# Star and mesh topologies

Computer systems (Paper 1) · revision notes

How the devices in a network are connected. OCR asks about the star topology (every device connected to a central switch) and the mesh topology (devices connected to several others, as a full or partial mesh). Expect questions asking you to identify or draw a topology, give advantages and disadvantages, and recommend one for a scenario.

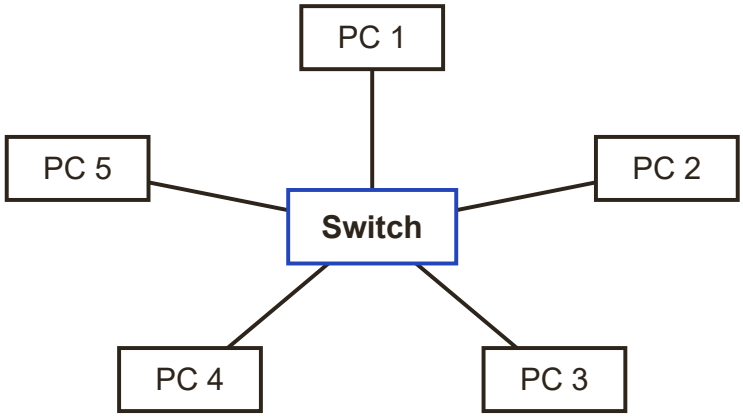
## Key facts

- Star: each device has its own cable to a central switch
- Star −: if the switch fails, the whole network fails; lots of cable
- Partial mesh: devices connected to several others, but not all
- Mesh −: many connections, so expensive and complex (less cabling if wireless)
- Star +: one cable failing affects only one device; easy to add devices; good performance
- Full mesh: every device connected directly to every other device
- Mesh +: several routes, data re-routed, no single point of failure
- Grade 7+ only Full mesh connections = n(n − 1) ÷ 2

## Notes

### Star topology

- Every device is connected by its own cable to a **central switch**.

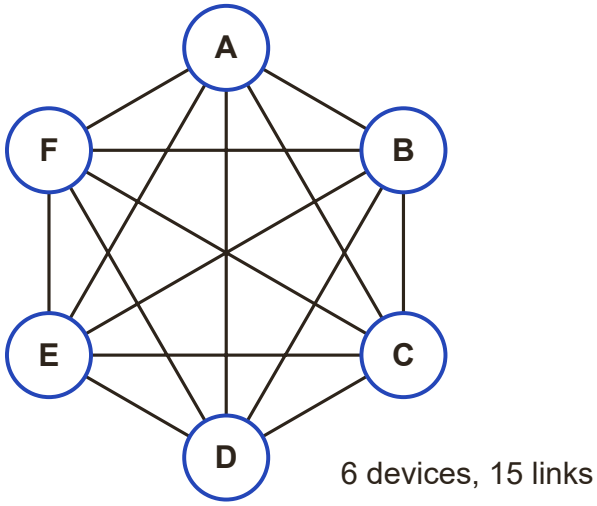



Star: every device has its own cable to the central switch

- If one cable or device fails, **only that device** is affected; the rest of the network keeps working.
- Easy to add or remove devices, and easy to find faults, because each device has its own cable.
- Good performance: the switch sends data only to the device it is intended for, so there is less unnecessary traffic.
- But if the **central switch fails, the whole network stops**. A lot of cable is needed, and the switch is an extra cost.

## Mesh topology

- In a **full mesh**, every device is connected directly to every other device. In a **partial mesh**, devices are connected to several others, but not to all of them.




Full mesh: every device links to every other, so data can be re-routed if a link fails

- Data can travel along **more than one route**. If a link or device fails, the data is re-routed, so there is **no single point of failure**.
- Very reliable (fault tolerant), and data can often take a direct route between devices.
- A full mesh needs a lot of cables or connections, so it is expensive and complex to set up and manage. A **wireless mesh** avoids most of the cabling.
- The Internet itself is a partial mesh of routers.
- A full mesh of n devices needs $n(n-1) \div 2$ connections. For 6 devices: $6 \times 5 \div 2 = 15$ connections, compared with 6 cables for a star. Grade 7+ only

## How to answer each type of question

### Identify or draw a topology

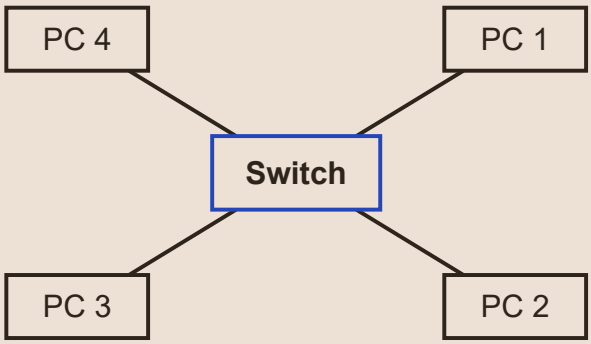
1 to 2 marks | **Grade 3**

1. Star: look for one central device with a separate line to every other device.
2. Mesh: look for devices joined to several others, giving more than one route between them.
3. When drawing, label the central device as a switch and draw one clear line for each connection.

**Example.** Draw a diagram of a star network with four computers and a switch. Label the switch. [2]

**Model answer.**

Four computers, each joined by its own line to one central device (1), with the central device labelled 'switch' (1). For example:




### Describe advantages and disadvantages

2 to 4 marks | **Grade 5**

1. State the advantage or disadvantage.
2. Explain the effect, e.g. 'so the other computers keep working'.
3. Keep star and mesh points separate unless the question asks you to compare.

**Example.** Describe **one** advantage and **one** disadvantage of a star topology. [4]

**Model answer.** Advantage: if one cable fails, only the device on that cable loses its connection (1), so the rest of the network keeps working (1). Disadvantage: if the central switch fails (1), every device loses its connection and the whole network stops (1).

### Calculate the number of connections

1 to 3 marks | Grade 7

1. Full mesh: each of the n devices connects to n − 1 others.
2. Multiply n × (n − 1), then divide by 2 because each cable joins two devices.
3. Star: one cable per device, so n cables.

**Example.** A network has 8 devices.
(a) Calculate the number of cables needed to connect them in a full mesh. [2]
(b) State how many cables would be needed in a star topology with one central switch. [1]

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**Model answer.**

(a) 8 × 7 = 56 (1), 56 ÷ 2 = 28 cables (1)
(b) 8 cables (1)

### Recommend a topology for a scenario

4 to 6 marks | Grade 7

1. Find what matters most in the scenario: reliability, or low cost and simplicity.
2. Recommend one topology and explain how it meets that need.
3. Compare with the other topology and deal with the drawback of your choice.

**Example.** A hospital is choosing a topology for the network that links its intensive care monitors to the nurses' station. The network must keep working at all times.
Recommend a star or mesh topology. Justify your recommendation. [4]

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**Model answer.** Mesh (1). There are several routes between devices, so if one cable or device fails, data is re-routed (1). There is no single point of failure, whereas in a star the whole network stops if the central switch fails (1). The extra cost and complexity of a mesh is justified because patients' safety depends on the monitors staying connected (1).

## Don’t lose marks

- Saying a star network fails if any cable breaks. Only the device on that cable is affected.
- Saying a mesh is 'faster' with no reason. Explain that data can take direct or alternative routes.
- Forgetting to divide by 2 when counting the connections in a full mesh.
- Calling a network a full mesh when some devices are not connected directly to every other device.

## More tips

### Memory tricks

- Star = the hub and spokes of a wheel. Mesh = a fishing net: cut one string and you can still get round.
- Single point of failure? Star: yes (the switch). Mesh: no.
- Full mesh sense check: 4 devices → 6 connections; 5 → 10; 6 → 15.

### Exam technique

- Always name the central device in a star as a switch.
- In recommendation questions, the scenario tells you what matters most: reliability (mesh) or low cost and simplicity (star).
- Show your working in connection calculations: $n \times (n - 1) \div 2$.

## What each grade needs

What you need to be able to do, from the first marks up to the top grade.

**Grade 3**

**Identify a star or mesh network diagram**

Star: all devices connected to one central device. Mesh: devices connected to several other devices.

**Grade 4**

**Draw a star or mesh topology**

Draw each device linked to a labelled central switch, or linked to several other devices.

**Grade 5**

**Give advantages and disadvantages of each topology**

E.g. a star is easy to add to but fails if the switch fails; a mesh is reliable but expensive.

**Grade 6**

**Explain how a mesh network re-routes data**

There are several routes between devices, so if one link fails the data is sent a different way.

**Grade 7**

**Calculate the connections in a full mesh**

A full mesh of n devices needs $n(n - 1) \div 2$ connections; a star needs n cables.

**Grade 7**

**Recommend a topology for a scenario**

Weigh reliability against cost for the organisation, and justify your choice.

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