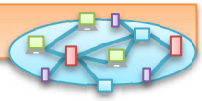
2024

Digital Systems & Networks

Orb education

Dan Collingbourne



☐	1. Wordlist
☐	2. Digital Systems
☐	3. Inputs and Outputs
☐	4. Working Together
☐	5. Types of Computers
☐	6. Evolution of Technology
☐	7. System Performance
☐	8. Connecting Systems
☐	9. Building Networks
☐	10. Using Networks
☐	11. Network Design
☐	12. Network Speed
☐	13. Packets and Protocols
☐	14. Network Security
☐	15. Encryption
☐	16. Encryption Spreadsheets

A system can be defined as 'a group of elements, working together to achieve some function'.

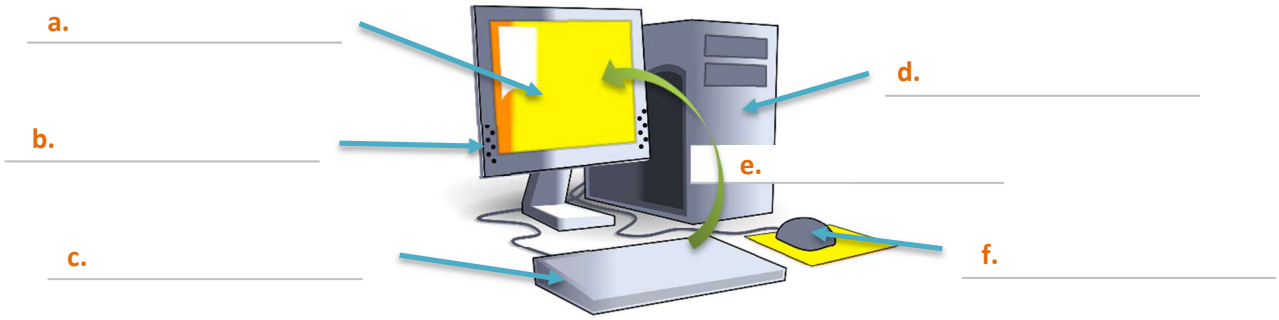
Aim: *To learn a little about the main internal components of a digital computer system.*

Task 1 – Computer Systems

A computer is an example of a digital system. It is digital because when you get down to the very basics of how a computer works, you are dealing with lots of 1s and 0s (and nothing in between). This is digital. Computers have billions of tiny electronic switches that can be either on (1) or off (0). Software programs can be boiled down to a stack of 1s and 0s. Data is passed around as streams of 1s and 0s.

Use the terms below to label the diagram of a computer system.

Speaker *Keyboard* *Flow of Data* *Screen* *Mouse* *CPU (inside)*



Task 2 – What's Inside the Box?

a. The box in this system contains various parts, or components. Match each of the components listed below to its description. Help is online if needed.

	Component				Description
1	Motherboard	•	•	a	The short-term storage space for the data that is currently in use.
2	Processor (CPU)	•	•	b	This feeds electricity at the correct voltage to the computer.
3	Memory (RAM)	•	•	c	This 'brain' of the system performs calculations and manipulates data.
4	Storage	•	•	d	The main circuit board connecting parts of the computer together.
5	Power supply	•	•	e	Additional circuit boards that boost the computer's performance.
6	Expansion cards	•	•	f	The place where files and programs are stored in the long term.

Task 2 – What's Inside the Box? (cont.)

b. Find out what the acronym 'CPU' stands for.

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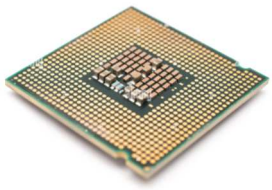
c. Label the parts shown below using the component names from the last question. Help is online.



1.

2.

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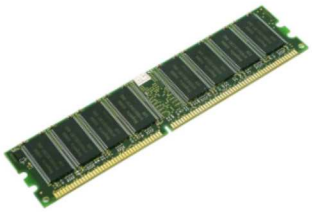


4.

5.

6.

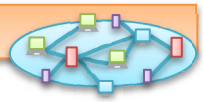
Extension

Most modern computer systems don't have the obvious 'box' shown in the previous example. However, they must still hide the required computer components somewhere inside. Search online for the internals of the systems below and add some notes suggesting where these can be found.

iMac

Laptop

Phone



Technology has changed hugely over the past 40 years. There has been an ever-increasing need for computers to become faster and more powerful. Businesses that adopted digital processing found they could save money on typists and data entry, instead spending the money on analysis of how to increase profits. To stay competitive, other businesses had to follow suit. Similarly, users purchased the better games and signed up to the more advanced social networks, leaving most things old in their wake. Things moved forward at an incredible pace.

Aim: *To learn about some of the factors that have inspired the evolution of computing technology.*

Task 1 – Technology Development

Study the statements below and organise them into groups of your choice. When you have done that, think of other ways to organise them. Share your most interesting categories with the rest of your class.

You can do your shopping and banking from the comfort of your home.	*Moore's law states that computer power will double every two years.*	*Modern apps create large files which need much more storage space.*	*People want to interact on social networks, sharing news, ideas and events.*
New technologies are sometimes invented, then ways found to use them.	*Game players want faster, more powerful machines or they'll be less competitive.*	*Stock levels are recorded in a database and updated automatically after every sale.*	*3D printers can create prototypes quickly and cheaply.*
Websites accept orders and take payment electronically.	*Transport options can be viewed, booked, paid for and monitored online.*	*You can read news from all over the world as events happen.*	*Smart devices promise to make our lives more hassle-free.*
Artificial intelligence will write a school essay for you in a second.	*Speech recognition software converts speech to text on the screen.*	*Videos and interactive websites can help you learn.*	*Computers and networks are forever getting faster.*
Sales and user information is stored on the internet for easy retrieval.	*Friends and families who live far apart can keep in touch over the internet.*	*Artificial intelligence learns from its own experiences.*	*You can store all your photos, music and other files on the internet.*
Your health records can be shared and accessed online.	*Robots can complete tasks quickly and accurately.*	*Many tasks can be carried out much more efficiently with the aid of technology.*	*People can check their CCTV cameras whilst away from home.*

Task 1 – Designing a Network

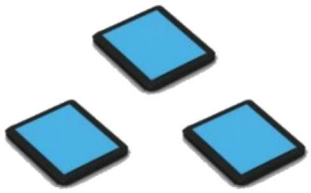
Aim: *To learn about network hardware and connections.*

Your task is to design the layout for a network of computers in a small room. All users need a connection to shared files on a server. They must also be able to print documents and access the internet.

If you have the editable version of this resource, you can work digitally. Otherwise, cut out the parts below, sort them, stick them down and then draw on the cables and radio waves. The rules for your network are as follows:

- The desktops, tablets and printer should be arranged as they might be in a small classroom.
- Your teacher needs easy access to the server. This one has its own screen and keyboard.
- The wall socket links to the internet. The modem router must be connected to this using the coaxial cable.
- The tablets only have Wi-Fi. They must communicate with the modem router using radio waves.
- The desktops also need to be connected to the modem router. You can use ethernet cables for this. The computers can be arranged in a single chain, a ring, or have separate wires all the way to the modem router.
- The desktops and tablets must all be able to communicate with the printer and server. The easiest solution is probably to connect these two components to the modem router as well, although you might connect the printer to the server instead.

Desktop Computers



Tablets / iPads

Server

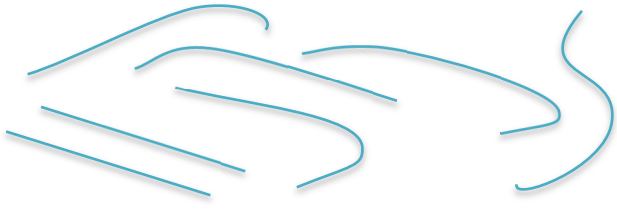
Modem Router

Printer

Wall Socket

Radio Waves

Coaxial Cable



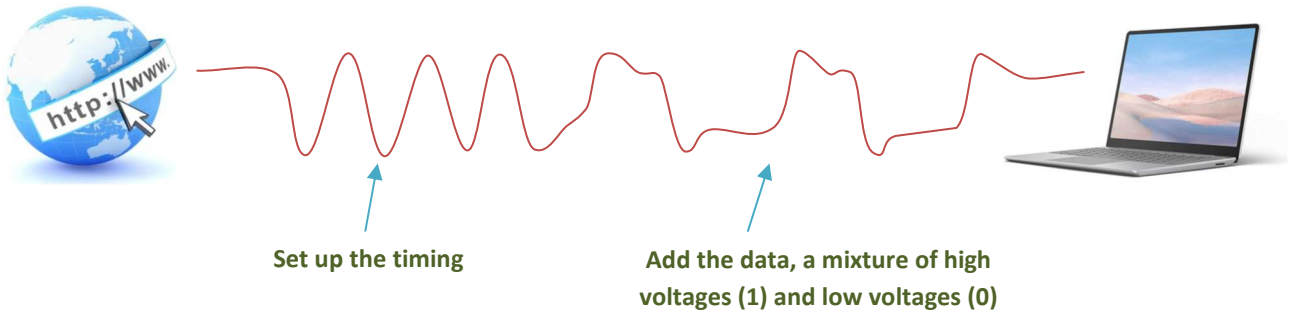
Ethernet Cables

We have learned that data is a series of 1s and 0s which can be stored, retrieved and then used to create some sort of output. But how do these 1s and 0s travel long distances? When you access a website based halfway round the world, how does it direct that stream of 1s and 0s all the way to your device? In the following tasks, we will learn about the data packets and protocols used to package up the data and guide it to its destination.

Aim: *To learn how digital data is transferred from one location to another.*

Task 1 – Data Packets

Data is sent down an electrical wire as a signal, something like the one below.



In theory, this could work well for any data. Unfortunately however, whilst you are receiving the data, no one else can use the wire. What would this mean if you watched a movie on a website for example? For the hour and a half you are receiving data no one else could use the connection. And that could be thousands of kilometres of wire you are hogging. There was need for a better way.

Let's think about what happens when you visit a webpage with an image. The statements below describe how the image file is sent to your device. Place the statements in order so that they make sense.

a. The webserver sends each packet off with a destination address i.e. your device.

b. The image is stored on a webserver as a long series of 1s and 0s.

c. Your device checks each package then joins them up to form the original image file.

d. Each packet is numbered so that the image file can be put back together later.

e. The data is passed through the wires and airwaves as short, intense bursts. There is no line hogging.

f. You request the image, so the webserver makes a copy of the file and chops it into small packets.

g. The packets travel through the internet until they reach you. It doesn't matter which route each packet takes.

Order _____