



Networks: communication and connections

GCSE Booster

Key Information

- 1) Remember this booster is here to help you. Please consider your behaviour in the chat.
- 2) If you are in a room with a teacher/group, please login to the meeting. This is so we can mark your attendance. This information goes into a **prize draw**.
- 3) Make sure the name on the meeting is the **SAME** as the name on your Isaac account. We can't mark you present if they don't match.





Network Protocols

GCSE Booster

Starter Question... in the **chat**:



What would happen if a different computers spoke different languages?
How would they communicate?

Isaac Computer Science

During this booster you may require access to the [Isaac Computer Science platform](#).

Accounts are free to create. You will be able to:


- Use the platform to develop your subject knowledge
- Use for GCSE for each exam board
- Take part in Gameboards
- Access self-marking questions



Intended learning outcomes

By the end of this session, you will be able to:

- Understand **packet switching**, **IP addresses** and **MAC addresses**
- Know how the **internet** works, using **DNS** and **URLs**
- Know the difference between the **Internet** and the **World Wide Web**
- Describe **protocols**, and say why they are arranged in **layers**

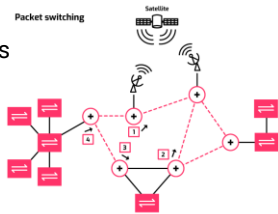


Network addressing



Packet switching

- Files are sent on a network in small chunks called **packets**.
- The packets are forwarded using a method called **packet switching**.
- Different packets from the same file **may** be sent over **different** routes.



Packet Header

To: 184.3.6.22
From: 84.91.11.4
Packet 1 of 6
Checksum: 4B0F

- Each packet has a **header** that helps it reach the correct destination and ensures all packets can be put back together correctly. The header includes:
- The IP address of the sender AND recipient
 - The MAC address of the sender and recipient
 - The packets number and position in the sequence
 - A **checksum**, used to check for errors

IP Address

This is a **logical address** because it is allocated by the switch or router software and can change.

IP Version 4 (IPv4) addresses have 32 bits, but are usually written in "dotted decimal" like this:

Binary	11000000	10101000	00001110	00010111
Dotted decimal	192	168	14	23

= 192.168.14.23

IPv6

32 bits only allows for 2^{32} or about 4 billion addresses which might seem a lot, but we have run out of them!

IPv6 allows 128 bits, and 2^{128} is over 3×10^{38} so we won't run out any time soon!

Binary	00100000	00011000	00000001	10000000	00000000	00000000	01101101	10101100
	00000001	00101101	00100100	01000100	00000000	00000001	10100110	10111011
Hex	2001	182D	1124	8044	0000	0001	6DA6	ACBB

= 2001:182D:1124:8044:0000:0001:6DA6:ACBB



MAC Address

This is a physical address hard-coded into the **NIC** which is used to route packets on a **LAN**.

Consists of six bytes usually written in hex e.g. 00:1s:99:f1:d2:4f

If you go to Settings on a smartphone, you can find all your device's addresses:



Activity 1–
Match the Address



Match the correct type of address (IP or MAC) for each scenario.

Scenario	IP Address or MAC Address
Used to locate a device on the internet	
A fixed address unique to your device	
Can change based on the network you join	
Assigned by the hardware manufacturer	

You have 4 minutes!



IP or MAC Address?

In the chat, type IP or MAC...

- 192.168.1.1
- AB:CD:EF:12:34:56
- 255.255.255.0

IP

MAC

IP


Why might an IP address change but not a MAC address?

Answers in the chat...

Standards and Protocols

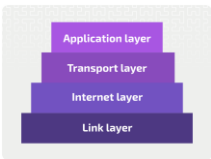
Protocols

- **Protocols** are sets of **rules** that govern how devices communicate with each other.
- They ensure that devices, even from different manufacturers, can work together.
- Most network communication uses groups of protocols organised in layers to manage tasks like sending and receiving data.



Layers of protocols

- Protocols are grouped into layers, and each layer has a defined responsibility.
- Data moves down through the **protocol stack** to the link layer to travel across the network, then back up again at the other end.



Some protocols

- APPLICATION LAYER**
- HTTP (Hyper Text Transfer Protocol) and HTTPS (HTTP Secure) – **web browsing**
 - FTP (File Transfer Protocol) – **file transfer**
 - POP (Post Office Protocol) – **retrieving email**
 - IMAP (Internet Message Access Protocol) – **retrieving email (but better!)**
 - SMTP (Simple Mail Transfer Protocol) – **sending email**

- TRANSPORT LAYER**
- TCP (Transmission Control Protocol) – **maintaining a reliable connection between two devices**
 - UDP (User Datagram Protocol) – **unmanaged transport link that prioritises speed over reliability (AQA only)**

Some protocols

- INTERNET LAYER**
- IP (Internet Protocol) – **routing data packets**

- LINK LAYER**
- Ethernet and Wi-Fi – **exchanging digital signals**

Please check your specification as different exam boards have different lists of protocols you are expected to know about.

Activity 2 – Match the protocols

Drag the protocols to match them with their purpose.
You have 3 minutes!


FTP

SMTP

HTTP/HTTPS

POP

Protocol	Purpose
	Web Browsing
	Sending Emails
	File Transfer
	Retrieving Emails




The Internet

The Internet

Millions of people use the **internet** daily for shopping, social media, streaming, research, and work.

- The internet isn't owned by anyone; it's a network of connections between systems owned by governments, companies, and universities.
- At its core is the backbone: high-speed fiberoptic cables and industrial routers, mostly provided by major telecom companies.



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Internet vs WWW

The **internet** is the network of devices, cables and wireless connections that span the globe.

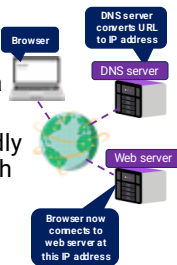


The World Wide Web (WWW) is all the **HTML** web pages that can be viewed in a browser, sent over the **internet**.



Domain Name System (DNS)

- When you browse a website, play an online game, or collect emails, you access the relevant server via its IP address.
- Each server also has a user-friendly name, called a domain name, such as bbc.co.uk or netflix.com.
- The **domain name system (DNS)** converts domain names to the IP addresses needed to locate resources on the internet.




URLs

- A Uniform Resource Locator (URL) is the address of a webpage or other internet resource.
- A URL is a standard format
- A URL typically has five parts:
 - scheme (usually a protocol)
 - sub domain
 - second-level domain
 - top-level domain
 - sub directory



Activity 3 – Label the URL

Handout 1

Identify the following parts of the URL:



1. Scheme: _____


2. Top-Level Domain: _____

3. Sub-Domain: _____


4. Sub-Directory: _____

You have 4 minutes!





Activity 3 – Label the URL – Answers

Handout 1


Identify the following parts of the URL:

1. Scheme: https

2. Top-Level Domain: com

3. Sub-Domain: www

4. Sub-Directory: products/shoes





Cloud computing

'The cloud' means a set of **remote** computing services that are accessed over the internet. Cloud computing services are run out of **server farms**.

Cloud computing may be used for:

- storage
- web hosting
- SaaS and IaaS





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Cloud computing

Positives	Negatives
Unlimited from the point of view of the user.	Can be expensive to store large amounts of data.
Can access your data from anywhere.	Can't access your data if your internet connection goes down or is poor.
Can collaborate with others.	Your data could be hacked without your knowledge.
Automatic backups of your data.	Your data may belong to third party providers.



Activity 4: Explain question



Now attempt the question in Activity
You have **8 minutes!**

Activity 4 – Explain question
A school has so far decided not to use cloud storage for its data storage. All data is stored locally on servers and secondary storage. The head teacher has been told they should move over to storing students' data such as their work in the cloud instead.
Explain **THREE** reasons why the school should move over to using the cloud and **ONE** reason why they should not. (Note: it's important you make a point for each and then relate your answer back to the students' data!)

Remember to use the context in your answer



Activity 4: Explain question



For this style of questions there is **NOT** an exact perfect answer.

You would use a point from the table above.
Then make sure to back it up with a supporting sentence.


Remember to use the context in your answer




Activity 4:

Example paragraph


“If the school moved their data over to the cloud it would allow students and staff to access their data from anywhere. This would be useful for students as they could work on tasks at home ready for school. Staff would benefit from this as they can plan and mark work anywhere, they have an internet connection. ”



Handout 1




Exam Qs




Activity 5:


Past Paper Style Question

Now attempt the question in Activity 5
You have **4 minutes!**





Handout 1



a. HTTP is an example of a network protocol. Define the term network protocol. [2 marks]

b. The application layer and the transport layer are two of the layers within the TCP/IP model. What are the names of the other two layers of the TCP/IP model? [2 marks]

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Activity 5 Answers

a. HTTP is an example of a network protocol.
Define the term network protocol. [2 marks]

Rules; that allow devices / networks to communicate / transfer data;

a. The application layer and the transport layer are two of the layers within the TCP/IP model.
What are the names of the other two layers of the TCP/IP model? [2 marks]

Internet • Link (layer) • Network (layer)



Activity 6:
Challenge: Match protocols



Now attempt the question in Activity 6
You have 6 minutes!



Protocol	Purpose
	Used to send emails
	Used to send webpages that need to be encrypted
	Used to download a copy of the email from the email server
	Used to error check packets and route packets to the correct destination
	Used to send unsecure web pages
	Allows remote control of a mailbox. Allows you to open an email without downloading it to your client machine
	Used to upload files to an online webserver such as HTML pages to a hosting provider



Activity 6:
Challenge: Match protocols

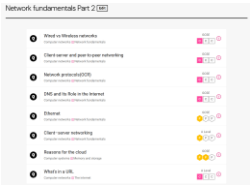


Protocol	Purpose
SMTP	Used to send emails
HTTPS	Used to send webpages that need to be encrypted
POP	Used to download a copy of the email from the email server
TCP/IP	Used to error check packets and route packets to the correct destination
HTTP	Used to send unsecure web pages
IMAP	Allows remote control of a mailbox. Allows you to open an email without downloading it to your client machine
FTP	Used to upload files to an online webserver such as HTML pages to a hosting provider



Isaac Gameboard practice

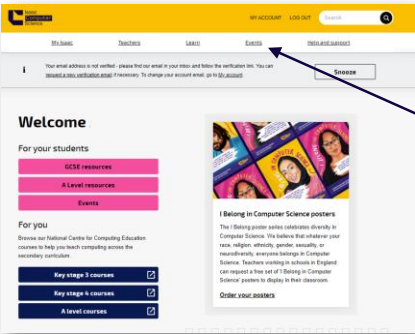
- Don't forget, if you want more networks practice, then try this gameboard.
- You will need to sign in to **Isaac Computer Science** or register for a free account if not done already.



ncce.io/isc-net2



Check for more ISAAC boosters



Keep an eye out for more student booster events



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- By the end of this session, you will be able to:
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Questions?

Thank You

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