The internet and its uses

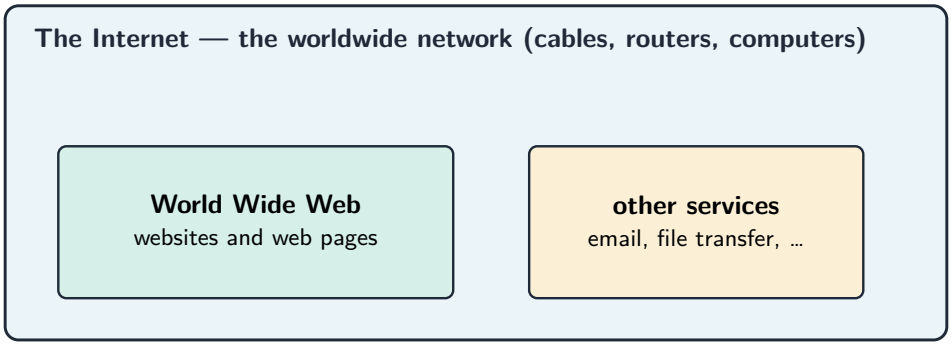
IGCSE Computer Science

The internet and the world wide web

People often mix up these two terms, but they are not the same.

- The **internet** 互联网 is the **infrastructure** 基础设施—the huge worldwide network of computers and the cables, routers and connections that join them.
- The **world wide web** 万维网 (WWW) is a collection of **websites** 网站 and web pages that you view using the internet.

So the internet is the network; the web is one of the things you use *on* that network.



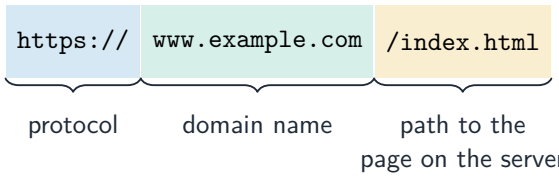
The internet is the worldwide network; the world wide web is one of the things you use on it

A router joins your home network to the internet and sends data to the right place

Image: Evan-Amos, Public domain (commons.wikimedia.org)

URL

A **uniform resource locator** 统一资源定位符 (URL) is a text-based address for a web page. You type it into a **web browser** 网页浏览器 to visit a page, for example `https://www.example.com/index.html`.



A URL has three parts: the protocol, the domain name, and the path to the page on the server

The web browser

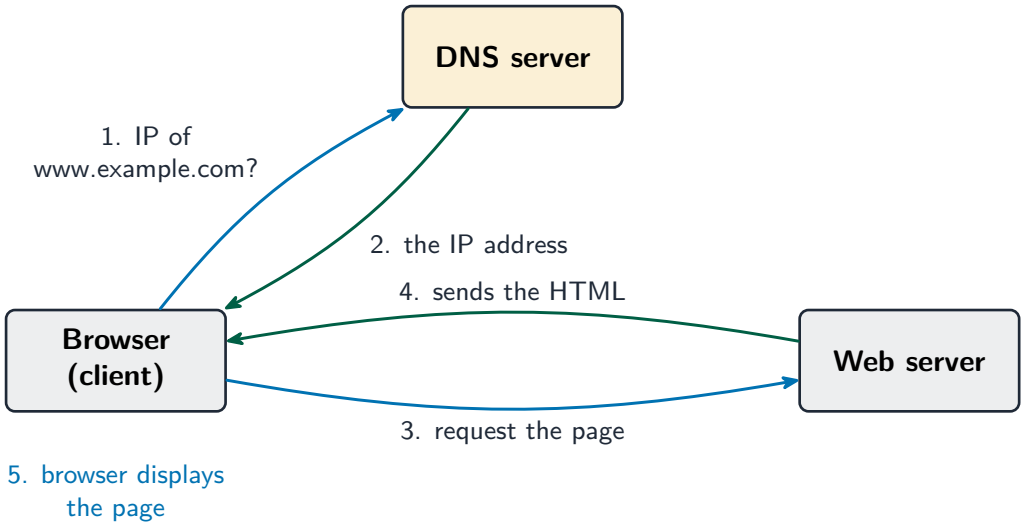
A web browser is the program you use to view web pages. Its role includes:

- **rendering** 渲染 the **hypertext markup language** 超文本标记语言 (HTML) —turning the page's code into what you see;
- **displaying web pages** on the screen;
- **managing how a web page is presented** —its layout, text and images.

How a web page reaches you

When you type a URL and press enter, several steps happen:

1. The browser needs the website's **IP address** 网际协议地址, but a URL uses a name, not a number.
2. The browser asks a **domain name service** 域名服务 (DNS) —a system that stores the IP address for each web address.
3. The DNS finds the matching IP address and sends it back to the browser.
4. The browser uses the IP address to contact the **web server** 网络服务器 that stores the page.
5. The web server sends the page's HTML back to the browser.
6. The browser turns the HTML into the page and displays it.



The browser asks a DNS for the site's IP address, then requests the page from the web server, which returns the HTML

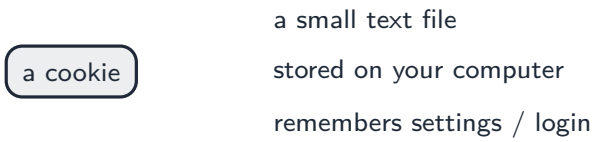
If the DNS does not have the address, it asks another DNS server until the address is found.

A data centre full of servers: powerful computers that store websites and send them to you

Worked example. Break down the URL `https://www.example.com/books/index.html`. `https` is the **protocol**, the set of rules used to transfer the page (the `s` means the transfer is encrypted). `www.example.com` is the **domain name**, which identifies the web server and which a DNS server turns into an IP address. `/books/index.html` is the **file path and file name** of the resource stored on that server. Name each part together with its **job**: an answer that says "the first bit" and "the last bit" describes the URL without ever explaining it.

Cookies

A **cookie** is a small text file that a website stores on your device. It lets the website remember things about you. There are two types.



A cookie is a small text file stored on your computer

Type	Kept when you close the browser?	Used for
session 会话 cookie	no —deleted when you close the browser	short-term data, e.g. items in a shopping basket
persistent 持久 cookie	yes —saved on the device	remembering you between visits

Cookies are used to:

- **save personal details** so you do not type them again (such as login or address);
- **track user preferences** 用户偏好, such as your language or the things you like, so the site can suggest content.

Digital currency

A **digital currency** 数字货币 is money that exists only in **electronic form** 电子形式. There are no coins or notes. It is stored and moved between people using computers, and can be used to pay for things online.

A problem with digital money is trust: how do you stop someone spending the same money twice, or changing the records? Blockchain solves this.

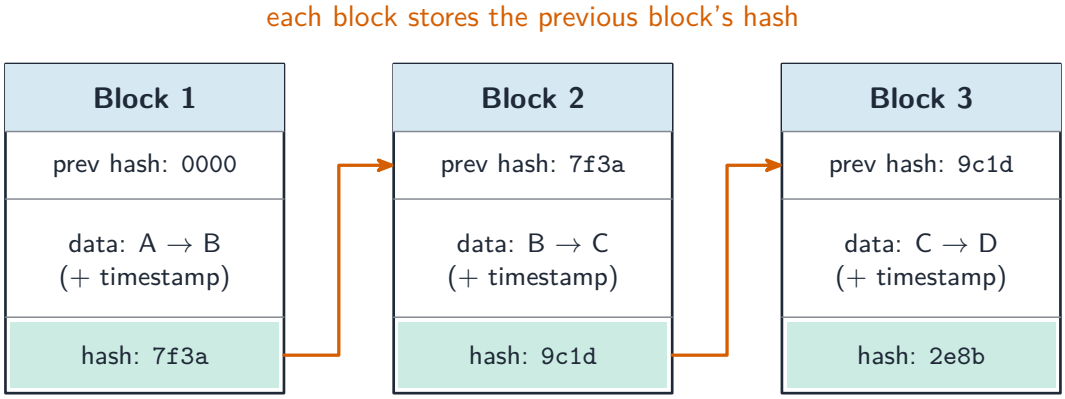
Blockchain

A **blockchain** 区块链 is a **digital ledger** 数字账本—a shared record of every **transaction** 交易. The record is copied across many computers, so no single person controls it and it is very hard to change.

The transactions are kept in blocks joined in a chain. Each block holds:

- the **data** of the transaction (who paid whom, and how much);
- a **timestamp** 时间戳 (the date and time);
- a **hash value** 哈希值—a special code worked out from the block's contents.

Each block also stores the hash of the block before it. If someone changes an old block, its hash changes, so it no longer matches the next block. This breaks the chain and the change is spotted at once. This is how blockchain tracks transactions safely.



Each block stores the previous block's hash, chaining the blocks; changing one block breaks the chain

Cyber security threats

Cyber security 网络安全 means keeping computers, networks and data safe from attack. You must know these threats.

Threat	What it is
brute force attack 暴力破解	trying many passwords very quickly until the right one is found
data interception 数据拦截	"listening in" to steal data while it travels across a network
distributed denial of service 分布式拒绝服务 (DDoS) attack	flooding a server with so many requests that it cannot respond, so the website goes down
hacking 黑客攻击	gaining access to a computer system without permission
malware 恶意软件	harmful software (see the table below)
pharming 域名欺骗	secret code sends you to a fake website even when you type the correct address
phishing 网络钓鱼	fake emails or messages that trick you into giving away private details
social engineering 社会工程	tricking a person (not a computer) into breaking security, e.g. pretending to be the boss

Types of malware

Malware is any software made to harm a computer. The main types are:

Malware	What it does
virus 病毒	attaches to a file and copies itself when the file is opened; can delete or damage data
worm 蠕虫	copies itself across a network on its own, without needing a file to be opened
Trojan horse 特洛伊木马	pretends to be useful software, but harms the computer once installed
spyware 间谍软件	secretly records what you do, such as the keys you press
adware 广告软件	floods you with unwanted adverts
ransomware 勒索软件	locks your files and demands payment to unlock them

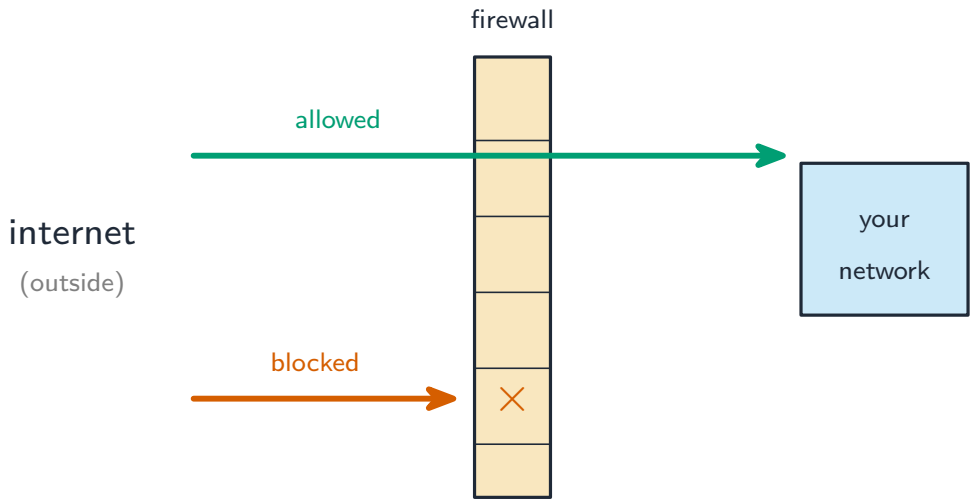
Impact of the threats

These attacks can **steal personal data**, **delete or change files**, **stop a service from working**, cost money, and make users lose trust in a company. For example, a DDoS attack can make an online shop unusable, so it loses sales.

Keeping data safe

You can protect data using these methods.

- **access levels** 访问权限—each user can only see or change the data they need, nothing more.
- **anti-malware** 反恶意软件 software, including **anti-virus** 杀毒软件 and **anti-spyware** 反间谍软件—scans for and removes harmful software.
- **authentication** 身份验证—proving who you are before you get access. Methods include:
  - **biometrics** 生物识别 (fingerprint or face),
  - a **password** 密码,
  - **two-step verification** 两步验证 (a code sent to your phone as well as a password).
- **automating software updates** —updates fix weak points (bugs) in software automatically.
- **checking the spelling and tone** of messages —bad spelling or an odd, urgent tone can show a message is fake (phishing).
- **checking the URL attached to a link** —a wrong or strange web address warns you the link is unsafe.
- **firewall** 防火墙—checks data going in and out of a network and blocks anything not allowed.
- **privacy settings** 隐私设置—control who can see your information online.



A firewall sits between the outside internet and your network, checking each connection and blocking any traffic that is not allowed

- **proxy server** 代理服务器—sits between the user and the internet, hiding the user's IP address and filtering out unsafe content.

Exam tips

- The **internet** is the worldwide network (the infrastructure); the **world wide web** is the pages you view on it —do not mix the two up.

- Learn how a page loads: the browser asks a **DNS** for the site's IP address, then requests the page from the **web server**, which returns the HTML.
- Match the malware types: **virus** (attaches to a file), **worm** (spreads by itself across a network), **Trojan horse** (pretends to be useful), **spyware**, **ransomware**.
- Match each threat to a defence: phishing/pharming → check the URL; brute force → strong passwords + two-step verification; interception → encryption; hacking/DDoS → a firewall.
- A **session** cookie is deleted when you close the browser; a **persistent** cookie is saved to remember you between visits.