- Suresh Khanal

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About the Author

Suresh Khanal is a native of Kathmandu, Nepal, where he works as a freelance developer, programmer and technical writer/editor. He has been involved in teaching computers science since 1998 and over the years has written several articles and tutorials on Office Applications and Web Programming. Khanal holds a Master's of Science Degree in Information Technology Science.

In his spare time, he enjoys travelling, browsing and play online games.

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Short Questions and Answers

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Computer Networking
Short Questions
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Answers

Transmission Media

What is transmission media?

Transmission media is a pathway through which data are transmitted in network. We use different types of cables or waves to transmit data.

What are the types of transmission media?

There are two types of transmission media namely: bound transmission media and unbound transmission media.

Describe bound transmission media.

Bound transmission media are the cables that are tangible or have physical existence and are limited by the physical geography. Popular bound transmission media in use are twisted pair cable, co-axial cable and fiber optical cable.

Describe unbound transmission media.

Unbound transmission media are the ways of transmitting data without using any cables. These media are not bounded by physical geography. Microwave, Radio wave, Infra red are some of popular unbound transmission media.

Bound Transmission Media

Explain twisted pair cable.

A pair of wires twisted with each other is known as twisted pair cable. A set of four pairs of twisted wires are bundled to form cable. These are the most common medium for LAN. Wires are twisted with each other so as to reduce the interference.

Figure 1: UTP Cable

Figure 2: UTP Cable Connector

We can find two types of twisted pair cables, namely: Unshielded Twisted Pair Cable (UTP) and Shielded Twisted Pair Cable (STP). The twisted pair cable that is protected against electro-magnetic interference (EMI) is known as STP and the one which is not shielded against EMI is called Unshielded Twisted Pair.

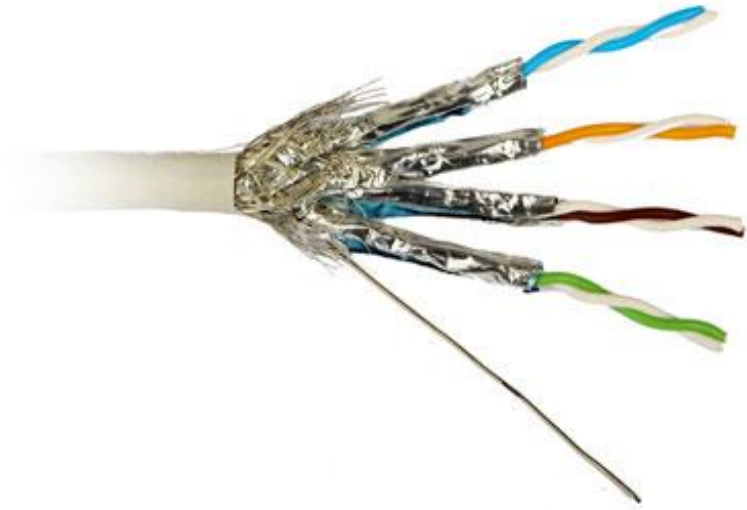
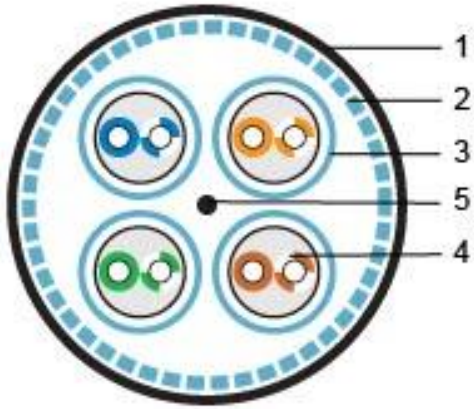


Figure 3: STP Cable



1–Jacket
2–Shield-braid
3–Shield-foil
4–Solid twisted pair
5–Drain wire

Figure 4: STP Cable Structure

Explain Co-axial cable.

A solid central conductor surrounded by insulating material and then by a cylindrical shield woven from fine wires is known as co-axial cable. The shield is usually connected to electrical ground to reduce electrical interference. Co-axial cables have broader bandwidth and thus suitable for audio, video data transmission.

Figure 5: Co-Axial Cable

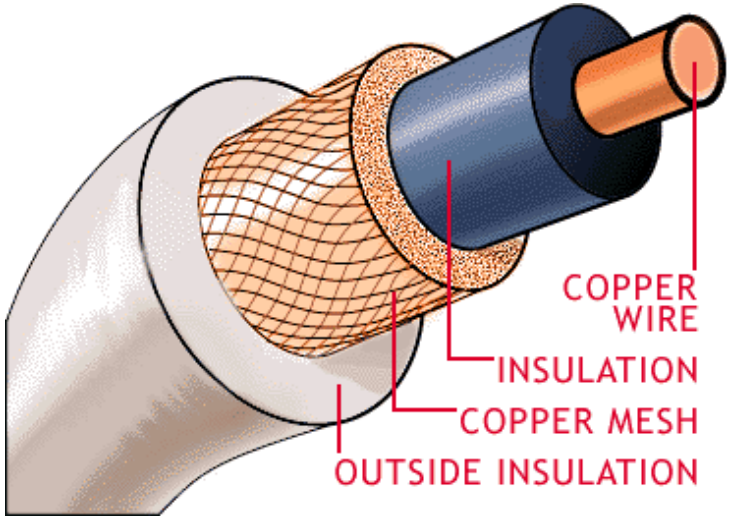


Figure 6: Co-Axial Cable Structure

Figure 7: Co-Axial Cable Connectors

Explain Fiber-Optics cable.

A cable with central glass tube covered with protective shield which transmit data using photons is fiber optics cable. These cables transmit data via concentrated bursts of laser beams which are carried through bundles of hair thin glass fibers. They have advantages over electronic cables in transmission speed and volume. This technology has revolutionized telecommunication applications which used electronic cables. Fiber optics cables as free from electro-magnetic interference as well as wire tapping.

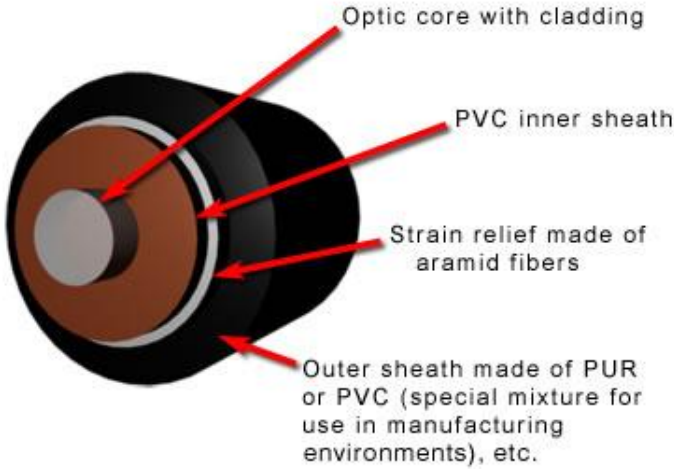


Figure 8: Fibre Optics Cable Structure

Figure 9: Fiber Optics Cable

Match the following types of connectors with the cables to which they are used.

Cable: (a) Thick Coax (100 Base 5), (b) UTP (10 Base-T), (c) Fiber Optics (10 Base-FL) (d) Thin Coax (100 Base 5)

Connectors: (1) AUI, (2) BNC, (3) RJ45, (4) SC or ST Type

Answer:- a -> 1, b -> 3, c -> 4, d -> 2

Figure 10: AUI Connector

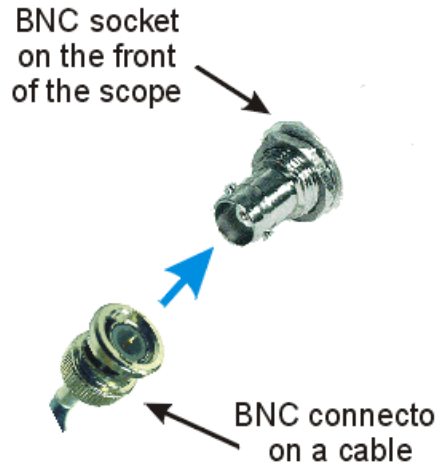


Figure 11: BNC Connector

Figure 12: RJ45 Connector

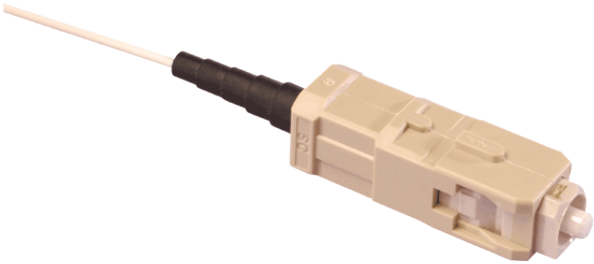


Figure 13: SC Connector

Compare BNC with UTP Cables

BNC	UTP
Derived from the thick Ethernet Coaxial Cable	Derived from telephone cable
Flexibility of adding nodes	Decided by Hub ports
Lower price and no need of Hub	Needs Hubs
Difficult to locate faults	Introduction of Hub makes fault finding much easier
Terminators needed	Terminators not needed
The cabling is comparatively less reliable	Inherently much reliable
Single segment length (node to node) up to 180 meters	Single segment length up to 200 meters

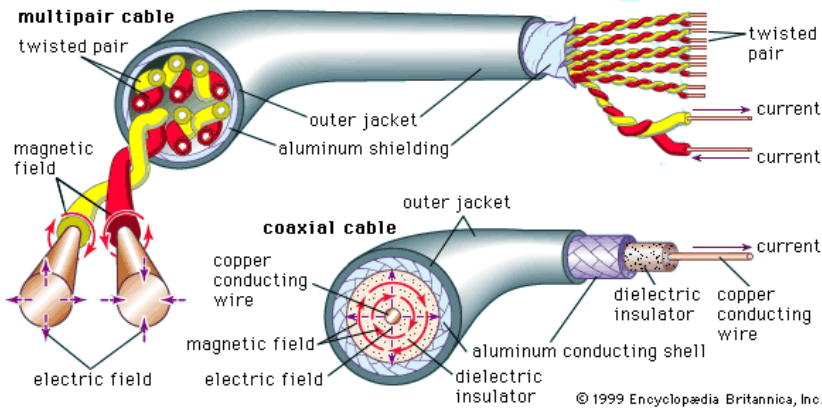


Figure 14: Comparison between Twisted Pairs and Co-Axial Cable

Unbound Transmission Media

Unbound transmission media extend beyond the limiting confines of cabling. They provide an excellent communication alternative for WANS. The lack of physical restrictions provides larger bandwidth as well as wide area capabilities. Unbound media typically operate at very high frequencies. The three types of unbound transmission media are: Radio wave, Micro wave, Infrared

Explain Radio Wave.

Although Radio waves are prevalent and well understood, we are just beginning to realize their enormous potential as a networking medium. Radio waves can operate on a single or multiple frequency bands.

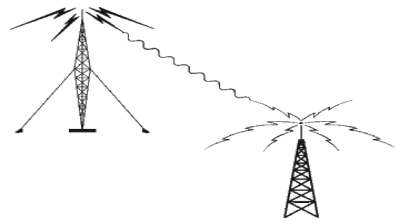


Figure 15: Radio Wave Transmission

What is Microwave?

Microwaves have been used in data communications for a long time. They have a higher frequency than radio waves and therefore can handle larger amounts of data.

Microwave transmission is line of sight transmission. The transmit station must be in visible contact with the receive station. This sets a limit on the distance between stations depending on the local geography. Typically the line of sight due to the Earth's curvature is only 50 km to the horizon! Repeater stations must be placed so the data signal can hop, skip and jump across the country.

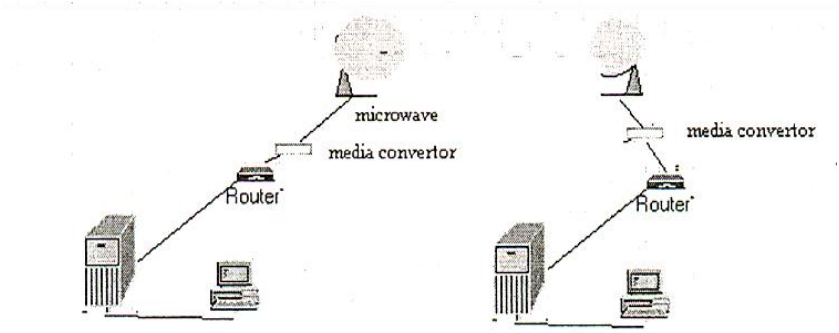


Figure 16: Microwave Transmission

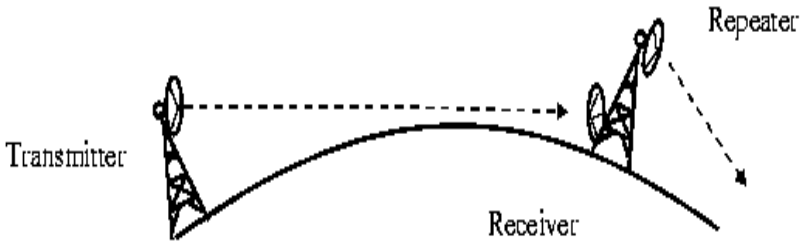


Figure 17: Microwave Transmitter, Receiver and Repeater

Microwaves operate at high operating frequencies of 3 to 10 GHz. This allows them to carry large quantities of data due to their large bandwidth.

List the Advantages of microwaves.

a. They require no right of way acquisition between towers.

b. They can carry high quantities of information due to their high operating frequencies.

c. Low cost land purchase: each tower occupies only a small area.

d. High frequency/short wavelength signals require small antennae.

What are the Disadvantages of Microwaves?

a. Attenuation by solid objects: birds, rain, snow and fog.

b. Reflected from flat surfaces like water and metal.

c. Diffracted (split) around solid objects.

d. Refracted by atmosphere, thus causing beam to be projected away from receiver.

Describe Infra Red.

Infrared offers a great unbound photonic solution. Like fiber-optic cabling, infrared communications use light, so they are not bound by the limitations of electricity.

Figure 18: Infrared Device

Computer Network

What is a computer network?

Computer Network is a collection of distributed intelligent machines that are connected with each other with transmission media for the purpose of data sharing, communication and sharing of computer resources.

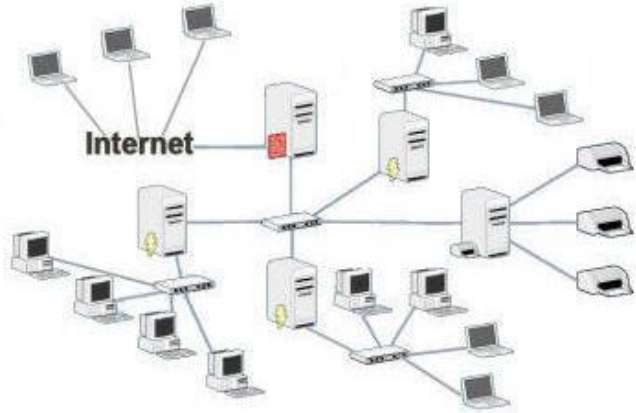


Figure 19: Computer Network

What are the advantages of Networking?

The following are the distinct notes in favor of computer networking.

a. The computers, staff and information can be well managed
b. A network provides the means to exchange data among the computers and to make programs and data available to people
c. It permits the sharing of the resources of the machine
d. Networking also provides the function of back-up.
e. Networking provides a flexible networking environment. Employees can work at home by using through networks ties through networks into the computer at office.

Explain Network Services

Network services are the thing that a network can do. The major networking services are

- File Services: This includes file transfer, storage, data migration, file update, synchronization and achieving.
- Printing Services: This service produces shared access to valuable printing devices.
- Message Services: This service facilitates email, voice mails and coordinate object oriented applications.
- Application Services: This services allows to centralize high profile applications to increase performance and scalability
- Database Services: This involves coordination of distributed data and replication.

What are the five major network services?

Major Network Services are:

a. File Services
b. Print Services
c. Message Services
d. Application Services
e. Database Services

What is Network Server?

Network Server is a computer in Network that is designated to provide one or more network service. For example file server, database server etc.

What is a client?

A computer in network that connects to the server and uses the network services to perform user's tasks is a client.

What is a dedicated server?

A network server designated to provide one particular service is known as dedicated server. For example if a computer is assigned for database service only then that computer is known as dedicated database server.

What is workstation?

A workstation is a node in network that is more powerful and can handle local information processing or graphics processing. A workstation usually has an inexpensive, small hard disk to carry out local tasks.

Figure 20: Workstation

Some workstations that have no disk drive of their own is known as diskless-workstation or dumb terminals. They terminals completely rely on LAN for their access. Network operating system lets the node work as if all the resources at the server belong to the node itself.

What are dumb terminals?

Those Workstations that have no disk drive of their own and rely completely on LAN for their access are called dumb terminals. The network operating system lets these terminals work as if all the resources at the server belong to the workstation itself.

Figure 21: Dumb Terminal

Types of Computer Network

Computer networks fall into three classes regarding the size, distance and the structure namely: LAN (Local Area Network), MAN (Metropolitan Area Network), WAN (Wide Area Network). A LAN links a small group of functionally similar workstations within a local geographic area such as a series of adjacent cubicles or offices on the same floor. Once the network expands to include other floors or divers office within a metropolitan area, it becomes a MAN. Finally, a WAN is simply a LAN of LANs. WANs expand the boundaries of networking to a global or even galactic scale.

What is a LAN?

A LAN is a Local Area Network, within a single building or a specific confined space. LANs typically comprise only one transmission media type such as coaxial cable or twisted pair. LANs are characterized by comparatively high-speed communications. These high speeds are possible because LANs use one kind of cable which generally is limited to 5 km or less.

What is MAN?

MAN stands for Metropolitan Area Networks. MAN is larger than a LAN and as its name implies, covers the area of a single city. MANs rarely extend beyond 100 KM and frequently comprise a combination of different hardware and transmission media.

The two most important components of MANs are security and standardization. Security is important because information is being shared between dissimilar systems. Standardization is necessary to ensure reliable data communication.

What is WAN?

A wide area network is simply a LAN of LANs. WANs connect LANs that may be on opposite sides of a building, across the country or around the world. WANS are characterized by the slowest data communication rates and the largest distances. WANs can be of two types: an enterprise WAN and Global WAN.

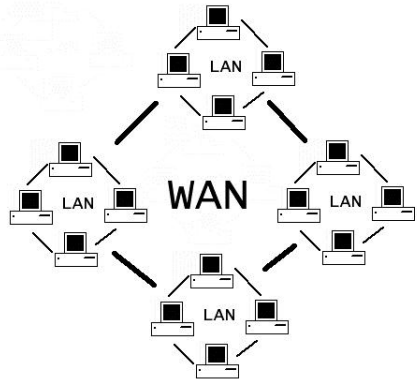


Figure 22: Wide Area Network

Clarify Enterprise WANs.

An enterprise WAN connects an entire organization including all LANs at various sites. This term is used for large, widespread organizations such as corporations, universities and governments.

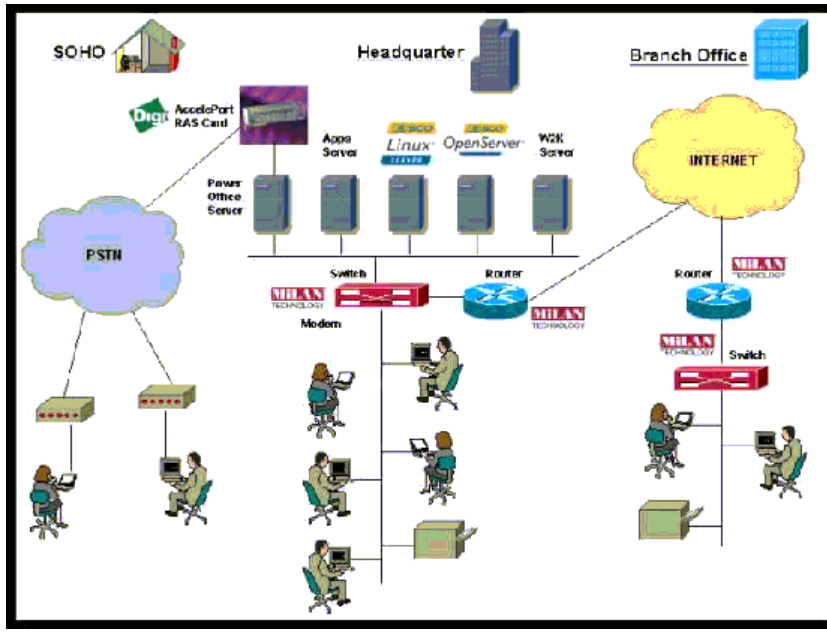


Figure 23: Enterprise WAN

Clarify Global WANs.

Global WANs also span the world but they do not have to connect LANS within a single organization. The Internet is an example of a global WAN. It connects diverse locations, organizations and institutions throughout the world. Global WANS can be public or private. Private WANs are called Intranet which belongs to an organization. Public WANs are open to everybody so that anybody can connect and use the resources and services available.

What are the two types of LAN?

There are basically two types of Local Area Networks namely: Arcnet and Ethernet.

Protocols

What is a protocol?

The term protocol refers to a set of rules and procedures that govern the transmission of messages over a physical networking medium. The most common network protocols are: (a) TCP/IP, (b) IPX/SPX and (c) NetBEUE

What are the three major network protocols?

The three major network protocols are:

1. TCP/IP
2. IPX/SPX (Used in Novell Netware)
3. NetBEUE (Product of Microsoft Co.)

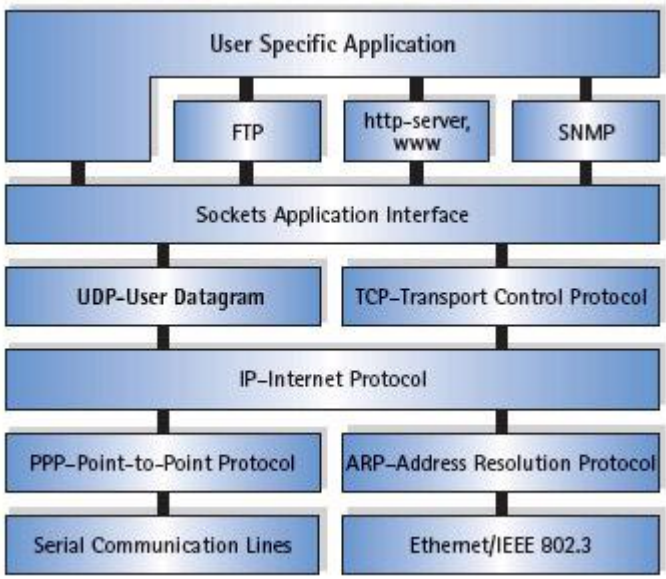


Figure 24: TCP/IP Structure

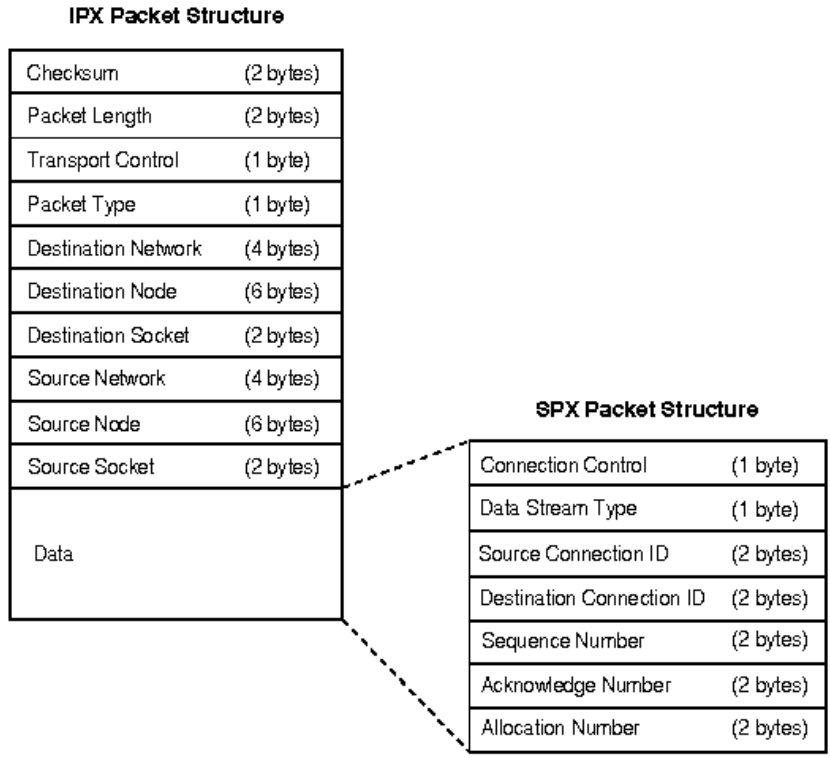


Figure 25: IPX/SPX Structure

Match the following protocols and their functions

(a) http, (b) pop, (c) ftp, (d) smtp, (e) MIME,

1. Send email messages
2. Transfer multimedia information
3. Send email attachment
4. Transfer files in servers and clients computers
5. Receive email messages

Answer: (a) -> 2, (b) -> 5, (c) -> 4, (d) -> 1, (e) -> 3

LAN Topologies

The term topology defines the geographic arrangement of networking devices. It describes the actual layout of the network hardware. Given the location of workstations and peripherals, the goal of topology is to find the most economical and efficient way to connect all the users to the network resources while providing adequate capacity to handle user demands, maintain system reliability and minimize delay.

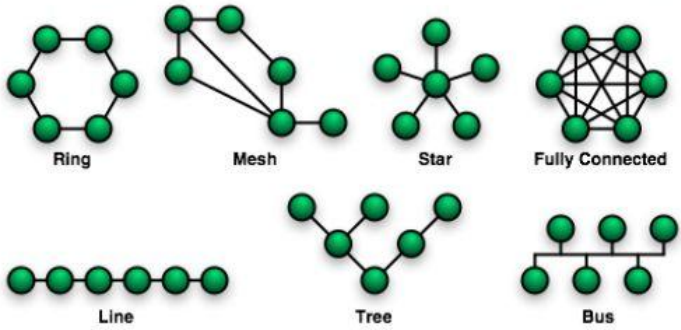


Figure 26: Different LAN Topologies

The selection of a topology for a network can not be done in isolation as it affects the choice of media and the access method used. Because it determines the strategy used in wiring a building for a network and deserves some careful study.

What are the two network connection types?

The two different network connection types are (a) point-to-point connection and (b) multipoint connection.

Explain Point-to-Point connection type.

A point-to-point connection is a direct link between two devices such as a computer and a printer. Most of today's point-to-point connections are associated with modems and PSTN (Public Switched Telephone Network) communications.

Explain multipoint connection.

A multipoint connection is a link between three or more devices. Historically, multipoint connections were used to attach central CPs to distributed dumb terminals. In today's LAN environments, multipoint connections link many network devices in various configurations.

What are the basic LAN topologies?

The three simple LAN topologies that are combined to form any practical topology are known as basic LAN topologies. They are, Bus Topology, Ring Topology and Star Topology.

Explain Bus Topology.

The physical Bus topology is the simplest and most widely used of the network designs. It consists of one continuous length of cable (trunk) and a terminating resistor (terminator) at each end. Data communication message travels along the bus in both directions until it is picked up by a workstation or server NIC. If the message is missed or not recognized, it reaches the end of the cabling and dissipates at the terminator.

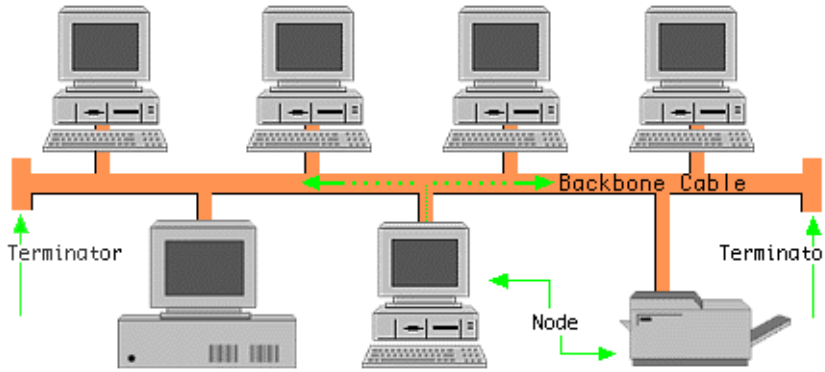


Figure 27: Bus Topology

All nodes on the bus topology have equal access to the trunk. This is accomplished using short drop cables or direct T-connectors. The number of devices and the length of the trunk can be easily expanded.

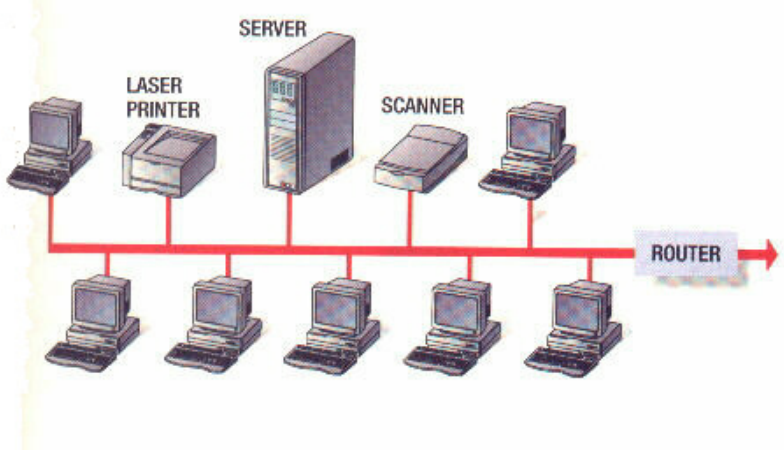
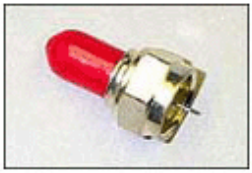


Figure 28: Bus Topology Network connected with other network

Figure 29: T Connector

CL-625-TRM
KS Port
Terminator



CL-35201
F Male Terminator
Swiveling
Precision Series

CL-F-TRS-1/2
F Male Terminator
Swiveling

Figure 30: Different Cable Terminators

What are the advantages of bus topology?

The advantages of physical bus topology are:

a. It uses established standards and it is relatively easy to install.
b. It requires less media than other topologies.

What are the disadvantages of bus topology?

The disadvantages of bus topology are:

a. The bus networks are difficult to reconfigure, especially when the acceptable number of connections or maximum distances have been reached.
b. They are also difficult to troubleshoot because everything happens on a single media segment. This can have dangerous consequences because any break in the cabling brings the network to its knee.

What is Ring Topology?

The physical ring topology is a circular loop of point-to-point links. Each device connects directly to the ring or indirectly through and interface device or drop cable. Message travel around the ring from node to node in a very organized manner. Each workstation checks the message for a matching destination address. If the address doesn't match the node simply regenerates the message and sends it on its way. If the address matches, the node accepts the message and sends a reply to the originating sender.

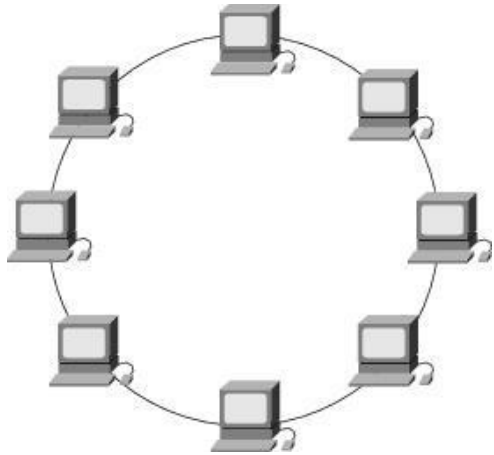


Figure 31: Ring Topology

Point out the major advantages of Ring Topology.

The advantages of ring topologies are:

a. They are very easy to troubleshoot because each device incorporates a repeater.
b. A special internal feature called beaconing allows troubled workstations to identify themselves quickly.

Point out the disadvantages of Ring Topology.

The disadvantages of ring topologies are:

a. It is considerably difficult to install and reconfigure ring topology
b. Media failure on unidirectional or single loop causes complete network failure.

Explain Star Topology.

The physical star topology uses a central controlling hub with dedicated legs pointing in all directions – like points of a star. Each network device has a dedicated point-to-point link to the central hub. This strategy prevents troublesome collisions and keeps the lines of communications open and free of traffic.

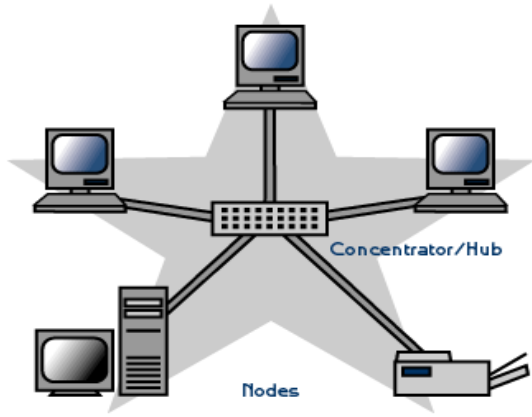


Figure 32: Star Topology

This topology, obviously, require a great deal of cabling. This design provides an excellent platform for reconfiguration and trouble-shooting. Changes to the network are as simple as plugging another segment into the hub and a break in the LAN is easy to isolate and doesn't affect the rest of the network.

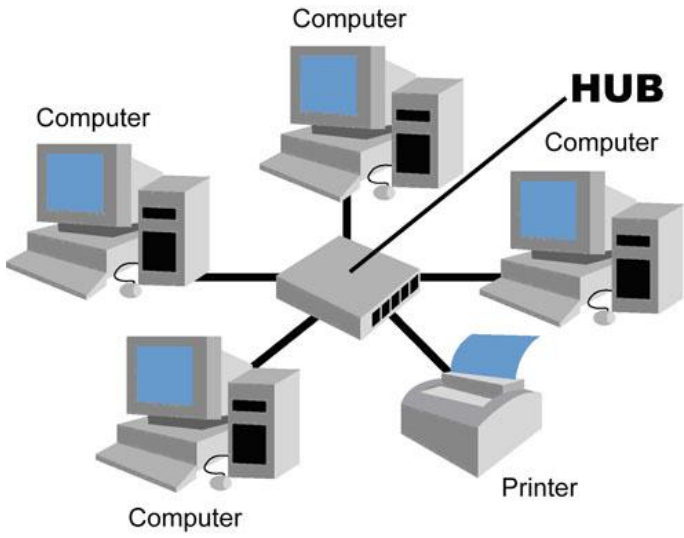


Figure 33: Star Topology

What are the benefits of Star Topology?

The benefits of star topology are:

a. Relatively easy to configure.
b. Easy to troubleshoot
c. Media faults are automatically isolated to the failed segment.

What are the disadvantages of Star Topology?

The disadvantages are considered as follows:

a. Requires more cable than most topologies.
b. Moderately difficult to install.

What are the popular topologies other than basic Topologies?

Apart from basic topologies some other topologies worth considering are: mesh topology (every device connected to all other devices), Cellular Topology (wireless point to pint and multipoint design), Tree Topology (Hierarchical connections of devices), Hybrid topology (combination of two or more basic topologies).

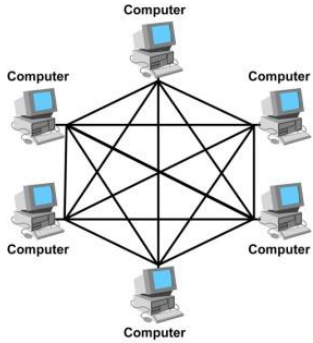


Figure 35: Mesh Topology

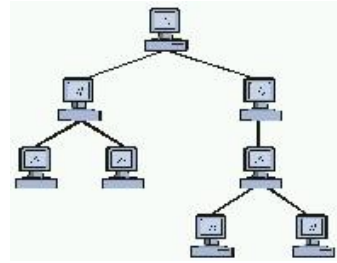


Figure 34: Tre Topology

Network Standards

What is a Networking Standard?

Protocol (the logical component) and Topology (the physical component) is combined together to create a networking standard. These standards are developed and controlled by the Institute of Electrical and Electronics Engineers (IEEE).

What are the four major industry standards?

The four major industry standards are (a) Ethernet, Token Ring, ARCNet and FDDI (Fiber Distributed Data Interface).

What is an Ethernet?

The Ethernet topology was developed at the University of Hawaii to connect computers on the various Islands. It was radio based design. Later, Robert Metacalfe went to Xeros's Palo Alto Research Center (PARC) laboratories and eliminated the radio portion and changed to co-axial cabling. Ethernet is one of the most popular LAN technologies in use today covering more than 85% of the networks. Ethernet system consists of three basic elements:

4. ***The physical medium*** use to carry Ethernet signals between computers on the network
5. ***A set of rules (protocols)*** embedded in each Ethernet interface that will decide how multiple computers on the network will have access to the data on the medium.
6. ***An Ethernet frame*** that consists of a standardized set of bits used to carry data over the system.

How an Ethernet Worked?

The operation of Ethernet can be described in simple terms as follows:

Each computer on the Ethernet Network, also known as a node, operates independently of all other nodes. All nodes attached to an Ethernet are connected to a shared medium over which the Ethernet signals travel serially, one data bit at a time.

To send data a station first listens to the channel and when the channel is idle the station transmits its information in the form of an Ethernet frame, or packet. The Ethernet rules (protocol) are defined in such a way that every node gets a fair amount of frame transmission opportunity.

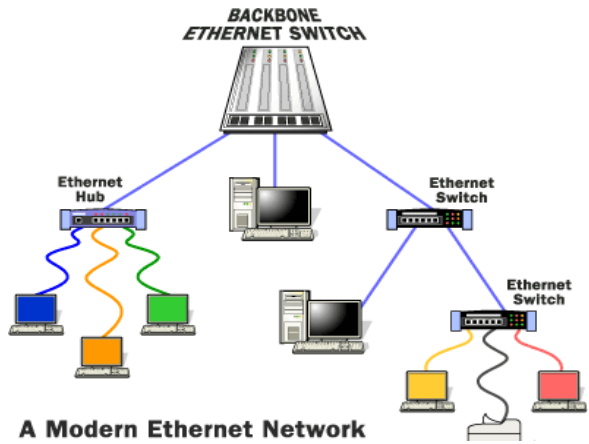


Figure 36: Ethernet Network

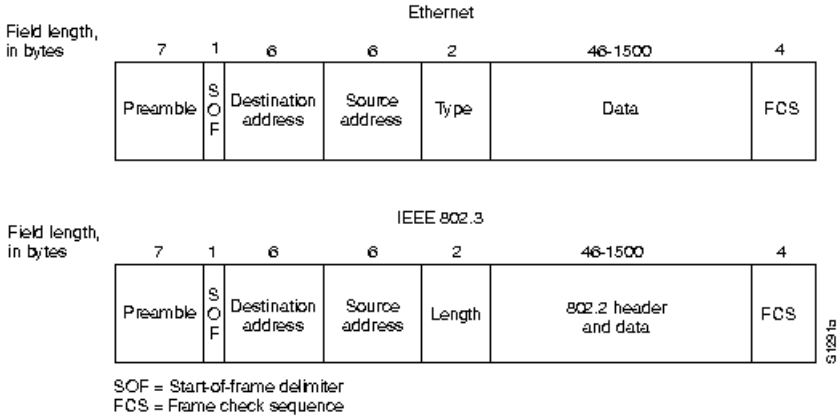
As each Ethernet frame is sent out on the shared medium, the Ethernet interfaces inside the node look at the destination address. The interfaces compare the destination address of the frame with their own address. The Ethernet interface with the same address as the destination address in the frame will read the entire frame and all other network interfaces will ignore the information.

What is Medium Access Control of Ethernet?

The set of rules which ensures that every node in an Ethernet gets a fair amount of frame transmission opportunity, are called the "Medium Access Control" mechanism. The Medium Access Control mechanism is based on a system called Carrier Sense Multiple Access with Collision Detection (CSMD/CD).

Explain Ethernet Frame.

The heart of Ethernet system is the Ethernet Frame, which is used to deliver information between the computers. The frame consists of a set of bits organized into several fields. These fields include address fields, a data field and an error checking field that checks the integrity of the bits in the frame to make sure that the frame has arrived intact.



List some advantages of Ethernet.

Ethernet's major advantages are:

1. It is an inexpensive way to achieve high speed LAN transmissions (10 to 100 MB/s)
2. It is a proven technology that supports various writing configurations.
3. It works well with a large number of LAN and micro-to-mainframe applications.
4. It is easy to install.

What are the disadvantages of Ethernet Cabling?

The Ethernet cabling ahs the following disadvantages:

1. Ethernet is not a high-level performer in high-load environments. This protocol (CSMA/CD: Carrier Sense Multiple Access/Collision Detection) can slow down dramatically if hundreds of workstations are competing for the same cabling trunk
2. Its linear bus cabling system can sometimes make it difficult to isolate problems.

What is ARCNet?

The Attached Resource Computer Network (ARCNet) standard was created in 1977 at the Data Point Corporation by a scientist – John Murphy. ARCNet uses the token-passing protocol over a star and bus topology. The star and bus topology combines the flexibility of a star with the simplicity and throughput of a bus. Thus, ARCNet standard has a unique protocol/topology combination: token-passing protocol and Distributed star/bus topology.

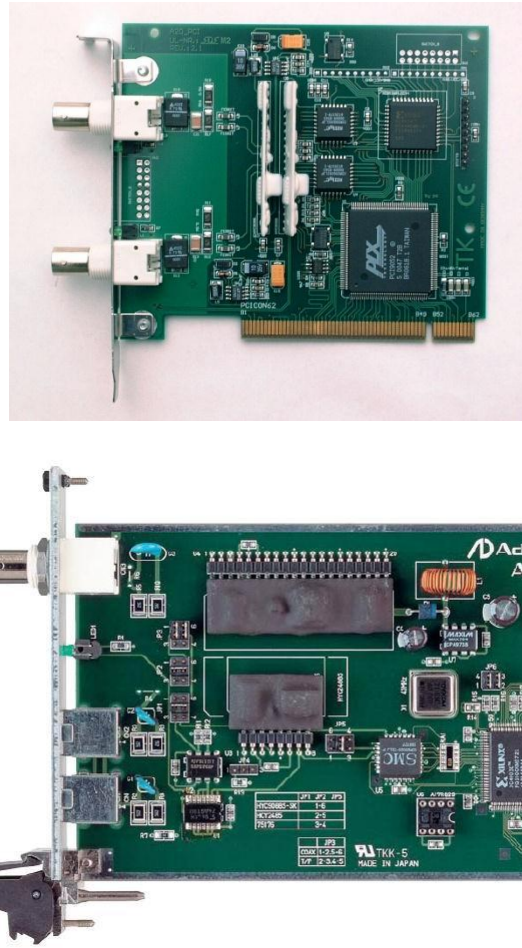


Figure 37: ARCNet Board and Card

List the advantages of ARCNet.

Here are some of the ARCNet's advantages:

1. It is extremely reliable.
2. ARCNet is easy to install and troubleshoot.
3. It has an excellent track record of interoperability for those using ARCNet components from various manufacturers.
4. ARCNet supports a variety of cable types including coaxial, UTP and Fiber Optics.
5. It is inexpensive and built to stay that way.

What are the disadvantages of ARCNet?

Here are some disadvantages of ARCNet:

1. Standard ARCNet is very slow (2.5 Mb/s). It is almost seven times slower than Token Ring.
2. ARCNet was not designed with interconnectivity in mind. For many installations, it's difficult to go beyond the confines of single LAN.

How does a Token-Passing Protocol works?

The token-passing protocol relies on a control signal called the token. A token is a 24-bit packet that circulates throughout the network from NIC to NIC in an orderly fashion. If a workstation wants to transmit a message, first it must seize the token. At that point, the workstation has complete control over the communications channel. The existence of only one token eliminates the possibility of signal collisions. This means that only one station can speak at a time.

Explain Logical Ring Physical Star topology for Token-Passing Standard.

It is sure that any break in the ring at any point will interrupt communications for all machines. To solve this problem, IBM developed a modified ring topology, which they called the logical ring

physical star. The central point of the physical star configuration is Token Ring hub called the multi-station access unit (MSAU, pronounced as masow). Workstations and servers attached to the MSAU through special STP adapter cables. IBM converted stars into a logical ring by connecting all MSAU hubs together through special ring-in (RI) and ring-out (RO) ports.

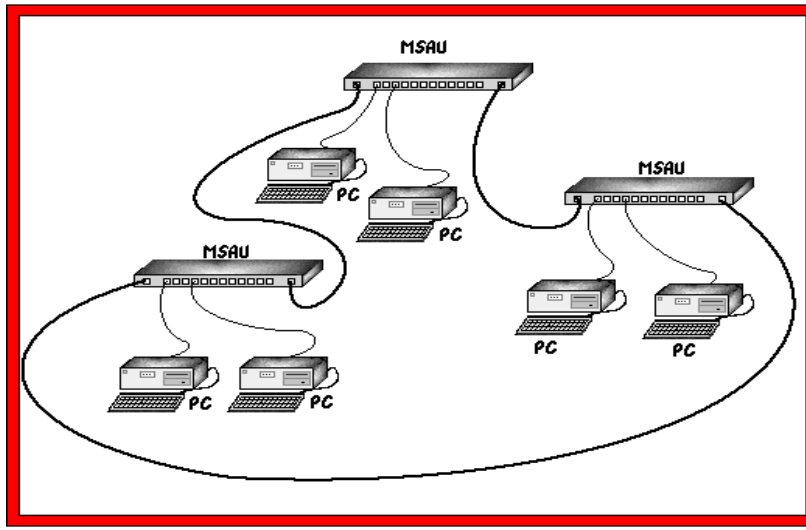


Figure 38: Network with MSAU

List some most useful advantages of Token Ring.

Here are Token ring's most useful advantages:

a. It offers excellent throughput under high-load conditions.
b. Token Ring facilitates LAN-to-LAN mainframe connections especially for interfacing with IBM's broader connectivity strategies.
c. It has built-in troubleshooting mechanisms such as beaconing and auto-reconfiguration and may now be used with UTP cabling.

d. It has the most reliable protocol (token-passing), the most trouble-free configuration (physical star) and the fastest connectivity scheme (r or 16 mb/s).

Point out the disadvantages of Token Ring.

Few of the disadvantages of Token Ring are:

a. Token Ring is very expensive. All topology components cost much more than other more popular standards.
b. It is relatively proprietary. Token Ring's complexity is built into the hardware components. This means hat you need to choose a manufacturer and stick with it.
c. Engineers must have considerable expertise to manage and troubleshoot token ring components.

What do you mean by Beaconing and Auto-Reconfiguration?

When a station does not receive a message from its nearest active upstream neighbor, it sends out a warning, otherwise known as a beacon. This beacon alerts everyone that something is wrong and helps to isolate the failure domain. When beacon occurs, the ring will attempt to fix the problem without your intervention. This process of self-healing is called auto-reconfiguration.

Network Architecture

What is Network Architecture?

When two or more computer are connected with one another for the purpose of communicating data electronically, besides physical connection of computers, communication devices and system servers, a well defined standard known as architecture is required to establish cohesive communication between devices in Network.

What are the popular Network Architectures?

The most popular architectures are:

a. ISO Open System Architecture (OSI)
b. IBM's System Network Architecture (SNA)

Explain ISO's OSI Architecture

The Open System Interconnection (OSI) is a standard reference model for communication between two end users in a network. It is used in developing products and understanding networks which means commonly used Internet product and services fit within the model. The OSI model describes seven layers of related functions that needed at each end, when a message is sent from one party to another party in a network. Each layer has its own set of special related function as follows:

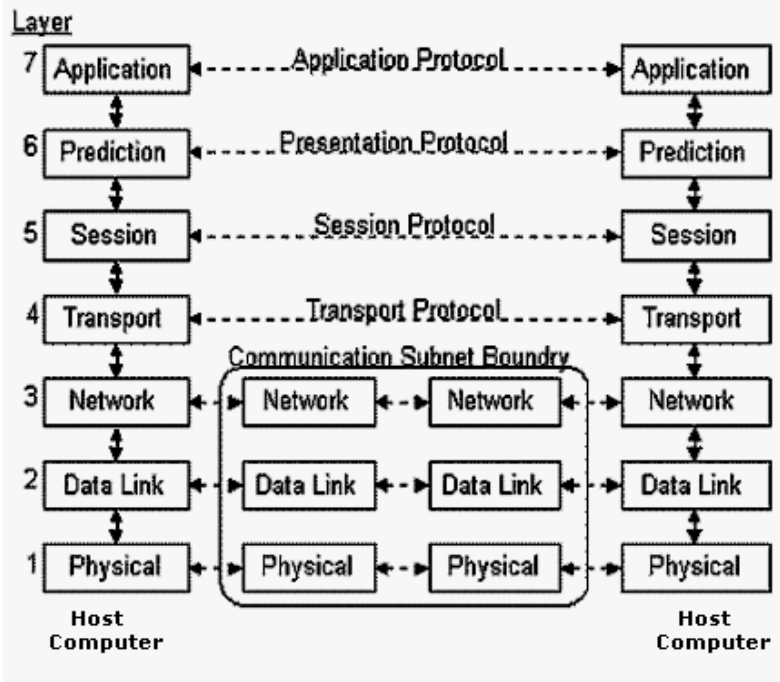


Figure 39: ISO's OSI Architecture

Layer 7 – Application Layer: Application programs that use the network.

Layer 6 – Presentation Layer: Standardize data presented to the application.

Layer 5 – Session Layer: Manages sessions between applications

Layer 4 – Transport Layer: Provides error detection and correction

Layer 3 – Network Layer: Provides data delivery across the physical connection

Layer 2 – Data Link Layer: Provides data delivery across the physical connection

Layer 1 – Physical Layer: Defines the physical network media.

Explain IBM's SNA Architecture

SNA is a computer networking architecture that was developed by IBM to provide a network structure for IBM mainframe, midrange, and personal computer systems. SNA defines a set of proprietary communication protocols and message formats for the exchange and management of data on IBM host networks.

<table>
<tr><th>OSI Model</th><th>SNA</th></tr>
<tr><td>Application</td><td>Transaction Services</td></tr>
<tr><td rowspan="2">Presentation</td><td>Presentation Services</td></tr>
<tr><td rowspan="2">Session</td><td rowspan="2"></td></tr>
<tr><td>Transport</td><td>Data Flow Control</td></tr>
<tr><td>Network</td><td>Transmission Control</td></tr>
<tr><td>Data Link</td><td>Path Control</td></tr>
<tr><td rowspan="2">Physical</td><td>Data Link Control</td></tr>
<tr><td>Physical</td></tr>
</table>

Figure 40: OSI an SNA Comparision

SNA can be used for the following types of tasks:

- Terminal access to mainframe and midrange computer applications.
- File transfer of data between computer systems.
- Printing of mainframe and midrange data on SNA printers.
- Program-to-program communications that allow applications to exchange data over the network.

SNA can be implemented in a networking infrastructure that uses either a hierarchical or peer-to-peer model.

Networking Model

Explain Peer-to-Peer Networking Model.

A networking model where each workstation has equivalent capabilities and responsibilities is known as peer-to-peer model. There is no central server in this network and computers join hands to share files, printers and Internet access. It is practical for workgroups of a dozen or less computers making it common environments, where each PC acts as an independent workstation that stores data on its own disk but which can share it with all other PCs on the network. Software for peer-to-peer network is included with most modern desktop operating systems such as Windows and Mac OS.

Explain Client/Server Networking Model.

A networking model where one or more powerful computers (servers) provide the different network services and all other user's computers (clients) access those services to perform user's tasks is known as client/server networking model. Client-server networking model became popular in the late 1980s and early 1990s as many

applications were migrated from centralized minicomputers and mainframes to networks of persona computers. The design of applications for a distributed computing environment required that they effetely be divided into two parts: client (front end) and server (back end). The network model on which they were implemented mirrored this client-server model with a user's PC (the client) typically acting as the requesting machine and a more powerful server machine to which it was connected via either a LAN or a WAN acting as the supplying machine. It requires special networking operating system. It provides user level security and it is more expensive.

Network and Internet Terminologies

NICs

Network interface cards, commonly referred to as NICs are used to connect a PC to a network. The NIC provides a physical connection between the networking medium and the computers' internal bus, and is responsible for facilitating an "access method" to the network. Most NICs are designed for a particular type of network, protocol and media, although some can serve multiple networks.

Figure 41: LAN NIC Card

Hubs/Repeaters

Hubs/Repeaters are used to connect together two or more network segments of any media type. In larger design, signal quality begins to deteriorate as segment exceeds their maximum length. A hub provides the signal amplification required to allow a segment to be extended a greater distance. ***Passive hub*** simply forwards any data packets they receive over one port from one workstation to all their remaining ports. ***Active hubs***, also sometimes referred to as "multiport repeaters", regenerate the data bits in order to maintain a strong signal.

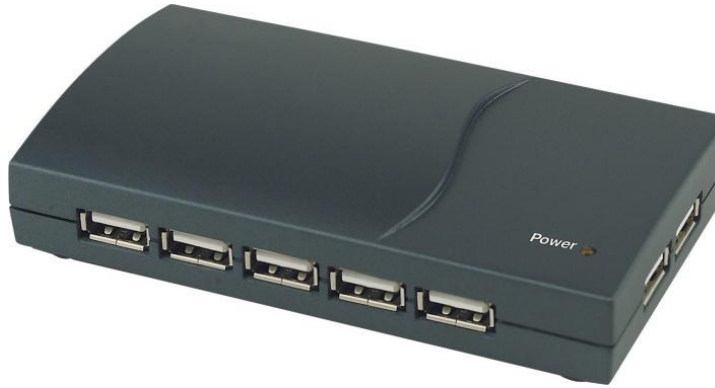


Figure 42: Hub

Bridges

The bridge function is to connect separate homogeneous networks. Bridges map the Ethernet address of the nodes residing on each network segment and allow only necessary traffic to pass through the bridge. When a packet is received by the bridge, the bridge determines the destination and source segments. If the segments are different, then the packet is "forwarded" to the correct segment. Bridges are also called "store-and-forward" device because they look at the whole Ethernet packet before making filtering or forwarding decisions.

Figure 43: Bridge

Router

Routing achieved commercially popularity in the mid – 1980s – at a time when large-scale Internetworking began to replace the fairly simple, homogeneous environments. Routing is the act of moving information across an Internetwork from a source to a destination. It is often contrasted with bridging, which perform a similar function. Routers use information within each packet to route it from one LAN to another, and communicate with each other and share information that allows them to determine the best route through a complex network of many LANs.

Figure 44: Router

Switches

LAN switches are an expansion of the concept in LAN bridging, which controls data flow, handles transmission errors, provides physical addressing, and manages access to the physical medium. Switches provide these functions by using various link-layer protocols. LAN switches can link four, six, ten or more networks together. A store-and-forward switch, on the other hand, accepts and analyses the entire packet before forwarding it to its destination.

Figure 45: Switch

Transceivers

Transceivers are used to connect nodes to the various Ethernet media. Most computers and network interface cards contain a built-in 10BaseT or 10Base2 transceiver, allowing them to be connected directly to Ethernet without requiring an external transceiver. Many Ethernet devices provide an AUI connector to allow the user to connect to any media type via an external transceiver.

Figure 46: Transceiver

Gateway

A Gateway is a device such as a mini or microcomputer capable of operating on a stand alone basis but which also provides connection for communication with the other computers and access to shared resources.

Figure 47: Gateway PC

Proxy Serer

Also called a proxy or application level gateway. It is an application that breaks the connection between sender and receiver. Thus, it helps us to prevent hacker from obtaining Internet address and detail of a private network.

Firewall

Firewall is a method for keeping a network secure. It is mostly used in giving users access to the Internet in a secure fashion as well as to separate a company's public web server from its internal network.

Node

A node is a hardware device or group of devices or station in a network that link one or more other unit to the network.

Wireless Network

The most and latest wireless LANs use electromagnetic airwaves either infrared or radio frequency to communicate information from one point to another without relaying on a physical connection. Radio waves are often referred to as radio carriers because they simply perform the function of delivering energy to a remote receiver. The

data being transmitted is superimposed on the radio carrier so that it can be accurately extracted at the receiving end. Multiple radio carriers can exist in the same space at the same time without interfering with each other if the radio waves are transmitted on different radio frequencies.

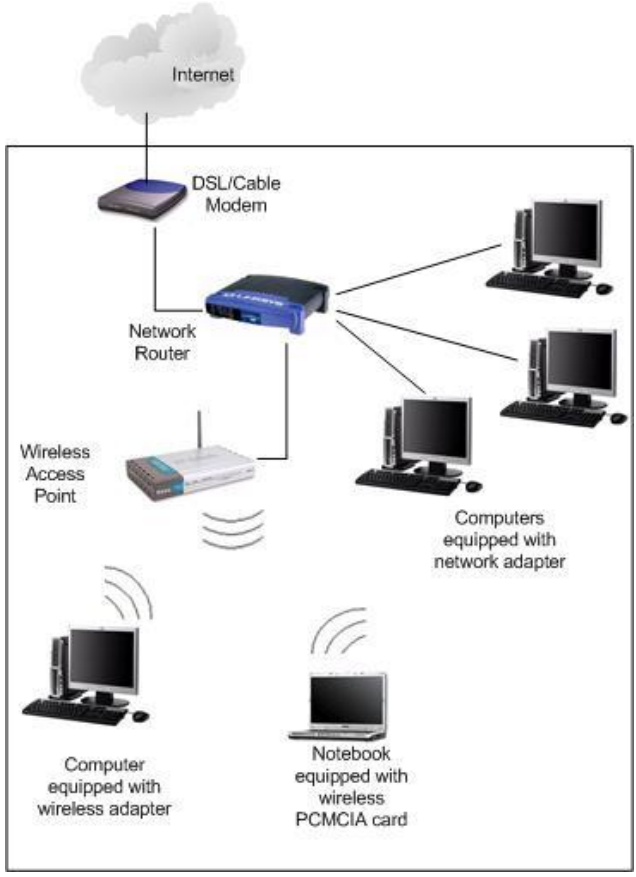


Figure 48: Nework with Wireless Stations

In a typical WLAN configuration, a transmitter/receiver (transceiver) device, called an ***Access Point (AP)***, connects to the wired network from a fixed location using standard Ethernet cable. The Access Point receives, buffers, and transmits data between the WLAN and the

wired network infrastructures. A single Access Point can support a small group of users and can function within a range of less than one hundred to several hundred feet. The Access Point (or the antenna attached to the Access Point) is usually mounted high but may be mounted essentially anywhere that is practical as long as the desired radio coverage is obtained. The wireless network, printers or other peripherals can be shared through a connected PC. The devices then communicate using a set of reserved high-frequency radio waves. An Access Point device connects to a DSL or cable modem and enables high-rate (broadband) Internet access for the entire network.

Internet

Internet is the large worldwide network of computes that facilitates data communication services, file transfer, electronic mail, World Wide Web and newsgroup with common protocols.

WWW

Figure 49: Tim Berners Lee

The WWW is the brainchild of Tim Berners Lee a CERN who had the idea of creating an electronic web of research information. The web is currently the fastest growing Internet information system, with new resources being added regularly. The web relies on a set of protocols, conventions and software to operate. The web is a distributed system of delivering linked documents over the Internet. It is called a distributed system because information can reside on different computers around the world. Yet be easily linked together using hypertext. The web uses hypertext to create links from together using hypertext. The web uses hyperte3xt to create links from one resource to another. A hypertext link is usually displayed by highlighted and underlined text on the page. A hypertext link or hyperlink can also be graphic that acts as a button linking to another resource.

IRC

Internet Relay Chat (IRC) is a system for sending public and private message to other users in "real time" – that is, your message appears on the recipient's screen as soon as you type it.

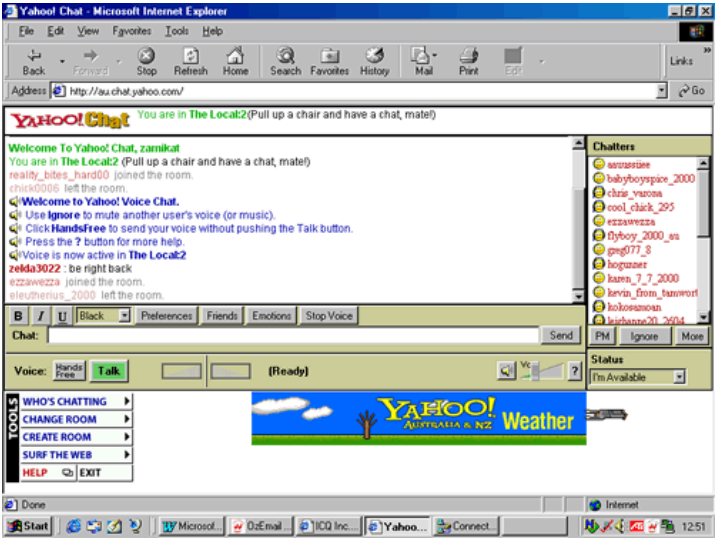


Figure 50: Yahoo Chat

CU-SeeMe

CU-SeeMe is a video conferencing system that allows users to send and receive sound and pictures simultaneously over the Internet.

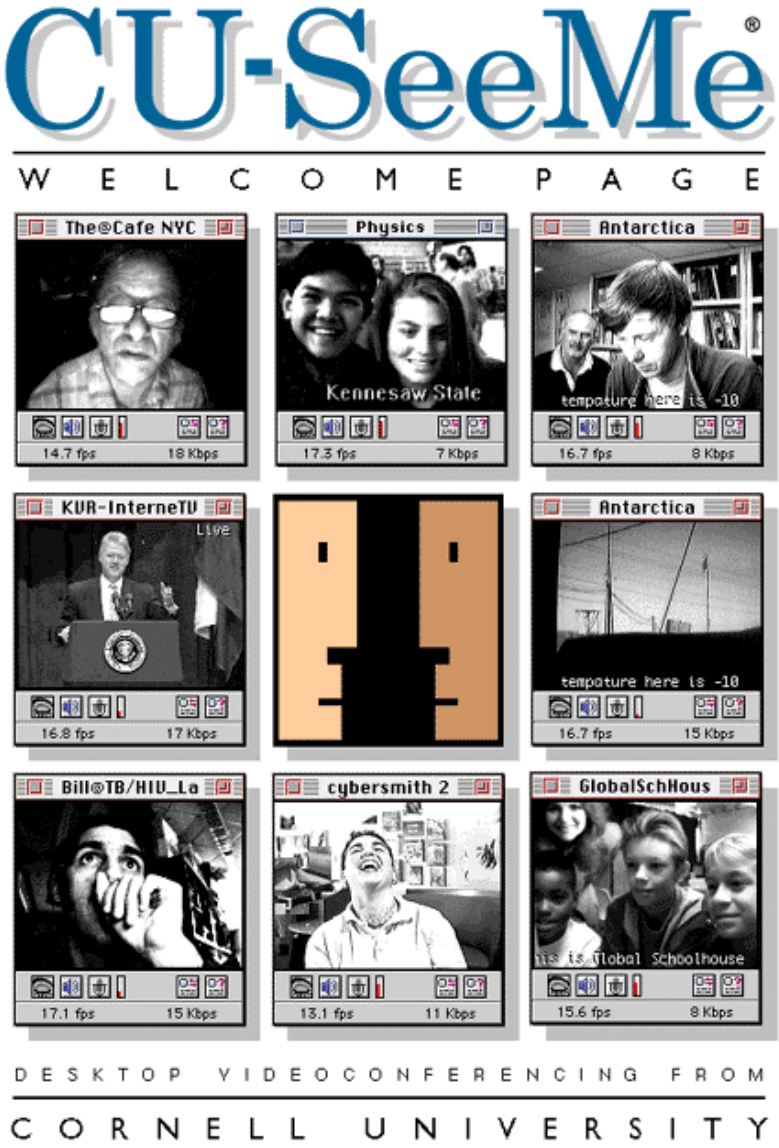


Figure 51: CU SeeMe

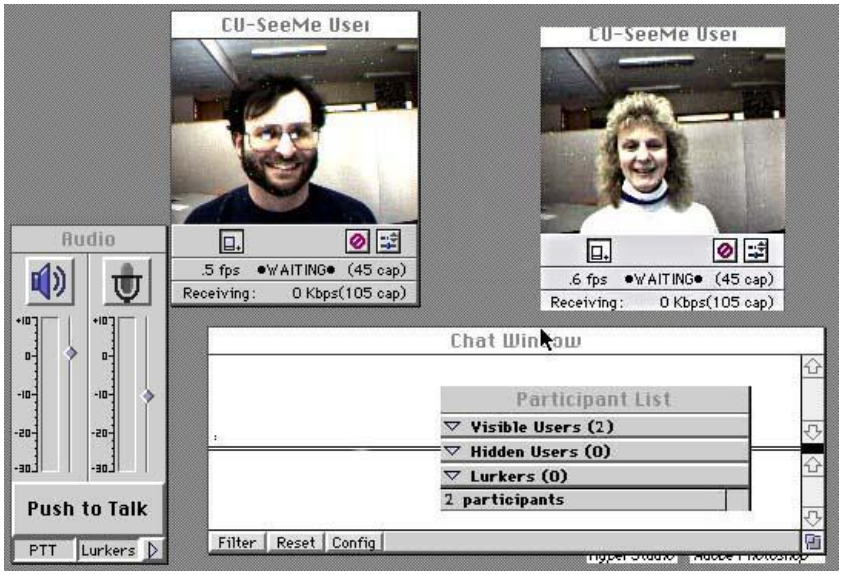


Figure 52: CU SeeMe Conferencing

Telnet

It is a protocol or set of rules that enables a computer to connect another computer in network. It is also known as a remote login. The telnet operates on client-server principle.

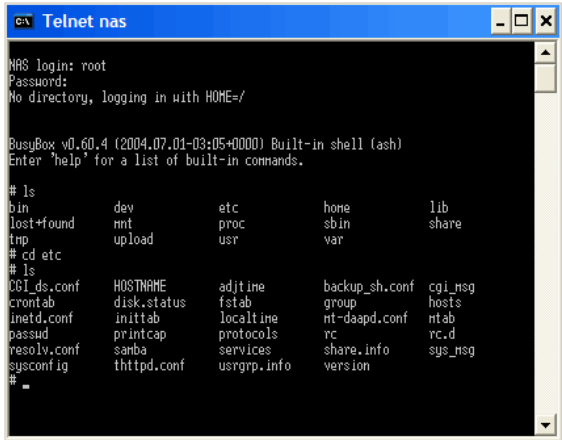
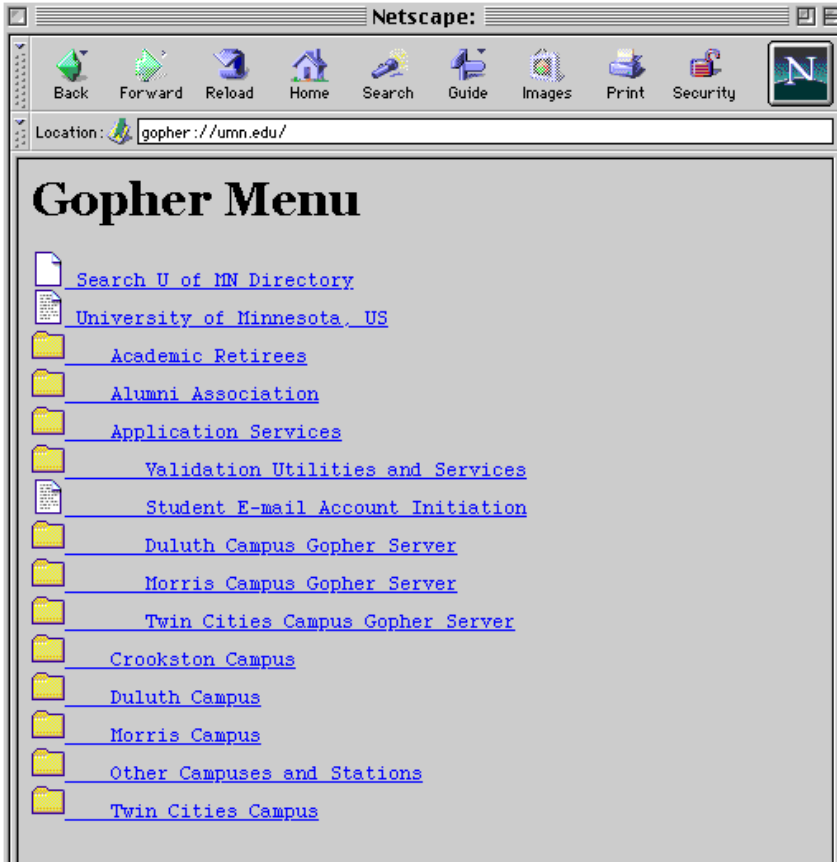


Figure 53: Telnet Screen

Gopher

The ghoper is a protocol designed to search, retrieve and display documents from remote sites on the Internet. The Ghoper was created as a piece of software to utilize some of the services that were becoming available on the Internet.



HTML

HTML stands for Hyper Text Markup Language. It is a standard coding language used to create all web documents (pages).

Browsers

Figure 54: Different Browsers Logo

A browser is the Internet Client software that acts as an interface between the user and the inner-workings of the Internet, specifically the WWW. We can find graphical web browser that displays multimedia content of text, graphics, audio and video, and text web

browser that displays only text. Internet Explorer, Netscape, Firefox are graphical web browser and Lynx is a well known text browser.

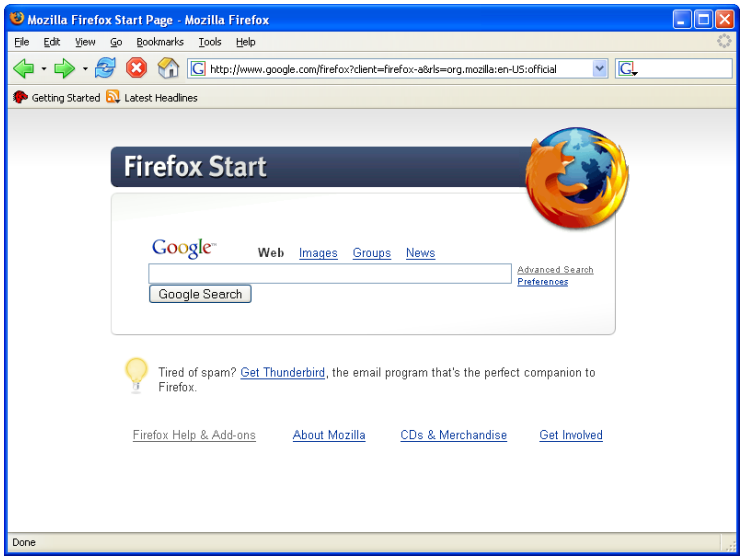


Figure 55: Mozilla Firefox

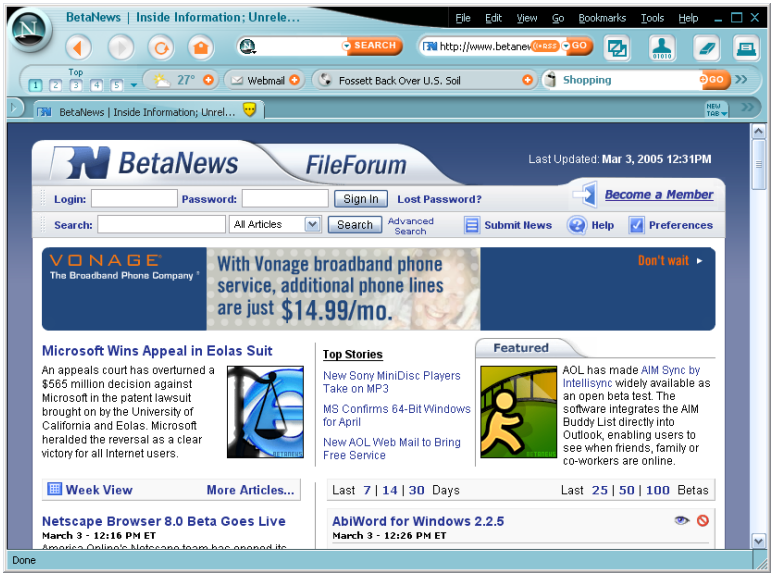


Figure 56: Netscape Navigator

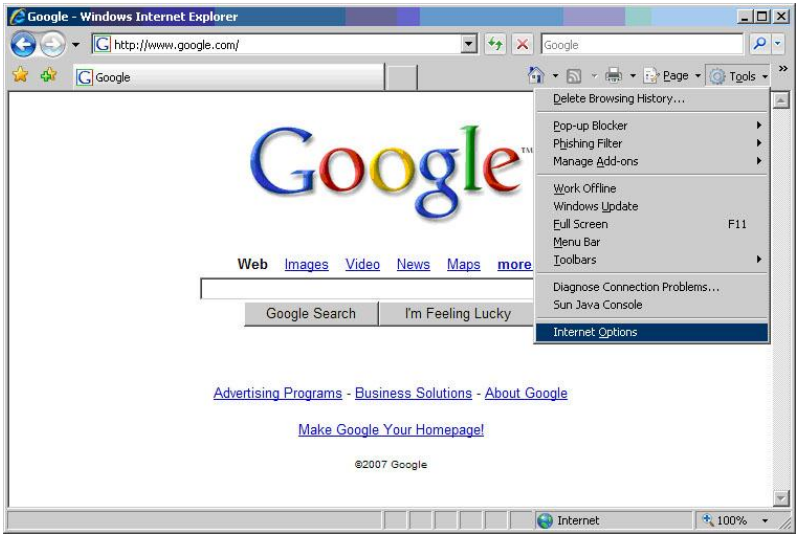


Figure 57: Internet Explorer

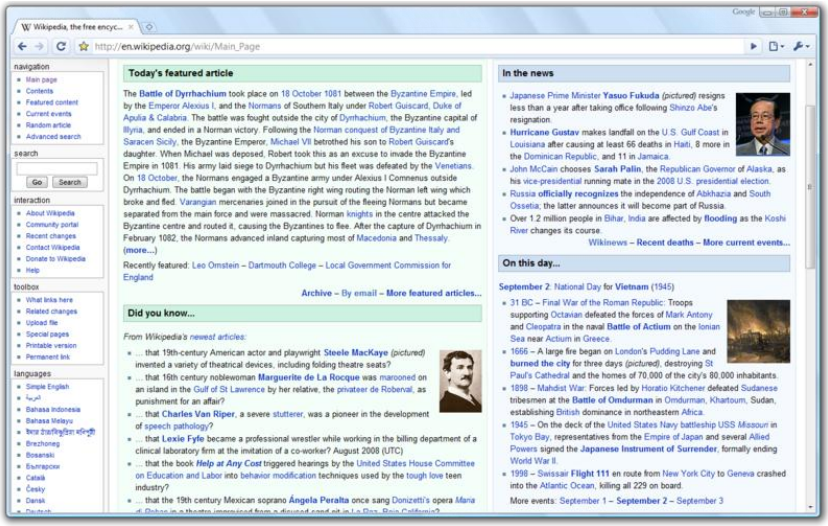


Figure 58: Google Chrome

Dialup Connection

Dialup connection is a means of connecting user to another computer (ISP) or a network such as the Internet with a modem equipped computer.

IP Address

IP Address is an identifier for particular machine on a particular network. It is part of scheme to identify computers on the Internet. IP addresses are a set of numbers separated with periods.

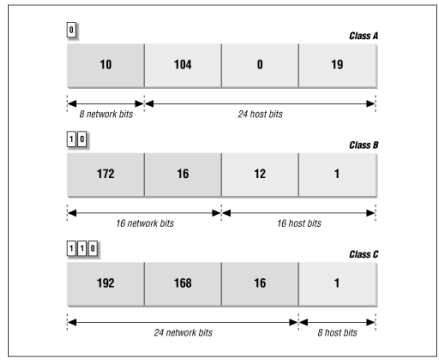


Figure 59: IP Address Structure

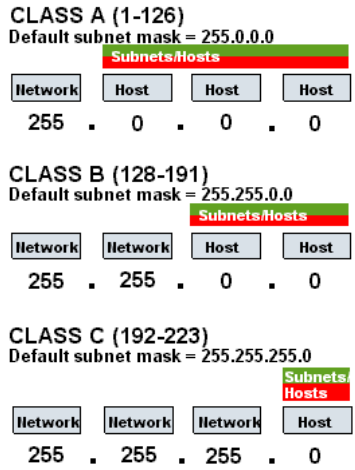


Figure 60: IP Address and Subnet Mask

Domain Name

A domain name is a way to identify and locate computers connected to the Internet. This is a text name of a computer in network or Internet. Domain names are converted to IP Addresses to locate computers and resources.

URL

URL stands for Uniform Resource Locator that identifies a particular Internet resource. URL help the user to locate web page, gopher service, library catalog and image or text file locations. URLs are the standard addressing system of the www. A complete URL provides the web client with all the information it needs to contact a server and make a request for information. URLs are divided into three basic parts:

Example: http://www.psexam.com/download.htm

a. Protocol (http://) – The information appearing before the colon in any URL indicates the type of information server or protocol. For example http:// indicates that the server to be connected is a www server.
b. Domain name (www.psexam.com) – The second piece of information is the address of the server. In this example psexam.com is the name of the machine at PS Exam in world wide web.
c. Resource name (download.htm) – The third piece of information is the path to the actual document requested. In this example the URL indicates that the document in the system directory and is named download.htm.

Web Browsing or Surfing

Browsing or Surfing is the process of visiting different web sites on the Internet hosted by various organizations.

Search Engine

The search engine is an interactive tool to help people locate information via the www and it is interface between the user and underlying database. The most popular search engines are Alta Vista Exite, Lycos, Yahoo!, Google, Ask etc.

Figure 61: Yahoo, Ask, MSN, Google Search Engines

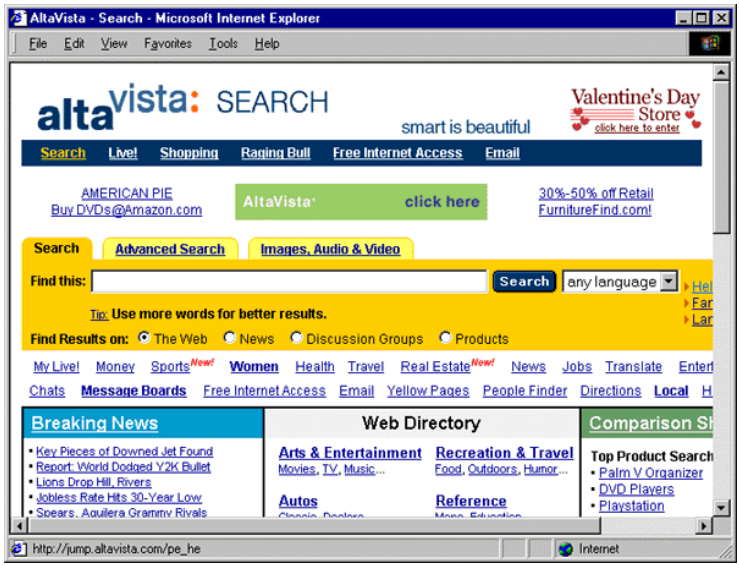


Figure 62: Alta Vista Search Engine

Figure 63: Lycos

Meta Search Engine

A web meta searcher is a tool that helps users to locate information available via the World Wide Web. Web meta-serchers provide a single interface that enables users to search many different search engines, indexes and databases simultaneously. Some meta search engines are Albany.net, Clnet (search.com), Cyberland, Eureaka!, Savvysearch and so on.

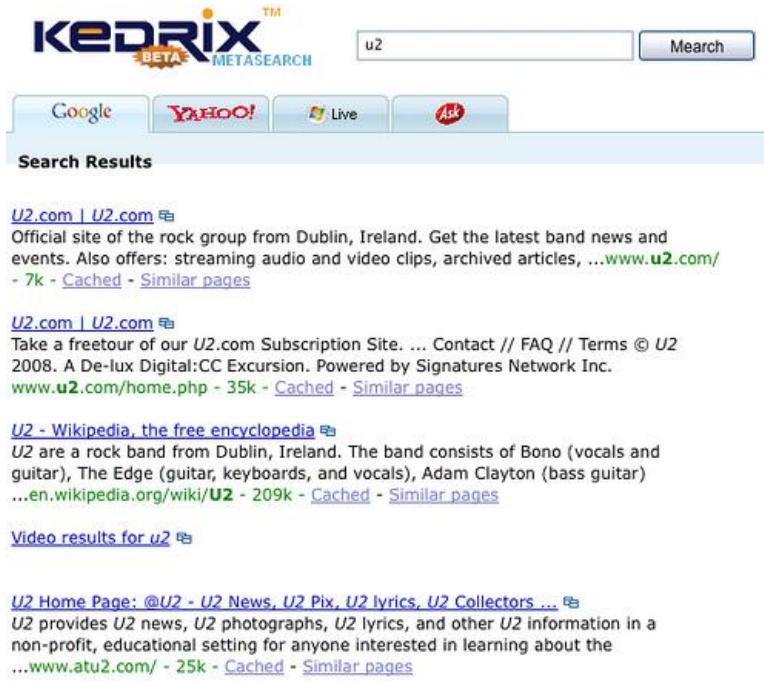


Figure 64: Meta Search Engine

Internet Access

We can access to the Internet in one of two basic ways, dialing into an Internet Service Provider's (ISP) computer or with a direct connection to an ISP. Connecting to ISP by dialing their hunting number (phone number) is called Dial-up connection. We require a username, password and ISP's hunting number to configure Dial up Connection.

Extranet

An Extranet is a type of Intranet (Internal TCP/IP Network) that has been selectively opened to a firm's suppliers, customers.

Intranet

An intranet can be defined as a network connecting an affiliated set of clients using standard internet protocols, esp. TCP/IP and HTTP or as an IP-based network of nodes behind a firewall, or behind several firewall connected by secure, possibly virtual, networks.

Web Index

A web index is designed to assist users in locating information on the World Wide Web. Web indexes are also referred to as catalogs or directories. A web index collects and organizes resources available via the www. Some of the web indexes are Yahoo!, Megallan, Apollo etc.

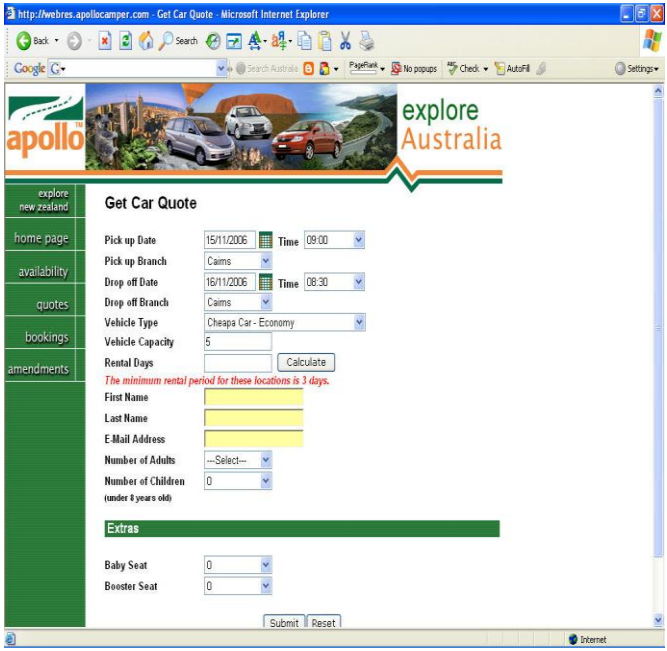


Figure 65: Web Index

Hypertext

The hypertext allows for the integration of text, graphics, audio and video on a web pate. This can make it very easy to browse and very exciting to view. A web page may have colorful graphics integrated with textual information. Links on a web page may take you to other web pages, recorded sonds, or digital video clips. A single click on any hyperlink allows you to follow the link to the specified resource.

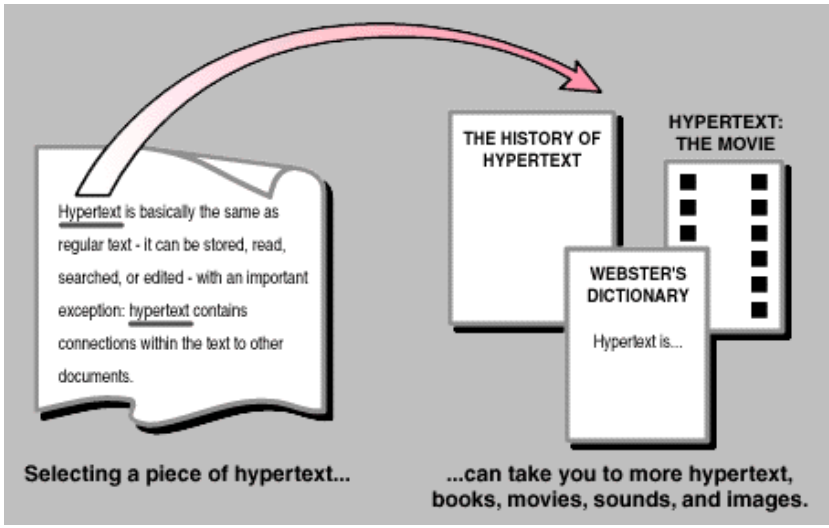


Figure 66: Hypertext and Hyper Link

Email

Electronic Mail (Email) is one of the most popular & powerful communication tools on the Internet. It is an efficient and effective means of network communication. Email allows you to communicate with people across the globe via electronic media (computer).

Email address

An Email Address identifies a person and the computer for the purpose of exchanging electronic mail message.

Example: admin@psexam.com

The email address contains three parts:

a. Username – The admin in example.
b. Domain name of organization – The psexam in example
c. Top Level Domain – The com in example

Signature

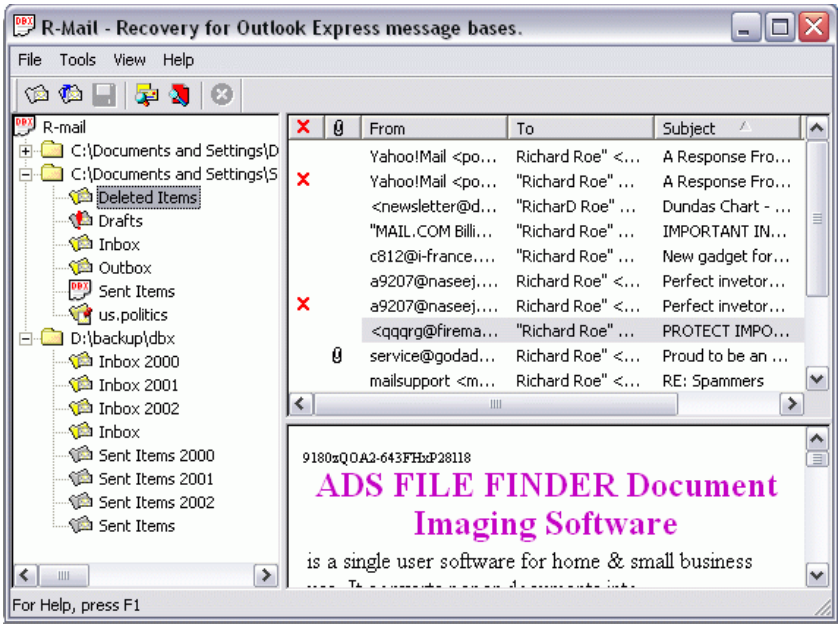


Figure 67: Email Client Interface

Inbox

It is an element of Email Application which collects all incoming mails.

Outbox

It is an element of Email Application which collects all outgoing mails, if it is created and sent in offline.

Trash

This is an element of Email Application that holds all the deleted emails.

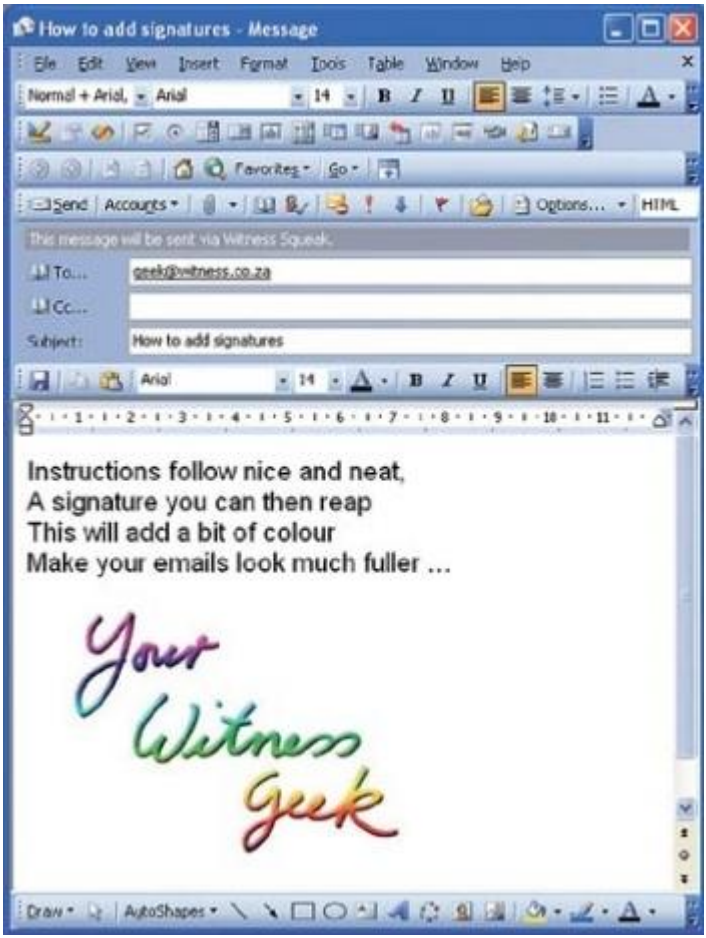


Figure 68: New Email Message

CC

CC stands for Courtesy copy or Carbon Copy. It is an element of Email used to specify the additional recipients when the mail sent needs to be acknowledged to them.

BCC

BCC stands for Blank Carbon Copy. It is similar to CC but the address of other receivers will not be shown to the receiver.

Reply

A reply is the response of an email you receive. After you read a mail and need to reply it you can use this feature.

Forward

A mail received can be sent to be other recipients known as forwarding.

Attachments

The documents created in other applications such as word, excel can be sent along with the email message. These documents that are sent with email is known as attachment. Documents, audio/video files, Zip files etc. can be sent as attachment along with email message.

Bounced

When a mail sent can't reach to destination and returns back, this is known as bounced. This happens often when the recipient's address is wrong or the server at the recipient's end is down or recipient's inbox is full.

Netiquette

It is essential for all users on the internet to recognize that they are responsible for their own individual actions while using the net. Netiquette is simply the use of common courtesy and polite behavior while using the net.

Emoticons

The convention of expressing feeling or a joke in symbolic form by user in Email or Chatting for example :-) for smiling ;-) for winking :-(for frowning etc are emoticons.

	:o3	puppy dog eyes - New!		[-O<	praying
	:-??	I don't know - New!		$-)	money eyes
	%-(	not listening		:-"	whistling
	:@)	pig		b-(	feeling beat up
	3:-O	cow		:)>-	peace sign
	:(|)	monkey		[-X	shame on you
	~:>	chicken		\:D/	dancing
	@};-	rose		>:/	bring it on
	%%-	good luck		;))	hee hee
	**==	flag		:-@	chatterbox
	(~~)	pumpkin		^:)^	not worthy
	~O)	coffee		:-j	oh go on
	*-:)	idea		(*)	star
	8-X	skull		o->	hiro
	=:)	bug		o=>	billy
	>-)	alien		o-+	april
	:-L	frustrated		(%)	yin yang

Figure 69: Emoticons

Wish you best of luck!

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