

Communication



Papers Dock

COMPUTER SCIENCE 9618 PAPER 3

Communication And Internet Technologies

Protocol

What is meant by Protocol ?

- Set Of Rules
- For Successful transmission and receipt of the data

Explain why protocols are essential for communication b/w computers

- Provides a set of standard for transmission of data
- that basically gives accepted set of rules for transmitting and receiving data.
- This enable communication between different platforms



They are able to communicate because of the same protocol

Types Of Protocol With Their Uses

POP 3/4 : Post Office Protocol.

Purpose: Downloads Email from server.

HTTP : Hypertext Transfer Protocol.

Purpose: Responsible for correct transfer of hypertext files.

FTP : File Transfer Protocol.

Purpose: Allows files to be transferred from one computer to another.

SMTP : Simple Mail Transfer Protocol.

Purpose: Responsible for sending Emails.

IMAP: Internet Message Access Protocol

Purpose: Same purpose as POP /receiving mails

BIT-TORRENT: Bit-torrent protocol.

Purpose: used for peer to peer file sharing.



Application

Transport

Network

Data Link

- It is a conceptual model for networking
- It consists of 4 layers

How these layers are implemented ?

- By Code / Program

Describe TCP/IP Protocol Suite ?

- A layered model
- with 4 layers
- Transmission Control Protocol with Internet Protocol
- uses a set of protocols for transmission of data
- Application Layer, Transport Layer, Network Layer, Data Link Layer.



Application Layer

It sends files to transport layer

Contains all programs that exchange data

E.g Web Browser

(1) HTTP

Explain what happens when a user access a website ?

1)



User types in URL

2) HTTP transmit URL from Application Layer to Transport Layer

3) TCP breaks the URL into Data Packets and sends the packet which contains domain name to DNS. DNS checks for matching IP.

4) Server sends back an acknowledgment

5) Web server sends back the web pages in HTML format

6) Browser Interpret the HTML file.

(2) FTP

FTP (File Transfer Protocol) is a standard network protocol used to transfer files between a client and a server over a TCP-based network, such as the internet. It allows users to upload, download, rename, delete, move, and copy files on a server.

1) SERVER : In FTP, the server is the central computer that stores files available for users to download. It manages the storage and distribution of files.

2) Command : This refers to the set of instructions a user can send to the FTP server, such as commands to delete, copy, or move files. These commands are executed on the server.

3) Anonymous : Anonymous FTP allows users to access files on a server without needing to identify themselves with a username and password. It is typically used for public file sharing

(3) SMTP

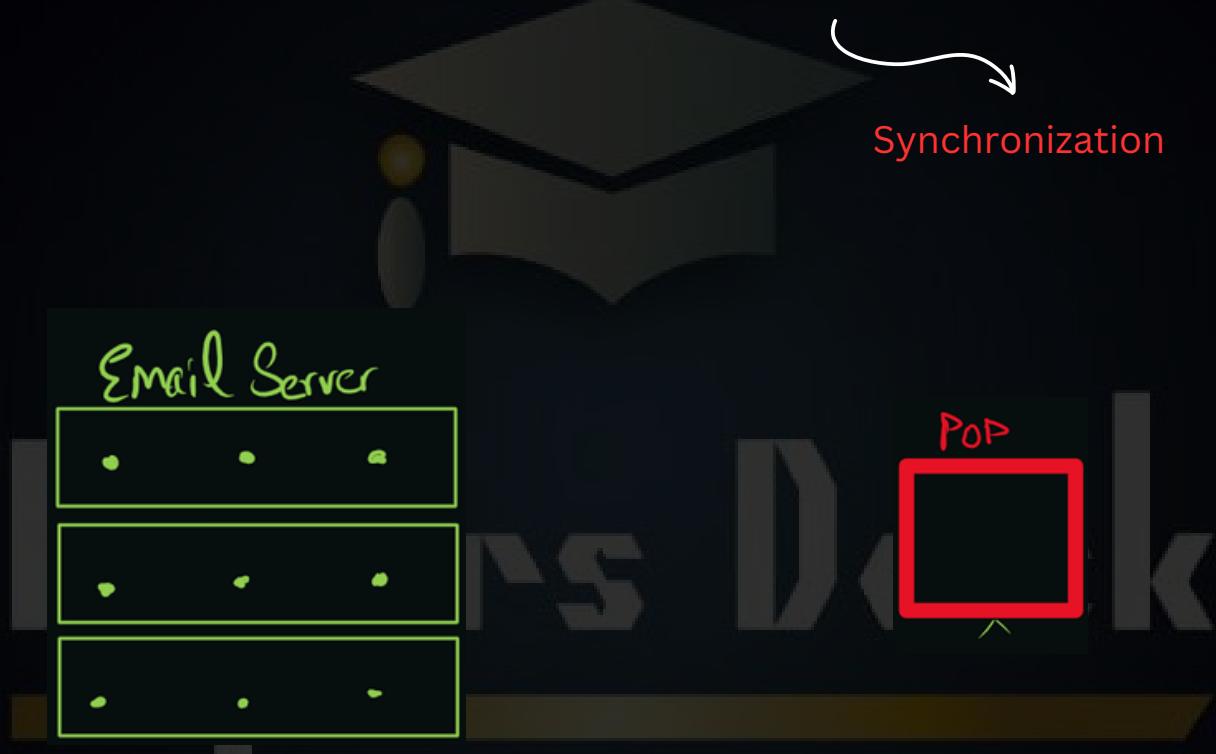
- SMTP stands for Simple Mail Transfer Protocol.
- It is used for sending emails from a client (like an email app) to a mail server.
- SMTP "pushes" outgoing emails from the sender to the recipient's mail server.
- The protocol works by breaking the email message into commands and responses.
- These commands ensure the email is routed correctly to its destination.
- SMTP is for sending mail, while IMAP or POP are for receiving mail.

Note : Does not handle binary files such as images and videos and to send binary files we need MIME (Multipurpose Internet Mail Extension)

(4) POP 3/4 AND IMAP

POP (Post Office Protocol) and IMAP (Internet Message Access Protocol) are "pull" protocols used for receiving emails from an email server to a client.

What is the difference between POP and IMAP



Note : On IMAP email does not get deleted and can be accessed from different devices.

Transport Layer

- Data are broken into packets and are sent to network layer
- uses TCP
- Ensures that packets arrive in sequence
- without error

Transmission Control Protocol

- It uses positive acknowledgment with re-transmission
- It automatically resends the data packets if it has not received positive acknowledgment
- It is connection oriented which means that a connection is required b/w both the devices
- Re transmits missing packets
- Re assembles packets in correct order

State the function of TCP part of TCP/IP protocol suite ?

- Allows application to exchange data
- Establishes and maintain the connection until exchange of data is completed
- Determines how to break application data into packets and add sequence / packet number to TCP header
- Sends packets to and accepts packets from the network layer
- Manages flow control of data to avoid congestion
- Acknowledges all packets that arrives
- Detects when a packet has not arrived at destination
- Handles re-transmission of dropped packets
- Re-assembles packets in correct order

Network / Internet Layer

- The Network Layer in the TCP/IP model uses Internet Protocol (IP) to manage data movement.
- It helps route and forward data across different networks.
- This layer is responsible for identifying and addressing devices on the network.
- It ensures data packets are sent to the correct destination across interconnected networks.

State the function of Internet Protocol ?

- Ensures correct routing of packets of data over over the internet.
- Takes a packet from your transport layer and add its own header
- Which includes IP address of recipient and sender both
- Encapsulate data into datagram
- Passes datagram to the link layer for transmission on the LAN

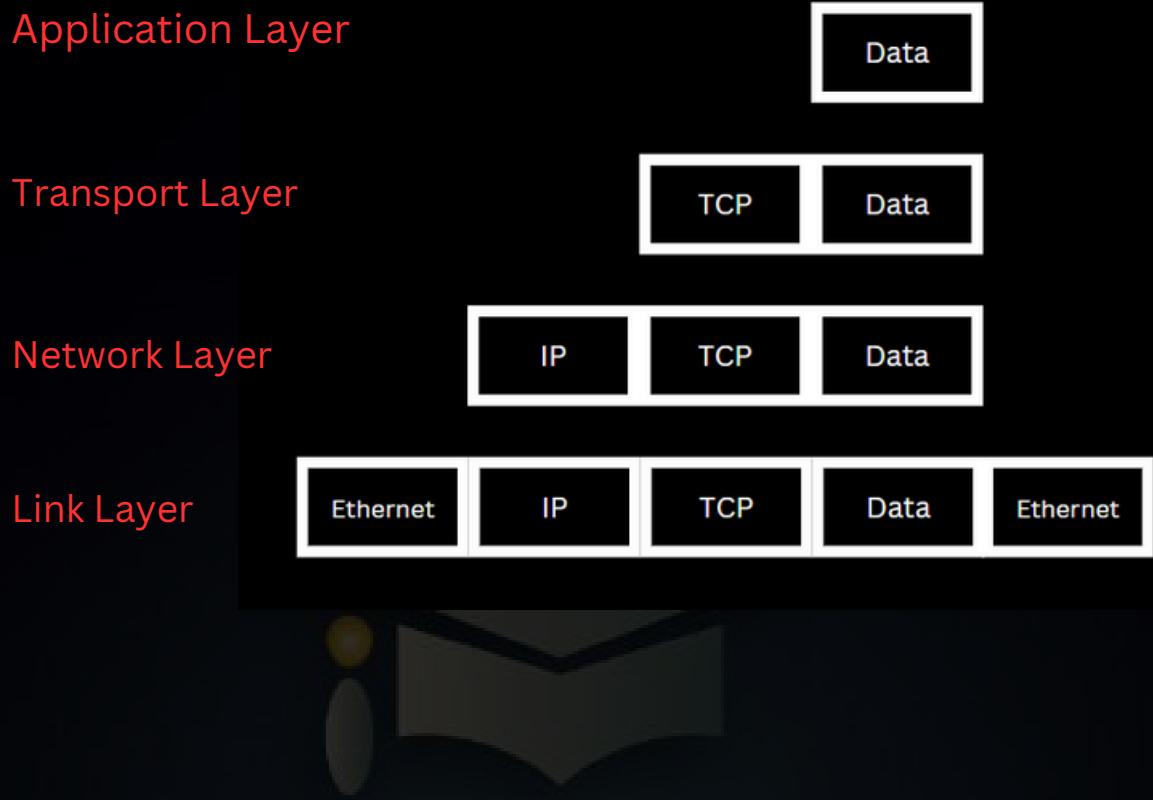
Link Layer

The protocol in this layer provides the means for the system to deliver data to the other devices

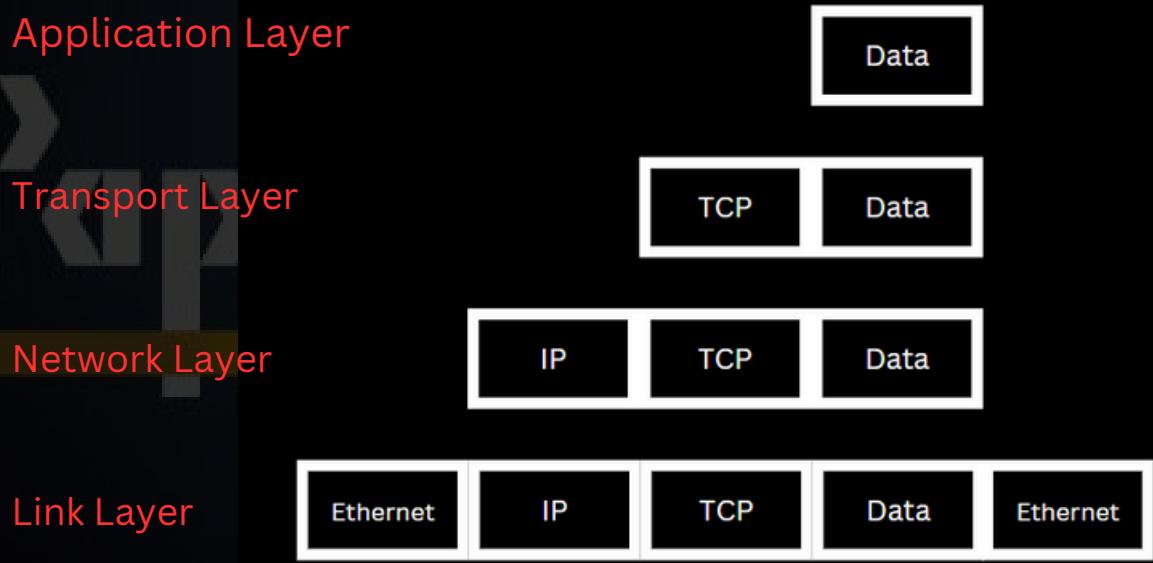
- Ethernet Protocol
- Wifi Protocol
- Bluetooth Protocol

Concept Of Packets

SENDER



RECEIVER



Describe the purpose of packet header ?

- To store data about packets
- And its routing to ensure that it reaches its destination
- To ensure that message can be properly reconstructed

What does TCP protocol header might contain ?

- To store data about packets
- And its routing to ensure that it reaches its destination
- To ensure that message can be properly reconstructed

What does IP data packet might contain ?

- Message Data
- IP version
- Size of Packet
- Sequence Number
- Protocol
- Source IP address
- Destination IP address

Bit-Torrent Protocol

The screenshot shows a search results page for "godzilla vs kong" on a Bit-Torrent search engine. The results are filtered under the "MOVIES" category. There are 76 results displayed, showing various torrent links and their details such as size, uploader, age, seed count, and leech count. The results are listed in descending order of size.

Rank	File Name	Size	Uploader	Age	Seed	Leech
1	Godzilla vs Kong 2021 1080p WEBRip x264-RARBG	2.2 GB	AlejandroAXL	1 month	16236	4578
2	Godzilla vs Kong 2021 1080p HMAX WEBRip DDP5 1 Atmos x264-MRCS	7.1 GB	AlejandroAXL	1 month	11410	2523
3	Godzilla vs Kong 2021 WEBRip x264-ION10	1.1 GB	AlejandroAXL	1 month	8175	2411
4	Godzilla vs Kong 2021 720p WEBRip 800MB x264-GalaxyRG ☆	796.5 MB	mazemaze16	1 month	3948	1636
5	Godzilla vs Kong 2021 2160p HMAX WEB-DL x265 10bit HDR DDP5 1 Atmos-SWTYBLZ	14.8 GB	AlejandroAXL	1 month	3159	1659
6	Godzilla vs Kong 2021 1080p WEBRip 1400MB DD5 1 x264-GalaxyRG ☆	1.4 GB	mazemaze16	1 month	3139	960
7	Godzilla vs Kong (2021) 1080p WEBRip x265 10bit RARBG	1.8 GB	marxspawn	1 month	3103	1042

The screenshot shows the uTorrent 3.2.1 application interface. The main window displays a single torrent named "WillisEarlBeal-BitTorrent" which is currently downloading at 99.4% completion. The torrent file size is 27.2 MB. The interface includes a sidebar for featured content, a toolbar with various icons, and a detailed status bar at the bottom showing network statistics like DHT nodes and upload/download speeds.



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What does seed 16236 means

- Peer Computer
- That has 100 % of file and is uploading downloaded content

What is the function of Swarm ?

- All the connected peer computer
- that have all or part of the file to be uploaded/ downloaded
- they share a torrent

Who is Tracker ?

- Central server
- that stores details of other computers that have all / part of files to be downloaded.
- Stores IP addresses of other peers in swarm allowing them to connect

Who are Leachers ?

- Peers who download much more data
- and upload less data
- negative impact on network

Explain how data is exchange using Bit-Torrent ?

- Torrent file is made available
- File to be shared is split into pieces
- Bit-Torrent client software is made available to other peers which allows them to work as seed or leaches
- A peer can act as a seed and a peer downloading file can get different pieces from other seed simultaneously
- Once a peer has a piece of a file it can become a seed for the parts downloaded and leaches download much more than they upload.
- Tracker keep record of all the peers and the parts of the file they have and can pause and restart at any time.

Network Model : Peer To Peer

Used for : File Sharing

Email Communication

Which protocols are used in Email Communication ?

- POP : Post Office Protocol
 - Downloading Email
- SMTP : Simple Mail Transfer Protocol
 - Sending Email
- IMAP : Internet Message Access Protocol
 - Downloading Email
- HTTP : Hypertext Transfer Protocol
 - Accessing email using a browser

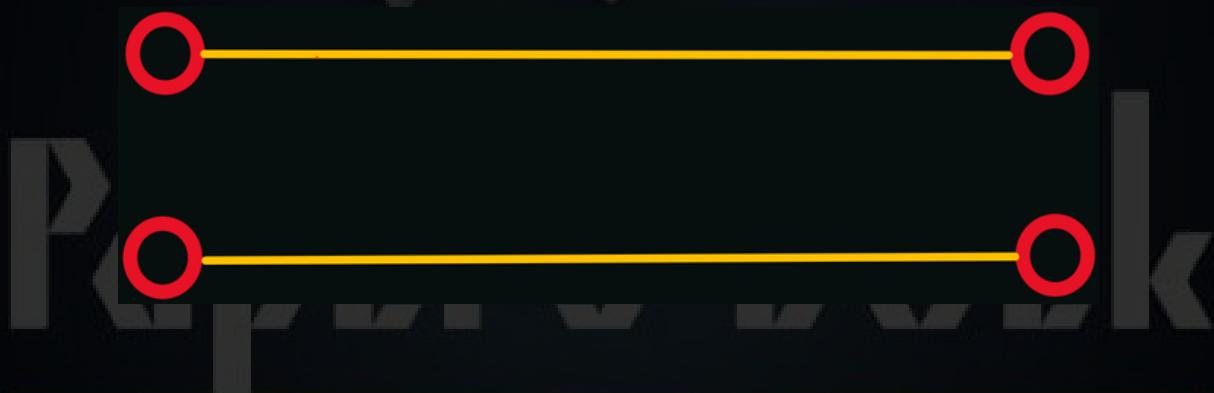
Packet Switching Vs Circuit Switching

Circuit Switching



If third person wants to join he/she would have to wait until one of them hangs up

Packet Switching



Question : Describe Circuit Switching ?

- A circuit is established at the start of the communication
- Between sender and receiver
- This lasts for the duration of the call / data transfer
- Then the link that make up the circuit are removed

Question : Describe Packet Switching ?

- A circuit does not have to be established at the start of the communication
- The data to be sent is divided into packet
- That can travel along different routes
- from node to node
- Packets are reassembled in the correct order at the receiver's end
- Must wait until the last packet is received to put the data together

Benefits Of Packet Switching

- Packets can be re-routed if there are problems
- Packets can take the least congested route
- transmission error can be detected
- missing / corrupt packets can be resent

Drawbacks Of Packet Switching

- Packets can be dropped / delayed
- Real time conversation is not possible

Benefits Of Circuit Switching

- The person communicating can see each other in real time
- better synchronization / full bandwidth available

Drawbacks Of Circuit Switching

- Bandwidth / channel not available to other users
- Extra time required to set up circuit at start of conversation
- alternative route not available without restarting the conversation
- Less secure as easier to intercept data if only one channel used
- failure in single route used means failure of transmission

Scenario Based Question

a) A large video file is shared ?

- Packet Switching
- File is divided into packets and necessary data is added to the packet e.g Header
- which are sent independently of each other
- and do not need to take the same route
- Packets are reassembled at the destination
- Missing / Corrupt packets can be resent

b) Person A and Person B wants to have a video conversation ?

- **Circuit Switching**
- **The circuit can easily be set up for the duration of the conversation**
- **set up before communication starts**
- **maintained throughout the transmission**
- **All data travels down the same route**
- **Dropped at the end of transmission**
- **complete bandwidth used**

Question : Describe what happens when the LAN transmit data from Computer X to Computer Y using circuit switching

- **Computer X sends a connection request to computer Y**
- **If computer Y is busy then Computer X waits and then resends the connection request to Computer Y**
- **If available, Computer X sets up path between nodes**
- **Computer X sends the data**
- **Computer Y sends the receipt signal**
- **The sender signals node to deallocate resources**

Question : Describe what happens when the LAN transmit data from Computer X to Computer Y using Packet switching

- **Message is split into packets**
- **Each packet is a fixed size**
- **Each packet is given a header**
- **Including destination IP, sequence number**
- **Packets are forwarded from one LAN to another**
- **Packets may take different routes**
- **Missing Packets are requested to be resent**
- **Packets re-assembled into each order at destination**

Question : State two problems that could arrive if video conferencing were to use packet switching.

- Picture and sound not synchronized // real time conversation is not possible.
- Interruption, data can be delayed by the other computing traffic.



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Communication And Network

Question 1

- 3 A mobile phone company uses circuit switching for voice calls and packet switching to send and receive other data.

- (a) (i) Describe circuit switching.

.....
.....
.....
.....
.....
..... [3]

- (ii) Explain why the company uses circuit switching for voice calls.

.....
.....
.....
.....
..... [2]

- (b) (i) Describe packet switching.

.....
.....
.....
.....
.....
..... [3]

- (ii) Explain why the company uses packet switching to send and receive other data.

.....
.....
.....
..... [2]

Question 2

- 3 The use of the TCP/IP protocol suite is essential for successful communication over the Internet.

- (a) (i) Describe the TCP/IP protocol suite.

[5]

[5]

- (ii) A group of over 100 students has produced a movie. The size of the movie file is very large.

The students would like to use peer-to-peer file sharing to share this file with friends and family.

Identify the **most appropriate** TCP/IP protocol for sharing this file over the Internet and describe the way this protocol works.

Protocol

Description
.....

[5]

- (b) (i) Files shared over the Internet are sent using packet switching or circuit switching methods.

Identify **and** describe the **most suitable** method for the large movie file from **part (a)(ii)**.

Method

Description

.....
.....
.....
.....
.....
.....
.....

[4]

- (ii) State **one** benefit and **one** drawback of the method you identified in **part (b)(i)**.

Benefit

Drawback

[2]

Question 3

- 3 The use of protocols is essential for successful communication between computers.

- (a) Define the term **communication protocol**.

.....
.....
.....

[2]

- (b) Identify **two** protocols that are used in the transfer of emails **and** state the purpose of each protocol.

Protocol 1

Purpose

.....

Protocol 2

Purpose

.....

[4]

(c) Manav and Miora want to have a video conversation over the Internet using a dedicated connection.

(i) Identify **and** describe the switching method used to implement this connection.

Method

Description

.....

.....

.....

[3]

(ii) State **one** benefit and **one** drawback of the method you identified in **part (c)(i)**.

Benefit

.....

Drawback

.....

[2]

Question 4

2 Packet switching can be used to transmit data across the Internet.

Packet switching is not always the most appropriate method of transferring data.

(a) Name an alternative method of transferring data across the Internet.

..... [1]

(b) Give an example of a situation where the method you identified in **part (a)** is more appropriate.

Justify your choice.

Example

.....

.....

.....

[3]

Question 5

3 Protocols are essential for communication between computers.

- (a) Explain why protocols are essential for communication between computers.

.....
.....
.....
.....
.....

[2]

Question 6

7 (a) Identify the **four** layers of the TCP/IP protocol suite.

1

2

3

4

[4]

- (b) The TCP/IP protocol suite is responsible for transmitting data across the Internet using packet switching.

- (i) Explain why packet switching is used when sending data across the Internet.

.....
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.....
.....

[2]

- (ii) Each packet requires a header.

Describe the purpose of a packet header.

.....
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.....
.....

[2]

- (iii) Identify **three** items that should be contained in a packet header.

Item 1

.....

Item 2

.....

Item 3

.....

[3]

Question 7

- (b) The sequence of steps 1 to 7 describes what happens when the LAN transmits data from Computer X to Computer Y using circuit switching. Four statements (4 to 7) are missing from the sequence.

A	Computer X sends the data.
B	The sender signals node to deallocate resources.
C	Computer Y sends a receipt signal.
D	If available, Computer X sets up path between nodes.

Write **one** letter (**A** to **D**) in the appropriate space to complete the sequence.

- 1 Computer X sends a connection request to Computer Y.
- 2 Computer Y sends ready or busy signal.
- 3 If busy, Computer X waits and then resends the connection request to Computer Y.

4

5

6

7

[3]

- (c) (i) Protocols are essential for successful transmission of data over a network. The TCP/IP protocol suite operates on many layers.

State the appropriate layer for each protocol in the following table.

Protocol	Layer
TCP	
IP	
SMTP	

[3]

- (ii) Peer-to-peer (P2P) file sharing uses the BitTorrent protocol.

Explain how the BitTorrent protocol allows files to be shared.

.....
.....
.....
.....
.....

[3]

Question 8

- 4 The TCP/IP protocol suite is used on the Internet.

- (a) The table has statements about transmitting data across the Internet.

Put a tick () in each row to identify whether the responsibility belongs to TCP or IP.

Responsibility	TCP	IP
Correct routing		
Host to host communication		
Communication between networks		
Retransmitting missing packets		
Reassembling packets into the correct order		

[5]

- (b) Identify **two** other internet protocols. State a use for each protocol.

Protocol 1

.....

Use

.....

Protocol 2

.....

Use

[4]

- (c) State the name of the TCP/IP layer that uses IP addresses.

..... [1]

- (d) Emails are transmitted across the Internet using packet switching and routing tables.

- (i) Give **four** items of data in an IP data packet.

1

2

3

4

[4]

- (ii) Describe **two** benefits of using packet switching.

Benefit 1

.....
.....
.....
.....

Benefit 2

.....
.....
.....
.....

[4]

- (iii) Give **two** items of data stored in a routing table.

1

2

[2]

Question 9

(b) The network uses the TCP/IP protocol to transfer files across the network.

(i) State **three** functions of the **TCP** part of this protocol.

1

.....
2

.....
3

[3]

(ii) State **two** functions of the **IP** part of this protocol.

1

2

[2]

(iii) Identify **one** other common protocol that could be used to transfer files across the college network.

.....[1]

(c) Protocols are essential for successful transmission of data over a network. The TCP/IP protocol suite operates on many layers.

Give an appropriate protocol for each layer in the table.

Layer	Protocol
Application	
Transport	
Internet	

[3]

- (d) The TCP/IP protocol is used to send an email message from one node on a LAN to a node on a different LAN.

State the steps that take place when the email message is sent and received.

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.....

[4]

Question 10

- (b) (i) Describe what is meant by **circuit switching**.

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.....

[2]

- (ii) The table shows statements that relate to circuit switching, packet switching or both.

Tick (**✓**) **one or more** boxes in each row to show whether the statement applies to circuit switching, packet switching or both.

Statements	Circuit switching	Packet switching
Shares bandwidth		
Data may arrive out of order		
Data can be corrupted		
Data are less likely to get lost		

[4]

Question 11

- 5 (a) A web browser is used to request and display a page stored on an internet web server.

Explain how each of the following items is used in this event.

(i) Packet:

.....
.....
.....

[2]

(ii) Router:

.....
.....
.....

[2]

(iii) TCP/IP:

.....
.....
.....

[2]

- (b) The Internet can be used for video conferencing. Data can be transmitted over the Internet using either packet switching or circuit switching.

- (i) State **two** problems that could arise if video conferencing were to use packet switching.

Problem 1

.....

Problem 2

.....

[2]

- (ii) Explain what is meant by **circuit switching**.

.....
.....
.....
.....

[2]

- (iii) Explain how the use of circuit switching overcomes the problems you have identified in part (i).

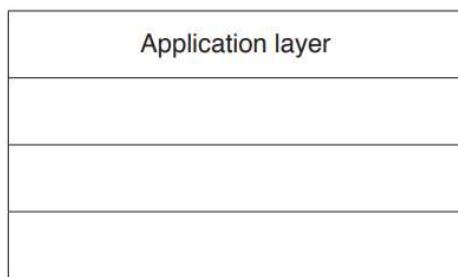
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[3]

Question 12

- 5 The TCP/IP protocol suite can be viewed as a stack with four layers.

- (a) Complete the stack by inserting the names of the three missing layers.



[3]

- (b) BitTorrent is a protocol used at the Application layer for the exchange of data.

- (i) State the network model used with this protocol.

..... [1]

- (ii) State the use of BitTorrent.

..... [1]

- (iii) Explain how the exchange of data is achieved using BitTorrent.

.....
.....
.....
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.....

[4]

- (c) State **two** additional protocols that are also used at the Application layer for the exchange of data.

For each protocol, give an example of an appropriate exchange of data.

Protocol 1

Example

.....

Protocol 2

Example

.....

[4]

Question 13

- 5 The TCP/IP protocol suite can be viewed as a stack with four layers.

- (a) (i) Complete the stack by inserting the names of the three missing layers.



[3]

- (ii) State how each layer of the stack is implemented.

..... [1]

- (b) A computer is currently running two processes:

- Process 1 is downloading a web page.
- Process 2 is downloading an email.

- (i) Describe **two** tasks that the Transport layer performs to ensure that the incoming data is downloaded correctly.

1

.....

.....

2

.....

.....

.....

[4]

(ii) Name a protocol that will be used by Process 1.

..... [1]

(iii) Name a protocol that will be used by Process 2.

..... [1]

Question 14

6 (a) Four descriptions and three protocols are shown below.

Draw a line to connect each description to the appropriate protocol.

Description	Protocol used
email client downloads an email from an email server	HTTP
email is transferred from one email server to another email server	POP3
email client sends email to email server	SMTP
browser sends a request for a web page to a web server	

[4]

(b) Downloading a file can use the client-server model. Alternatively, a file can be downloaded using the BitTorrent protocol.

Name the model used.

.....[1]

(c) For the BitTorrent protocol, explain the function of each of the following:

(i) Tracker

.....
.....

[2]

(ii) Seed

.....
.....

[2]

(iii) Swarm

.....
.....

[2]

Question 15

(b) A user downloads a file using the FTP protocol.

Explain the function played by each of the following:

(i) Server

.....
.....

[2]

(ii) Command

.....
.....

[2]

(iii) Anonymous

.....
.....

[2]

Question 16

3 An email is sent from one email server to another using packet switching.

- (a) State **two items** that are contained in an email packet apart from the data.

1

2 [2]

- (b) Explain the role of routers in sending an email from one email server to another.

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.....

[3]

- (c) Sending an email message is an appropriate use of packet switching.

Explain why this is the case.

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.....
.....
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.....
.....

[2]

- (d) Packet switching is not always an appropriate solution.

Name an alternative communication method of transferring data in a digital network.

..... [1]

- (e) Name an application for which the method identified in **part (d)** is an appropriate solution.
Justify your choice.

Application

Justification

.....
.....
.....
.....

[3]

Question 17

- 3 (a)** Explain what is meant by circuit switching.

[2]

- [2]

- (b)** There are many applications in which digital data are transferred across a network. Video conferencing is one of these.

For this application, circuit switching is preferable to the use of packet switching.

Explain why this is so.

...[6]

- (c) A web page is transferred from a web server to a home computer using the Internet.

Explain how the web page is transferred using packet switching.

.. [3]

Question 18

- 6** Give **two** benefits and **two** drawbacks of packet switching.

Benefit 1

.....

Drawback 2

[4]

Question 19

- 6 (a) Explain how packet switching is used to transfer messages across the internet.

[5]

- (b)** Outline the function of a router in packet switching.

[3]

Question 20

- 3 Data can be sent over networks using either circuit switching or packet switching.

Describe both methods of data transmission. Include a different advantage and disadvantage for each method.

Circuit switching

.....
.....
.....
.....

Advantage

.....
.....

Packet switching

.....
.....
.....
.....

Advantage

.....

[8]

Question 21

3 The TCP/IP protocol suite has four layers. The application layer provides user services.

(a) Identify **two** protocols used by this layer. Describe the use of each protocol.

Protocol 1

Description

.....

.....

Protocol 2

Description

.....

.....

[4]

(b) Identify **two other** layers of the TCP/IP protocol suite. Describe the function of each layer.

Layer 1

Description

.....

.....

Layer 2

Description

.....

.....

[4]

Question 22

- 2 Outline the functions of the Transport and Internet layers of the TCP/IP protocol suite.

Transport layer

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.....
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Internet layer

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[5]

Question 23

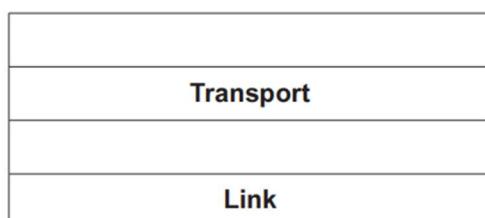
- 3 (a) Explain why a protocol is used in communication between computers.

.....
.....
.....
.....

[2]

- (b) The TCP/IP protocol implementation can be viewed as a stack.

Complete the diagram for the TCP/IP protocol stack.



[2]

- (c) Describe the purpose of the IMAP protocol.

.....
.....
.....
.....

[2]

Question 24

- 5 (a) State, with a reason, where it would be appropriate to use circuit switching.

.....
.....
.....
..... [2]

- (b) Give **two** benefits and **two** drawbacks of circuit switching.

Benefit 1

.....
.....
Benefit 2

.....
.....
Drawback 1

.....
.....
Drawback 2

[4]

Question 25

- 7 (a) State **two** examples of where it would be appropriate to use packet switching.

.....
.....
.....
..... [2]

- (b) Give **four** differences between circuit switching and packet switching.

1

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2

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3

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.....
4

[4]

Question 26

- 2 (a) Draw **one** line to connect **each** protocol to its most appropriate use.

Protocol	Use
HTTP	to provide peer-to-peer file sharing
BitTorrent	when retrieving email messages from a mail server over a TCP/IP connection
SMTP	when transmitting hypertext documents
IMAP	to map MAC addresses onto IP addresses
	when sending email messages towards the intended destination

[4]

- (b) Outline the purpose of the **Link layer** in the TCP/IP protocol suite.

.....
.....
.....
.....

[2]

Question 27

- 4 Complete the following paragraph about a **protocol suite**, using words from the given list.

Some words are **not** used.

BitTorrent	circuit switching	layered	link	list
peer-to-peer	queue	stack	star	TCP/IP

The protocols in a determine the interconnectivity
rules for a network model such as the
..... model.

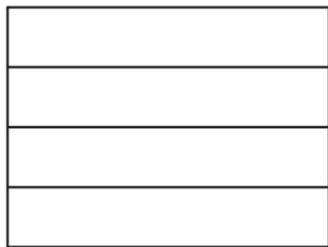
[3]

Question 28

- 2 The TCP/IP protocol suite has four layers:

Transport, Application, Link, Internet

- (a) Complete the diagram to show the correct order for these layers.



[2]

- (b) Describe the function of the Transport layer.

.....
.....
.....
..... [2]

- (c) Outline **one** protocol that is associated with the Application layer.

.....
.....
.....
..... [2]

Question 29

- 2 (a) Outline why protocols are essential for communication between computers.

.....
.....
.....
.....

[2]

- (b) State the names of **two** different protocols associated with the sending and receiving of emails between computers.

Sending

Receiving

[2]

- (c) Explain the meaning of the phrase:

BitTorrent protocol provides peer-to-peer file sharing.

.....
.....
.....
.....
.....
.....
.....

[3]

Answers

Answer 1

3(a)(i)	<p>Any three from:</p> <ul style="list-style-type: none"> • A circuit is established at the start of the communication • Between sender and receiver • This lasts for the duration of the call/data transfer • Then the links that make up the circuit are removed 	3
3(a)(ii)	<p>Any two from:</p> <ul style="list-style-type: none"> • A dedicated channel // Not sharing channel • ...can use all bandwidth • Two-way real time conversation • No delay as no switching • Data arrives in order it is sent 	2
3(b)(i)	<p>Any three from:</p> <ul style="list-style-type: none"> • A circuit does not have to be established at the start of the communication • The data to be sent is divided into packets • That can travel along different routes • From node to node • Packets are reassembled in the correct order at the receiver's end • Must wait until the last packet is received to put the data back together 	3
3(b)(ii)	<p>Any two from:</p> <ul style="list-style-type: none"> • Communication is asynchronous • Allows for error checking • Real time transmission is not required • Smaller amounts of data are sent (than voice calls) therefore dedicated line/higher bandwidth not required // can share the bandwidth • Doesn't matter if data arrives out of order 	2

Answer 2

3(a)(i)	<p>Any five from A layered model / stack ... with 4 layers</p> <p>Uses a set of protocols for transmission of data .. transport control protocol with internet protocol</p> <p>Named layers of Application Layer, Transport Layer, Internet/Network Layer,</p> <p>Data Link Layer two layers correct all four layers correct ... in the correct order</p>	5
---------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------

3(a)(ii)	<p>One mark for protocol, four marks for description</p> <p>Protocol: BitTorrent Description: Any four from</p> <p>BitTorrent client software made available to friends and family's computers a complete copy of the torrent/file to be shared is available on at least one computer the torrent/file is split into small pieces... ... rare pieces are given priority for downloading the torrent descriptor file is made available a computer/user joins (the swarm) by using the BitTorrent software to load the torrent descriptor file the computer/user can now download a piece of the torrent/file once a computer has a piece/ the whole file, it can become a seed (and upload to other members of the swarm) pieces of the torrent/file are both downloaded and uploaded (by each member of the of the swarm) a server called a tracker keeps records of all the computers in the swarm the tracker shares their IP addresses allowing connection to each other</p>	5
3(b)(i)	<p>One mark for method Method: Packet switching Three marks for description, any three from</p> <p>Description: file is divided into packets ... and necessary data added to each packet, e.g. header which are sent independently of each other and do not need to take the same route packets are reassembled at the destination missing / corrupt packets can be resent</p>	4
3(b)(ii)	<p>One mark for benefit, one mark for drawback</p> <p>Benefit: packets can be rerouted if there are problems // packets can take the least congested route // transmission errors can be detected // missing / corrupt packets can be resent</p> <p>Drawback: packets can be dropped / delayed</p>	2

Answer 3

3(a)	Set of rules For (successful) transmission (and receipt) of data	2
3(b)	<p>One mark for protocol, one mark for purpose must match protocol Any two pairs from</p> <p>Protocol: POP3 Purpose: downloading email Protocol: SMTP Purpose: sending/transferring email Protocol: IMAP Purpose: downloading email // storing/organising emails on an email server Protocol: HTTP/HTTPS Purpose: accessing email using a browser</p>	4

3(c)(i)	<p>One mark for method, max two marks for description</p> <p>Method: Circuit switching</p> <p>Description: Set up for the duration of the conversation Set up before communication starts Maintained throughout the transmission All data travels down the same route Dropped at the end of the transmission Complete bandwidth used</p>	3
3(c)(ii)	<p>One mark for benefit, one mark for limitation</p> <p>Benefit: Manav and Miora can see other in real time // better synchronisation // full bandwidth available</p> <p>Drawback: Bandwidth / channel not available to other users // extra time required to set up circuit at start of conversation // alternative route not available without restarting the conversation // less secure as easier to intercept data if only one channel used // failure single route used means failure of transmission</p>	2

Answer 4

2(a)	Circuit switching	1
2(b)	<p>1 mark</p> <p>Any real-time application e.g. video conferencing // live streaming of a concert</p> <p>Justification 1 mark per bullet to max 2</p> <ul style="list-style-type: none"> ∞ reduced latency ∞ there are little/no delays in sending/receiving data once the circuit is set up ∞ because (stringent) error checking (as used in packet switching) is not required ∞ circuit made available is dedicated to this communication stream 	3

Answer 5

3(a)	<p>1 mark per bullet point to max 2</p> <ul style="list-style-type: none"> • Provide a set of standards for transmission of data • ... that gives a known/accepted set of rules for transmitting and receiving data • This enables communication/compatibility between devices from different manufacturers/platforms etc. 	2
------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---

Answer 6

7(a)	<p>1 mark per bullet point</p> <ul style="list-style-type: none"> • Application • Transport • Internet / Network • Data Link 	4
7(b)(i)	<p>1 mark per bullet point to max 2</p> <ul style="list-style-type: none"> • Packet switching makes best use of the available (channel) capacity • ... by using alternative routes • ... which is more secure / robust • ... as packets to / from different sources and destinations can share the same route 	2
7(b)(ii)	<p>1 mark per bullet point to max 2</p> <ul style="list-style-type: none"> • To store data about packet • ... and its routing // to ensure it reaches its destination • ... to ensure that message can be properly reconstructed 	2
7(b)(ii)	<p>1 mark per item to max 3</p> <p>For example:</p> <ul style="list-style-type: none"> • IP address of sender • IP address of destination • IP version • Number of packets the message consists of • ID number of that packet • Protocol used • Packet length • Time to live // max number of hops • Synchronisation data • Source port • Destination Port • Checksum 	3

Answer 7

3(b)	<p>1 mark for each correct pair of letters in the right order max 3</p> <table border="1"> <tr> <td>1</td><td>Computer X sends a connection request to Computer Y.</td></tr> <tr> <td>2</td><td>Computer Y sends ready or busy signal.</td></tr> <tr> <td>3</td><td>If busy, Computer X waits and then resends the connection request to Computer Y.</td></tr> <tr> <td>4</td><td>D</td></tr> <tr> <td>5</td><td>A</td></tr> <tr> <td>6</td><td>C</td></tr> <tr> <td>7</td><td>B</td></tr> </table>	1	Computer X sends a connection request to Computer Y.	2	Computer Y sends ready or busy signal.	3	If busy, Computer X waits and then resends the connection request to Computer Y.	4	D	5	A	6	C	7	B	3
1	Computer X sends a connection request to Computer Y.															
2	Computer Y sends ready or busy signal.															
3	If busy, Computer X waits and then resends the connection request to Computer Y.															
4	D															
5	A															
6	C															
7	B															

3(c)(i)	<p>1 mark for each layer</p> <table border="1"> <thead> <tr> <th>Protocol</th><th>Layer</th></tr> </thead> <tbody> <tr> <td>TCP</td><td>Transport</td></tr> <tr> <td>IP</td><td>Internet/Network</td></tr> <tr> <td>SMTP</td><td>Application</td></tr> </tbody> </table>	Protocol	Layer	TCP	Transport	IP	Internet/Network	SMTP	Application	3
Protocol	Layer									
TCP	Transport									
IP	Internet/Network									
SMTP	Application									
3(c)(ii)	<p>Any three points from:</p> <ul style="list-style-type: none"> ∞ BitTorrent client software made available ∞ One computer must keep a complete copy of the torrent/file to be shared ∞ Torrent/file is split into small pieces ∞ A computer joins (a swarm) by using the BitTorrent software to load a torrent descriptor file ∞ The computer can now download a piece of the file ∞ Once a computer has a piece it can become a seed and upload (to other members of the swarm) ∞ Pieces of the torrent are both downloaded and uploaded (by each member of the of the swarm) ∞ A server called a tracker keeps records of all the computers in the swarm ∞ The tracker shares their IP addresses allowing them to connect to each other 	3								

Answer 8

4(a)	<p>1 mark per correct row</p> <table border="1"> <thead> <tr> <th>Responsibility</th><th>TCP</th><th>IP</th></tr> </thead> <tbody> <tr> <td>Correct routing</td><td></td><td>✓</td></tr> <tr> <td>Host to host communication</td><td>✓</td><td></td></tr> <tr> <td>Communication between networks</td><td></td><td>✓</td></tr> <tr> <td>Retransmitting missing packets</td><td>✓</td><td></td></tr> <tr> <td>Reassembling packets into the correct order</td><td>✓</td><td></td></tr> </tbody> </table>	Responsibility	TCP	IP	Correct routing		✓	Host to host communication	✓		Communication between networks		✓	Retransmitting missing packets	✓		Reassembling packets into the correct order	✓		5
Responsibility	TCP	IP																		
Correct routing		✓																		
Host to host communication	✓																			
Communication between networks		✓																		
Retransmitting missing packets	✓																			
Reassembling packets into the correct order	✓																			
4(b)	<p>1 mark for name, 1 mark for matching use, max 4 for 2 protocols</p> <ul style="list-style-type: none"> • POP3/IMAP (1) receiving emails // download emails from a server (1) • SMTP (1) sending emails (1) • FTP (1) allows files to be transferred from one computer to another (1) • HTTP/HTTPS (1) transfer of web pages/hypertext (1) • Bit Torrent (1) used for peer-to-peer file sharing (1) 	4																		
4(c)	Internet / Network (layer)	1																		

4(d)(i)	<p>1 mark per bullet to max 4</p> <ul style="list-style-type: none"> • Message data / payload • IP version number • Internet header length • Type of service • Explicit Congestion Notification • Total length/size of packet (in bytes) • Identification / sequence / packet number • Fragmentation flags • Fragmentation offset • Time to live // number of hops • Protocol • (Header) checksum • Source (IP) address • Destination (IP) address 	4
4(d)(ii)	<p>1 mark per benefit, 1 mark per expansion, max 4 for 2 benefits</p> <p>For example :</p> <ul style="list-style-type: none"> • alternative route available... • in case of network problem • If packet fails to arrive... • then only that packet has to be resent 	4
4(d)(iii)	<p>1 mark per bullet to max 2</p> <ul style="list-style-type: none"> • Network ID // (IP Address of) network destination (1) Subnetmask (1) • Routing metric // data to decide best route • (IP Addresses of possible) next hop / Gateway • Interface 	2

Answer 9

3(b)(i)	<p>1 mark per bullet point to max 3:</p> <ul style="list-style-type: none"> ∞ allows applications to exchange data ∞ establishes and maintains a connection ... ∞ ... until exchange of data is complete ∞ determines how to break application data into packets ∞ adds sequence / packet number to (TCP) header ∞ sends packets to and accepts packets from the network / Internet layer ∞ manages flow control // manages congestion avoidance ∞ acknowledges all packets that arrive ∞ detects when a packet has not arrived at destination ∞ handles retransmission of dropped packets ∞ reassembles packets into the correct order 	3
3(b)(ii)	<p>1 mark per bullet point to max 2</p> <ul style="list-style-type: none"> ∞ routes the packets around the network ∞ adds to the IP header a source/destination address for each packet ∞ encapsulates data into datagram ∞ passes datagram to the network access layer (for transmission on the LAN)// passes datagram to the transport layer (on arrival at destination) ∞ Defines the addressing method e.g. subnetting, NAT 	2

3(b)(iii)	HTTP(S) // FTP // POP3 // SMTP // UDP // etc...	1								
3(c)	1 mark for appropriate protocol in each layer <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Layer</th> <th style="text-align: center;">Protocol</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Application</td> <td>HTTP(S) // FTP // POP3 // SMTP // UDP etc...</td> </tr> <tr> <td style="text-align: center;">Transport</td> <td>TCP</td> </tr> <tr> <td style="text-align: center;">Internet</td> <td>IP</td> </tr> </tbody> </table>	Layer	Protocol	Application	HTTP(S) // FTP // POP3 // SMTP // UDP etc...	Transport	TCP	Internet	IP	3
Layer	Protocol									
Application	HTTP(S) // FTP // POP3 // SMTP // UDP etc...									
Transport	TCP									
Internet	IP									
3(d)	1 mark per bullet point to max 4: <ul style="list-style-type: none"> oo Message is split into packets oo Each packet is a fixed size oo Each packet is given a header.... oo ...including destination IP address, sequence number etc. oo Packets are forwarded from one LAN to the other LAN oo Packets may take different routes oo Missing packets are requested to be resent oo Packets re-assembled into order at destination 	4								

Answer 10

2(b)(i)	1 mark per bullet point to max 2: <ul style="list-style-type: none"> • dedicated circuit/channel//(physical) path • connection established before/at the start of the communication • which lasts for duration of connection // circuit released at end of the communication • all data is transmitted along the same route 															
2(b)(ii)	1 mark for each row: <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Statements</th> <th style="text-align: center;">Circuit switching</th> <th style="text-align: center;">Packet switching</th> </tr> </thead> <tbody> <tr> <td>Shares bandwidth</td> <td></td> <td style="text-align: center;">✓</td> </tr> <tr> <td>Data may arrive out of order</td> <td></td> <td style="text-align: center;">✓</td> </tr> <tr> <td>Data can be corrupted</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> </tr> <tr> <td>Data are less likely to get lost</td> <td style="text-align: center;">either✓</td> <td style="text-align: center;">or✓</td> </tr> </tbody> </table>	Statements	Circuit switching	Packet switching	Shares bandwidth		✓	Data may arrive out of order		✓	Data can be corrupted	✓	✓	Data are less likely to get lost	either✓	or✓
Statements	Circuit switching	Packet switching														
Shares bandwidth		✓														
Data may arrive out of order		✓														
Data can be corrupted	✓	✓														
Data are less likely to get lost	either✓	or✓														

Answer 11

5(a)(i)	Packet: Both web page and web page request are split into packets Each packet is sent individually from device to device	1 1	2
5(a)(ii)	Router: Transmit packets Contain connections to many other routers When packets arrive at router, router decides where next to send packet 1 mark for any valid point		Max 2
5(a)(iii)	TCP/IP: Is the protocol Rules for communication between web server and browser	1 1	2

		Max 2
5(b)(i)	<p>Two from:</p> <p>Picture and sound not synchronised Interruptions // video not continuous Can be degraded by other competing traffic</p>	1 1 1
5(b)(ii)	<p><u>Dedicated</u> communications channel between the two communicating devices Established prior to start of communication // removal of links at end of communication</p>	1 1
5(b)(iii)	<p>In packet switching, packets can take different routes and may not arrive in order Will arrive in order (only one route) As packets can take many different routes / share paths with others can be delayed Dedicated circuit has full bandwidth No loss of synch 1 mark for any valid point</p>	Max 3

Answer 12

5(a)	Option 1	Option 2	3
	Application Layer	Application Layer	
	Transport	Transport (Layer)	
	Internet	Network (Layer)	
Network Interface		(Data) Link (Layer)	1 1 1
5(b)(i)	Peer-to-peer		1
5(b)(ii)	File sharing		1
5(b)(iii)	Any four points from the following: <ul style="list-style-type: none"> • Torrent descriptor file is made available • File to be shared is split into pieces • BitTorrent client software made available to other peers / users / computers Allowing them to work as seeds or leeches. A peer can act as a 'seed' – used to upload pieces of a file Peer downloading file can get pieces from different seeds simultaneously • Once a peer has a piece of the file it can become a seed for the parts downloaded Leeches download much more than they upload • Central server called a tracker keeps records of all the peers ('swarm') and the parts of the file they have Can pause and restart at any time. 		Max 4
5(c)	Any two protocols from: HTTP/HTTPS ... Used for transfer of web pages from server to client FTP ... Used for interactive file transfer SMTP ... Used for sending email messages POP3 ... Used for incoming email messages		Max 4

Answer 13

5 (a) (i)

Application	[1]
Transport	
Internet	[1]
Network / Link	[1]

(ii) software / module / program / code [1]

(b) (i) For example:

- check packet port ... [1]
 - to identify the application type [1]
- check packet destination socket ... [1]
 - so that packet sent to correct application [1]
- check incoming packet sequence number ... [1]
 - to ensure data is reassembled in correct order [1]
- recalculate checksum of packet ... [1]
 - to ensure integrity of packet [1]
- if packet checksum invalid ... [1]
 - send message to have packet retransmitted [1]

[Max 2 tasks]

[Max 4]

(ii) HTTP / HTTPS [1]

(iii) POP3 [1]

Answer 14

6 (a)

Description	Protocol used	
email client downloads an email from an email server	HTTP	1 mark for correct arrow from each description
email is transferred from one email server to another email server	POP3	
email client sends email to email server	SMTP	
browser sends a request for a web page to a web server		

(b)	peer-to-peer	1
(c) (i)	Tracker: central server that: stores details of other computers that have all / part of file to be downloaded // has data on those peers downloading and uploading file // shares IP addresses with other clients in swarm allowing them to connect	1
(ii)	Seed: peer computer that has 100% of file // is uploading downloaded content	1
(iii)	Swarm: all the connected peer computers that have all or part of the file to be downloaded / uploaded // share a torrent	1
		Total: 11

Answer 15

(b) (i)	Server: central computer stores files that are to be downloaded	1 1
(ii)	Command: user can send action/instruction (or by example, e.g. change directory) that are carried out on server	1 1
(iii)	Anonymous: allows user to access files user does not need to identify themselves to server	1 1

Answer 16

3 (a) Any point 1 mark

sender's IP address
receiver's IP address
packet sequence number
checksum

[Max 2]

(b) Any point 1 mark

email has been split up into packets
packet has destination address
packets pass through many different routers in journey
packets don't take same route
routers use IP addresses
packets reassembled at destination to rebuild email

[Max 3]

(c) Any point 1 mark

email message is only read when all of it is received
time delays due to lost/delayed packets not significant
so sending different packets by different routes is not issue/is efficient
packets arriving out of order not an issue
no requirement for a continuous circuit (circuit switching)

[Max 2]

(d) Circuit switching [1]

(e) e.g. real-time video/video conferencing [1]

Any point 1 mark

circuit made available is dedicated to this communication stream
full bandwidth available/no sharing
no lost packets
guaranteed quality of service

[Max 2]

Answer 17

3 **(a)** dedicated circuit/channel/physical path [1]
which lasts for duration of connection [1]

(b) e.g.

cs: gives dedicated circuit [1]
ps: split into packets/chunks [1]
ps: sends packets on individual routes [1]
cs: whole bandwidth available // ps: shares bandwidth [1]
cs: faster data transfer [1]
cs: packets arrive in order they are sent [1]
cs: packets cannot get lost [1]
cs: better for a real-time application [1]
ps: packets may arrive out of order so delay until packet order restored [1]
ps: packets may get lost so retransmission causes delays [1]

[max. 6]

(c) web page divided into packets/chunks [1]

each packet has destination address [1]
router looks at IP address... [1]
and decides where to send packet next for most efficient path [1]
packets can take different routes [1]
home computer reassembles packets to rebuild web page [1]

[max. 3]

Answer 18

6	<p>One mark for each correct benefit (Max 2)</p> <ul style="list-style-type: none"> • Accuracy – Ensures accurate delivery of the message • Completeness – Missing packets can be easily detected and a re-send request sent so the message arrives complete • Resilience – if a network changes the router can detect this and send the data another way to ensure it arrives • Path also available to other users // Doesn't use whole bandwidth // allows simultaneous use of channel by multiple users • Better security as packets hashed and sent by different routes. <p>One mark for each correct drawback (Max 2)</p> <ul style="list-style-type: none"> • Time delays to correct errors // Network problems may introduce errors in packets • Requires complex protocols for delivery • Unsuitable for real time transmission applications 	4
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Answer 19

6(a)	<p>One mark for each correct marking point (Max 5)</p> <ul style="list-style-type: none"> • A large message is divided up into a group of smaller chunks of the same size called packets • The packet has a header and a payload • The header contains a source IP address, destination IP address (and sequence number) • Each packet is dispatched independently • ... and may travel along different routes / paths • The packets may arrive out of order • ... and are reassembled into the original message at the destination • If packets are missing / corrupted a re-transmission request is sent. 	5
6(b)	<p>One mark for each correct marking point (Max 3)</p> <ul style="list-style-type: none"> • The router examines the packet's header • It reads the IP address of the destination (from the packet header) • A router has access to a routing table • ...containing information about, e.g., available hops / netmask / gateway used • ... and the status of the routes along the route • ... the router decides on the next hop / best route • ... and sends the packet on its next hop. 	3

Answer 20

3	<p>Circuit switching max four marks Any two from</p> <ul style="list-style-type: none">• a dedicated circuit• circuit is established before transmission starts // circuit is released after transmission ends• data is transferred using the whole bandwidth• all data is transferred over the same route <p>Two from</p> <ul style="list-style-type: none">• Advantage – data /frames arrive in order and do not need to be reassembled• Disadvantage – nobody else can use the same circuit even if it is idle //less secure as only one route used <p>Packet switching max four marks Any two from</p> <ul style="list-style-type: none">• data is split into packets• each packet is given its own route• the routing for a packet depends on the congestion• packets may not arrive in the order sent <p>Two from</p> <ul style="list-style-type: none">• Advantage – packets can be rerouted if there are problems// more secure as harder to intercept messages• Disadvantage – time taken to reassemble packets at the destination
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Answer 21

3(a)	<p>Protocol one mark, description one mark, max four Any two from</p> <ul style="list-style-type: none">• HTTP(S) (1) for sending and receiving web pages / hypertext documents (1)• FTP (1) for sending and receiving files over a network / between devices (1)• SMTP (1) for sending/uploading emails /push protocol (1)• POP(3) (1) for receiving/downloading emails /pull protocol (1)• IMAP (1) for receiving/downloading emails /pull protocol (1)
3(b)	<p>Layer one mark, matching function one mark, max four Any two from</p> <ul style="list-style-type: none">• Transport (1) handles packets (1)• Internet (1) handles transmission of data using IP addresses // provides (optimal) route (1)• <u>Network Access (Interface)</u> // (Data) Link // Physical (1) Handles how data is physically sent (1)

Answer 22

2	<p>One mark for each point (Max 3)</p> <p>MP1 The Transport Layer breaks data into manageable packets / performs segmentation MP2 It sequences the packets // adds data to the packet header // adds a packet header MP3 It sends the packets to the Internet / Network Layer // It receives data from the Application Layer MP4 It controls the flow of packets MP5 It handles packet loss/corruption // Acknowledges receipt of complete error free packets</p> <p>One mark for each point (Max 3)</p> <p>MP6 The Internet Layer identifies the intended network and host MP7 It transmits packets to the (Data) Link / Physical Layer MP8 It routes the packets independently through the optimum route MP9 It addresses packets with their source and destination <u>IP addresses</u> MP10 It then uses an <u>IP address</u> and port number to form a socket.</p>
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Answer 23

3(a)	One mark per point (Max 2) <ul style="list-style-type: none"> Protocols set a standard for communication Protocols enable communication/compatibility between devices from different manufacturers/platforms If two devices were sending messages to each other but using different protocols, they would not be able to communicate properly 				
3(b)	One mark for each correct answer <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td>Application (Layer)</td></tr> <tr><td>Transport</td></tr> <tr><td>Internet/Network (Layer)</td></tr> <tr><td>Link</td></tr> </table>	Application (Layer)	Transport	Internet/Network (Layer)	Link
Application (Layer)					
Transport					
Internet/Network (Layer)					
Link					
3(c)	One mark per point (Max 2) <ul style="list-style-type: none"> used by email clients to retrieve email messages // a pull protocol from a mail server (over a TCP/IP connection) keeps the server and client in sync (by not deleting the original email). // allows a copy of the email to be downloaded from the mail server. 				

Answer 24

5(a)	One mark per mark point (Max 2) <ul style="list-style-type: none"> Circuit switching is used where a dedicated path needs to be sustained throughout the call / communication // where the whole bandwidth is required // where a real time communication is used. A typical application is standard voice communications / video streaming / private data networks 	2
5(b)	One mark per benefit (Max 2) <p> MP1 Whole of bandwidth is available MP2 Dedicated communication channel increases the quality of transmission MP3 Data is transmitted with a fixed data rate MP4 No waiting time at switches MP5 Suitable for long continuous communication MP6 Fast method of data transfer MP7 Data arrives in the same order as it was sent MP8 Data can't get lost MP9 Data all follows the same path / route MP10 Better for real-time MP11 Simple method of data transfer. </p> One mark per drawback (Max 2) <p> MP1 A dedicated connection makes it impossible to transmit other data even if the channel is free MP2 Not very flexible MP3 No alternative route in case of failure MP4 The time required to establish the physical link between the two stations can be too long MP5 The need to establish a dedicated path for each connection can have cost implications MP6 Dedicated channels require the whole bandwidth / bandwidth can't be shared </p>	4

Answer 25

7(a)	<p>One mark per mark point (Max 2)</p> <p>MP1 Packet switching is most commonly used on data networks such as the internet to send large data files that don't need to be live streamed.</p> <p>MP2 Packet switching is used when it is necessary to be able to overcome failed/faulty lines by rerouting.</p> <p>MP3 Packet switching is used when it is necessary for the communication to be more secure.</p> <p>MP4 Packet switching is used for high volume data transmission.</p> <p>MP5 Packet switching is used when it isn't necessary to use all the bandwidth.</p> <p>MP6 Specific examples e.g. email, text messages, documents, VOIP etc. (up to two marks).</p>	2
7(b)	<p>One mark per mark point (Max 4)</p> <p>MP1 Circuit switching uses a dedicated channel to make communication, whereas packet switching forms data into packets to transmit over a digital network.</p> <p>MP2 The dedicated path for circuit switching must be established before the transfer of data can commence, which is not the case with packet switching (as it doesn't require a dedicated path).</p> <p>MP3 Data in packet switching is split into packets, in circuit switching the message remains intact.</p> <p>MP4 All of the transmission in circuit switching follows the same path whereas different packets in packet switching can take different routes.</p> <p>MP5 The message is received in the same order in which it is sent with circuit switching, but with packet switching, the packets can be received out of order (for assembly at the destination).</p> <p>MP6 Circuit switching is implemented at the physical layer while packet switching is implemented at the network layer.</p> <p>MP7 Circuit switching uses the whole bandwidth of the channel used, packet switching can share bandwidth.</p> <p>MP8 Circuit switching communication ends with an error but packet switching allows packets to be re-sent.</p> <p>MP9 Circuit switching is a simpler process than packet switching.</p>	4

Answer 26

2(a)	<p>One mark for each correct line connecting a protocol to its most appropriate description (Max 4).</p> <table border="1"> <thead> <tr> <th style="text-align: center;">Protocol</th><th style="text-align: center;">Use</th></tr> </thead> <tbody> <tr> <td>HTTP</td><td>to provide peer-to-peer file sharing</td></tr> <tr> <td>BitTorrent</td><td>when retrieving email messages from a mail server over a TCP/IP connection</td></tr> <tr> <td>SMTP</td><td>when transmitting hypertext documents</td></tr> <tr> <td>IMAP</td><td>to map MAC addresses onto IP addresses</td></tr> <tr> <td></td><td>when sending email messages towards the intended destination</td></tr> </tbody> </table>	Protocol	Use	HTTP	to provide peer-to-peer file sharing	BitTorrent	when retrieving email messages from a mail server over a TCP/IP connection	SMTP	when transmitting hypertext documents	IMAP	to map MAC addresses onto IP addresses		when sending email messages towards the intended destination	4
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2(b)	<p>One mark per mark point (Max 2)</p> <p>MP1 To ensure correct network protocols are followed MP2 To enable the upper layers to access the physical medium // enables connection/ communication with the internet / network layer MP3 To be responsible for transporting data within the network/local segments MP4 To format the data into frames for transmission MP5 Maps IP addresses to MAC/Physical addresses.</p>	2												

Answer 27

4	<p>One mark for each correct word (Max 3)</p> <p>The protocols in a stack determine the interconnectivity rules for a layered network model such as the TCP/IP model.</p>	3
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Answer 28

2(a)	<p>Two marks for all protocols in correct position One mark for at least two protocols in correct position</p> <table border="1"> <tr> <td>Application</td></tr> <tr> <td>Transport</td></tr> <tr> <td>Internet</td></tr> <tr> <td>Link</td></tr> </table>	Application	Transport	Internet	Link	2
Application						
Transport						
Internet						
Link						
2(b)	<p>One mark per mark point (Max 2)</p> <p>MP1 The transport layer is responsible for delivery of data from the source host to the destination host MP2 It is where data is broken up into packets and sent to the internet layer MP3 Adds the sequence number to the packet header MP4 It establishes end to end contact MP5 It ensures data arrives error free // It retransmits packets if lost.</p>	2				

2(c)	<p>One mark for name of protocol and one mark for expansion (Max 2)</p> <p>HTTP(S) – responsible for correct transfer of files / hypertext documents that make up web pages on the world wide web</p> <p>FTP – used when transferring files from a server to a client on a network</p> <p>POP3 – handles the receiving of emails</p> <p>IMAP – handles the receiving of emails</p> <p>SMTP – handles the sending of emails</p> <p>BitTorrent – provides peer-to-peer file sharing</p>
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Answer 29

2(a)	<p>One mark per mark point (Max 2)</p> <p>MP1 Protocols provide a standard set of rules that enables successful data transfer between devices.</p> <p>MP2 Allows communication between devices on different platforms.</p> <p>MP3 Makes communications independent of software and hardware.</p>
2(b)	<p>One mark per mark point</p> <p>MP1 Sending - SMTP</p> <p>MP2 Receiving – POP3 // IMAP // Post Office Protocol 3</p>
2(c)	<p>One mark per mark point (Max 3)</p> <p>MP1 BitTorrent allows the sharing of files between thousands of users who are connected together over the internet.</p> <p>MP2 It allows more users to share files with each other than would be the case with a peer-to-peer network.</p> <p>MP3 Users share files directly with each other // the users' computers are acting as peers</p> <p>MP4 ... no web server / central device is used // all users are of equal status.</p>