Al-Mustaqbal University

College of Engineering and Technology

Department of Medical Instrumentation Techniques Engineering

Class: Second Class

Subject: Computer Applications/2

Lecturer: Assistant Lecturer Dheyauldeen Faaiz Sahib,

Dr. Maiser Monther

Lecture Address: Introduction to Networking

2024 - 2025

Introduction

A single technology has dominated each of the past three centuries. People were doing lot of paper work in organizations because, lack of advance systems which will help them in their day-to-day work. The 18th century was the time of the great mechanical systems accompanying the Industrial Revolution. Computer industry has made spectacular progress in short time. During the first two decades of their existence. Computer systems were highly centralized, usually within the single large room. A medium-sized company or university might have had one or two computers, white large institutions had at most a few dozen. The idea that within 20 years equally powerful computers smaller than postage stamps would be mass-produced by the millions was pure science fiction. We can see the development of Computer Generations below at fig.1.

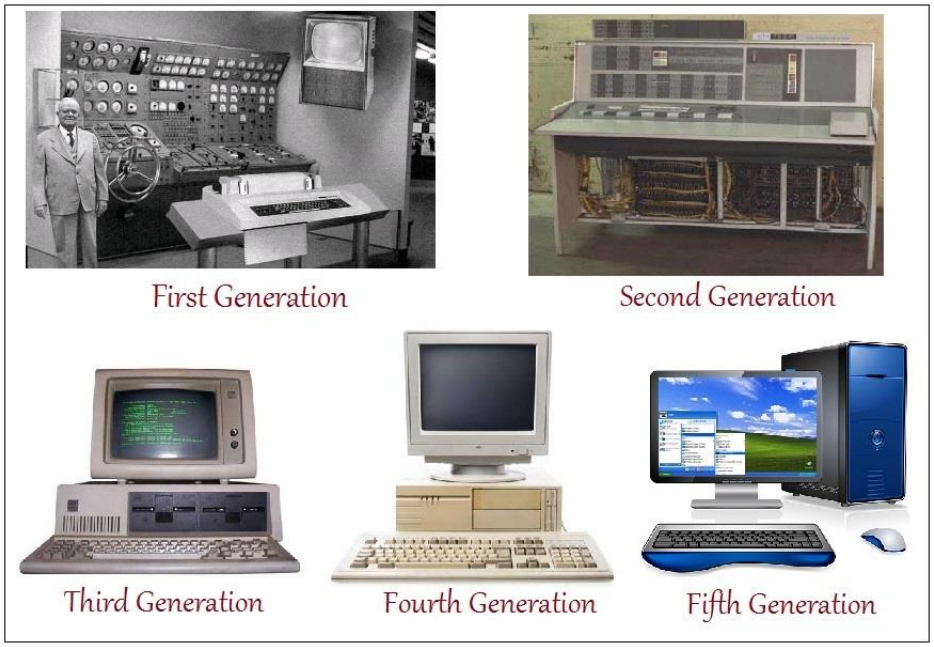


Fig.1 The computer Generations

The merging of computers and communications has had a profound influence on the way computer systems are organized. The old model of single computer serving all of the organization computational need has been replaced by one which the-large number of separate but interconnected computers with each other. These systems are called has **computer networks.**

A network is a group of two or more computer systems sharing services and interacting in some manner. This interaction is, accomplished through a shared communication link, with the shared components being data. Put simply a network is a collection of machines have been linked both physically and through software components to facilitate communication and the sharing of information. A physical pathway known as transmission medium, connects the systems and a set of rules determines how they communicate. These rules are known as protocols. A network protocol is software installed on a machine that determines the agreed –upon set of

rules for two or more machine to communicate with each other. One common metaphor used to describe different protocols is to compare them to human languages.

Think of a group of people in the same room who know nothing about each other. In order for them to communicate, this group must determine what language to speak, how to handle identifying each other, whether to make general announcements or have private conversations and so on.

Machines using different protocols installed can't communicate with each other. Networks are widely used by companies or on personal level also. Network for companies should provide high reliability, cost efficiency, and resource sharing.

1.2 CLIENT SERVER MODEL

Normally network should provide high reliability; emergency backup… etc. For satisfying this purpose big mainframe computers are required. But this will be not cost efficient. On other side small computers have a much better price/performance ratio than the large Ones. Mainframes (room-Size) computers are roughly a factor of ten faster than personal computers, but they cost thousand times more. This imbalance has cost many system designers to build systems consisting of personal computers, one per user with data kept on one or more shared file server machines.

In this model, the users are called clients, and the whole arrangement is called as Client-Server model, as shown below in Fig.2.

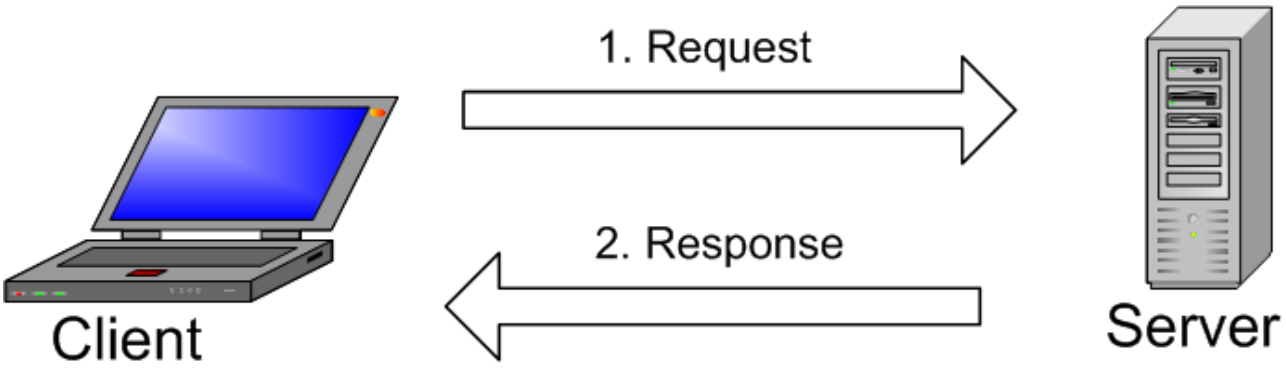


Fig.2 Client-Server model

In the client-server model communication generally takes the form of a request Message from the client to server asking for some work to be done. The server then does the work and sends back the reply. Usually, there are many clients using a small number of servers.

1.3 TYPES OF NETWORKS

The network can be divided into geographical areas and fall into three major categories

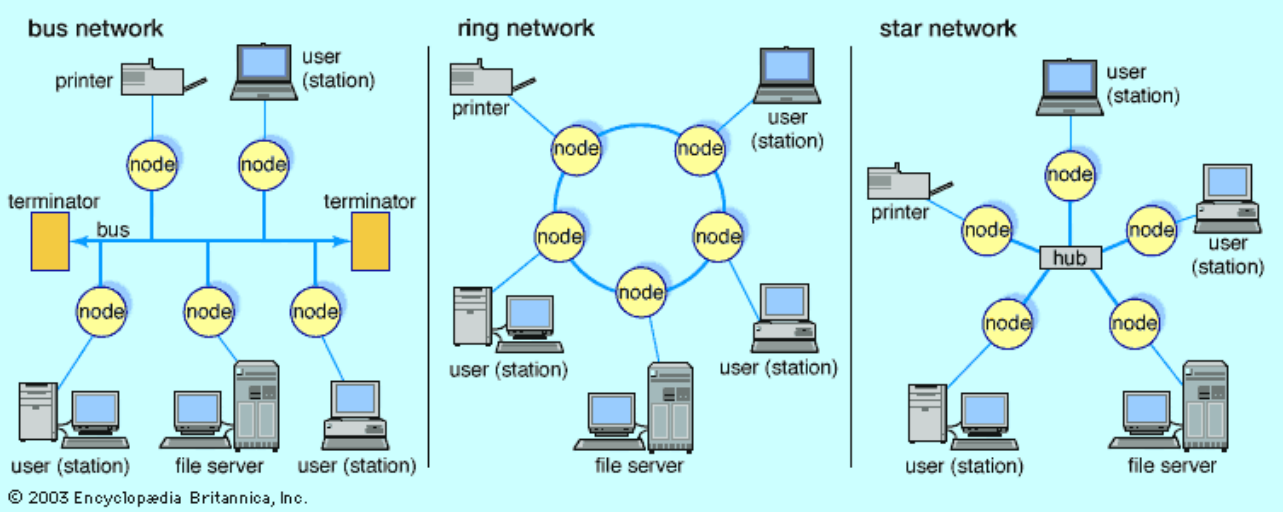
- Local Area Network (LANs)
- Metropolitan Area Network (MANs)
- Wide Area Network (WANs)

1.3.1 Local Area Network

A LAN is generally confined to a specific location, such as floor, building or some other small area. By being confined it is possible in most cases to use only one

transmission medium (cabling). The technology is less expensive to implement than WAN because you are keeping all of your expenses to a small area, and generally you can obtain higher speed. They, are widely used to connect personal computers and workstations in company offices and factories to share recourses.

LANs often use a transmission all the machines are attached with each other. Traditional LANs runs at speed of 10 to 100 Mbps have low delay and make very few errors. Never LANs may operate at higher speed up to 100 megabytes/sec.



Local Area Networks (LAN)

1.3.2 Metropolitan Area Network (MAN)

Metropolitan Area Network is basically a bigger version of LAN and normally uses same technology. It might cover a group of nearby corporate offices or a city and might be either private or public. On other hand, MAN is a network running throughout a metropolitan area such as a backbone for a phone service carrier.

Metropolitan Area Network (MAN)

1.3.3 Wide Area Network (WAN)

A wide area network spans a large geographical area, often a country or continent. It multiplies multiple connected LANs; that can be separated by any geographical distance. A LAN at the corporate headquarters in Indianapolis can be connected to a LAN at field office in Chicago and to another field office LAN in St. Louis to form a single Wide Area Network.

In most WANs the network contains numerous cables or telephone lines, each one connection a pair of routers. If two routers that do not share a cable nevertheless and wish to communicate, they must do it indirectly. On personal computers, we use modems to communicate indirectly with other computers.

Wide Area Network (WAN)

1.3.4 Transportation types;

There are two transportation types to transfer the data

- **Wire networks**.

Some of the transportation types in Wire networks are:

1) Ethernet
2) Token Ring

Examples of cable types used in the wire networks to transport the data:

a) Coaxial Cables

- **Thin Ethernet 10 Base 2**

  It's a thin cable, similar to CCTV cables, and they can carry the signal up to 185 meters.

10BASE2 50 Ohm Coax Cable

- **Thick Ethernet 10 Base 5**

It's a thick cable equipped with greater protection and flexibility. These cables can carry signals up to 500 m and are considered a backbone for connecting subnetworks.

10BASE5 Thicknet Cable

Coaxial cable design

-It is a thin metal core of copper called a conductor.

- This core is surrounded by an insulating material such as Poly Vinyl Chloride (PVC).

- The insulator is surrounded by a metal mesh shielding and then a plastic wrap

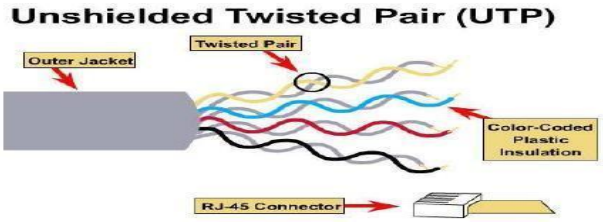
Advantages of coaxial cables

- High frequency range, which means its ability to transfer larger data
- Its ability to protect transmitted data from interference
- It is used to transfer sound, images and data

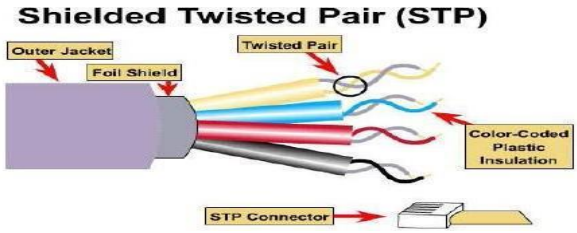
b) Twisted pair cables

Twisted cables are used for distances not exceeding 100 m. It consists of twisted pair connections made of thin copper wires. The wires are braided to protect them from interference and distortion. It's divided into:

1- Unshielded Twisted Pair (UTP)



2- Shielded Twisted Pair (STP)

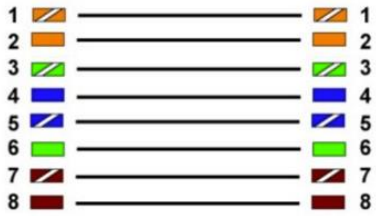


Twisted pair type connection

to connect twisted pair cables from one device to another at the network, there are two connection types

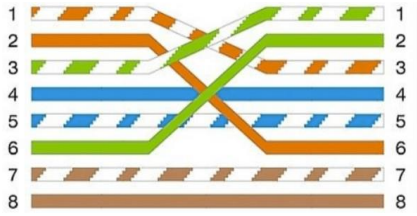
1) Straight Through Cable

Each end of the Straight-through has the same pin out. It uses the same color code throughout the LAN for consistency. This type of twisted-pair cable is used in LAN to connect a computer or a network hub such as a router. It is one of the most common types of network cable.



2) Crossover cable

In this type of cable connection, Pin 1 is crossed with Pin 3, and Pin 2 is crossed with Pin 6.



Crossover cable is used to connect two or more computing devices. The internal wiring of crossover cables reverses the transmission and receive signals. It is widely used to connect two devices of the same type: e.g., two computers or two switches to each other.

NOTE:

- Like devices require a crossover cable.
- Unlike devices require a straight-through cable.

- **wireless networks.**

Some of the transportation types in Wireless networks:

a) **Infrared.**

The word infra means under, and this means that we are in the infrared region, whose frequency is lower than the frequency of red rays. Infrared rays are thermal rays and are emitted from all things and are also emitted from our bodies.

An example is remote control devices to control devices remotely.

Among its downsides:

- The device must be oriented directly, as with remote devices.
- Do not use on computers.

b) Radio Frequency (RF).

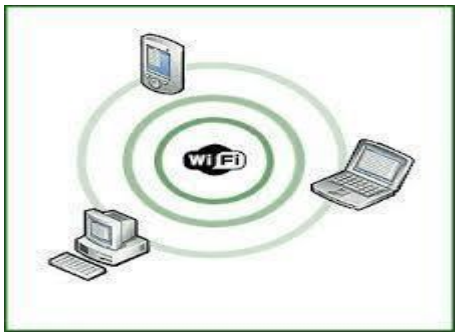
It is a part of electromagnetic waves with a wavelength higher than infrared rays and has many uses, such as radio broadcasting and also in computer networks and cellular communications.

c) Bluetooth

It is a communications technology in the short-range wave band designed to transfer data over short distances and consuming small amounts of energy. This technology is widely used in transferring data between Mobile devices. The Bluetooth features are low energy consumption and low cost.

d) Wireless Fidelity (WIFI)

It is the technology on which most wireless networks are based. It uses radio to exchange information instead of wires and cables. It is also able to penetrate walls and barriers and has a high speed in transmitting and receiving data, up to 54 Mbps.



Wi-Fi waves are broadcast on frequencies between 2.4Ghz and 5Ghz, which are relatively higher than the frequencies used by wireless phones.

SO, **the WIFI features are:**

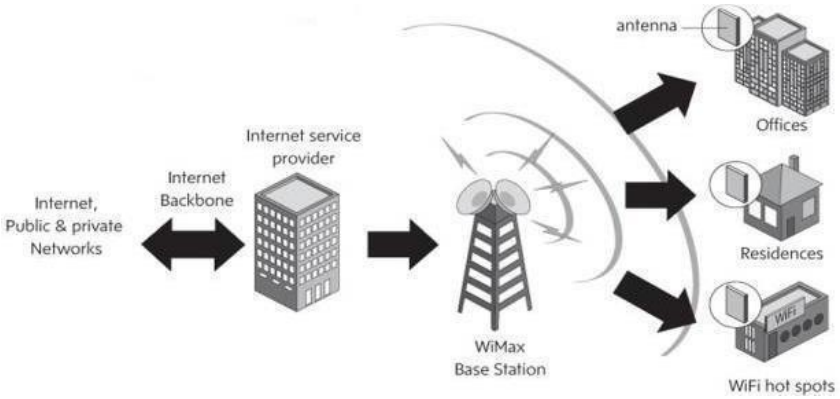
- Its network setup process is quick and easy
- Devices can be moved in all directions
- Connection speed via Wi-Fi reaches 54 MB per second
- It may be installed in places where it is difficult to extend cables.

It has drawbacks too:

- Interference and confusion, High energy consumption, Limited coverage area, and the possibility of personal data being hacked.

e) WIMAX

This method is considered one of the modern broadband technologies for wireless communications, which replaces high-cost cables such as optical fibers. Wireless communications cover large areas without being exposed to the problems of drilling, and WIMAX technology gives high speeds in transferring data between the sender and the receiver over large geographical areas to cover entire cities.



WIMAX over WIFI technology is superior in several points, including:

Wi-Fi technology can provide wireless Internet in an area of slightly more than 90 square meters at speeds ranging from 11 Mbps to 54 Mbps, while WiMAX can cover an area of 45 kilometers so that it can cover entire cities at speeds of up to 70 Mbps.

Also WiMAX technology operates at frequencies between 2-11 GHz and between 10-66 GHz, while Wi-Fi technologies operate between frequencies ranging between 2.4 GHz and 5 GHz.

1.4 SUMMARY

In this lecture we have studied the old model of single computer serving all of the organization's computational need has been replaced by one in which the large number of separate but interconnected computers do the job. These systems are called as computer network. A network is a group of two or more computer systems sharing services and interacting in some manner.

The Computer network are mainly divided into Local Area Network, Metropolitan area network, wide area network.

In the end there are two transportation way to transfer the data which it's wire and wireless.