

4.1 Networks

Syllabus 2026 - 2028

WHAT YOU NEED TO KNOW

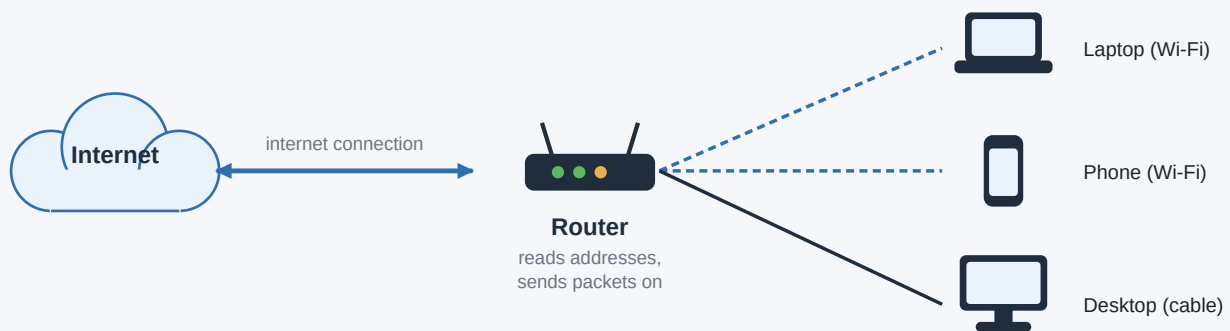
- The operation and purpose of a router: connecting networks and devices to the internet, storing computer addresses, routing data packets
- Common network devices: network interface card (NIC), hub, bridge and switch
- The uses of Wi-Fi and Bluetooth, how to connect a device using each, and their similarities and differences
- The characteristics, uses and issues of cloud computing; how data is stored, managed and shared in the cloud
- Advantages and disadvantages of cloud storage compared with other methods

Router

A **router** is a device that connects networks together and connects devices to the internet. It sits between a local network (LAN) and the internet and decides where each piece of data should go.

- Connecting networks and devices to the internet:** the router joins the home or school network to the internet service provider (ISP). Devices connect to the router by cable or Wi-Fi
- Storing computer addresses:** the router keeps a table of the addresses of the devices on the network, such as IP addresses and MAC addresses, so it knows which device is which
- Routing data packets:** data travels as small packets. Each packet has the destination address. The router reads it and sends the packet on towards the correct device or the next network by the best route
- A router also gives each device on the network a private IP address and often includes a firewall and a Wi-Fi access point

Figure 1: A router connects a local network to the internet

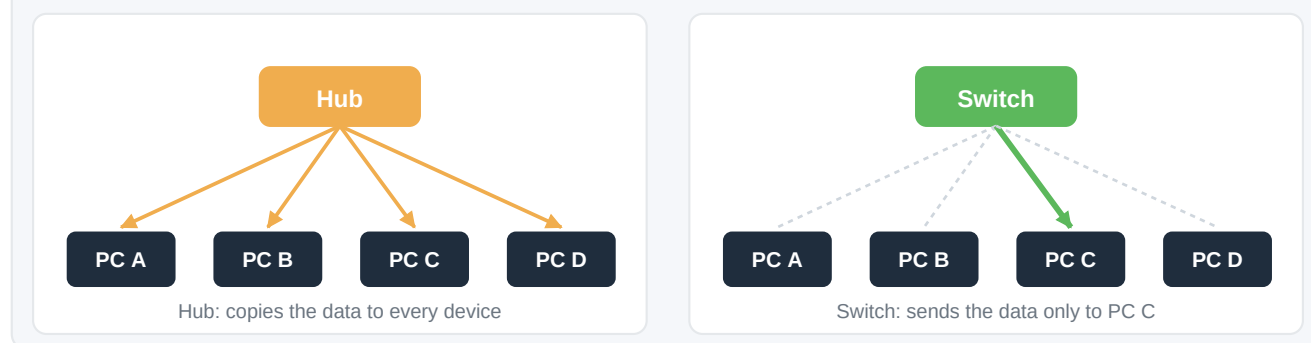


Common network devices

Device	Purpose
Network interface card (NIC)	Fitted in or built into a device so it can connect to a network, by cable or wirelessly. Each NIC has a unique MAC address that identifies the device.
Hub	Connects several devices in one network. It receives data and sends it to every device , whether it was meant for them or not. This wastes bandwidth and is less secure.
Switch	Connects several devices in one network. It keeps a table of MAC addresses and sends data only to the device it is intended for . Faster, more efficient and more secure than a hub.
Bridge	Connects two separate networks or network segments so they act as one. It can filter traffic so only data meant for the other side passes across.

Device	Purpose
Router	Connects different networks together, including a LAN to the internet, and routes data packets using IP addresses.

Figure 2: A hub sends data to every device, a switch only to the right one



Wi-Fi and Bluetooth

	Wi-Fi	Bluetooth
Uses	Connecting laptops, phones, tablets, smart TVs and printers to a network and the internet; wireless access in homes, schools and public places	Connecting devices over a short distance: wireless headphones, speakers, keyboards and mice, smart watches, transferring files between phones, in-car hands-free calls
Range	Wider: about 30 m indoors, more with extenders	Short: about 10 m for most devices
Speed	Faster data transfer	Slower data transfer
Power use	Higher	Lower, so it suits small battery devices
Needs	A router or access point and a password	Two devices that are paired; no router needed
Devices	Many devices at once on one network	A small number of paired devices

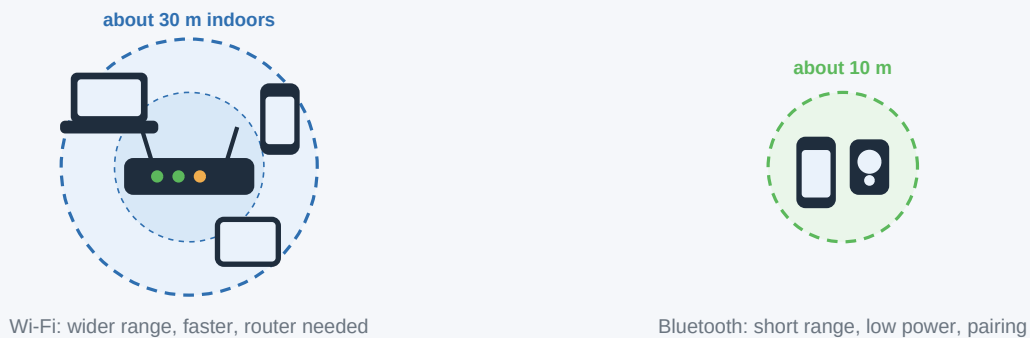
Connecting a device

Wi-Fi	Bluetooth
1. Turn Wi-Fi on in the device settings.	1. Turn Bluetooth on in both devices.
2. Choose the network name (SSID) from the list.	2. Make one device discoverable and search for devices.
3. Enter the network password (key).	3. Select the other device in the list.
4. The router gives the device an IP address and it joins the network.	4. Confirm the pairing code or PIN on both devices. The devices are now paired and connected.

Wi-Fi and Bluetooth compared

- **Similarities:** both are wireless, use radio waves, need no cables, work only within a range, and can connect to many kinds of device
- **Differences:** Wi-Fi has a longer range and faster speed and connects to a network and the internet, while Bluetooth has a shorter range, uses less power and mostly connects two devices directly
- Both can be affected by interference and by obstacles such as walls, and both need security: use a strong Wi-Fi password and turn off Bluetooth discovery when it is not needed

Figure 3: Wi-Fi covers a wider area than Bluetooth

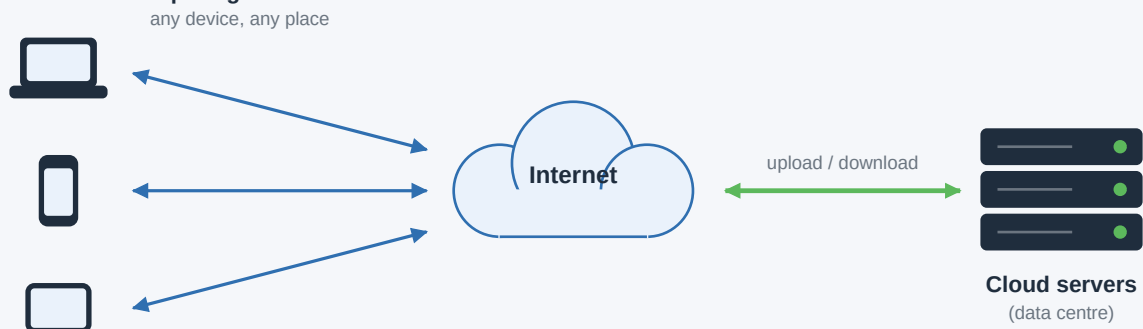


Cloud computing

Cloud computing means using servers on the internet, owned and run by a provider, to store data and run software instead of using only your own device. The servers are held in data centres in many places.

- **Characteristics:** accessed over the internet; reached from any device and any place; storage and processing can grow or shrink as needed (scalable); the provider looks after the hardware; usually paid for by use or free up to a limit
- **Uses:** storing and backing up files, photos and email; sharing and working on documents together online; streaming music and video; running software without installing it (web apps)
- **Issues:** needs an internet connection; data is held by another company, raising privacy and security concerns; the provider could be hacked or lose service; costs can build up; data may be stored in another country

Figure 4: Cloud computing stores data on remote servers reached over the internet



How data is stored, managed and shared in the cloud

- **Stored:** files uploaded from a device are saved on the provider's servers and are usually copied to more than one server so they are not lost
- **Managed:** the provider looks after the hardware, backups, security and updates. The user manages their own files and account, and can add storage when needed
- **Shared:** the user can send a link or invite others, choosing whether they can only view or can also edit. Changes are seen by everyone, and different people can work on the same file at once
- **Synchronised:** changes made on one device appear on the user's other devices

Cloud storage compared with other storage

Advantages	Disadvantages
+ Access files from any device and any place with internet	- Needs an internet connection, and uploads and downloads can be slow
+ Easy to share files and work together on one copy	- Data is held by a third party, so privacy and security risks are possible

Advantages	Disadvantages
+ Automatic backup, so data is safe if the device is lost or broken	- Subscription costs for large amounts of storage
+ No need to buy and look after your own storage; easy to add capacity	- If the provider has a fault or closes, access may be lost
+ Not affected by a fire or theft at home or school	- Local storage such as a hard drive or flash drive is under your own control and works without internet

EXAM TIP

Do not describe a hub as 'smart'. Say that it sends data to **all** devices and a switch sends it to the **correct** device only. For Wi-Fi and Bluetooth questions, give one similarity and one difference in the same answer, and name the feature (range, speed or power use).

Key terms

Term	Meaning
Router	Connects networks and routes data packets to their destination.
Data packet	A small unit of data, with source and destination addresses.
IP address	Address that identifies a device on a network or the internet.
MAC address	Unique hardware address built into a network interface card.
NIC	Network interface card; lets a device connect to a network.
Hub	Sends data to every device on the network.
Switch	Sends data only to the intended device.
Bridge	Connects two networks or segments.
Wi-Fi	Wireless networking using radio waves, with wide range and high speed.
Bluetooth	Short-range wireless link between paired devices.
Pairing	Linking two Bluetooth devices so they can communicate.
Cloud computing	Using remote servers over the internet to store data or run software.
Data centre	A building housing the servers that provide cloud services.