Lesson: The internet

Introduction

This lesson explores the internet and its uses. Students watch a video explaining the internet and its history. Students gain an appreciation of the vastness of the internet. They watch the video *A Packet's Tale* which explains how messages can be successfully sent from one device to another across the planet in under a second using packets and IP addresses.

Learning objectives

- Define what the internet is
- Explain how data travels between computers across the internet
- Describe key words such as 'packets', and 'addressing'

Key vocabulary

Internet, packet, router, IP address, packet header, packet payload

You will need:

- Slides_The internet

Outline plan

**Timings are rough guides*

Starter activity (Slide 2) 5 mins	**What is the internet?** In this activity, you will be able to determine the learners' current level of understanding with regard to the internet and its uses. Ask learners what the internet is and what it is used for. Ask learners to work in pairs and put their definitions and examples of use on a sticky note or sheet of paper. Read out a few examples from the class. At this stage, do not give the answer. Learners will be able to review their answers later on in the lesson.
Activity 1 (Slides 4–6) 8 mins	**The internet explained** Ask the learners to watch the video on slide 4: www.youtube.com/watch?v=Dxcc6ycZ73M The video is 3 minutes, 44 seconds long. It explains at a high level how the internet works. Vinton Gray Cerf explains the history of the internet and that no one person is in charge of it. Vinton Gray Cerf is an American internet pioneer and widely known as one

	of the “fathers of the internet”. Whilst the video is playing, learners should continue to think about the questions, “What is the internet?” and “What is it used for?”. Display slide 5 to give the learners a definition of the internet. Explain to them that it is a network of networks. It includes all of the physical components of a network, such as the cables, routers, and other pieces of hardware used to connect devices together. Display slide 6, which shows common examples of what the internet is used for, such as entertainment, communication, and social networking. Some of the facts below may be useful to emphasise the enormity of the internet and its uses: • 95 million photos are uploaded to Instagram every day via the internet • Facebook boasts a massive 2.2 billion users • 250 billion emails are sent out daily across the internet. 200 billion of these are spam. • 400 hours of video content are uploaded to YouTube every minute (Facts taken from: lifehacks.io/facts-about-the-internet)
Activity 2 (Slides 7–9) 12 mins	**Data transmission across continents** Move on to slide 7. Learners now know what the internet is, and they understand that it is global. Learners now need to think about how data can transfer from one continent to another. Ask learners to ‘think, pair, share’: ‘How is Australia connected via networks?’. Display slide 8. Some students may have discussed the use of satellites to connect a network. Satellites are used to connect distant networks in some instances, particularly in remote locations where cables are not present, but it is not the most common way. 99% of internet data passing across continents travels through cables that lie on the seabed. These are faster and cheaper than satellites. Ask the learners to visit www.submarinecablemap.com. Share the interesting facts related to oceanic internet cables on slide 9. • The first oceanic cable was laid in 1851 • 99% of internet data is transmitted through cables under the oceans • Ocean cables can be damaged by anchors, trawling fishing nets, and even shark bites! • The longest network is 39,000 kilometres (Facts taken from: www.computerworld.com/article/3412237/10-top-facts-about-google-s-undersea-internet-cable.html) Note: See the appendix for further interesting facts about oceanic internet cables, including about spies and cyberwarfare.

Activity 3 (Slides 10–11) 6 mins	***A Packet's Tale*** Move on to slide 10. In lesson 1, learners found out that there are 27 billion devices connected to the internet. This is more than there are people on the planet. Learners will watch a video called *A Packet's Tale* which will explain how messages can be successfully sent from one device to another using packets that travel through cables from sender to receiver and back again to simulate a person viewing a website. The video is 3 minutes, 30 seconds long. You can find the video at: www.youtube.com/watch?v=ewrBalT_eBM Display slide 11, and summarise the content of the video: • Networks send and receive messages in small units of data known as 'packets'. • A single message may be too large to fit in one packet. It is often split into many packets. • Each packet contains a part of the message, an address of where it came from, and an address of where it is going. These addresses are known as 'IP addresses', and they are unique.
Activity 4 (Slides 12–13) 4 mins	**IP addresses** Display slide 12, and explain to the learners what an IP address looks like. An IP address is made up of four groups of numbers between 0 and 255, each separated by a full stop. These are unique for every device on the internet. Typically, this would be the address of the router that connects to the internet. An example might look like this: 192.168.5.43 Demonstrate to the learners how to find the IP address of the router that connects your machine to the internet. This will have a unique IP address, as it is part of the internet. Any device outside the school network would need to use this IP address to make contact. To look up the router IP address, you simply need to open Google in a web browser and type into the search bar "what is my ip address". Learners could try this at home to see what the IP address of their home router is.
Activity 5 (Slides 14–18) 10 mins	**Packets and routers** Remind the learners about the role of a router. Explain to them that a router joins networks together across the internet. It is important to emphasise at this stage that there are many different ways of getting from one place to another across the internet, and packets of data making up a single message may take different routes. Use the diagram on slide 14 to help illustrate this. For example, a packet travelling from the home router at the top of the diagram to the home router at the bottom of the diagram may travel through internet routers 1,2,3,4, or it may travel through internet routers 1,7,3,4. Packets are sent/passed on to the internet in the correct order, but may travel along different routes until they get to their destination.

Ask the learners which internet routers **all** packets will pass through.

Answer: All packets will pass through internet router 1 and internet router 4. Other internet routers may not all be used, as alternative pathways exist.

Introduction to the order of packets

Move on to slide 15. Explain to the learners that whilst packets are sent in the right order, they may arrive in the wrong order, as they may take different routes across the internet before arriving at their destination. Some of these routes are longer or slower than others, so it is quite possible that the packets will be in the wrong order.

Ask the learners to complete the activity on slide 16, which is as follows:

Imagine that a message to be sent across the internet from device A to device B was "hello how are you?".

The packets are split as follows:
Packet 1: "hello"
Packet 2: "how"
Packet 3: "are"
Packet 4: "you?"
The packets are received at their destination as follows:
Packet 1, Packet 3, Packet 4, Packet 2

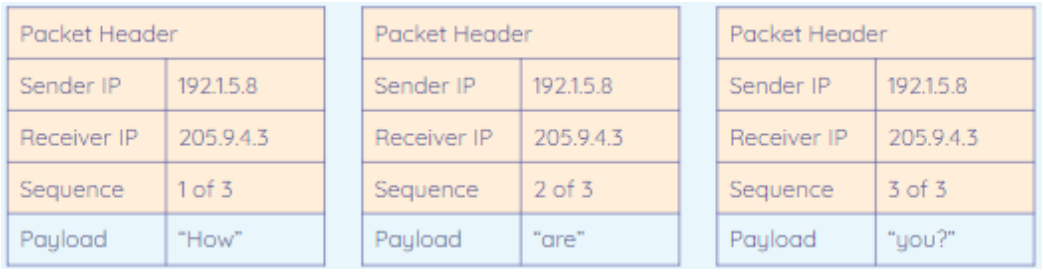
Ask the learners what this message would be if the packets were read in the order in which they arrived, and how this problem might be solved.
Answer: hello are you? how
The payload and the header

Display slide 17. Explain to learners how the problem of unsorted packets is solved. The packet is split into two parts, the **payload** and the **header**:

- The payload contains the piece of the message.
- The header contains information to allow the sequence of packets to be identified. Each packet header holds the total number of packets used to send the whole message, and the sequence number of this particular packet.

Show the learners the simple example of a message sent across the internet on slide 18.

The message is "How are you?", and it is split into three packets. Each packet includes where it came from, where it is going, the data itself (in this case, a single word from the three-word message) and importantly, the sequence number, which allows the packets to be reordered at their destination if required. It would look like this:

	
Activity 6 (Slides 19–20) 5 mins	**The order of packets: Fill in the blanks** Ask learners to complete the 'Fill in the blanks' activity in their worksheets. In this activity, they need to assemble the data packets for a simple four-word message, sent between two devices. There are four packets, one for each word. Some packets have been partially completed. • Sender IP address: 1.1.1.1 • Receiver IP address: 2.2.2.2 • Message: "What is your name?" Display the answers to the learners (slide 20).