



Network Communication and Mobile OS



SNAP RECAP

1. What is networking?
2. What are the different types of networks?
3. What is an operating system? Why do you need it?
4. Discuss various types of operating system available in the market.
5. State the various uses of a mobile phone.

LEARNING OBJECTIVES

You will learn about:

- computer network and its components
- types of network
- network topology and its types
- types of transmission channels
- mobile operating systems and its types



Computer Network

(A network consists of two or more computers linked together for sharing resources such as printers and exchanging files, or allowing electronic communications.) The computers on a network may be linked through cables, telephone lines, radio waves, satellites, or infrared light beams.

(A large number of users belonging to the same area or organisation who are spread out at different places can communicate and share useful files, software programs and information only when their computers are networked. This type of networking specific to only users of an organisation is called the **Intranet**.) It is a network which is not open to all.



Computers linked in a network

Advantages of a Computer Network

Networking of computers is a basic need of today's world. Let us study some advantages of computer networking.

1. Centralised Software

Management: Software can be loaded on the main computer, that is, the file server. This eliminates the need to spend time and energy in installing, updating and tracking files on independent computers throughout the same building.

FACT FILE

Extranet is another form of a network. It is private to an organisation with little external interference and is used for official purposes only. That is, it is any Intranet that also uses the Internet.



2. **Resource Sharing:** Resources such as printers, fax machines, scanners and modems can be shared by connecting them on a network. This saves space of the work area and is also economical.
3. **Speed:** Files can be sent and received rapidly using a computer network. This method saves time, and is more convenient than manual delivery of data.
4. **Cost Efficient:** Individually licenced copies of many popular software programs can be costly. Storing the software on a file server and making it available to other computers connected to it saves money.
5. **Security:** Sensitive files and programs on a network are protected by passwords. They can be made available as read only files, which helps to avoid copying of programs.

Disadvantages of a Computer Network

Some of the disadvantages of a computer network are:

1. In case the server develops a fault, users may not be able to run the application programs and chances of data loss increase.
2. In case the network stops operating, computers connected to the network cannot access the data/files stored on the network, thus affecting work of the entire system.
3. As traffic increases on a network the performance degrades unless it is designed properly.
4. It becomes difficult to manage when a large number of computers is connected to a network.
5. In case the server is hacked or attacked by a virus, the security of data of all connected computers is at risk.

Basic Components of a Network

Computers are connected to a network using some special hardware devices which are termed as **network devices** or components of a computer network. Following are the different components of a computer network.

Server

A server is a computer that manages the network resources, software and files (Fig. 1.1). It is normally dedicated to an allocated task and it performs no other task.

For example, a **file server** is a computer that manages storage and retrieval of files. A **print server** is a computer that manages one or more printers required on a network.)

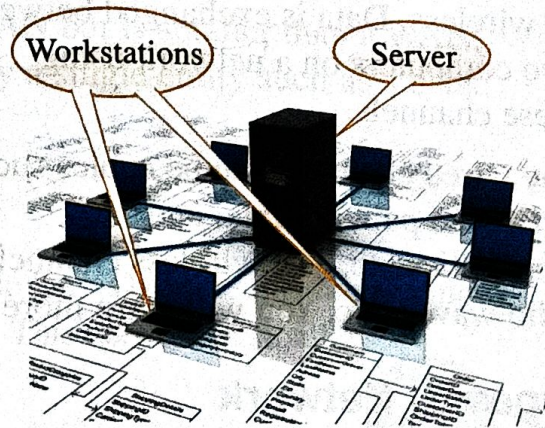
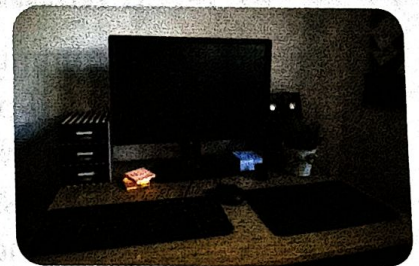


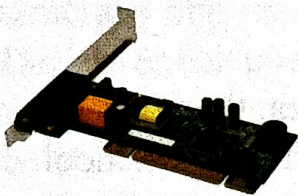
Fig. 1.1 Workstations connected to a server

Workstation

A workstation is a computer intended for individual use in a networking environment. It is like a personal computer except that it is also connected to other computers along with the main computer, that is, the server.)



Workstation



Network Interface Card

Network Interface Card

A network interface card (NIC) is a piece of hardware placed inside the system unit. It is part of the motherboard. It is designed to allow computers to communicate over a computer network. It provides physical access to a networking medium.

Hub

A hub is a device that connects multiple devices and makes them work as a single network segment. A hub has multiple ports. A specific cable connects the hub to the NIC. The NIC transfers the data on a computer to a hub, which then transfers it to the other connected computers.)



Hub

Transmission Channels

Each computer on a network is interconnected through transmission channels. These channels can be wired or wireless. Data is exchanged between two computers on a network using these channels.

The wired channels can be cables such as twisted pair, co-axial and fibre-optics etc. The wireless channels can work through satellites using microwaves, radio waves, etc. You will learn more about them later in this chapter.

FACT FILE

A **switch** is a smarter replacement of a hub. This is because, a hub transfers the data received from an NIC to all the computers whereas, a switch transfers it to the specific computer.



Types of Network

A network can be categorised on the basis of the geographical area as mentioned below.

Personal Area Network (PAN)

It is a network for communication among personal devices of an individual. The devices can include cell phones, computers, cameras, laptops and tablets. These devices are connected through a wired or wireless PAN. PAN covers a short radius of only a few metres. It is used to share or transfer files, songs, etc. USB cable is a source of a wired PAN. Bluetooth and Wi-Fi are sources of a wireless PAN.

Local Area Network (LAN)

When computers are interconnected within a limited geographical area, they form a Local Area Network. For example, a network within a building, an office and school. Such a network covers a radius of a few kilometres.

In addition to operating in a limited space, LANs are also typically owned, controlled and managed by a single person or organisation. A LAN which is created with the help of Wi-Fi, without using cables, is called a WLAN.

Wide Area Network (WAN)

When a network is spread across cities, countries or even continents, covering a large geographical area, it becomes a Wide Area Network. The Internet is the best example of a WAN as it is the largest WAN covering the globe.

Computer networks may also be classified according to the functional relationships that exist among the elements of the network. For example, client server and peer-to-peer (workgroup) architecture.

Metropolitan Area Network (MAN)

When computers are interconnected within the same city, for example in different branches of an organisation in one city, it becomes a Metropolitan Area Network. Local libraries, different divisions of the same school in a city are some such examples.

A MAN spans over a larger physical area than a LAN but is smaller than a WAN, such as a city. It is typically owned and operated by a single entity such as a bank, government body or large corporation.

FACT FILE

There is another type of network connecting multiple LANs confined within a campus. This is known as a **Campus Area Network (CAN)**. This network is smaller than a **MAN**.

For example, different colleges connected in the same university campus and branches of the same office in a specific region.



Client/Server Architecture

Client/Server architecture is defined as a specific type of network which consists of a single powerful computer acting as a **server**, usually connected to multiple computers called **clients** (Fig. 1.2).

Generally one server supports numerous clients.

The server has powerful central processors, added memory, and larger disk drives in comparison to the clients. A server device typically stores files and databases including more complex applications like websites. The client contains the software programs based on the requirements of its users.

Network clients make requests to a server by sending messages, and servers respond to their clients by acting on each request and returning results.

A client/server network can be utilised by desktop computers and laptops, as well as other mobile devices that are properly equipped.

An example of a client/server is when you try to access your bank account from a computer. A client program on your computer forwards the request to a server program at the bank. The server accesses the data of that specific account and sends the request back with the account details to the client machine.

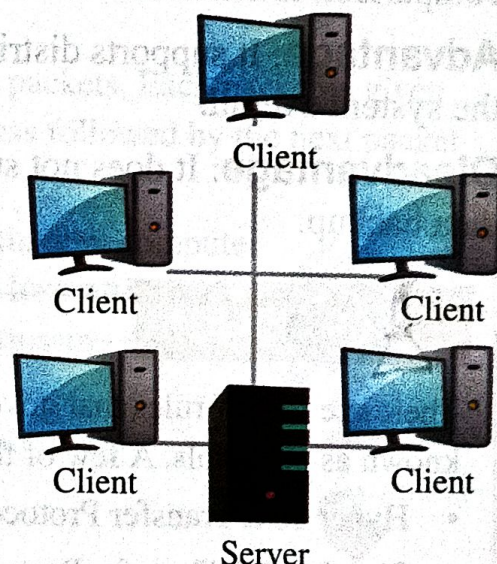


Fig. 1.2 Client-Server architecture

Advantage: The centralised handling of data provides increased security. For example, password protection which ensures that the data is only available to qualified individuals.

Disadvantage: It runs the risk of a system overload. If too many different clients attempt to reach a shared network at the same time, there may be a failure or slowing down of the connection.

Peer-to-peer Architecture

Peer-to-peer architecture is a type of network in which each workstation has equivalent capabilities and responsibilities.

The workstations are connected to each other but do not have a server (Fig. 1.3). Files can be shared among workstations, and a printer connected to one workstation can be also accessed by other workstations.

Peer-to-peer networks can be set up among only a few computers within an office or single room. Such a network is much simpler to set up in comparison to client/server networks.

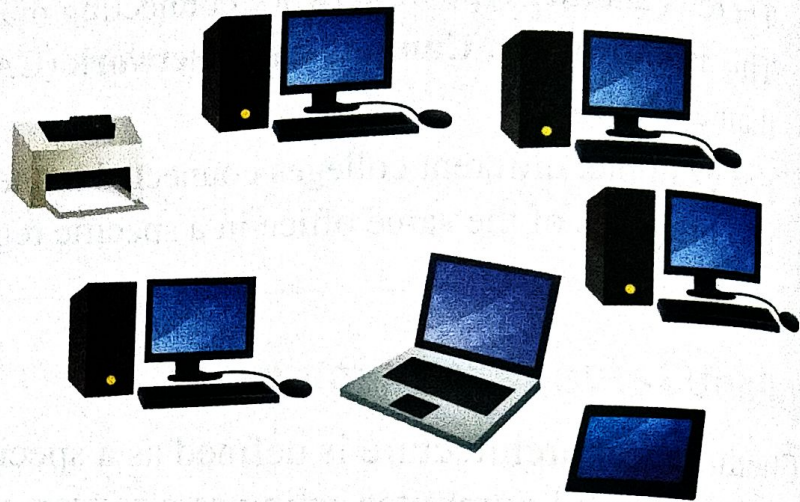


Fig. 1.3 Peer-to-peer architecture

Advantage: It supports distributed processing, so the increased load does not affect the system overall.

Disadvantage: It does not support centrally managed security, nor does it provide data backup.

FACT FILE

There are sets of rules that governs data communication in a networking environment known as protocols. A few of them are given below:

- Hyper Text Transfer Protocol (HTTP)
- Simple Mail Transfer Protocol (SMTP)
- File Transfer Protocol (FTP)
- Transmission Control Protocol/Internet Protocol (TCP/IP)



Network Topology

The physical arrangement of cables, computers and other peripheral devices to form a network is known as a topology.

A few such network topologies have been described below.

Bus Topology

A bus topology is made up of a main single cable with terminators at both ends (Fig. 1.4). It is a shared communication medium that makes the backbone of the system. Computers and other devices including the server are connected to this linear cable for communication.



Fig. 1.4 Bus topology

Advantages: The advantages of a network with bus topology are given below:

- It is easy to install.
- It does not require much cabling, hence it is very cost effective.

Disadvantages: The disadvantages of a network with bus topology are given below:

- If the backbone cable fails, the entire network becomes inoperable.
- In case of an entire network shut down, it becomes very difficult to locate the problem area.

FACT FILE

The data to be delivered on a network is divided into small packets. Each packet is given a sequence number. The first packet has a destination address followed by the next packet number.

The last packet has an end of file pointer that helps the destination computer to know that the number of packets are complete. Any data loss while data transmission on a network can be found out by tracing the missing packet number.



Star Topology

Star topology is the most commonly used topology. In such a setup all the workstations are connected to a central connection point called a hub (Fig. 1.5). Any data that is sent, first goes to the central hub and is redirected from there to the destination computer.

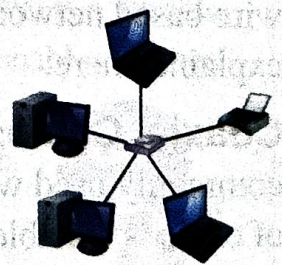


Fig. 1.5 Star topology

Advantages: A few advantages of a star topology are:

- It is easy to add and remove workstations by upgrading the hub.
- It is easy to install.

Disadvantages: A few disadvantages of a star topology are:

- It requires more cable length.
- Failure in the central hub will break down the entire network.

Ring Topology

In a ring topology, every workstation has exactly two neighbours for communication purposes. All messages travel through a ring in the same direction either clockwise or anticlockwise (Fig. 1.6).

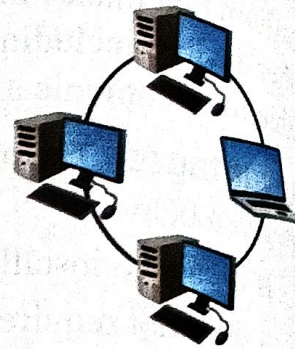


Fig. 1.6 Ring topology

Advantages: A few advantages of a ring topology are:

- It is easier to detect faults in the network.
- Less number of cable wires are required.

Disadvantages: A few disadvantages of a ring topology are:

- A failure in any cable or device breaks the loop leading to breakdown of the entire network.
- Adding or removing a device/workstation requires rewiring and re-routing all the existing cables.

Types of Transmission Channels

The medium used for transmission of data between the nodes in a network is called a transmission channel. This channel can be:

- Wired
- Wireless

Wired Transmission Channels

Wired transmission channels help in transmission of data over a wire based networking. A few examples of wired channels are explained here.

Coaxial Cable: It is one of the cheapest and the most commonly used wire based networking mediums. This type of cable is suitable for transmitting low powered signal over a small distance. It is widely used in small networks, cable TV, etc.



Coaxial cable

Twisted Pair Cable: It consists of two independently insulated wires, twisted around one another. The twisting eliminates hindrance of signals due to adjacent pairs or other sources.



Twisted pair cable

FACT FILE

There are generally two types of twisted pair cables. These are Shielded Twisted Pair (STP) and Unshielded Twisted Pair (UTP).



Fibre-optic Cable: It is made up of optical fibres that use the concept of light for transmission of data. High speed data can be made to travel over a long distance with less damage to it. It is steadily replacing copper wire as an appropriate means of communication through signal transmission.



Fibre-optic cable

Wireless Transmission Channels

Wireless communication is the transfer of information over a distance without use of wires. It is the fastest growing segment of the communication industry today. The distances involved may be short, that is, a few metres as in the case of the television remote control or long as in the case of thousands or millions of kilometres for radio communications. There are many types of wireless networks that make data communication possible, both over long range and short range. All of these networks operate at different frequencies.

Some examples of wireless communication are:

- Remotes of electronic devices
- Bluetooth
- Cell phones
- Wireless networking
- Wireless computer devices like mouse and keyboard
- Satellite televisions
- Radio waves

FACT FILE

Wi-Fi (Wireless Fidelity) is a wireless LAN technology that enables laptops, PCs and other devices to connect easily to the Internet.



There can be various channels for wireless transmission. A few are explained here:

Radio Waves: Radio waves are generally used for long distance wireless communication. Signals can pass through thick objects such as non-metallic substances. Radio waves are used in radio communication (AM/FM), communication satellites, radars, computer networks, etc.

Infrared: Infrared is one of the most primitive forms of wireless communication. It is an electromagnetic radiation. It is basically suitable for short distance communication. For example, a television and a remote control connect to each other using infrared rays. The signals travel in a straight line and cannot penetrate walls.

Microwave: Microwave is the most commonly used wireless transmission medium, which is spread widely across the world. Most of the wireless access points and wireless devices work on microwave communication. This communication medium is not only cost effective, it is also extensively used in cellular communication.

Bluetooth: Bluetooth is another wireless communication medium operating over short distances. It has a normal range of approximately 3–300 feet depending on the connected devices. These devices can be mobile phones, personal computers, laptops, digital camera, MP3 players, etc. Bluetooth enabled devices form a small network. In Bluetooth technology, eight devices can be connected to each other at the same time. Bluetooth can also be found in headsets, hands-free kits, wireless keyboards and mouse. Bluetooth uses the radio wave technology which is not very expensive and has low power consumption.



A Bluetooth device

Mobile Operating System

Initially, when mobile phones were introduced in the late 90s, they were just designed to support dialing and receiving calls and sending simple text messages. Usage of mobile phones has increased drastically over the last few years, which has brought a huge revolution in the features of mobile handsets.

Nowadays mobile phones are just like a compact computer loaded with basic applications. These mobile applications can be designed and uploaded easily. Wireless establishment of connections can be achieved through Bluetooth and infrared technologies. Mobile phones having such features are referred to as **smartphones**.

ACTIVITY

Make a list of networking devices available in your computer lab.



To manage all these important features in phones, we need a special type of operating system called **Mobile Operating System** (or mobile OS). This operating system is used in smartphones, tablets and other mobile devices.

Difference Between Mobile OS and Desktop OS

Desktop operating systems are designed keeping computers in mind. They provide an environment that helps in better functioning of different application software having a wide range of connected hardware. Desktop OS also supports multiple users sharing a network. The same OS cannot be used for mobile phones as they are compact computers having limited power, processing speed and memory. Keeping these limitations in mind, separate operating systems, specially designed for mobiles were introduced. They are designed keeping in mind different devices and they perform different functions.

Development of both, computer and mobile OS, is different for different set of users. Following factors determine the requirement of different OS for smartphones:

- A mobile phone is a compact machine with small battery size so the OS should be designed in a simple way to work with limited power for a longer period of time.
- Limited memory is available in mobile phones, therefore the OS should be less complex to occupy less storage capacity.
- Mobile phones are equipped with in-built keyboard, so a different Graphical User Interface (GUI) is required.

Types of Mobile OS

The technological advancements mentioned above resulted in development of various solutions that cater to functioning of mobile phones. Some of the popular mobile OS are Android by Google, iOS by Apple, Windows phone by Microsoft, BlackBerry OS by RIM, webOS by Hewlett-Packard and Symbian OS by Nokia. A detailed description of these OS is given below.

Android OS

It is one of the most popular operating systems designed by Android, Incorporation. in Silicon Valley before Google acquired it in 2005. Its first commercial version was officially launched in 2008. It is an open source and freely available Linux based operating system mainly designed for smartphones and tablets with touchscreens. It has the basic operating system features with calls and messaging services that can be used to establish connections using different communication networks on different devices.

Different versions of the Android OS are named after desserts, for example, Android 1.5 is known as Cupcake, 1.6 as Donut, 2.0/2.1 as Eclair, 2.2 as Froyo and 2.3 is dubbed Gingerbread. The latest 9.0 version is called Pie. Since it is an open source system, it can be easily used and modified by anyone making it more prone to malwares and data stealing.

IOS

This is a mobile operating system designed by Apple Incorporation mainly for iPhones, iPods and iPads. It was made available commercially in 2007 as an operating system for iPhones. It is the second most popular mobile operating system after Android. iOS is a closed source system owned by Apple and no other company or person can use it or modify it, thus providing strong security features against data theft or malwares. iOS 12 is the latest version of iOS in iPhones and iPads.

Windows Phone OS

It is a mobile operating system developed by Microsoft. It was first made available for Microsoft's Pocket PC 2000. The same was later designed for Nokia devices. It has a tile-like interface. Windows Mobile 2003 – Ozone, Windows Mobile 5 – Magento, Windows Mobile 6 – Crossbow, etc. are different versions of the Windows phone. Windows 10 is its latest version.

BlackBerry OS

This mobile operating system has been developed by Blackberry Limited for its own devices just as iOS has been designed only for iPhones. The BlackBerry platform is best known for strong wireless activation and synchronisation of emails, calendar, notes, contacts and tasks. Blackberry 10 is the latest version of this OS. Nowadays, this mobile OS seems to be losing popularity because of increasing market demand for Android and iOS based phones.

webOS

This operating system was developed by Palm Incorporation. It is a Linux based open source operating system which was taken over by HP and later sold to LG for smart phones and smart TVs. webOS strongly supports multitasking and is better than iOS when running multiple applications at one time. Its various versions are Pre, Pixi and Veer for smartphones. Since 2014, LG has been using webOS for its smart projectors, refrigerators and smart TVs.

Symbian OS

This mobile operating system has been discontinued with smartphones. It supported closed-source operating system which was initially designed for Personal Digital Assistant (PDA) in 1988 by Symbian Ltd. It was used by many popular brands such as Samsung, Sony Ericsson and Nokia. It was the first modern mobile OS for smartphones designed for Ericsson R380. In 2006, it was the most popular mobile OS so Nokia took over the company in 2010 and named it Symbian Foundation. Its touchscreen was not as smooth as Android and iOS, so with increase in popularity of iOS and Android in 2012, it lost its market value and Nokia discontinued its usage as a smartphone mobile OS.

Mobile Applications Development

Mobile application development is a set of instructions written to develop applications for smartphones and mobile devices. Mobile apps are small software units with limited functionalities. Initially mobile apps were device specific but recently app developers have developed applications that can work efficiently on multiple platforms, including Android, iOS and Windows.

Due to a drastic increase in the use of smartphones, there are more mobile users in comparison to desktop users today. With mobile apps, the user can access general information about any product, prices, booking forms, search features, user accounts, messengers, news feeds and much more.

ACTIVITY



1. Find out the language used to develop Android operating system. List its two important features.
2. Can we shut down Mobile OS? List out the steps to shut down an Android OS.

GLOSSARY



Android OS It is an open source and freely available Linux based mobile OS.

BlackBerry OS This mobile OS has been developed by Blackberry Limited for its own devices.

- Client** It is a computer connected to the server on a network.
- File server** It is a computer that manages the storage and retrieval of files.
- Hub** It is the central connection point on a network.
- iOS** This mobile OS has been designed by Apple Incorporation, mainly for iPhones, iPods and iPads.
- Mobile OS** It is a GUI developed for smartphones.
- Print server** It is a computer that manages the printers required on a network.
- Server** It is a computer that manages the network resources.
- Symbian OS** It supported the closed-source operating system, which was initially designed for Personal Digital Assistant (PDA) in 1988 by Symbian Ltd.
- Topology** It is the physical arrangement of computers on a network.
- webOS** It is a Linux based open source operating system which was taken over by HP and later sold to LG for smart phones and smart TVs.
- Windows phone OS** It is a mobile OS developed by Microsoft for Windows based phone.
- Workstation** It is a computer intended for individual use on a network.



1. A network consists of two or more computers linked together for the purpose of sharing resources.
2. Workstations, Server, Hub, Network Interface Card and Transmission channels together form a network.
3. When a network connects personal devices of an individual, it forms a Personal Area Network (PAN).
4. When the computers are interconnected within a limited geographical area it becomes a Local Area Network (LAN).
5. A network connecting multiple LANs limited within the same campus is known as Campus Area Network (CAN).
6. When computers are interconnected within the same city, that is, branches located at different places in the same city, it becomes a Metropolitan Area Network (MAN).
7. When a network is spread across cities, countries or even continents covering a large geographical area, it becomes a Wide Area Network (WAN).
8. A specific type of a network consisting of a single powerful computer acting as a server usually connected to multiple computers called clients is known as a Client/Server architecture.
9. Peer-to-peer architecture is a type of network on which each workstation has equivalent capabilities and responsibilities.

10. Medium used for transmission of data between the nodes on a network is called transmission channels. These channels can be wired or wireless.
11. Wired transmission channels refer to transmission of data over a wire based networking. For example, twisted pair, coaxial cable and fibre-optic.
12. Wireless communication is the transfer of information over a distance without the use of wires. Microwaves, bluetooth, infrared rays are used in wireless communication.
13. Development of both computer and mobile OS is different for different set of users.
14. Some of the mobile OS are Android by Google, iOS by Apple, Windows phone by Microsoft, BlackBerry OS by RIM, webOS by HP and Symbian OS by Nokia.
15. Mobile application development is a set of instructions written to develop applications for smartphones and mobile devices.



A. State true or false.

1. Bluetooth technology is a form of wireless communication. ☐
2. In a bus topology, all workstations are connected to the central hub. ☐
3. A mobile phone is capable of handling unlimited memory. ☐
4. Androids are more prone to malwares and data stealing. ☐
5. webOS is a Linux based open source operating system. ☐

B. Fill in the blanks.

1. Types of transmission channels are and
2. is a computer that manages storage and retrieval of files.
3. In, computers are interconnected within a limited geographical area.
4. is a set of instructions written to develop applications for smartphones and mobile devices.
5. is one of the most popular operating systems designed by Android, Inc.

C. State the differences between:

1. LAN and MAN
3. Desktop and Mobile OS
5. Client/server and Peer-to-peer architecture

2. Star and Bus topology
4. Android and iPhone OS

D. Match the following.

1. Android

2. webOS

3. Smartphones

4. iOS

5. Mobile apps

a. Apple products

b. Small software units with limited functions

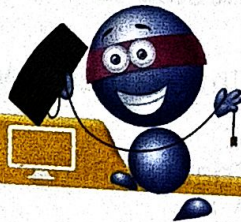
c. Linux based OS

d. Compact computers

e. Prone to malware threat

E. Answer the following questions.

1. What is networking? State its advantages and disadvantages.
2. What are the different components of a computer network? Explain them briefly.
3. What is a topology? Explain the different types of topologies used in computer networks.
4. What is Mobile OS? Give few examples.
5. Give two reasons for developing a mobile app.



LAB WORK

- A. Find out the topology of the network used in your school's computer lab. Find out the main reason for implementing that specific topology in the lab. Write an article in MS Word 2010 stating the definition, advantages and disadvantages of using that specific topology. Insert a few relevant pictures using the Internet.
- B. How do cell phones work? Try to find out the technology used and the wireless transmission channel used in the cell phone technology. Take help of the Internet to research on this topic.
- C. Make a presentation on different types of Mobile OS. Take help of the Internet to get information and insert pictures wherever possible.
- D. These days we can buy and sell products like clothes, cars, furniture, medicines, cosmetics and lot more through mobile apps. Make a document of any five most commonly used apps for buying and selling products these days. Also, name a few websites associated with these specific apps listed by you.



PROJECT WORK

Work in groups and select a mobile OS for your group. Now prepare a chart mentioning the latest devices which use that particular mobile OS and mention their important features.