

3(a)	One mark per mark point (Max 2) MP1 Protocols set a standard for communication // Protocols establish a standard set of rules for communication MP2 Protocols enable compatibility between devices from different manufacturers/platforms MP3 Two devices wouldn't be able to communicate/send messages to each other if they were using different protocols
3(b)	One mark for a protocol and one mark for a description (Max 4) Example answers: SMTP [1] a protocol used to send emails between mail servers // a protocol used to send emails from a computer to a mail server [1] IMAP [1] allows users to access/read their emails from any device without removing the message from the mail server // synchronises emails on any device [1]
3(c)	Two marks for each description mark as 2 x 2 (Max 4) Example answers: Packets checked at receiving end / on arrival [1] ... if packets arrive damaged or don't arrive at all, a re-send request is sent [1] Packets routed through different paths / sent individually [1] ... if a route is blocked, the packet is sent through a different route to ensure it arrives [1] If the packet's hop count is exceeded [1] ... the packet will be retired, which can generate a re-send request [1]

3(a)	One mark per mark point (Max 2) • HTTP to send and receive / transfer web pages / hypertext / images / videos • IMAP allows users to access/read their emails from any device without removing the message from the mail server // synchronises emails on any device
3(b)	One mark per mark point (Max 4) MP1 Files are shared over a peer-to-peer network MP2 A small file, a torrent (descriptor file), is initially created by a peer MP3 The torrent (descriptor file) contains metadata about the file to be shared MP4 The whole file must initially be located on at least one peer MP5 The file is broken into equal sized pieces MP6 Other peers who wish to download the file first obtain the torrent (descriptor file) and connect to a tracker MP7 A tracker acts like a server that holds all the data about all the computers connected to it / the swarm MP8 Each peer downloads parts of the file from other peers until the entire file has been downloaded MP9 As each peer receives a piece of the file, they become a source for that piece of the file MP10 A peer who has a complete file and is sharing it is a seed // Once a peer has completely downloaded the file and made the file available to others in the swarm, they become a seed.

4(a)	One mark for a benefit of circuit switching (Max 1) MP1 Once the connection is made, it is available until the end of the transmission (suitable for long continuous transmission) MP2 The dedicated path ensures a steady rate of data transmission, once connection has been made (because the whole bandwidth is available) MP3 The dedicated path ensures data is less likely to be lost. MP4 No intermediate delays once the circuit is established, enables real time transmission MP5 No additional time/delay to reorder needed because data arrives in the order it was sent / data sent as a continuous stream One mark for a benefit of packet switching (Max 1) MP6 No need to tie up a communication line // path available to multiple users // bandwidth can be shared by multiple users MP7 Possible to overcome failed / faulty / busy lines by re-routing packets MP8 Individual packets can be resent if lost/damaged MP9 Users only charged for the duration of connectivity MP10 High rate of data transmission possible MP11 Always uses digital networks so data is transmitted directly to the destination MP12 Good security because all packets can take different routes // A more secure method because all packets can take different routes
4(b)	One mark per difference (Max 2) MP1 Circuit switching requires a dedicated line to be connected before the data transfer takes place, in packet switching, data transfer commences directly/ straight away MP2 In circuit switching, each data unit knows the entire path address, but in packet switching, each data unit only knows the final address (routers decide intermediate paths) MP3 Circuit switching uses the whole bandwidth of the transmission path, but packet switching shares it with other users // circuit switching uses a constant high bandwidth. Packet switching has variable bandwidth MP4 In circuit switching each data unit follows the same route, but in packet switching, packets can follow any route MP5 In circuit switching data arrives in the correct order but in packet switching it has to be reordered MP6 Data remains intact / a continuous stream in circuit switching but is segmented in packet switching MP7 Lost data in circuit switching requires the whole transmission to be resent, but individual packets can be resent in packet switching MP8 Circuit switching doesn't suffer data loss but packets can be lost in packet switching.

3	One mark per mark point (Max 4) MP1 the message is divided into small chunks called packets MP2 each packet is given a header with important data including source and destination IP addresses MP3 each packet is sent independently // packets can be sent through different routes MP4 packets are sent through the optimum route // packets can be re-routed if a route is unavailable MP5 packets are reassembled at the destination into the whole message
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4	One mark for a correct protocol and one mark for a correct corresponding description (Max 6) Three from: HTTP/S [1] a protocol/secure protocol used to transfer hypermedia documents / web pages / (data) files between networked devices [1] FTP [1] a protocol to download, upload and transfer files from one location to another on a network [1] POP3 [1] a protocol used to retrieve/receive emails from a mail server to a computer [1] IMAP [1] allows users to access/read their emails from any device without removing the message from the mail server // synchronises emails on any device [1] SMTP [1] a protocol used to send emails between mail servers // a protocol used to send emails from a computer to a mail server [1] BitTorrent [1] a communication protocol used for peer-to-peer file sharing [1]
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4	One mark per mark point (Max 4) MP1 Each layer can only accept input from the next higher layer or the next lower layer MP2 There is an interface between the adjacent layers which is the only interaction between layers MP3 Data is added to the headers as the frames/packets pass through the layers MP4 The interactions are carried out by installed software MP5 User interaction takes place at the highest/Application layer of the stack through protocols associated with that layer of the stack MP6 Direct access to hardware takes place at the lowest/Link layer of the stack.
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