

Solutions

Each answer shows the steps, then the **result**.

2.1

- on-demand computing services – storage, processing or software – provided **over the internet** by a **third party**

2.2

- a **public** cloud is owned by a provider and shared by many customers over the public internet
- a **private** cloud is dedicated to **one** organisation, on its own hardware or hosted for it alone
- the difference is **who may use it**, not where the hardware is kept

2.3

- any two: a much higher bandwidth; it carries light, so it is immune to electromagnetic interference; it runs far longer distances without a repeater; it is hard to tap, so it is more secure

2.4

- **Carrier Sense Multiple Access with Collision Detection**
- carrier sense: the device **listens to the medium before transmitting**, and waits if another device is already sending

2.5

- it converts the computer's **digital** signal into an **analogue** signal that a telephone line can carry
- and converts the analogue signal back to digital at the receiving end (modulation and demodulation)

3.1

- benefits, any two: the files are reachable from any site or device with an internet connection; the storage scales up or down and they pay only for what they use; the provider handles the hardware, the backups and the security updates; there is no server to buy, house or maintain
- drawbacks, any two: nothing is reachable without an internet connection; the data sits on a third party's hardware, so its security and privacy depend on the provider; there is an ongoing subscription cost instead of a one-off purchase; the provider could fail or be attacked; large files may be slow to transfer

3.2

(a) **microwave**

- a microwave link is point-to-point and needs a **line of sight**, which the clear view across the valley provides, and it avoids laying cable across the valley

(b) **fibre-optic cable**

- it has the bandwidth to carry the whole campus's traffic, runs the distance without repeaters and is immune to interference

(c) **satellite**

- it reaches a place no cable does; the delay and the cost are accepted because there is no alternative

3.3

- both computers **detect the collision** while they are still transmitting, because each keeps listening to the medium as it sends
- both **stop transmitting** immediately and send a short **jam signal**, so that every device on the medium knows a collision has occurred
- each then waits a **random** length of time – the backoff
- when its wait ends, a computer listens again to check the medium is idle and retransmits; the waits are random so the two are very unlikely to clash a second time

3.4

- the wired connections give the lab computers higher speed, lower latency and fewer errors, and they are more secure because a cable has to be physically tapped
- the lab computers never move, so they lose nothing by being cabled
- the wireless access points let laptops and phones **move** around the building and join without new cable being run to each seat
- adding a device costs nothing in cabling, and a device with no network port can still connect; the school accepts the lower speed and the interference for those devices

3.5

(a) advantage: it is **always on**, with a fixed bandwidth that is **not shared** with other customers, so it is faster and more reliable

- disadvantage: it is **expensive**, and a physical line must be installed all the way to the ISP

(b) **satellite**

- any two consequences: there is a noticeable **delay**, because every signal travels to orbit and back, which makes real-time use such as video calling awkward; the link is affected by **weather**; it is expensive, both the equipment and the service
- neither of the others can be used: a modem needs a telephone line and a dedicated line needs cable laid the whole 400 km