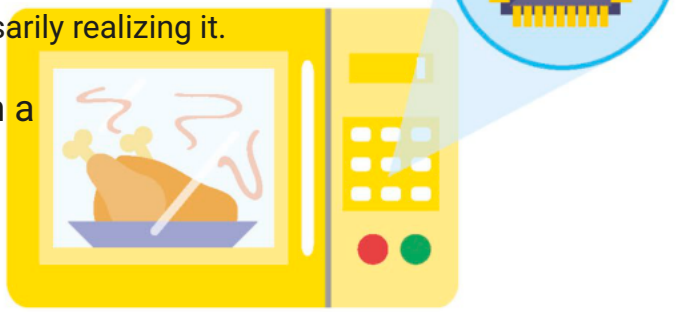
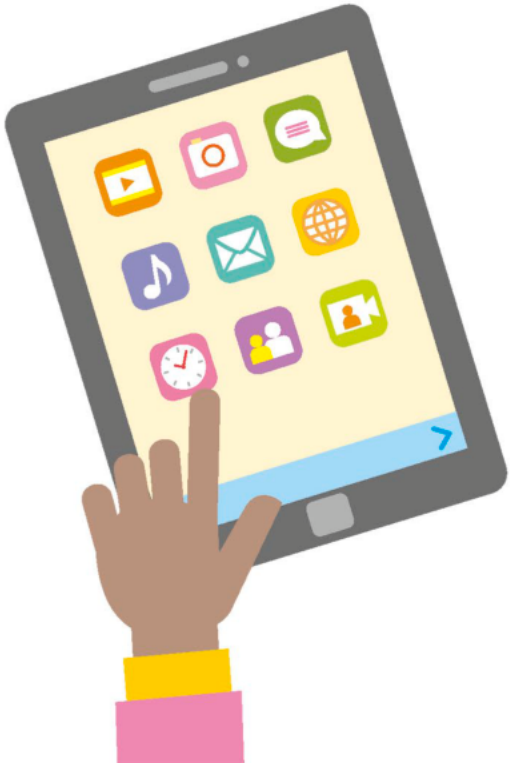
# Computers are everywhere

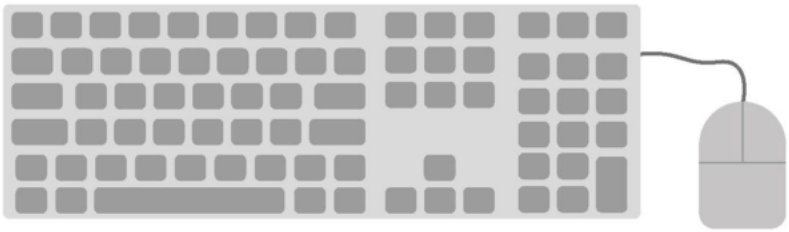
SEE ALSO
Computing for you 16–17›
Inside a computer 34–35›
Peripheral devices 36–37›
The computer chip 38–39›
What is hardware? 48–49›
Smartphones and tablets 52–53›

Some people feel computers are too complex for them to use without special skills and knowledge. However, they interact with computers all the time without necessarily realizing it.

Look closely Pressing the buttons on a







microwave's control panel runs

Computers are almost everywhere, not just in the code on its internal microprocessor. conventional setup that includes a monitor, keyboard,

and mouse. They are also found in everyday devices

such as mobile phones, lifts, televisions, and cars. From

watching movies to playing games, and even making

dinner, computers can be used to do almost anything.

## Household devices

Many household devices contain computers. Selecting a program on a microwave, for

example, actually runs a small program on

the computer embedded in the device.

## Hardware and software

The physical parts of a computer are called hardware. These

include things we can see, such as the monitor and computer

case, as well as things we can't see, such as the motherboard and

microprocessor inside the computer case. Things like programs,

the operating system, and firmware (a type of program that is

embedded into the microprocessor) are called software. They

allow users to access the capabilities of the hardware.

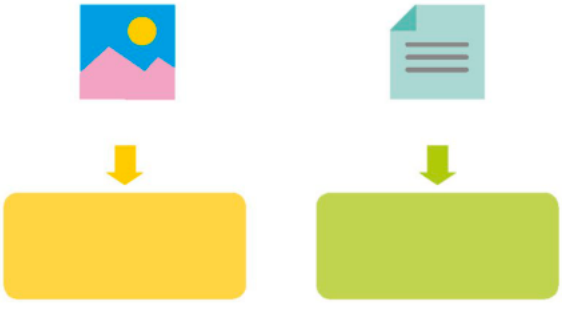
## Input devices

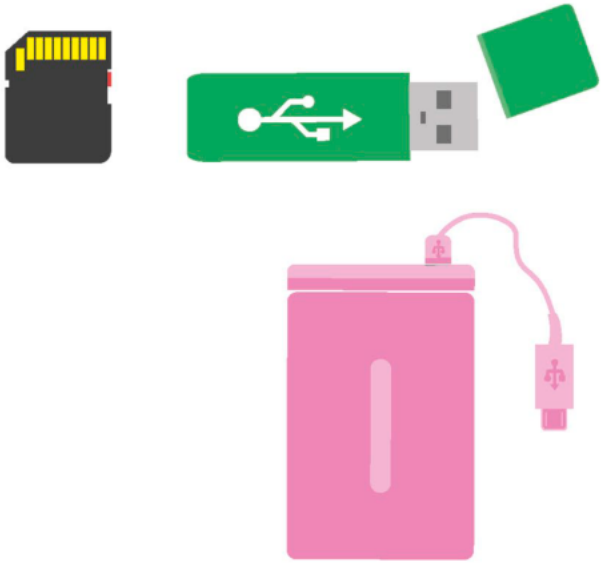
There are a lot of ways to input information and

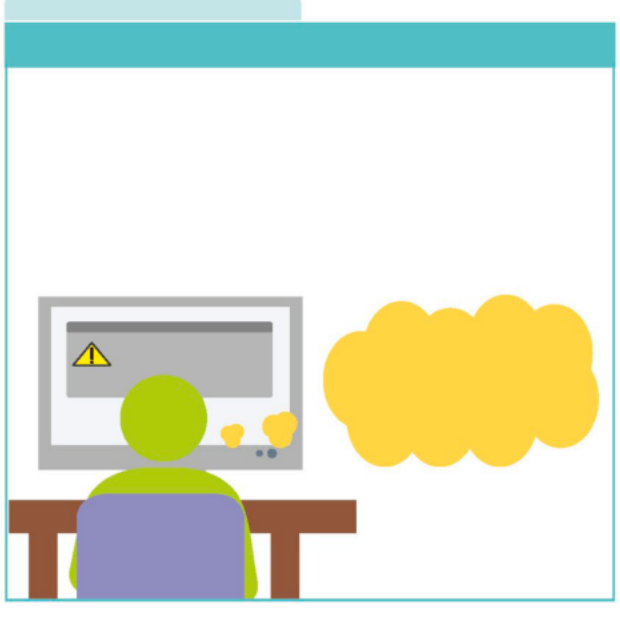
interact with software running on a computer.
The most common ways to do this are by using

a keyboard, a mouse, or a touchscreen.

Looking for files Moving data







Searching for files on a computer is similar to finding them in a real-world filing cabinet. The file system on a computer is usually accessed using a window containing small icons of folders or documents. A folder can be opened to display the files inside by touching with a finger on a touchscreen or double-clicking with a mouse or trackpad.

There are various ways to transfer data between computers. Emails can be used to attach pictures, documents, and other files to a message. There are also systems, such as Google Drive or Dropbox that allow people to upload large files and folders to the cloud. These can be shared with others through a link to the uploaded file, which can then be downloaded, or even edited online.

| Searching for files | Secure Digital | USB pen drive |
|---|---|---|

The best way to look for a file is to find the magnifying glass icon. Then, click on it and type the filename or keywords in the search bar.

(SD) memory card

u Removable storage

You can also move files between computers through storage devices such as USB pen drives and removable hard drives. Data can be stored on memory cards, which can be plugged into computers to be read.

| .jpg | .docx | Removable hard dri |
|---|---|---|

| Image viewer | Text viewer | REALWORLD |
|---|---|---|

Opening files

Saving and backing up

A filename usually includes a full stop followed by some letters. Computers and applications can crash without warning. To
This is the file extension, which identifies the type of file and tells avoid losing important work, it's good practice to save a file
the computer what kind of program it should use to open it. frequently while working on it. It's also useful to back up files

using either a separate hard disk or an online backup service.

These services are a part of cloud computing, where people

use the storage facilities of a specialist provider to save data.

System crash

At least my data is saved on the cloud!

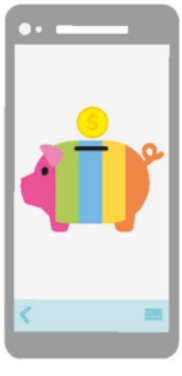
In the bin

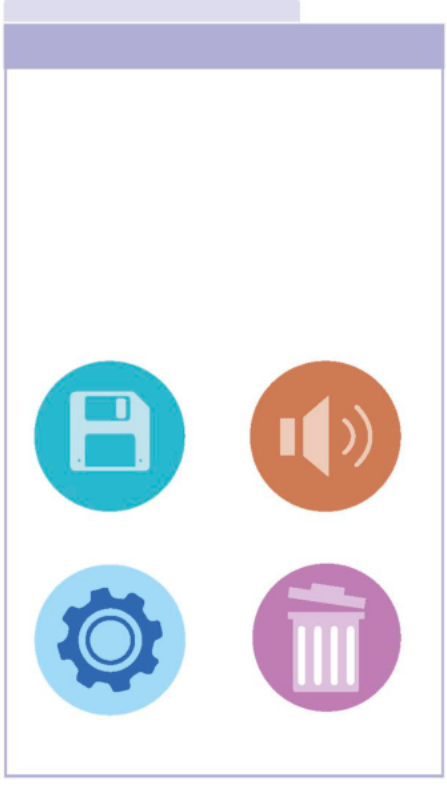
Deleting a file by mistake is quite common.

Deleted files usually go into the recycle or trash

bin, and can be restored by opening the bin

and taking the file out.





# Computing for you

SEE ALSO

‹14–15
Computers are everywhere

Operating systems 44–45›

Software is programs that allow people to use a computer's hardware. Most computers come with pre-installed software, but additional pieces of software are also widely available.

Desktop computers and laptops 50–51›

## System software

System software allows user applications to run on the computer's hardware.

The operating system (OS) – which controls the computer's basic functions – is the most common example. It makes the computer work by displaying information on the screen and getting user input from the keyboard, touchscreen, or mouse. For computer security, it's important to install any updates that become available for the OS.

Different operating systems
There are many operating systems available.
Microsoft Windows and Linux are the most commonly used ones. Apple machines use a specific operating system, called macOS.

| Windows | Linux | macOS |
|---|---|---|

## Application software I N D E P T H

| | |
|---|---|
| Application software is designed to complete specific tasks on a computer. Some of these are paid, as either a one-off purchase or | Icons |

a monthly subscription. Others may be free to download and use.

Small symbols representing applications

A lot of free software is also open source, which enables users to

or functions on a computer are called icons.
see and modify the application's code.

They make it easier for people to use their

computer. Many functions are symbolized by similar icons across different operating systems – for instance, a floppy disk

denoting the save option, or a magnifying

glass symbolizing the search option.

Save Volume

Email Banking

Different platforms

Application software is available for
different types of device.
Those used for mobile phones and tablets are usually known

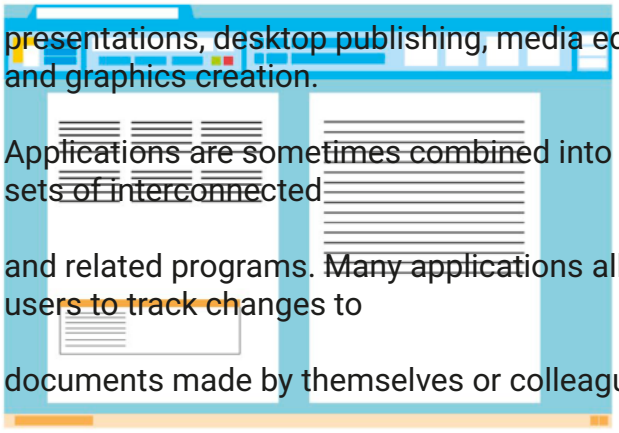
| | | |
|---|---|---|
| as apps. Apps can perform a variety of tasks, such as sending | Settings | Trash |

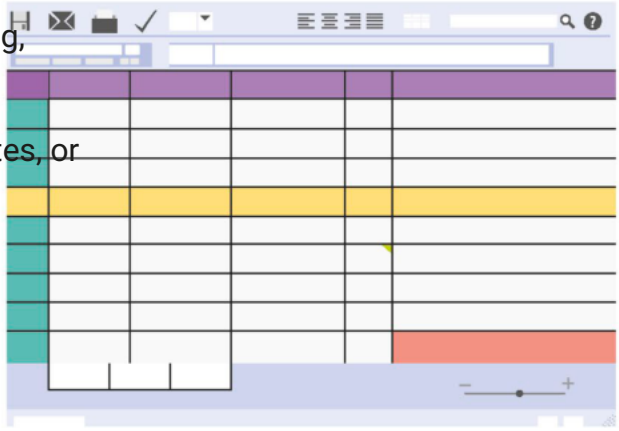
emails, social networking, and even banking.

## Types of application software

Modern application software comes in a variety of forms. Some popular

types include software for email, word processing, spreadsheets, databases,





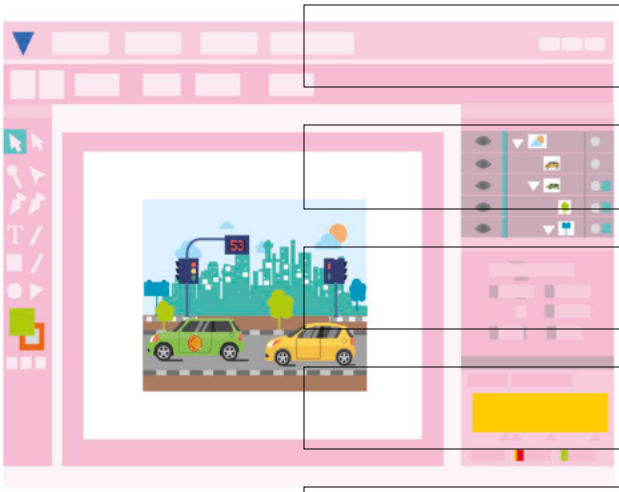
presentations, desktop publishing, media editing, and graphics creation.

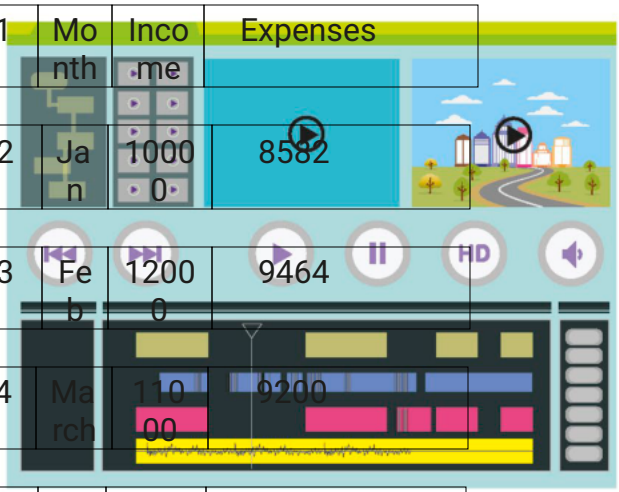
Applications are sometimes combined into suites, or sets of interconnected

and related programs. Many applications allow users to track changes to

documents made by themselves or colleagues.

| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | Month | Income | Expenses | | |
| 2 | Jan | 10000 | 8582 | | |
| 3 | Feb | 12000 | 9464 | | |
| 4 | March | 11000 | 9200 | | |
| 5 | April | 12000 | 9500 | | |
| 6 | May | 10000 | 8580 | | |





7

| | | | |
|---|---|---|---|
| 8 | Sum | 55000 | 45326 |

9

Words Numbers

Word processors are one of the most widely used applications. Spreadsheets allow users to work with numbers and

They can be used to create many styles of document, from a other data, applying mathematical and statistical

simple letter or business contract, to a complex report or even formulae. They can be used for simple tasks, such as

a whole book. A very simple version of a word processor is called basic accounts, and also for complex analyses of data.

a text editor, but this is solely for text and can’t handle images.

Images Videos

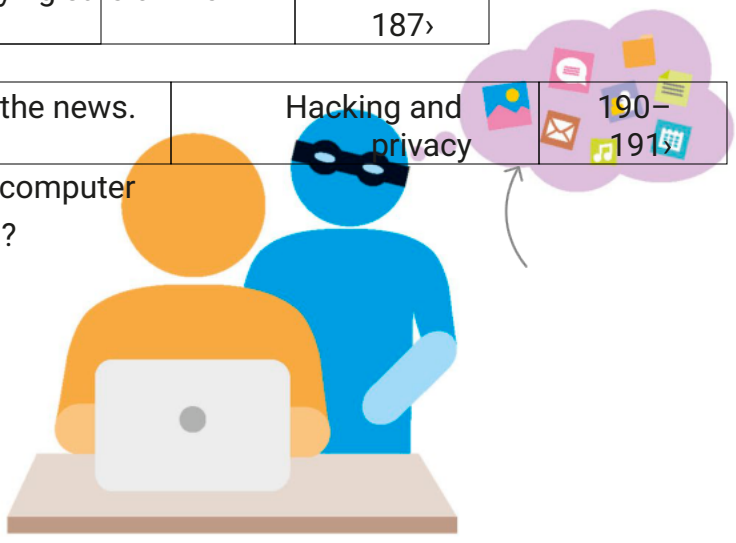
With the spread of digital cameras, many people use Video applications allow users to adjust and improve lighting
computers to organize and edit pictures. Photo editing and colour, and add special effects. They can also edit video
applications allow users to modify their pictures – for clips, combine clips into longer videos, and add titles and
instance, by altering the lighting and colour. transitions – such as crossfades – between scenes.

# Cybersecurity

SEE ALSO
Malware 156–157›
Staying safe online 186–187›
Hacking and privacy 190–191›

Cybersecurity is an issue that's often in the news.

Exactly what is it though? And how can computer users protect themselves and their data?



## What is cybersecurity?

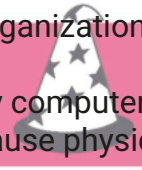
Cybersecurity is the protection of computers and

data from attacks by malicious individuals on the

internet. Attacks can include stealing data, such as

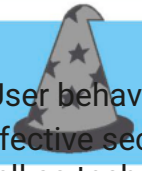
a person's banking details, or infecting computers with viruses that lock users out of their machine. In organizations where physical systems are controlled by computers, it's even possible for cyber attacks to cause physical damage to equipment.

Hackers can steal all kinds of data if they gain access to a computer.



### User behaviour

Effective security depends on user behaviour as well as technical safeguards.



### Social engineering,

where hackers use psychological tricks and insights

to deceive people and gain access to computer

systems, is a very successful technique.

## Hacked computers L I N G O

Once a hacker gains access to a computer, there are many ways to harm its Hacking methods

| | |
|---|---|
| owner, their family, or colleagues. Computers contains a lot of information<br><br>its owner would not want others to have. Data such as passwords, documents,<br><br>emails, and photographs can all be copied and used for criminal purposes. | Brute-force attack: trying all possible<br>password values to find one that works |

Distributed Denial of Service (DDoS):
overloading a website with fake traffic

White hat so that it becomes unavailable

| | |
|---|---|
| These hackers use their skills to help people. They obtain<br><br>permission to hack into systems to identify weaknesses | Keylogger: a program that secretly records |

for the owners. every key pressed by a user

Phishing: impersonating a website via email to get users to reveal login details

| | |
|---|---|
| Grey hat<br><br>These hackers hack into systems without permission,<br><br>which is a crime, but subsequently tell the system owners | Social engineering: manipulating<br><br>someone to gain access to their data |

about any flaws they find. Virus: a malicious program that spreads to other computers by replication

Black hat

Black hat hackers hack into systems without permission in order to steal data or cause disruption to the system's operation and its owners.

Types of hacker

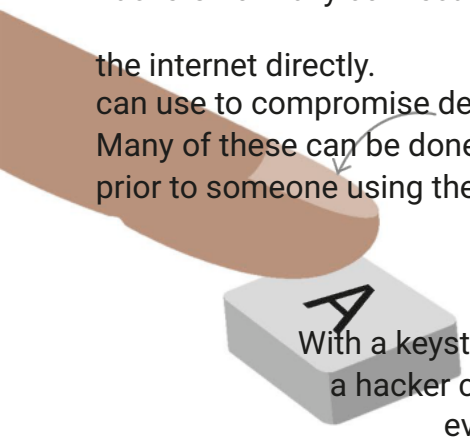
Hackers are often described in terms of hat colours. This comes from cowboy films where heroes wore white hats and villains wore black.

## Stealing data

Data is valuable, particularly personal information or financial data. There are a number of methods hackers normally connect to

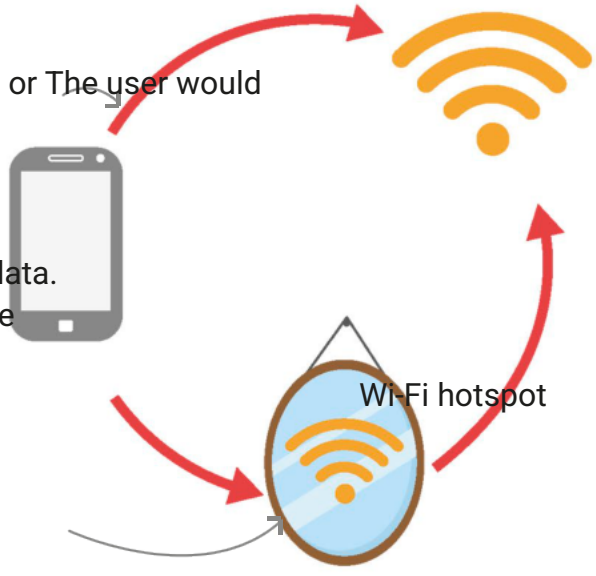
the internet directly.
can use to compromise devices in order to steal data. Many of these can be done remotely, or some time prior to someone using the device.

The user would



With a keystroke logger a hacker can read everything typed,

including any passwords.




Device connecting to Wi-Fi

The mirroring device looks and

acts just like the regular hotspot,

but the hacker can see everything

people connected to it do online.

u Keyloggers u Wi-Fi mirror

Wi-Fi mirror

1. Use secure sites for making online payments
2. Clear browser cache
3. Update computer software
4. Use trusted Wi-Fi connections
5. Download files only from trusted sources
6. Log out of a session once you have finished

Keystroke loggers are programs that silently store every key Hackers can use Wi-Fi mirroring devices that mimic public

pressed on the computer they're installed on. They are often Wi-Fi hotspots. Instead of connecting directly to the hotspot,

used to steal users'passwords and bank details. Both software unsuspecting users connect to the mirror device, and as they

and hardware keystroke loggers exist. browse online, the hacker can see what they do.

## Staying safe from scammers Hazards and good practices

Scammers try to gain access to people's money via email. It's While the presence of malware may make the internet

wise not to click on any links or open any attachments in emails seem very dangerous, there are simple ways of making

from strangers. In phishing attacks, the scammers try to imitate your information safer. Installing or activating firewall and

an email from a bank or other organization in order to get anti-virus software to scan network traffic for suspicious

people to give up details such as PIN numbers or passwords. packets is a good first step. Downloading and installing a

Banks and other legitimate organizations will never ask for password manager means passwords for multiple sites can

security details via email in this way. be stored and operated using only one master password.

Hackers can even target
social media accounts.

Social media
Hackers can compromise
social media accounts.
Changing the

password for

that site will usually fix this. However, contacting the

site's support team will be

necessary if a hacker

changes a user's password.

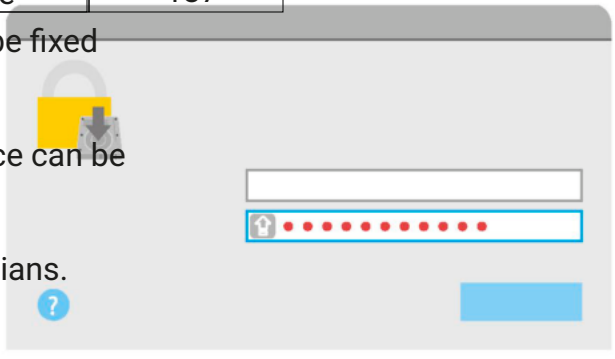
# Fixing common problems

SEE ALSO
Peripheral devices 36–37›
Connections 148–149›
Staying safe online 186–187›

Computer glitches are common and most can be fixed easily and

quickly. This is known as troubleshooting. Advice can be found

online, or from local computer stores or technicians.

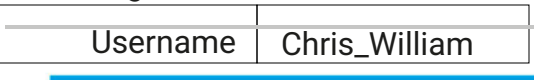


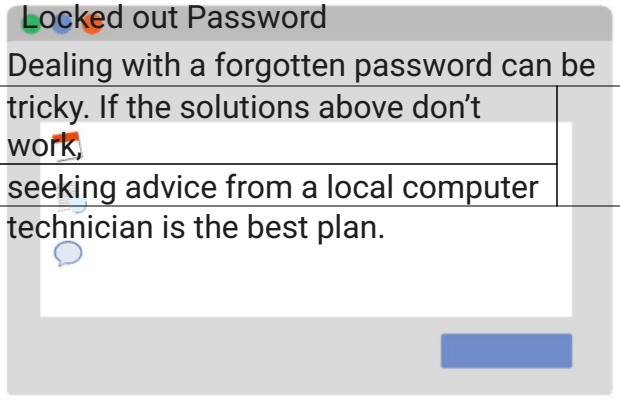
## Difficulty logging in

Problems with logging in to a computer can be caused by

having pressed the caps lock key, or accidentally trying to log in to another user's account. Forgotten logins can be fixed by using the administrator account to reset the login, or by using a password reset disk.

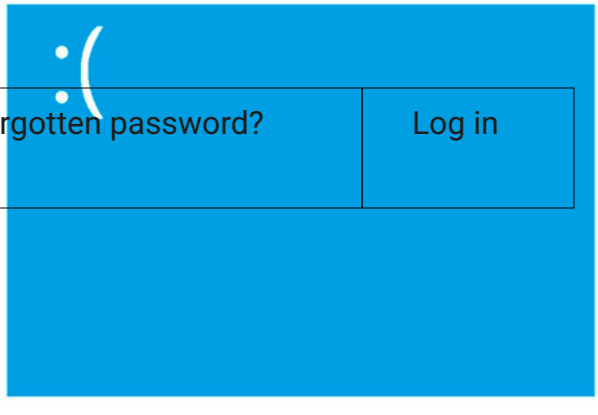
The username or password you entered is incorrect.



## Locked out Password

Dealing with a forgotten password can be tricky. If the solutions above don't work, seeking advice from a local computer technician is the best plan.



## Simple problems

A very common issue is the computer freezing or failing to

respond to a mouse or keyboard input. This can usually be fixed by shutting down the machine by pressing the power

button for several seconds and then restarting it again.
Avoid simply switching off at the mains as this can make matters worse.

"...there is a solution to every problem. It may take you a while, but eventually you're going to find it."

Tony Cardenas (b. 1953), American politician

Force Quit Applications

If an app doesn't respond for a while, select its name and click Force Quit.

Calendar

Your PC ran into a problem that it couldn't handle, and now it needs to restart.

Notes

Messages

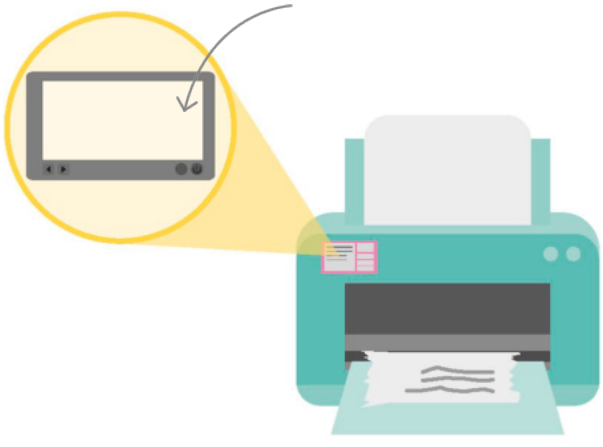
You can search for the error online: HAL _INITIALIZATION_FAILED

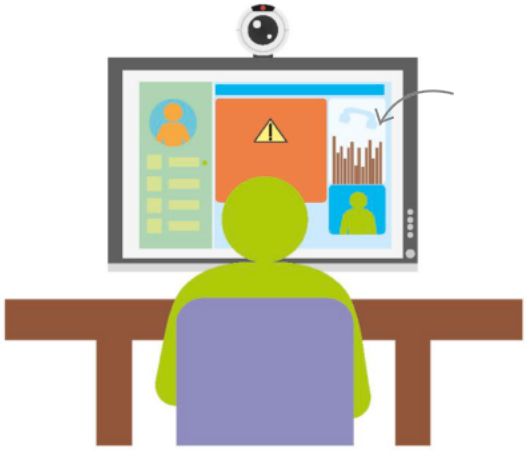
| | |
|---|---|
| You can open this window by pressing<br><br>Command-Option-Escape | Force Quit |

Task Manager  Blue Screen of Death

If a particular program isn’t responding, hold down Windows shows the“Blue Screen of Death”when a
the ctrl, alt, and delete keys on a computer running serious fault occurs. After restarting, the computer
Windows or cmd, option, and escape keys on a Mac. should be able to guide users towards a solution.

## Printers Sound and webcams





Printer problems are often caused by a lack of paper or Problems with sound and webcams can be frustrating,

paper jams. Most printers have warning lights and displays particularly for users trying to take part in online meetings.
to indicate these issues. Another possible issue is low ink Checking the computer's settings for sound output and

or toner levels. Opening the printer settings in the Control input might help to solve the problem. Forgetting that

Panel in Windows, or System Preferences on a Mac will headphones are plugged in can also be the source of

reveal more specific error messages. missing sound. Some computers and headphones have

built-in microphones, but a computer may still need an

external microphone to be plugged in.

Most printers display error messages or symbols.

Paper Jam

No sound could be down to the computer being muted, or the sound settings not being set up properly.

## Quality issues

Bad quality printing can be caused by badly  Webcam connectivity

aligned or clogged print heads. Printers usually People often cover the webcam when not in use come with software that allows users to to protect against hackers. If so, it's important to

diagnose and fix these types of issue. remember to uncover it before use.

## Wi-Fi and data

Wi-Fi connections can sometimes be temperamental.

| | | |
|---|---|---|
| Check that the computer is actually connecting to the | 1MB | 25MB |
| correct Wi-Fi and not a neighbouring one with a weaker | | |

signal. If there seems to be no signal at all, try switching the router off for a few seconds and then turn it back on. If a Wi-Fi connection seems slow, there are speed-test

| | | |
|---|---|---|
| websites online that can determine the current speed. | Viewinganemailwith | Browsing for an hour |
| Aslowconnectionisusuallyshort-livedandmostly | an attached picture | |

due to issues with the internet provider, possibly affecting many users in a local area.

150MB 2GB

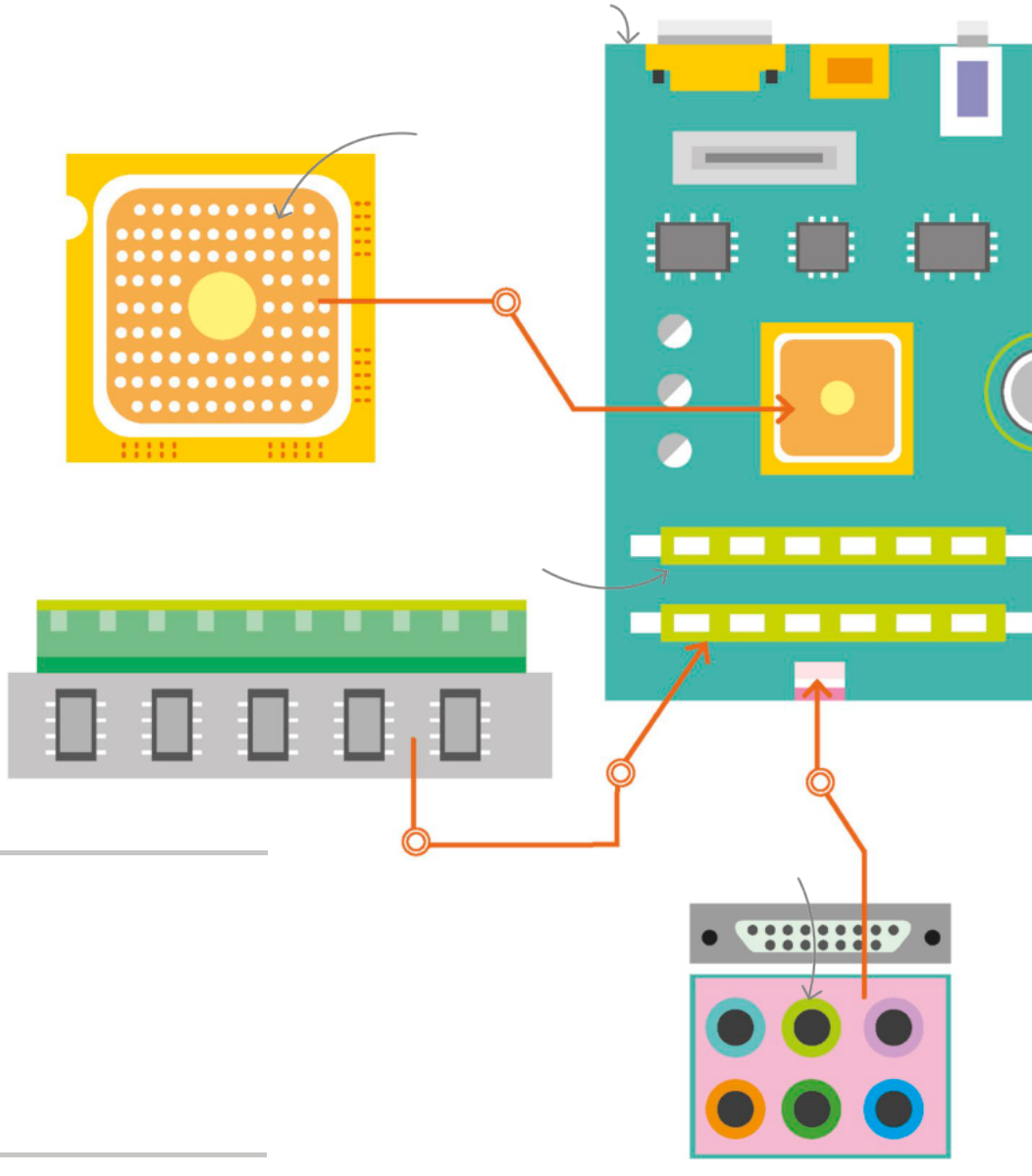
Data usage

Some internet providers, and many mobile

phone contracts, limit the amount of data

customers can use each month. It therefore

| | | |
|---|---|---|
| is useful to know how much data different | Downloading music | Streaming HD videos |
| online activities use. | for an hour | for an hour |



# Inside a computer

SEE ALSO

‹14–15
Computers are everywhere

Peripheral devices 36–37›

Under the casing, a computer's hardware is a host of electronic circuitry, components, and connections. As they become ever more powerful, their components need to be smaller, use less power, and generate less heat.

Processing and memory 42–43›

## Components of a computer

The components inside a computer are fairly similar, regardless of the type of computer it is. The parts may look a bit different, but they fulfil the same functions. Understanding what the various parts do and how they work can help users troubleshoot problems or decide whether it is time to upgrade their hardware.

The motherboard connects every part of the computer. either directly or indirectly to the CPU.

The CPU is a ceramic square with a silicon chip located inside.

Central processing unit

The central processing unit (CPU), also known as a microprocessor, acts as the brain of the computer. It controls most of the machine's operations and carries out commands. Instructions are sent to the CPU by pressing a key,

clicking the mouse, or starting an application, or file.

The RAM is slotted into a reader on the motherboard. RAM can be removed and RAM upgraded if more is needed. This is the system's short-term memory. Whenever a computer performs calculations, it temporarily stores the data in the random-access memory (RAM) until it is needed. The data on the RAM is cleared when the computer is turned off.

Ports are colour-coded for clear identification.

"...computers have become the most

empowering tool we've ever created. They're tools of communication,

they're tools of creativity, and

they can be shaped by their user."

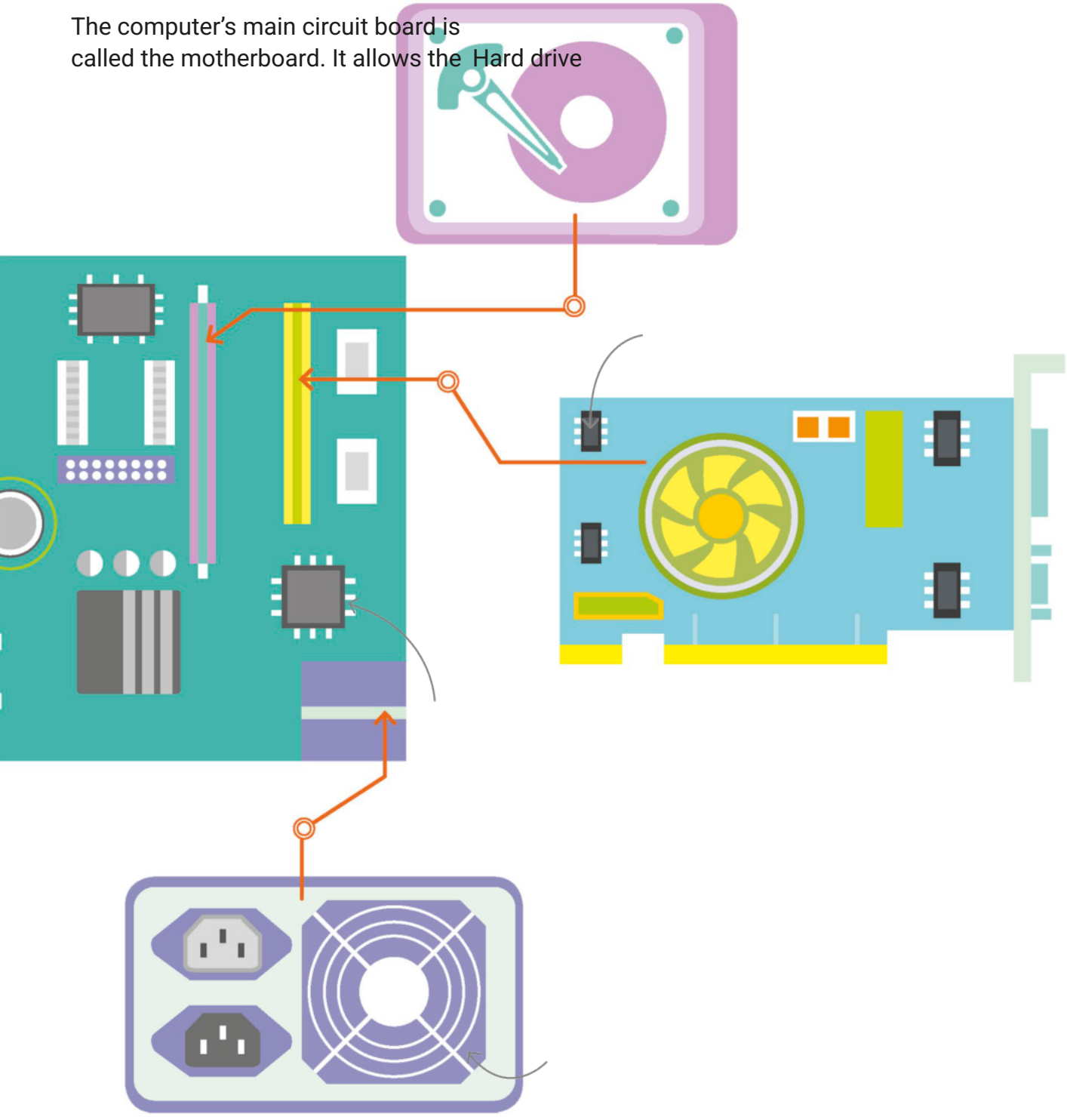
Bill Gates (b. 1955), American co-founder

Ports

Computers have an array of ports that allow users to connect external devices to the motherboard. Common ports include universal serial bus (USB), Ethernet (used to connect computers together to form a network), video-graphic array (VGA), high-definition multimedia interface of Microsoft (HDMI), and ports for headphones and microphones.

## Motherboard

The computer's main circuit board is called the motherboard. It allows the



other components to communicate A computer's software, documents,
with each other. The motherboard is and other files are stored on its hard
a thin plate that holds the CPU, drive as binary code. It holds data,

memory, connectors for the hard even if the computer is switched off
drive and optical drive, expansion or unplugged. The quicker the hard
cards to control the video and audio, drive, the faster the computer can

and connections to a computer's start up and load programs.
ports. It holds all the
circuitry that

ties the functions of
the computer

components together.

A computer system generally
has between one and
seven expansion slots.

Chips provide extra processing power

Expansion slots
These slots allow the user to add various types of
for specific parts of

expansion card, which help to boost or update the
the computer.
performance of a computer.
Expansion cards can

upgrade the sound or video, or

enable the computer
to connect to networks or Bluetooth.

Power unit

This converts the power from the wall outlet

to the type of power needed by the computer. Power is

sent to the motherboard and other components through

cables. The power unit also regulates overheating by

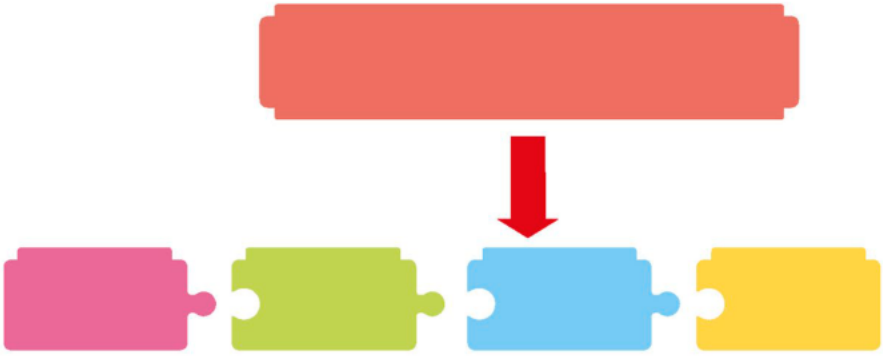
controlling voltage, which may change automatically

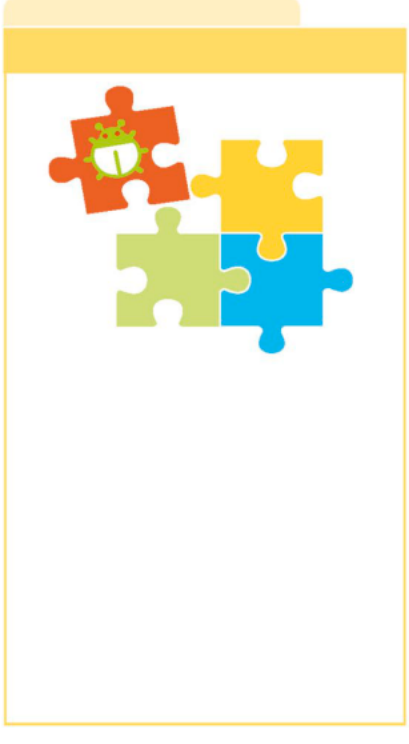
or manually depending on the power supply.

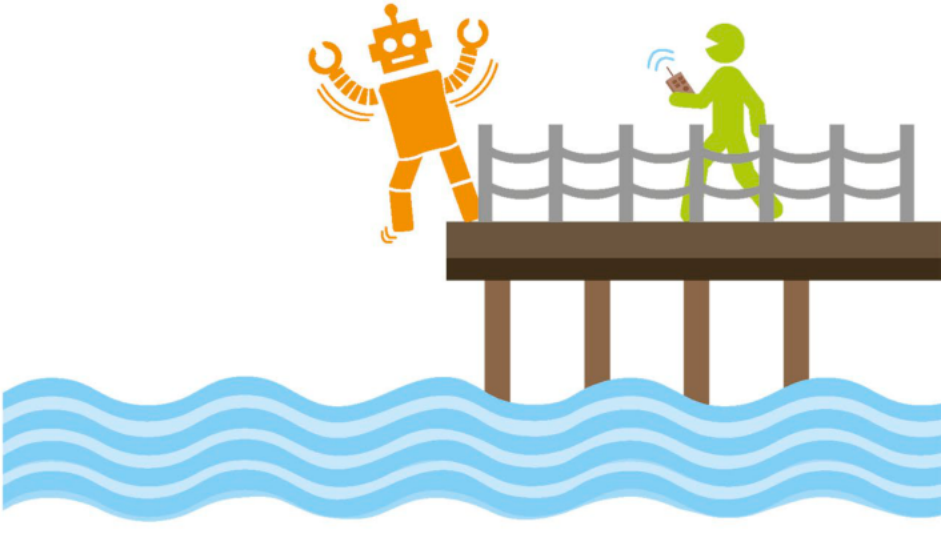
Power units usually have a

fan that stops the computer’s

components from overheating.







# Decomposition

SEE ALSO

‹28–29 Computer science

‹68–69 What is computational thinking?

Decomposition doesn't sound like the sort of thing anyone would want happening near a computer. Luckily, this decomposition is actually the first step in the computational thinking process.

What do programming languagesdo? 118–119›

## What is decomposition?

Decomposition is the process of breaking down problems into smaller components. An effective tool

| | |
|---|---|
| in computational thinking, it allows programmers to<br>build effective solutions. When an apple decomposes,<br>it's breaking down into simpler chemicals that other | PROBLEM |

plants can use as food. In a similar way, a problem

can be solved by splitting it into smaller parts that

a programmer already knows how to tackle.

| | | | | |
|---|---|---|---|---|
| Find the sub-problems | P | RO | BL | EM |
| A lot of everyday problems are | | | | |
| actually made up of smaller parts, | | | | |

which we can call sub-problems.

L I N G O Computer sense

| | |
|---|---|
| Modular code | Computers, unlike people, don't have any common sense or knowledge<br><br>of how things work. They do exactly what they're told to do, even if the |

instructions are ridiculous or totally wrong. When writing a program for a

computer to solve a problem, computer scientists must include precise

and detailed instructions on how to do each tiny step.

Building a program by writing small

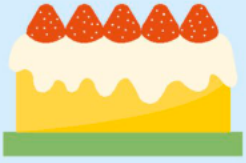
amounts of code to solve sub-
problems  Task gone wrong
is known as a modular approach. If If a computer is given instructions
there is a problem with a part of the that are inaccurate, in the wrong
code, it can easily be taken out and order, or incomplete, it won't
fixed. Each smaller solution is tested complete the task successfully.
before it's added to the main program.
Breaking the original
problem into

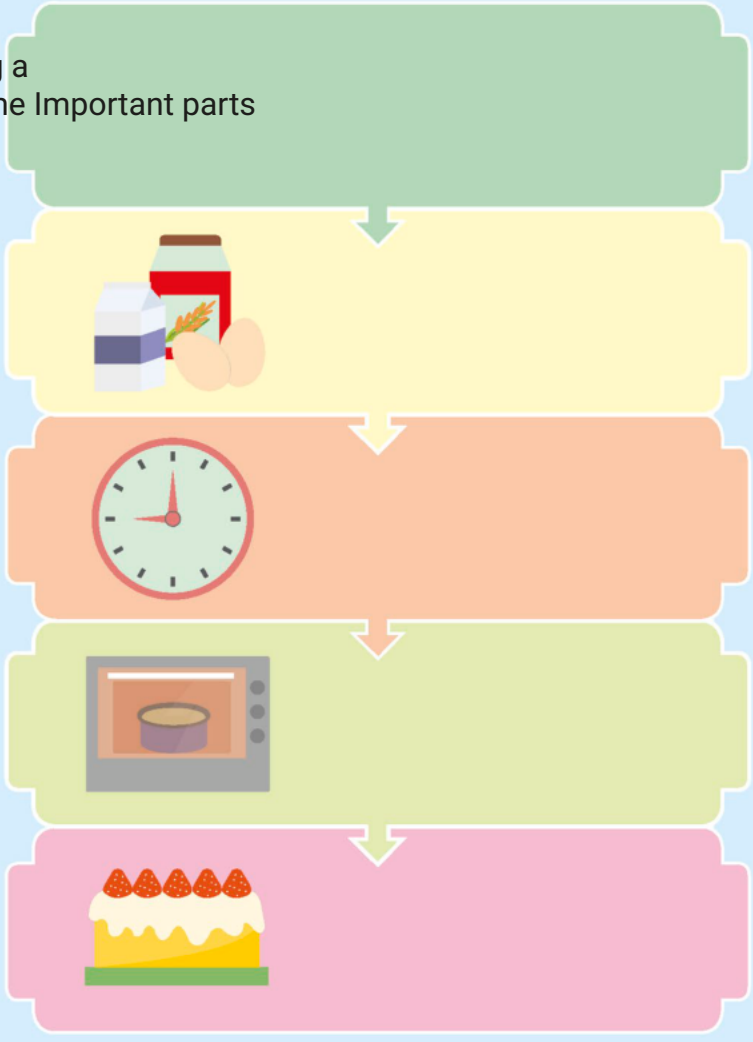
sub-problems also
gives programmers

the option of sharing
the work
among a team.

## Decomposition in action

Decomposition is a lot like baking a cake. Both involve a task and some Important parts





tools. In baking, the task is to make a cake, and the tools are the bowl, spoon, oven, and ingredients. In computing, the task might be to write a program, and the tools are a computer and programming language.

Breaking down a problem into smaller parts helps find an effective solution. Each part must then be completed successfully and in the right order to get the required result.

A good way to start is to look at the Ingredients and preparation

problem in more detail and break it To bake a cake, the first step is to buy or down into smaller tasks.

gather the ingredients. The right amount of

each ingredient must then be prepared while

the oven heats up to the correct temperature.

Timing and combining

Each ingredient must be added and

combined at the right time before the

mixture is put in the oven.

Getting it right

Breaking down the steps and then

successfully completing each one

will result in getting the cake right. Baking

In computer science, it’s important The next step is to ensure that the

to know what the objective is before mixture is baked at the right

beginning to write code. temperature and for the

required amount of time.

Finishing

Finally, the cake must be removed

| | |
|---|---|
| Getting it wrong | from the tray and allowed to cool.<br>It can then be decorated so that it |

Not working in a step-by-step manner both looks and tastes nice.

to bake a cake or build a solution will result in failure.

R E A L W O R L D

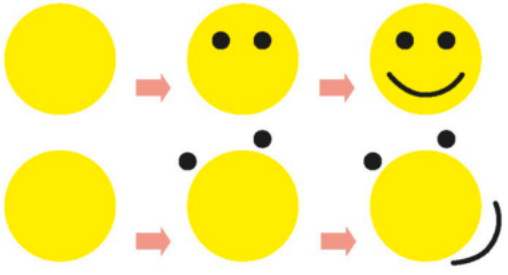
Building a spaceship

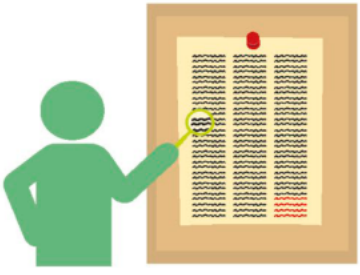
We often solve a

No matter how complex a computer

program is, it's made up of solutions problem by breaking it

| | |
|---|---|
| to lots of tiny problems. The process<br><br>of building a complicated model of a spaceship out of building blocks is<br><br>similar. Each part is the solution to<br><br>a sub-problem and combining the<br><br>components creates the spaceship. | down into smaller parts. |





# Algorithms

SEE ALSO

‹30–31 Computing before computers

‹68–69 What is computational thinking?

Though the word itself might sound unfamiliar, we all use algorithms every day. Baking a cake, knitting a jumper, or putting together a piece of furniture are all activities that use algorithms.

Applying algorithms 102–103›

## What is an algorithm?

An algorithm is a series of steps to solve a problem or carry out a task. To develop an algorithm, start by using decomposition to break down the problem into smaller tasks, then look for patterns in these tasks, and finally ignore unimportant details. This should give you the information you need to create an algorithm made of small steps that can all be described very clearly.

Unambiguous

Step by step

Each step in an algorithm must be precise and unambiguous,

Algorithms describe a series of steps that must happen
with only one possible meaning. Vague instructions give

in sequence in order for the problem to be solved. In
incorrect results. An algorithm for drawing a smiley face

athletics, the triple jump competition involves the
might read:“draw a circle, then a curved line, and then two

competitor running, then performing a hop, a bounce,
dots”. But this doesn’t tell us where the curved line and
and a horizontal jump at specific places in order to
record a successful effort. the dots should go in relation to the circle, or each other.

H-N

## Types of algorithm

Algorithms exist for many different computer tasks: from

| | |
|---|---|
| smartphone apps that can tell what song is being played<br><br>to the algorithms used by online search engines. One area | Rejected Pass 1 |

where algorithms are very influential is data-processing;
in particular, algorithms for searching and sorting data. There
are different kinds of searching and sorting algorithm. Rejected Pass 2

r Linear search

To find one item in a Pass 3: book found
million, start at the first
one and see if it’s the right

item. If it is, stop searching;  Binary search

otherwise, look at the next For data that’s already sorted – for instance, an alphabetical item. This isn’t efficient as bookshelf – a binary search is efficient. At each stage, you decide

it might involve looking at which half of the data the item you want is in. The half you don’t

every item on the list. need is discarded. This is repeated until the item is found.

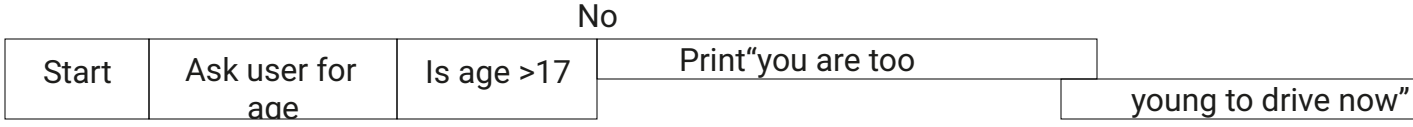
## Describing algorithms

Algorithms can be described using flowcharts or pseudocode. A flowchart is made up of boxes linked by

arrows. Each box contains a step in solving the problem

or a question. Pseudocode is laid out like a computer

program, but it's written in a human language.




This is the output of the program for people more than 17 years of age

```
Ask the user to enter their age in years
If the user's age is greater than 17
    Print"you can apply for a driving licence"
Else
    Print"you are too young to drive now"
End
```

Pseudocode

Describing algorithms in pseudocode allows

### BIOGRAPHY

The word "algorithm" comes from the name of 9th-century mathematician Abu Abdullah Muhammad ibn Mūsā al-Khwārizmī. Al-Khwārizmī lived in Baghdad, Iraq, and translated a number of scientific books from ancient Greek and Sanskrit into Arabic. He also wrote several books on mathematics, astronomy, geography, and history.

print “You can apply for a driving licence”

programmers to understand

These books were later translated

else

them, no matter what

into Latin and studied in European

computer languages

universities. The word“algebra”comes

print “You are too young to drive just now”

they are familiar with. This makes the whole range of algorithms available.

from the title of one of his books.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| P1 | 6 | 2 | 4 | 5 | I | E | U | K |
| P2 | 2 | 6 | 4 | 5 | I | E | U | K |
| P3 | 2 | 4 | 6 | 5 | E | I | K | U |
| P4 | 2 | 4 | 5 | 6 | E | I | K | U |

The final list is ordered alphabeti cally.

Bubble sort Merge sort

This looks at the items a pair at a time, swapping This breaks a list of items into many tiny lists. It then
them round if the second one of the pair is larger merges all these lists into newly sorted ones, finally
than the first. It’s not very efficient as it’s often producing a single sorted list. It uses more code than
necessary to go through the list several times. bubble sort, but is more efficient.

# Software errors

SEE ALSO

‹112–113
Assemblers, interpreters, and compilers

Languagebreakthroughs 122–123›

Maintenance and support 174–175›

No program is ever entirely error-free. Luckily, there are many techniques and tools that programmers can use to detect and fix these errors.

## Bugs in a program I N D E P T H

An important part of being a programmer is First bug

the ability to recognize software errors, also

called “bugs”, and fix them. There are three

types of bugs – syntax, logic, and runtime

errors. While some bugs cause obvious crashes

and are easy to locate, others are subtle and
can take months to find.

In 1945, computers filled entire rooms

and produced a lot of heat that

attracted bugs, which crawled inside
the machines and caused short circuits.

On 9 September 1945, American computer scientist Grace Hopper

(1906–1992) found that a moth had
caused a malfunction in the Harvard
Mark II computer, and she taped the
moth into the computer’s log book.
The term“bug”for a computer problem has been used ever since.

Syntax errors

A syntax error is a typo or a small mistake, introduced by a programmer into the wording of the program. The compiler – which translates programming languages into machine code –will not work until all syntax errors are fixed.

## Logic errors

A logic error is a flaw in the program's design that causes unanticipated behaviour.

These bugs can be harder to find as they

don't always produce crashes.

What to do when an error Debugging

| | |
|---|---|
| message appears<br>When an error message appears, the first task for programmers<br><br>is to locate the bug. The compiler usually indicates which line of<br>code caused a crash. However, some errors have a trickle-down<br>effect and the actual error is several lines higher. | A debugger is a program used to find bugs in other<br><br>programs. Most debuggers can run through the script<br><br>(the program's instructions) in a step-by-step mode<br><br>to isolate the source of the problem. Some debuggers<br>can then fix the problem, or offer ways in which this can<br>be done. The program can then be run again to see if |

the debugger has fixed the problems it found.

Run script Step over

Continue Step out

debug script

Status:

| | | |
|---|---|---|
| Stop script | Step in | Message area |

Breakpoints

A program freezes when it reaches a breakpoint,

allowing programmers to detect the errors at

their leisure. They can also check through the

code one line at a time.

Runtime errors

A runtime error is a specific

type of logic

error that occurs in the middle of a working

program and causes it to crash. Usually,

the program freezes or a pop-up box appears.

# Malware

SEE ALSO
‹22–23 Cybersecurity
Staying safe online 186–187›

Malicious software, or malware, is harmful programs that gain illegal access to digital devices. They can make their way into a computer or device via email attachments or unprotected websites.

Hacking and privacy 190–191›

## Types of malware

Malware can break into a computer and wreak havoc. These programs can slow down a device, send spam emails, or  Viruses

even steal or delete personal data. Malware is classified Viruses are tiny pieces of code that

based on how it enters the computer, and what it does sneak in by attaching themselves once it's there. Here are the different types of malware that to pre-existing files, such as email can attack a digital device. attachments. The goal of a virus is

to spread to as many files on as many

systems as possible. They corrupt data

and slow down operating systems.

Worms

Similar to viruses, worms tag along

with legitimate downloads. They're

self-replicating and can spread

through networks, often via

automated email spam. Unlike

viruses, worms are stand-alone software. They don't need human

triggers and are only installed on

each computer once.

Rootkits

Rootkits hide inside an operating system.

They gain root

(administrator) access to

a computer and modify
critical files,

which can lower security
and let in other

types of malware. As they
hide inside

operating systems, they are
difficult to

detect and destroy.

Spyware

Spyware is a general term for any program that tracks data without permission.

Examples include keyloggers (programs that track what keys are pressed in order to gain

Trojans

Named after the Greek tale of the Trojan Horse, a trojan is a malicious program that looks safe. Once downloaded, the trojan installs its payload on

access to passwords and other the computer. This could be a information) or programs that copy keylogger, a backdoor, or any browser history and Google searches. number of malicious programs.

## Botnets

An internet bot is a software application

that performs automated functions over the Infected computers

internet. A botnet is a network of bot-infected spread malware.
computers. While the infected computer might

run normally, there's software on it that lets a

"puppet master"hijack the computer. Botnets

can be used to store illegal content or mount

cyberattacks without the user's knowledge.

The botnet's originator

Computer under attack

Bots can be used

DDoS attacks for illegal activity.

DDoS stands for Distributed Denial of Service. A DDoS attack overwhelms a server by flooding it with data, often sent by botnets. The server receives

so many requests that it can't function

properly, sometimes causing it to crash.

### Backdoors

A backdoor allows users to bypass all regular security checks, such as passwords and permission settings. Sometimes, backdoors are created by accident when developers leave a loophole in the software. Other times, they are installed by malicious code.

IN DEPTH

### Ransomware Cookies

Ransomware sneaks onto a computer and encrypts files, effectively holding them for ransom. Unless attackers are paid, everything on the computer is inaccessible. Ransomware uses strong encryption protocols. It's

Cookies are small files stored inside the browser cache, which is a temporary storage location for downloaded files. Websites send cookies to a computer to keep track of sessions, making it possible

almost impossible to break the code to log in and out of online accounts.

without paying for access to the key. However, some cookies track activity

across multiple sites. While cookies don't

contain personal information, hackers

Hybrid threats can steal a session by intercepting

Programs that have characteristics of multiple types of them. This could give them access to

malware are called hybrid threats. A worm may drop a virus information, such as credit card details,

on a computer, or it may behave like a trojan. Classification stored on a user's account.

provides a starting point for identification and defence, but

each threat must be neutralized individually.

# Staying safe online

SEE ALSO

‹22–23
Cybersecurity

‹36–37
Peripheral devices

The internet is a useful tool both socially and educationally, but it also has its pitfalls. It's essential that users are aware of the dangers and ways to avoid them.

Hacking and privacy 190–191›

## Keeping devices safe

The first stage in staying safe online is to keep computers and mobile phones secure. All devices should have up-to-date virus protection. If using a public computer, in a library or at school, remember to log out of accounts before leaving.

### Webcam

It's possible for hackers to take control of your webcam and film without permission. Cover the webcam on a computer or phone with stickers, tape, or a cover when not in use.

Cover webcam with tape.

## Dangerous content

R E A L W O R L D

The internet gives access to many sites that parents would Sharing personal information
prefer young people not to see. These can include hate sites,
racist sites, websites that encourage anorexia or self-harm, It's important for young people to develop a healthy level
and pornography. Discussing these issues with young people of distrust when interacting online, particularly if websites
can help counteract this kind of negative influence, as can or people ask them for personal information. Contact details,
encouraging them to evaluate what they read critically, such as email address, phone number, home address, and
comparing it with other sources of information. school, shouldn't be given out to strangers. These can all be
used to identify someone's location, which could potentially put them in danger.

Bigoted material

Young people are often anxious to find a group where they belong, but this can make them prey to unpleasant ideologies. Sites that promote racism or sexism, or encourage prejudiced views against minority groups such as gay people, can encourage bad behaviour and, in some cases, criminal acts.

Drugs

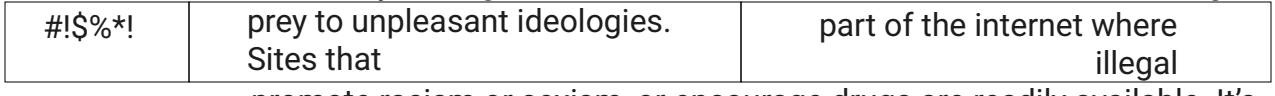
The dark web is an underground part of the internet where illegal drugs are readily available. It's also easy to obtain potentially dangerous substances known as"legal highs"online.

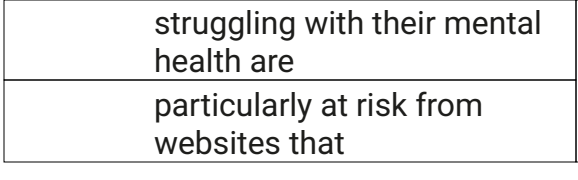
Self-harm

Young people who are under stress or struggling with their mental health are particularly at risk from websites that

Pornography

It's very easy for young people to access sexually explicit content on the internet, as man don't require



encourage self-harm or suicide. Sites payment. Activating parental controls
that promote anorexia also exist and on devices and internet connections can
can endanger vulnerable teenagers. help restrict access to these sites at home.

## Social media

Although it is a positive way to connect with friends, social media can often be stressful for young people. This could be due to unrealistic pressures to look a certain way, or unkind comments from others. There's also the danger of private messages or pictures being circulated widely. Parents can help by making All kids aware of these issues and discussing practical ways to avoid feelings of inadequacy. Boosting their Only me confidence and making them aware of their right to Blocking say no can also help.

Home

Profile

General

Visible to

Privacy

My Friends

Notification

Public

Geolocation

Privacy settings

Social media privacy settings allow users to hide their posts so that strangers can't access them. Disabling location settings can stop people from identifying where a person is.

Support

Off

On

## False identities

While chatting with new people on the internet can be a great way

to make friends and connect with people with shared interests, it Fake profiles
can also present some dangers. People don't have to use real photos People who want to insult or antagonize others
of themselves, or their real name, or be telling the truth about online – also known as"trolling"– often set up a new
anything they say. While this can be a way for users to explore their profile under a fake name so their activities are hard
identities, it is unfortunately also possible for criminals to use it as a to trace back to them. As a result, it's usually relatively
way to contact young people. easy to spot these social media profiles.

?

| | | |
|---|---|---|
| A fake profile often doesn't | Fake profiles may not include much | Having an extremely small |
| include a photo or uses a very | personal information, while real profiles | number of friends or followers |
| artificial-looking generic photo. | list information like interests or job. | is another feature to be wary of. |

%&$@&%@##

Fake profiles sometimes use screen A account that posts abusive
names made of a series of random content only is most likely
letters and numbers. a fake account.

# Cyberbullying

SEE ALSO

‹180–181
Maintaining balance

‹182–183 Being a
digital citizen

Coupled with the rise of instant online communication is an increase in online bullying, but support from parents and teachers can really help with upsetting interactions.

What is social media? 194–195›

## What is cyberbullying?

Threatening or embarrassing someone using internet-connected devices is called cyberbullying. This can happen in many forms, including sending threatening or unpleasant text messages, impersonating someone online in order to obtain information, posting personal information without someone's consent, setting up a poll about someone, passing on secrets, and threatening to make information public.

### How it feels to be a victim

Cyberbullying can make the victim feel scared and isolated. They may feel embarrassed and ashamed about what is being said about them, which can make it harder for them to ask for help.

## What makes it different?

Unfortunately, bullying is fairly common in schools and among groups of young people, but cyberbullying has features that mark it out as different. Some of these make it easier to identify the bully and deal with the problem, but others make it much more difficult.

02:15 AM

| | | |
|---|---|---|
| Any time | Anonymous | Large audience |

| | | |
|---|---|---|
| Cyberbullying can happen around the clock, | Cyberbullies have the ability to remain | Cyberbullies can reach large audiences very |
| even in the victim's home where, before | anonymous, and tracing the source can | quickly, increasing the victim's distress. Many |
| internet and mobile devices, they would | be extremely difficult, meaning that the | people can become complicit by passing on |
| have been safe from this kind of abuse. | victim doesn't know who to trust or blame. | a bullying image or remark. |

## Dealing with cyberbullying

There are a number of ways to deal with cyberbullying. The best way for young people to respond to the problem is by blocking bullies on conversations and

Save online

social media and reporting offensive behaviour screen shots of websites to the site. Contacting a bullying helpline can that contain bullying also be useful, along with telling family or friends messages or images so that they can provide support. as evidence.

Contact a helpline for

young people struggling

| REALWORLD | with issues like bullying to access advice |
|---|---|

Cyberbullying and the law and support.

| | | |
|---|---|---|
| Cyberbullying isn't a specific criminal | Blockandreport | Tellfamilymembers, |
| ofenceinmostcountries,butthere | the bully if they are | friends, or teachers, as |
| areoftenlawsthatrelatetobehaviour | usingsocialmedia | theycanprovidesupport |
| or communications that can apply | or a public website. | and practical help. |
| to cyberbullying. As the problem | | |

becomes more widespread, police

and prosecutors are starting to issue Don't retaliate or reply

guidelines on these laws. Remarks to the bully as this made on social media may also lead may simply encourage to people being sued for defamation them to continue.

in the civil courts.

The ability to make comments anonymously often brings out the worst in people.

INDEPTH

Why do people do it?

Govind There are a variety of reasons why young people may become involved in cyberbullying behaviour. If they have been the victims of bullying, or have problems at home, they may take it out on others. Some see it as a way to increase their popularity at the expense of others. Young people may feel uncomfortable about being involved in a group that's picking on someone,

| | | |
|---|---|---|
| Evidence | Thoughtless remarks | but don't have the confidence to point |

| | | |
|---|---|---|
| In cases where the bullying isn't anonymous, | Some instances of cyberbullying aren't | out and stop the bad behaviour. |

online messages or incidents are evidence intentional. A thoughtless remark might

of the bully's behaviour and can be shown unintentionally hurt someone after it is

to teachers or the police. shared by many people.

# Hacking and privacy

SEE ALSO
‹22–23
Cybersecurity
‹156–157
Malware

Every internet user creates data that could be harvested for‹186–187 Staying safe online
malicious purposes. It's important to understand the potential
pitfalls in order to minimize the risks.

## Nothing is private A picture can be

As a rule of thumb, assume that nothing posted on
copied and stored

on multiple devices.
the internet will be kept private. Account settings

might restrict who can view posts on social media, Copied to a tablet
but it's easy enough to download pictures or take

screenshots. The pictures can then be shared and

re-uploaded at any time. Many websites also have

automatic backups, so deleting content only removes

it from the main website directory and doesn't

necessarily get rid of copies. Copied to a laptop

Privacy on the internet

To stay safe, avoid posting anything

online that you wouldn't be comfortable

for strangers to know about you. Copied to a server

## Hacking

Making a piece of technology do something it wasn't designed to do is called hacking. A common example is bypassing software security to illegally access someone else's account. There are many types of hacking, but they can all be avoided with the right precautions.

Phishing
Tricking a person into entering their credentials in a fraudulent website. Mockups often mimic legitimate social media sites or banks.

Social engineering
Studying a person's social media account to gain information that could be used to help guess a password. habits or even posts from logged-in accounts.

Fake browser extensions
Tricking someone into downloading a malicious extension that tracks browsing or steal

Password grabbing
If a user tends to reuse the same password for many sites, stealing it once from a low-security website means that they have access to all the sites the password has been used for.

Keyloggers
Once downloaded, REC keyloggers record user key presses and send data, such as passwords, back to the Password **** original hacker.

## Browsing habits Prevention

Online browsing can be compared to dropping crumbs. The best advice for preventing data theft is obvious: only

A single crumb isn't a big deal, but many crumbs create visit trusted websites; be selective about social media posts;
a mess. Most users aren't even aware of what information if a problem is identified or even suspected, address it

they're giving away when browsing the internet. Continuously right away. For advanced protection, consider two-factor

harvesting these small, harmless pieces of data can lead to authentication (2FA) and encryption services. While it might

serious privacy breaches. To prevent this, it's important be annoying to go through extra security steps online, in
to understand how user data is created and monitored. the long term, it's a small price to pay for maintaining privacy
and preventing problems.

Cookies  Anonymous browsing

| | |
|---|---|
| Cookies are small pieces of data that websites use to store<br><br>information about a user's browsing session. Along with<br><br>the IP address and search history, they can be used to<br><br>create a detailed portrait of a user's habits and interests. | When browsing in a private or<br><br>incognito window, no cookies are<br><br>stored. Your search history, download<br><br>history, and search queries aren't<br>recorded and therefore can't be stolen. |

Privacy settings  Proxy servers

When installing a new app, many people hit the “I agree”button without reading the software licence agreement. This potentially makes it possible for apps to collect personal information without the user’s knowledge, but with their permission.

These servers are used to hide the IP address, making it difficult to tell what websites the user is visiting. It’s just like using someone else’s phone to call a taxi – the taxi will still turn up, but they have no information about you.

### IP addresses

An IP address is a 32-bit or 128-bit unique number used to identify a computer. An eavesdropper on a network can use this IP address to monitor the websites a user is visiting.

### Clearing data

When using a regular browser, make sure you clear the history, cache, and cookies periodically. You can also configure the browser to automatically clear these after each browsing session.

## REALWORLD

### Targeted Advertising

Targeted advertising is designed to show people content they’re interested in. If someone’s browsing history contains a lot of travel websites, they might be shown ads for flight discounts and holiday packages. While targeted advertising isn’t a violation of privacy, there’s a fine line between safety

| Books | Search | designed to show people | INDEPTH |
|---|---|---|---|

| Search results... | Ads | content they’re interested | Parental advice |
|---|---|---|---|

Keeping kids safe online means teaching them responsible browsing habits. Update the browser settings to block adult content and periodically check their browser history. Have conversations about online safety. Parents of younger kids may also want to have access to their passwords, but for teenagers, there’s a fine line between safety

and privacy.
of privacy, it reveals how If you decide to use GPS tracking apps or monitoring
much information can software, it’s better to be open about it.
be obtained by studying
search histories.