

# OCR Computer Science AS Level

## 1.3.2 Network

### Concise Notes



## **Specification**

### **1.3.3 a)**

- Characteristics of a Network
- Importance of Protocols and Standards

### **1.3.3 b)**

- The internet Structure:
  - The TCP/IP stack
  - Protocol Layering
  - LANs and WANs
  - DNS
  - Packet and Circuit Switching

### **1.3.3 c)**

- Client-server
- Peer-to-peer



## Networks and Protocols

### Characteristics of a network

- Two or more computers connected together that can transmit data
- Physical topology is the **physical layout** of the network
- Logical topology is the **way in which data flows** around a network

### Topologies

- Bus topology: network topology where all **terminals** (devices) are connected to a **backbone cable**

Advantages of Bus Topology	Disadvantages of Bus Topology
Cheaper to set up, doesn't require any <b>additional hardware</b>	<p>If <b>backbone cable fails</b>, the entire network gets disconnected</p> <p>As traffic increases, <b>performance decreases</b></p> <p>All computers can <b>see the data transmission</b></p>

- Star Topology: uses a central node (**switch/computer**) to direct the flow of data, **MAC** (Media Access Control) addresses identify each device.

Advantages of Star Topology	Disadvantages of Star Topology
<p>Performance is <b>consistent</b> even if network is being <b>heavily used</b></p> <p>If one cable fails, <b>only that station is affected</b></p> <p><b>Transmits data faster</b>, so it gives better performance than bus topology</p> <p>It's easy to add new stations</p> <p><b>No data collisions</b></p>	<p><b>Expensive</b> due to switch and cabling</p> <p>If the central <b>switch fails</b>, the rest of the <b>network fails</b></p>

- Mesh Topology: every node is connected to every other node
- Most commonly found with wireless technology like **Wi-Fi**



Advantages of Mesh Topology	Disadvantages of Mesh Topology
<p>No cabling cost</p> <p>As nodes increase, the <b>reliability and speed</b> of network becomes better</p> <p>Nodes <b>automatically get incorporated</b></p> <p>It's <b>faster</b> since nodes don't go through a central switch</p>	<p>You have to purchase devices with wireless capabilities</p> <p>Maintaining the network is <b>difficult</b></p>

### Protocols

- Sets of rules defining how two devices communicate with each other
- Need to be standard so all devices can communicate, regardless of manufacturer

## The Internet Structure

- A **network of networks**
- Allows computers on opposite sides of the globe to communicate with each other

### The TCP/IP Stack

- Transmission Control Protocol / Internet Protocol
- A **stack of networking protocols** that work together passing packets during communication

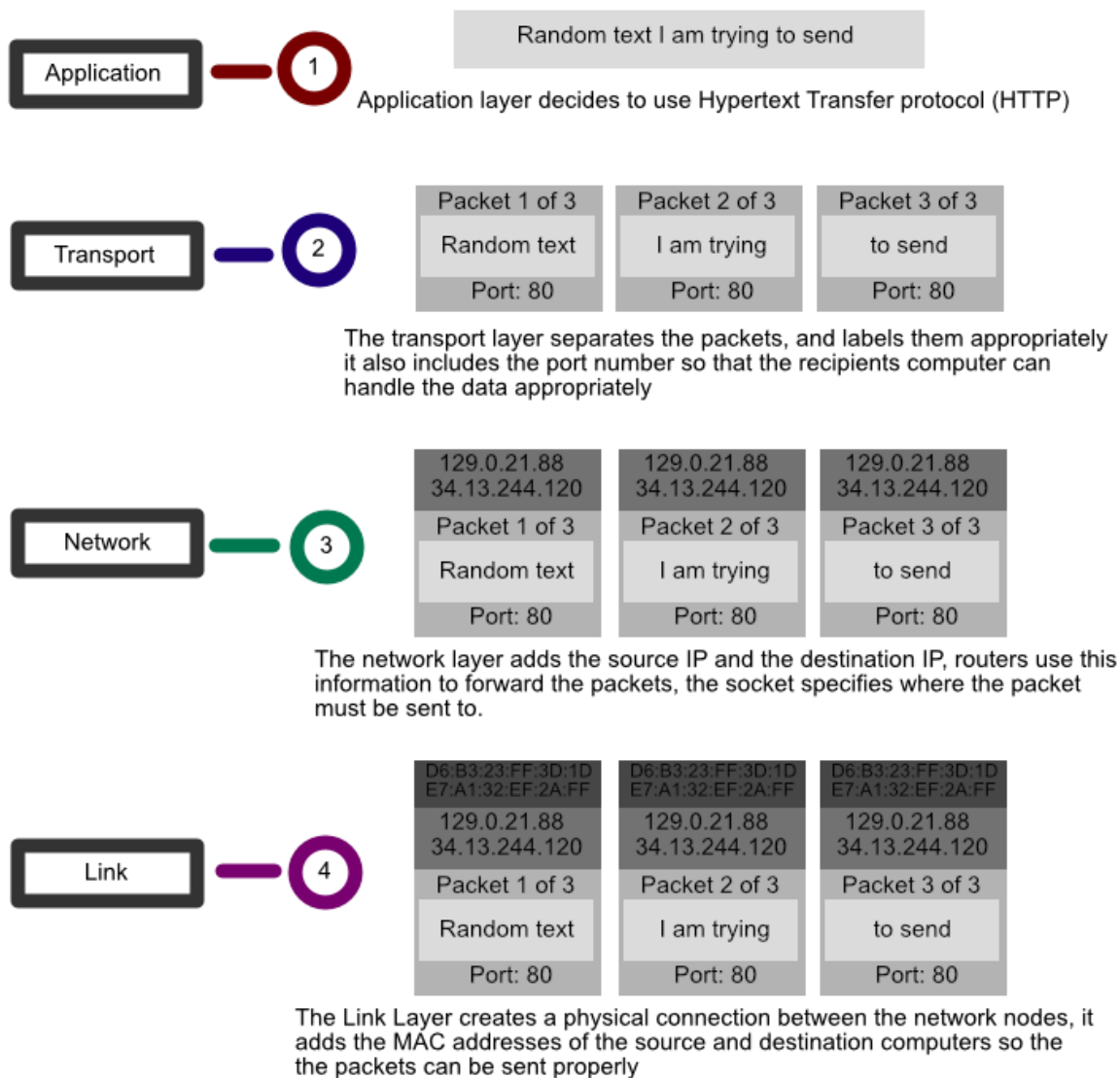
### Protocol Layering

- Application Layer
  - Based at the top of the stack
  - Specifies **what protocol** needs to be used in order to **relate the application that's being sent**
- Transport Layer
  - Uses the TCP to establish an **end-to-end connection** between the source and recipient computer
  - **Splits up data into packets**
  - Labels packets with their packet number
  - Requests **retransmission** of any lost packets
- Network Layer
  - Adds source and destination **IP addresses**
  - **Routers** operate on the network layer and the router is what uses the IP addresses to forward the packets
- Link Layer
  - The **connection between the network devices**
  - Adds the **MAC address** identifying the **Network Interface Cards** of the source and destination computers



- On the recipient's computer the layers occur again in reverse:
  - Link Layer
    - Removes the MAC addresses
  - Network Layer
    - Removes the IP addresses
  - Transport Layer
    - Removes the port number and reassembles the packets
  - Application layer
    - Presents the data to the recipient in the form it was sent

This is a diagram of the TCP/IP Stack



## LANs and WANs

- Local Area Network (LAN) is a network spread over a **small geographical area**
- Wide Area Network (WAN) is a network spread over a **large geographical area**, that typically requires **extra hardware**

## DNS

- Domain Name System
- The system given to the **method of naming internet resources**
- A hierarchy where each smaller domain is separated from the larger domain by a full stop
- DNS server translates domain names into IP addresses when we access a website.

## Packet and Circuit Switching

- Circuit Switching
  - A method of communication where a **direct link** is created between two devices
  - Link maintained for the **entire conversation**
  - The two devices must transfer and receive data at the **same rate**
- Packet Switching
  - A method of communicating **packets** of data across a network
  - A packet is just a **section of the data**
  - Packets aren't limited to a single route

Circuit Switching		Packet Switching	
Advantages	Disadvantages	Advantages	Disadvantages
The data arrives in a logical order which results in a <b>quicker reconstruction</b> of the data.	<b>Bandwidth is wasted</b> during periods of time where no data is sent.	There are multiple methods to ensure data arrives (check <b>Checksum</b> and <b>Cyclic Redundancy Check</b> )	Time is spent deconstructing and reconstructing the data packets.
This enables two users to hold a call <b>without delay</b> in speech.	The devices must transfer and receive data at the <b>same rate</b> .	There is more than one method of getting to the other devices, so if one path breaks you can use another.	
	Since switches are used, electrical interference is produced which can <b>corrupt</b> or <b>lose data</b> .	You can transfer packets over <b>very large networks</b> to allow communication globally.	



## Data Packets

- Segments of data
- Contain various pieces of information
  - Header
    - Sender and the recipient's **IP addresses**
    - **Protocol** being used
    - **Order** of the packets
    - **Time To Live / Hop Limit**
  - Payload
    - The raw data
  - Trailer
    - **Checksum**, or **cyclic redundancy check**

## **Client-Server and Peer-to-Peer**

### Client-Server

- Client-Server networks have **terminals** known as clients connected to a **server**
- The server is just a **powerful central computer**
- The server holds all of the **important information** and has **extra processing power** and the clients can request to use it

Advantages of Client-Server	Disadvantages of Client-Server
<ul style="list-style-type: none"> <li>● More <b>secure</b></li> <li>● <b>Central backups</b> eliminate the need for client backups</li> <li>● <b>Sharing data and resources</b> between clients</li> </ul>	<ul style="list-style-type: none"> <li>● <b>Expensive</b> to set up</li> <li>● Staff with training are required to <b>maintain the server</b></li> </ul>

### Peer-to-Peer networks

- Computers are **connected to each other** so that they can share files
- **Inexpensive** to set up
- Allow users to **share resources**
- **Easy to maintain**

