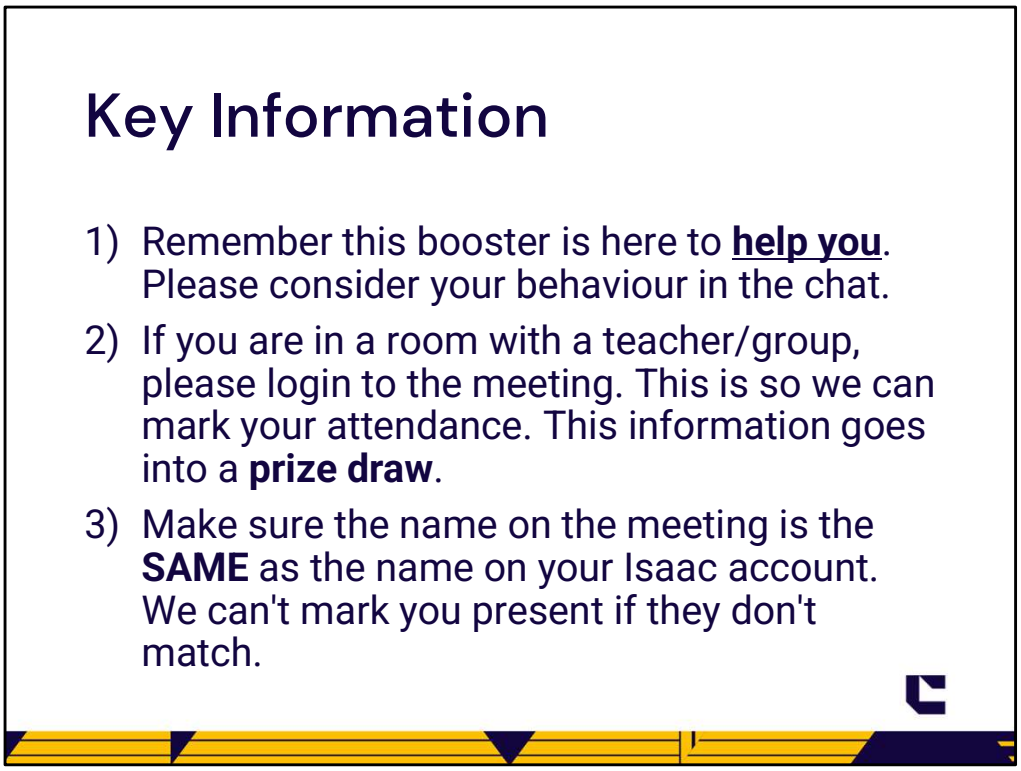
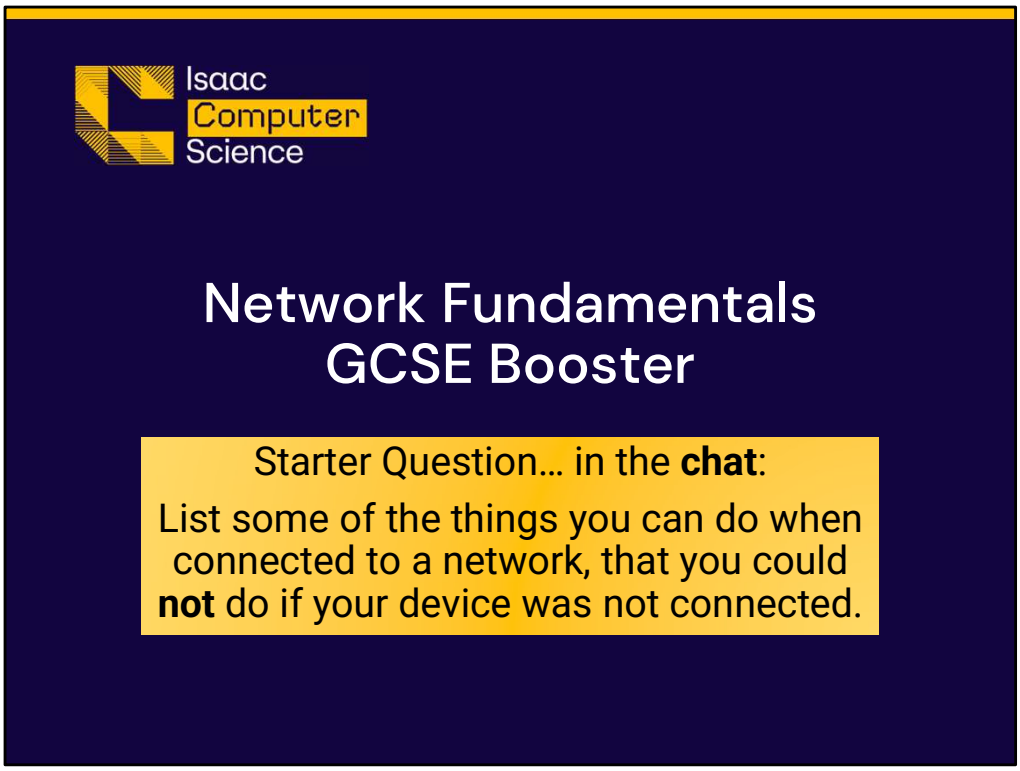
Isaac Computer Science

Network Fundamentals

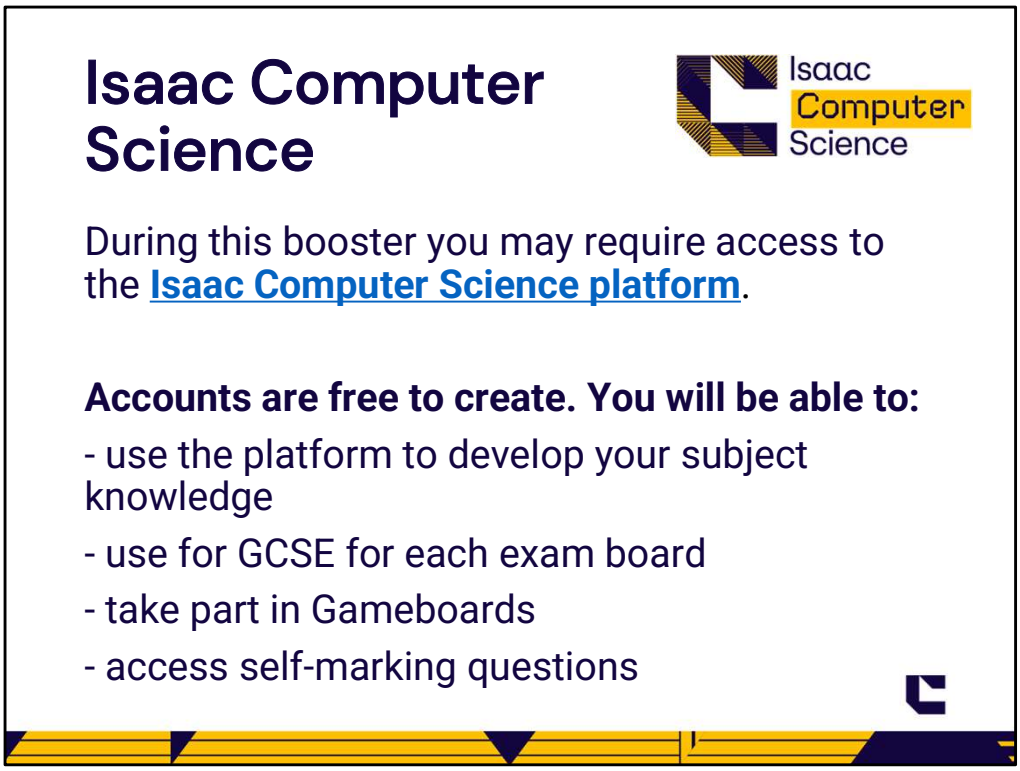
GCSE Booster



Timing: 1 minute
Key outcome: Remind students on behaviour, checking all students are on the meeting, also checking they have the right name so we can track them.
Activity: Check names against register, check they are using preferred name, no nicknames
Background:
Questions:
Misconceptions/issues to note:

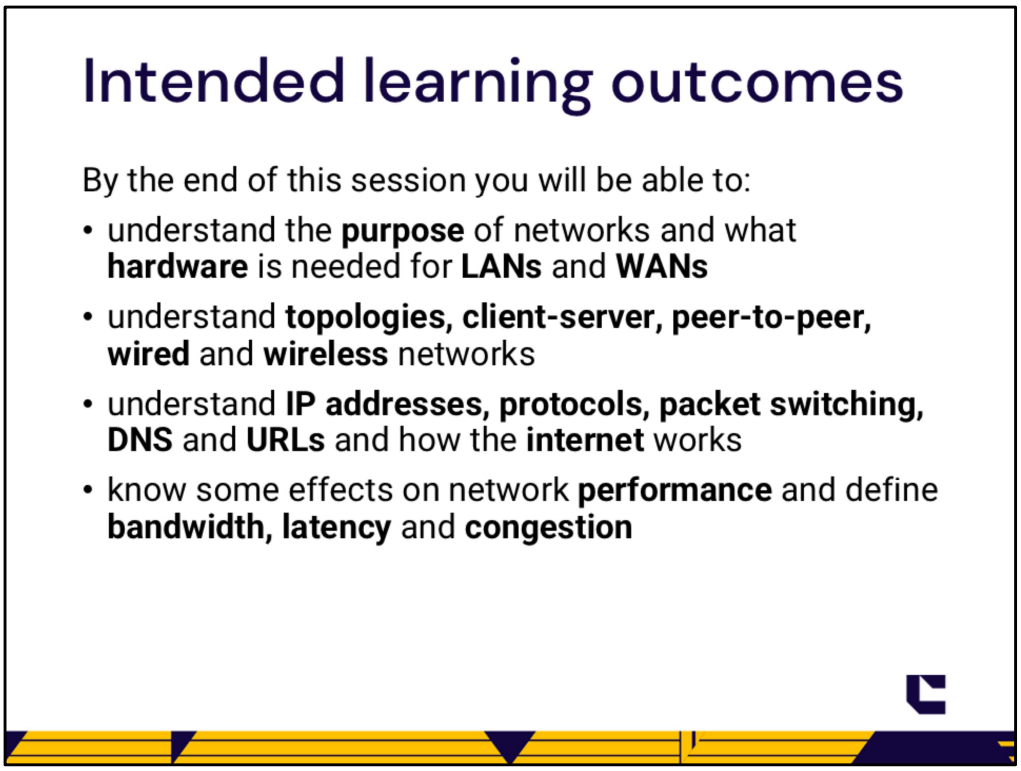


Timing: 2 minutes
Key outcome:
Activity:
Background:
Questions:
Misconceptions/issues to note:



Timing: 1 minute
Key outcome: Introduce Isaac
Activity: Advise they create an account - platform is totally free.
Briefly share the benefits for teachers and students
Background: Isaac is a high-quality online textbook with short videos and practice questions. Can be used for self-study, homework and testing.
Teachers can set "gameboards" (quizzes) and track results by class/student.
Questions:
Misconceptions/issues to note:

Isaac platform link: https://isaaccomputerscience.org/



Timing: 1 minute

Key outcome: know the LOs

Activity: Discuss the slide

Background:

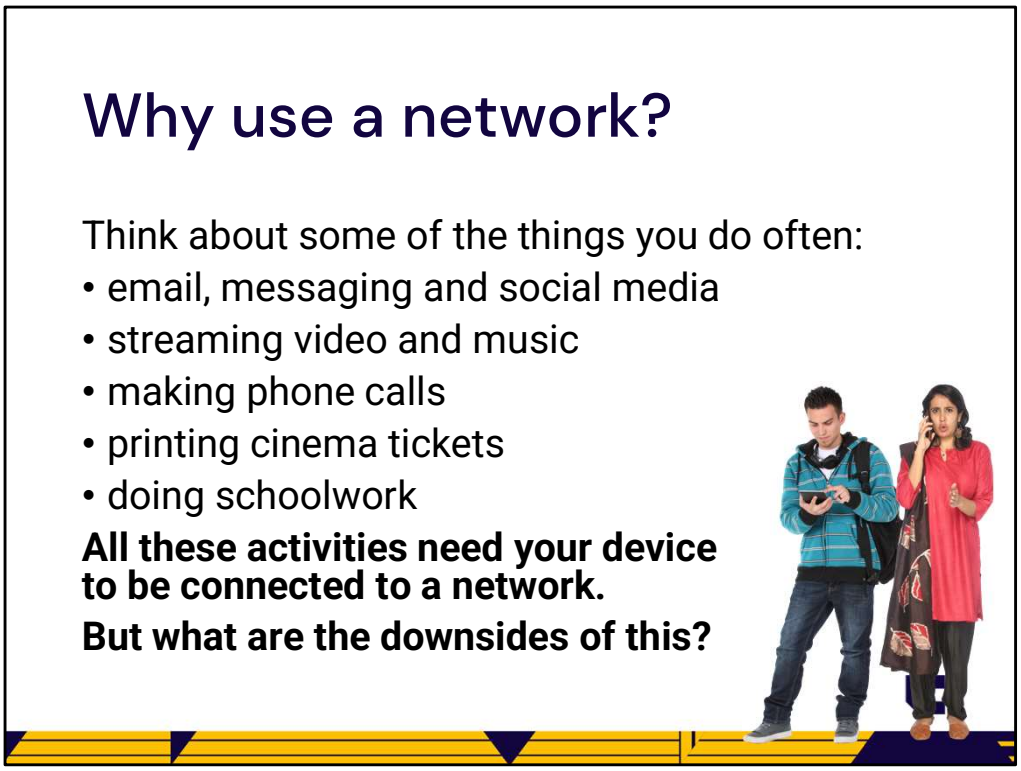
Questions:

Misconceptions/issues to note:

Slide 5

PR0 I wonder how we could condense this into 4 LO's? Which are the most important as might overload students with 6 LOs.

Paul Robson, 2024-10-21T10:39:39.614

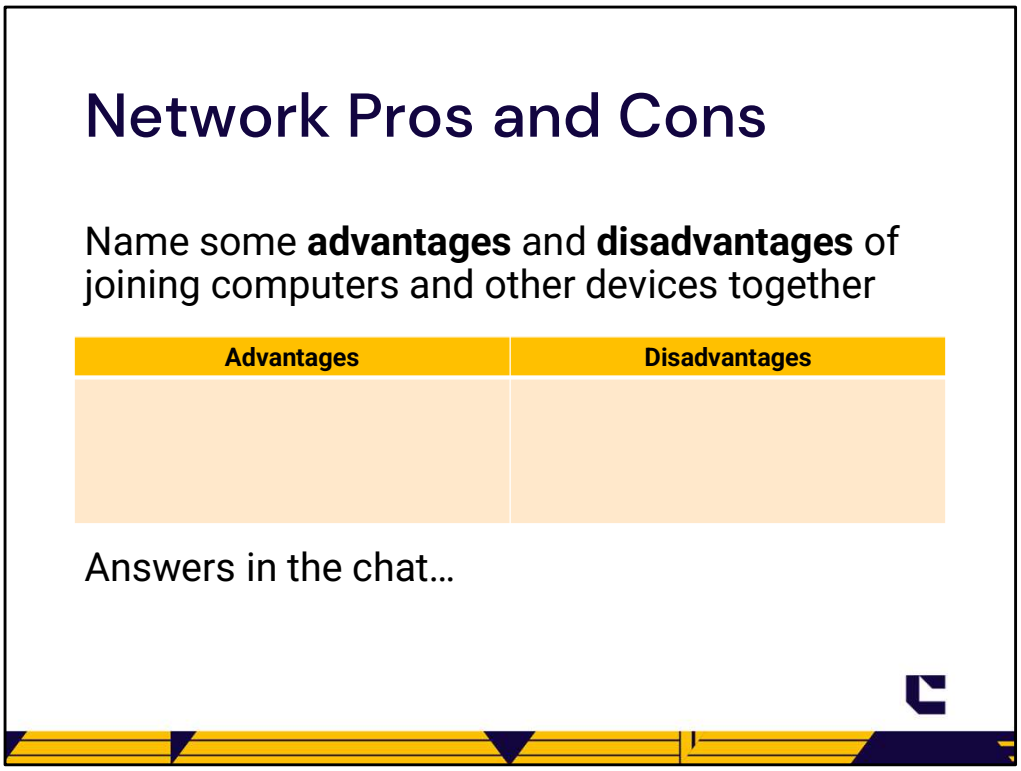


Timing: 2 minutes
Key outcome: Begin to understand the purpose of a network
Activity: Discuss the slide, all of these things need a network
Background:
Questions: What are the downsides of being connected? A. cyberbullying, inappropriate content, hacking, scamming etc…
Next slide we will gather some pros and cons of being on a network

Misconceptions/issues to note: Not all of these things

need the **internet**, but they all need networks.
E.g. phone calls are usually made over the telephone companies' WANs, and printing uses your home LAN.

Images: Powerpoint icon set



Timing: 2 minutes

Key outcome: Know some pros and cons of networks

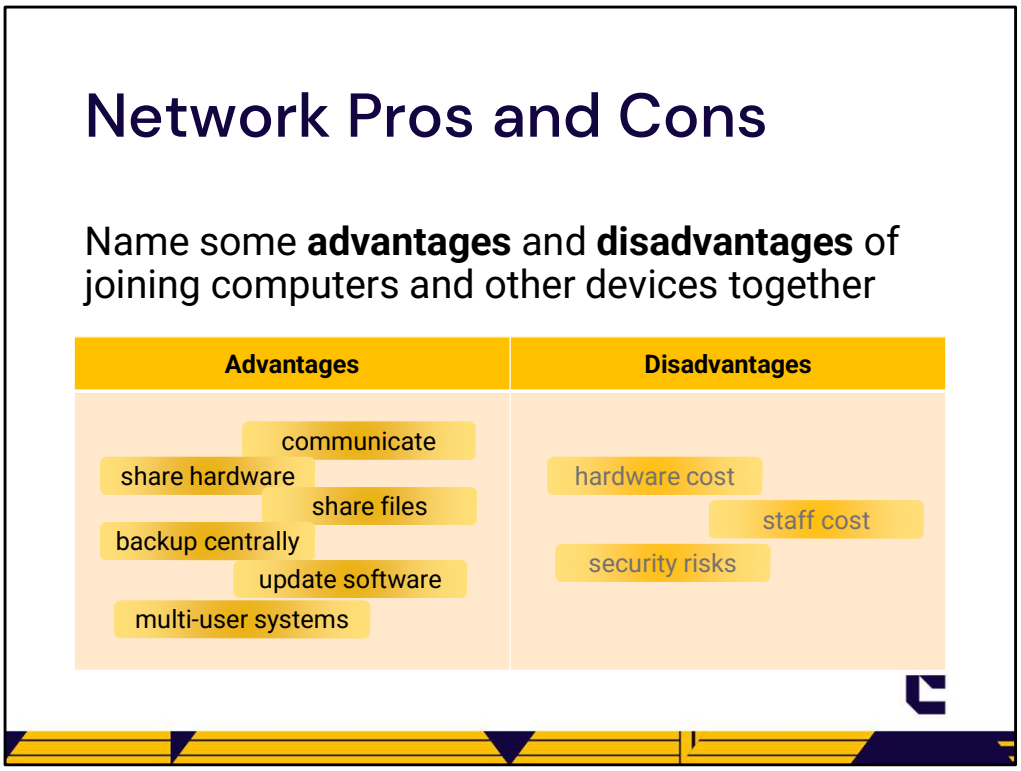
Activity: Ask the question on the slide and get answers in the chat

Background:

Questions: What are some **advantages** and **disadvantages** of joining computers and other devices together?

Answers on next slide

Misconceptions/issues to note:



Timing: 2 minutes
Key outcome: Know some pros and cons of networks
Activity: Click to reveal some suggested answers
Background: More info, advantages:

- Communication includes email, social media, phones and VoIP etc
- Hardware e.g. printers and file storage can be shared, e.g. in school you might store your files on a file server or in the cloud (across the internet)
- Central backups can be done with backup software or by using cloud services (OneDrive, Google Drive, iCloud etc.)
- Software is automatically updated over the internet

e.g. Windows patching, auto update of apps from AppStore/Play Store

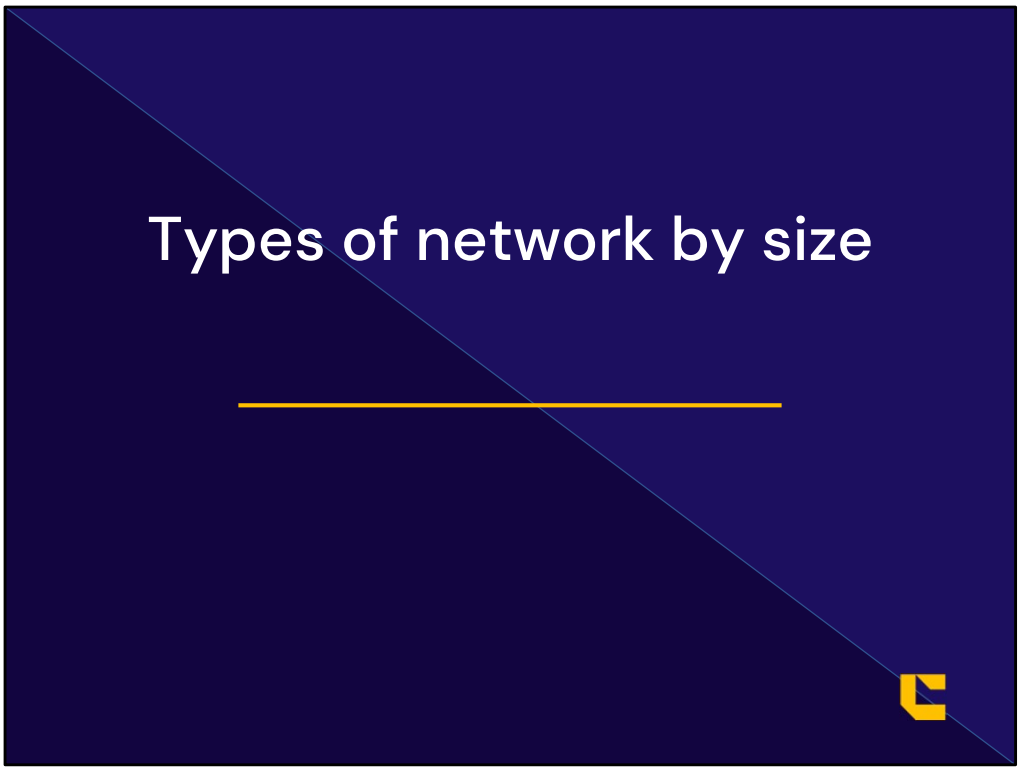
- Multi-user systems are common in the workplace, where staff all use a central computer system, e.g. helpdesk call logging, banking ledger systems, restaurant booking software

Disadvantages

- Hardware cost includes the routers, switches, WAPs and cables to make the network work
- Staff cost means extra IT experts to install and maintain the network
- Security risks include hacking, scamming, cyberbullying etc. that put the computers, software or people at risk

Questions: Why do we still do it? Save cost, enable business and personal objectives

Misconceptions/issues to note:



Timing: 20 secs
Key outcome: This section deals with size of network (LAN v WAN v PAN)
Activity:
Background:
Questions:
Misconceptions/issues to note:

Personal area network (PAN) – AQA only

- enables communication between computer devices near a person
- range typically is a few meters
- Typically uses Bluetooth (but can use WiFi or NFC)
  - Bluetooth speakers, headphones or earbuds
  - computer peripherals (mouse, keyboard)
  - tethering / hotspotting a smartphone and a laptop
  - tapping a device to pay for something

Timing: 2 minutes
Key outcome: Know what a PAN is
Activity: Discuss the slide

Background: AQA say "only Bluetooth needs to be considered" but for clarity you may wish to mention other technologies that create PANs:

Bluetooth headsets, earbuds and speakers all create a PAN. Also Bluetooth or Wifi keyboard and mouse.

Near-Field Communications (NFC) on a smartphone creates a brief PAN whenever you tap to pay with Google Pay or Apple Pay

"Tethering" is not common now, smartphones usually have a Wireless Hotspot feature, where the cellular network connection is shared via a Wireless hotspot through the phone's WifI radio.

Multiple devices could connect this way but usually it's only one device, hence personal.

PAN is only AQA but useful to know as general knowledge / drawing upon comparisons of scale.

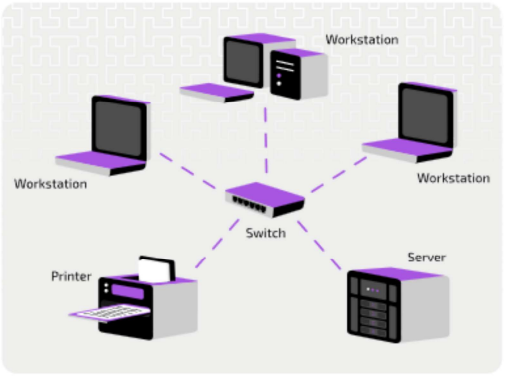
Questions:
Misconceptions/issues to note:
Key outcomes:

Image:

PAN: https://vectorportal.com/vector/computer-technology-illustration/17475

Local area network (LAN)

- local area networks use **devices connected** in a **small geographical area**
- devices connected using their **own hardware**
- examples could include a school, a small business, a museum



Timing: 2 minutes

Key outcome: Know what a LAN is

Activity: Discuss the slide

Relate to home networks which are likely to be a mixture of wired and wireless.

Background:

Important; if a question asks "State what is meant by a LAN" then students need to show knowledge of "local area" and also "network" hence the mark scheme will have "connected using their own hardware" and "in a small geographical area" underlined as required elements of the answer. Ideally they could give some examples of hardware such as transmission media, switches.

Questions: Why is your home network a LAN? A. small geographic area, all hardware owned by you.

Misconceptions/issues to note:

"A LAN is in one building". This is incorrect although many LANs **may be** within one building. More importantly all the hardware is usually **owned** by the organisation, where WANs usually use 3rd party connections and devices.

"A LAN is so that devices can connect to the Internet" – this may be the case but as a LAN may not necessarily be connected to the Internet this cannot be used to define a LAN, it is more an example of a likely purpose of a LAN.

Isaac Computer Science
https://isaaccomputerscience.org/concepts/net_network_network

Slide 11

PR0 I would add to the notes about the owned hardware and add some examples for PDL to mention e.g. a switch, transmission media, WAP

Paul Robson, 2024-10-21T10:45:56.941

Wide area network (WAN)

- a WAN (wide area network) is created when **LANs are connected together**
- a WAN covers a **large geographical area**
- the largest WAN is the **internet**
- uses **third party infrastructure**

Timing: 2 minutes
Key outcome: know what a WAN is

Activity: Discuss the slide

Background:

A WAN is different to a LAN in size but also uses public or 3rd party hardware although:

Some corporations have their own global WAN on leased communications infrastructure (e.g. Shell)

Question: What are the benefits of a WAN for big organisations?

Answers: communicate between offices, work globally across many sites, work from home or remotely without cost of an office. share applications and storage

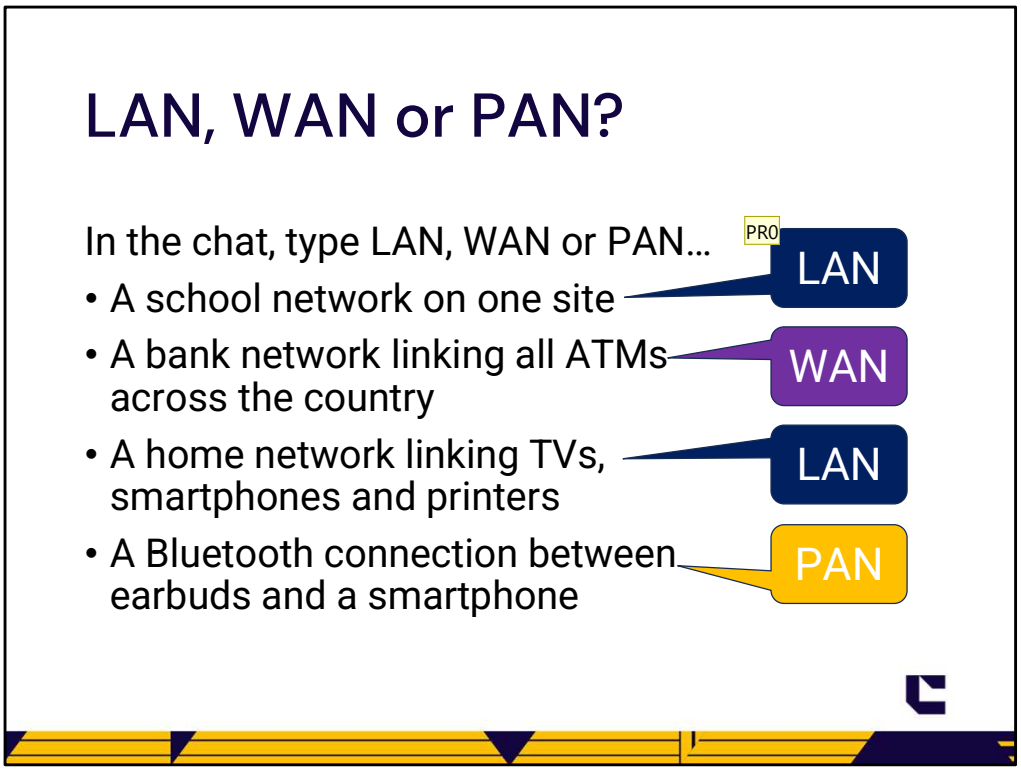
Misconceptions/issues to note:

Images:

WAN: https://freesvg.org/img/internet_schema.png

Slide 12

PR0 The bold underline on last slide was useful. I am guessing you are doing the same on here?
Paul Robson, 2024-10-01T12:32:03.743



Timing: 2 minutes
Key outcome: check understanding of LAN, WAN, PAN
Activity: ask each question in turn and click to reveal
For extra credit, why? (e.g. school network is a LAN because it is all on one site and uses only hardware owned by the school)
Background:
Questions:
Misconceptions/issues to note:
Background:

Slide 13

PR0 Might be worth adding to the PDL notes EBI if you can say why.
Paul Robson, 2024-10-21T10:46:48.459

Timing: 20 secs
Key outcome: Introduce new section on Hardware
Activity:
Background:
Questions:
Misconceptions/issues to note:

Hardware: Network Interface Card / Controller (NIC)

- usually now integrated into a PC, laptop or mobile device
- connects a device wired or wirelessly **to a LAN**
- it uses a **protocol** to ensure successful communication with other devices
- every NIC has a permanent, unique number, called the **MAC address** (or physical address)

Timing: 2 minutes
Key outcome: Know what a NIC is
Activity: Discuss the slide
Background:

C in NIC is either controller or card. Card is a throwback to when NICs were an additional purchase to most PCs and had to be installed and plugged into a slot on the motherboard.

The NIC is now a chip on the motherboard in modern devices.

The NIC will receive frames from the wire and inspect the destination MAC address, if this is the local address or the broadcast address the frame will be passed on to the CPU for further processing. If not the frame will be discarded.

Questions:
Misconceptions/issues to note:

Images:
https://www.flickr.com/photos/51036506@N05/

Hardware: Switch

- A switch sends data between computers on a **local area network.**
- It can only route traffic on a **single network**
- It uses the **MAC address** on a device to route traffic

Timing: 2 minutes
Key outcome: Know what a switch does
Activity: Discuss the slide

Background:

A switch routes traffic on a local area network only. It uses MAC (physical) addresses of devices.

More accurately it receives packets from machines via its ports, sends packets to destination via its ports, and in this way connects devices together on a LAN.

contained within a home "router" which is really a multi-function device containing router, switch and WAP.

Additional info beyond GCSE A switch “learns” which machines are connected to which ports so that it can send data directly to the intended recipient rather than having to broadcast to all devices (like a Hub would).

Questions:
Misconceptions/issues to note:

Image:

Switch https://pixabay.com/photos/it-switch-network-data-processing-1361846/

Hardware: Router

- a router connects **different networks**
- it reads the **IP address** and forward messages to the correct **network**
- A “home router” is not just a **router**, it contains a **WAP**, a **switch** and a **modem** too.

Timing: 2 minutes

Key outcome: Know what a router does

Activity: explain the slide, the top image are Cisco "core routers" that enable the internet backbone, and stand over a metre high!

Background:

A router often provides connectivity to the Internet but it does not always do so if it is connecting devices on a LAN for example. Students often use the term router synonymously with switch, hub, wifi, modem and so on. It is worth spending time telling students that a modern “Home Hub” is a box that performs a range of functions that separate pieces of hardware (as listed) would all do separately. It is a piece of hardware integrating several functions and actually when we refer to a router as an “internet router” this still performs the same function of forwarding data packets.

It is true to say though that the **main** purpose of a router is in fact to connect multiple networks and forward data packets.

Questions:

Misconceptions/issues to note:

Images:

Hardware:
Wireless access point (WAP)

- wireless access points allow **wireless** devices to connect to a wired network
- WAPs **convert** data they receive through cables into a wireless signal (& vice versa)
- they're commonly found in public places
- a "home router" also contains a WAP

Timing: 2 minutes

Key outcome: Know what a WAP is

Activity:

Explain to participants the role of a wireless access point (WAP), explain the fact it converts data that is received via a wired connection into a wireless connection and are commonly found in public places.

You may wish to touch upon the benefits / risks of using a wired / wireless network connection at this point – more detail on this topic is included in the media transmission PDE.

Background: A device like the image shown may be found on the ceiling of many classrooms or in the corridors, ask students to look out for them.

There is a WAP inside a home router also. Inside these devices are antennae (aerials) which are now usually concealed within the plastic case, but earlier devices had visible antennae sticking out.

Improvements in the WiFi protocols mean that they can function very effectively these days without the external antennae.

Questions: Where have you seen these? (School, shopping malls, public buildings)

Misconceptions/issues to note:

that your home "router" is a router. It is is actually a multi-function device with a switch, WAP and router in one device.

Image:

http://www.linksys.com/images/productmt_aem/898d12ba-e1d2-4486-ad88-765b51151708/renditions/cq5dam.web.372.372.jpeg

Hardware: Transmission Media

Fibre Optic

Long-distance connections and **wide area networks** are usually connected with fibre optic cable

Fibre optic has a **higher bandwidth** than copper and suffers from **less interference**

Copper

Local area networks are usually made with unshielded twisted pair (UTP) copper cable

It is **cheap** and flexible which makes it easy to install

Wireless

Laptops, tablets and smartphones usually connect **wirelessly**.

It's **cheaper** than installing lots of cables. Users can **work flexibly**.

But is **less secure** and can be affected by **obstructions** and **congestion**

Timing: 3 minutes

Key outcome: Know types of transmission media

Activity: Discuss the slide

Background: This is the way signals travel between devices.

"Fibre broadband" means that the cables between your ISP and your house (or the cabinet in the street) are fibre-optic so you get higher bandwidth (higher Mbps speed)

If you're not on fibre broadband you're on copper cable. The wired LANs in school are probably copper UTP cable, of a standard called CAT5 (category 5), CAT6 or CAT7.

Once the internet arrives at your house over fibre or copper (or both, even in fibre broadband, usually the "last 100 yards" from the cabinet is copper) then

your internet streams usually travel over WiFi, then copper, then fibre!

Questions:

Misconceptions/issues to note:

Images:

Optic fibre: https://cdn.pixabay.com/photo/2014/10/25/18/46/fiber-optic-cable-502894_960_720.jpg

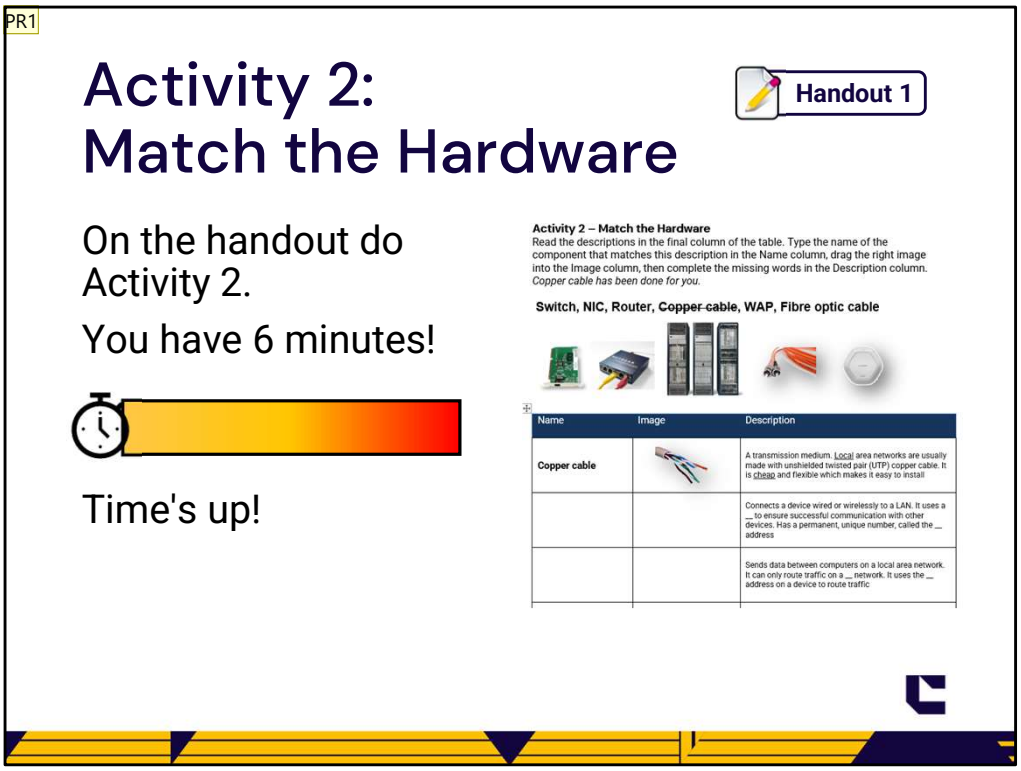
CAT5: https://api.ndla.no/image-api/raw/mt8BmjkS.jpg

Wireless: author's own image made in Canva Pro – Alan Harrison

Slide 19

PR0 I think it looks a bit odd that it's too realistic images then a icon?
Paul Robson, 2024-10-21T10:49:54.169

AH0 0 I made one
Alan Harrison, 2024-11-08T14:46:48.121



Timing: 6 minutes

Key outcome: Apply knowledge of hardware devices

Activity: On the handout, students do activity 2. Click to start the timer. (The timer bar will fill up over 6 minutes)

They should drag and drop the icons and type the names of the devices, then fill in the missing words marked with underscores.

Background:

Questions:

Misconceptions/issues to note:

Slide 20

PR0 Would be useful to have a clock with timing on for student.
Paul Robson, 2024-11-11T10:27:36.431

PR1 I would add in answers for PDL to review?
Paul Robson, 2024-11-11T10:30:25.467

Activity 2 Answers

Name	Image	Description
Copper cable		A transmission medium. Local area networks are usually made with unshielded twisted pair (UTP) copper cable. It is cheap and flexible which makes it easy to install
NIC		Connects a device wired or wirelessly to a LAN. It uses a **protocol** to ensure successful communication with other devices. Has a permanent, unique number, called the **MAC** address
Switch		Sends data between computers on a local area network. It can only route traffic on a **local** network. It uses the **MAC** address on a device to route traffic
Router		Connects different networks. It reads the **IP** address and forward messages to the correct **network**
WAP		Allows wireless devices to connect to a wired network. Converts data it received through cables into a **wireless** signal (& vice versa)
Fibre optic cable		Long-distance connections and wide area networks are usually connected with this. It has a higher **bandwidth** than copper and suffers from less **interference**.

Timing: 2 minutes
Key outcome: Check knowledge of hardware devices
Activity: Go through the answers and check for understanding.
Background:

NIC: Connects a device wired or wirelessly to a LAN. It uses a **protocol** to ensure successful communication with other devices. Has a permanent, unique number, called the **MAC** address
Switch: Sends data between computers on a local

area network. It can only route traffic on a **local** network. It uses the **MAC** address on a device to route traffic

Router: Connects different networks. It reads the **IP** address and forward messages to the correct **network**

WAP: Allows wireless devices to connect to a wired network. Converts data it received through cables into a **wireless** signal (& vice versa)

Fibre optic cable: Long-distance connections and wide area networks are usually connected with this. It has a higher **bandwidth** than copper and suffers from less **interference**.

Questions: Did you get everything? Any alternative answers?

Misconceptions/issues to note:

NIC: Connects a device wired or wirelessly to a LAN. It uses a **protocol** to ensure successful communication with other devices. Has a permanent, unique number, called the **MAC** address

Switch: Sends data between computers on a local area network. It can only route traffic on a **local** network. It uses the **MAC** address on a device to route traffic

Router: Connects different networks. It reads the **IP** address and forward messages to the correct **network**

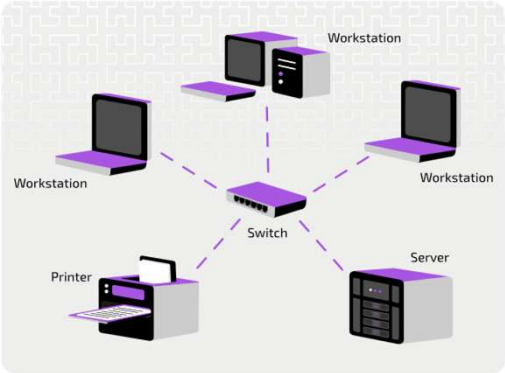
WAP: Allows wireless devices to connect to a wired

network. Converts data it received through cables into a **wireless** signal (& vice versa)
Fibre optic cable: Long-distance connections and wide area networks are usually connected with this. It has a higher **bandwidth** than copper and suffers from less **interference**.

Timing: 20 secs
Key outcome: Start new section on topologies
Activity:
Background:
Questions:
Misconceptions/issues to note:

Network Topologies – Star

- Devices connect to a central **switch**.
- The switch directs each message to the intended recipient device



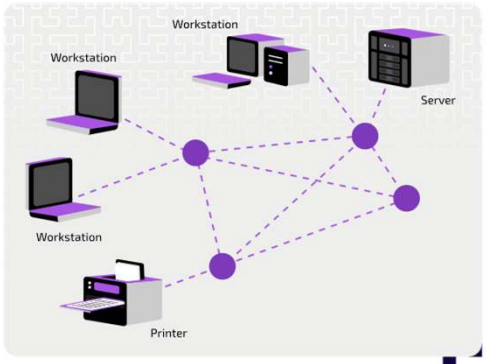
Time: 2 minutes
Key outcome: Know the Star topology basic features
Background information:

Advantages: More secure than bus or ring as packets are routed only to the authorized recipient.
Individual devices and cables are not critical and can fail leaving the network working, unlike bus or ring topologies.
Disadvantages: Central switch is a single point of failure.
Misconception: A common misconception is that a **server** is at the centre of a star network, but as you can see a **switch** is at the centre with a server connected to it.

Image from Isaac comp sci
https://isaaccomputerscience.org/api/v3.5.0/api/images/content/computer_science/computer_networks/networking/figures/isaac_cs_net_network_star.svg

Network Topologies – Mesh

- No central switch. Instead, there are multiple paths between the **switches**, **WAPs** and **routers** that form the network.
- A **partial mesh** topology connects some devices directly and others through intermediary nodes, unlike a **full mesh** where each device connects to every other.



Time: 2 minutes
Key outcome: Know the Mesh topology basic features

Background information:
The purple dots on the diagram are either **switches, WAPs**, or **routers.** Not shown is an internet connection, which would usually be provided as well.
Advantages: No critical point of failure (like the single switch in a Star network) as multiple pathways and switches.
Disadvantages: Expensive, complicated, hence a **full mesh** topology, where every device connects to every other, is often impractical due to cost and complexity, so a **partial mesh** is more common

Misconception: A mesh is sometimes shown with every client device connected to every other device. This is an over-simplification, and the diagram above where each node is a **switch** or **WAP** is more accurate. Think about a shopping mall with hundreds of wireless access points (WAPs) all meshed and connected to a big, fast router and on out to the internet. Every shopper with a mobile phone will connect to the nearest WAP but then get multiple routes out to the internet. Also home wireless mesh systems are now available such as Amazon Eero or BT Whole Home which create a mesh of WAPs in the home for greater coverage.

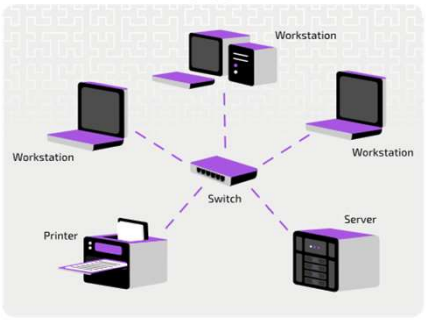
Image from Isaac
https://isaaccomputerscience.org/api/v3.5.0/api/images/content/computer_science/computer_networks/networking/figures/isaac_cs_net_network_mesh_topology.svg

Activity 4: Hide and Draw!

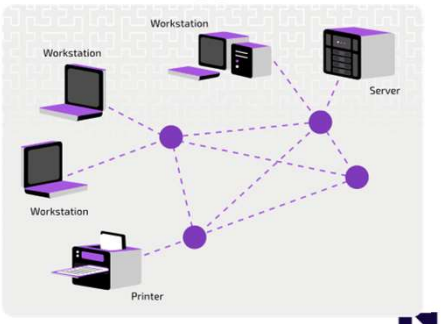
PR0

Memorise the Star and Mesh diagrams, you will draw them in a moment…

Star



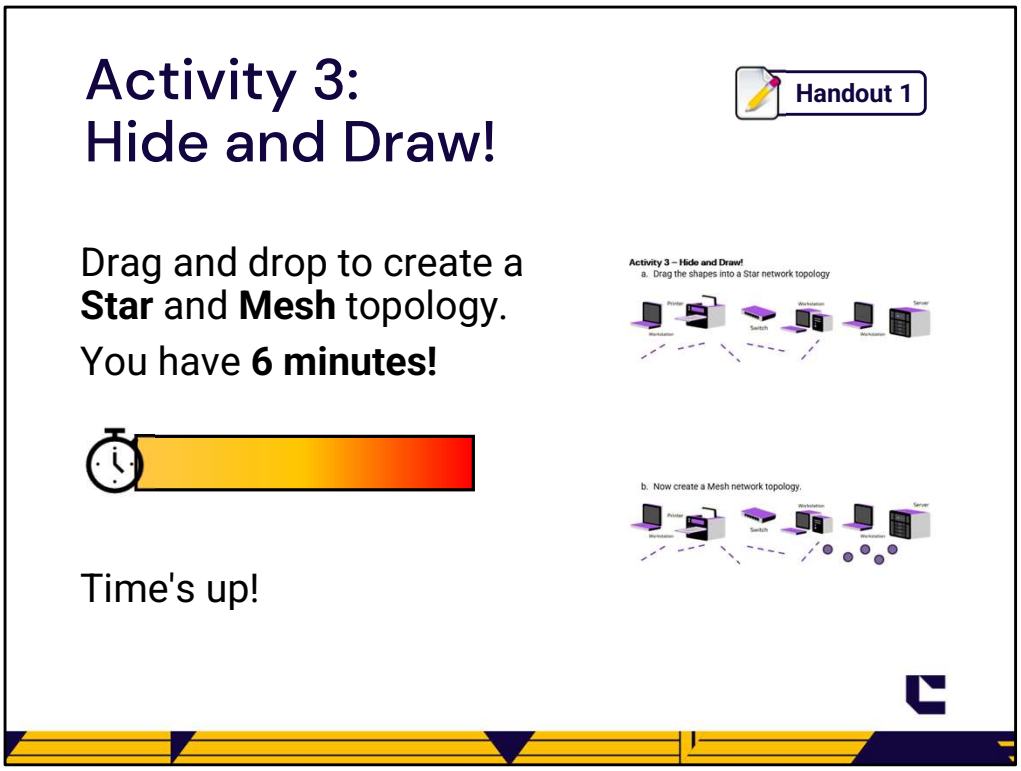
Mesh



Timing: 1 minute
Key outcome: Memorise the topologies ready for the activity
Activity:
Background:
Questions:
Misconceptions/issues to note:

Slide 25

PR0 No notes at all on the next 3 slides can we add.
Paul Robson, 2024-11-11T09:47:17.559

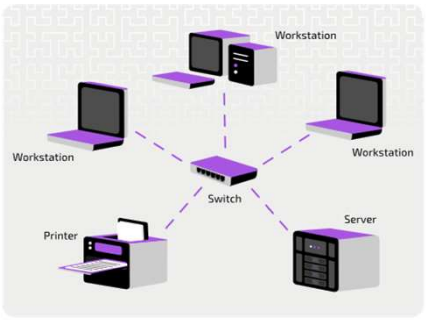


Timing: 6 minutes
Key outcome: Recall the star and mesh topologies
Activity: Activity 3 on the handout. Click to start the timer, the clock will pulse and the bar will animate until it's fully filled in.
Background:
Questions:
Misconceptions/issues to note:

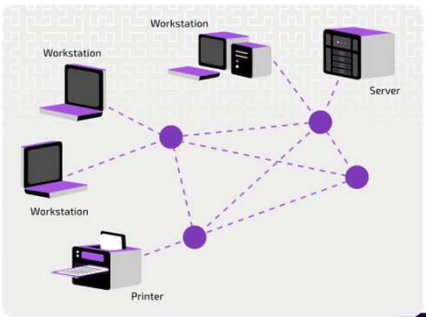
Activity 4: Hide and Draw!

Solutions, how did you do?

Star

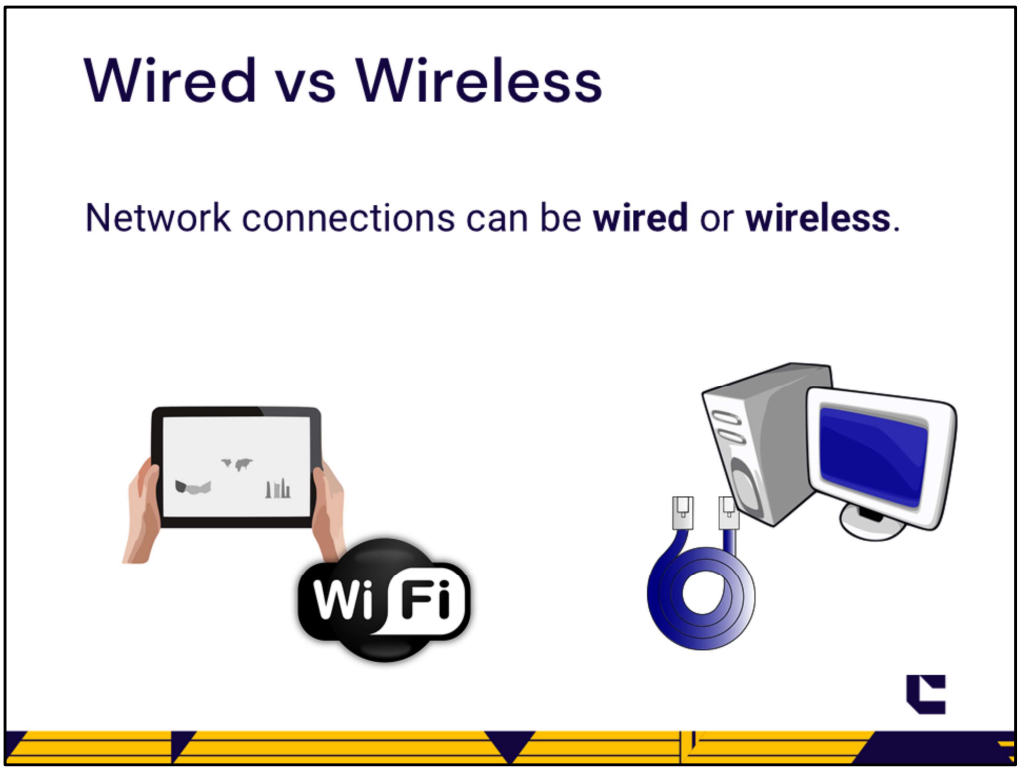


Mesh



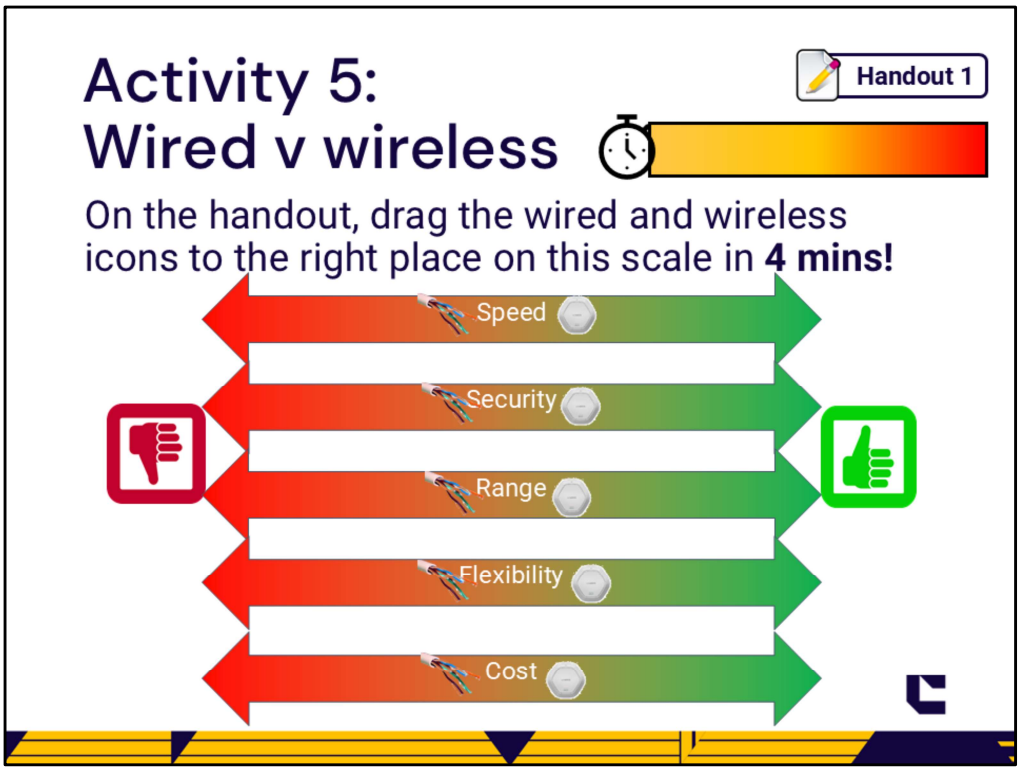
Timing: 2 minutes
Key outcome: Reveal and check the topologies
Activity: Discuss the solution, did they get it right?
Background: AQA also require they know a "logical
Questions:
Misconceptions/issues to note:

Timing: 20 secs
Key outcome: Introduce new section wired v wireless
Activity:
Background:
Questions:
Misconceptions/issues to note:



Timing: 1 minute
Key outcome: Know that network connections can be wired or wireless
Activity: Discuss the slide
Background:
Wireless connections use WiFi, Bluetooth or NFC and wired connections usually use an ethernet cable (although a PAN could be made over USB or Firewire).
Most consumer devices now make wireless connections (phone, tablet, laptop, smart TV, games console etc.)
Wired connections are still used by desktops in schools and offices, and by servers.
Questions:
Misconceptions/issues to note:

Images:
Tablet: https://pixabay.com/vectors/tablet-pc-computer-technology-311350/
Cable: https://pixabay.com/vectors/cable-network-data-transfer-38382/
PC: https://pixabay.com/vectors/computer-hardware-monitor-tower-23232/
Wifi: https://pixabay.com/vectors/wifi-access-internet-logo-network-158401/



Timing: 4 minutes

Key outcome: Compare properties of wired v wireless networks

Activity: On the handout, drag the wired and wireless icons onto the scale, for each of the properties shown. Click to start the timer bar.

Background:

Questions:

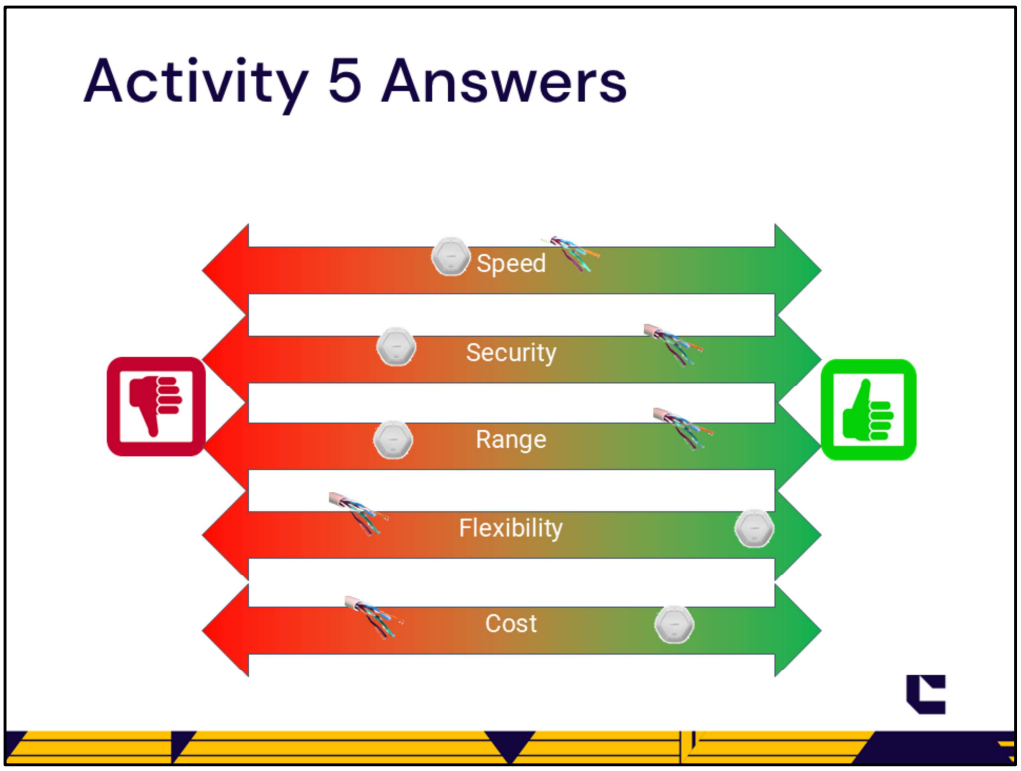
Misconceptions/issues to note:

Activity:

Images:

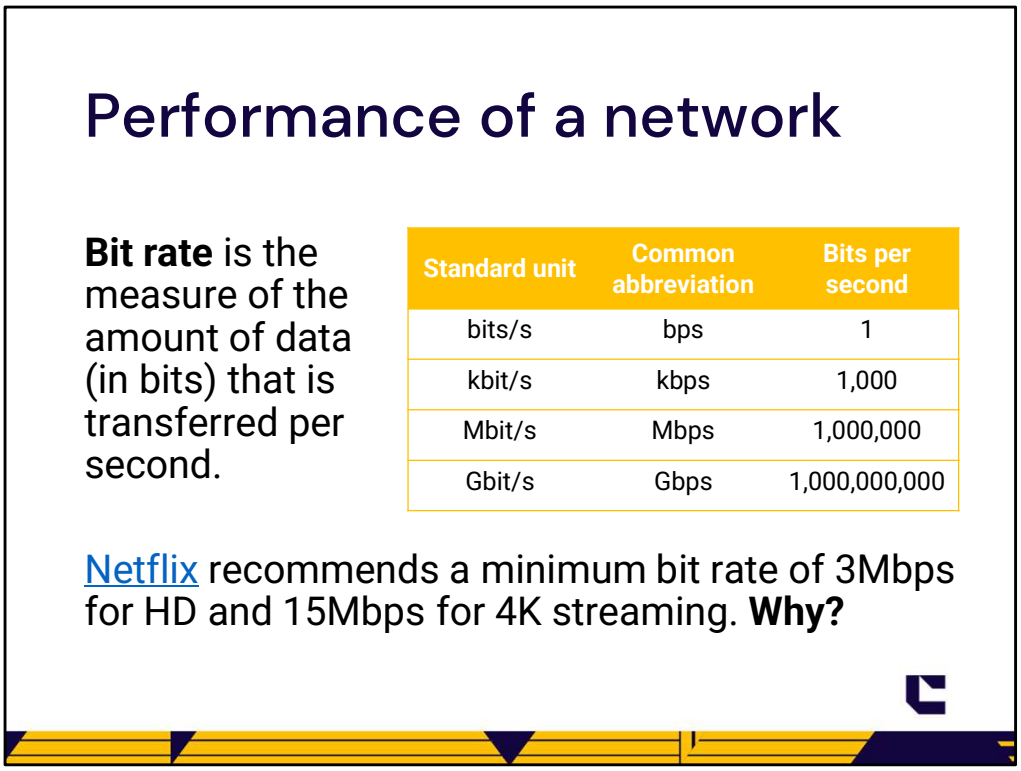
Green thumb: https://pixabay.com/vectors/good-hand-up-green-thumb-thumb-up-157436/

Red thumb: https://pixabay.com/vectors/bad-hand-down-red-thumb-157437/



Timing: 4 minutes
Key outcome: Compare properties of wired v wireless networks
Activity: Go through the answers using the advice below. Note that these are rough averages, because there are many standards with overlapping performances, and these are improving all the time.
Background:
Speed: Wired networks are usually faster than wireless, but this is changing as WiFi gets faster.
Security: Wired networks are more secure because an attacker needs a physical connection, wireless networks can be hacked from outside the building (if poorly

configured)
Range: Wired networks can run for hundreds of metres, but standard WiFi is only tens of metres.
Flexibility: Wireless networks are more flexible and easy to set up, users can work anywhere.
Cost: Wireless is usually cheaper than wired, because of the cost of all the cables and switches.
Questions: Do you disagree?
Misconceptions/issues to note: Be flexible on disagreements, as these are just rough rules of thumb and technology is always changing.



Timing: 2 minutes

Key outcome: Know some performance key terms

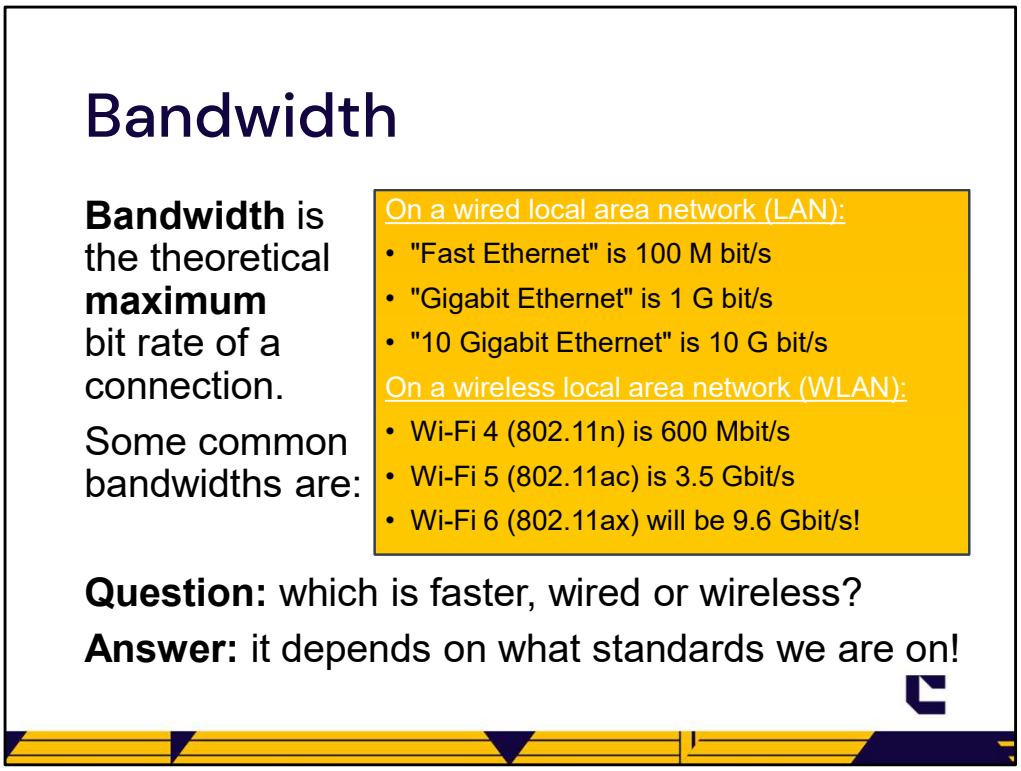
Activity: Discuss the slide

Background:

Questions: Question on slide

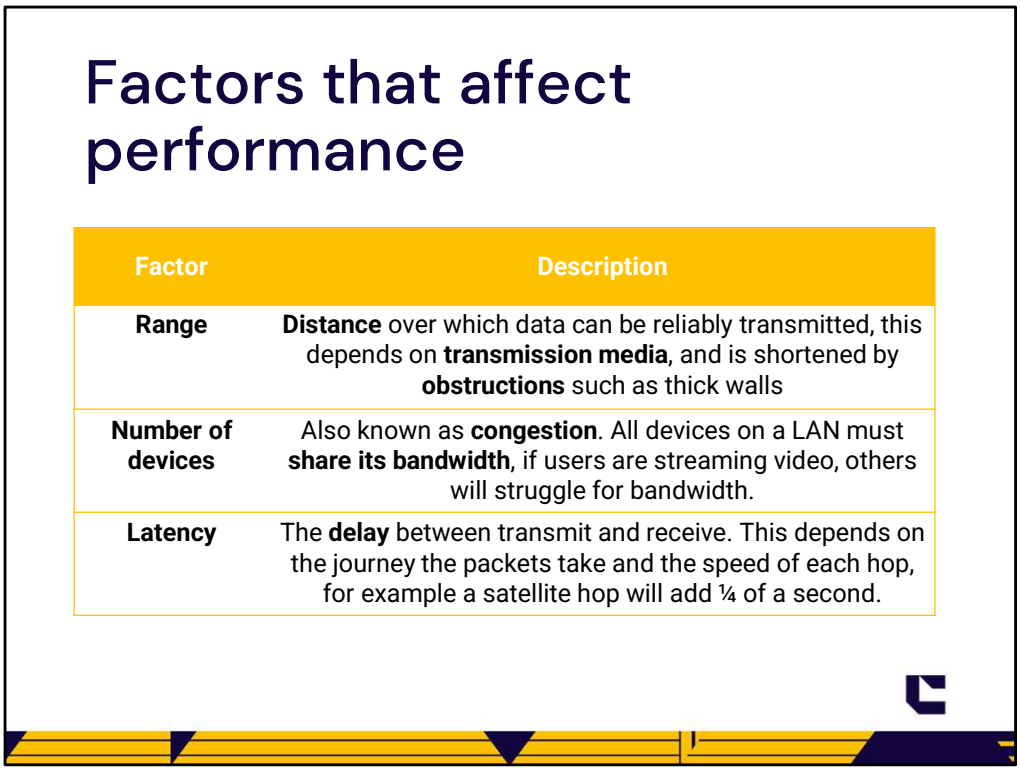
Answer: Video streams are a sequence of bitmaps, i.e. grids of binary values that represent the colour of pixels on the screen. A HD film contains a lot of data, so to watch without buffering we need a connection that supports 3Mbps.
4K contains about 4x the number of pixels of HD so needs at least 4 times the bit rate (plus a bit extra to cater for congestion).

Misconceptions/issues to note:



Timing: 2 minutes
Key outcome: Understand bandwidth, and some common bandwidths
Activity: Discuss the slide
Background: connection standards get faster all the time. Beware of out-of-date textbooks, websites and exam questions!
Questions: On the slide…
Answer: Both technologies get faster all the time. Exam questions have previously insisted that wired connections are faster, but this is no longer simple!
BT's current home hubs run Wi-Fi 5 and Gigabit Ethernet, so its wireless connections are faster than its wired ones.

Misconceptions/issues to note:



Timings: 2 mins
Key outcome: Know some factors that affect network performance. They can be error rates and transmission media as these affect the bandwidth of the device.
Activity: Discuss the slide contents
Background: Transmission media can be copper, fibre optic or wireless, and among wireless networks, later WiFi standards have better bandwidth and range.
Range issues can be solved by adding additional WAPs, creating a partial mesh network (e.g. using BT Whole Home or Amazon Eero products)
These performance factors can combine, e.g. in a busy network heavy congestion can reduce the effective range. Also network devices should be placed away from walls and not close to each other
Questions:
Misconceptions/issues to note:

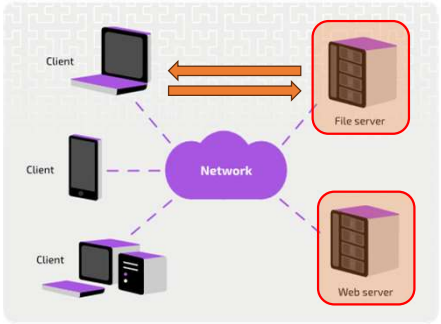
Timing: 20 secs
Key outcome: Introduce new section CS/P2P
Activity:
Background:
Questions:
Misconceptions/issues to note:

Client–server model

Client-server networks have **servers** and allow you to access your files and services from any **client** device.

Centrally you can manage

- Security
- Software installation
- Updates / patching
- Backups



Time: 3 minutes

Key outcome: Understand client-server model

Activity: Discuss the slide.

Emphasise the term **network model** refers to the relationship between computers and the way they interact, it is NOT related to topology.

That client-server is the first of two distinct network **models**, differing in several aspects, including security, software management (backup/install), and permissions.

Misconception: A common misconception is that a star network **must** be client-server and a mesh must be peer-to-peer. This comes from a misunderstanding of the diagrams of **logical** relationships found in some textbooks and on Wikipedia. Those diagrams show logical relationships (how computers share files etc.) and not physical ones.

Background:

Server

A **server** is a specialized computer or a program on a computer that shares resources with, or provides services to, any authorised client. Most servers will run 24 hours a day, 7 days a week, so that a client can send a request for resources at any time.

There are many types of server:

•**File servers** store and provide files.

•**Web servers** store and provide webpages.

•**Email servers** store and forward emails. Some email servers filter out spam.
•**Database servers** store databases, run queries, and allow data to be manipulated.
•**Print servers** provide printing services across the network and manage print queues.

Client

A **client** is a program that typically runs on a device used by an end-user such as a laptop or mobile phone.
A client sends a **request** to the server. The server **processes** the request and then sends a **response** back to the client. For example, when you want to view a webpage, you will use a web browser (which is a web client). The browser will request the page from a web server. The server will send the page back to the browser and the page will be displayed.

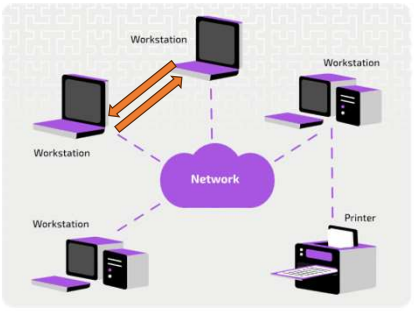
Image from Isaac
https://isaaccomputerscience.org/api/v3.5.0/api/images/content/computer_science/computer_networks/networking/figures/isaac_cs_net_network_client_server.svg

Peer-to-peer model (P2P)

In a peer-to-peer network, there are no central servers. All computers are equal, and as **peers** they communicate directly with each other.

On individual computers you must:

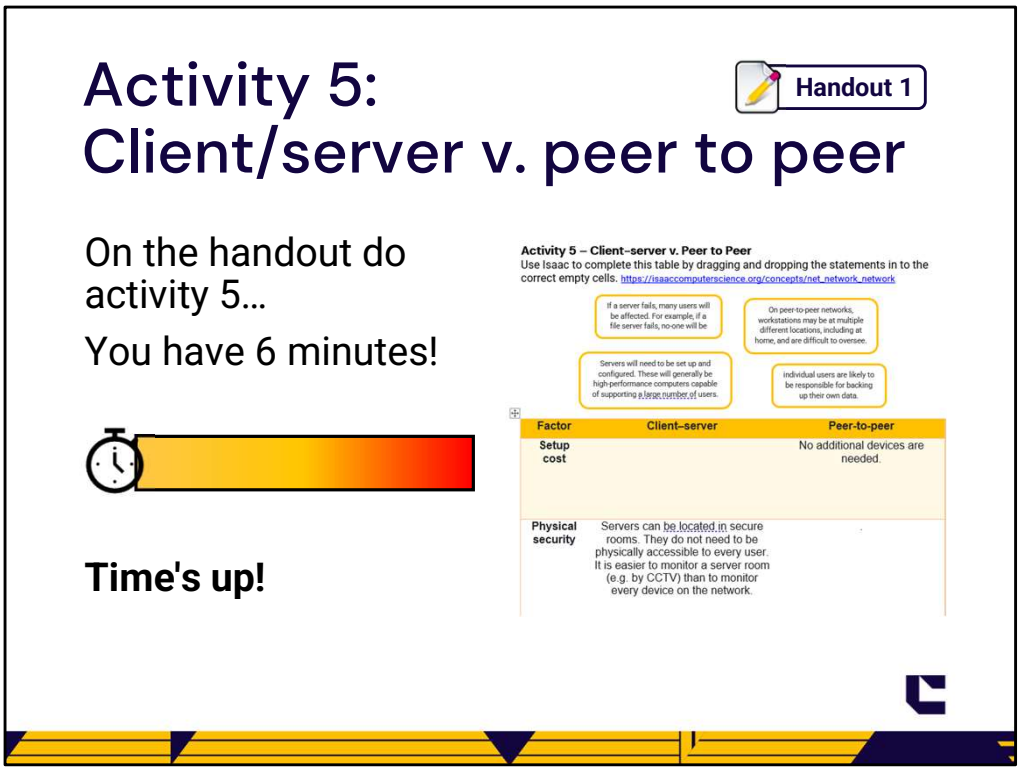
- Manage security
- Install software
- Install updates / patches
- Backup files



Timing: 3 minutes
Key outcome: Understand the peer-to-peer model
Activity: Discuss the slide
Explain that peers communicate directly with each other. The owner of each device gives permission to access some or all of the device's resources.
This needs to be done with care; if you give someone write-access to your disk drive, they would be able to delete all of your files.
Background information:
This model is cheaper because no server is needed, but has many downsides (see slide)

Image from Isaac computing
https://isaaccomputerscience.org/api/v3.5.0/api/images/content/computer_science/computer_networks/networking/figures/isaac_cs_net_network_p2p.svg

https://pixabay.com/vectors/group-people-members-team-business-42917/
https://pixabay.com/vectors/speech-bubble-shape-text-chat-35342/



Timing: 6 minutes
Key outcome: Know the difference between client-server and peer to peer
Activity: They drag and drop the missing paragraphs into the correct places on the table.
Background:
Questions:
Misconceptions/issues to note:

More Background:
<u>Advantages of client-server model:</u>
1.Centralized control for efficient data management and resource sharing.
2.Scalability to accommodate more clients or requests as needed.
3.Simplified maintenance due to centralized updates and management.
4.Enhanced security with centralized security policies.
5.Remote accessibility for clients to access services from anywhere.

<u>Disadvantages of client-server model:</u>
1.Single point of failure risking service availability if the server fails.
2.Scalability limits that can be reached, affecting performance.
3.Potential for traffic congestion with many client requests.

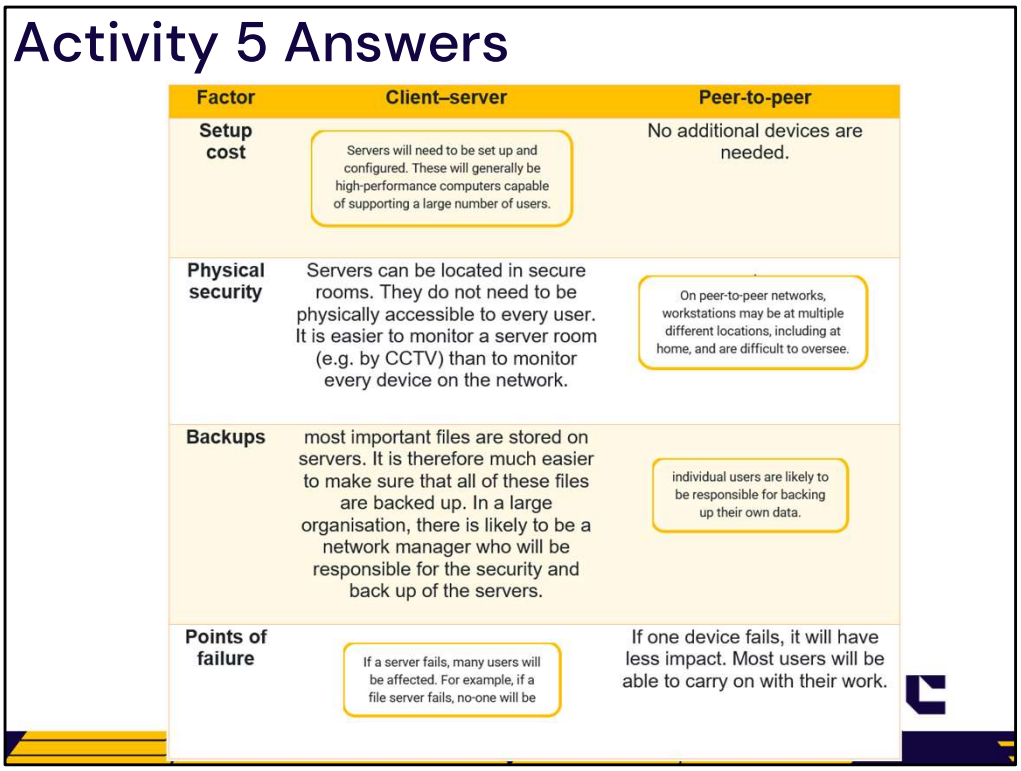
4. **Higher costs** for server hardware and maintenance.
5. **Network dependency** where connectivity issues can disrupt services.

Advantages of Peer-to-Peer (P2P) model:

- **Simple Setup**: Easy to start and connect devices directly.
- **No Single Failure Point**: If one device fails, the network can still work.
- **Direct Sharing**: Files can be shared directly between devices.
- **Easy to Add More Devices**: New devices can join without much trouble.

Disadvantages of Peer-to-Peer (P2P) model:

- **Less Secure**: More open to risks as all devices are potential targets.
- **Hard to Backup**: Difficult to keep track of and backup data properly.
- **Variable Speeds**: Performance depends on the devices' own power.
- **Harder to Control**: No central place to manage the network or data.
- **Relies on Devices Being On**: If a device is off, its files can't be accessed.



Timing: 2 minutes
Key outcome: Check for understanding of the difference between client-server and peer to peer
Activity: Go through the answers
Background: below
Questions: Do you agree?
Misconceptions/issues to note:

More Background:
<u>Advantages of client-server model:</u>
1.Centralized control for efficient data management and resource sharing.
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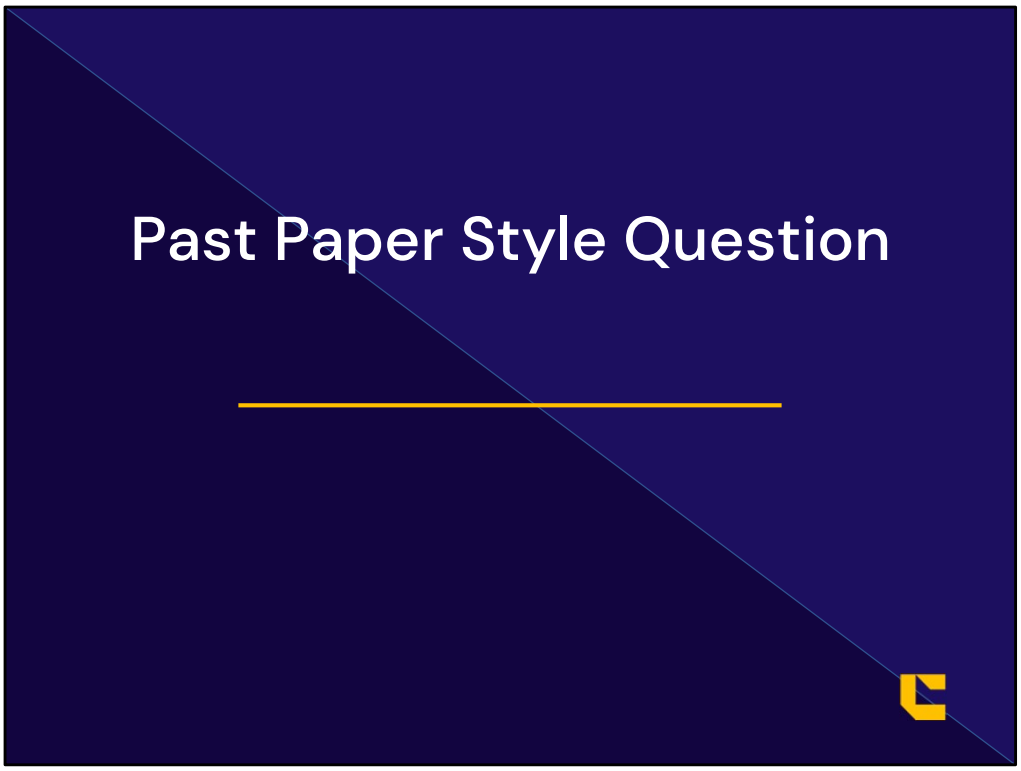
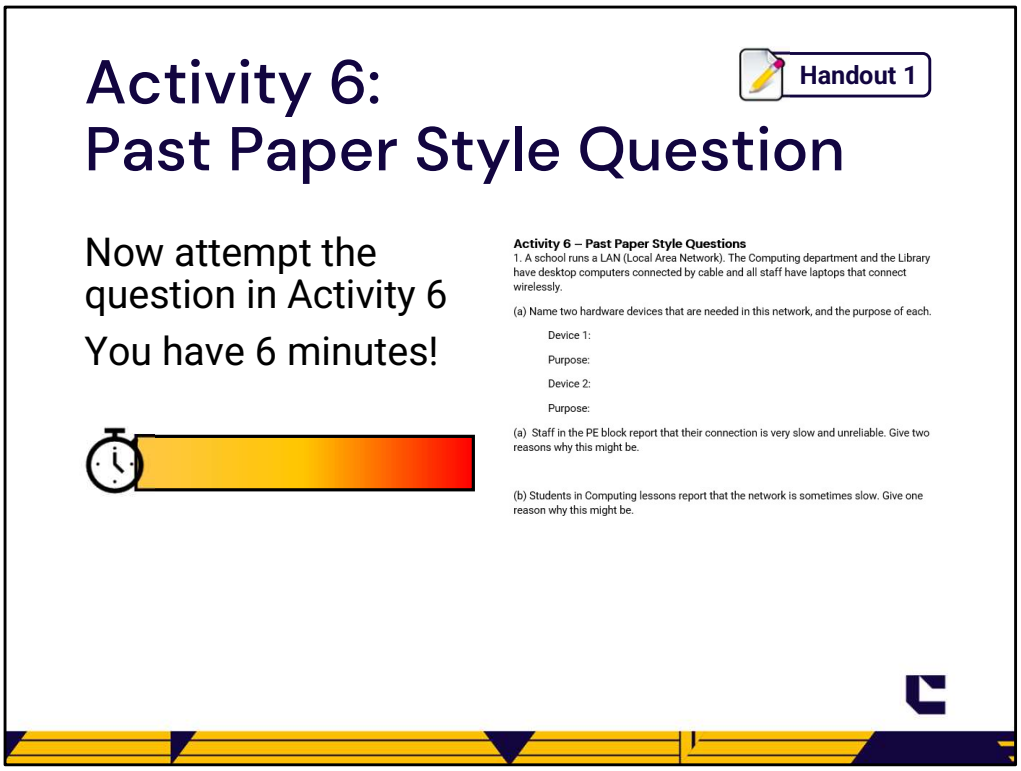
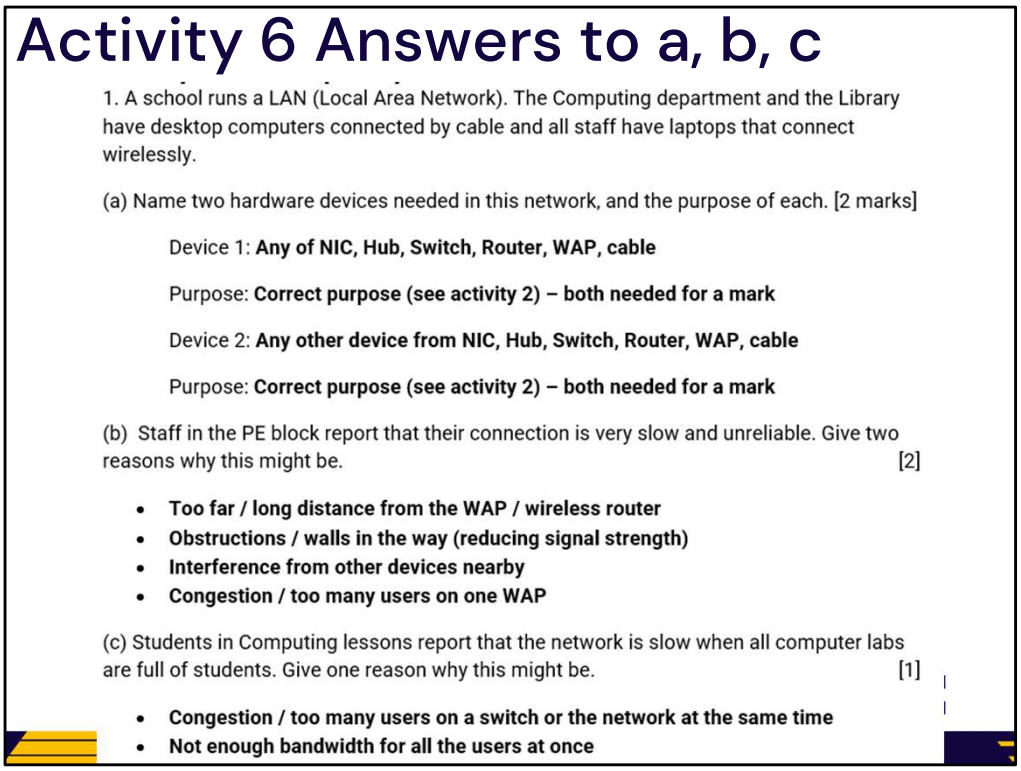


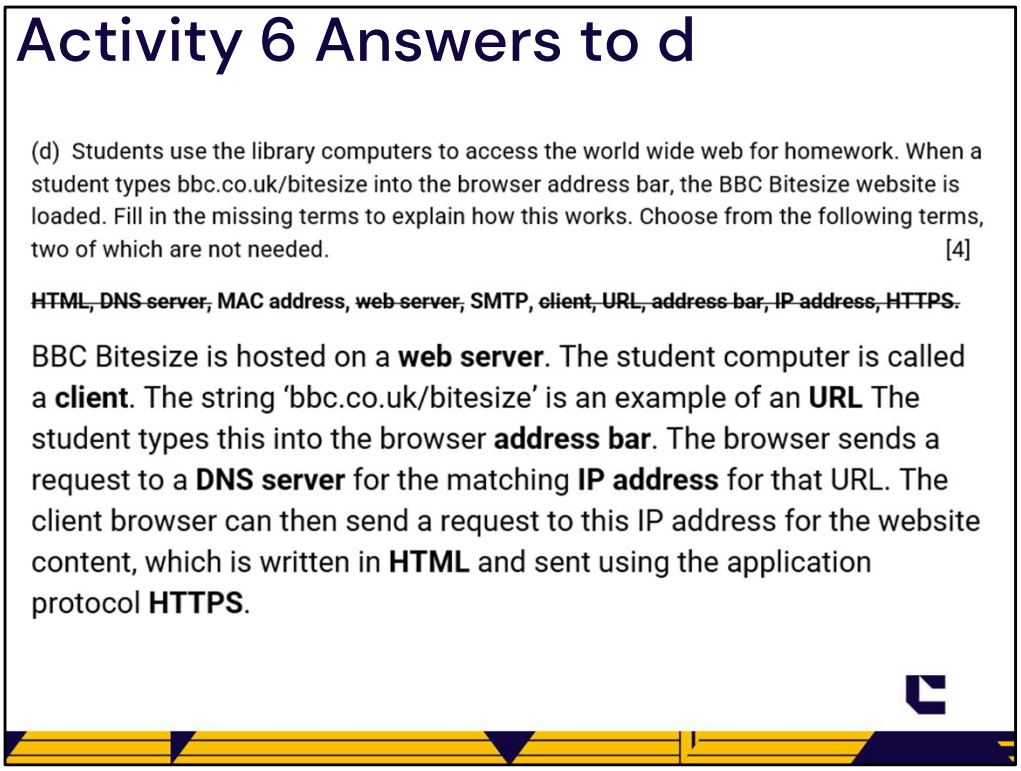
Timing: 20 secs
Key outcome: Introduce new section CS/P2P
Activity:
Background:
Questions:
Misconceptions/issues to note:



Timing: 6 minutes
Key outcome: Check understanding of today's content with a past paper question
Activity: They complete the question
Background: allow 6 mins then 4 mins to review
This is loosely based on OCR J277 Paper 1, June 2022 Question .
Questions:
Misconceptions/issues to note:
There are 9 marks so usually they would get 10 minutes in the exam, but we will run as a walking-talking mock, with 60% of the time to do the Q and 40% to review



Timing: 2 minutes
Key outcome: Check understanding of today's content with a past paper question
Activity: Go through the answers
Background: Questions:
Misconceptions/issues to note:

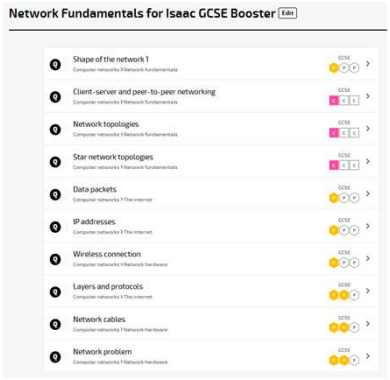


Timing: 2 minutes
Key outcome: Check understanding of today's content with a past paper question
Activity: Go through the answers
Background: Questions:

Misconceptions/issues to note:

Isaac Gameboard practice

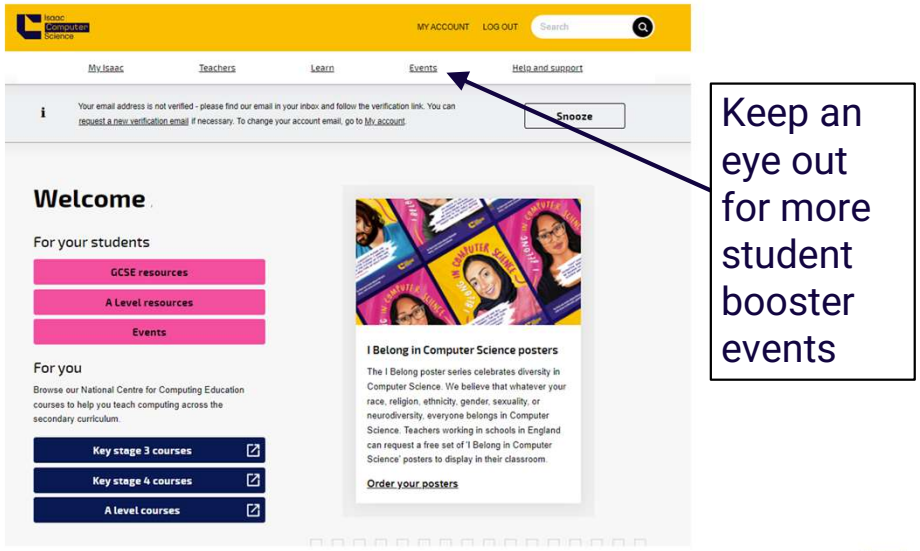
- Don't forget, if you want more networks practice, then try this gameboard.
- You will need to sign in to **Isaac Computer Science** or register for a free account if not done already.



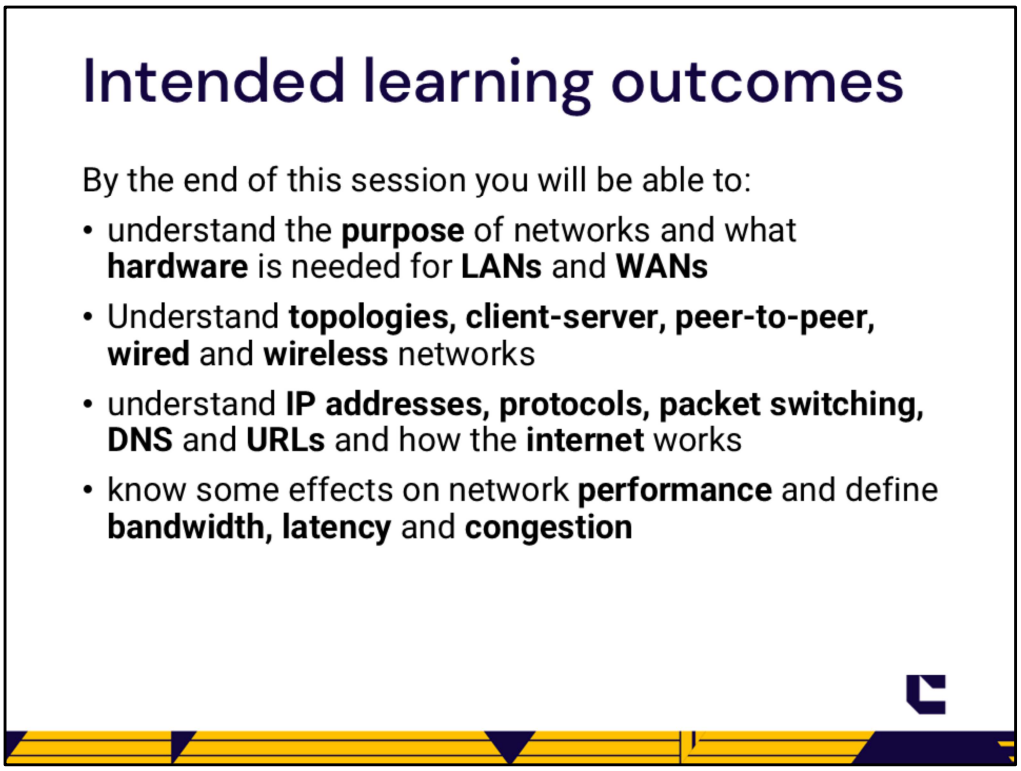
ncce.io/isc-net1

Timing: 1 minute
Key outcome: Remind them of the gameboard
Activity: Discuss Isaac again, it's free!
Background: This does NOT have to form part of the booster. It's to give students more practice if they want it.
Questions:
Misconceptions/issues to note:

Check for more ISAAC boosters



Timing: 1 min
Key outcome: Be aware of Isaac booster events
Activity: Show where to find the boosters on the Isaac page
Background information:
Questions:
Misconceptions / issues to note:



Timing: 1 minute
Key outcome: Review LOs again
Activity: Discus the slide
Background:
Questions:
Misconceptions/issues to note:

Timing: 1 minute
Key outcome: Any questions?
Activity:
Background:
Questions:
Misconceptions/issues to note:

Thank You