

THEME A: CONCEPTS · A2.2

Network architecture — Mark scheme

33 marks · covers A2.2.1–A2.2.4

How to mark. Each creditworthy point is on its own line and ends with a semicolon (;). A line beginning with ... is an *expansion* of the line above it, so the pair is worth the marks shown. A slash (/) separates acceptable alternative wordings. Words in (brackets) are not needed for the mark. Mark positively: credit what the student has got right rather than penalising what is missing, and accept any valid alternative not listed here. Do not award more than the maximum for a part. Where a later part uses a wrong answer from an earlier part correctly, award follow-through marks (**FT**). **HL** marks parts that assess higher level only content.

Q	ANSWER	MARKS
1(a) A2.2.1	Award [2] max Award [1] per point up to [2] max. Every device is connected by its own separate cable to one central device, usually a switch; There is no direct connection between the devices themselves; All traffic between two devices passes through that central device;	2
1(b) A2.2.1	Award [3] max Award [1] per point up to [3] max. The answer must be applied to the practice. Each computer has its own dedicated link to the switch, so the links are independent of one another; A break in one cable only affects the single computer on the end of it; ...(so) the other 11 computers and the printer continue to communicate normally; Only the affected machine is isolated, and it can be restored by replacing that one cable; Award [1] max for a general statement about reliability with no reference to the independent links.	3
1(c) A2.2.1	Award [1] max Any one, [1] max. The central switch is a single point of failure: if it fails the whole network fails; The number of devices is limited by the number of ports on the switch; It uses more cable than some other topologies, so installation costs more;	1
2(a) A2.2.1	Award [2] max Award [1] per point up to [2] max. Devices are connected directly to one another, so there are multiple links between nodes; In a full mesh every device has a direct connection to every other device; There is therefore more than one possible route between any two devices;	2
2(b) A2.2.1	Award [3] max Award [1] per point up to [3] max. A justification, not just a description, is required. A mesh provides several alternative paths, so if one link fails traffic is rerouted along another; ...(so) patient monitoring continues, which a star topology could not guarantee; A star topology depends on one central switch, and if that fails every monitor is disconnected at once;	3

Q	ANSWER	MARKS
	Traffic is spread across many links rather than concentrated at one central point, reducing congestion and collisions; The higher cabling and configuration cost is justified because a loss of monitoring could endanger patients;	
2(c) A2.2.1	Award [1] max A topology that combines two or more different topologies in one network, for example star sections joined together in a mesh;	1
3(a) A2.2.3	Award [4] max Award up to [1] per comparison point, [4] max. Both models must be referred to. Award a maximum of [2] if only one model is described with no contrast drawn. In a client-server model, dedicated servers provide resources and clients request them, whereas in peer-to-peer every device acts as both client and server; Client-server keeps files in one central place, making backup, updating and access control straightforward, whereas peer-to-peer files are spread across many machines; Client-server security is easier to enforce centrally, whereas peer-to-peer relies on each individual machine; The server is a single point of failure and a bottleneck under load, whereas a peer-to-peer network has no single point of failure; Client-server needs investment in server hardware and administration, whereas peer-to-peer uses the machines already present and costs less to set up; Peer-to-peer generally gets faster as more peers join because each adds capacity, whereas a client-server system slows as demand on the server grows;	4
3(b) A2.2.3	Award [2] max Award [1] for naming a valid application and [1] for explaining how peer-to-peer is used in it. File sharing using BitTorrent or a similar protocol; ...(where) each downloader also uploads pieces of the file to others, so no central server carries all the traffic; A cryptocurrency blockchain; ...(where) every node holds a copy of the ledger and validates transactions, so there is no central authority; Voice over IP (VoIP) or video calling; ...(where) the call data passes directly between the two users' devices rather than through a central server;	2
4(a) A2.2.4	Award [2] max Award [1] per point up to [2] max. Network segmentation divides one network into smaller, separate sections; Traffic is kept within its own section, and movement between sections is controlled; It can be done physically, or logically using subnets or VLANs;	2
4(b) A2.2.4	Award [3] max Award [1] per point up to [3] max. Must be a security benefit applied to the school. Devices on the student VLAN cannot reach the administration VLAN directly, even though both use the same physical cabling and switches; ...(so) a student cannot browse to staff records or examination data simply by being on the network; If a student device is infected with malware, the infection is contained within its own VLAN;	3

Q	ANSWER	MARKS
	...(so) it cannot spread to the machines holding sensitive data; Traffic crossing between the VLANs must pass through a router or firewall, where rules can be applied and access logged; The number of people who can reach the sensitive systems is reduced, which limits the damage a compromised account can do;	
5(a) A2.2.4	Award [2] max Award [1] per point up to [2] max. Subnetting splits one large IP network into several smaller logical networks called subnets; Part of the host portion of the IP address is used to identify the subnet, set by the subnet mask; Devices in different subnets communicate through a router;	2
5(b) A2.2.4	Award [2] max Award [1] for the point and [1] for the expansion. Any one way. Broadcast traffic is contained within a single subnet; ...(so) there is less unnecessary traffic across the whole school and performance improves; Each department or building can be given its own subnet; ...(so) the administrator can apply rules, monitor usage and locate a faulty device more easily; Addresses are allocated in blocks per subnet; ...(so) the administrator can tell from an IP address where a device sits on the network;	2
HL 6(a) A2.2.2	Award [2] max Award [1] per point up to [2] max. A DNS server translates a human-readable domain name into the IP address of the machine hosting it; ...(so) users can type a name rather than having to know a numeric address; If it does not hold the record, it passes the request on to other DNS servers and caches the reply for future requests;	2
HL 6(b) A2.2.2	Award [2] max Award [1] per point up to [2] max. A proxy server sits between the users and the internet and forwards their requests on their behalf; It can cache frequently requested pages and serve them locally, reducing traffic and speeding up access; It can filter requests, blocking access to certain sites and logging what is accessed; It hides the internal IP addresses of the company's machines from outside;	2
HL 6(c) A2.2.2	Award [2] max Award [1] for the point and [1] for the expansion. The amount of data the company stores will grow as it operates; ...(so) storage must be able to be added without replacing the server or interrupting access; The number of employees using the file server at once may rise; ...(so) it must handle more simultaneous requests without becoming a bottleneck;	2

Total for this paper: 33 marks