

Solutions

Each answer shows the steps, then the **result**.

2.1

- any two of: share resources (printers, files); share/access the same data; central management and backup; communication; remote access

2.2

- any two differences, e.g. LAN covers a small area / WAN a large area; LAN owned by the organisation / WAN uses telecom links; LAN faster, lower latency / WAN slower

2.3

- **star**
- advantage e.g. one device (or its cable) failing does not affect the others

2.4

- a public IP is unique across the whole internet; a private IP is used only inside a local network

3.1

(a) powerful **servers** provide services (files, web pages)

- **client** machines request those services

(b) advantage e.g. central management / easier backup and security

- disadvantage e.g. the server is a single point of failure / cost of the server

3.2

(a) four numbers 0–255 separated by dots, e.g. 192.168.0.5

(b) IPv4 addresses ran out / IPv6 gives many more addresses

(c) static = fixed and does not change

- dynamic = assigned when the device joins and can change

3.3

- the browser takes the domain name from the URL
- it sends it to a DNS server, which looks it up and returns the matching IP address
- the browser then connects to the web server at that IP to fetch the page

3.4

(a) the internet is the global **network of hardware**

- the WWW is the **pages and resources** carried over it

(b) advantage e.g. mobility / no cabling

- disadvantage e.g. slower / less secure / more interference

3.5

(a) a **WAN** (wide area network)

(b) many paths, so if one link fails the traffic reroutes — high fault tolerance

3.6

(a) it joins the home LAN to the internet and routes data between the two networks

(b) a switch sends data only to devices **within** the same LAN

- a router sends data **between different networks** (e.g. the LAN and the internet)

3.7

- the two devices detect that they sent at the same time, and stop transmitting
- each waits a **random** length of time before resending, so they are unlikely to collide again

3.8

(a) **public** — unique across the whole internet, assigned by an ISP, and routable on it

- **private** — used only inside a LAN, not routable on the internet, so the same range can be reused in every building
- **static** — the same address every time the device connects, rather than one allocated afresh by DHCP

(b) **IPv6** — eight groups of four hexadecimal digits separated by colons

- any one of: it has a simpler header so routers process packets faster; it has built-in support for encryption and authentication; it removes the need for network address translation

(c) **real-time**: the event is broadcast as it happens, encoded and sent immediately, and cannot be paused or rewound past the live point

- example: the live question-and-answer session
- **on-demand**: the file already exists on a server and is streamed when the user asks for it, so it can be paused, rewound and replayed
- example: a recorded lecture

(d) the **bit rate** must be at least as large as the rate at which the video consumes data, or the stream cannot keep up

- a higher bit rate also allows a higher resolution
- the **buffer** stores data ahead of the play position
- short dips in the connection speed are covered by data already downloaded, so playback continues smoothly

(e) the data arrives more slowly than it is played, so the buffer **empties**, and playback must stop until it refills

- any one of: choose a lower-resolution stream so the required bit rate falls; use a wired connection or move closer to the router; allow a larger buffer before playback starts