



**ADVANCED**  
**General Certificate of Education**  
**January 2011**

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**Applied Information and  
Communication Technology**

**Assessment Unit A2 13**

*assessing*

**Unit 13: Networking and Communications**

**[A6J71]**

**FRIDAY 21 JANUARY, MORNING**

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**MARK  
SCHEME**

1 (a) Bus topology	[1]	
(b) (accept Coaxial cable), thin net or thick net	[1]	
(c) Mention of baseband signalling on the cable Ethernet. Mention of data sent in frames. Source address of frame, destination address of frame. One computer will 'sense' the carrier (cable). If the cable is free of data then the computer will send data onto the cable. The data will travel to the other computer. The other computers will have similar access to the use of the cable. If they attempt to send at the same time this will result in 'collisions' of data. If collisions occur, both computers will back off sending for a random period of time before resending the data. Mention of terminators.		
Any 4 correct points – 1 mark per correct point	[4]	6

2 Network card		
<ul style="list-style-type: none"> <li>● It allows the computer to become part of the network</li> <li>● It identifies the computer in the network by means of a unique code (MAC address)</li> <li>● It is used to send and receive data on the network</li> <li>● It sends and receives electrical signals and converts them into data</li> <li>● It may be fitted onto a slot on the computer's motherboard</li> <li>● It may be used in a wireless network</li> </ul>		
Any 2 correct points × 2	[4]	4

3 Network Features		
<ul style="list-style-type: none"> <li>● It allows centralised administration and support             <ul style="list-style-type: none"> <li>○ User accounts and passwords may be set up</li> <li>○ User can be granted rights and permissions</li> </ul> </li> <li>● Allows hardware sharing             <ul style="list-style-type: none"> <li>○ Printers</li> </ul> </li> <li>● It allows software sharing             <ul style="list-style-type: none"> <li>○ Software need only be purchased once and placed on a client server setup</li> </ul> </li> <li>● It allows information sharing             <ul style="list-style-type: none"> <li>○ Data can be sent from one computer to another (or to all)</li> </ul> </li> <li>● Any other correct feature</li> </ul>		
Any 3 correct features and description × 2	[6]	6

#### 4 Switches and Hubs

Level of response	Marking criteria	Mark band
Excellent	<p>The candidate compares and contrasts many of the correct features of a switch and a hub. Their use of spelling, punctuation and grammar are excellent and clearly legible.</p> <p>Their discussion of the switch and hub shows a very good knowledge of the filtering and forwarding of packets between LAN segments. Their description of the differences of a switch and hub will show a very good knowledge of the different properties of each.</p> <p>Their discussion of the switch and hubs uses an excellent form and style.</p> <p>Their discussion is highly coherent and is very well organized and they use a wide range of correct specialist terms.</p>	[6–8]
Good	<p>Candidate compares and contrasts some features of a switch and a hub. Their use of spelling, punctuation and grammar are satisfactory and legible.</p> <p>Their discussion of the switch and the hub shows a satisfactory knowledge of the filtering and forwarding of packets between LAN segments. Their description of the differences of a switch and hub will show a satisfactory knowledge of the different properties of each.</p> <p>Their discussion of the switch uses a satisfactory form and style.</p> <p>The discussion is coherent and is organized and they use a range of correct specialist terms.</p>	[3–5]
Poor	<p>Candidate describes few of the features of a switch or a hub. Their use of spelling punctuation and grammar are poor and their work is not that legible.</p> <p>Their discussion of a switch or hub is not organized and uses a poor form and style.</p> <p>The discussion is coherent and may use few (if any) correct specialist terms.</p>	[1–2]

When a response is not worthy of credit a [0] mark should be awarded.

**4 Answers should include any of the following points:  
(The descriptions should include comparisons between the switch and the slower, less efficient hub shown in the table below.)**

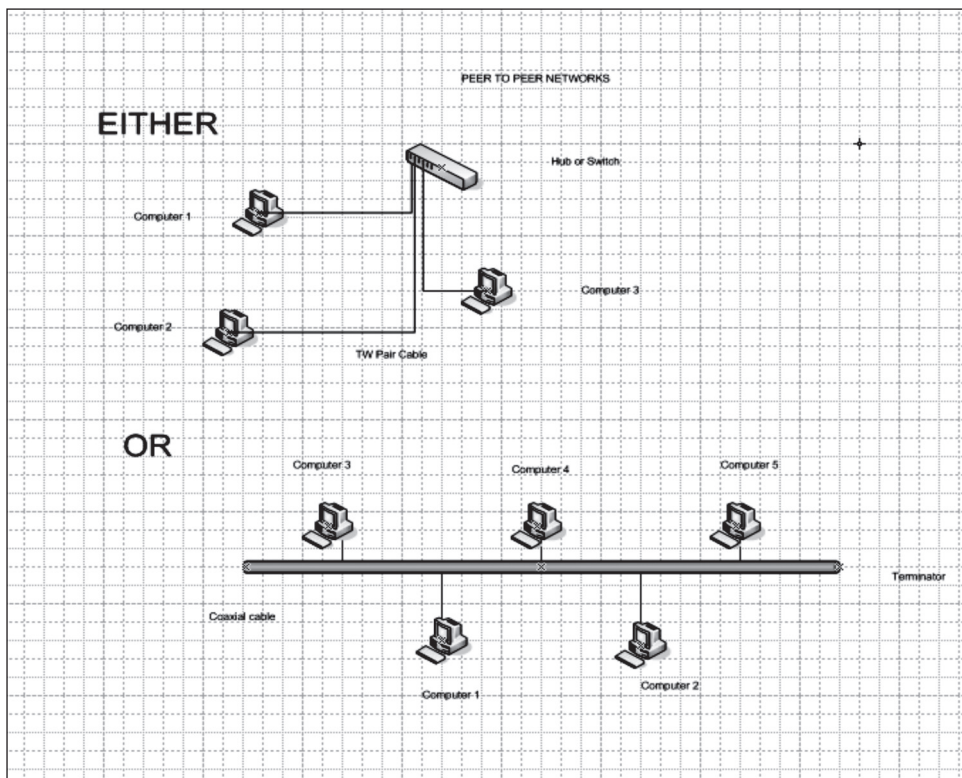
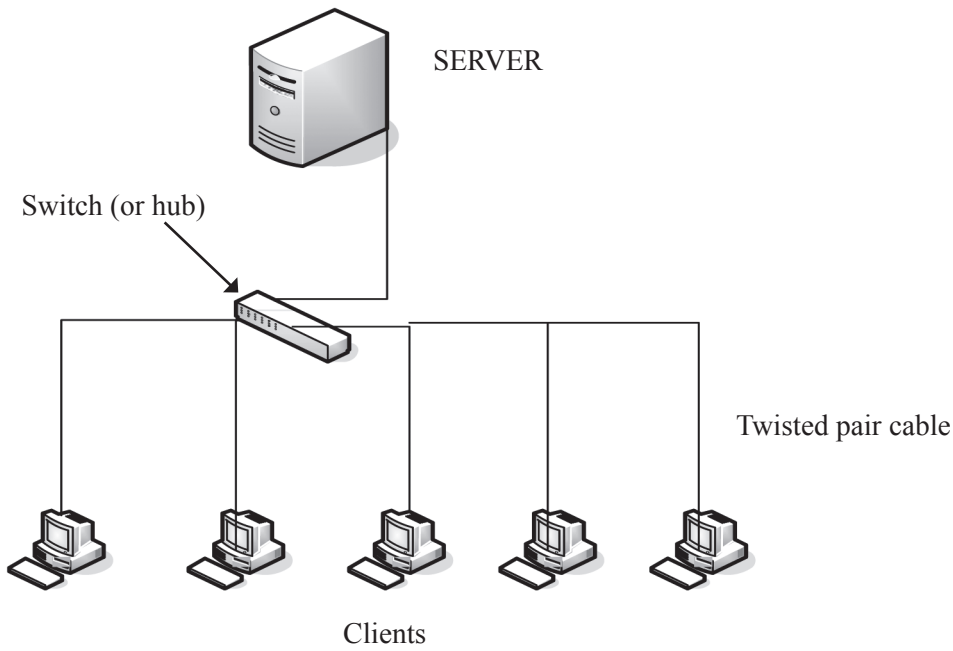
1. Description of the switch
  - i. Filters and forwards packets between LAN segments
  - ii. Switched LAN
2. Transmission to a specific computer rather than to all computers
  - i. Can carry out multiple transfers
  - ii. Can connect devices at different speeds
3. Can allow 'port trunking'
  - i. Configure a group of ports to a file server to operate at increased speeds
4. They operate at layer 2 on the OSI model
  - i. Support for any packet switching protocol
5. Description of the hub
  - i. Contains multiple ports
  - ii. Conduit for data enabling the data to go from one device (or segment) to another
  - iii. When a packet arrives at one port it is retransmitted to all other ports
  - iv. All segments of the LAN can see all packets
  - v. Managed hubs include features to allow administrators to monitor traffic

Parameter	Hub	Switch
Cost	Least expensive, becoming obsolete	More expensive but has almost replaced hub
Intelligent	Least intelligent unaware of data being transmitted Does not read data	Most intelligent Learns where addresses are and filters Reads destination address
Complexity	Least complex Quick and easy to connect	Most complex
Action	All computers connected to hub Can see everything Transmits data to all connected to hub Sends out through all ports	Divides network into multiple segments Does not automatically send traffic to every other port Sends to a specific port
Ports	✓	✓
Size of network	Limited due to collisions	Larger allowed
Speed	Generally slower Collisions high	Generally faster Micro segmentation Allows two computers to be networked at a faster speed with fewer collisions Point to point connection
OSI	1	2

Level of response	Marking criteria	Mark band
Excellent	<p>Candidate draws appropriate labelled sketches of client server and peer to peer networks. Their use of spelling, punctuation and grammar are excellent and clearly legible.</p> <p>Their discussion of client server and peer to peer networks shows a very good knowledge of the main properties of client server and of peer to peer.</p> <p>Their description of the differences of a client server and peer to peer will show a very good knowledge of the different properties of each.</p> <p>Their discussion of client server and peer to peer networks uses an excellent form and style.</p> <p>Their discussion is highly coherent and is very well organized and they use a wide range of correct specialist terms.</p>	[9–12]
Good	<p>Candidates may draw satisfactory diagrams of client server and peer to peer networks. Candidate describes some features of client server and peer to peer networks.</p> <p>Their use of spelling, punctuation and grammar are satisfactory and legible.</p> <p>Their discussion of client server and peer to peer shows a satisfactory knowledge of the properties of client server and peer to peer networks.</p> <p>Their description of the differences of client server and peer to peer will show a satisfactory knowledge of the different properties of each.</p> <p>Their discussion of client server and peer to peer networks uses a satisfactory form and style.</p> <p>The discussion is coherent and is organized and they use a range of correct specialist terms.</p>	[5–8]
Poor	<p>Candidate may produce unsatisfactory diagrams (or even no diagrams). Candidate describes few of the features of client server and peer to peer.</p> <p>Their use of spelling, punctuation and grammar are poor and their work is not that legible.</p> <p>Their discussion of client server and peer to peer networks is not organized and uses a poor form and style.</p> <p>The discussion is coherent and may use few (if any) correct specialist terms.</p>	[1–4]

When a response is not worthy of credit a [0] mark should be awarded.

Answers should include annotated diagrams similar to these shown:



(The descriptions should include comparisons of client server and peer to peer networks).

- Client
  - i. Individual user’s computer (or user application)
  - ii. Does processing on its own
  - iii. Sends and receives requests from one or more servers
  
- Server
  - i. One or more computers that receive or process requests from one or more client machines
  - ii. Has some redundancy in power and file storage
  - iii. Applications can be accessed from clients to the server
  
- Peer to peer
  - i. Small number of computers
  - ii. Resources can be shared
  - iii. Either diagram – description
  - iv. Problems with maintenance

<b>PEER – PEER</b>	<b>CLIENT – SERVER</b>
Cumulative bandwidth	Centralised bandwidth
No notion of clients – all equal peer nodes	Server provides data and information for each client
No central server	Central file server – software and data files
All clients can share resources – bandwidth, storage space	Server allocates resources and storage space
Maximum node capacity	
	Login names and passwords
No single point of failure	Fault may disrupt all clients
No file server, no central storage, each user stores work on computer’s local hard disc	S/W and data held on a file server.
Less cost – no expensive file server	
Cheaper to maintain – no network manager	Network manager
Security an issue – usually less secure	Control and security easier to maintain Security controlled centrally
S/W and data stored on each computer	Software and data held on file server
Individual node backup strategy	Back up strategy of files

There are other alternative statements that are acceptable.



6 e-mail attachments

(a) Problems:

- Security (Virus or worm or Trojan horse) problems plus description
- Size of attachment issues
- Any other correct problem

(b) Solution:

- Use appropriate firewall
- Use virus detection software
- Don't open e-mails from un-trusted sources
- Any other correct solution

Any problem described –  $[2] \times [2] = [4]$

Any solution described –  $[2] \times [2] = [4]$  [8]

8

7

A proxy server may hold copies of previously requested web pages.	TRUE
A firewall is software used to provide greater network security.	TRUE
Routers can divide single networks into logically separate networks.	TRUE
A media access control address (MAC) is a unique identifier attached to network equipment.	TRUE
An IP address can be either static or roaming.	FALSE
A subnet mask is used to identify the name of a user who has logged onto the Internet.	FALSE
A worm is similar to a virus and needs a host, such as an e-mail attachment, to enable it to travel from place to place.	FALSE
An example of a valid URL is www.exam.org	TRUE

Each correct answer  $1 \times 8$  [8]

8

8 Wireless Advantages

- Easy to install – no cabling required
- Easy to use – all new laptops come with wireless card fitted
- Small local area networks can be set up
- Possible to include security WPA or WEP
- Most systems have a suitable range (work outside is possible)
- Can buy signal boosters
- Possible to connect wireless computer to wired Ethernet network

Any 3 advantages × 2

[6]

6

9 Worms and DoS

WORM

- Similar to a virus (sub class of virus)
- Spread from computer to computer but doesn't need a host
- Uses file or information transport features to travel unaided
- Ability to replicate itself with huge effect
- Can send a copy of itself to everyone in your address book
  - It can then repeat this down the line
- Can cause web servers, network servers to stop responding

Denial of service attacks

- It is not a virus
- It is an attempt to prevent legitimate users of a network service from using that service
- It can flood a network with useless traffic
- It can maliciously alter server configurations

WORM Any 2 problems × 2 = 4

DoS Any 2 problems × 2 = 4

[8]

8

10

A statement about restrictions on how to use the Internet for personal purposes	TRUE
A request that unsuitable material should not be accessed	TRUE
Information about the Computer Misuse Act	TRUE
Information about security measures within the organisation	TRUE
A reminder that all material accessed on the Internet is available for employees to download	FALSE
A statement that the normal rules of copyright do not apply to Internet usage in the company	FALSE
A statement telling users how to write down or store their passwords	FALSE
A statement of the legal implications of improper Internet use	TRUE
A statement of Internet policy that an employee must accept before being allowed to use the Internet	TRUE
The roles of the senior managers in the organisation with regard to employees' work hours and duties	FALSE

Each correct row =  $10 \times 1$

[10]

10

## 11 NAT

The description of NAT security may include the following:

- (a) It was not originally designed for security
- It essentially 'hides' an organisation's IP addresses from the outside world
    - Local networks use designated 'private' IP address subnets.
  - These are 192.168.x.x, 172.16.x.x to 172.31.x.x and 10.x.x.x
  - A router on this network will also have a private address (such as 191.168.0.1)
  - The router is also connected to the Internet with a 'public' address(es)
  - The router thus appears to be the source and destination of traffic
  - If a computer on the Internet sends a packet to a LAN, NAT looks up an address translation table and determines the destination address.

Any 4 points  $\times$  1 = [4]

- (b)
- Most computers inside organisations communicate using inside local addresses – no outsider can see these
  - Some computers communicate with the outside world
    - Static addressing
      - One to one mapping between a private unregistered IP address and a registered address
    - dynamic (supplied) addressing
      - An unregistered IP address can be mapped to a registered IP address from a group

Any 2 points  $\times$  2 = [4]

- (c) A firewall
- Prevents most viruses from entering the company network
  - Can act as a proxy
  - Controls traffic between networks
  - Can prevent certain web pages from being viewed
  - Performs NAT
  - Prevents unauthorised access to or from a private network
  - Uses packet filtering

Any 2 points  $\times$  2 = [4]

12

Level of response	Marking criteria	Mark band
Excellent	<p>Candidate discusses many features of the web page journey from request to destination to request.</p> <p>Their use of spelling, punctuation and grammar are excellent and clearly legible.</p> <p>Their discussion of the way in which the journey takes place shows a very good knowledge of the main properties of URL, DNS MAC default gateway, firewalls and proxy servers.</p> <p>Their description will show a very good knowledge of the different properties of each.</p> <p>Their discussion uses an excellent form and style.</p> <p>Their discussion is highly coherent and is very well organized and they use a wide range of correct specialist terms.</p>	[9–12]
Good	<p>Candidate describes some features of the web page journey from request to destination to request.</p> <p>Their use of spelling, punctuation and grammar are satisfactory and legible.</p> <p>Their discussion of the way in which the journey takes place shows a satisfactory knowledge of some of the properties of URL, DNS MAC default gateway, firewalls and proxy servers.</p> <p>Their description will show a satisfactory knowledge of the different properties of each.</p> <p>Their discussion uses a satisfactory form and style.</p> <p>The discussion is coherent and is organized and they use a range of correct specialist terms.</p>	[5–8]
Poor	<p>Candidate may discuss few of the features of the journey from request to destination to request.</p> <p>Their use of spelling, punctuation and grammar are poor and their work is not that legible.</p> <p>Their discussion of the journey is not organized and uses a poor form and style.</p> <p>The discussion is coherent and may use few (if any) correct specialist terms.</p>	[1–4]

When a response is not worthy of credit a [0] mark should be awarded.

The description of the journey may include the following:

- If the student does not know the homepage address then use a search engine to locate it.
- Enter the URL into Explorer (or similar) browser on students' computer.
- The Domain Name Server (DNS) is queried for the required address.
- The IP address of the required homepage is found
  - An Ethernet frame is broadcast to the DNS server
  - It responds with a unicast frame (to one machine only)
- A subnet mask is used to identify the parts of the address that give the network address
  - (use of binary 1 means compare)
  - AND
- This process will discover that the student network computer and the required other school computer are not on the same network
- A packet is then sent to the default gateway
  - ARP is used to identify the MAC address of the default gateway
- The students computer will now send the required web address of the other school to the default gateway
- (There may be a proxy server)
  - The proxy server may already hold the required address
  - It is quicker (and cheaper) to retrieve the address from here
  - The security policy checks if the URL is allowed
  - The proxy server handles the retrieval of the required web page
- If the proxy server doesn't know the address the request will travel to the default gateway
- The default gateway (router) determines the best path and switches the packet
- If the packet passes successfully through the firewall it will be placed onto the Internet
- Routers will look up huge routing tables for the required address
- On arrival at the location requested the destination firewall will check if the packets are to be allowed
- Again the MAC address of the host will be located (it may be known or ARP can find it).
- The request is examined
- The return journey begins (in reverse as above).

12

**Total**

**100**