Unit No	Topics / Sub-topics
1	**Basics of Computer Network** **1.1 Introduction to Computer Network: Definition of Computer network, sharing information, sharing resources, file sharing.** **1.2 Categories of Network: Based on scope - LAN, MAN, WAN . Based on Connection - Peer to Peer network, Client- Server Network, Centralized network, Distributed network.** **1.3 Network Architecture:-Features and Applications** **1.4 Applications and Benefits of Computer Network.** **Course Outcome: CO1 Teaching Hours : 06 hrs Marks:08 (R- 2, U-4, A-2)**

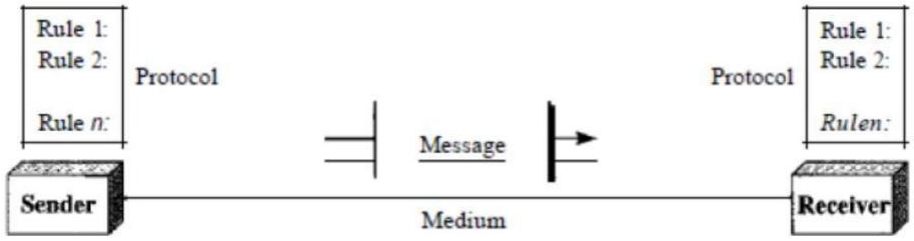
Chapter No:1
Overview of data communication
1.1 Introduction to communication

1.1DATA COMMUNICATIONS

Data communications are the exchange of data between two devices via some form of transmission medium such as a wire cable. For data communications to occur, the communicating devices must be part of a communication system made up of a combination of hardware (physical equipment) and software (programs). The effectiveness of a data communications system depends on four fundamental characteristics: delivery, accuracy, timeliness, and jitter.

1. **Delivery. The system must deliver data to the correct destination. Data must be received by the intended device or user and only by that device or user.**
2. **Accuracy. The system must deliver the data accurately. Data that have been altered in transmission and left uncorrected are unusable.**
3. **Timeliness. The system must deliver data in a timely manner. Data delivered late are useless. In the case of video and audio, timely delivery means delivering data as they are produced, in the same order that they are produced, and without significant delay. This kind of delivery is called real-time transmission.**
4. **Jitter. Jitter refers to the variation in the packet arrival time. It is the uneven delay in the delivery of audio or video packets.**

Components:
A data communications system has five components.



1. Message. The message is the information (data) to be communicated. Popular forms of information include text, numbers, pictures, audio, and video.
2. Sender. The sender is the device that sends the data message. It can be a computer, workstation, telephone handset, video camera, and so on.
3. Receiver. The receiver is the device that receives the message. It can be a computer, workstation, telephone handset, television, and so on.
4. Transmission medium. The transmission medium is the physical path by which a message travels from sender to receiver. Some examples of transmission media include twisted-pair wire, coaxial cable, fiber-optic cable, and radio waves
5. Protocol. A protocol is a set of rules that govern data communications. It represents an agreement between the communicating devices.

Note 3

Data:– information formatted in human/machine readable form
•examples: voice, music, image, file

Signal :– electric or electromagnetic representation of data
•transmission media work by conducting energy along a physical path; thus, to be transmitted, data must be turned into energy in the form of electro-magnetic signals

Transmission:– communication of data through propagation and processing of signals

1.1.1 Signals

In electrical engineering, the fundamental quantity of representing some information is called a signal. It does not matter what the information is i-e: Analog or digital information. In mathematics, a signal is a function that conveys some information. In fact any quantity measurable through time over space or any higher dimension can be taken as a signal. A signal could be of any dimension and could be of any form.

Analog signals:

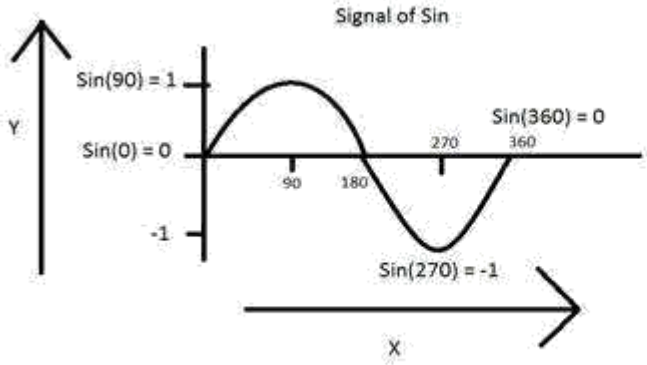
A signal could be an analog quantity that means it is defined with respect to the time. It is a continuous signal. These signals are defined over continuous independent variables. They are difficult to analyze, as they carry a huge number of values. They are very much accurate due to a large sample of values. In order to store these signals , you require an infinite memory because it can achieve infinite values on a real line. Analog signals are denoted by sin waves.

For example: Human voice

Human voice is an example of analog signals. When you speak, the voice that is produced travel through air in the form of pressure waves and thus belongs to a mathematical function, having independent variables of space and time and a value corresponding to air pressure.

Another example is of sin wave which is shown in the figure below.

Y = sin(x) where x is independent



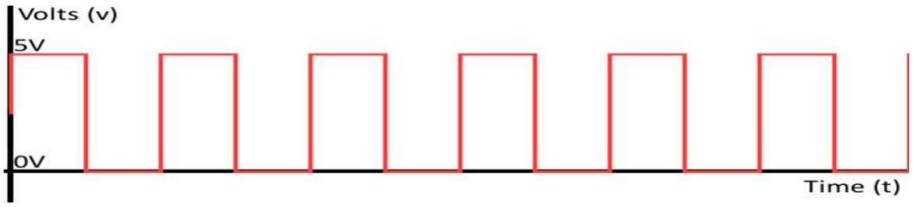
Digital signals

As compared to analog signals, digital signals are very easy to analyze. They are discontinuous signals. They are the appropriation of analog signals.

The word digital stands for discrete values and hence it means that they use specific values to represent any information. In digital signal, only two values are used to represent something i-e: 1 and 0 (binary values). Digital signals are less accurate then analog signals because they are the discrete samples of an analog signal taken over some period of time. However digital signals are not subject to noise. So they last long and are easy to interpret. Digital signals are denoted by square waves.

For example: Computer keyboard

Whenever a key is pressed from the keyboard, the appropriate electrical signal is sent to keyboard controller containing the ASCII value that particular key. For example the electrical signal that is generated when keyboard key a is pressed, carry information of digit 97 in the form of 0 and 1, which is the ASCII value of character a.



Difference between analog and digital signals

Comparison element	Analog signal	Digital signal
Analysis	Difficult	Possible to analyze
Representation	Continuous	Discontinuous
Accuracy	More accurate	Less accurate
Storage	Infinite memory	Easily stored
Subject to Noise	Yes	No
Recording Technique	Original signal is preserved	Samples of the signal are taken and preserved
Examples	Human voice, Thermometer, Analog phones e.t.c	Computers, Digital Phones, Digital pens, e.t.c

	Analog	Digital
Signal	Analog signal is a continuous signal which represents physical measurements.	Digital signals are discrete time signals generated by digital modulation.
Waves	Denoted by sine waves	Denoted by square waves
Representation	Uses continuous range of values to represent information	Uses discrete or discontinuous values to represent information
Example	Human voice in air, analog electronic devices.	Computers, CDs, DVDs, and other digital electronic devices.
Technology	Analog technology records waveforms as they are.	Samples analog waveforms into a limited set of numbers and records them.
Data transmissions	Subjected to deterioration by noise during transmission and write/read cycle.	Can be noise-immune without deterioration during transmission and write/read cycle.
Response to Noise	More likely to get affected reducing accuracy	Less affected since noise response are analog in nature

	Analog	Digital
Flexibility	Analog hardware is not flexible.	Digital hardware is flexible in implementation.
Uses	Can be used in analog devices only. Best suited for audio and video transmission.	Best suited for Computing and digital electronics.
Applications	Thermometer	PCs, PDAs
Bandwidth	Analog signal processing can be done in real time and consumes less bandwidth.	There is no guarantee that digital signal processing can be done in real time and consumes more bandwidth to carry out the same information.
Memory	Stored in the form of wave signal	Stored in the form of binary bit
Power	Analog instrument draws large power	Digital instrument drawS only negligible power
Cost	Low cost and	Cost is high and not easily portable
Impedance	portable Low	High order of 100 megaohm
Errors	Analog instruments usually have a scale which is cramped at lower end and give considerable observational errors.	Digital instruments are free from observational errors like parallax and approximation errors.

1.1.2&1.1.3Analog & digital Modulation

We convey our messages to someone and outside world through voice, facial expressions, gestures. This is the communication method between human beings. However in technological point of view these messages can be base-band audio, video and even digital bits from computer. Telecommunication is the core subject for sending messages from one place to another place. Here we are discussing various types of modulations which are the core mechanisms for any telecommunication devices. Before we start this subject let us go back in the history of telecommunication. Telephone was the first device to send analog audio signals over long distance through copper wire. Telegraph was on the other way to send messages in the forms of dash-dots. Telephone and telegraph remains the base of all modern day's communication. Present days we send audio, video, bitstreams from computes through copper wires, co-axial cable, even through wireless radio waves, microwaves, infrared, and in the form visual lights through optical fibre. Baseband signals can be sent to some distance through copper wire but sending those to a long distance has many challenges. Letus discuss these problems and how modulation came in to picture.

Modulation needs

Electronic devices produce messages like analog baseband signals in the form of audio, video or even messages can be in the form of digital bits from computer. To send these messages we must have some communication channel like wires, co-axial cable, even wireless radio waves, microwaves or infrared. We can easily transmit messages through wires or cables. Voice, Video, bit streams from computer are having lower frequency band and can travel few distance with wires but cannot be sent through wireless media. Voice signal has lower Bandwidth therefore it will not propagate through space and will be attenuated. To transmit voice signal a large size antenna is required as antenna length is proportional to half of wavelength. The size of the antenna will be more than the distance between transmitter and receiver. Again when more than one transmitter is involved all station will overlap in one frequency band. For those above reasons we choose a carrier, which is a high frequency radio wave, can travel long distance without attenuation and as the frequency is high smaller antenna is required. Selecting different carrier frequency for different transmitting stations can eliminate overlapping of frequency band.

Problem:

1. **Voice, Video, bit streams from computer are having lower frequency band**
2. **They canntravel few distance with wires but not cannot propagate through space**
3. **Antenna size is half of wavelength thus antenna length for Voice, Video, bit streams would be impractical**
4. **Assume we transmit Voice, Video, bit streams over an imaginary antenna but being in the same frequency range all channels will overlap**

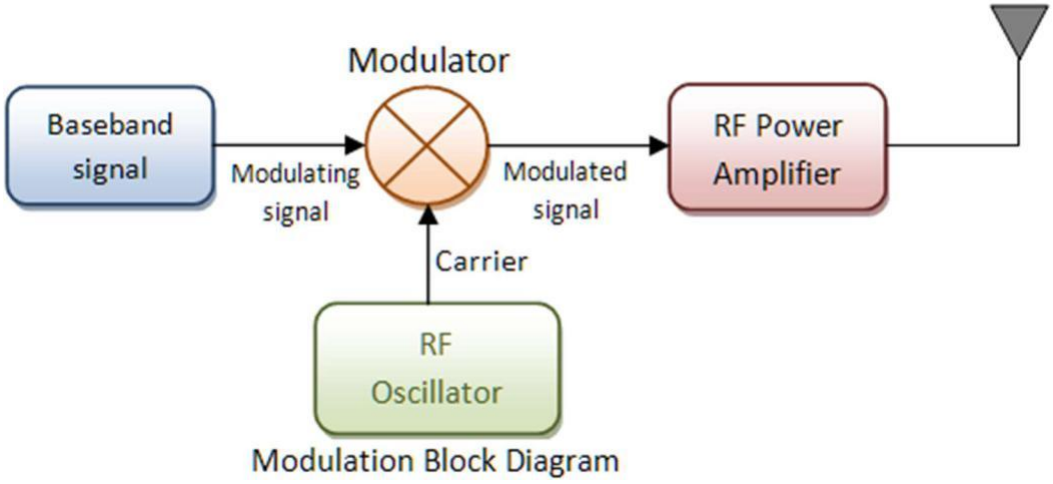
Solution:

1. **carrier signal is used to carry signal to long distance**
2. **Modulation is used with a selected carrier frequency signal to mix baseband with carrier**
3. **carrier frequency is in higher frequency radio wave length and thus antenna size would be smaller**
4. **Radio waves can travel longer distance with very less att**
5. **Radio wave has a wide range of frequencies to select individual non-overlapping channels**

Modulation:

Now we have to develop some way to send the information of message signal via this carrier signal. The carrier signal is a high frequency sinusoidal signal represented by amplitude, frequency and phase. We can vary one of this parameter accordingly with the message information.

Definition: Operation of varying amplitude, frequency or phase of carrier signal accordingly with the instantaneous amplitude of the message signal is called modulation.



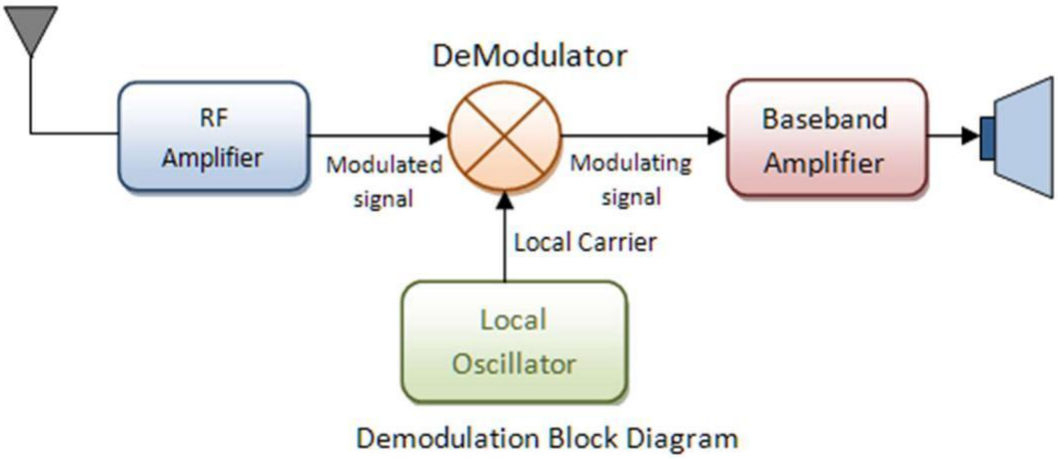
Modulation Block Diagram

Here baseband signals comes from a audio/video or computer. Baseband signals are also called modulating signal as it modulates carrier signal. career signals are high frequecy radio waves it generally comes from a radio frequency oscillators. These two signls are combined in modulator. Modulator takes the instantenious amplitute of baseband signal and varies amplitute/frequency/phase of career signal. Resultant signal is a modulated signal. It goes to an RF-amplifier for signal power boosting and then feed to antenna or a co-axial cable.

There are two types of modulation analog and digital. Analog modulation delas with the voice, video and regular waves of base band signals. Where as digital modulations are with bit streams or symbols from computing vevices as base band signals.

DeModulation:

Demodulation is the opposite process of modulation. Modulator is a part of signal transmitter where as demodulator is the receiving side. In broadcast system radio tranmitting station does to modulation part. A radio receiver acts as a demodulator. A modem receives signals and also transmits signals thus it does modulation and demodulation at the same time. Thus the name modem has been given. A radio antenna receives low power signal. A co-axial cable end point can also taken as an signal input. An RF amplifer boosts the signal amplitude. Then the signal goes to a demodulator. demodulator does the reverse of modulation and extracts the backband signal from career. Then the base band signal is amplified to feed a audio speaker or video moitor or TTL/CMOS signal levels to match computer inpts.



Demodulation Block Diagram

Analog Modulation:

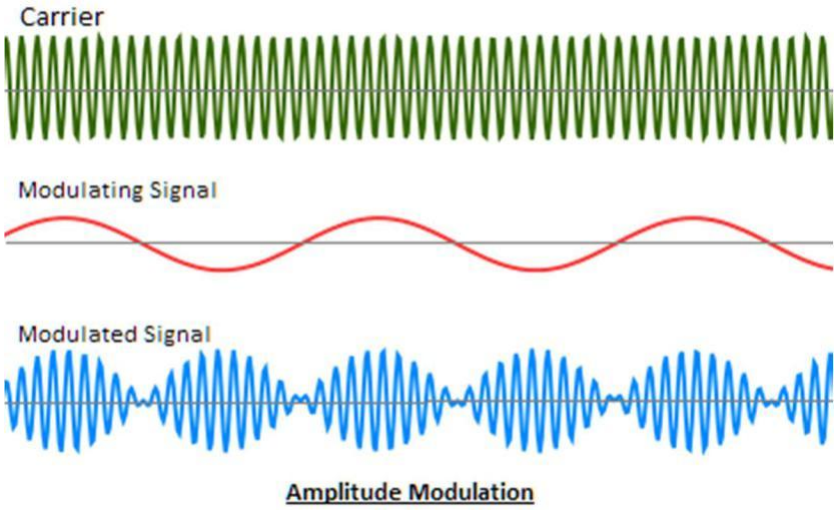
Baseband signal is always analog for this modulation. There are three properties of a carrier signal amplitute, frequency and phase thus there are three basic types of analog modulations.

1. **Amplitude Modulation (AM)**
2. **Frequency Modulation (FM)**
3. **Phase modulation (PM)**

Amplitute Modulation

Amplitude modulation or AM is the process of varying the instantaneous amplitude of carrier signal accordingly with instantaneous amplitude of message signal. Thus, if m(t) is the message signal and c(t)=Acosw_ct then AM signal F(t) is written as F(t)= Acosw_ct+m(t) cosw_ct

F(t)=[A+m(t)] cosw_ct



Amplitude Modulation

AM Advantage

AM is the simplest type of modulation. Hardware design of both transmitter and receiver is very simple and less cost effective.

AM Disadvange:

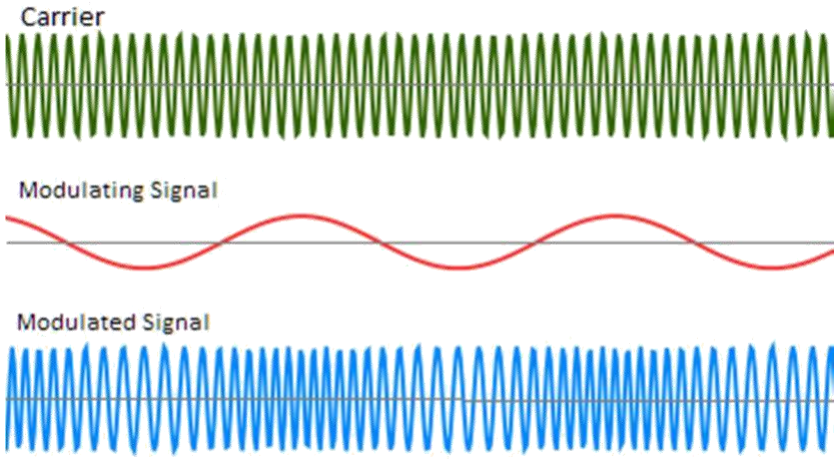
AM is very susceptible to noise.

Application:

1) AM radio broad cast is an example

Frequency modulation

FM:-FM or Frequency modulation is the process of varying the in instantaneous frequency of Carrier signal accordingly with instantaneous amplitude of message signal. Thus, if m(t) is the message signal and c(t)=Acosw_ct then FM signal will be F(t)= Acos(w_c t+k_f ∫m(α)dα)



Frequency Modulation

FM Advantage

Modulation and demodulation does not catch any channel noise.

FM Disadvange:

Circuit needed for FM modulation and demodulation is bit complicated than AM

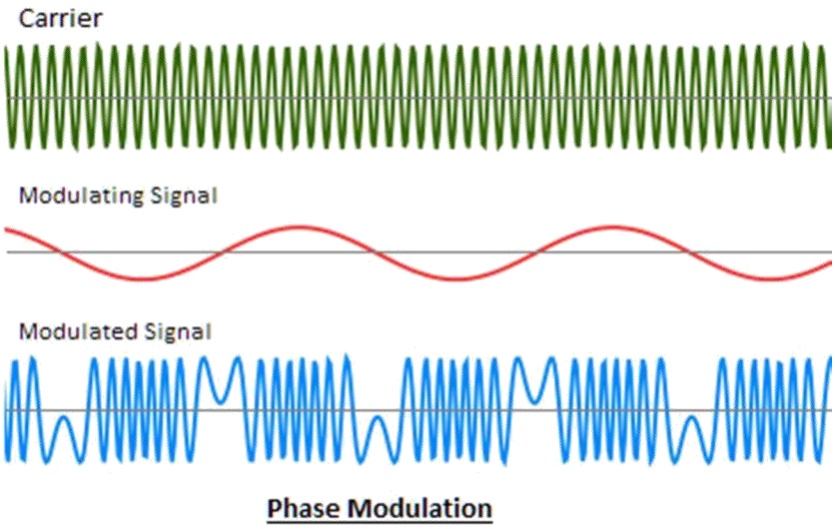
Application:

1) FM radio broad cast is an example

Phase modulation (PM)

PM or Phase modulation is the process of varying the instantaneous phase of Carrier signal accordingly with instantaneous amplitude of message signal. Thus if m(t) is the message signal and c(t)=Acoswct then PM signal will be

$F(t)= A\cos(w_c t+k_p m(t))$



Phase Modulation

PM Advantage

Modulation and demodulation does not catch any channel noise.

PM Disadvange:

Circuit needed for PM modulation and demodulation is bit complicated than AM and FM

Application:

1) Satellite communication.

Digital modulation:

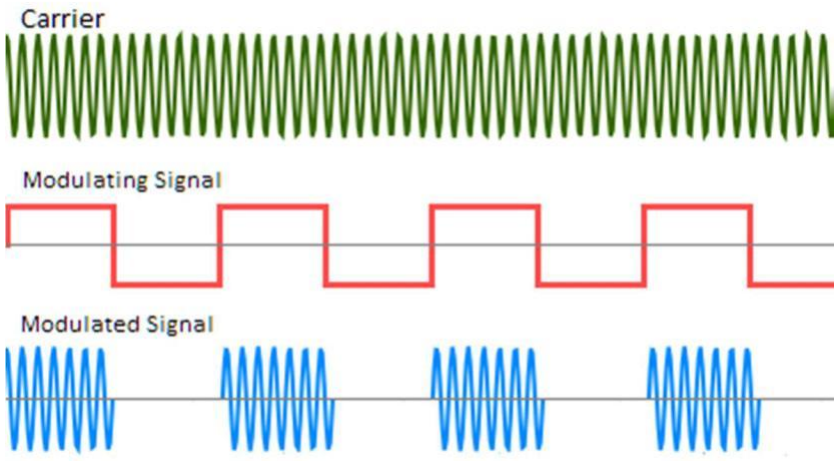
Digital modulation in somewhat similar to the analog modulation except base band signal is of discrete amplitude level. For binary signal it has only two level, either high or logic 1 or low or logic 0. The modulation scheme is mainly three types.

1. **ASK or Amplitude shift Key**
2. **FSK or Frequency shift key**
3. **PSK or Phase shift key**

ASK or Amplitude shift Key:

When the carrier amplitude is varied in proportion to message signal m(t). We have the modulated carrier $m(t)\cos w_c t$ where $\cos w_c t$ is the carrier signal. As the information is an on-off signal the output is also an on-off signal where the carrier is present when information is 1 and

carrier is absent when information is 0. Thus this modulation scheme is known as on-off keying (OOK) or amplitude shift key.



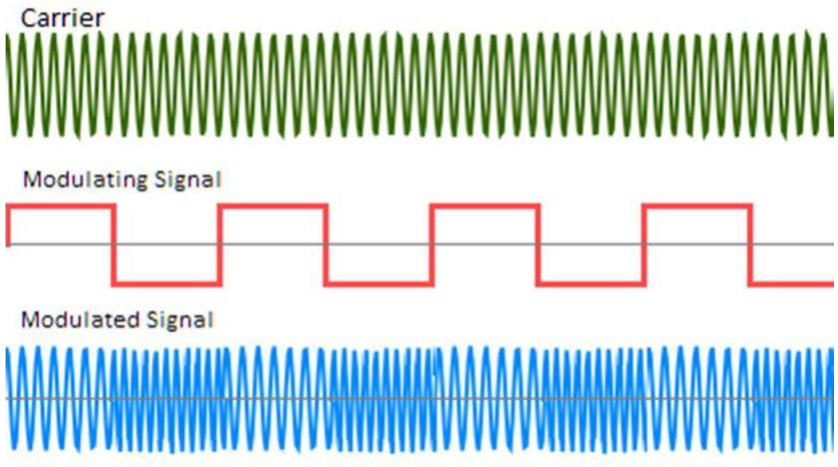
Amplitude Shift Key

Application:

1. **Used in our infrared remote controls**
2. **Used in fibre optical tranmitter and receiver.**

FSK or Frequency shift key:

When Data are transmitted by varying frequency of the carrier, we have the case of frequency shift key. In this modulation carrier has two predefined frequency w_{c1} and w_{c2}. When information bit is 1 carrier with w_{c1} is transmitted i.e. $\cos w_{c1}$ and When information bit is 0 carrier with w_{c0} is transmitted i.e. $\cos w_{c0}$



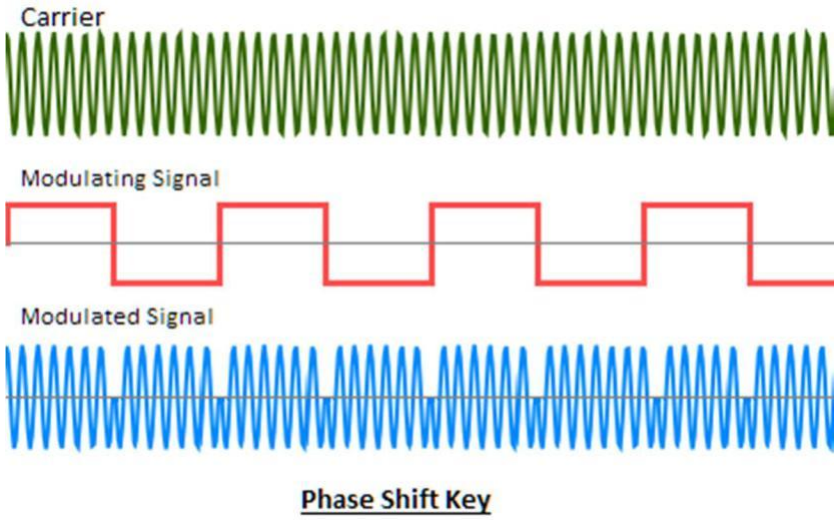
Frequency Shift Key

Application:

1. **Many modems used FSK in telemetry systems**

PSK or Phase shift key:

The phase of the carrier is shifted for this modulation. If the base band signal m(t) =1 carrier in phase is transmitted. If m(t)=0 carrier with out of phase is transmitted i.e. cos($w_c t+\Pi$). If phase shift is done in 4 different quadrants then 2bit of information can be sent at a time. This scheme is a special case of PSK modulation known as QPSK or Quadrature Phase Shift Key.



Phase Shift Key

Application:

1. **Used in our ADSL broadband modem**
2. **Used in satellite communication**
3. **Used in our mobile phones**

1.2Data transmission

1.2.1 Serial Transmission, Parallel Transmission

1.2.2 Synchronous Transmission, Asynchronous Transmission

Definition Data Transmission: When we enter data into the computer via keyboard, each keyed element is encoded by the electronics within the keyboard into an equivalent binary coded pattern, using one of the standard coding schemes that are used for the interchange of information. To represent all characters of the keyboard, a unique pattern of 7 or 8 bits in size is used. The use of 7 bits means that 128 different elements can be represented, while 8 bits can

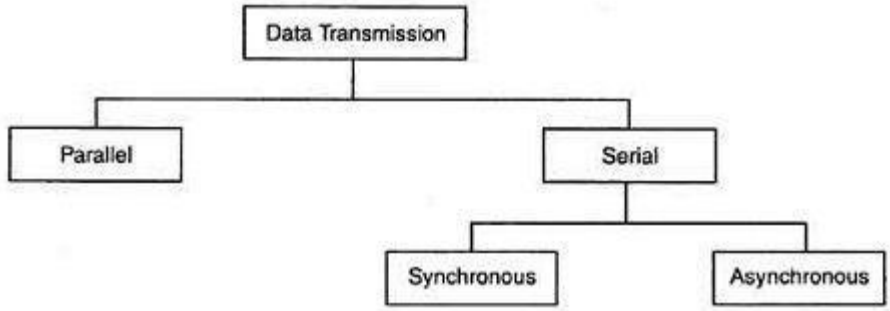
represent 256 elements. A similar procedure is followed at the receiver that decodes every received binary pattern into the corresponding character.

The most widely used codes that have been adopted for this function are the Extended Binary Coded Decimal (EBCDIC) and the American Standard Code for Information Interchange codes (ASCII). Both coding schemes cater to all the normal alphabetic, numeric, and punctuation characters, collectively referred to as printable characters and a range of additional control characters, known as non-printable characters.

Data transmission refers to the movement of data in form of bits between two or more digital devices.

This transfer of data takes place via some form of transmission media (for example, coaxial cable, fiber optics etc.)

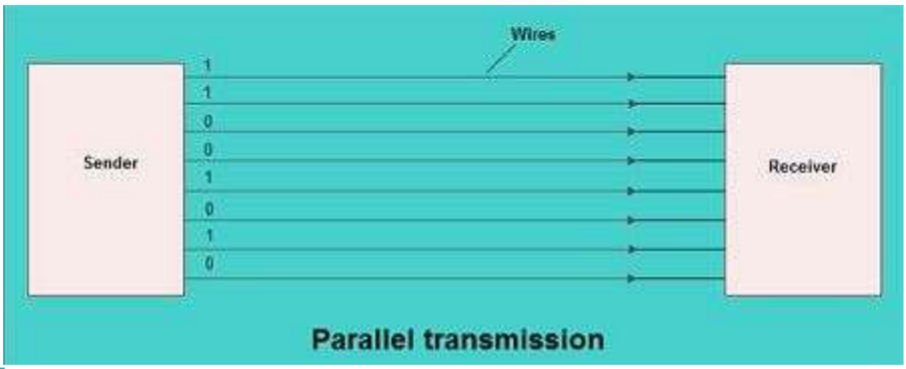
Types of Data Transmission



Parallel transmission

Defination: Within a computing or communication device, the distances between different subunits are too short. Thus, it is normal practice to transfer data between subunits using a separate wire to carry each bit of data. There are multiple wires connecting each sub-unit and data is exchanged using a parallel transfer mode. This mode of operation results in minimal delays in transferring each word.

- **In parallel transmission, all the bits of data are transmitted simultaneously on separate communication lines.**
- **In order to transmit n bits, n wires or lines are used. Thus each bit has its own line.**
- **All n bits of one group are transmitted with each clock pulse from one device to another i.e. multiple bits are sent with each clock pulse.**
- **Parallel transmission is used for short distance communication.**
- **As shown in the fig, eight separate wires are used to transmit 8 bit data from sender to receiver.**



Advantage of parallel transmission

It is speedy way of transmitting data as multiple bits are transmitted simultaneously with a single clock pulse.

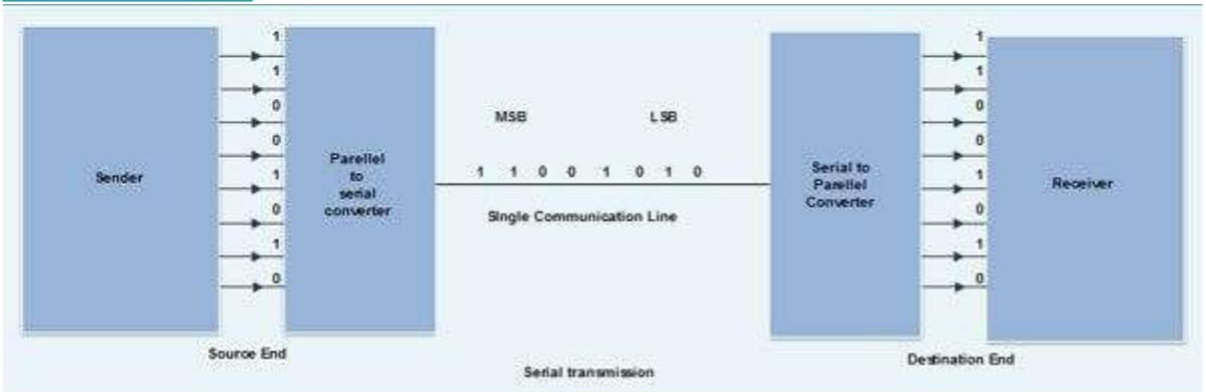
Disadvantage of parallel transmission

It is costly method of data transmission as it requires n lines to transmit n bits at the same time.

Serial Transmission

Defination: When transferring data between two physically separate devices, especially if the separation is more than a few kilometers, for reasons of cost, it is more economical to use a single pair of lines. Data is transmitted as a single bit at a time using a fixed time interval for each bit. This mode of transmission is known as bit-serial transmission.

- In serial transmission, the various bits of data are transmitted serially one after the other.
- It requires only one communication line rather than n lines to transmit data from sender to receiver.
- Thus all the bits of data are transmitted on single line in serial fashion.
- In serial transmission, only single bit is sent with each clock pulse.
- As shown in fig., suppose an 8-bit data 11001010 is to be sent from source to destination. Then least significant bit (LSB) i,e. 0 will be transmitted first followed by other bits. The most significant bit (MSB) i.e. 1 will be transmitted in the end via single communication line.
- The internal circuitry of computer transmits data in parallel fashion. So in order to change this parallel data into serial data, conversion devices are used.
- These conversion devices convert the parallel data into serial data at the sender side so that it can be transmitted over single line.
- On receiver side, serial data received is again converted to parallel form so that the interval circuitry of computer can accept it



• Serial transmission is used for long distance communication.

Advantage of Serial transmission

Use of single communication line reduces the transmission line cost by the factor of n as compared to parallel transmission.

Disadvantages of Serial transmission

1. Use of conversion devices at source and destination end may lead to increase in overall transmission cost.
2. This method is slower as compared to parallel transmission as bits are transmitted serially one after the other.

Types of Serial Transmission

There are two types of serial transmission-synchronous and asynchronous both these transmissions use 'Bit synchronization'

Bit Synchronization is a function that is required to determine when the beginning and end of the data transmission occurs.

Bit synchronization helps the receiving computer to know when data begin and end during a transmission. Therefore bit synchronization provides timing control.

Asynchronous Transmission

- Asynchronous transmission sends only one character at a time where a character is either a letter of the alphabet or number or control character i.e. it sends one byte of data at a time.
- Bit synchronization between two devices is made possible using start bit and stop bit.
- Start bit indicates the beginning of data i.e. alerts the receiver to the arrival of new group of bits. A start bit usually 0 is added to the beginning of each byte.
- Stop bit indicates the end of data i.e. to let the receiver know that byte is finished, one or more additional bits are appended to the end of the byte. These bits, usually 1s are called stop bits.

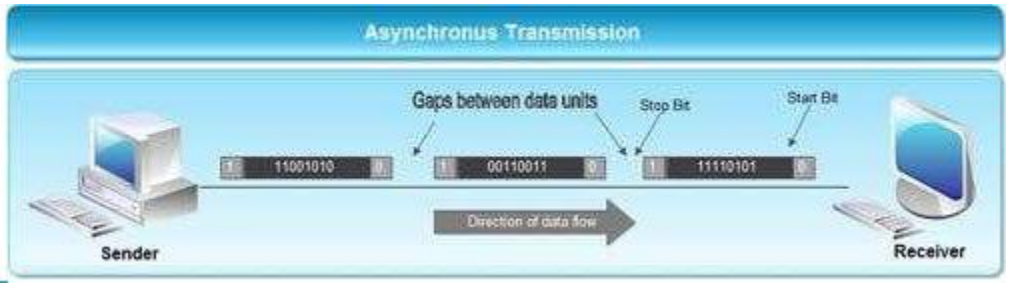
• Addition of start and stop increase the number of data bits. Hence more bandwidth is consumed in asynchronous transmission.

• There is idle time between the transmissions of different data bytes. This idle time is also known as Gap

• The gap or idle time can be of varying intervals. This mechanism is called Asynchronous, because at byte level sender and receiver need not to be synchronized. But within each byte, receiver must be synchronized with the incoming bit stream.

Application of Asynchronous Transmission

1. Asynchronous transmission is well suited for keyboard type-terminals and paper tape devices. The advantage of this method is that it does not require any local storage at the terminal or the computer as transmission takes place character by character.



2. Asynchronous transmission is best suited to Internet traffic in which information is transmitted in short bursts. This type of transmission is used by modems.

Advantages of Asynchronous transmission

1. This method of data transmission is cheaper in cost as compared to synchronous e.g. If lines are short, asynchronous transmission is better, because line cost would be low and idle time will not be expensive.

2. In this approach each individual character is complete in itself, therefore if character is corrupted during transmission, its successor and predecessor character will not be affected.

3. It is possible to transmit signals from sources having different bit rates.

4. The transmission can start as soon as data byte to be transmitted becomes available.

5. Moreover, this mode of data transmission in easy to implement.

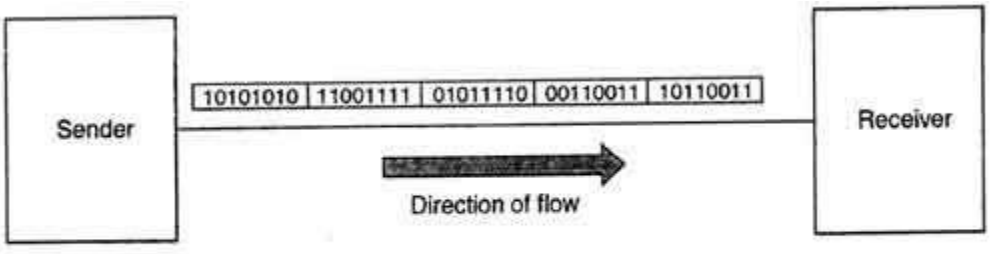
Disadvantages of asynchronous transmission

1. This method is less efficient and slower than synchronous transmission due to the overhead of extra bits and insertion of gaps into bit stream.

2. Successful transmission inevitably depends on the recognition of the start bits. These bits can be missed or corrupted.

Synchronous Transmission

- Synchronous transmission does not use start and stop bits.
- In this method bit stream is combined into longer frames that may contain multiple bytes.
- There is no gap between the various bytes in the data stream.



Synchronous Transmission

- In the absence of start & stop bits, bit synchronization is established between sender & receiver by 'timing' the transmission of each bit.
- Since the various bytes are placed on the link without any gap, it is the responsibility of receiver to separate the bit stream into bytes so as to reconstruct the original information.
- In order to receive the data error free, the receiver and sender operates at the same clock frequency.

Application of Synchronous transmission

- Synchronous transmission is used for high speed communication between computers.

Advantage of Synchronous transmission

1. This method is faster as compared to asynchronous as there are no extra bits (start bit & stop bit) and also there is no gap between the individual data bytes.

Disadvantages of Synchronous transmission

1. It is costly as compared to asynchronous method. It requires local buffer storage at the two ends of line to assemble blocks and it also requires accurately synchronized clocks at both ends. This lead to increase in the cost.

2. The sender and receiver have to operate at the same clock frequency. This requires proper synchronization which makes the system complicated.

Comparison between Serial and Parallel transmission

Sr. No.	Factor	Serial	Parallel
1.	Number of bits transmitted at one clock pulse	One bit	*n* bits
2.	No. of lines required to transmit *n* bits	One line	*n* lines
3.	Speed of data transfer	Slow	Fast
4.	Cost of transmission	Low as one line is required	Higher as *n* lines are required.
5.	Application	Long distance communication between two computers	Short distance communication. like computer to printer.

Comparison between Asynchronous and Synchronous.

Sr. No.	Factor	Asynchronous	Synchronus
1.	Data send at one time	Usually 1 byte	Multiple bytes
2.	Start and Stop bit	Used	Not used
3.	Gap between Data units	Present	Not present
4.	Data transmission speed	Slow	Fast
5.	Cost	Low	High

1.3 Communication Modes:
Simplex, Half Duplex, Full duplex

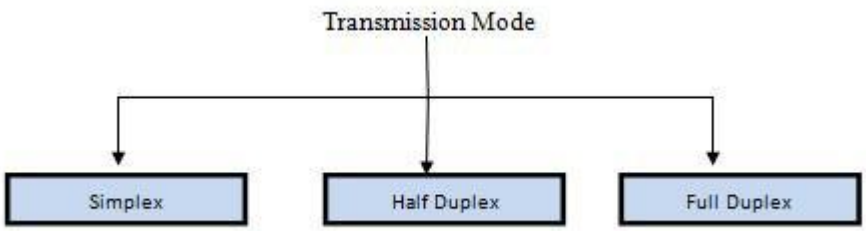
Transmission Modes in Computer Networks

Transmission mode means transferring of data between two devices. It is also called communication mode. These modes direct the direction of flow of information. There are three types of transmission mode. They are :

Simplex Mode

Half duplex Mode

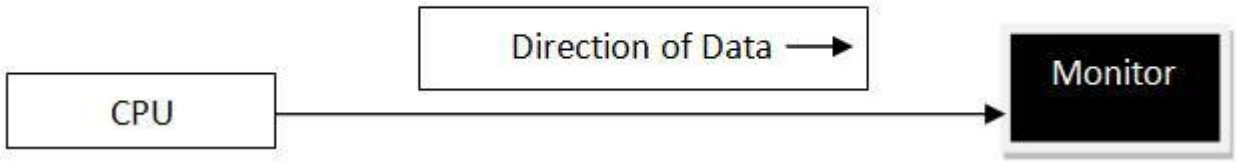
Full duplex Mode



SIMPLEX Mode

In this type of transmission mode data can be sent only through one direction i.e. communication is unidirectional. We cannot send a message back to the sender. Unidirectional communication is done in Simplex Systems.

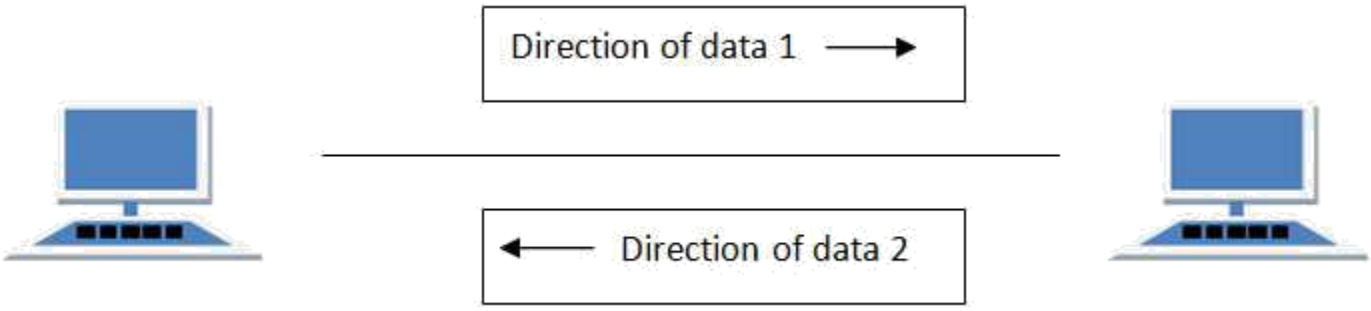
Examples of simplex Mode is loudspeaker, television broadcasting, television and remote, keyboard and monitor etc.



HALF DUPLEX Mode

Half-duplex data transmission means that data can be transmitted in both directions on a signal carrier, but not at the same time. For example, on a local area network using a technology that has half-duplex transmission, one workstation can send data on the line and then immediately receive data on the line from the same direction in which data was just transmitted. Hence half-duplex transmission implies a bidirectional line (one that can carry data in both directions) but data can be sent in only one direction at a time.

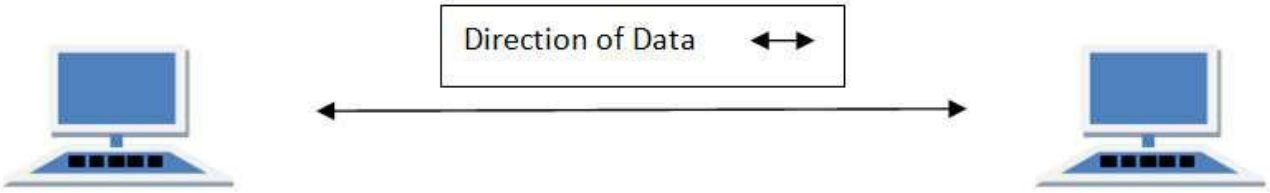
Example of half duplex is a walkie- talkie in which message is sent one at a time and messages are sent in both the directions.



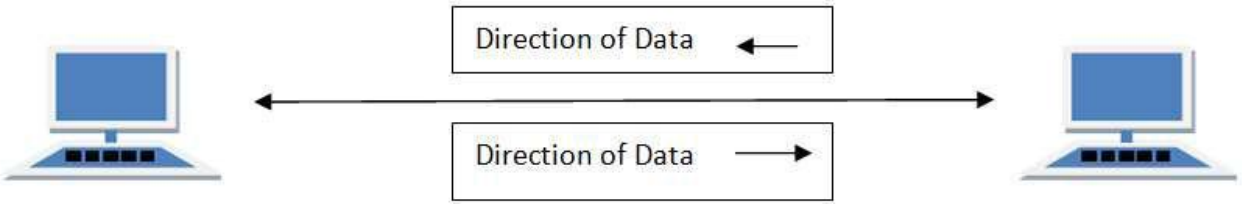
FULL DUPLEX Mode

In full duplex system we can send data in both directions as it is bidirectional. Data can be sent in both directions simultaneously. We can send as well as we receive the data.

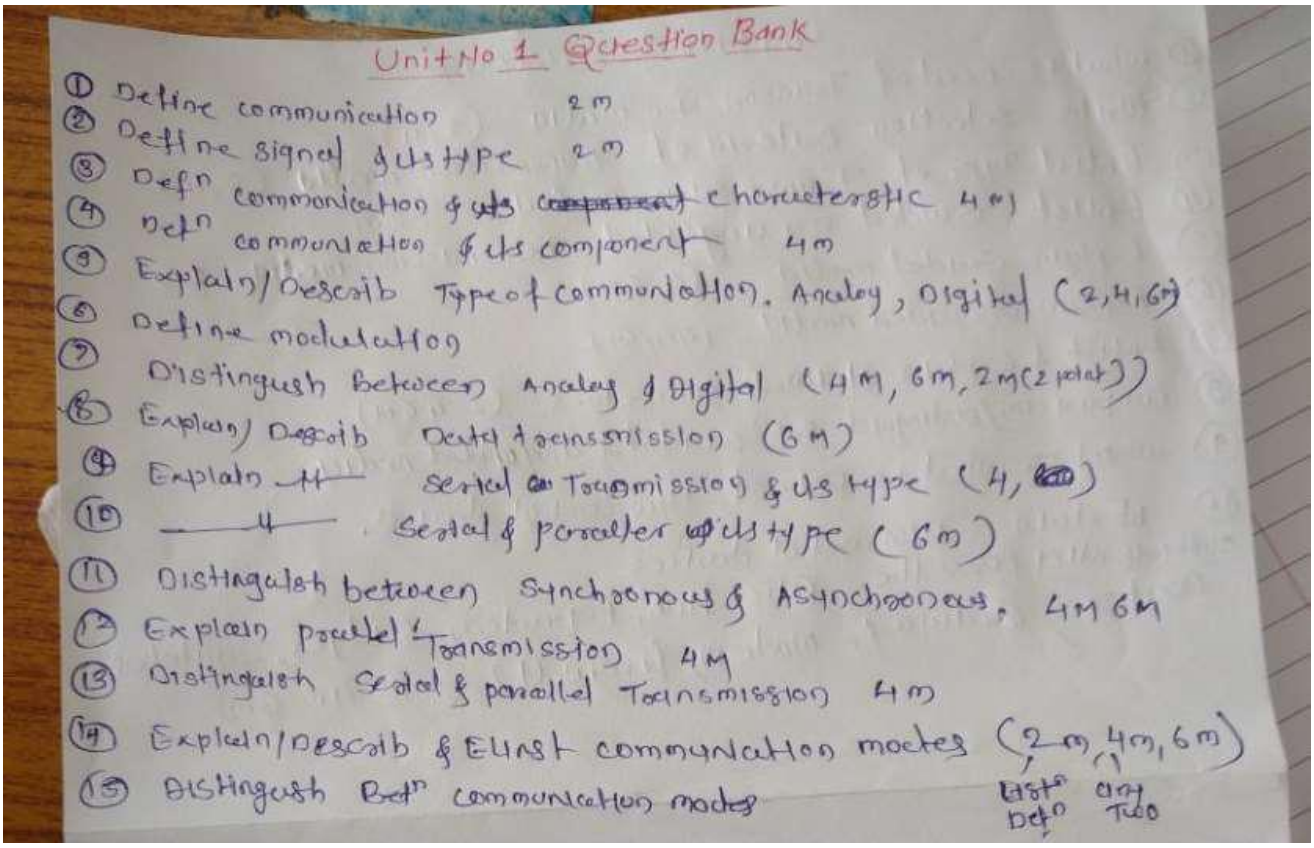
Example of Full Duplex is a Telephone Network in which there is communication between two persons by a telephone line, through which both can talk and listen at the same time.



In full duplex system there can be two lines one for sending the data and the other for receiving data.



Question Bank Chapter1



Unit No 1 Question Bank

1. Define communication 2m
2. Define signal & its type 2m
3. Defn communication & ~~its component~~ characteristic 4m
4. Defn communication & its component 4m
5. Explain/Describ Type of communation. Analog, Digital (2,4,6m)
6. Define modulation
7. Distinguish between Analog & Digital (4M, 6m, 2m(2 points))
8. Explain/Describ Serial Transmission (6M)
9. Explain ~~—11—~~ Serial & Transmission & its type (4, ~~6m~~)
10. ~~—11—~~ Serial & parallel ~~&~~ its type (6m)
11. Distinguish between Synchronous & Asynchronous. 4M 6M
12. Explain parallel Transmission 4M
13. Distinguish Serial & parallel Transmission 4m
14. Explain/Describ & List communation modes (2m, 4m, 6m)
15. Distinguish Betn communation modes List any Two Diff

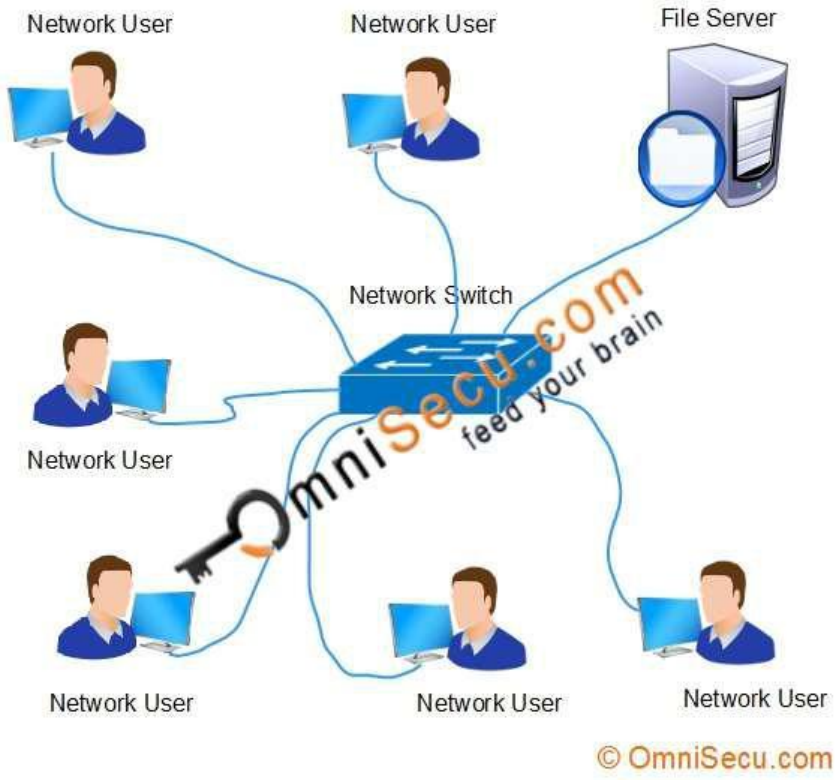
Unit no:`1

2.1 Why WE need computer network? Need for computer networking?

Computer networks help users on the network to share the resources and in communication. Can you imagine a world now without emails, online newspapers, blogs, chat and the other services offered by the internet?

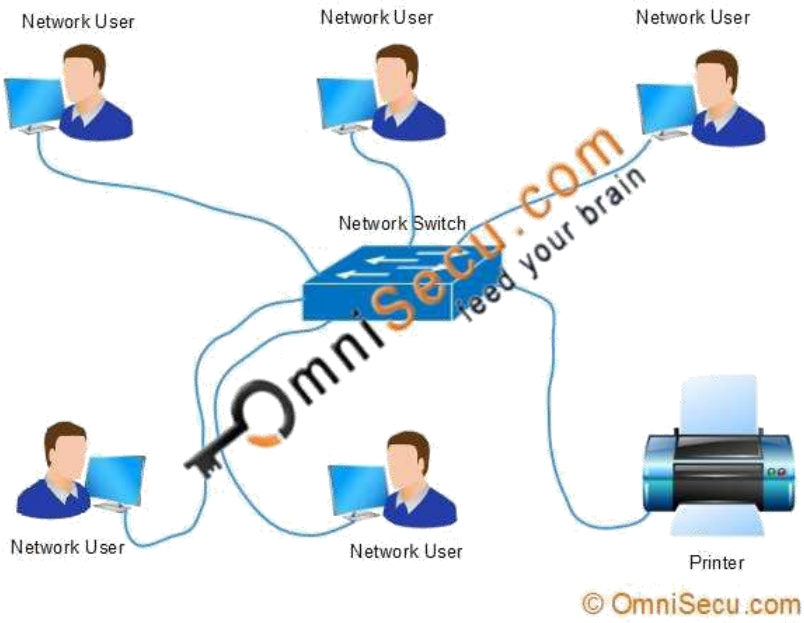
The following are the important uses and benefits of a computer network.

File sharing: Networking of computers helps the network users to share data files.



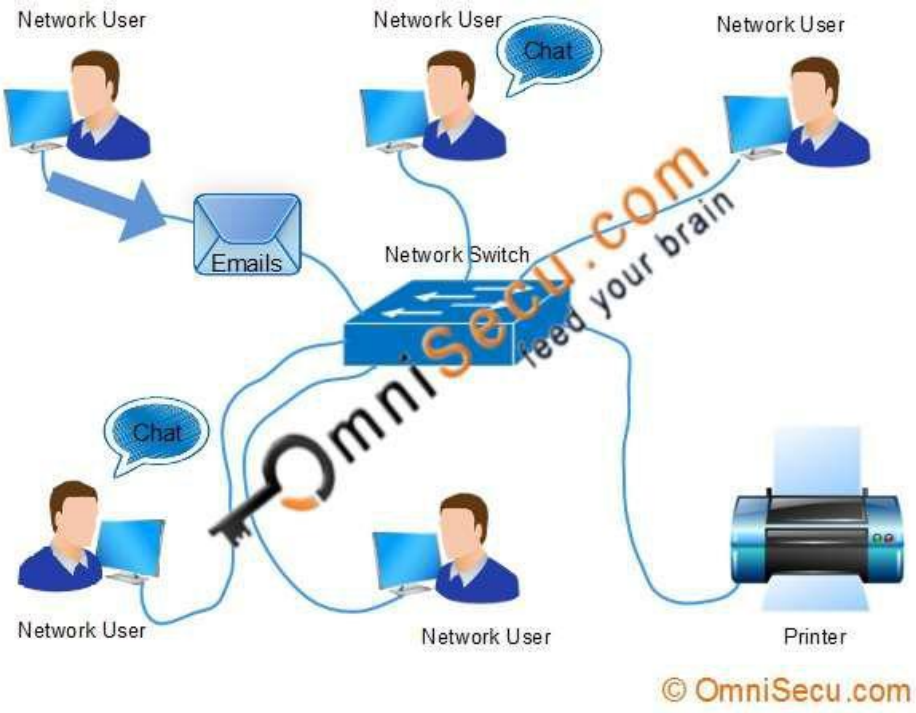
Hardware sharing: Users can share devices such as printers, scanners, CD-ROM drives, hard drives etc.

Without computer networks, device sharing is not possible.



Application sharing: Applications can be shared over the network, and this allows to implement client/server applications

User communication: Networks allow users to communicate using e-mail, newsgroups, and video conferencing etc.



Network gaming: A lot of network games are available, which allow multi-users to play from different locations.

Voice over IP (VoIP): Voice over Internet Protocol (IP) is a revolutionary change in telecommunication which allows to send telephone calls (voice data) using standard Internet Protocol (IP) rather than by traditional PSTN.

Applications of Computer Networks

These are network software applications that utilize the Internet or other network hardware infrastructure to perform useful functions for example file transfers within a network.

Uses of Computer Networks

Had it not been of high importance, nobody would have bothered connecting computers over a network. Let's start exploring the uses of Computer Networks with some traditional usecases at companies and for individuals and then move on to recent developments in the area of mobile users and home networking.

Business Applications

Resource Sharing: The goal is to make all programs, equipments, and especially data, available to anyone on the network without regard to the physical location of the resource and the user.

Server-Client model: One can imagine a company's information system as consisting of one or more databases and some number of employees who need to access them remotely. In this model, the data is stored on powerful computers called servers. Often these are centrally housed and maintained by a system administrator. In contrast, the employees have simple machines, called clients, on their desks, with which they access remote data.

Communication Medium: A computer network can provide a powerful communication medium among employees. Virtually every company that has two or more computers now has e-mail (electronic mail), which employees generally use for a great deal of daily communication

E-Commerce: A goal that is starting to become more important is doing business with consumers over the Internet. Airlines, bookstores and music vendors have discovered that many customers like the convenience of shopping from home. This sector is expected to grow quickly in the future. The most popular forms are listed in the below figure:

Tag and Full Name	Example
B2C - Business-to-Consumer	Ordering books on-line
B2B - Business-to-Business	Car manufacturer ordering tires from supplier
C2C - Consumer-to-Consumer	Auctioning second-hand products on line
G2C - Government-to-Consumer	Government distributing tax forms electronically
P2P - Peer-to-Peer	File sharing

Home Applications

Some of the most important uses of the Internet for home users are as follows:

Access to remote information

Person-to-person communication

Interactive entertainment

Electronic commerce

Mobile Users

Mobile computers, such as notebook computers and Mobile phones, are one of the fastest-growing segments of the computer industry. Although wireless networking and mobile computing are often related, they are not identical, as the below figure shows.

Wireless	Mlobile	Applications
No	No	Desktop computers in offices
No	Yes	A notebook computer used in a hotel room
Yes	No	Networks in older, unwired buildings
Yes	Yes	Portable office; PDA for store inventory

There are 2 types of network applications:-

1. **Pure network applications**
2. **Standalone network application**

(A) PURE NETWORK APPLICATIONS

These are applications created to be used in networks; using pure network applications on a single computer doesn't make sense. Such applications have a separate and distinct user interface that users must learn for instance:-

1. Email programs

They allow users to type messages at their local nodes and then send to someone on the network. It is a fast and easy way of transferring mail from one computer to another. Examples of electronic mail programs (Clients) are:-

Pegasus mail

Outlook express

Eudora Windows

mail Fox mail

Opera

Poco mail

Mozilla Thunderbird

Windows mail

2. File transfer protocol (FTP)

This application facilities transfer of files from one computer to another e.g. from a client to a server. There are 2 common processes involved in FTP

Downloading: - This is the process of obtaining files from a server to a workstation or a client (for example when you download programs and music from a server).

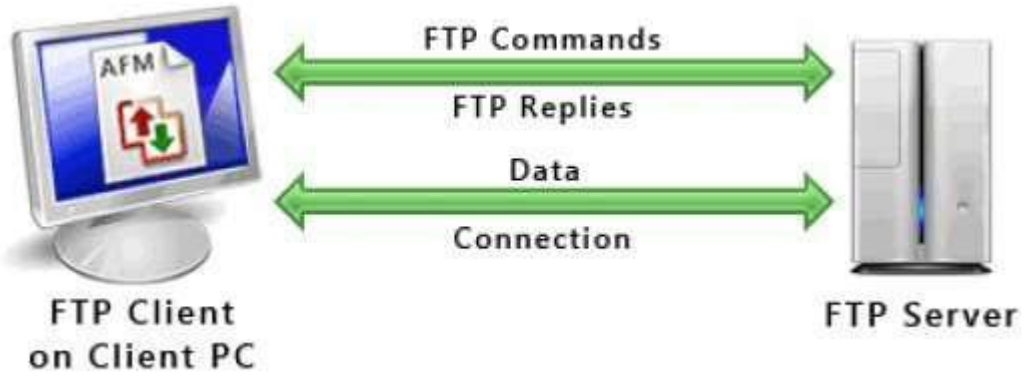
Uploading:- This is obtaining of files from a workstation to a server (for instance when you attach documents and upload them to a server, a good example being when you upload photos to Facebook).

Examples of FTP programs are:-

FTP in Unix

FTP in Linux or

FTP in Windows



File transfer protocol process

Mozilla thunderbird

3. Terminal emulation (TELNET)

It allows a workstation to access the server for an application program. This enables you to control the server and communicate with other servers on the network. The workstation appears as a down terminal that is directly attached to the server. The user feels like he/she is using the server directly. TELNETenables PCs and workstations to function as dumb terminals in sessions with hosts on inter-networks.

4. Groupware

These applications are used to automate the administration functions of a modern office for instance video conferencing and chatting. They facilitate the work of groups and improve on their productivity; they can be used to communicate, co-operate, coordinate, solve problems, compete, negotiate among others.

(i) Video Conferencing

This is the process of conducting a conference between two or more participants at different sites by using computer networks to transmit audio and video data. For example, a point-to-point (two-person) video conferencing system works much like a video telephone.

Each participant has a video camera, microphone, and speakers mounted on his or her computer. As the two participants speak to one another, their voices are carried over the network and delivered to the others speakers, and whatever images appear in front of the video camera appear in a window on the other participant's monitor.

*** Tandberg TTC6-08 Multisite Video Conferencing Unit w/ rackmounts ***
Current Bid: $89.99

(ii) Chatting

It is a real-time communication between two users via computer. Once a chat has been initiated, either user can enter text by typing on the keyboard and the entered text will appear on the other user's monitor. The two must be online for a chat to be initiated. Most networks, cybers and online services offer a chat feature which enables computer users to chat as they go on with their work.

(B) STAND ALONE APPLICATIONS

These are applications that run on stand alone computers (computers not connected to any other). In order to extend their activity, they are rebuild to run on network environments e.g. word processors, spreadsheets, database management systems, presentations graphics, project management etc. They function even when the computer is offline.

Basic computer network components

Computer networks share common devices, functions, and features including servers, clients, transmission media, shared data, shared printers and other hardware and software resources, network interface card(NIC), local operating system(LOS), and the network operating system(NOS).

Servers - Servers are computers that hold shared files, programs, and the network operating system. Servers provide access to network resources to all the users of the network. There are many different kinds of servers, and one server can provide several functions. For example, there are file servers, print servers, mail servers, communication servers, database servers, print servers, fax servers and web servers, to name a few.

Clients - Clients are computers that access and use the network and shared network resources. Client computers are basically the customers(users) of the network, as they request and receive services from the servers.

Transmission Media - Transmission media are the facilities used to interconnect computers in a network, such as twisted-pair wire, coaxial cable, and optical fiber cable. Transmission media are sometimes called channels, links or lines.

Shared data - Shared data are data that file servers provide to clients such as data files, printer access programs and e-mail.

Shared printers and other peripherals - Shared printers and peripherals are hardware resources provided to the users of the network by servers. Resources provided include data files, printers, software, or any other items used by clients on the network.

Network Interface Card - Each computer in a network has a special expansion card called a network interface card(NIC). The NIC prepares(formats) and sends data, receives data, and controls data flow between the computer and the network. On the transmit side, the NIC passes frames of data on to the physical layer, which transmits the data to the physical link. On the receiver's side, the NIC processes bits received from the physical layer and processes the message based on its contents.

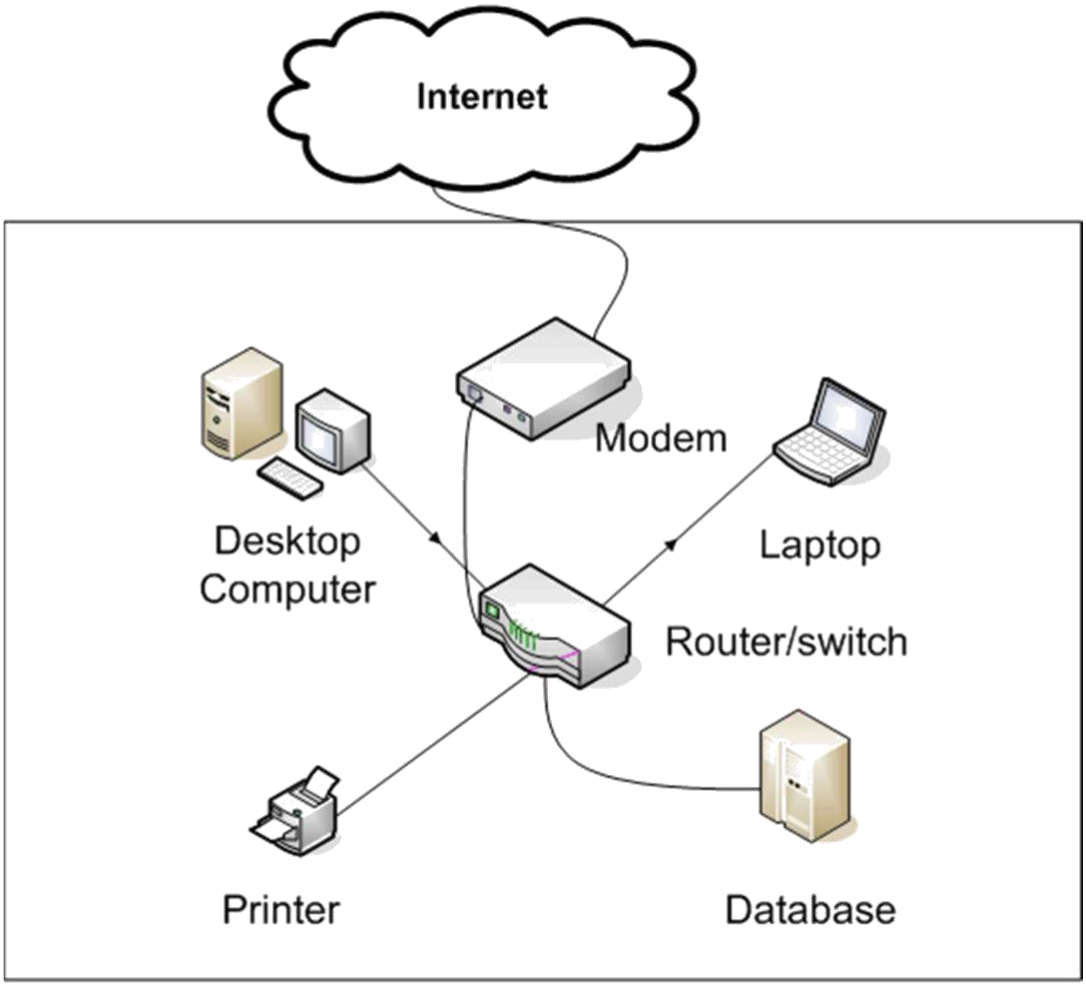
Local Operating System - A local operating system allows personal computers to access files, print to a local printer, and have and use one or more disk and CD drives that are located on the computer. Examples are MS-DOS, Unix, Linux, Windows 2000, Windows 98, Windows XP etc.

Network Operating System - The network operating system is a program that runs on computers and servers, and allows the computers to communicate over the network.

Hub - Hub is a device that splits a network connection into multiple computers. It is like a distribution center. When a computer request information from a network or a specific computer, it sends the request to the hub through a cable. The hub will receive the request and transmit it to the entire network. Each computer in the network should then figure out whether the broadcast data is for them or not.

Switch - Switch is a telecommunication device grouped as one of computer network components. Switch is like a Hub but built in with advanced features. It uses physical device addresses in each incoming messages so that it can deliver the message to the right destination or port.

Like Hub, switch don’t broadcast the received message to entire network, rather before sending it checks to which system or port should the message be sent. In other words switch connects the source and destination directly which increases the speed of the network. Both switch and hub have common features: Multiple RJ-45 ports, power supply and connection lights.



Question: What Are the Benefits of Networking?

Answer: The benefits of networking (either wired or wireless) in homes are:

file sharing - Network file sharing between computers gives you more flexibity than using floppy drives or Zip drives. Not only can you share photos, music files, and documents, you can also use a home network to save copies of all of your important data on a different computer.Backups are one of the most critical yet overlooked tasks in home networking.

printer / peripheral sharing - Once a home network is in place, it's easy to then set up all of the computers to share a single printer. No longer will you need to bounce from one system or another just to print out an email message. Other computer peripherals can be shared similarly such as network scanners, Web cams, and CD burners.

Internet connection sharing - Using a home network, multiple family members can access the Internet simultaneously without having to pay anISP for multiple accounts. You will notice the Internet connection slows down when several people share it, but broadband Internet can handle the extra load with little trouble. Sharing dial-up Internet connections works, too. Painfully slow sometimes, you will still appreciate having shared dial-up on those occasions you really need it.

multi-player games - Many popular home computer games support LAN mode where friends and family can play together, if they have their computers networked.

Internet telephone service - So-called Voice over IP (VoIP) services allow you to make and receive phone calls through your home network across the Internet, saving you money.

home entertainment - Newer home entertainment products such as digital video recorders (DVRs) and video game consoles now support either wired or wireless home networking. Having these products integrated into your network enables online Internet gaming, video sharing and other advanced features.

Although you can realize these same benefits with a wired home network, you should carefully consider building a wireless home network instead, for the following reasons:

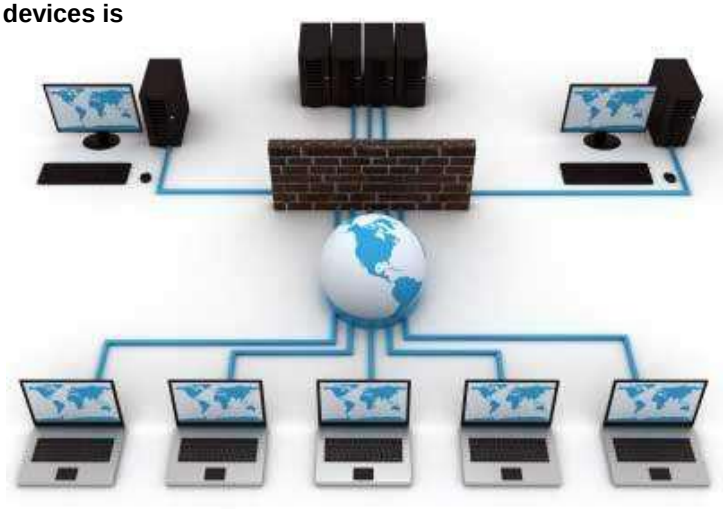
1. Computer mobility. Notebook computers and other portable devices are much affordable than they were a few years ago. With a mobile computer and wireless home network, you aren't chained to a network cord and can work on the couch, on your porch, or wherever in the house is most convenient at the moment.

2. No unsightly wires. Businesses can afford to lay cable under their floors or inside walls. But most of us don't have the time or inclination to fuss with this in our home. Unless you own one of the few newer homes pre-wired with network cable, you'll save substantial time and energy avoiding the cabling mess and going wireless.

3. Wireless is the future. Wireless technology is clearly the future of networking. In building a wireless home network, you'll learn about the technology and be able to teach your friends and relatives. You'll also be better prepared for future advances in network technology coming in the future.

Computer network

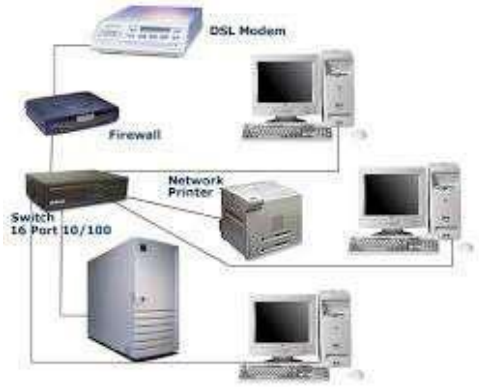
A computer network is a telecommunications network that allows computers to exchange data. The physical connection between networked computing devices is established using either cable media or wireless media. The best-known computer network is the Internet.



Network devices that originate, route and terminate the data are called network nodes.[1] Nodes can include hosts such as servers and personal computers, as well as networking hardware. Two devices are said to be networked when a process in one device is able to exchange information with a process in another device.

Computer networks support applications such as access to the World Wide Web, shared use of application and storage servers, printers, and fax machines, and use of email and instant messaging applications. The remainder of this article discusses local area network technologies and classifies them according to the

following characteristics: the physical media used to transmit signals, the communications protocols used to organize network traffic, along with the network's size, its topology and its organizational intent.



Types of computer networks:

A network is a group of two or more computer systems linked together. There are many types of computer networks, including:

local-area networks (LANs) :
wide-area networks (WANs) :
metropolitan-area networks MANs):
PAN

Local area network[

A local area network (LAN) is a network that connects computers and devices in a limited geographical area such as a home, school, office building, or closely positioned group of buildings. Each computer or device on the network is a node. Wired LANs are most likely based on Ethernettechnology. Newer standards such as ITU-T G.hn also provide a way to create a wired LAN using existing wiring, such as coaxial cables, telephone lines, and power lines.[11]

The defining characteristics of a LAN, in contrast to a wide area network (WAN), include higher data transfer rates, limited geographic range, and lack of reliance on leased lines to provide connectivity. Current Ethernet or other IEEE 802.3 LAN technologies operate at data transfer rates up to 10 Gbit/s. The [redacted] investigates the standardization of 40 and 100 Gbit/s rates. A LAN can be connected to a WAN using a router.

LAN looks like an acronym that a board of directors spent a lot of money and time trying to create, but it actually stands for any generic local area network. A network is a group of computers and other devices connected together so they can pass information back and forth

The local area network (LAN) is a network which is designed to operate over a small physical area such as an office, factory or a group of buildings. LANs are very widely used in a variety of applications.

- LANs are easy to design and troubleshoot. The personal computers and workstations in the offices are interconnected via LAN.
- The exchange of information and sharing of resources becomes easy because of LAN.

• **Local Area Network technology connects people and machines within a site.**

• **A LAN is a form of local (limited-distance), shared packet network for computer communications.**

• **In LAN all the machines are connected to a single cable. Different types of. Topologies such as Bus, Ring, Star, Tree etc. are used for LANs.**

• **LAN uses a layered architecture and they are capable of operating at hundreds of Mbits/sec.**

• **A local area network (LAN) is usually a privately owned and links the devices in a single office, building or campus of upto a few kilometers in size.**

• **Depending on the needs of an organization and the type of technology used, a LAN can be as simple as two personal computers and a printer in someone's office or home or it can extend throughout a company and include voice, sound and video peripherals.**

• **LAN s are widely used to allow resources to be shared between personal computers or workstations. The resources to be shared can be hardware like a printer or softwares or data.**

• **A common example of a LAN found in many business organizations, links a work group of task related computers, e.g. accounting and finance PCs, administrative PCs or engineering workstations.**

• **One of the computer in a network can become a server serving all the remaining computers called clients. Software can be stored on the server and it can be used by the remaining clients.**

• **In a LAN its size can be determined by licensing restrictions on the number of users per copy of software or by restricting the number of users licensed to access the operating system.**

• **LAN's are also distinguished from MAN's and WAN's based on the transmission media they use and topology. In general a given LAN will use only one type of transmission medium. The most common topologies used are bus, ring and star.**

• **The term LAN can also refer just to the hardware and software that allows you to connect all the devices together. In this sense, Local Talkis one kind of LAN, Ethernet is another. (AppleTalk is the protocol for Local Talk.)**

The data rates for LAN range from 4 to 16 Mbps with the maximum of 100 Mbps.

The components used by LANs can be divided into cabling standards, hardware, and protocols. Various LAN protocols are Ethernet, Token Ring: TCP/IP, 5MB, NetBIOS and NetBeui, IPX/SPX, Fiber Distributed Data Interchange (FDDI) and Asynchronous Transfer Mode (ATM).

LAN Applications and Benefits

LANs are used almost exclusively for data communications over relatively short distances such as within an office, office building or campus environment. LANs allow multiple workstations to snare access to multiple host computers, other workstations, printers and other peripherals, and connections to other networks. LANs are also being utilized for imaging applications, as well. They are also being used for video and voice communications, although currently on a very limited basis.

LAN applications include communications between the workstation and host computers, other workstations, and servers. The servers may allow sharing of resources. Resources could be information, data files, e-mail, voice mail, software, hardware (hard disk, printer, fax, etc.) and other networks.

LAN benefits include the fact that a high-speed transmission system can be shared among multiple devices in support of large number of active terminals and a large number of active applications in the form of a multi-user, multi-tasking computer network. LAN-connected workstations realize the benefit of decentralized access to very substantial centralized processors, perhaps in the form of mainframe host computer and storage capabilities (information repositories). Additionally, current technology allows multiple LANs to be inter-networked through the use of LAN switches, routers and the like.

Disadvantages of LANs include concern for security of files and accounts.

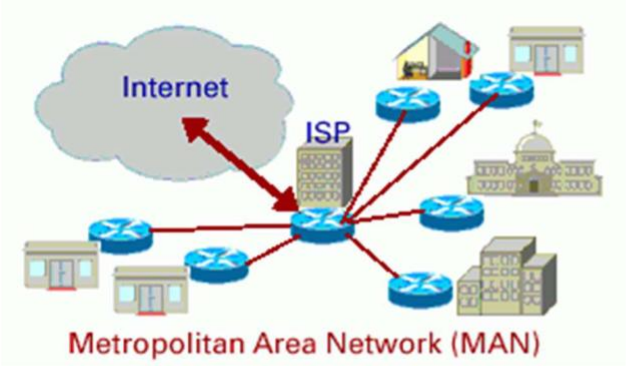
nd.

Metropolitan area network

A Metrop olitan area network (MAN) is a large computer network that usually spans a city or a large campus.

Metropolitan Area Network (MAN) covers larger geographic area such as cities or districts. By interconnecting smaller networks within a large geographic area, information is easily disseminated throughout the network. Local libraries and government agencies often use a MAN to connect to citizens and private industries. It may also connect MANs together within a larger area than LAN. The geographical limit of a MAN may span a city.

In MAN, different LANs are connected through a local telephone exchange. Some of the widely used protocols for MAN are RS-232, X.25, Frame Relay, Asynchronous Transfer Mode (ATM), ISDN (Integrated Services Digital Network), OC·3 lines (1.55 Mbps), ADSL (Asymmetrical Digital Subscriber Line) etc. These protocols are quite different from those used for LANs.



Definition, advantages and disadvantages of MAN

Posted by : sidiq zaenalWednesday, May 1, 2013

Definition MAN

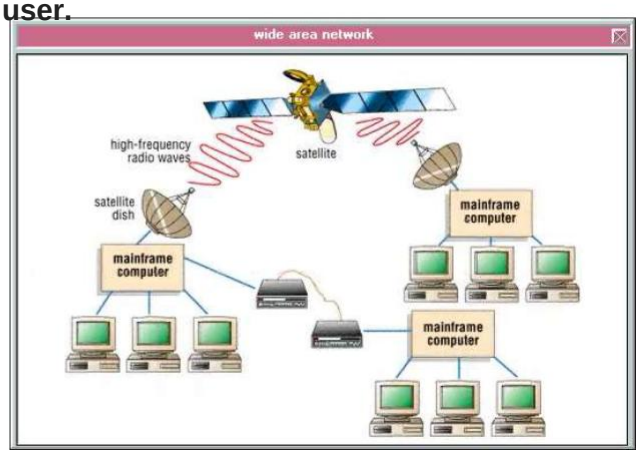
Metropolitan area network or shortened by MAN. A network in a city with high speed data transfer, which connects various locations such as campuses, offices, government, and so on. MAN network is a combination of several LANs. The MAN range of between 10 to 50 miles, this MAN is a network that tepaMetropolitan area network or shortened by MAN. A network in a city with high speed data transfer, which connects various locations such as campuses, offices, government, and so on. MAN network is a combination of several LANs. The MAN range of between 10 to 50 km, MAN this is the right network to establish a network between offices in the city between the factories / establishments and headquarters that are within his reach.

MAN advantages:

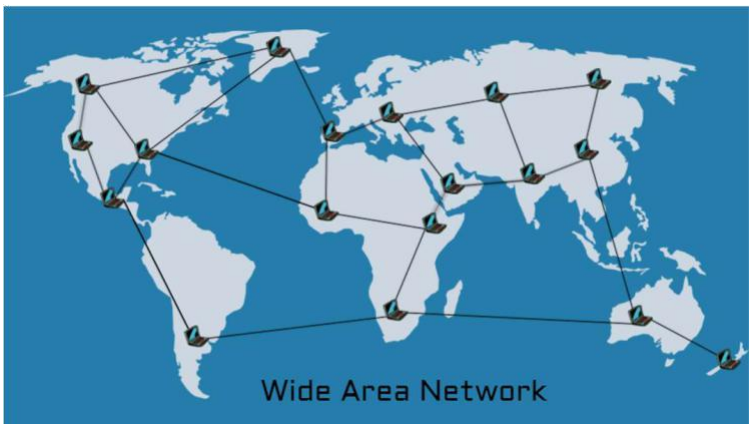
MAN can cover a wider area than a LAN. MAN networks are usually operated at airports, or a combination of several pieces at a local school. By running a large network connectedness, information can be disseminated more widely, rapidly and significantly. Public libraries and government agencies typically use a MAN.

Disadvantages MAN:

MAN will only apply if the personal computer or a terminal can compete. If a personal computer is used as a terminal, move the file (file transfer software) allows users to retrieve files (downloaded) from the hose or hose to deliver the data (upload). Download files means open and retrieve data from a personal computer to another and deliver the data to the computer pertaining requested by the user.



Wide area network[



A wide area network (WAN) is a computer network that covers a large geographic area such as a city, country, or spans even intercontinental distances. A WAN uses a communications channel that combines many types of media such as telephone lines, cables, and air waves. A WAN often makes use of transmission facilities provided by common carriers, such as telephone companies. WAN technologies generally function at the lower three layers of the OSI reference model: the physical layer, the data link layer, and the network layer

A Wide Area Network (WAN) is a network that covers a broad area (i.e., any telecommunications network that links across metropolitan, regional, or national boundaries) using private or public network transports. Business and government entities utilize WANs to relay data among employees, clients, buyers, and suppliers from various geographical locations. In essence, this mode of telecommunication allows a business to effectively carry out its daily function regardless of location. The Internet can be considered a WAN as well and is used by businesses, governments, organizations, and individuals for almost any purpose imaginable. Other types of networks include but are not limited to personal area networks (PANs), local area networks (LANs), campus area networks (CANs), and metropolitan area networks (MANs), which are usually limited to a room, building, campus, or specific metropolitan area respectively. The classical definition of a WAN is a computer network spanning regions, countries, or even the world. However, in terms of the application of computer networking protocols and concepts, it may be best to view WANs as computer networking technologies used to transmit data over long distances and between different LANs, MANs, and other localized computer networking architectures. This distinction stems from the fact that common LAN technologies operating at Layer 1/2, such as the forms of Ethernet or WiFi, are often geared towards physically localized networks and, thus, cannot transmit data over tens, hundreds, or even thousands of miles or kilometers. WANs necessarily do not just connect physically disparate LANs. A CAN, for example, may have a localized backbone of a WAN technology, which connects different LANs within a campus. This configuration could be to facilitate higher bandwidth applications or to provide better functionality for users in the CAN. WANs are used to connect LANs and other types of networks together so that users and computers in one location can communicate with users and computers in other locations. Many WANs are built for one particular organization and are private. Others, built by Internet service providers, provide connections from an

organization's LAN to the Internet. WANs are often built using leased lines. At each end of the leased line, a router connects the LAN on one side with a second router within the LAN on the other side. Leased lines can be very expensive. Instead of using leased lines, WANs can also be built using less costly circuit switching or packet switching methods.

The following is a list of the commonly used techniques for building WAN:

ATM: a dedicated-connection switching technology that organizes digital data into 53-byte cell units; Frame Relay (FR): a high-speed packet-switched data communications service, similar to X.25; SONET/SDH: Synchronous Optical Network is an international standard for high speed communication over fiber-optic networks. The SONET establishes Optical Carrier (OC) levels from 51.8 Mbps to 10 Gbps (OC-192) or even higher. Synchronous Digital Hierarchy (SDH) is a European equivalent of SONET; X.25: the X.25 protocol allows computers on different public networks to communicate through an intermediary computer at the network layer level; PPP: a point-to-point link provides a single, pre-established WAN communications path from the customer premises through a carrier network, such as a telephone company, to a remote network. Point-to-point lines are usually leased from a carrier and, thus, are often called leased lines. Recently, with the proliferation of the low cost of Internet connectivity, many companies and organizations have turned to VPN to interconnect their networks, creating a WAN in that way.

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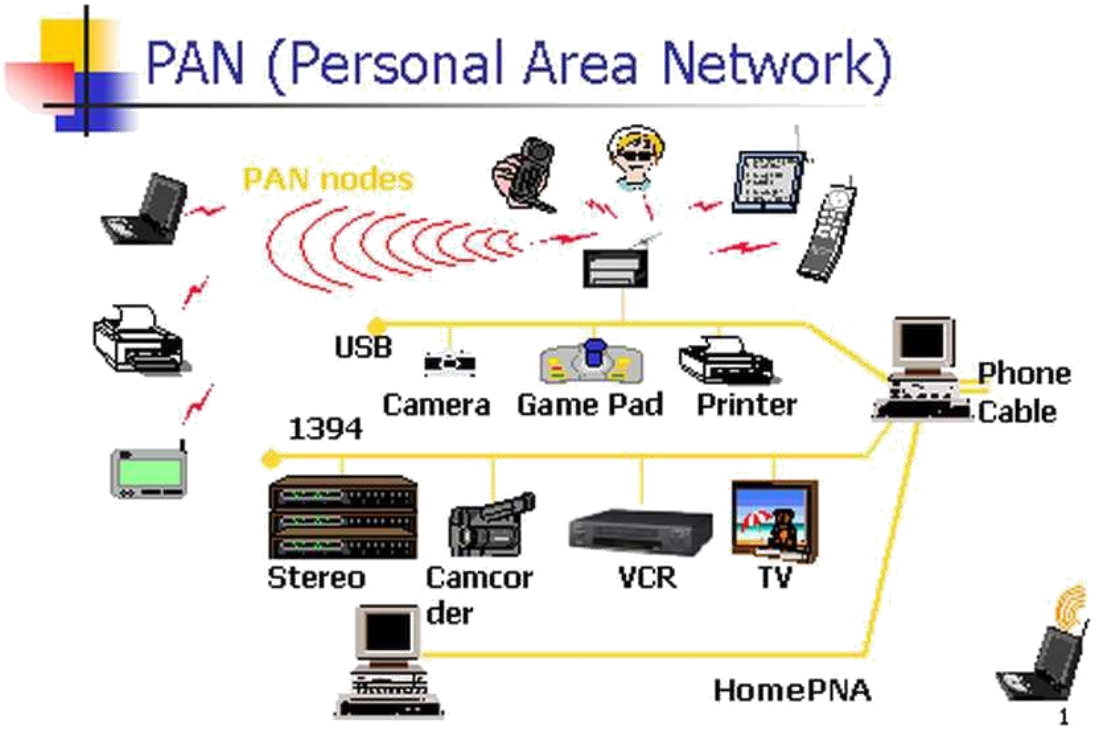
PAN:

Definition: A personal area network - PAN - is a computer network organized around an individual person. Personal area networks typically involve a mobile computer, a cell phone and/or a handheld computing device such as a PDA. You can use these networks to transfer files including email and calendar appointments, digital photos and music.



A campus network, campus area network, corporate area network or CAN is a computer network made up of an interconnection of local area networks (LANs) within a limited geographical area.[1][2] The networking equipments (switches, routers) and transmission media (optical fiber, copper plant, Cat5 cabling etc.) are almost entirely owned by the campus tenant / owner: an enterprise, university, government etc.[3]

Personal Area Networks

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- Infrared
- Radio networks

What issues should I consider when buying WPAN equipment?
What are the implementation issues for Personal Area Networks?
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What is a Personal Area Network?

A personal area network (PAN) could be thought of as the interconnection of devices within the range of an individual person and nowadays typically uses wireless technology (WPAN). Devices are normally within 1-10m range of each other although some WPAN technologies are limited to a range of ~10cm or indeed, with higher power output, a range of 100 meters or more. WPANs are highly mobile and also designed to be quick and simple to set up. Thus, associated WPAN devices are usually small and relatively light.

Whilst PANs can use wired technologies this technical paper focuses on WPANs as most development work in this field is for WPAN technologies.

Differences between WPANs and WLANs

The goal for WPANs is replacing wires between objects that are close to each other and have a short range. Wireless Local Area Networks (WLANs) are used as wireless replacements for traditional Ethernet type networks and currently have a greater data rate and range than most WPANs. Whilst WLANs are often associated with portable devices such as laptops this type of network is often not considered to be as portable as WPANs.

Ideally, WPANs should complement WLANs but there is inevitably some overlap in the technologies. For example, Bluetooth devices can be purchased that can form a WPAN with other devices that are located within a few metres or connected to a WLAN from distances up to 100m.

What WPAN devices are there?

There are many devices currently on the market that have a WPAN technology built in to them. PDAs, mobile phones and laptops can all be bought that have inbuilt WPAN technology (usually Bluetooth or Infra-red). In addition, it is possible to buy wired equipment that enables devices without inbuilt WPAN technologies to join a WPAN.

Where and how can WPANs be used in education?

One of the common features of WPANs is that they aim to make creating a network easy to do. Thus, WPANs often mean immediate deployment of a dynamic network.

Examples of how WPANs can be useful within an educational setting include:

- **exchanging information directly between PDAs**
- **synchronising files between a desktop PC and a PDA**
- **connecting a keyboard or mouse wirelessly to a desktop computer**
- **printing a document using a WPAN enabled printer and laptop**
- **connecting a WPAN enabled mobile phone to a laptop to use the Internet via GSM/GPRS whilst doing fieldwork.**
- **dynamic network creation for group work using WPAN enabled devices.**

What are the advantages and disadvantages of Wireless Personal Area Networks?

WPANs have a number of key advantages when used in an educational environment:

dynamic network setup

usually quick and relatively simple to set up

WPAN enabled devices are usually portable

typically need less technical skills to deploy than LANs or WLANs.

General (rather than specific to educational use) disadvantages of WPANs include:

typically have a limited range

currently limited to relatively slow data rates when compared with WLAN technologies

compatibility and interoperability issues; WPAN technologies are not usually compatible with each other. Some WPAN technologies such as Bluetooth are known to have had interoperability issues between devices from different manufacturers.

as small devices that are often associated with WPANs often have limited potential for adding extra hardware it is sometimes difficult to find suitable upgrade equipment.

devices with inbuilt WPAN technologies can be considerably more expensive than devices without WPAN technologies.

What types of Wireless Personal Area Networks are currently available?

Infrared

Infrared technology is probably the best known and most mature WPAN technology. Communication takes place between two devices that are in line of site of each other. This means that if an object obstructs the infrared path between the two devices the network link will fail. Thus, infrared technology is unsuitable for WPAN use unless both devices can be placed close together and kept relatively static. Whilst infrared technology has drawbacks it does have several advantages including:

a relatively high data rate when compared to other WPAN technologies (currently up to 4Mbps)

being free from interference from radio

technologies being cheap to install in devices

a lack of complicated addressing issues between devices.

Gartner analysts suggest that this technology will continue to be built into many laptops in the near future because its data rates exceeds other WPAN technologies, has low power requirements and is low-cost for suppliers to implement.

Infrared technology can be found in a range of devices including PDAs, mobile phones, laptops and remote controls.

Radio networks

HomeRF (home radio frequency): Whilst HomeRF technology can still be found in such devices as keyboards, future development work on HomeRF products has now stopped and thus it is unlikely that devices with this technology will feature strongly in future WPANs.

Bluetooth: Bluetooth is a short range wireless technology endorsed by major technology companies and has now been accepted as the IEEE 802.15.1 standard. Bluetooth utilises the 2.45GHz radio band (the same as 802.11b/g) and supports data rates of up to 780Kbps. This technology was originally designed for short range wireless connectivity between two devices replacing traditional wired solutions and unlike infrared there doesn't have to be a clear line of sight between Bluetooth devices. Although wirelessly

connecting two devices over a short distance (up to 1-10 metres) is the most common use for Bluetooth the range of networking options with Bluetooth is now wider. Options include using Bluetooth in the same way as WLANs are used over a distance of up to 100 metres (although data rates of Bluetooth are significantly lower (~780Kbps)).

Not all Bluetooth devices have the same functionality implemented which can lead to confusion. The functionality of Bluetooth is defined by the Bluetooth profiles that have been included with a particular device. All Bluetooth devices have a minimum set of functionality that will allow them to locate another Bluetooth device but to use Bluetooth as part of a larger network for example, certain additional profiles are required. For example, to gain access to the education institution's LAN via Bluetooth a Bluetooth Access Point and Bluetooth device such as a laptop would need the LAN profile to be included in both Bluetooth devices. Forming a network between three or more laptops would require the PAN profile to be built into each device.

There are currently many Bluetooth enabled devices available including mobile phones, laptops, PDAs and headsets but due to interoperability issues and confusion in terms of usability the Bluetooth logo should not currently be seen as a guarantee of usability or interoperability.

What issues should I consider when buying WPAN equipment?

Most WPAN equipment is preinstalled in computing devices although it is possible to buy additional equipment to add WPAN functionality to an existing desktop computer.

What do you want to use it for? Be realistic about the capabilities of the network. Remember that in most instances WPANs have limited range and limited data rates.

Is it easy to set up a WPAN on your chosen device? It is worth experimenting with several devices and WPAN technologies to see if one device or technology is easier to use than another. There is often bespoke software packaged with devices that makes WPAN set up easier.

Even if a WPAN is established this doesn't necessarily mean that two devices can exchange user data. A WPAN can be established between two or more devices but it may still not be possible for a user to exchange data with a device if a different operating system is being used as the data being sent may not be understood by the receiving device. This is a similar problem to exchanging data between two desktop computers with different operating systems. In some cases such as when establishing links between a mobile phone and a PDA with different operating systems, software is packaged with one of the WPAN devices to enable exchanging user data.

Are the implementations of the WPANs in each device compatible? As mentioned above, there are several WPAN technologies available (and in future this is likely to increase) but currently none of these are compatible with each other. This means that for two WPAN enabled devices the WPAN technology in both devices has to be the same. In addition, Bluetooth devices need to be checked before procurement to verify that they have the functionality implemented in both devices (in the form of Bluetooth profile implementation) to form the type of WPAN required.

What is the effect on battery life of devices when WPANs are enabled? This may depend on the type of WPAN technology chosen and whether the technology is set to actively looking for devices or has been set to only search or receive a connection upon user request. If a considerable amount of time is spent exchanging data using a current WPAN technology a user should expect battery life of a device to be significantly reduced. The suggested battery life on the respective device literature may not give a realistic indication of battery life for how you intend to use the device as part of a WPAN.

Does the device currently owned provide the WPAN connectivity required or is supplementary hardware needed? If additional hardware is needed ensure that it is compatible with your current device

Is the cost of additional equipment within your budget? Additional hardware for current WPANs is relatively expensive especially for PDA type devices. For example, Bluetooth SD adapters currently typically cost £75-100.

What are the implementation issues for Personal Area Networks?

It is important to be clear and realistic about the tasks and types of use for which WPANs are appropriate and those for which they are not.

How easy is it to establish a network? In the case of infrared, sending data from one device to the next usually requires the user to set the device to allow incoming infrared beam requests. (If this setting is turned off then the device will not be available to receive data.) Once another device comes in range of a network and attempts to send data a network is established.

In the case of Bluetooth, a device is set so that it actively tries to discover other Bluetooth devices or is set to a mode that allows itself to be discovered by all other Bluetooth devices or chosen devices (this depends on the manufacturer of the device though). Some manufacturers have a third setting that allows a Bluetooth device to seamlessly connect to a chosen second Bluetooth device. For example a user with a Bluetooth mobile phone with Bluetooth headset could define that his headset should always be allowed to connect to his mobile phone once it becomes in range. A network is established when a device that is seeking another device locates another Bluetooth device.

In both WPAN technologies, once a network is established a receiving device normally has to wait for the user to actively accept incoming data before it can be viewed or stored.

Although there are many different scenarios for WPANs there are currently three main different uses that are worth outlining:

Synchronising with a desktop or portable computer: In this instance, data such as emails, calendar details and work notes are synchronised between a portable device, typically a PDA, and a desktop computer. Infrared technology has been in use for several years to form a WPAN to synchronise data but it is now possible to purchase devices that use Bluetooth technology to carry out this task. Both devices (the desktop computer and portable device) must use the same WPAN technology in order to synchronise data and in most cases software is packaged with a PDA or mobile phone that aids the synchronisation process.

Connecting two devices to exchange data: In this instance, two devices can exchange data dynamically rather than synchronising specified data as in the example above. There are several implementation issues that need to be considered.

How much data needs to be exchanged? Current WPAN technologies are suitable for transferring smaller files. Thus, large files may be better transferred between devices using a wired PAN technology. If there are multiple devices using the same WPAN as can be the case with Bluetooth, data rates are contended between the devices.

Are the devices stationary? If one or more of the devices are not stationary, it is unlikely that infrared technology is suitable to use for a WPAN as it would be difficult to achieve a constant line of sight between the infrared ports of the devices. Thus, another WPAN technology such as Bluetooth needs to be used.

Are the operating systems compatible? As mentioned above, whilst a network connection may well be able to be set up between two devices, exchanging devices between them may be hampered if the operating systems are not the same. Devices normally require additional software in order to exchange information between two devices using different operating systems.

In future there will be WPAN technologies that automatically set a WPAN up as soon as two enabled devices come within range of each other.

Using WPAN features to connect a device to the internet: This is another common use for WPAN especially amongst those people who spend time away from their fixed network connection point. A connection to the internet is made by a WPAN device (normally a mobile phone) via GSM/GPRS. A WPAN is then formed from this device to another Bluetooth enabled device such as a laptop. In this way the user can use the laptop to wirelessly gain access to the internet.

What are the standards issues relating to WPANs and how might WPANs develop in future?

As with many areas of technology, the area of WPAN standards is quite complex. As one of the important issues for WPAN technologies concerns compatibility between devices, current WPAN technologies all have a related recognised standard and there is no reason to believe that in general, this relationship between standards and technologies will not continue in the future.

One of the main standards bodies for WPAN technologies is the IEEE (Institute of Electrical and Electronic Engineers). This is the same body that governs the 802.11(Wifi) standards. WPAN technology standards governed by the IEEE come under the 802.15 umbrella.

IEEE 802.15.1 and Bluetooth: The 802.15.1 WPAN standard is based on Bluetooth version 1.1 specifications. Whilst Bluetooth devices that are currently available are most likely to be v1.1, the Bluetooth standards' body has pushed ahead of the 802.15.1 standard and developed a specification that should see devices being developed that offer data rates of ~10Mbps. Whilst the maximum range of Bluetooth v2.0 devices (currently 10-100m) is still being discussed the greater data rates means that Bluetooth is likely to be used both as a WPAN technology and as a WLAN technology that competes with 802.11b WLANs. Whether Bluetooth version 2.0 will also be ratified under the 802.15 standard is unclear.

IEEE 802.15.2: A standard looking at recommended practices for coexistence between WPANs and WLANs(802.11). This standard is yet to be ratified.

IEEE 802.15.3: The 802.15.3 working group has been tasked with developing a high data rate (up to 55Mbps) WPAN technology capable of handling multimedia content. This technology has been designed to offer quality of service meaning that data such as video should be delivered between devices with no break down in quality of picture. This draft standard is yet to be ratified and as such no devices with 802.15.3 connectivity are currently available.

IEEE 802.15.3a and Ultra Wide Band (UWB): UWB is being considered by the IEEE as the 802.15.3a standard. This technology is a short range technology (up to 10m) with high data rates (planned data rates of ~400Mbps) for applications which involve imaging and multimedia. Unfortunately, at the time of writing, it appears that two separate UWB implementations may appear as rivals in the market place leading to potential interoperability issues.

IEEE 802.15.4 and Zigbee: The Zigbee standard has now been endorsed by the IEEE as the official 802.15.4 standard. This is a further WPAN technology developed by an alliance of companies with the aim of producing a low power consumption and low cost WPAN technology that could be included in a range of low data rate devices such as mouse, keyboard, joystick and educational games platforms. The data transfer rates of Zigbee depends on the frequency used (250Kbps at 2.4GHz, 40Kbps at 915MHz and 20Kbps at 868MHz) and the range of Zigbee can be up to 75 metres depending on a number of factors including the power used.

Analysts suggest that Zigbee will be included in devices in 2004 especially in such areas as computer mice, keyboards and headphones. At the time of writing though, no consumer devices with Zigbee included are commercially available.

Infrared: The Infrared Data Association (IrDA) ratify the standards regarding infrared technologies. There are too many standards to mention in this paper but all are available from http://www.irda.org/standards/specifications.asp.

Near Field Communication: Near Field Communication (NFC) technology is a WPAN technology being developed jointly by Philips and Sony. This technology differs from current WPAN technologies in that a network is established merely by bringing two NFC enabled devices close together (up to a range of 20cm).

NFC devices will operate in an active or passive mode. Passive mode enables a powerless NFC device such as a smart card to communicate with a powered device such as a PDA. This mode will also allow accessing of data when one of the NFC enabled devices is turned off.

Data rates of NFC are relatively slow when compared with other WPANs technologies (106Kbps, 212Kbps or 424Kbps) but it is anticipated that this technology will not primarily be used for large file transfers. Possible future educational usage could be in transferring data from a PDA to a personalised smart card or storage device or accessing and saving a timetable or homework requirement by holding a NFC enabled device next to a NFC enabled data sheet.

At the time of writing, no NFC products are commercially available.

CAN(Controling Area network)

1. CAN History

Bosch originally developed the Controller Area Network (CAN) in 1985 for in-vehicle networks. In the past, automotive manufacturers connected electronic devices in vehicles using point-to-point wiring systems. Manufacturers began using more and more electronics in vehicles, which resulted in bulky wire harnesses that were heavy and expensive. They then replaced dedicated wiring with in-vehicle networks, which reduced wiring cost, complexity, and weight. CAN, a high-integrity serial bus system for networking intelligent devices, emerged as the standard in-vehicle network. The automotive industry quickly adopted CAN and, in 1993, it became the international standard known as ISO 11898. Since 1994, several higher-level protocols have been standardized on CAN, such as CANopen and DeviceNet. Other markets have widely adopted these additional protocols, which are now standards for industrial communications. This white paper focuses on CAN as an in-vehicle network.

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2. CAN Benefits

Low-Cost, Lightweight Network
CAN provides an inexpensive, durable network that helps multiple CAN devices communicate with one another. An advantage to this is that electronic control units (ECUs) can have a single CAN interface rather than analog and digital inputs to every device in the system. This decreases overall cost and weight in automobiles.

Broadcast Communication
Each of the devices on the network has a CAN controller chip and is therefore intelligent. All devices on the network see all transmitted messages. Each device can decide if a message is relevant or if it should be filtered. This structure allows modifications to CAN networks with minimal impact. Additional non-transmitting nodes can be added without modification to the network.

Priority
Every message has a priority, so if two nodes try to send messages simultaneously, the one with the higher priority gets transmitted and the one with the lower priority gets postponed. This arbitration is non-destructive and results in non-interrupted transmission of the highest priority message. This also allows networks to meet deterministic timing constraints.

Error Capabilities
The CAN specification includes a Cyclic Redundancy Code (CRC) to perform error checking on each frame's contents. Frames with errors are disregarded by all nodes, and an error frame can be transmitted to signal the error to the network. Global and local errors are differentiated by the controller, and if too many errors are detected, individual nodes can stop transmitting errors or disconnect itself from the network completely.

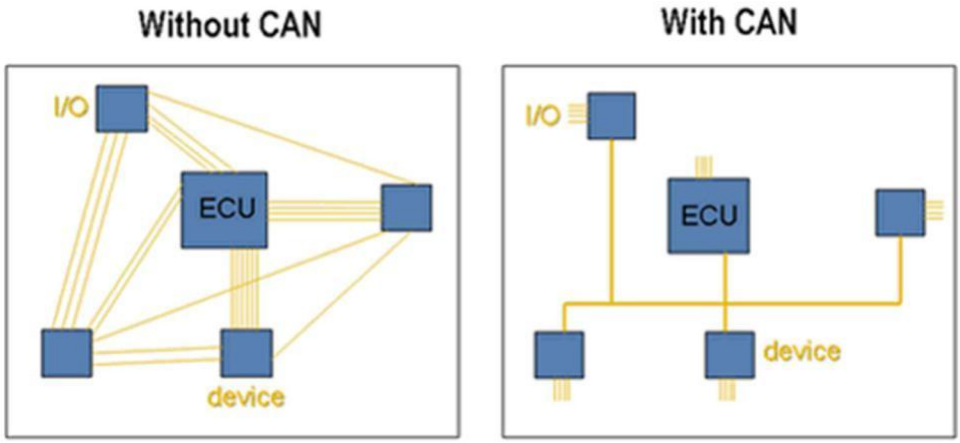

Figure 1. CAN networks significantly reduce wiring.

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3. CAN Applications

CAN was first created for automotive use, so its most common application is in-vehicle electronic networking. However, as other industries have realized the dependability and advantages of CAN over the past 20 years, they have adopted the bus for a wide variety of applications. Railway applications such as streetcars, trams, undergrounds, light railways, and long-distance trains incorporate CAN. You can find CAN on different levels of the multiple networks within these vehicles – for example, in linking the door units or brake controllers, passenger counting units, and more. CAN also has applications in aircraft with flight-state sensors, navigation systems, and research PCs in the cockpit. In addition, you can find CAN buses in many aerospace applications, ranging from in-flight data analysis to aircraft engine control systems such as fuel systems, pumps, and linear actuators.

Medical equipment manufacturers use CAN as an embedded network in medical devices. In fact, some hospitals use CAN to manage complete operating rooms. Hospitals control operating room components such as lights, tables, cameras, X-ray machines, and patient beds with CAN-based systems. Lifts and escalators use embedded CAN networks, and hospitals use the CANopen protocol to link lift devices, such as panels, controllers, doors, and light barriers, to each other and control them. CANopen also is used in nonindustrial applications such as laboratory equipment, sports cameras, telescopes, automatic doors, and even coffee machines.

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4. CAN Physical Layers

CAN has several different physical layers you can use. These physical layers classify certain aspects of the CAN network, such as electrical levels, signaling schemes, cable impedance, maximum baud rates, and more. The most common and widely used physical layers are described below:

High-Speed/FD CAN

High-speed CAN is by far the most common physical layer. High-speed CAN networks are implemented with two wires and allow communication at transfer rates up to 1 Mbit/s. Other names for high-speed CAN include CAN C and ISO 11898-2. Typical high-speed CAN devices include antilock brake systems, engine control modules, and emissions systems. CAN with Flexible Data-Rate (CAN FD) is the next generation of high-speed CAN communication with evolving standards for higher data rates. NI has enabled speeds up to 8 Mbit/s using the TJA1041 and TJA1043 transceivers through the NI-XNET driver. As transceiver vendors complete qualifications for CAN FD speeds, NI will update our documentation as necessary.

Low-Speed/Fault-Tolerant CAN Hardware

Low-speed/fault-tolerant CAN networks are also implemented with two wires, can communicate with devices at rates up to 125 kbit/s, and offer transceivers with fault-tolerant capabilities. Other names for low-speed/fault-tolerant CAN include CAN B and ISO 11898-3. Typical low-speed/fault-tolerant devices in an automobile include comfort devices. Wires that have to pass through the door of a vehicle are low-speed/fault-tolerant in light of the stress that is inherent to opening and closing a door. Also, in situations where an advanced level of security is desired, such as with brake lights, low-speed/fault-tolerant CAN offers a solution.

Single-Wire CAN Hardware

Single-wire CAN interfaces can communicate with devices at rates up to 33.3 kbit/s (88.3 kbit/s in high-speed mode). Other names for single-wire CAN include SAE-J2411, CAN A, and GMLAN. Typical single-wire devices within an automobile do not require high performance. Common applications include comfort devices such as seat and mirror adjusters.

Software-Selectable CAN Hardware

With National Instruments CAN hardware products, you can configure the software-selectable CAN interfaces to use any of the onboard transceivers (high-speed, low-speed/fault-tolerant, or single-wire CAN). Multiple-transceiver hardware offers the perfect solution for applications that require a combination of communications standards. With software-selectable CAN hardware, you also can choose your own external CAN transceiver.

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5. CAN Terminology

CAN devices send data across the CAN network in packets called frames. A CAN frame consists of the following sections.

> CAN Frame -- an entire CAN transmission: arbitration ID, data bytes, acknowledge bit, and so on. Frames also are referred to asmessages.

Figure 2. The standard CAN frame format.

SOF (start-of-frame) bit – indicates the beginning of a message with a dominant (logic 0) bit.

Arbitration ID – identifies the message and indicates the message's priority. Frames come in two formats -- standard, which uses an 11-bit arbitration ID, and extended, which uses a 29-bit arbitration ID.

IDE (identifier extension) bit – allows differentiation between standard and extended frames.

RTR (remote transmission request) bit – serves to differentiate a remote frame from a data frame. A dominant (logic 0) RTR bit indicates a data frame. A recessive (logic 1) RTR bit indicates a remote frame.

DLC (data length code) – indicates the number of bytes the data field

contains. Data Field – contains 0 to 8 bytes of data.

CRC (cyclic redundancy check) – contains 15-bit cyclic redundancy check code and a recessive delimiter bit. The CRC field is used for error detection.

ACK (ACKnowledgement) slot – any CAN controller that correctly receives the message sends an ACK bit at the end of the message. The transmitting node checks for the presence of the ACK bit on the bus and reattempts transmission if no acknowledge is detected. National Instruments Series 2 CAN interfaces have the capability of listen-only mode. Herein, the transmission of an ACK bit by the monitoring hardware is suppressed to prevent it from affecting the behavior of the bus.

CAN Signal – an individual piece of data contained within the CAN frame data field. You also can refer to CAN signals aschannels. Because the data field can contain up to 8 bytes of data, a single CAN frame can contain 0 to 64 individual signals (for 64 channels, they would all be binary).

In the following image, there are six channels contained in the data field of a single CAN frame. Each signal contains 8 bits of data.

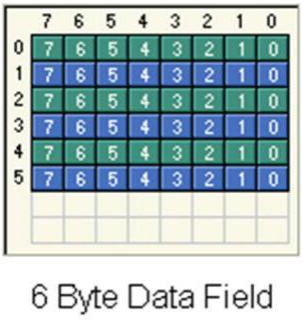

Figure 3. Signals can be defined as a certain number of bits inside of a CAN frame.

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6. CAN Database Files

CAN database files are text files that contain scaling information for CAN frames and signal definitions. National Instruments NI-XNET database editor software recognizes FIBEX database files (.xml), Vector database files (*.dbc), and National Instruments CAN database files (*.ncd).

For each signal, CAN databases define rules for conversion to engineering units. The following data is stored in databases:

Channel name

Location (start bit) and size (number of bits) of the channel within a given

message Byte order (Intel/Motorola)

- Data type (signed, unsigned, and IEEE float) Scaling and units string
- Range
- Default value
- Comment

You can use this information to easily convert the "raw" frame information (usually bytes) to a "real world" value. The picture below illustrates an example of this conversion.

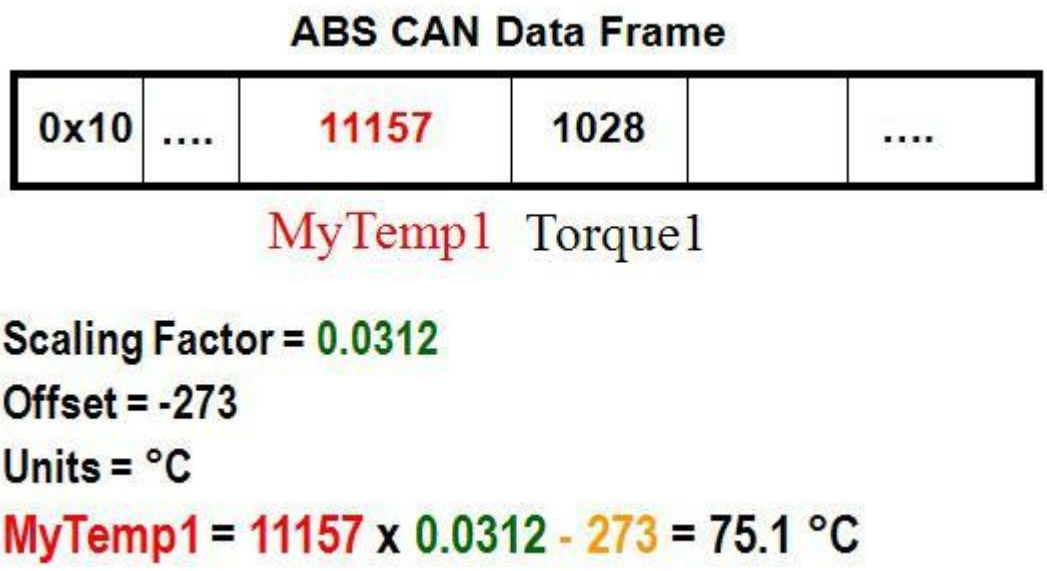

Figure 4. All of the necessary scaling data is contained in a database for converting frames to signals.

CAN database files may contain frame and signal definitions for an entire vehicle. Every network has its own unique database file. Additionally, these database files are vendor-specific and usually confidential.

By using a database file for many frames on the CAN network, many CAN APIs (like NI-XNET) can automatically convert the frame information directly to a real-world value. This simplifies application development because you never need to worry about the raw frame values.

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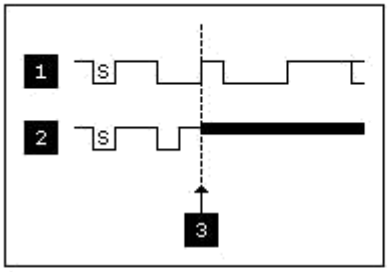
7. How CAN Communication Works

As stated earlier, CAN is a peer-to-peer network. This means that there is no master that controls when individual nodes have access to read and write data on the CAN bus. When a CAN node is ready to transmit data, it checks to see if the bus is busy and then simply writes a CAN frame onto the network. The CAN frames that are transmitted do not contain addresses of either the transmitting node or any of the intended receiving node(s). Instead, an arbitration ID that is unique throughout the network labels the frame. All nodes on the CAN network receive the CAN frame, and, depending on the arbitration ID of that transmitted frame, each CAN node on the network decides whether to accept the frame.

If multiple nodes try to transmit a message onto the CAN bus at the same time, the node with the highest priority (lowest arbitration ID) automatically gets bus access. Lower-priority nodes must wait until the bus becomes available before trying to transmit again. In this way, you can implement CAN networks to ensure deterministic communication among CAN nodes.



1 Device A: ID = 11001000111 (647 hex)
2 Device B: ID = 11011111111 (6FF hex)
3 Device B Loses Arbitration; Device A Wins Arbitration and Proceeds
S = Start Frame Bit

Figure 5. CAN contains built in priority for messages to avoid conflicts.

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8. National Instruments CAN Tools

National Instruments provides a variety of hardware and software tools for CAN application development. NI offers CAN interfaces for different platforms including PCI, PXI, USB, PCMCIA, NI CompactRIO, and NI CompactDAQ. For PCI, PXI, NI CompactDAQ, NI CompactRIO, and PCMCIA, you can choose from high-speed/FD, low-speed/fault-tolerant, and single-wire physical layers. For PCI and PXI, National Instruments provides the industry's first software-selectable CAN interface that contains a high-speed/FD, low-speed/fault-tolerant, and single-wire transceiver on each board, for each port, on a single device. This means you can simply select in your software which mode you want to use.

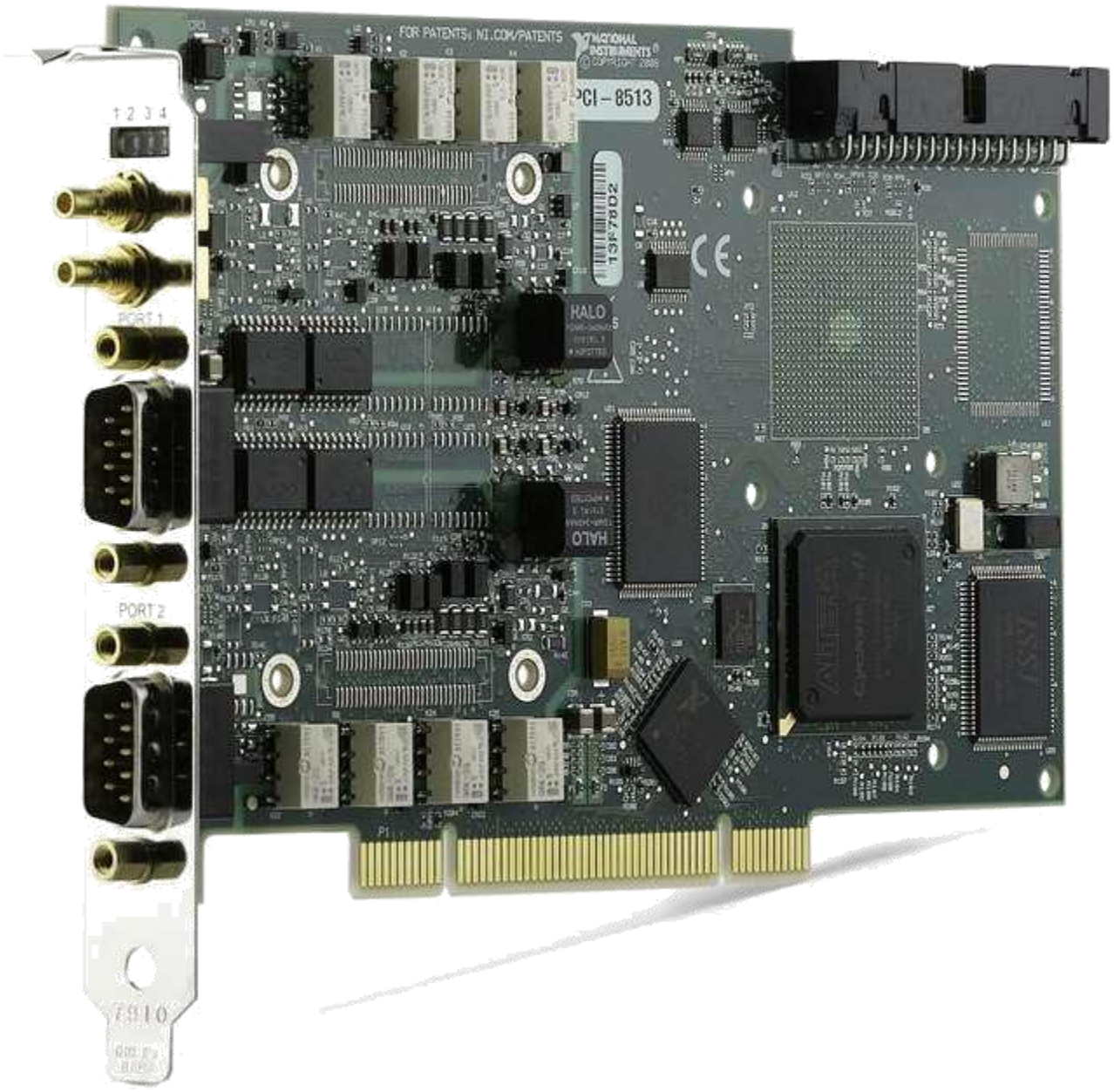


Figure 6. NI PCI-8513 Software-Selectable (XS) CAN Device

In addition, NI ships each of these devices with the appropriate driver software. NI CAN interface driver software is described below.

The National Instruments ECU Measurement and Calibration Toolkit extends the NI LabVIEW, NI LabWindows™/CVI, and C/C++ development environments to support measurement and calibration applications for the design and validation of electronic control units (ECUs). The ECU Measurement and Calibration Toolkit provides high-level, easy-to-use functions based on the CAN Calibration Protocol (CCP) that ECU designers, testers, and engineers can use to build their own customized measurement and calibration applications.

peer-to-peer communications:

Peer-to-peer is a communications model in which each party has the same capabilities and either party can initiate a communication session. Other models with which it might be contrasted include the client/server model and the master/slave model. In some cases, peer-to-peer communications is implemented by giving each communication node both server and client capabilities. In recent usage, peer-to-peer has come to describe applications in which users can use the Internet to exchange files with each other directly or through a mediating server.

IBM's Advanced Peer-to-Peer Networking (APPN) is an example of a product that supports the peer-to-peer communication model.

2) On the Internet, peer-to-peer (referred to as P2P) is a type of transient Internet network that allows a group of computer users with the same networking program to connect with each other and directly access files from one another's hard drives. Napster and Gnutellaare examples of this kind of peer-to-peer software. Major producers of content, including record companies, have shown their concern about what they consider illegal sharing of copyrighted content by suing some P2P users.

Meanwhile, corporations are looking at the advantages of using P2P as a way for employees to share files without the expense involved in maintaining a centralized server and as a way for businesses to exchange information with each other directly.

How Does Internet P2P Work?

The user must first download and execute a peer-to-peer networking program. (Gnutellanet is currently one of the most popular of these decentralized P2P programs because it allows users to exchange all types of files.) After launching the program, the user enters the IP address of another computer belonging to the network. (Typically, the Web page where the user got the download will list several IP addresses as places to begin). Once the computer finds another network member on-line, it will connect to that user's connection (who has gotten their IP address from another user's connection and so on).

Users can choose how many member connections to seek at one time and determine which files they wish to share or password protect.

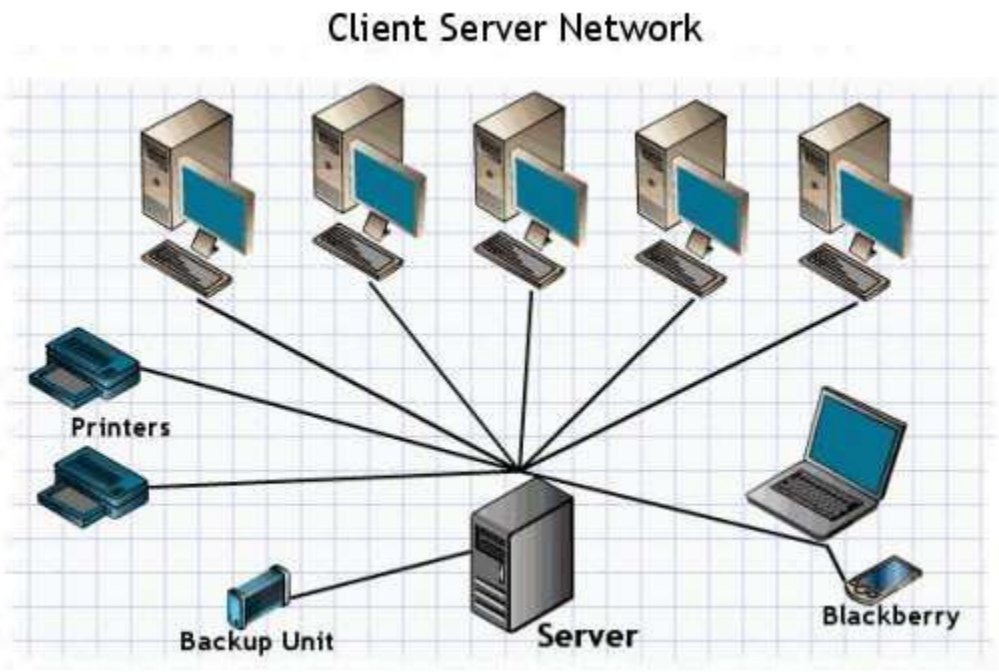
client/server

Client/server describes the relationship between two computer programs in which one program, the client, makes a service request from another program, the server, which fulfills the request. Although the client/server idea can be used by programs within a single computer, it is a more important idea in a network. In a network, the client/server model provides a convenient way to interconnect programs that are distributed efficiently across different locations. Computer transactions using the client/server model are very common. For example, to check your bank account from your computer, a client program in your computer forwards your request to a server program at the bank. That program may in turn forward the request to its own client program that sends a request to a database server at another bank computer to retrieve your account balance. The balance is returned back to the bank data client, which in turn serves it back to the client in your personal computer, which displays the information for you.

The client/server model has become one of the central ideas of network computing. Most business applications being written today use the client/server model. So does the Internet's main program, TCP/IP. In marketing, the term has been used to distinguish distributed computing by smaller dispersed computers from the "monolithic" centralized computing of mainframe computers. But this distinction has largely disappeared as mainframes and their applications have also turned to the client/server model and become part of network computing.

In the usual client/server model, one server, sometimes called a daemon, is activated and awaits client requests. Typically, multiple client programs share the services of a common server program. Both client programs and server programs are often part of a larger program or application. Relative to the Internet, your Web browser is a client program that requests services (the sending of Web pages or files) from a Web server (which technically is called a Hypertext Transport Protocol or HTTP server) in another computer somewhere on the Internet. Similarly, your computer with TCP/IP installed allows you to make client requests for files from File Transfer Protocol (FTP) servers in other computers on the Internet.

Other program relationship models included master/slave, with one program being in charge of all other programs, and peer-to-peer, with either of two programs able to initiate a transaction.



Note imp : Line Configuration in Computer Networks

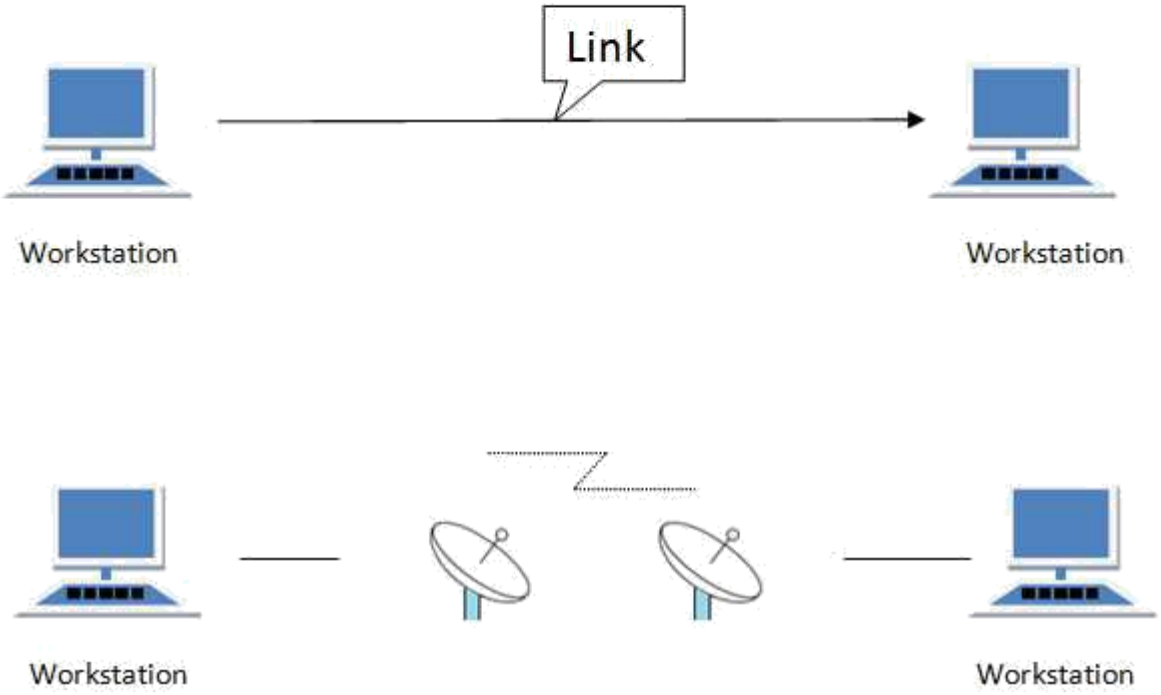
Network is a connection made through connection links between two or more devices. Devices can be a computer, printer or any other device that is capable to send and receive data. There are two ways to connect the devices :

1. **Point-to-Point connection**
2. **Multipoint connection**

Point-To-Point Connection

It is a protocol which is used as a communication link between two devices. It is simple to establish. The most common example for Point-to-Point connection (PPP) is a computer connected by telephone line. We can connect the two devices by means of a pair of wires or using a microwave or satellite link.

Example: Point-to-Point connection between remote control and Television for changing the channels.



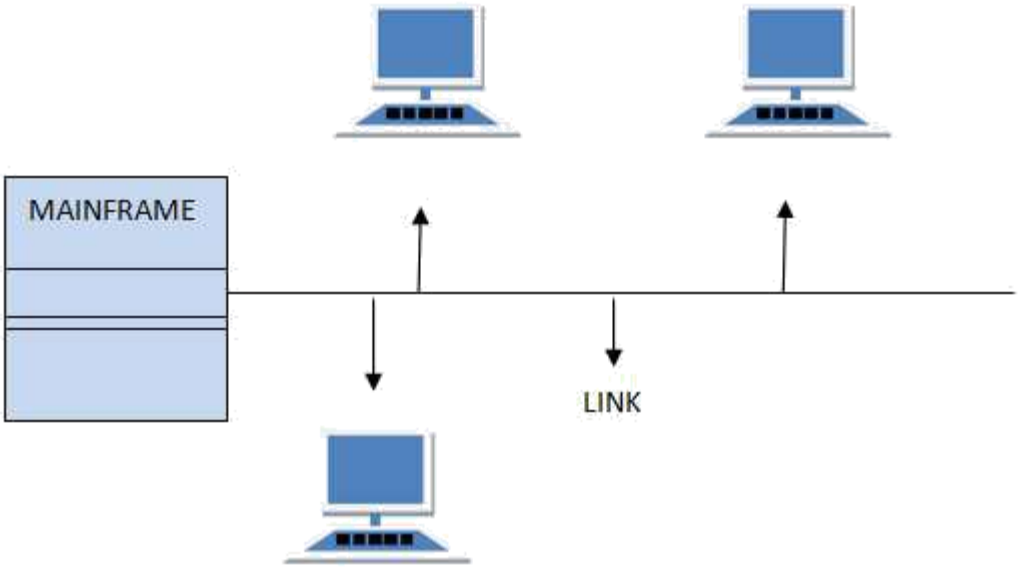
MultiPoint Connection

It is also called Multidrop configuration. In this connection two or more devices share a single link.

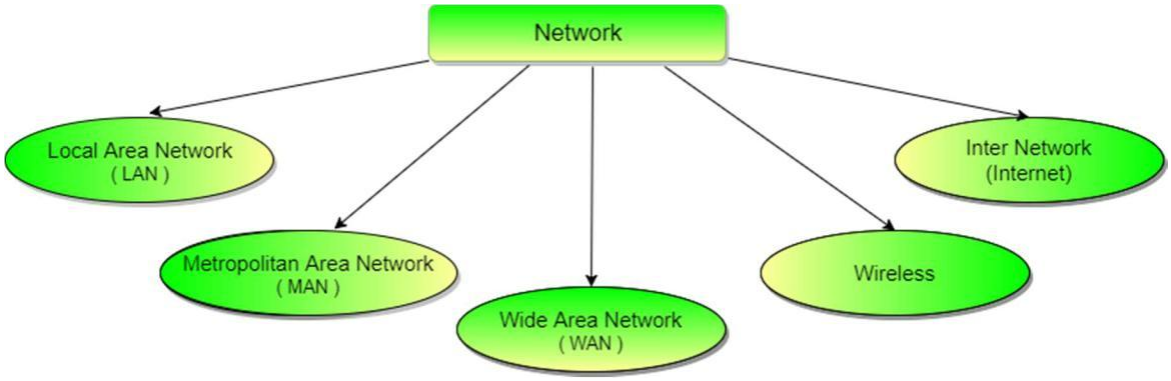
There are two kinds of Multipoint Connections :

If the links are used simultaneously between many devices, then it is spatially shared line configuration.

If user takes turns while using the link, then it is time shared (temporal) line configuration.



Types of Communication Networks

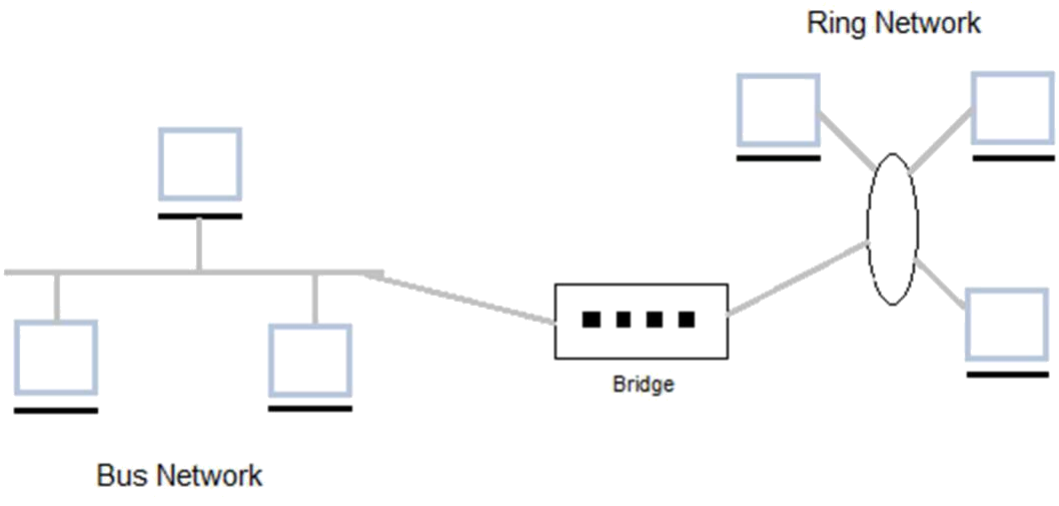


Local Area Network (LAN)

It is also called LAN and designed for small physical areas such as an office, group of buildings or a factory. LANs are used widely as it is easy to design and to troubleshoot. Personal computers and workstations are connected to each other through LANs. We can use different types of topologies through LAN, these are Star, Ring, Bus, Tree etc.

LAN can be a simple network like connecting two computers, to share files and network among each other while it can also be as complex as interconnecting an entire building.

LAN networks are also widely used to share resources like printers, shared hard-drive etc.



(Different Topologies interconnected in a Local Area Network)

Characteristics of LAN

LAN's are private networks, not subject to tariffs or other regulatory controls.

LAN's operate at relatively high speed when compared to the typical WAN.

There are different types of Media Access Control methods in a LAN, the prominent ones are Ethernet, Token ring.

It connects computers in a single building, block or campus, i.e. they work in a restricted geographical area.

Applications of LAN

One of the computer in a network can become a server serving all the remaining computers called clients. Software can be stored on the server and it can be used by the remaining clients.

Connecting Locally all the workstations in a building to let them communicate with each other locally without any internet access.

Sharing common resources like printers etc are some common applications of LAN.

Advantages of LAN

Resource Sharing: Computer resources like printers, modems, DVD-ROM drives and hard disks can be shared with the help of local area networks. This reduces cost and hardware purchases.

Software Applications Sharing: It is cheaper to use same software over network instead of purchasing separate licensed software for each client a network.

Easy and Cheap Communication: Data and messages can easily be transferred over networked computers.

Centralized Data: The data of all network users can be saved on hard disk of the server computer. This will help users to use any workstation in a network to access their data. Because data is not stored on workstations locally.

Data Security: Since, data is stored on server computer centrally, it will be easy to manage data at only one place and the data will be more secure too.

Internet Sharing: Local Area Network provides the facility to share a single internet connection among all the LAN users. In Net Cafes, single internet connection sharing system keeps the internet expenses cheaper.

Disadvantages of LAN

High Setup Cost: Although the LAN will save cost over time due to shared computer resources, but the initial setup costs of installing Local Area Networks is high.

Privacy Violations: The LAN administrator has the rights to check personal data files of each and every LAN user. Moreover he can check the internet history and computer use history of the LAN user.

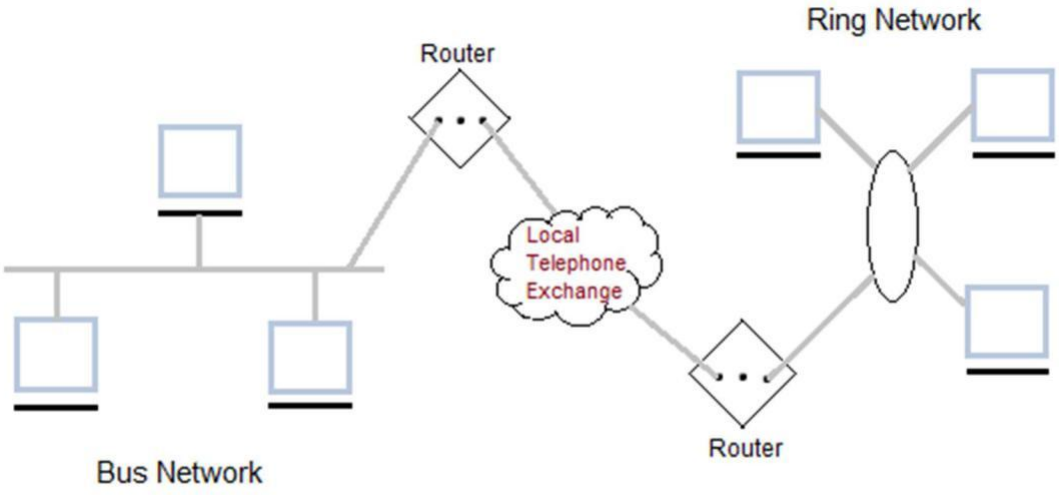
Data Security Threat: Unauthorised users can access important data of an organization if centralized data repository is not secured properly by the LAN administrator.

LAN Maintenance Job: Local Area Network requires a LAN Administrator because, there are problems of software installations or hardware failures or cable disturbances in Local Area Network. A LAN Administrator is needed at this full time job.

Covers Limited Area: Local Area Network covers a small area like one office, one building or a group of nearby buildings.

Metropolitan Area Network (MAN)

It was developed in 1980s.It is basically a bigger version of LAN. It is also called MAN and uses the similar technology as LAN. It is designed to extend over the entire city. It can be means to connecting a number of LANs into a larger network or it can be a single cable. It is mainly hold and operated by single private company or a public company.



Characteristics of MAN

It generally covers towns and cities (50 km)

Communication medium used for MAN are optical fibers, cables etc. Data rates adequate for distributed computing applications.

Advantages of MAN

Extremely efficient and provide fast communication via high-speed carriers, such as fibre optic cables.

It provides a good back bone for large network and provides greater access to WANs.

The dual bus used in MAN helps the transmission of data in both directions simultaneously.

A MAN usually encompasses several blocks of a city or an entire city.

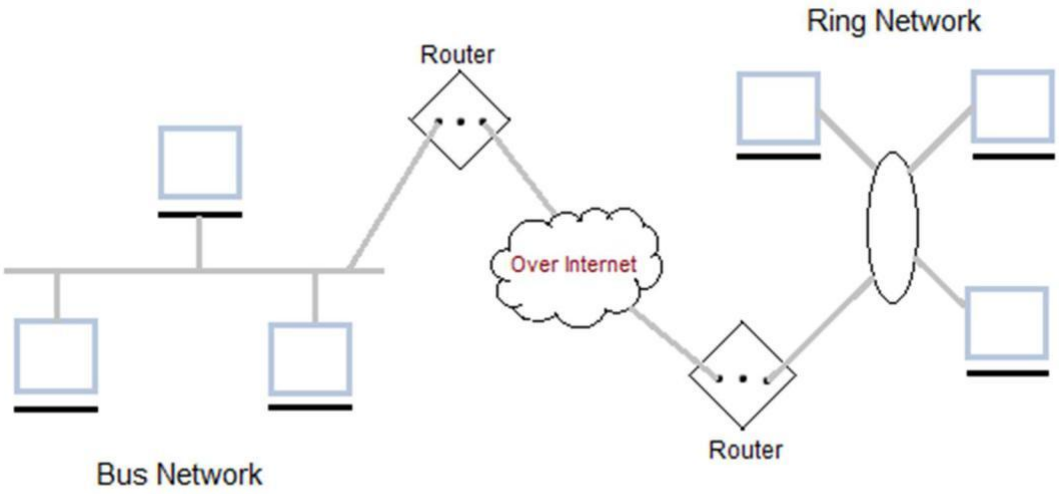
Disadvantages of MAN

More cable required for a MAN connection from one place to another.

It is difficult to make the system secure from hackers and industrial espionage(spying) graphical regions.

Wide Area Network (WAN)

It is also called WAN. WAN can be private or it can be public leased network. It is used for the network that covers large distance such as cover states of a country. It is not easy to design and maintain. Communication medium used by WAN are PSTN or Satellite links. WAN operates on low data rates.



Characteristics of WAN

It generally covers large distances(states, countries, continents).

Communication medium used are satellite, public telephone networks which are connected by routers.

Advantages of WAN

Covers a large geographical area so long distance business can connect on the one network.

Shares software and resources with connecting workstations.

Messages can be sent very quickly to anyone else on the network. These messages can have picture, sounds or data included with them(called attachments).

Expensive things(such as printers or phone lines to the internet) can be shared by all the computers on the network without having to buy a different peripheral for each computer.

Everyone on the network can use the same data. This avoids problems where some users may have older information than others.

Disadvantages of WAN

Need a good firewall to restrict outsiders from entering and disrupting the network.

Setting up a network can be an expensive, slow and complicated. The bigger the network the more expensive it is.

Once set up, maintaining a network is a full-time job which requires network supervisors and technicians to be employed.

Security is a real issue when many different people have the ability to use information from other computers. Protection against hackers and viruses adds more complexity and expense.

Wireless Network

Digital wireless communication is not a new idea. Earlier, Morse code was used to implement wireless networks. Modern digital wireless systems have better performance, but the basic idea is the same.

Wireless Networks can be divided into three main categories:

1. **System interconnection**
2. **Wireless LANs**
3. **Wireless WANs**

System Interconnection

System interconnection is all about interconnecting the components of a computer using short-range radio. Some companies got together to design a short-range wireless network called Bluetooth to connect various components such as monitor, keyboard, mouse and printer, to the main unit, without wires. Bluetooth also allows digital cameras, headsets, scanners and other devices to connect to a computer by merely being brought within range.

In simplest form, system interconnection networks use the master-slave concept. The system unit is normally the master, talking to the mouse, keyboard, etc. as slaves.

Wireless LANs

These are the systems in which every computer has a radio modem and antenna with which it can communicate with other systems. Wireless LANs are becoming increasingly common in small offices and homes, where installing Ethernet is considered too much trouble. There is a standard for wireless LANs called IEEE 802.11, which most systems implement and which is becoming very widespread.

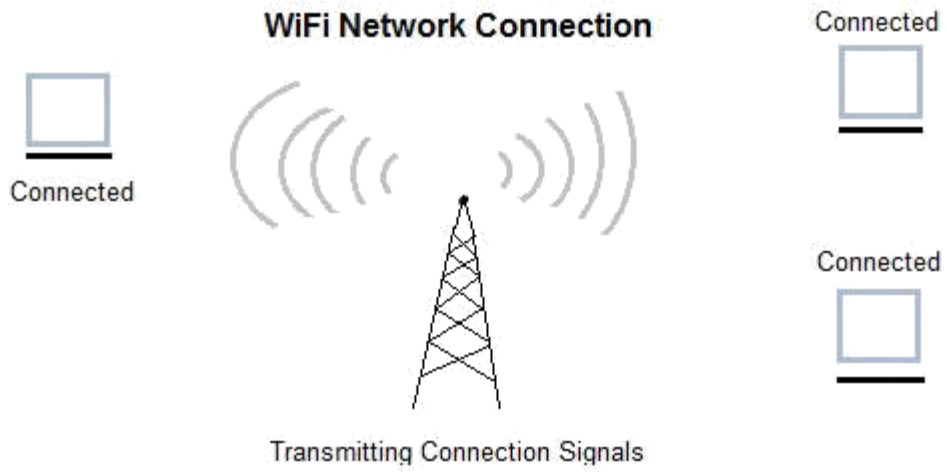
Wireless WANs

The radio network used for cellular telephones is an example of a low-bandwidth wireless WAN. This system has already gone through three generations.

The first generation was analog and for voice only.

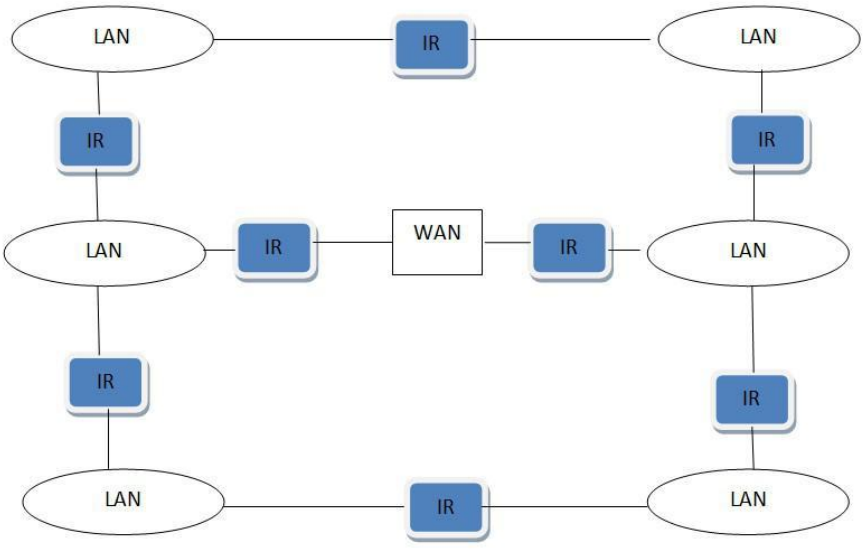
The second generation was digital and for voice only.

The third generation is digital and is for both voice and data.



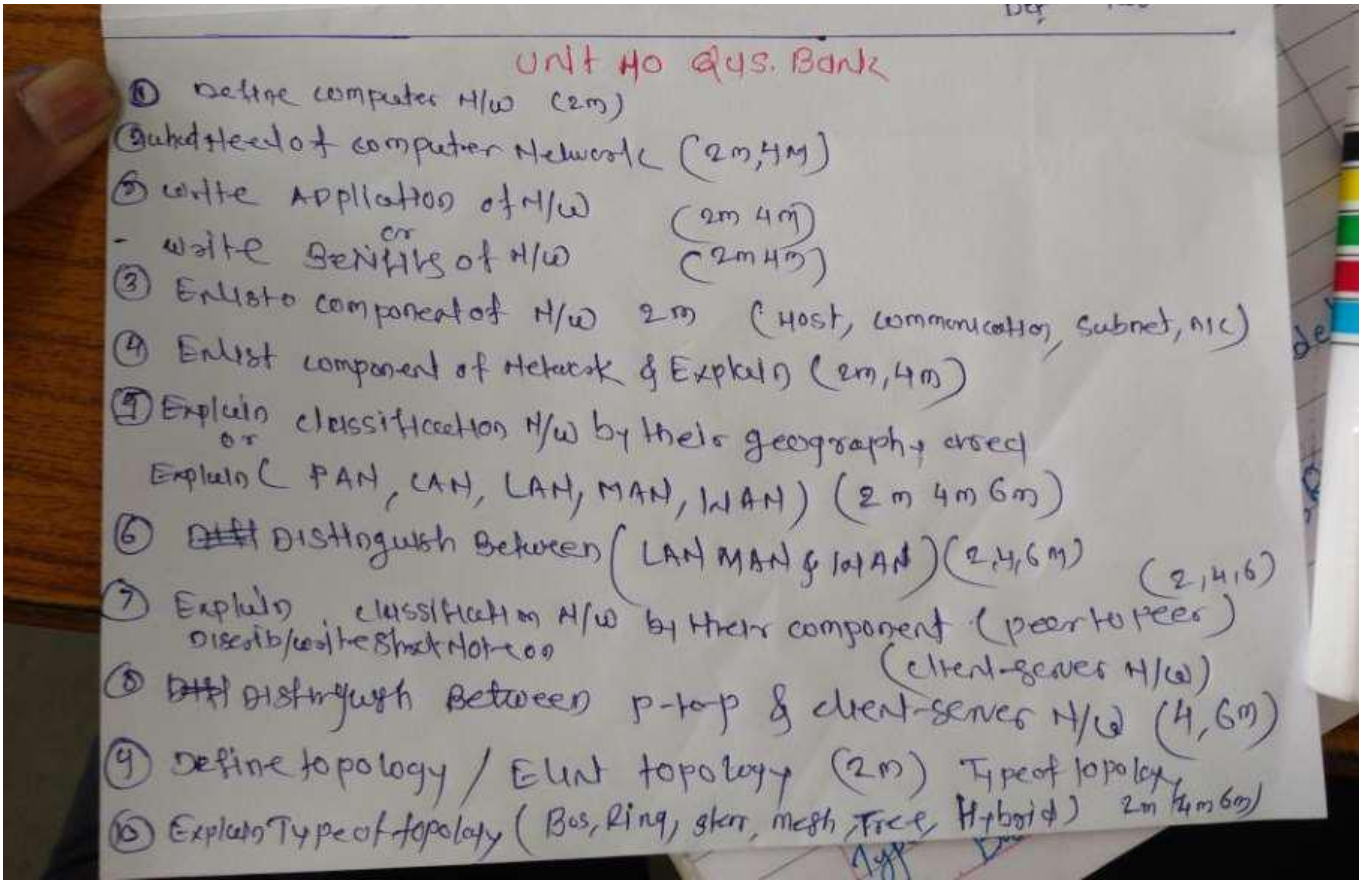
Inter Network

Inter Network or Internet is a combination of two or more networks. Inter network can be formed by joining two or more individual networks by means of various devices such as routers, gateways and bridges.



INTERNETWORK

Question Bank Chapter 1



Unit No Qus. Bank

1. Define computer H/w (2m)
2. Need/Need of computer Network (2m, 4m)
3. write Application of H/w (2m 4m)
   - write Benifits of H/w (2m 4m)
4. Enlist to componeat of H/w 2m (Host, communication, Subnet, NIC)
5. Enlist component of Network & Explain (2m, 4m)
6. Explain classification N/w by their geography creed
   Explain (PAN, CAN, LAN, MAN, WAN) (2m 4m 6m)
7. ~~Diff~~ Distinguish Between (LAN MAN & WAN) (2,4,6m)
8. Explain classification N/w by their component (peer to peer) (2,4,6)
   Discrib/write Short Note on (client-server N/w)
9. ~~Diff~~ Distinguish Between p-to-p & client-server N/w (4,6m)
10. Define topology / Enlist topology (2m) Type of topology
11. Explain Type of topology (Bus, Ring, star, mesh, Tree, Hybrid) 2m 4m 6m)