SS3 DIGITAL TECHNOLOGIES: Networking – IP Addressing, Subnetting and Network Protocols

Computer networking is the process of connecting two or more computers or digital devices so that they can communicate and share information, resources and services. A network allows devices to exchange files, share printers, access websites, send messages and use shared internet connections.

Components of a computer network

1. Computers and end devices: Computers, smartphones, printers, servers and other devices that send or receive data.
2. Networking devices: Routers, switches, wireless access points and modems help devices connect and communicate.
3. Transmission media: The channels through which data travels, such as Ethernet cables, fibre-optic cables and wireless radio signals.
4. Network software and protocols: Software and agreed rules that enable devices to exchange data correctly.

Types of Computer Networks

Networks can be classified according to the area they cover.

Network type	Full meaning	Description	Example
PAN	Personal Area Network	Covers a very small area around an individual.	Phone connected to wireless earbuds.
LAN	Local Area Network	Covers a limited area.	School laboratory or office network.
WLAN	Wireless Local Area Network	A LAN that uses wireless connections.	School Wi-Fi network.
MAN	Metropolitan Area Network	Connects networks across a town or city.	A network spanning multiple sites within a city.
WAN	Wide Area Network	Covers large geographical areas.	A company's network across several countries.

The internet is a global network of interconnected networks.

IP ADDRESSING - Meaning of an IP Address

IP address means Internet Protocol address. It is a logical address used to identify a network interface and help route data across an IP network. When one device sends data to another, IP addressing helps the network determine where the data should be delivered.

Example of an IP address

`192.168.1.25` This is an example of an IPv4 address.

Types of IP Addresses

IPv4: IPv4 (Internet Protocol version 4) uses 32-bit addresses, normally written as four decimal octets. Example: `192.168.1.10`

IPv6: IPv6 (Internet Protocol version 6) uses 128-bit addresses. They are written in hexadecimal groups separated by colons. Example: `2001:db8:1234::10`

Public and Private IP Addresses

Public IP address

A public IP address is an address used for routing across the public internet. Public addresses are assigned or delegated through internet address allocation systems and service providers.

Private IP address

A private IP address is used within private IPv4 networks and is not directly routed across the public internet.

Static and dynamic IP addresses

Static IP address: An address configured to remain the same unless an administrator changes it or the network configuration changes.

Dynamic IP address: An address assigned automatically, commonly using DHCP, and potentially changed over time.

SUBNETTING

Subnetting is the process of dividing a larger IP network into smaller logical networks called subnets.

Instead of placing every device in one large network, a network administrator can divide devices into smaller groups according to their location, function, department or security requirements.

Practical example: Subnetting in a school

Imagine a school with three departments:

- Administration
- Computer laboratory
- Teachers' offices

NETWORK PROTOCOLS

A network protocol is a set of rules that determines how devices communicate and exchange data over a network. Protocols specify matters such as how information is formatted, addressed, transmitted, received and interpreted.

Types of Network Protocols

TCP/IP: TCP/IP stands for Transmission Control Protocol/Internet Protocol. It is the collection of protocols that underpins communication across the internet and many private networks.

HTTP: HTTP stands for Hypertext Transfer Protocol.

It is an application-layer protocol used for transferring web resources between clients and servers.

HTTPS: HTTPS is HTTP carried over a connection protected by TLS (Transport Layer Security).

It helps provide:

- Encryption of data in transit.
- Authentication of the server, when certificate validation succeeds.
- Protection against certain forms of tampering during transmission.

FTP: FTP stands for File Transfer Protocol. It is designed for transferring files between computers over a network.

Uses include:

- Uploading website files to a server.
- Downloading files from a server.
- Managing files on a remote server.

SMTP: SMTP stands for Simple Mail Transfer Protocol.

It is used to send email, including transferring outgoing messages from email clients to mail servers and between mail servers.

For example, when you send an email to a colleague, SMTP may be used to submit or relay the message.