

## Learning Aims

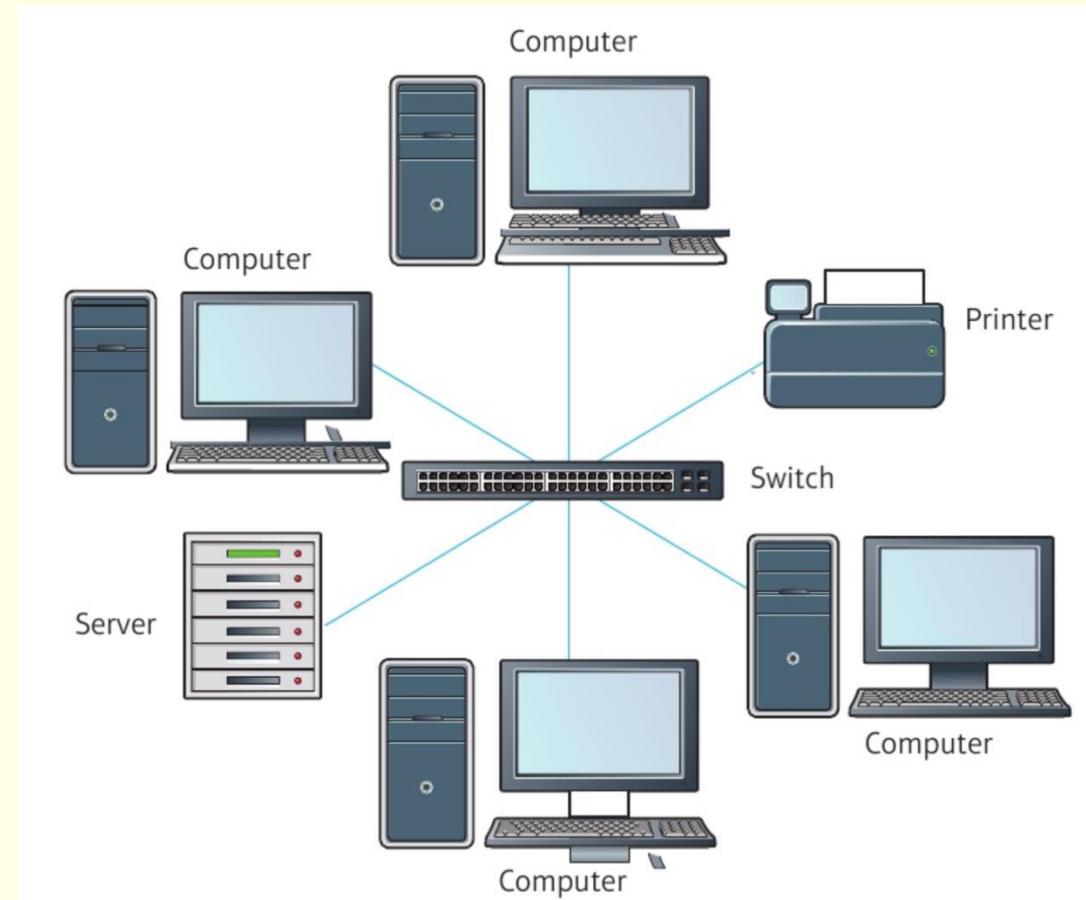
- Describe the characteristics of network topologies
- Star
- Bus
- Mesh



# Network Topologies –layout and flow of data in a network

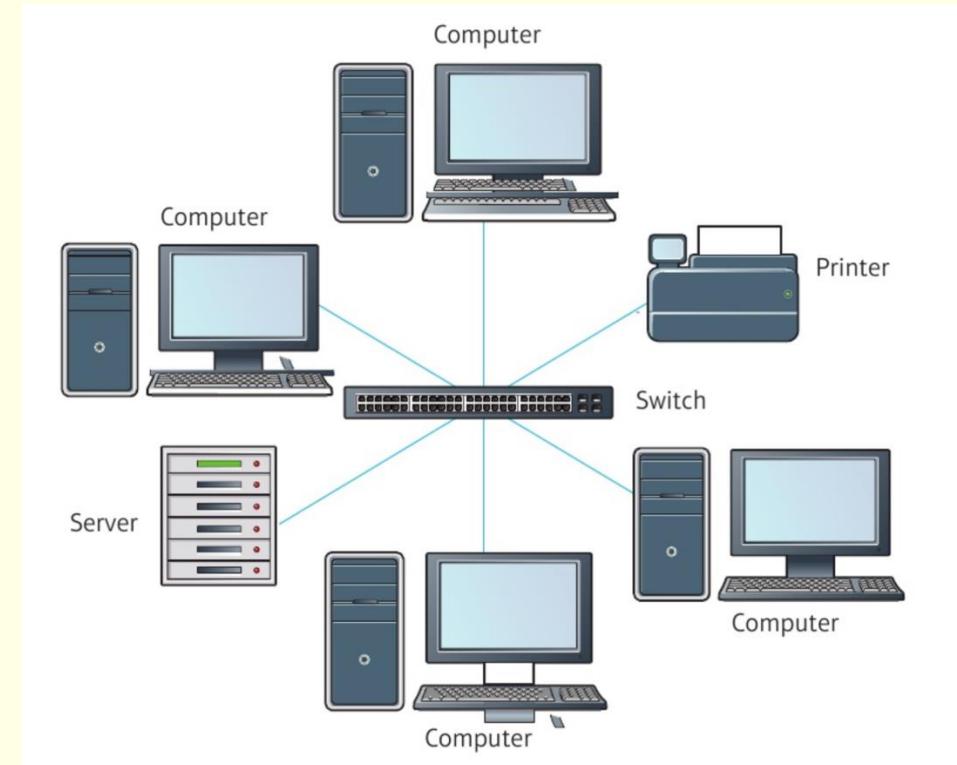
## A Star Network

- Requires all clients to be connected to a **central point**
- The **switch** acts as a central point through which all communications are passed.
- Large networks using a star topology are usually controlled by one or more **servers**.

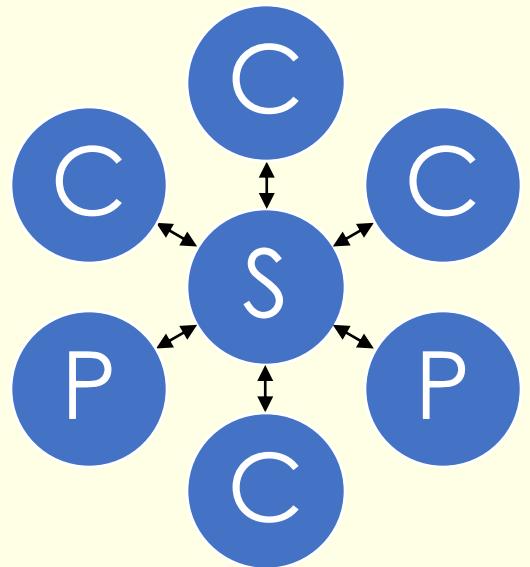


# Star topologies in use

- **Offices and organisations**, such as educational establishments and businesses, where **high performance** is a must.
- They are also found in home networks, especially those that are wireless. In this case, a **router** with a **wireless access point (WAP)** provides the central connection for all nodes.
- Home routers are a switch, modem and WAP all in one.



In an exam, you could draw this diagram using symbols:



C = Computer

P = Printer (optional)

S = Switch

Include the arrows showing bi-directional travel of data.



# Advantages and disadvantages of the star network topology include:

<b>Advantages</b>	<b>Disadvantages</b>
If a cable is broken, only the connected device is affected.	If the switch fails, then the whole network will fail.
Using a switch, data is only sent to the device that needs to receive the data. This improves security as the data only goes to the intended device and makes data transmission faster because there will be less collisions.	There is a lot of cabling required which makes this expensive to install.
Any device can be added to the network by connecting it to the switch without disrupting the rest of the network.	
Data can be transmitted at the same time by several devices as they each have their own connection to the switch.	



# Bus Topology

The bus topology is an older arrangement of devices, although it is still used in some places including cars and aircraft.

It includes a cable known as a **backbone**.

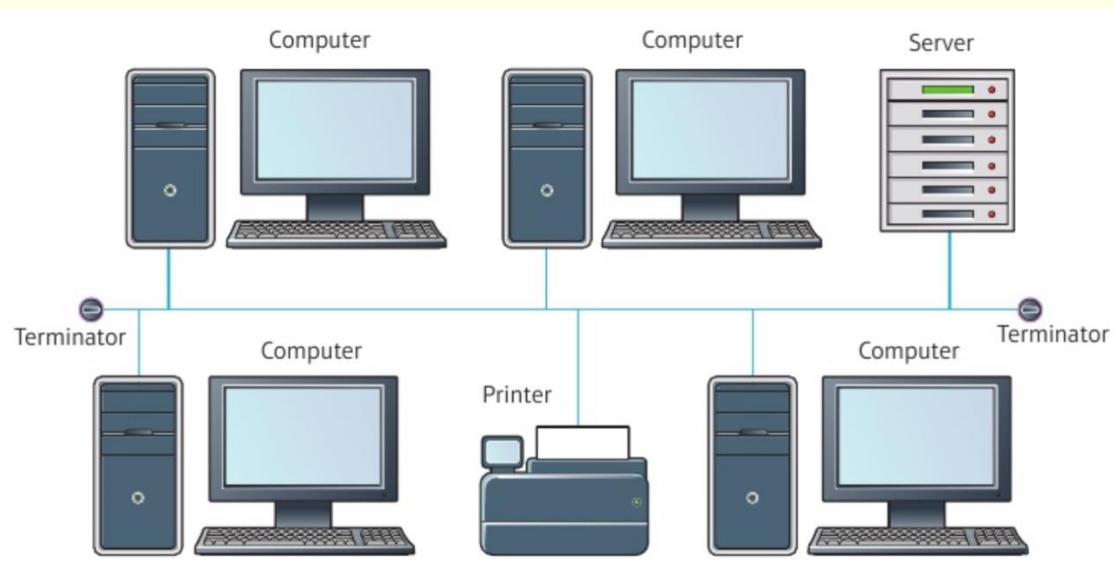
Each device connects to the backbone cable.

At each end of the backbone is a **terminator** (T).

The terminator prevents data from being sent back along the cable which prevents data collisions

All data must travel along the backbone cable. This means that all devices see all the data that is transmitting along the cable, although only the intended device will use the data. Data travels in both directions.

Only one device can send data at a time. If more than one device tries to send data at the same time, then a **data collision** occurs which has to be dealt with and this slows down the network performance. The more devices that are added to the network, the more frequently data collisions will occur and the slower the network will be.



# How to prevent collisions?

A simplified CSMA/CD sending algorithm works like this:

- 1** Check if bus is busy.
- 2** If not busy then send message, else go to step 1.
- 3** Listen to see if message received correctly.
- 4** If message not received correctly then go to step 5, else go back to listening for messages.
- 5** Wait random amount of time, go to step 1 to retry sending message.

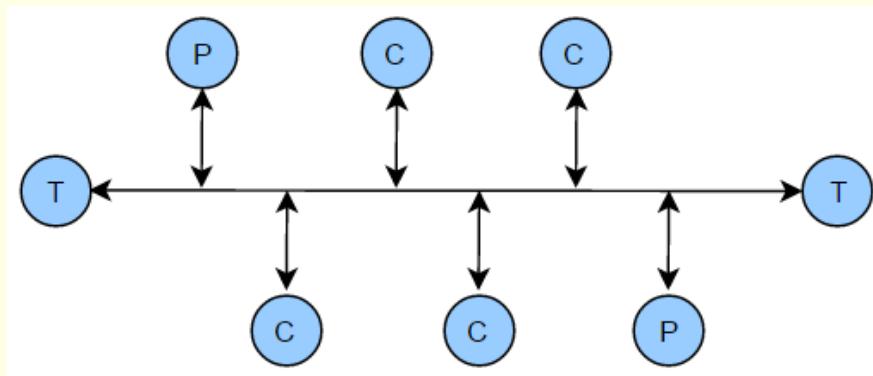
## Activity



Draw the CSMA/CD algorithm as a flowchart.



In an exam, you could draw this diagram using symbols:



c = Computer

P = Printer (optional)

T = Terminator

Include the arrows showing bi-directional travel of data.



Advantages and disadvantages of the bus network include:

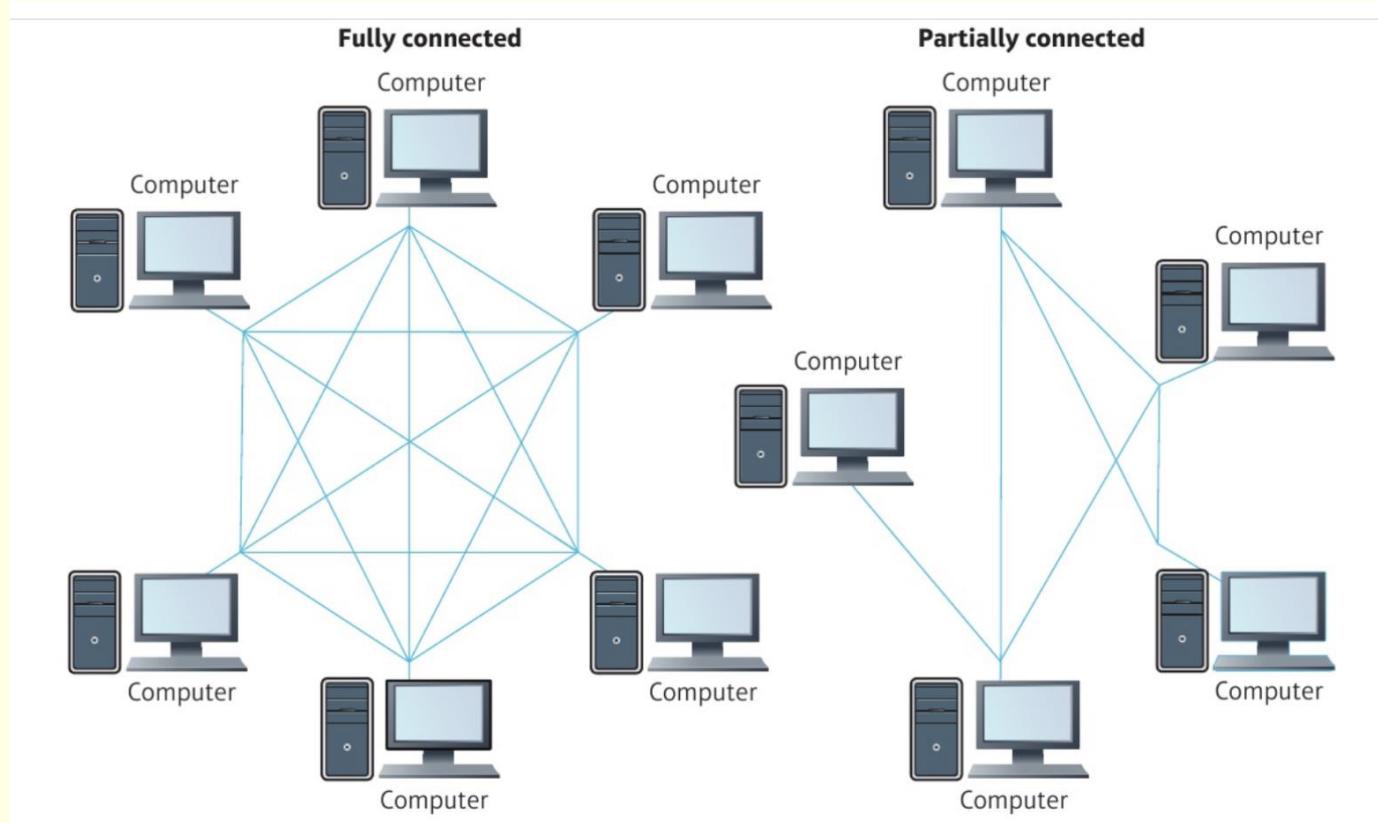
<b>Advantages</b>	<b>Disadvantages</b>
Less cable is required than a star network making it cheaper to install.	If the backbone breaks, the whole network goes down.
It works well for a small network.	If there is a problem with a terminator, the whole network goes down.
New nodes can be added anywhere on the bus.	Collisions slow down the performance of the network.
	More devices on the network will mean more collisions so it's not good for larger networks.
	Only one device can send data at a time.



# Mesh

## A Mesh Network is ....

- Mesh networks connect devices directly to each other
- No central switch
- Each device is a node in the network.
- Data can flow in any direction.
- Every device on a mesh network has to be able to send/receive data
- Data packets are sent by hopping from one node to another until they reach their destination.



## Mesh topologies in use

**Military and emergency organizations** often use mesh topologies to avoid breakdowns in communication as they need to be reliable.

Coventry City Council has developed a network of connected devices in the provision of 'Intelligent Transport'.

In 2017 it had 500 devices connected using a mesh network, including traffic lights, signs, CCTV, automated number plate recognition (ANPR) and parking meters.

New nodes can easily be added to their network as their 'Intelligent Transport' system grows.

The internet is an example of a mesh topology

It is a topology commonly used for wireless networks.



Advantages and disadvantages of the mesh topology include:

<b>Advantages</b>	<b>Disadvantages</b>
Devices can be added to the network within range of an existing node.	If cables are used, it can be very expensive.
The more nodes there are, the larger the area that can be covered.	Security needs to be in place to prevent unauthorised nodes from connecting.
If a connection is lost, another route can be found.	Each node must be capable of routing data.
Wireless mesh networks are cheaper to setup than traditional wireless networks over a large area.	Each node requires additional power which can drain battery-powered devices.
The network can run faster because data packets don't have to go via a switch.	

