

For example,

URL:UK +universities will find only British universities.

title: 'English language' will find only sites which contain this phrase in their titles.

**Tip 9**

AltaVista supports the use of wildcard searches. If you insert a \* to the right of a partial word, say hydro\*, it will find matches for all words beginning with hydro such as hydrocarbon and hydrofoil. Wildcards can also be used to search for pages containing plurals of the search terms as well as to catch possible spelling variations, for example alumin\*m will catch both aluminium (UK) and aluminum (US).

**Tip 10**

If you are looking for multimedia files then save yourself time by selecting images, audio or video with the radio buttons on AltaVista's search box and then entering your search.

- 1 a street map of Edinburgh, Scotland
- 2 train times between London and Paris
- 3 the exchange rate of your currency against the US dollar
- 4 a recipe for chocolate chip or hazelnut brownies
- 5 video clips of the Beatles
- 6 sumo wrestler competitions in Japan this year
- 7 the weather in New York city tomorrow
- 8 heart disease amongst women
- 9 New Zealand universities which offer courses in computing
- 10 Sir Isaac Newton's laws of motion

**8** Test your answers using AltaVista.

**WRITING**

**9** Write your own description of how your browser finds the page you want. Use Fig 2 to help you. When you have finished, compare your answer with the listening script to Task 4 on page 198.

**SPECIALIST READING**

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

- 1 Name three different email protocols mentioned in the text.
- 2 Which email protocol is used to transfer messages between server computers?
- 3 Why is SMTP unsuitable for delivering messages to desktop PCs?
- 4 Name two host-based mail systems mentioned in the text.
- 5 Where are email messages stored in an SMTP system?
- 6 What happens when you use your Web mail account to access a POP3 mailbox?
- 7 Give an advantage and a disadvantage of having an option to leave POP3 messages on the server.
- 8 What are the advantages of using the IMAP4 protocol?

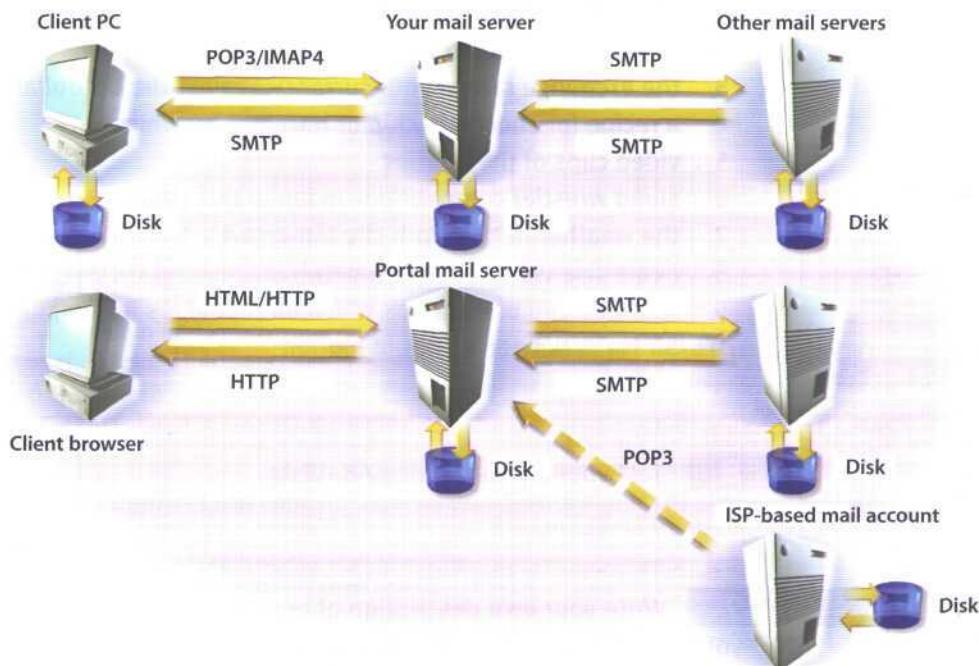
Web mail systems use some of the same protocols as client/server mail. Some can access an ISP-based POP3 mailbox, allowing you to read your mail anywhere you can find a browser.

# Email Protocols

Although the format of a mail message, as transmitted from one machine to another, is rigidly defined, different mail protocols transfer and store messages in slightly different ways. The mail system you're probably used to employs a combination of SMTP and POP3 to send and receive mail respectively. Others may use IMAP4 to retrieve mail, especially where bandwidth is limited or expensive.

## 10 Simple Mail Transfer Protocol

SMTP is used to transfer messages between one mail server and another. It's also used by email programs on PCs to send mail to the server. SMTP is very straightforward, providing only facilities to deliver messages to one or more recipients in batch mode. Once a message has been delivered, it can't be recalled or cancelled. It's also deleted from the sending server once it's been delivered. SMTP uses 'push' operation, meaning that the connection is initiated by the sending server rather than the receiver. This makes it unsuitable for delivering messages to desktop PCs, which aren't guaranteed to be switched on at all times.



- In host-based mail systems, such as Unix and Web mail, SMTP is the only protocol the server uses.
- Received messages are stored locally and retrieved from the local file system by the mail program. In the case of Web mail, the message is then translated into HTML and transmitted to your browser. SMTP is the only protocol for transferring messages between servers. How they're then stored varies from system to system.

### Post Office Protocol

- POP is a message-retrieval protocol used by many PC mail clients to get messages from a server, typically your ISP's mail server. It only allows you to download all messages in your mailbox at once. It works in 'pull' mode, the receiving PC initiating the connection. PC-based POP3 mail clients can do this automatically at a preset interval. When you use your Web mail account to access a POP3 mailbox, the mail server opens a connection to the POP3 server just as a PC-based application would. The messages are then copied into your Web mailbox and read via a browser.

Since POP3 downloads all the messages in your mailbox, there's an option to leave messages on the server, so that they can be picked up from different machines without losing any. This does mean that you'll get every message downloaded every time you connect to the server. If you don't clean out your mailbox regularly, this could mean long downloads. When using a Web mail account to retrieve POP3 mail, be careful about leaving messages on the server - if too many build up, each download will take a long time and fill up your inbox. Many Web mail systems won't recognise messages you've already downloaded, so you'll get duplicates of ones you haven't deleted.

### Internet Mail Access Protocol

- IMAP is similar in operation to POP, but allows you more choice over what messages you download. Initially, only message headers are retrieved, giving information about the sender and subject. You can then download just those messages you want to read. You can also delete individual messages from the server, and some IMAP4 servers let you organise your mail into folders. This makes download times shorter and there's no danger of losing messages.

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

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

- Different mail systems transfer emails in different ways.
- IMAP4 requires more bandwidth than the other email protocols.
- SMTP is used for sending emails from a PC to a server.
- SMTP delivers messages one at a time.
- SMTP does not allow a delivered message to be cancelled.
- SMTP is only one of many protocols used to send mail between servers.
- POP protocol allows the user to download one message at a time.

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

Table A

- SMTP
- 'Push' operation
- POP
- 'Pull' operation
- IMAP

Table B

- An email transfer process in which the connection is initiated by the sending computer rather than the receiving computer.
- A mail transfer protocol that initially only retrieves the message headers.
- An email transfer process in which the receiving computer initiates the connection.
- A simple mail transfer protocol that is used to send messages between servers.
- A message-retrieval protocol that downloads all email messages at the same time.



# Software Engineering

**STARTER****1**

Put these five stages of programming in the correct sequence.

- a Design a solution
- b Code the program
- c Document and maintain the program
- d Clarify the problem
- e Test the program

**2**

To which stage do each of these steps belong?

- 1 Clarify objectives and users
- 2 Debug the program
- 3 Write programmer documentation
- 4 Do a structured walkthrough
- 5 Select the appropriate programming language

**LISTENING****3**

You are going to hear an interview between a systems analyst and a hotel owner who wants to introduce a better computer system. What questions do you think the analyst will ask? Make a list; then compare your list with others in your group.

**4**

Listen to the recording to compare your list of questions with those asked by the analyst.

**5**

Listen again to find the answers to these questions:

- 1 What system does the hotelier have at present?
- 2 What problem is there with the existing system?
- 3 What form of output does the hotelier want?
- 4 Who will use the new system?
- 5 Which members of staff will require the most training?
- 6 What concerns has the hotelier about the new system?
- 7 What kind of hardware will be required?
- 8 What is the next step?

## LANGUAGE WORK

Revision: *If X, then Y*

In this section, we will revise structures commonly used in programming. You have met these structures in earlier units but in different contexts.

Study this decision table. It shows the rules that apply when certain conditions occur and what actions to take. Using it, we can make rules like this:

- 1 *If a guest stays 3 nights in January and if one night is Sunday, then charge 2 nights at full price and 1 night at half-price.*
- 2 *If a guest stays 3 nights and one night is not Sunday and it is not January, then charge 3 nights at full price.*

CONDITIONS	DECISION RULES	
	1	2
guest stays 3 nights	Y	Y
1 night is Sunday	Y	N
month is January	Y	N
Actions		
charge 3 nights at full price	N	Y
charge 2 nights at full price	Y	N
charge 1 night at half-price	Y	N

6 Now make similar statements about this decision table.

Conditions	Decision Rules					
	1	2	3	4	5	6
guest books bed and breakfast	Y	Y	Y	N	N	N
guest books half-board	N	N	N	Y	Y	N
guest books full-board	N	N	N	N	N	Y
and guest has lunch	N	Y	N	N	Y	-
and guest has dinner	N	N	Y	-	-	-
Actions						
charge rate A	Y	Y	Y	N	N	N
charge rate B	N	N	N	Y	Y	N
charge rate C	N	N	N	N	N	Y
charge menu price less 20%	N	Y	Y	N	Y	N

## LANGUAGEWORK

## Do until, do while

Study these extracts from a program flowchart.

They show iteration or loop structures in which a process is repeated as long as certain conditions remain true.

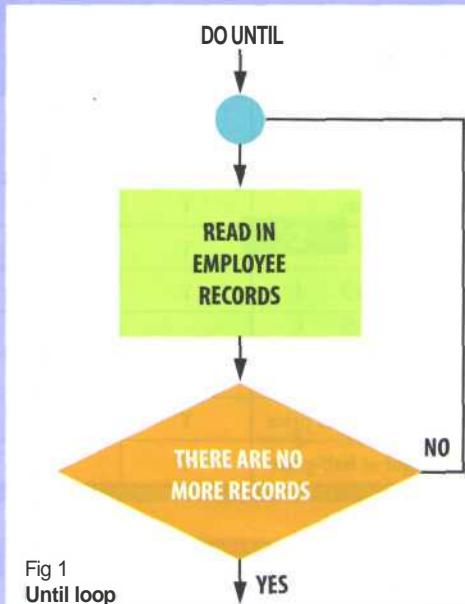


Fig 1  
Until loop

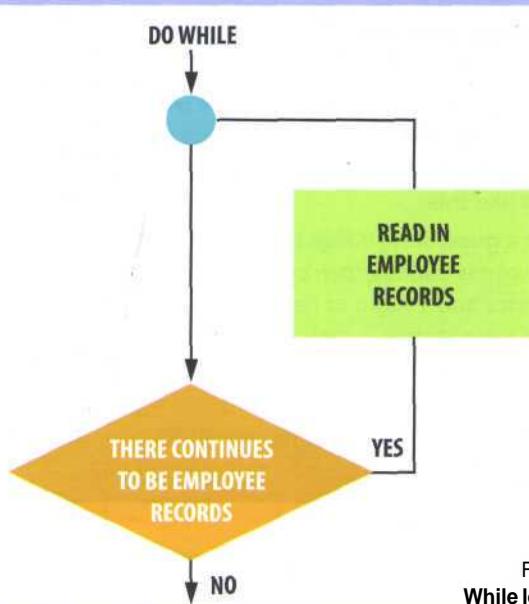


Fig 2  
While loop

We can describe these structures like this:

- 1 Read in the employee records *until* there are no more employee records.

Note that *until* links an action and the limit of that action.

- 2 Read in the employee records *while* there continues to be employee records.

Note that *while* links actions or states happening at the same time.

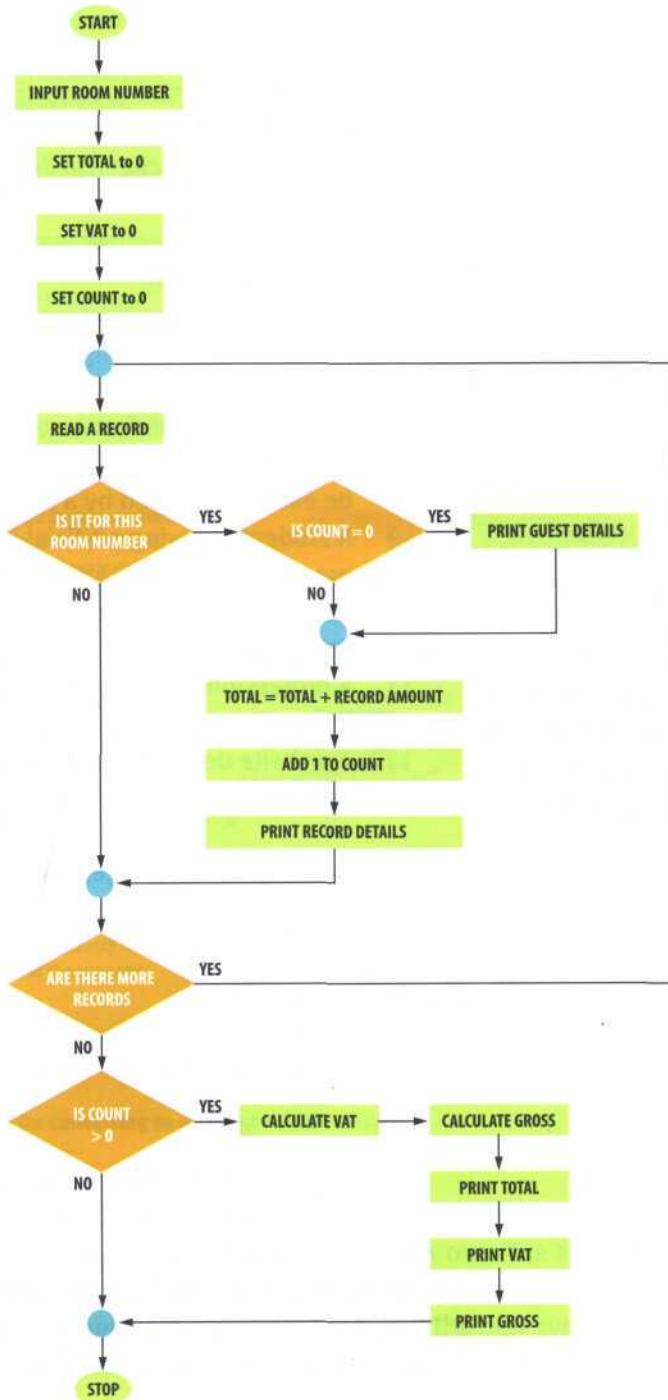
## 7

Link these statements with *while* or *until*, whichever is most appropriate.

- 1 Calculate all sales. There are no more sales.
- 2 Search for records containing the term. There are still records containing the term.
- 3 Total extra items. Extra items remain.
- 4 Search member records. There are no more records.
- 5 Print all addresses. There are still addresses available.
- 6 Display client names. There are no names remaining.
- 7 List all guests. There are no guests left.
- 8 Total monthly sales. There are no more sales for the current year.

**8** Flowcharts are sometimes used for designing parts of programs. Describe this extract from a program flowchart using the structures revised in this unit and the sequence expressions listed in Unit 2, Task 11.

Fig 3  
Hotel accommodation invoicing flowchart



**SPEAKING****9**

Work in pairs, A and B. You each have information about some programming languages. Together decide what would be the most appropriate language to use for each of these situations.

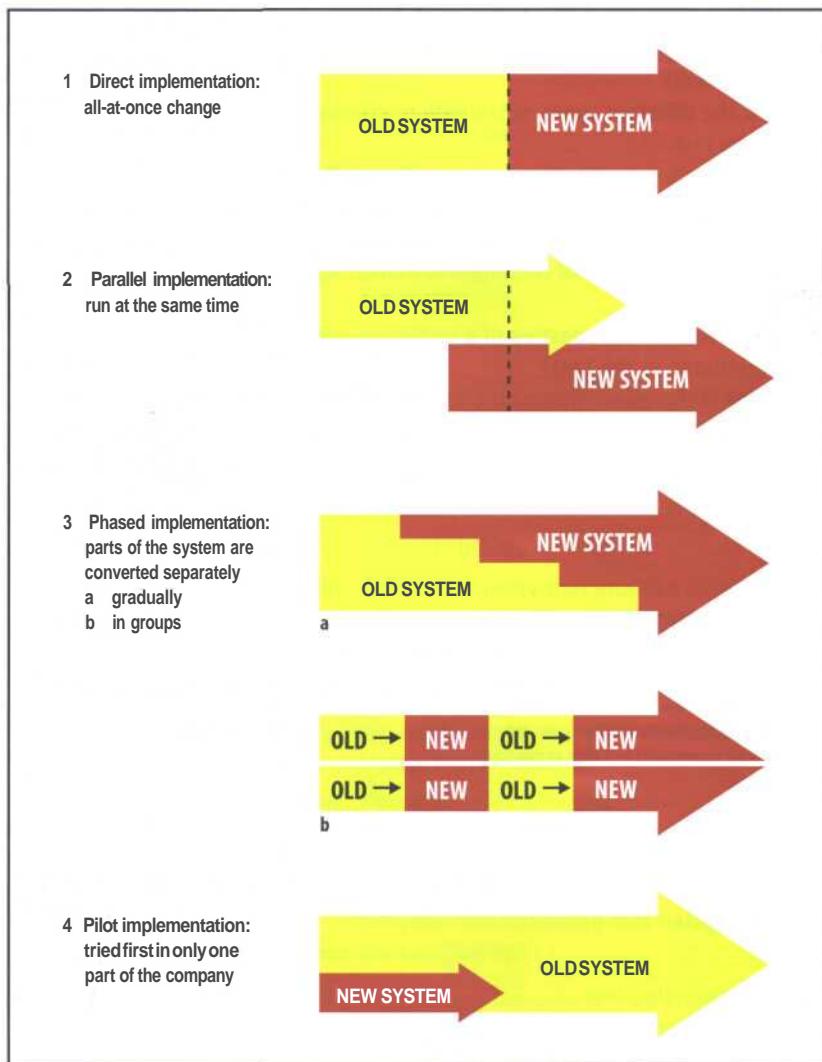
- 1 A schoolteacher wants his young pupils to learn some basic mathematics by controlling a simple robot.
- 2 The owner of a small business wants to create a simple database program to keep track of his stock.
- 3 An engineer wants to develop a program for calculating the stresses in a mechanical device.
- 4 A student wants to create webpages for a personal website.
- 5 A systems programmer wants to add some new modules to an operating system.
- 6 A programmer working for the US army wants to create a program for controlling a new type of weapon.
- 7 A finance company needs to process data from its branch offices on its mainframe computer.
- 8 A website designer wants to enable the data on his website to be easily processed by a number of different programs.
- 9 A student studying artificial intelligence wants to write some programs for a course project.
- 10 A college lecturer wants his students to learn the principles of programming.
- 11 A professional programmer wants to create and sell a program for use in language learning.
- 12 A website designer wants to password-protect a section of a website.

**Student A** Your languages are on page 188.

**Student B** Your languages are on page 194.

**WRITING****10**

**Converting to a new system** Write a paragraph describing each of these strategies for converting to a new computer system. Explain what its advantages and disadvantages are. The first strategy is described for you as an example.



**Fig 4**  
**Strategies for converting to a new computer system**

1 *Direct implementation:*

Direct implementation means that the user simply stops using the old system and starts using the new one. The advantage is that you do not have to run two systems at the same time. The disadvantage of this approach is that if the new system does not operate properly, there is nothing to fall back on.

**SPECIALIST READING**

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

- What advantages of using object-oriented programming are mentioned in the text?
- What are the three key features of OOP?
- What multimedia data types are referred to in the text?
- List the different types of triangle mentioned in the text.
- What feature avoids the problem of deciding how each separate type of data is integrated and synchronized into a working whole?
- What specific type of rectangle is named in the text?
- What common properties of a rectangle are mentioned in the text?
- What features are made quicker by code reusability?

**OBJECT-ORIENTED PROGRAMMING**

One of the principal motivations for using OOP is to handle multimedia applications in which such diverse data types as sound and video can be packaged together into executable modules.

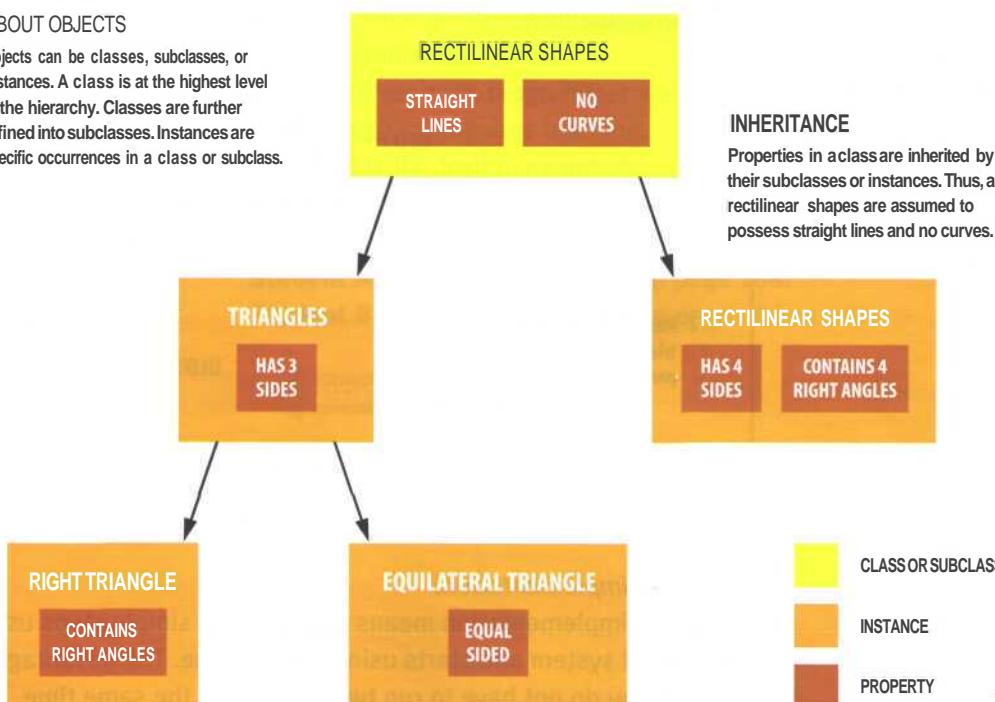
- 5 Another is writing program code that's more intuitive and reusable; in other words, code that shortens program-development time.

Perhaps the key feature of OOP is encapsulation - bundling data and program instructions into

- 10 modules called 'objects'. Here's an example of how objects work. An icon on a display screen might be called 'Triangles'. When the user selects the Triangles icon - which is an object composed of the properties of triangles (see fig. below) and  
 15 other data and instructions - a menu might appear on the screen offering several choices. The choices may be (1) create a new triangle and (2) fetch a triangle already in storage. The menu, too, is an object, as are the choices on it. Each  
 20 time a user selects an object, instructions inside the object are executed with whatever properties or data the object holds, to get to the next step. For instance, when the user wants to create a

**ABOUT OBJECTS**

Objects can be classes, subclasses, or instances. A class is at the highest level of the hierarchy. Classes are further refined into subclasses. Instances are specific occurrences in a class or subclass.

**INHERITANCE**

Properties in a class are inherited by their subclasses or instances. Thus, all rectilinear shapes are assumed to possess straight lines and no curves.

triangle, the application might execute a set of instructions that displays several types of triangles - right, equilateral, isosceles, and so on.

Many industry observers feel that the encapsulation feature of OOP is the natural tool for complex applications in which speech and moving images are integrated with text and graphics. With moving images and voice built into the objects themselves, program developers avoid the sticky problem of deciding how each separate type of data is to be integrated and synchronized into a working whole.

A second key feature of OOP is inheritance. This allows OOP developers to define one class of objects, say 'Rectangles', and a specific instance of this class, say 'Squares' (a rectangle with equal sides). Thus, all properties of rectangles - 'Has 4 sides' and 'Contains 4 right angles' are the two shown here - are automatically inherited by Squares. Inheritance is a useful property in rapidly processing business data. For instance, consider a business that has a class called 'Employees at the Dearborn Plant' and a specific instance of this class, 'Welders'. If employees at the Dearborn plant are eligible for a specific benefits package, welders automatically qualify for the package. If a welder named John Smith is later relocated from Dearborn to Birmingham, Alabama, where a different benefits package is available, revision is simple. An icon representing John Smith - such as John Smith's face - can be selected on the screen and dragged with a mouse to an icon representing the Birmingham plant. He then automatically 'inherits' the Birmingham benefit package.

A third principle behind OOP is polymorphism. This means that different objects can receive the same instructions but deal with them in different ways. For instance, consider again the triangles example. If the user right clicks the mouse on 'Right triangle', a voice clip might explain the properties of right triangles. However, if the mouse is right clicked on 'Equilateral triangle' the voice instead explains properties of equilateral triangles.

The combination of encapsulation, inheritance and polymorphism leads to code reusability. 'Reusable code' means that new programs can easily be copied and pasted together from old programs. All one has to do is access a library of objects and stitch them into a working whole. This eliminates the need to write code from scratch and then debug it. Code reusability makes both program development and program maintenance faster.

### 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 OOP
- b Encapsulation
- c Object
- d Menu
- e Square
- f Polymorphism
- g Library

Table B

- i An OOP property that allows data and program instructions to be bundled into an object
- ii A list of choices
- iii An OOP property that enables different objects to deal with the same instruction in different ways
- iv A reusable collection of objects
- v A module containing data and program instructions
- vi Object-Oriented Programming
- vii A rectangle with equal sides

#### 2 Complete the following text using words from the reading text:

Encapsulation, ..... and polymorphism are key features of ..... programming. Encapsulation allows data and program instructions to be bundled together in ..... called objects. Inheritance means that specific ..... of a class of objects ..... the properties of the class of objects. Polymorphism means that instructions are treated differently by different ..... . The combination of these ..... features of OOP means that program code is reusable. This speeds up ..... and ..... of programs.