

2.1 Networks including the internet

Name: _____ Class: _____ Date: _____ Total: 45 marks

KEY WORDS router 路由器 • wide area network 广域网 • ip address IP 地址 • star 星形
• mesh 网状

Objective

Build the skills to answer exam questions on **networks** 网络 — the types and topologies of networks, the client-server and peer-to-peer models, IP addressing, and how a web page is found.

You must be able to:

- compare a **LAN** 局域网 and a **WAN** 广域网, and the **client-server** and **peer-to-peer** models
- describe the **bus**, **star** and **mesh** topologies
- explain **IP addresses** (IPv4 / IPv6, public / private, static / dynamic)
- explain how a **URL**, the **DNS** and the difference between the **internet** and the **WWW** work

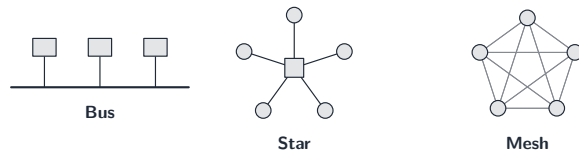
1 Worked examples

Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

■ Network types and topologies

A **LAN** (local area network) covers a **small area** (one site), is owned by the organisation, and is fast. A **WAN** (wide area network) covers a **large area** using telecom links — the internet is the biggest WAN. A WAN joins LANs together.

The **topology** 拓扑 is how the devices are linked:



- **bus** — one shared cable: cheap, but the whole LAN fails if the cable does. Only one device can send at a time, so devices must **detect and manage collisions**

冲突 — if two send at once, they stop, wait a random time, and resend.

- **star** — each device to a central switch: one device failing doesn't affect others (most common).
- **mesh** — every device linked to others: very **fault-tolerant** (traffic reroutes), but lots of cabling.

■ Network hardware

- a **router** 路由器 joins different networks and sends (routes) data between them — it connects a LAN to the internet.
- a **switch** 交换机 connects devices **inside** one LAN and sends each message only to the device it is addressed to.
- a **network interface card (NIC)** gives a device its fixed physical **MAC address** 物理地址 and connects it to the network.

■ Client-server vs peer-to-peer

	client-server	peer-to-peer
Roles	servers 服务器 provide; clients 客户端 request	every node is both client and server
Control	central, easy to manage and back up	no central control
Weakness	server is a single point of failure	harder to secure / keep consistent

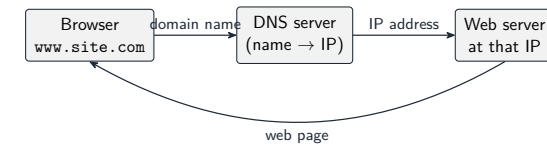
■ IP addresses

Every device on a network has an **IP address**.

- **IPv4** — four numbers 0–255, e.g. 192.168.0.5. **IPv6** — much longer (hex), created because IPv4 addresses ran out.
- **public** = unique across the whole internet; **private** = used only inside a LAN (not reachable directly from outside → safer).
- **static** = fixed; **dynamic** = assigned when the device joins and may change.

■ Finding a web page: URL and DNS

The **internet** is the global network of hardware; the **World Wide Web (WWW)** is the pages and resources carried on it. To open a page, the browser turns the **URL**'s domain name into an IP address using the **DNS** (Domain Name Service):



2 Practice

Now apply the methods above.

2.1 State **two** benefits of connecting computers in a network. [2]

2.2 State **two** differences between a LAN and a WAN. [2]

2.3 Name the topology in which every device connects to a central switch, and give one advantage of it. [2]

2.4 State the difference between a **public** and a **private** IP address. [1]

3 Exam-style questions

3.1 (a) Describe the **client–server** model of a network. [2]

(b) Give one advantage **and** one disadvantage of client–server compared with peer-to-peer. [2]

3.2 (a) State the format of an **IPv4** address. [1]

(b) Give one reason **IPv6** was introduced. [1]

(c) State the difference between a **static** and a **dynamic** IP address. [2]

3.3 Describe how the **DNS** is used when a user types a URL into a browser. [3]

3.4 (a) State the difference between the **internet** and the **World Wide Web**. [2]

(b) Give one advantage **and** one disadvantage of a wireless connection compared with a wired one. [2]

3.5 A company has offices in two cities, each with a star-topology LAN.

(a) Name the type of network that connects the two offices together. [1]

(b) State one benefit of using a mesh topology for the links between the key servers. [1]

3.6 A home has a router and several devices connected to a switch.

(a) State the role of the **router**. [1]

(b) State **one** difference between a **switch** and a **router**. [2]

3.7 A LAN uses a single shared cable (a bus). Describe how the network deals with a **collision** when two devices send data at the same time. [2]

3.8 A college streams recorded lectures to students and also runs live question-and-answer sessions.

(a) **Complete** the table by describing each type of IP address. [3]

type of IP address	description
public	
private	
static	

(b) Consider the address 2001:0db8:0000:0000:0000:ff00:0042:8329. **Identify** which version of IP this is, and **give** one advantage of it over the other version besides the number of addresses available. [2]

(c) **Describe** the difference between **real-time** and **on-demand** bit streaming, giving one example of each. [4]

(d) **Explain** why a high **bit rate** and a large enough **buffer** both matter when streaming video. [4]

(e) A student watching an on-demand lecture sees the video pause repeatedly to reload. **Explain**, in terms of the buffer, why this happens, and **give** one change that would reduce it. [3]

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