A2 NETWORKS · A2.1

Network fundamentals

What networks are for, the types you must know, the **devices** that run them, the key **protocols**, and the four-layer **TCP/IP model**.

01 Why networks

Purpose	Share files, printers, and an internet link.
Bandwidth	How much data flows per second.
Latency	The delay before data arrives.
Reliability	Consistent, error-free delivery.
Scale	Cope as more devices join.

02 Network types

PAN	Around one person (~10 m).
LAN	One site; fast, low latency.
MAN	A city, linking LANs.
WAN	Countries; the internet is the biggest.
VPN	Private, encrypted link over a public WAN.

03 The TCP/IP model · four layers

Application	Apps exchange data. Protocols: HTTP, HTTPS, SMTP, DNS, DHCP.	L4
Transport	End-to-end delivery via ports. TCP (reliable) and UDP (fast).	L3
Internet	Addresses and routes packets across networks with IP.	L2
Network interface	Physical transmission and MAC addressing. Ethernet, Wi-Fi.	L1

04 Network devices

Router	Routes packets between networks (internet).
Switch	LAN; sends a frame to its target port.
Hub	Older; copies data to every port.
Modem	Digital data to and from a line signal.
Access point	Joins Wi-Fi devices to a wired network.
NIC	The adapter that connects a device.

05 Protocols

TCP	Reliable, ordered delivery (transport).
UDP	Fast, no guarantee (transport).
HTTP/S	Web pages; HTTPS is encrypted (app).
SMTP	Email (app).
DNS	Domain name to IP address (app).
DHCP	Assigns IP addresses (app).
IP	Addressing and routing (internet).

06 Worked example · loading a web page (down the layers)

Application	The browser builds an HTTP request after DNS resolves the domain to an IP address.	HTTP
Transport	TCP splits the request into numbered segments and prepares to guarantee delivery.	TCP
Internet	IP wraps each segment in a packet addressed to the server; routers forward it.	IP
Network interface	Packets become signals on the medium. The server unwraps them in reverse (encapsulation).	SIGNAL

FINAL PASS BEFORE THE EXAM

Rapid exam tips

Eight things that lose marks in Paper 1 if you slip on them. Skim before you walk in.

01

TCP is reliable and ordered; **UDP** is fast but not guaranteed.

02

A **switch** sends a frame to its target port; a **hub** copies it to every port.

03

A **router** connects different networks; a **switch** connects devices in one LAN.

04

The TCP/IP model has **four** layers, not seven. Seven is the OSI model.

05

IP addresses route across networks; **MAC addresses** deliver within a local network.

06

HTTPS is encrypted; **HTTP** sends data in plain text.

07

DNS turns a domain name into an IP address; **DHCP** assigns IP addresses.

08

Data is **encapsulated** (wrapped) going down the layers and unwrapped going up.