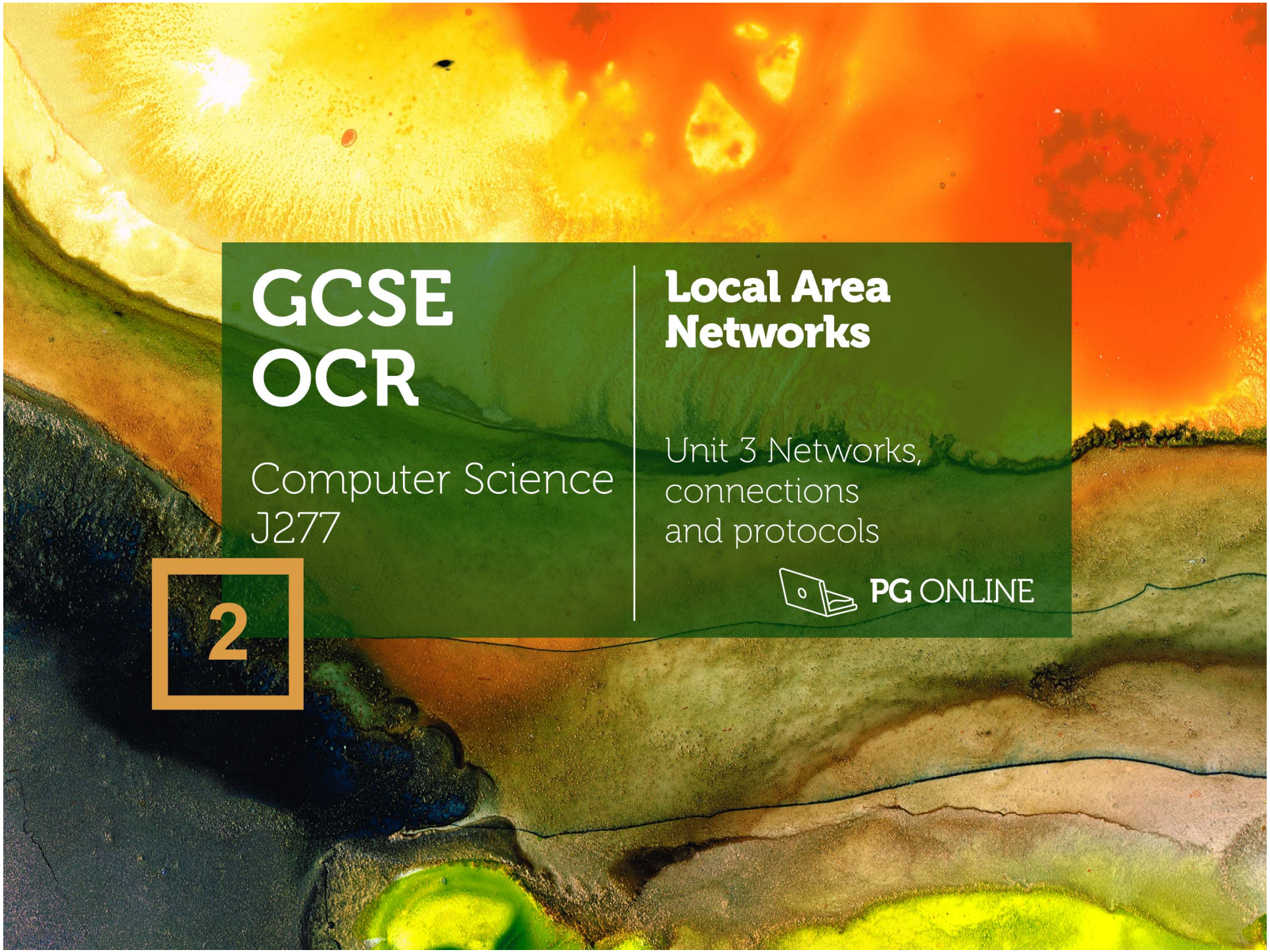
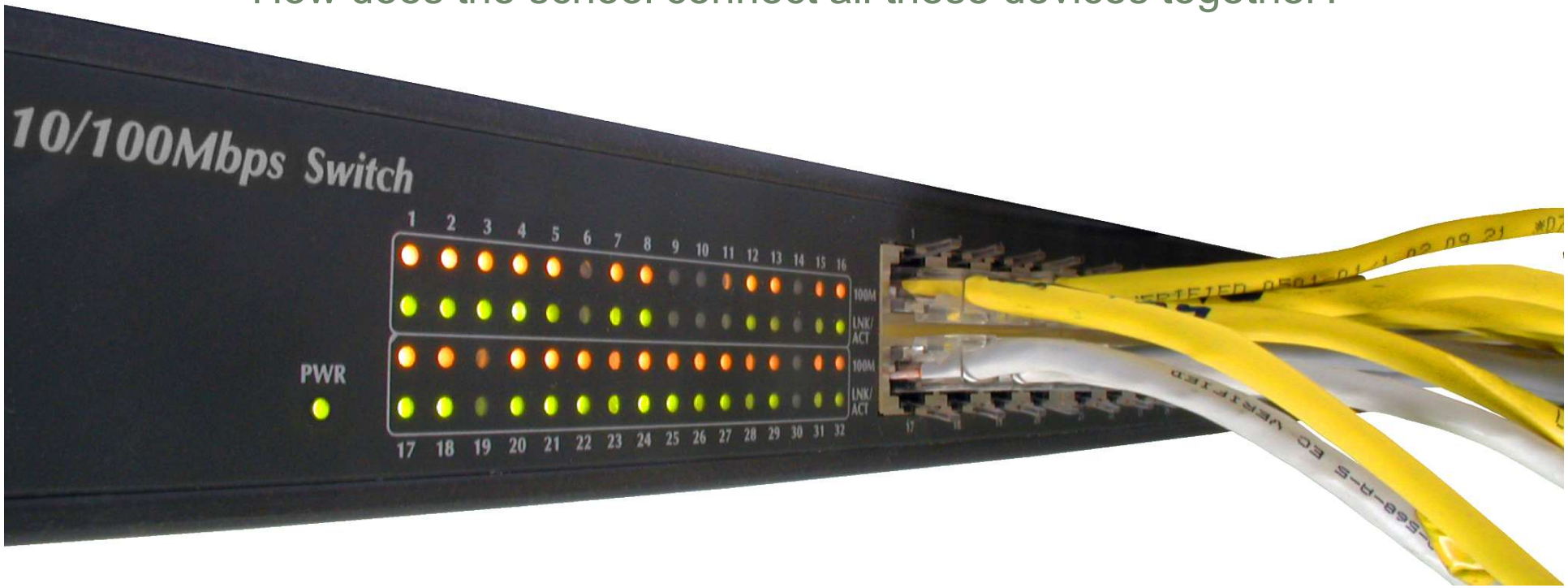

GCSE
OCR
Computer Science
J277
2
Local Area Networks
Unit 3 Networks, connections and protocols
PG ONLINE

Objectives

- Describe the difference between a Local Area Network and a Wide Area Network
- Describe star and mesh network topologies
- Describe routers and switches needed to connect stand-alone computers into a Local Area Network
- Explain the use of Ethernet standards to transmit data over a wired network
- Explain the concept of virtual networks

Starter

- A typical school network contains many computers
- It may include desktop computers, laptops and other devices such as tablets and smartphones
  - How does the school connect all these devices together?

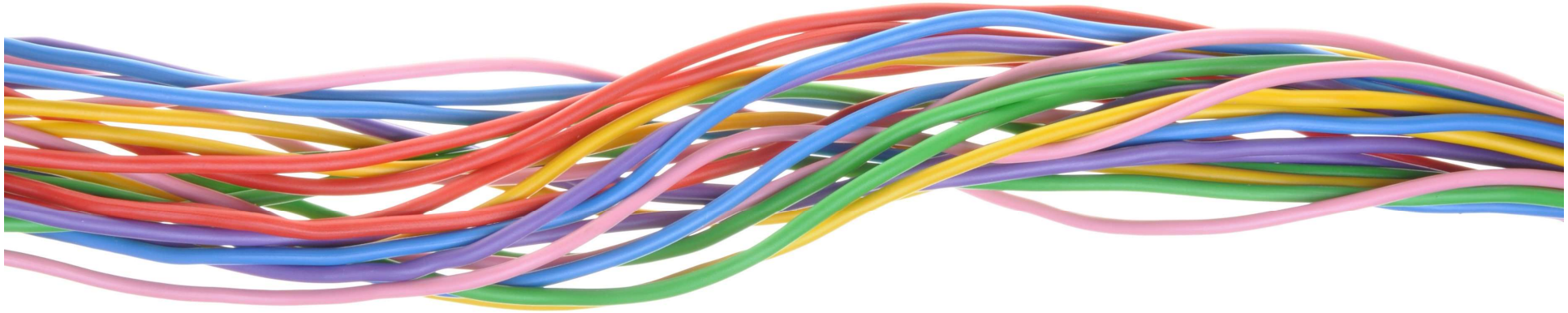


What is a LAN?

- **LAN** stands for **Local Area Network**
- A LAN operates on a single site such as a school, hotel or business using their own cabling systems

Networked computers

- What is the difference between a LAN and a WAN?
  - What are the advantages and disadvantages of connecting together computers in a LAN compared to leaving the computers as standalone machines?



Networked computers

Answers

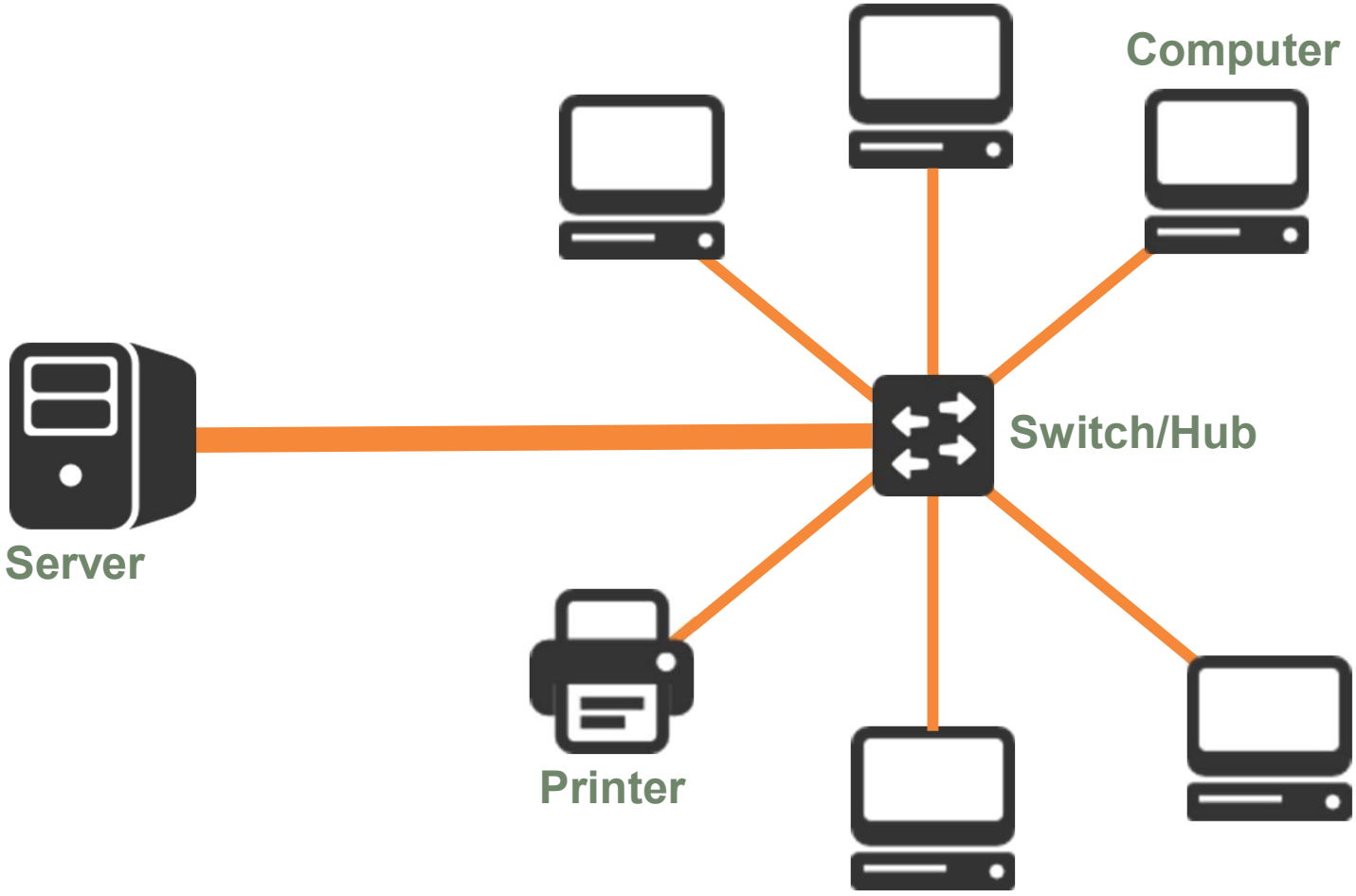
- LANs are local and located within one location such as a building
  - WANs connect networks at remote locations via leased lines

Advantages of networks	Disadvantages of networks
Computers can share resources such as printers	Purchasing the network hardware is expensive
Files can be accessed through any computer in the network	Managing a large network is complicated
Data is easy to back up as it is stored centrally on the server	Viruses may be able to infiltrate the network and infect every computer

Network topologies

- A topology is the way in which parts of a system are connected
  - For instance, the London Underground network has a topology that shows where connections, and lines are
- There are many topologies for setting up networks and LANs
- Two of these topologies are:
  - Star
  - Mesh

Star network

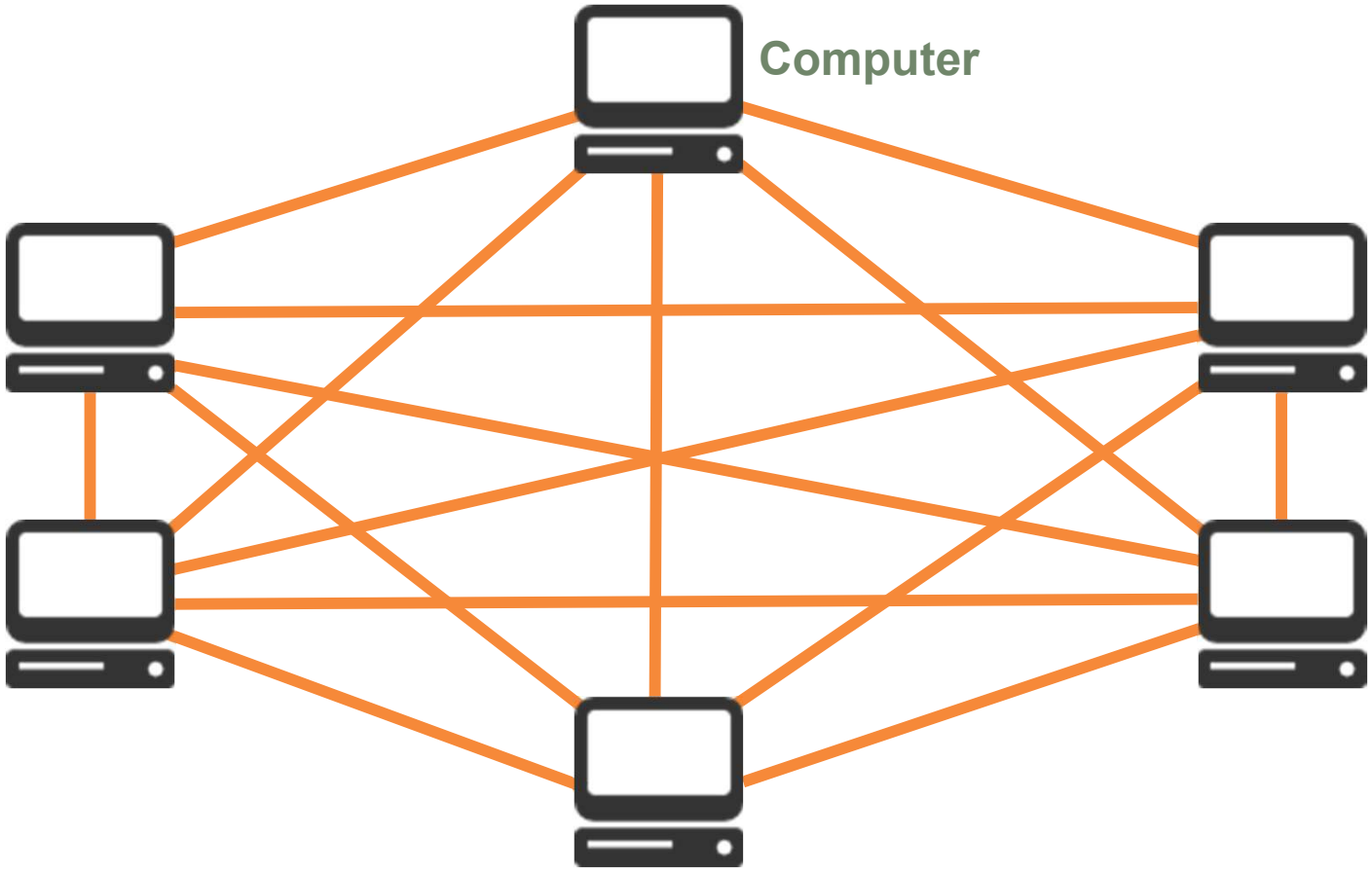


Star network

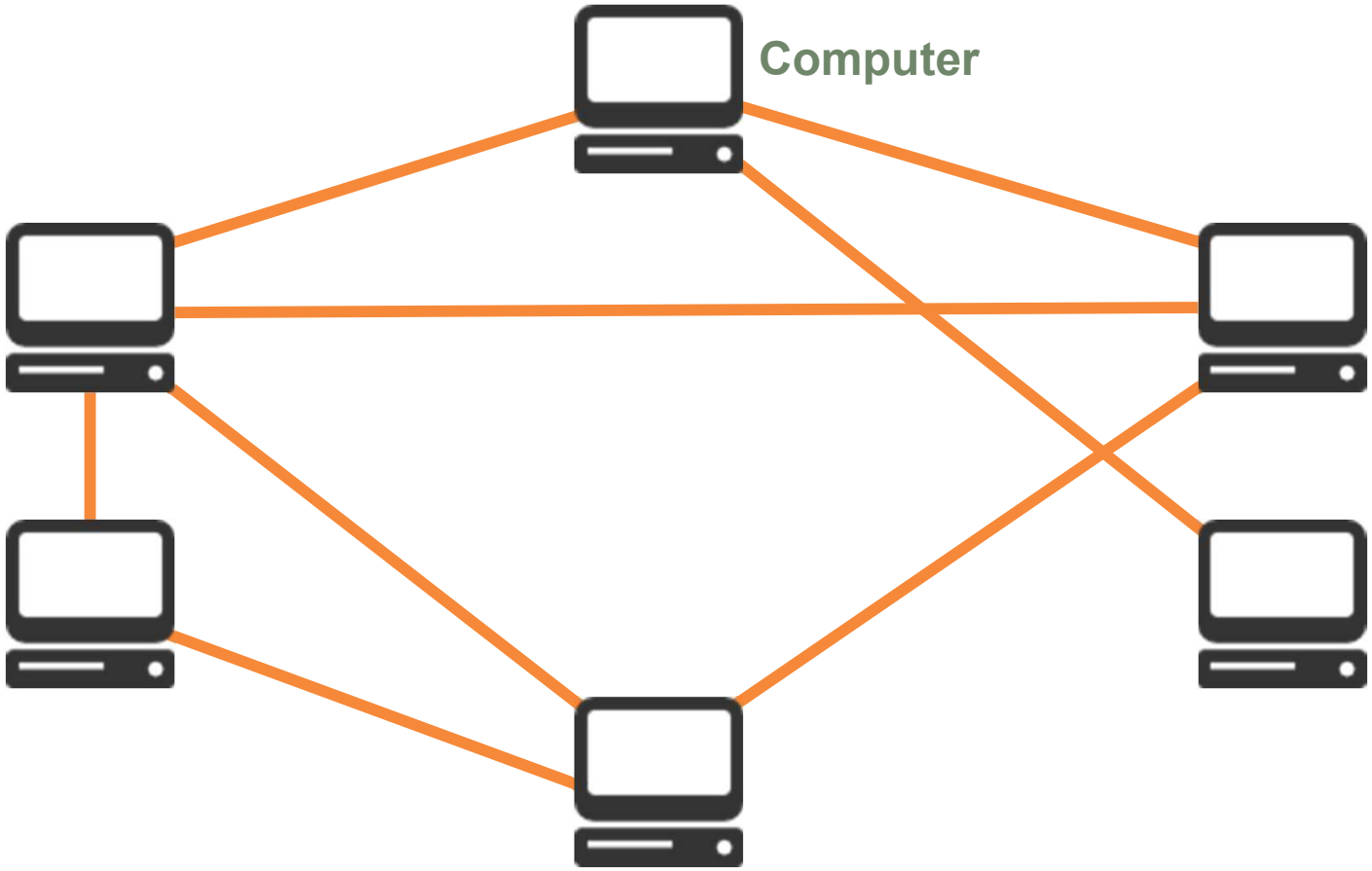
- In a star network, computers and other devices (known as nodes) are all connected to a central switch

Advantages	Disadvantages
Fast data transfer to the hub as each wire isn't shared with other computers	Requires additional hardware such as the central switch and network cables
If one cable fails the other computers are not affected	If the central switch fails the whole network goes down

Full Mesh network



Partial Mesh network



Mesh networking

- Nodes act as routers for data in order to relay and propagate data in the network
- A partial mesh network is usually used, often in conjunction with star topologies to create larger networks
  - What topology does the Internet use?
  - How might mesh principles affect wireless networks?

Internet topology

Answers

- The Internet is highly complex as it combines many networks together, but many parts operate as a **partial mesh**
  - For example, ISPs will connect to many other networks on the Internet. If one connection is lost, packets are directed through other connections
- Many LANs that connect to the Internet use a **star topology**, although mesh Wi-Fi is increasing in popularity

Wireless mesh networks

- Wireless mesh networks have enormous potential to provide Wi-Fi solutions for entire organisations, cities or even countries
  - Only one node needs a wired Internet connection – no other cabling or infrastructure is required
  - The more nodes that use the network, the more routes there are for data to travel through
  - A node within broadcast distance of three other nodes, will have triple the standard bandwidth
  - As the distance between one node and another is halved, signal strength becomes four times stronger

Mesh network

Advantages	Disadvantages
No single point of failure – it is resilient	Can involve redundant connections
Expansion and modification can be done without disrupting the network	Expensive to install cabling if using wired connections
Data can be transmitted from different devices simultaneously	Network maintenance and administration is difficult

Worksheet 2

- Complete **Task 1** of **Worksheet 2**

Network hardware

- Additional hardware is required to connect a stand-alone computer to a LAN
  - A **Network Interface Card/Controller** (NIC) in your computer or device
  - A **router** or **switch,** which provides access to a local area network
  - A **modem** is required to connect to the Internet – this is usually combined with the router inside a single device
  - A **Wireless Access Point** connects wireless devices to a network. Many home wireless access points are part of a router

Routers and switches

- **Router**
  - Looks at the destination of packets of data and sends them to the network that is closer towards their destination
  - A home router will route packets between the home LAN and the Internet

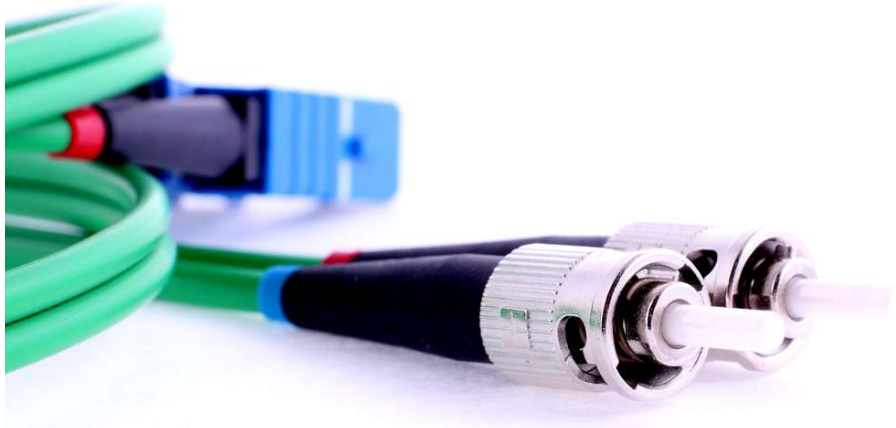
- **Switch**
  - Switches connect each node (computer) in a network
  - They know the MAC address of all connected computers and devices
  - When a packet of data arrives, they can send it to the correct computer
  - Hubs, by comparison will send the data to all connected computers

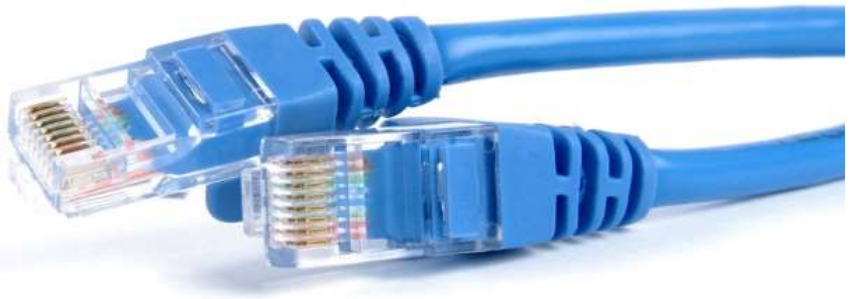
Ethernet protocols

- ‘Ethernet’ refers to a *family of standard local networking ‘protocols’* or rules
- It describes how devices should format data ready for transmission between computers on the same network
  - Similar to polite human conversation, nodes will wait until the connection is quiet before attempting to ‘speak’ or transmit
  - Two nodes attempting to transmit simultaneously will stop and each wait a random period before reattempting

Transmission media

- Transmission media is the way that communication is sent through the network
  - Ethernet is sent through twisted copper cables (typically with 100 meters range) or fibre optic cables
  - Internet connections to UK houses are typically sent through copper cables or coaxial cables. Fibre connections often only go as far as the local green cabinet





Worksheet 2

- Now complete **Task 2** of the worksheet

Plenary

- Define the following words:
  - LAN
  - Star network
  - Mesh network
  - Router
  - Switch
  - NIC
- Name **four** types of transmission media

Plenary

Answers

- LAN – local area network; connects nearby computers such as in a school, business, home
- Star network – each computer connects to central switch
- Mesh network – each computer/router can connect to other computers/routers
- Router – routes packets of data towards their destination
- Switch – sends data to the appropriate connected computer
- NIC – Network Interface Card/Controller

- Name **four** types of transmission media
  - Ethernet cable, fibre optic cable, Wi-Fi/wireless/microwaves, coaxial cable, copper cable

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