Islamic Republic Of Afghanistan

Ministry Of Higher Education

Ghazi Amanullah Khan Institute Of Higher Education

Computer Network

Date [27/10/2018]

For Basic BCS Students

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Date [27/10/2018]

What is network?

Network

Is a connection of two or more than computers resources

And computer network consists of two computers connected to each other by cable that always them to share data.

Why we use network?

1- Share information or fata

2- Sharing hardware and software

3- Centralizing administration and support

4 - E-mail message

5- Word processing software

6- Live Audio & video Broadcasts

7- Printers

8- Fax machines

9- Modems

10- CD Room devices

11- Hard disks drives

Categories of networks

There are 3 categories of networks.

1- Local area network (LAN)
2- Metropolitan area network (MAN)
3- Wide area network (WAN)

Local area network

Is group of computers and network communication devices that a limited geographic area such us an office building.

Components of local area network

1- Computers
2- Network interface cards
3- Networking media
4- Network devices

- Local area network communication is fast.
- Local area network communication is inexpensive.
- Local area network has free error.
- System administrator work in local area network.

Type of LAN

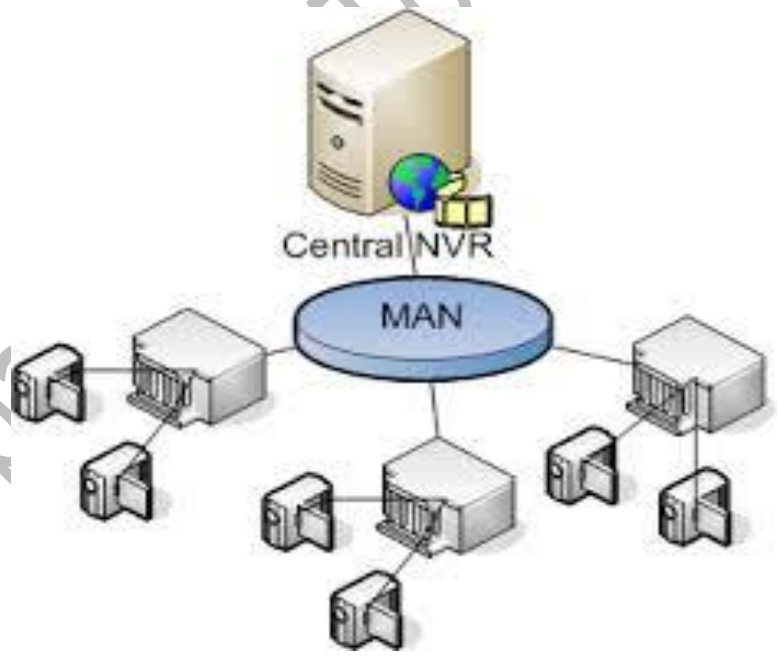
Metropolitan Area network (MAN)

It is a network which connects different LAN on same city it maybe single network.

For example TV cable.

- Metropolitan area network communication is slow.
- Metropolitan area network is expensive then local area network
- Metropolitan area network had small errors.
- Network administrator work on metropolitan area network.

Type MAN



Wide area network (WAN)

Is a network which connect different LANs MANs throughout the world WAN connects cities tows states countries and it is unlimited area network.

Internet is the big example of wide area network.

- Wide area network communication is slow.
- Wide area network is expensive then LAN and MAN.
- Wide area network has small errors.
- Network engineer and system engineer work on wide area network.

Type of WAN

Network terms

Server: who gives services for the Clients.

Clients: how accept services from the server.

Host: the terms IP address used.

Node: any device that can communicate with other on network known as node.

Segment: a group PC is known segment.

Internet: combination of networks.

Intranet: private network of organization.

Extranet: private network between organizations.

Types of networks

There are tow types of networks

1- Work group or pear to pear network.
2- Server base or domain network.

1-Work group or pear to pear network

Is a group of computers which are connected with each other computer has several right every computer itself is server as well as client every computer in this system.

2- Server client network

The type of network in which we have server client database and clients the full control with server and clients to tally depend on server.

In a network what things we can share
And what things we cannot share?

Sharable things

1- Printer
2- Floppy
3- Flash memory
4- Scanners
5- Hard disks (HDD)
6- CD Room
7- Modem internet
8- Data software

Not sharable things

1- Keyboard
2- Mouse
3- Speakers
4- Monitor

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Network operating system

Operating system operates all computer hardware.

Windows server O.S

Windows server 2000
Windows server 2008
Windows server 2012
Linux Unix

Clients O.S

Windows XP
Windows vista
Windows 7
Windows 8
Windows 8.1
Windows 10

Windows server editions

1- Windows server 2012 standard edition
2- Windows server 2012 web edition
3- Windows server enterprise edition
4- Windows server data center edition

Standard edition: is used for normal or low level organization.

Web edition: is used for web services.

Enterprise edition: is used for larger eniverment. Ex banks

Data center edition: is used for business applications. Ex large organizations.

Network topology

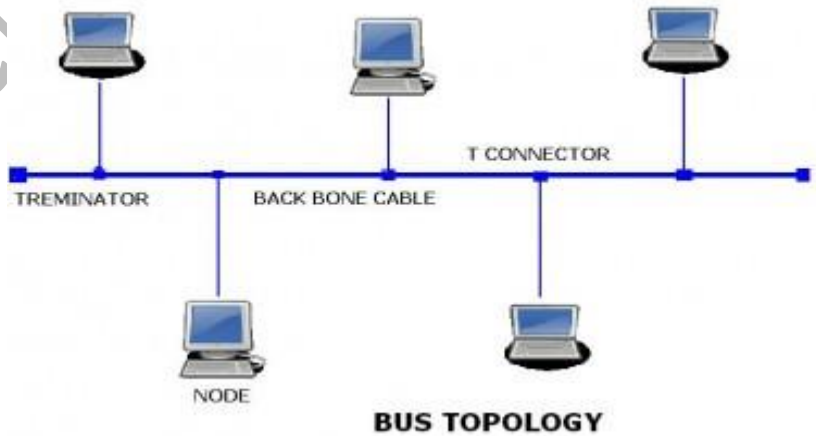
Topology is Greek word it show the physical structure of our network or layout of network.

Categories of topology

1- Bus topology
2- Ring topology
3- Mesh topology
4- Star topology
5- Tree topology

Bus topology

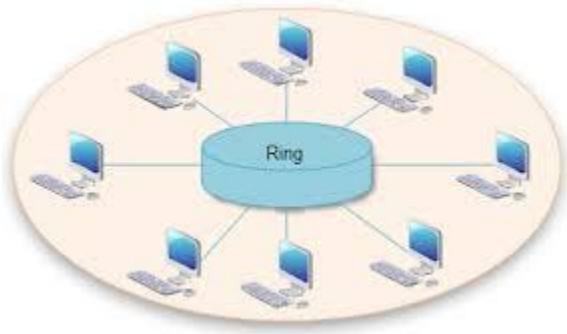
Bus single backbone segment (length of cable) that all hosts connect to directly.



BUS TOPOLOGY

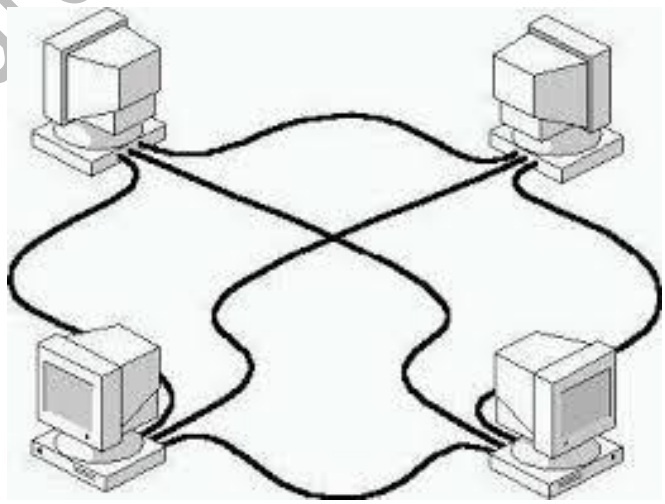
Ring topology

Ring topology is a network in the shape of ring or circle with nodes connected around the ring.



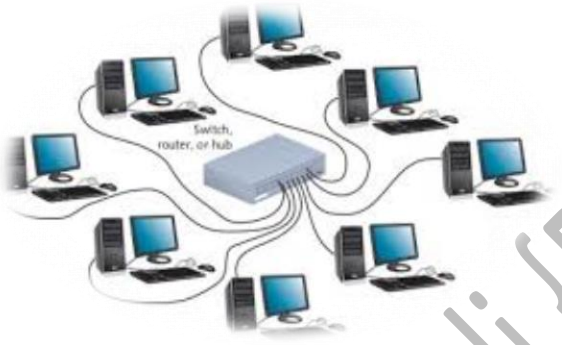
Mesh topology

The mesh topology connects all devices (nodes) to each other for redundancy and fault tell ance .



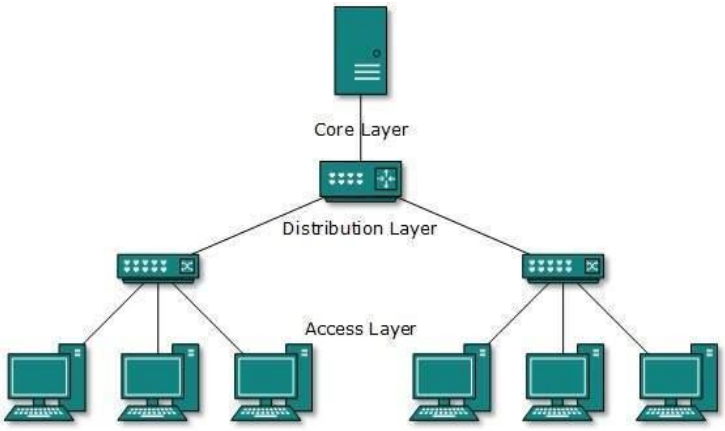
Star topology

The star topology is a network configured with a central hub and individual cable segments connected to the hub.



Tree topology

When tow or more than tow servers connect each other by some media will create a tree topology.



Devices of network

1. Computers
2. Lan card or nic
3. Media
4. Connectors
5. Hub
6. Switch
7. Bridge
8. Repeater
9. Router
10. Access point
11. - Firewall
12. Modem

Computer

Computer is electronic digital machine which is use for calculation we give input to the computer.

LAN card or nic

To connect a computer with LAN network then there is need of a nic or LAN card

LAN cards types

1- Category (4) (10MBPS)
It is used in Ethernet .

2- Category (5) 100MBPS)
It is used in fast Ethernet .

3- Category (6) (1.0 GBPS)
It is used in GIGA Ethernet.

Media

Anything that carries some data (information) from one device to another is called media.

Types of media:

1- Bounded media or (cable/wire)
2- Unbounded media or (wireless)

Connecters

Connecters are used to plug a cable with a device and make the cable capable of to connect to device.

Hub (hybrid universal broadcast)

Hub is used to connect two or more than computers in LAN with other hub is non intelligent device because hub done understand the mac address no cam cable hub so no broadcasting control.

Switch

Switch is to connect multiple computers with each other in LAN.

Bridge

Bridge is device that connects a local area network (LAN) to another local area network that use the same protocol.

For example Ethernet.

Repeater

A repeater connects two segments of network cable.

Router

Router is an internet working component that connects networks which area at different geographical location.

Access point

Access point is used to connect our computer with each other without any wire and it is used for wireless network.

Firewall

Is a secure trusted device that is between a privet network and a public network.

Modem

Modem short for modulator is an electronic device that converts a computers digital signals into specific frequencies to travel over telephone or cable television lines.

Protocol

Protocol is a set of rules is used by computers to communicable with each other cross and network.

Common protocols

1- IP (internet protocol)
2- TCP (transmission control protocol)
3- UDP(user data gram protocol)
4- HTTP(hyper text transfer protocol)
5- FTP(file transfer protocol)
6- SMTP(simple mail transfer protocol)
7- POP3(post office protocol 3)
8- DHCP(dynamic host configuration protocol)

(1) IP (internet protocol)

It give an ip address to the device on the network.

(2) TCP (transmission control protocol)

TCP is reliable protocol for data delivering from one device to another.

(3) UDP (user data gram protocol)

Is used for data delivering from one device to another UDP provides a simple but unreliable data delivering services.

(4) HTTP (hyper text transfer protocol)

It is used for web browsing on computing. HTTP is a method of transmitting the information on the web.

(5) FTP (file transfer protocol)

It is used for (upload / download) data from one computer to another over their internet or through computer network.

(6) SMTP (simple mail transfer protocol)

SMTP is a protocol which is used to send the e-mail messages between services.

(7) POP3 (post office protocol)

POP is used for e-mail receiving.

(8) DHCP (dynamic host configuration protocol)

It is used for assign a unique IP address to the device dynamically and automatically .

Network Media

Anything that carries some data (information) from one device to another is called network media.

Types Of Media

We have tow types of network media.
1- Guided (Bounded) wired media
2-Unguided (unbounded) wireless media.

Guided media

Guided media, which are those that provide a physical link from one device to another

include : twisted-pair cable, coaxial cable, and fiber-optic cable

A signal traveling along any of these media is directed from Sender to Receiver

There are more than 2200 types of cables available in the markets; according to Belden a leading cable manufacturer, however only three major groups cabling connect the majority of networks today:

Twisted Pair cable

- A twisted pair consists of two conductors (normally copper)
- each with its own plastic insulation, twisted together
- One of the wires is used to carry signals to the receiver,
- the other is used only as a ground reference

There are more than 2200 types of cables available in the markets; according to Belden a leading cable manufacturer, however only three major groups cabling connect the majority of networks today:

Types of twisted pair cable

- ✓ Unshielded twisted pair cable (UTP)
- ✓ Shielded twisted pair cable (STP)

Unshielded twisted pair cable (UTP)

- The most common twisted-pair cable used in communications is referred to as unshielded twisted-pair (UTP).
- consist of 8 wires covered by plastic insulation
- Four wires are completely colored as Orange, Blue, Green, Brown
- Four wires are Partially colored as White-orange, White-Blue, White-green, white-Brown
- Nowadays mainly focuses is on UTP because STP is seldom used
- Out of 8 wires 4 wires are used for data communication
- 2 wires are used for Sending of data
- 2 wires are used for Receiving of data

Shielded twisted pair (STP) cable

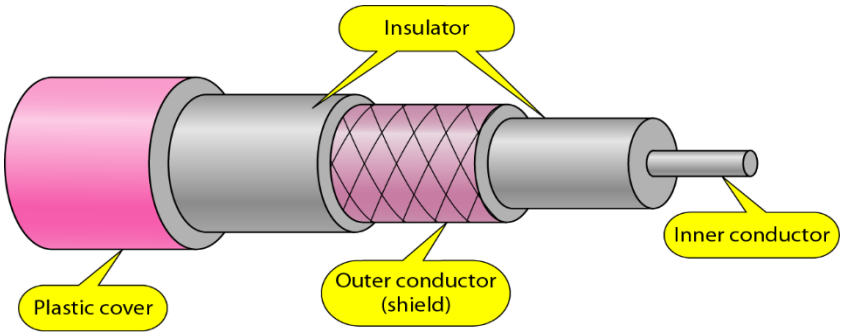
- This is a version of twisted-pair cable for its use called shielded twisted-pair (STP)
- STP cable has a metal foil or braided-mesh covering that encases each pair of insulated conductors.
- Although metal casing improves the quality of cable by preventing the penetration of noise or crosstalk,
- it is more expensive.

Coaxial Cable

At one time, coaxial cable was the most widely used network cable. There were a couple of reasons for coaxial cable's wide usage: it was relatively inexpensive, and it was light, flexible, and easy to work with.

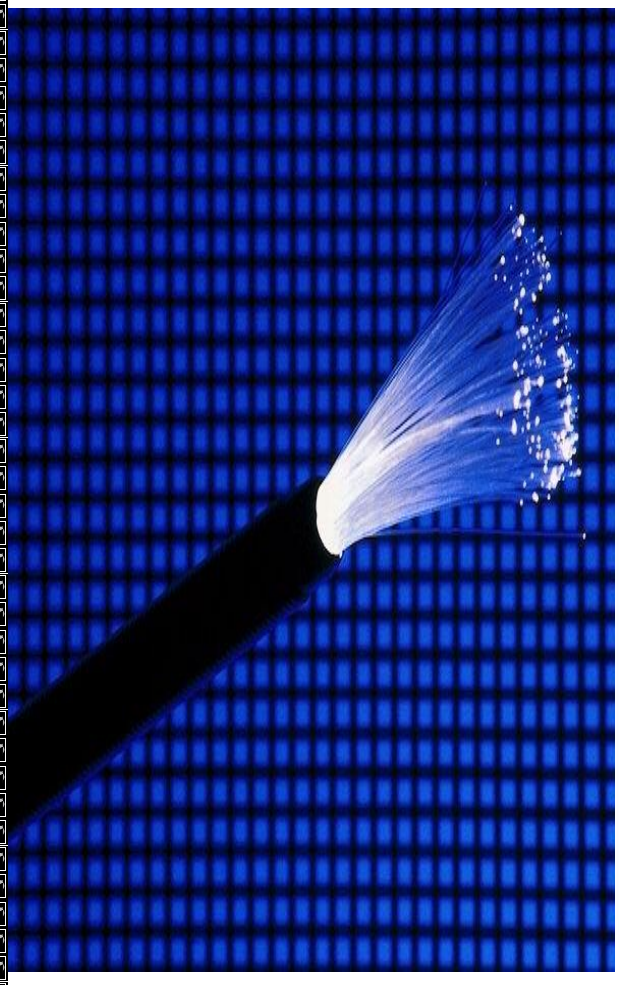
Usage of Coaxial cable

- Coaxial cable was widely used in analog telephone networks
- where a single coaxial network could carry 10,000 voice signals.
- Later it was used in digital telephone networks where a single coaxial cable could carry digital data up to 600 Mbps
- Used in Cable TV network
- Used in LANs



Fiber-Optic Cable

- A fiber-optic cable is made of glass or plastic and transmits signals in the form of light.
- Optical fibers use reflection to guide light through a channel.
- A glass or plastic core is surrounded by a cladding of less dense glass or plastic
- The difference in density of the two materials must be such that a beam of light moving through the core is reflected off the cladding instead of being refracted into it

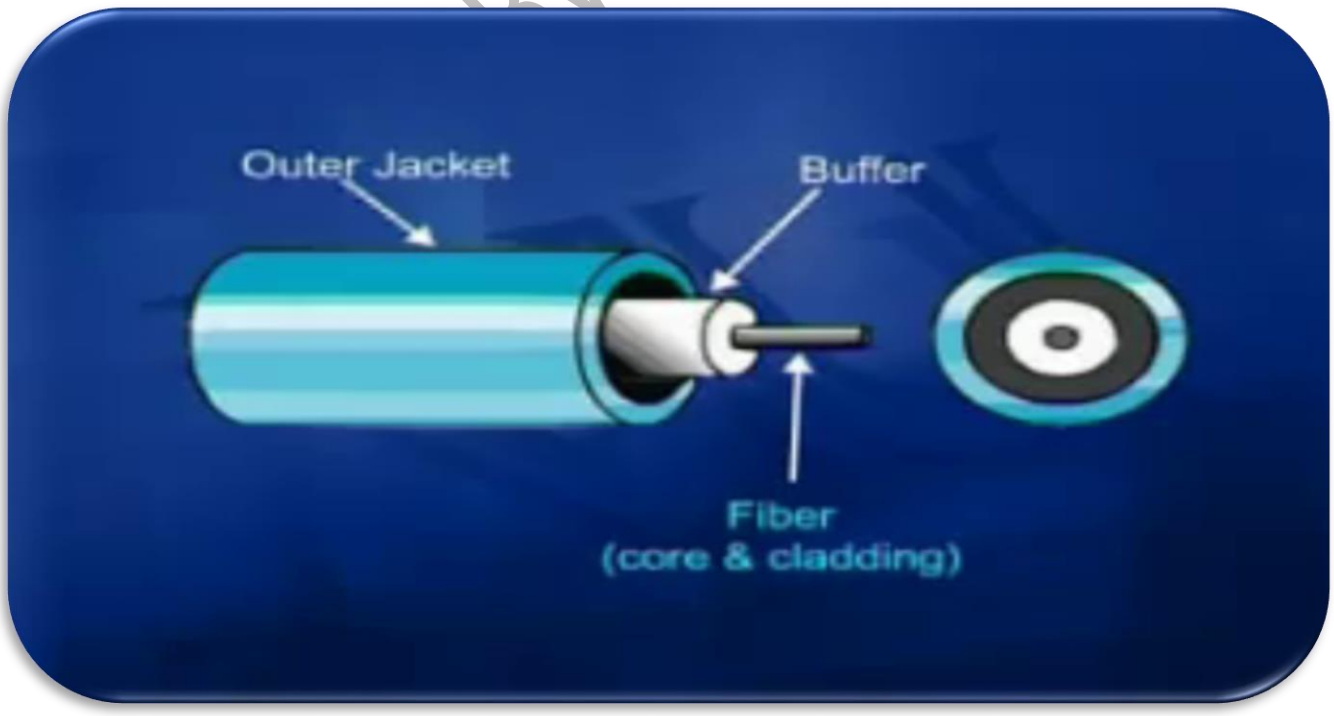


Fiber Sizes

- Common Fiber Types

Fiber type	Core	Cladding
62.5/125	62.5	125
50/125	50	125
100/140	100	140
8.3/125	8.3	125

Fiber Structure



Advantages Of Fiber

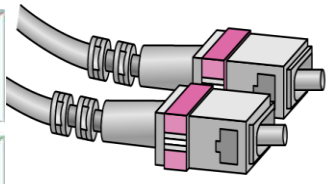
- ✓ Noise resistance
- ✓ Less signal attenuation
- ✓ Higher bandwidth

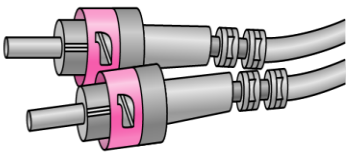
Disadvantages Of Fiber

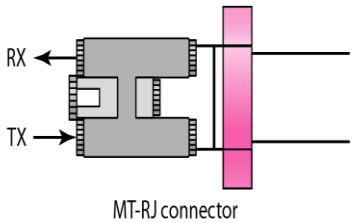
- ✓ Coast
- ✓ Instalation / maintence
- ✓ fragility

Fiber Optic Connector

- There are three types of connectors for fiber-optic cables
- The **subscriber channel** (SC) **connector** is used for cable TV.
- The **straight-tip** (ST) **connector** is used for connecting cable to networking devices
- It uses also uses locking system
- it is more reliable than SC.
- **MT-RJ** is a connector that is the same size as RJ45


SC connector


ST connector

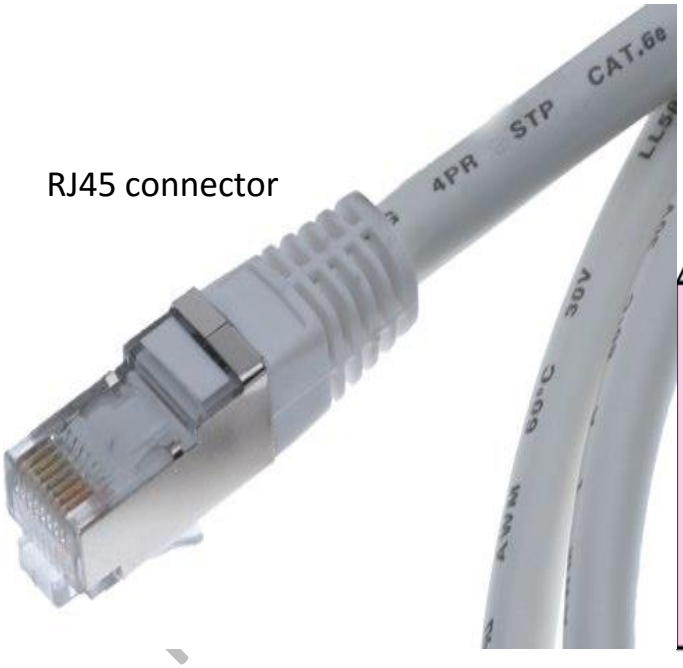


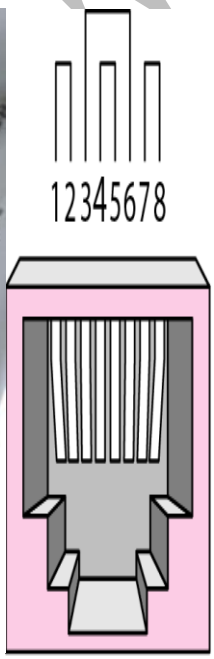
MT-RJ connector

Comon guided media Connectors

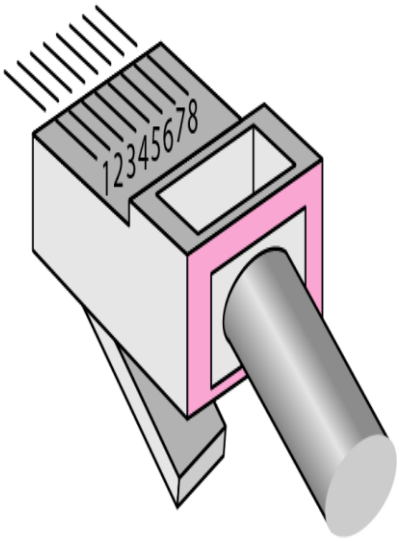
- The most common UTP connector is RJ-45 (RJ stands for registered jack), and RJ 11
- RJ 11 is for telephone and DSL modem
- RJ 45 is used for internetworking device like switch,hub
- The RJ45 is a keyed connector,
- as shown in Figure 7.5.

RJ45 connector





RJ-45 Female

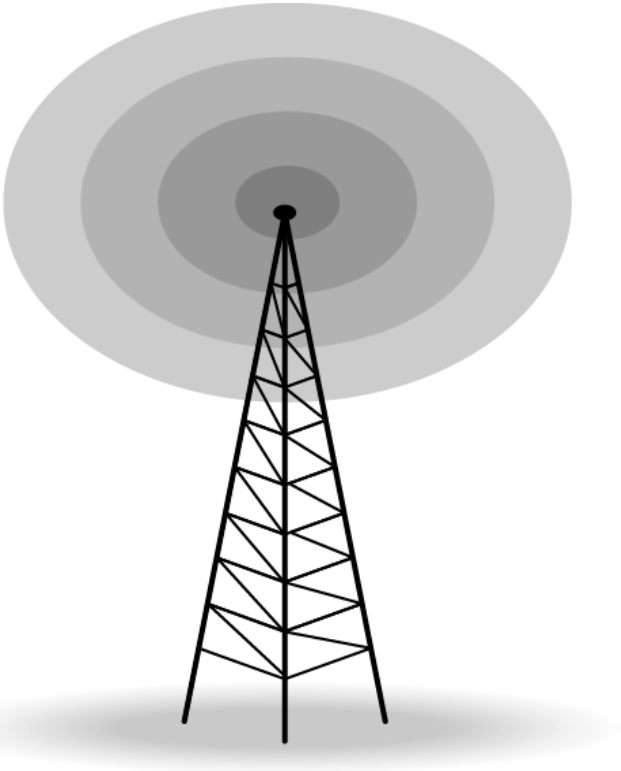


RJ-45 Male

Unguided (Unbounded) wireless media

- Unguided media transport electromagnetic waves without using a physical conductor
- This type of communication is often referred to as wireless communication
- Signals are normally broadcast through free space and thus are available to anyone who has ability of receiving the signal

Figure 7.20 *Omnidirectional antenna*



Wireless Communication System

- Radio Waves
- Microwaves
- Satellite
- Infrared
- Bluetooth
- Cellular Telephone

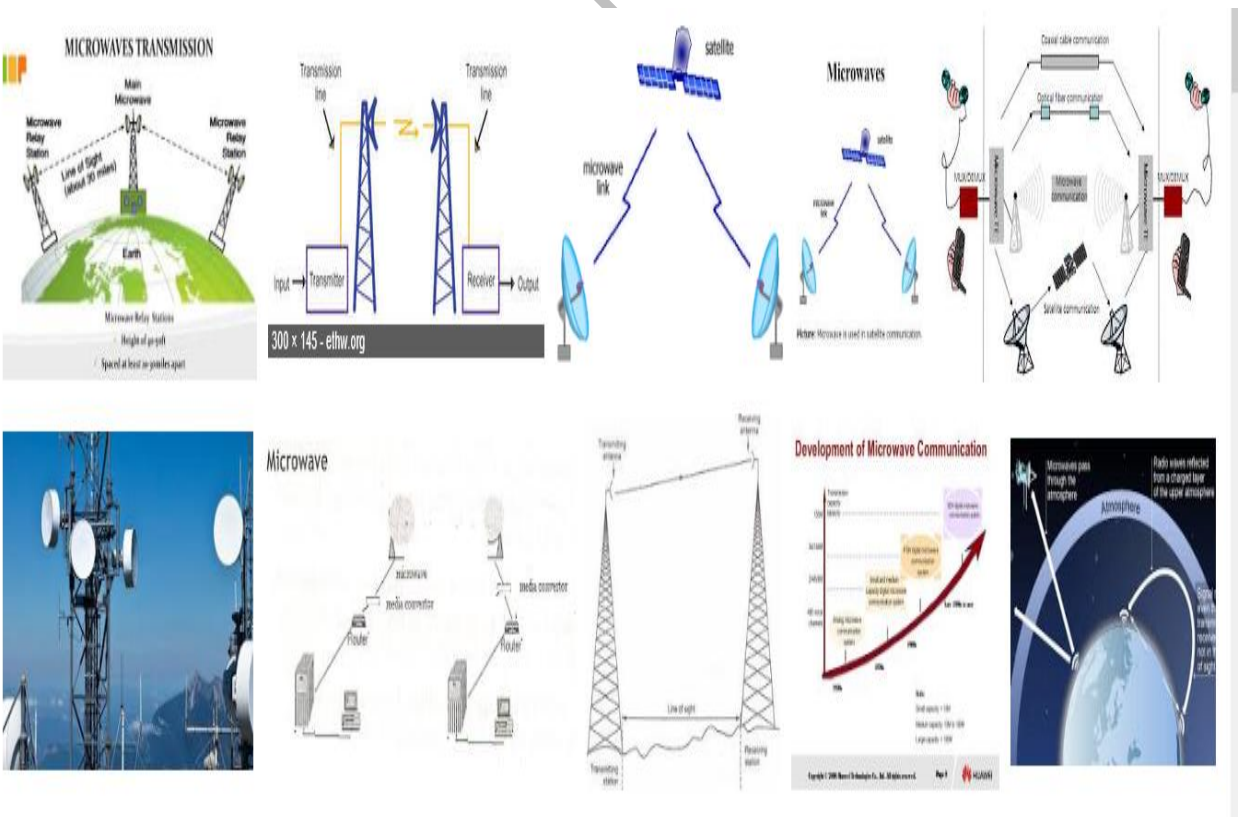
Radio Waves

- Electromagnetic waves ranging in frequencies between 3 kHz and 1 GHz are normally called radio waves;
- Radio waves are Omni-directional
- When an antenna transmits radio waves, they are propagated in all directions
- This means that the sending and receiving antennas do not have to face each other
- A sending antenna sends waves that can be received by any receiving antenna
- ***Note***
- **Radio waves are used for multicast communications, such as radio and television**

Microwaves

- Electromagnetic waves having frequencies between 1 and 300 GHz are called microwaves
- Microwaves are unidirectional
- When an antenna transmits microwave waves, they can be narrowly focused
- ***Note***
- **Microwaves are used for unicast communication such as cellular telephones, satellite networks, and wireless LANs.**

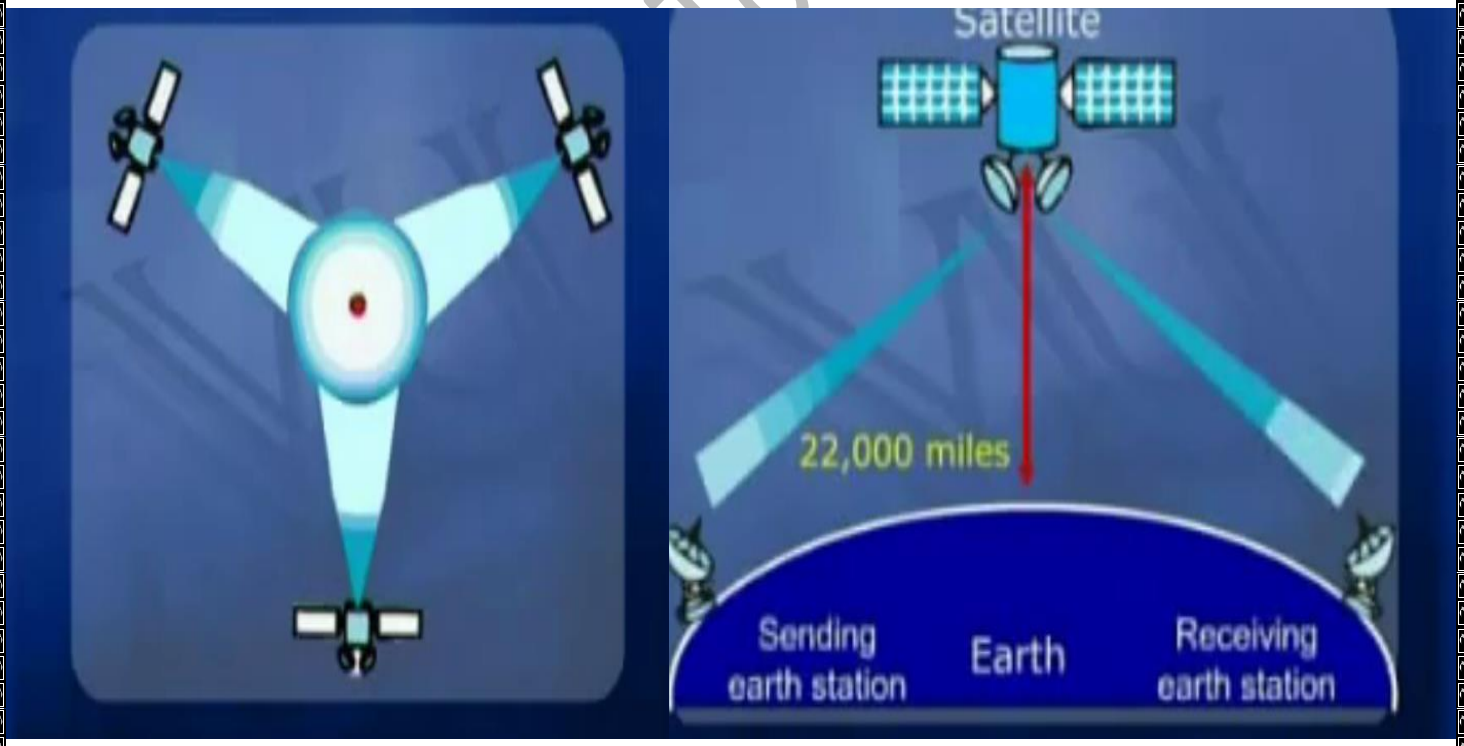
A form of micro waves



Satellite Communication

- Satellite contains two segments
- Earth Segment
- Space Segment
- Downlink: The link from satellite down to one or more ground stations or receivers
- Uplink: The link from ground stations up to satellite
- Frequency ranging from 11GHZ-14GHZ
- Transmission speed of 1Mbps-10Mbps
- Television Stations, Corporations and the other telecommunication carries.

Satellite example



Infrared waves

- used for short-range communication
- Infrared waves, having high frequencies
- This advantageous characteristic prevents interference between one system and another;
- a short-range communication system in one room cannot be affected by another system in the next room
- When we use our infrared remote control, we do not interfere with the use of the remote by our neighbors

Aform of Infrared waves

Advantages of using infrared communication technologies

- Advantage 1:Security
  In the modern world, a huge amount of information is exchanged and the confidentiality of information must be emphasized when communication takes place. Infrared communication has high directionality and can identify the person with whom you are communicating, which is different from wireless communication in which information diffuses, allowing for high confidentiality to be maintained.
- Advantage 2:Effect on the human body Many are concerned about using IR in cars or in a place with many people. However, when used in remote controls for TVs, infrared communication has no harmful effect on the human body. It is therefore not necessary to worry about using IR in crowded places. You can therefore be worry free about using IR in crowded places.
- Advantage 3:Data communication speed
  Compared with the wireless communication with a maximum speed of about 100 Mbps, the infrared communication has a potential of 1 Gbps. It also has a much shorter wavelength than wireless communication, which is easily enough for broadband communication. It is optimal for when large-volume data such as video must be

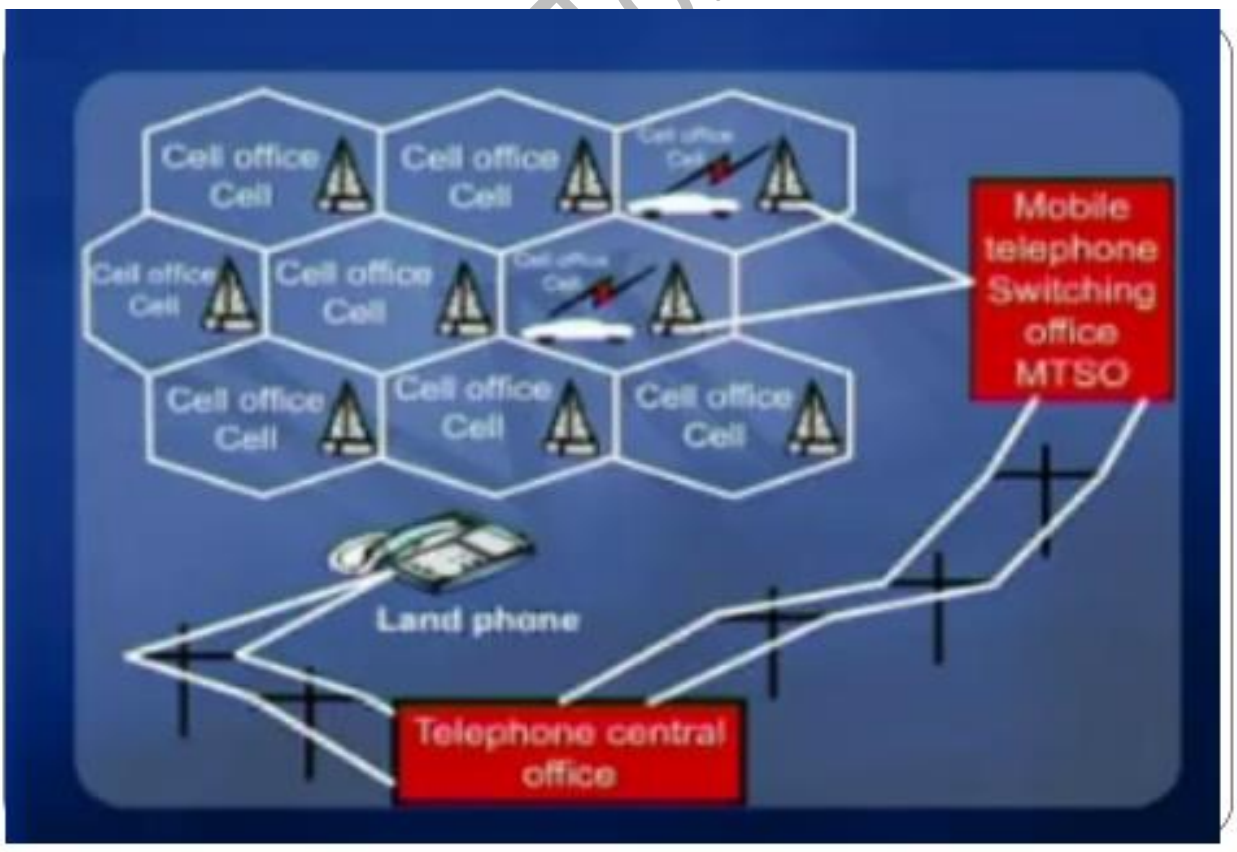
Bluetooth

- Bluetooth is a technology that makes use of 2.4 GHZ
- It is limited to low-speed, short range communications, but has advantages of communicating with many devices at the same time
- This one to many communication has made Bluetooth technology the preferred method over IR for connecting computer peripherals such as mice, keyboards, and printers.

Cellular Telephone System

- Cellular telephone system works based on Cell.
- Each Service area is divided into small ranges called cell.
- Each cell office is controlled by a switching office called MTSO
- Cellular telephone system provides a wireless connection for any user in a particular geographic area
- Cellular telephone system use from limited frequency spectrum
- Each cell has an unique frequency with small geographic coverage area
- The same frequency is reused in other base station

example of Cellular telephone system



The Osi Model

Established in 1947, the International Standards Organization (ISO) is a multinational body dedicated to worldwide agreement on international standards. An ISO standard that covers all aspects of network communications is the Open Systems Interconnection (OSI) model. It was first introduced in the late 1970s

Seven layers of osi model

- ✓ Physical Layer
- ✓ Data Link Layer
- ✓ Network Layer
- ✓ Transport Layer
- ✓ Session Layer
- ✓ Presentation Layer
- ✓ Application Layer

Physical Layer

The physical layer coordinates the functions required to carry a bit stream over a physical medium.

It deals with the mechanical and electrical specifications of the interface and transmission medium. It defines the procedures and functions that physical devices and interfaces have to perform for transmission to Occur

Data Link Layer

The data link layer transforms the physical layer, a raw transmission facility, to a reliable link. It makes the physical layer appear error-free to the upper layer (network layer).

Network layer

 The network layer is responsible for the source-to-destination delivery of a packet, possibly across multiple networks (links). Whereas the data link layer oversees the delivery of the packet between two systems on the same network (links), the network layer ensures that each packet gets from its point of origin to its final destination. If two systems are connected to the same link, there is usually no need for a network layer.

Transport Layer

 The basic function of the transport layer is to accept data from above, split it up into smaller units if need be, pass these to the network layer, and ensure that the pieces all arrive correctly at the other end. The transport layer is responsible for process-to-process delivery of the entire message.

Session Layer

 The services provided by the first three layers (physical, data link, and network) are not sufficient for some processes. A network session is analogous to a computer terminal session where a user logs in, performs a task by sending keystrokes, receives text characters on his monitor, and then logs out. Once the connection has been established, the Session layer can manage the dialogue

Presentation Layer

The presentation layer is concerned with the syntax and semantics of the information exchanged between two systems. Translation: The processes (running programs) in two systems are usually exchanging information in the form of character strings, numbers, and so on.

Application Layer

 The application layer enables the user, whether human or software, to access the network. It provides user interfaces and support for services such as electronic mail, remote file access and transfer, shared database management, and other types of distributed information services.

Addressing

Four levels of addresses are used in an internet employing the TCP/IPprotocols: physical, logical, port, and specific

Types of addressing

Physical Addresses

Logical Addresses

Port Addresses

Specific Addresses

Physical Addresses

The physical address, also known as the link address, is the address ofa node as defined by its LAN or WAN. It is included in the frame used by the data link layer.

Logical Addresses

Logical addresses are necessary for universal communications that are independent of underlying physical networks. Physical addresses are not adequate in an internetwork environment where different networks can have different address formats

Port Addresses

The IP address and the physical address are necessary for a quantity of data to travel from a source to the destination host. However, arrival at the destination host is not the final objective ofdata communications on the Internet.

Specific Addresses

Some applications have user-friendly addresses that are designed for that specific address. Examples include the e-mail address (for example, forouzan@fhda.edu)

IP address

IP address is sprat separated in dotted decimal format each computer on the network has at least one IP address that uniquely identifies it from all other computer on the network.

Types of IP address

There are two types of IP address.

1) IP.v4

2) IP.v6

Note: IP address start from 0.0.0.0 and end to 255.255.255.255

IP is made of tow portion

1) Network portion. Same left side

2) Host portion. Unique right side

IP.v4

History of IP.v4

IPv4 has just over four billion unique IP addresses. It was developed in the early 1980s and served the

Global Internet community for more than three decades. But IPv4 is a finite space, and after years of

Rapid Internet expansion, its pool of available unallocated addresses has been fully allocated to Internet

Services providers (ISPs) and users.

Only 3.7 billion IPv4 addresses are usable by ordinary Internet access devices. The others are used for

Special protocols, like IP Multicasting. Almost three and a half billion addresses was enough for the .

Experiment that the Internet started as in the 1980s, but it is not enough for a production network in

Today's world, with its population of almost seven billion people.

Classes of IP.v4

We have 5 IP address class in IP v.4

1- Class A
2- Class B
3- Class C
4- Class D
5- Class E

Class A IP Address

Class A IP address range start from 1.0.0.0 and ending to 126.255.255

Class A subnet mask: 255.0.0.0

In the class A IP address 1 is octet is network portion. And 2nd 3rd and 4th octets are host portion.

Class B IP Address

Class B IP address range start from 128.0.0.0 and ending to 190.255.255.255
Class B subnet mask: 255.255.0.0

In the class B IP address 1st and 2nd octets are portion s
And 3rd and 4th octets are host portion.

Class C IP address

Class C IP address range start from 192.0.0.0 and ending to 223.255.255.255
Class C subnet mask is: 255.255.255.0

In the class C IP address 1st and 2nd and 3rd are network portion
And 4th octet is host portion.

Note: class A, B and C used by privet and public network.

Class D IP address

Class D IP address range start from 224.0.0.0 and ending 239.255.255.255

Class D IP address is used for multicasting communication and it is used by protocols.

Class E IP address

Class E IP address range start from 240.0.0.0 and ending to 255.255.255.255

Class E IP address is used for researching.

Introduction to

CCNA

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Date [27/10/2018]

What CCNA ?

Stand for Cisco certified network administrator

In computer science the following filed

1-Programming

2-web designing

3-networking

Our course under network filed those people works In network field

1-System administrator

2-Network administrator

3-Database administrator

History of Cisco and CCNA

the word Cisco comes from American city state sanfrancisco Cisco is multinational American company means Cisco has branches in more then (65)countries about 75000 employee related to Cisco headquarter of Cisco in American city California

in 1996 Cisco offer a course by name CCP (stand for carrier certified path)which include information about Cisco devices

The Cisco courses is the following

1-CCNA Voice 4- CCNA security 7-CWNA wireless 10- CCNP (R&S)
2-CCNP voice 5-CCNP security 8-CWNP wireless 11-CCIE (R&S)
3-CCIE voice 6-CCIE security 9-CCIE wireless
1-CCNA stand for Cisco certified network administrator
2-CCNP Cisco certified network Professional
3-CWNA stand for Cisco wireless network administrator
4-CWNP stand for Cisco wireless network processional
5-CCIE Cisco certified internetwork Expert
NOTE :the Cisco company last course is CCIE
CCIE is PHD in Cisco
CCIE has two paper one is written paper fee is 300$ anther one is practical fee is 1200$ the CCIE Exam just is Dobi and India

Introduction of CCNA

In1980 a married couple Leonard bosack and sandy learner works as computer operating staff af stand ford university USA create a Gateway to connect different network and through this Gateway communicate with each other in 1984 they establish a company by name small c
the CCNA First name was small c
in 1992 the Cisco company converted small c into CCNA and also change device name Gateway to router and introduce different series router
example:2000,3000,4000,7000
Cisco company that time very famous when Cisco company produce 4000 series router this router configuration is very simple and compatible with other company devices

1-System Administrator or IT Manager

the responsibility of IT Manager is installation configuration maintenance and troubles ting
the IT manager must be study MCITP and MCSE
NOTE:MCITP and MCSE THE Microsoft company courses
the every course first letter was is M all of the Microsoft courses
the CEO of Microsoft is Bill Gate

Network Engineer or Network Administrator

the responsibility of Network Engineer design of networks or configure network devices such us router switch and MLS
NOTE :the network Engineer must be study CCNA and CCNP
THE every course first letter was C all of the CISCO company course
note :the CEO of CISCO IS Ghan Chamber

Database administrator

the responsibility of database administrator is update backup and restore the data In organization

The must popular companies which are working for network

1-CISCO is using 80-85 %
2-Microsoft is using 80 – 91 %
3-Red hat is using 5- 10 %
4-Hawai and Novel is using 3-5 %
5-Juniper is using 3-4

Addresses

- 1-Mac address
- 2-logical address
- 3-port address
- 4-socket address
- 5-specific address

MAC Address

- MAC address stand for media access control
- Every Lan card it own address is called MAC address
- Also called physical address or hard ware address
- also called Link address
- How to check the computer MAC address

start---run ----cmd----getmac---enter

- MAC address authorize by IEEE
- IEEE stand for institute of electrical of electronic engineering
- Mac address represent in hexa decimal
- Hexa decimal numbers contain (0,1,2,3,4,5,6---9,a,b,c,d,e,f)
- Mac address consist of 6 parts
- Each part consist of 2 hexa
- 1 hexa =4bits
- Example of Mac address
- oo-ob-42-84-co-db
- Mac address is 48 bits

Logical address or IP Address

- Is a type of address which is defining from user every time a user can changing means it is changeable address
- Example of 10.0.0.100
- Example of 20.0.0.100
- Example of 192.168.10.100

Port address

- Port address is a logical channel for communication port address consist of 16 bits
- Port address identify the sender and receiver
- Of the message
- Transport layer assign port number

Important protocols and port numbers

Number	protocol	port
1	FTP	21
2	SSH	22
3	TELNET	23
4	SMTP	25
5	DNS	51
6	DHCP	67
7	HTTP	69
8	HTTPS	443

Socket Address

- The combination of IP address and port address are called socket address
- Example of socket address
- 10.0.0.1:23

Specific Address

- Is a type of IP address user friendly address
- Or it is using for specific sites are called specific address
- Example of specific address
- www.google .com
- www.yahoo.com
- www.gmail.com
- www.facebook.com

END

I wish you to have a succesful life

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