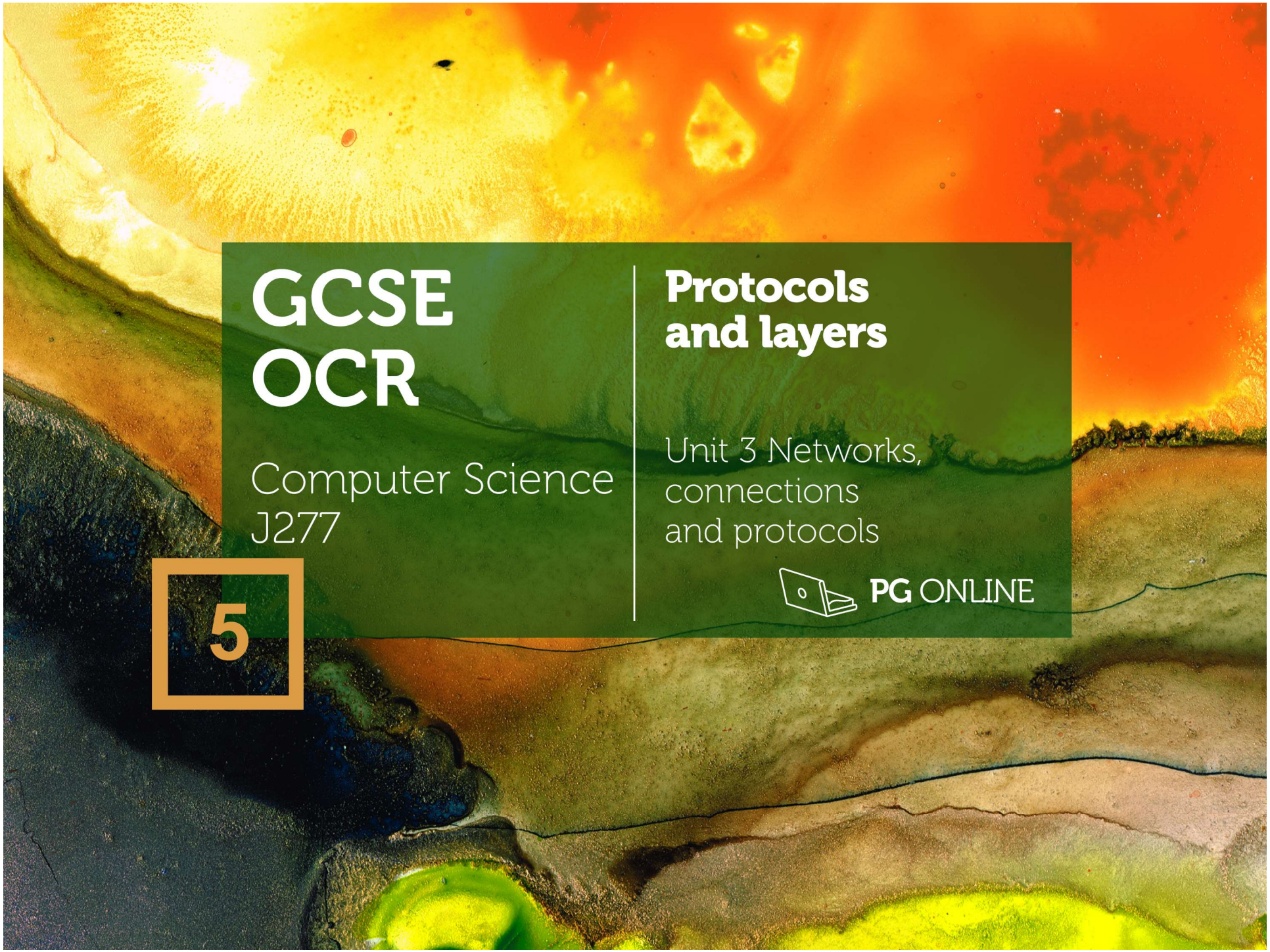
GCSE
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Computer Science
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5
Protocols
and layers
Unit 3 Networks,
connections
and protocols
PG ONLINE

Objectives

- Describe the uses of communications protocols including:
  - HTTP
  - HTTPS
  - FTP
  - POP
  - IMAP
  - SMTP
  - TCP/IP
- Explain the concept of layers in the TCP/IP protocol stack

Starter

- What are the rules around meeting people for the first time
  - What does each person do or say?
  - What can go wrong if people are using different rules?

Protocols

- The set of rules is called a **protocol**
- What is the ‘meet and greet’ protocol for meeting someone new?
  - Smile
  - Say hello
  - Does this work in all countries?
    - Eskimos rub noses
    - Japanese bow
    - Tibetans stick their tongues out!
  - Shaking hands with your left hand can be considered rude in many countries

HTTP and HTTPS protocol

- HTTP (hypertext transfer protocol) is used for accessing and receiving web pages via the Internet
  - These are written in HTML (Hypertext mark-up language)
- The protocol requests a web page from the web server
  - The server then sends its response which contains the web page
- HTTPS (secure HTTP) encrypts the information so that it cannot be understood by an eavesdropper
  - Which websites might require the use of HTTPS?

Websites with HTTPS

Answers

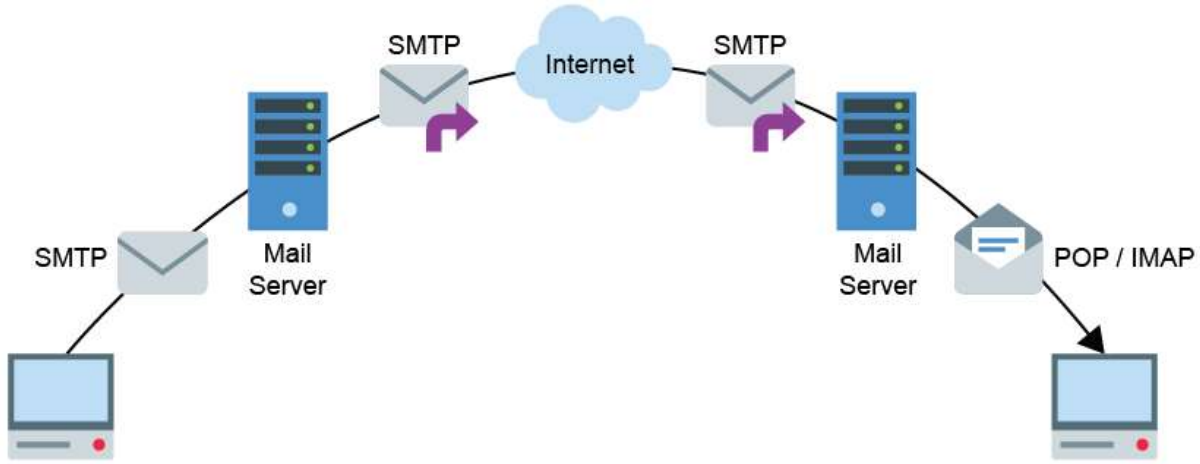
- These days, most websites use HTTPS as they deal with personal data
- Some specific types of site that use HTTPS are:
  - Banks – to prevent theft
  - Online shops – for bank and log in details
  - Social networks – for log in details and personal data

FTP

- File Transfer Protocol (FTP) is used for sending or retrieving files to or from a FTP server
  - A graphical interface will allow files to be dragged from your computer to the server

How email works

- When an email is sent from a computer it will first be sent to a mail server using the SMTP protocol
  - It is then forwarded on by other SMTP servers
  - When it reaches the destination mail server it is stored
  - The user's computer uses POP or IMAP to access the email

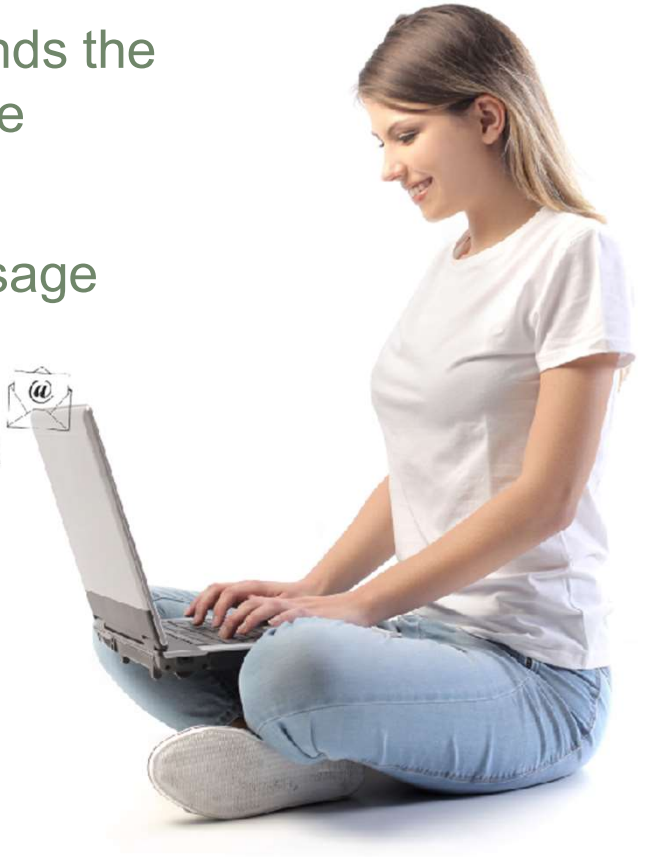


POP and IMAP

- These email retrieval protocols fetch message data and attachments from your remote mail server
  - **POP** (Post-Office Protocol) will download every new message to your local device and with them no longer being available on the server – This is similar to the protocol of sending a letter through a post office
  - **IMAP** (Internet Message Access Protocol) will leave the messages on a server. They can be accessed by multiple devices and they only are removed if the user deletes them

SMTP

- This is an email protocol used for sending email
  - Email software, such as Outlook, sends the email to the SMTP server used by the company or individual
  - The mail server then relays the message through various other servers known as mail relays
  - Finally, the email arrives at the destination mail server



Worksheet 5

- Now complete **Task 1** on **Worksheet 5**

TCP/IP protocol

- TCP (Transmission Control Protocol)
  - Breaks up messages sent over the Internet into small chunks called packets
  - Reassembles the packets at the other end
  - Detects errors
  - Resends lost messages
- IP (Internet Protocol)
  - Routes the individual packets from one IP address to another

The TCP/IP protocol stack

- The protocol stack defines four layers that enable communication on the Internet
  - This is a modular design with each layer being responsible for a small part of the communication process
- The four layers are divisions of network functionality, each carrying out different roles:
  - Application layer
  - Transport layer
  - Internet layer
  - Link layer

Sending data

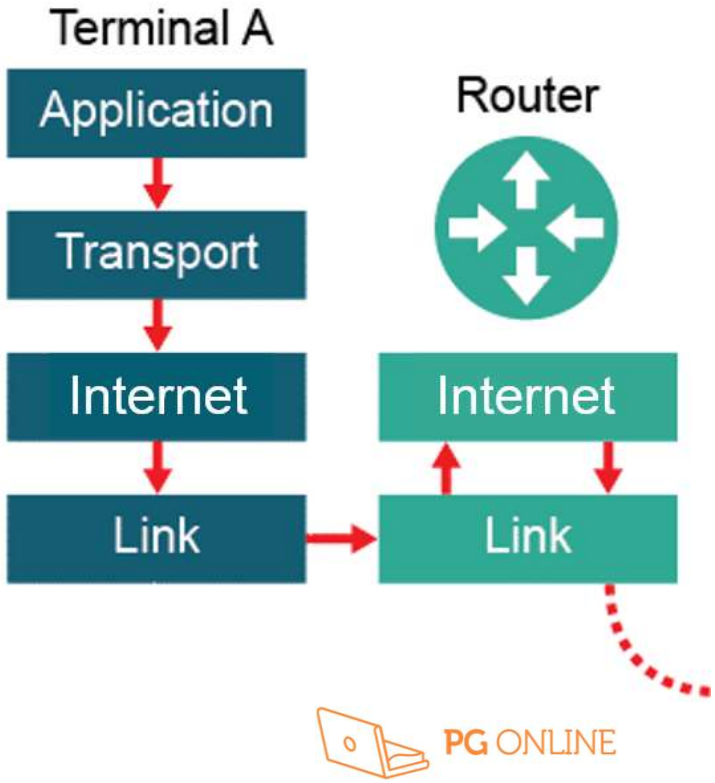
- The application you are using to send data will determine the correct protocol to use to communicate

Computer application produces data for sending

Splits data into packets

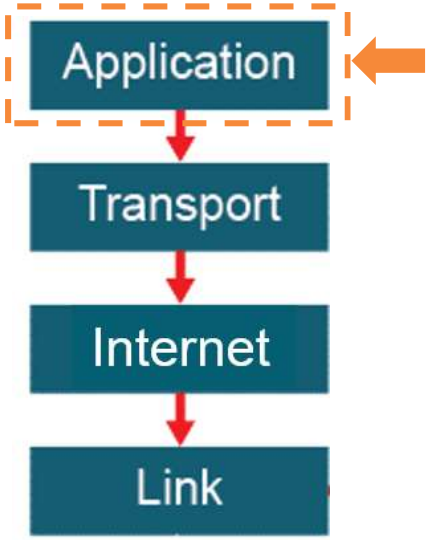
Sends and routes the packets

Physical hardware and cables



Application layer

- Applications such as email clients and web browsers create data to send in this layer
  - SMTP, FTP and HTTP operate in this layer
- Which application protocol would be selected by:
  - A browser connecting to a banking website?
  - An email program used to send a message?
  - File transfer software used to upload files to a website?



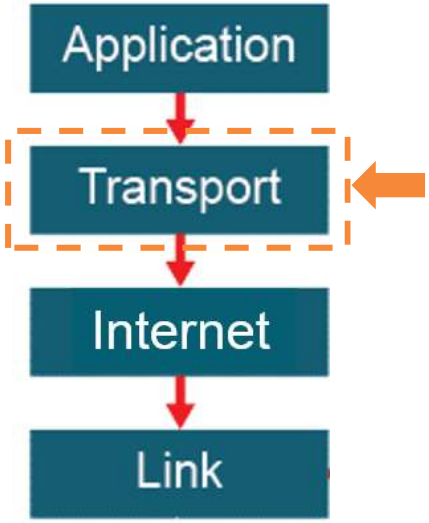
Application layer

Answers

- A browser connecting to a banking website
  - Uses HTTP
- An email program used to send a message
  - Uses SMTP
  - It also uses POP or IMAP to receive mail
- File transfer software used to upload files to a website
  - Uses FTP

Transport layer

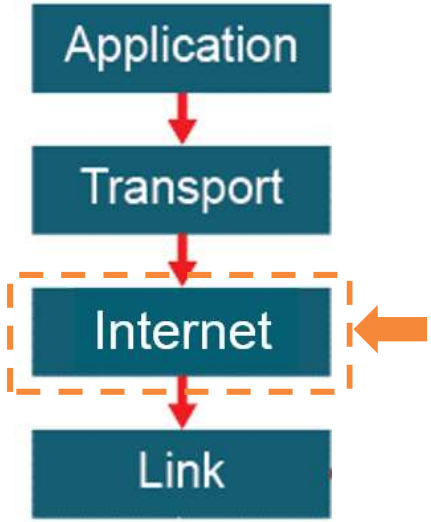
- The Transport layer creates the connection between two computers, or 'hosts'
  - Data is then divided up into packets and given a packet number
  - Packets are reassembled by the recipient's Transport layer
  - Lost packets are resent
  - This layer uses TCP (Transmission Control Protocol)



TG – can alternatively use UDP

Internet layer

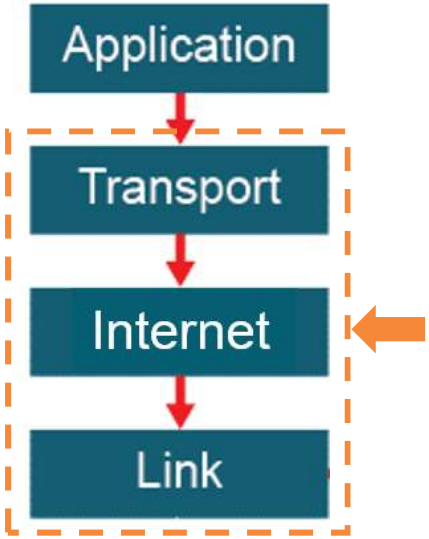
- The Internet layer is responsible for routing packets
  - Routers operate on this layer
- Source and destination addresses are written on to the packets ready for transmission
  - Which protocol operates on the Transport layer (in the last slide)?
  - Which protocol operates on the Internet layer?
  - Which protocols do you think operate in the Link layer?



Layer protocols

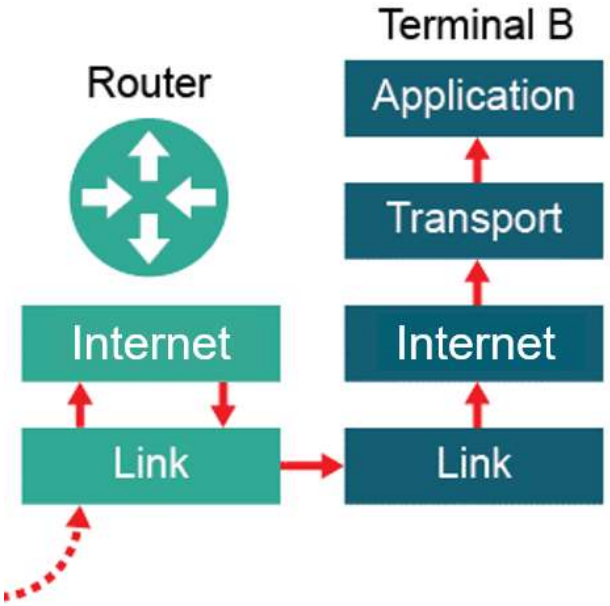
Answers

- Transport Layer
  - TCP (Transmission Control Protocol)
- Internet Layer
  - Internet Protocol (IP)
- Link Layer
  - MAC (Media Access Control)
  - Ethernet
  - Wi-Fi



Receiving data

- Data packets move back up the layers on arrival:



- The link layer removes the MAC address and passes packets up to the Internet layer
- The Internet layer removes the IP addresses and passes packets up to the Transport layer
- The Transport layer reassembles the packets and passes the data to the Application layer
- The Application layer uses the correct protocol to correctly display the data, web page or email for the user

The advantages of layers

- Layers are self-contained
  - The functionality of one layer can be changed without affecting the functionality of other layers
- Different hardware or software operates on a particular layer providing interoperability between providers and systems
  - This means that manufacturer's routers operating on the Internet layer, will operate with another manufacturer's Network Interface Cards (NICs) operating on the Link layer
  - Senders and receivers using different software and hardware can communicate using the same layer protocols

Worksheet 5

- Now complete **Task 1** on **Worksheet 5**

Plenary

- Work in a pair to decide what each of the following acronyms stand for
  - HTTP
  - HTTPS
  - FTP
  - POP
  - IMAP
  - SMTP
  - TCP/IP
- Which pair in the class got the most correct?

Plenary

Answers

- HTTP – Hypertext Transfer Protocol
- HTTPS – Hypertext Transfer Protocol Secure
- FTP – File Transfer Protocol
- POP – Post Office Protocol
- IMAP – Internet Message Access Protocol
- SMTP – Simple Mail Transfer Protocol
- TCP/IP – Transmission Control Protocol / Internet Protocol

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