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Unit 5:Computer Networks and Internet Services (10 Hrs.)

- Introduction
- Importance of Networking
- Network Devices
- Data Transmission Media (Twisted pair, Coaxial cable, Optical fiber, RF transmission, Microwave transmission, Satellite transmission).
- Data transmission and Data Networking

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- Introduction to Internet of Things(IOT),Wearable Computing, Cloud Computing and Smart City.
- Case Study: ISP in Nepal and Their services.

Computer Network

Introduction

Two or more autonomous computers are connected together to form a computer network. A **computer network** is a set of computers sharing resources located on or provided by network nodes. Computers use common communication protocols over digital interconnections to communicate with each other.

Importance of Networking

Networking of computers provides a communication link between the users, and provides access to information. Networking of computers has several uses, described as follows:

- Resource Sharing—In an organization, resources such as printers, fax machines and scanners are generally not required by each person at all times. Moreover, for small organizations it may not be feasible to provide such resources to each individual. Such resources can be made available to different users of the organization on the network.

Importance of Networking

- Sharing of Information

In addition to the sharing of physical resources, networking facilitates sharing of information. Information stored on networked computers located at same or different physical locations, becomes accessible to the computers connected to the network.

Importance of Networking

- As a Communication Medium—Networking helps in sending and receiving of electronic-mail (email) messages from anywhere in the world. Data in the form of text, audio, video and pictures can be sent via e-mail. This allows the users to communicate online in a faster and cost effective manner. Video conferencing is another form of communication made possible via networking. People in distant locations can hold a meeting, and they can hear and see each other simultaneously.

Importance of Networking

- For Back-up and Support—Networked computers can be used to take back-up of critical data. In situations where there is a requirement of always-on computer, another computer on the network can take over in case of failure of one computer.

Advantages of Network

- It provides cheaper and faster communication services.
- It is easy to share the resources like software ,data ,hardware ,network etc.
- It provides faster and cheaper data transmission between multiple computers.
- It uses a tool for e-mail, chat, facebook, videoconferencing which facilitates communication.
- It provides centralized administration and control.

Disadvantages of Network

- It increases the cost.
- It cannot maintain and control the privacy of the people.
- High chances of spreading the viruses through network.
- It is very complicated for use and maintenance.
- Well trained technical person or expertise is required.

Network connecting media or devices

1. Computers

- Server

- Clients

2. NIC(network cards) Network interface card is essential to connect the computers using communication media.

3. Communication media

The path to transfer data from one computer to another computer is called communication media.

Network connecting media or devices

There are two types of communication media.

- Bounded media
 - Unbounded media
 - Bounded media are twisted pair, co-axial cable, fiber optics cable etc.
 - Unbounded media are Wi-Fi, microwave, satellite, Bluetooth etc.
4. Network connecting devices are Hub, Switch, Bridge and repeaters etc.

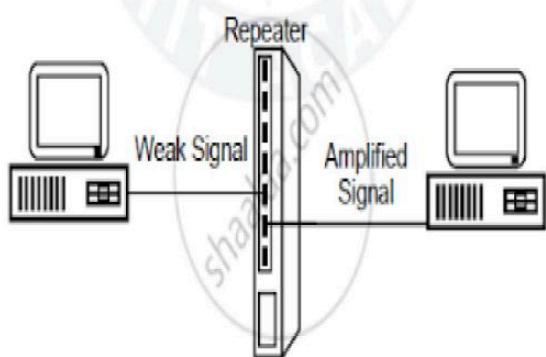
Network connecting media or devices

Repeaters

These are the signal amplifier used to amplify weak signal and increase length of LAN. It links similar LAN's. When networking operating system(NOS) are similar for any two or more LAN then these LAN's are called similar LAN's.

Computer connecting media or devices

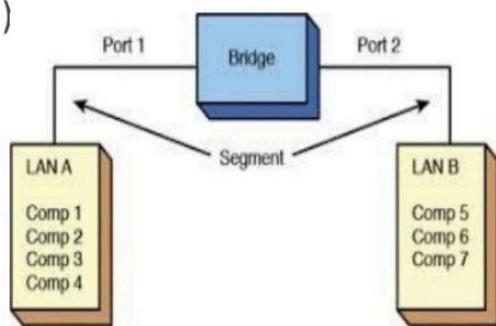
Repeaters



Network connecting media or devices

Bridge

It is a store and forward device used to connect different or similar networks(LAN)



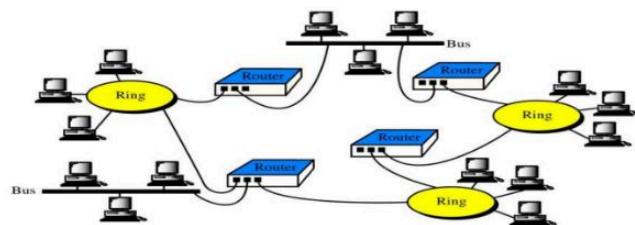
Network connecting media or devices

Routers

It is a highly intelligent , protocol sensitive linking device used to link similar or dissimilar LAN'S. A router which can be hardware, software or both.

Figure 21-11.

Routers in an Internet



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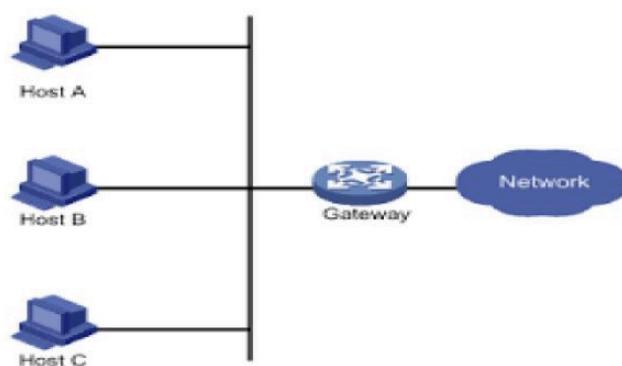
Network connecting media or devices

Gateway

It is used to link dissimilar LAN's. It also performs all functions of bridge and router . It is slower than bridge and router because it converts entire protocol of one network to other. Gateway converts Ethernet protocol into token ring protocol.

Network connecting media or devices

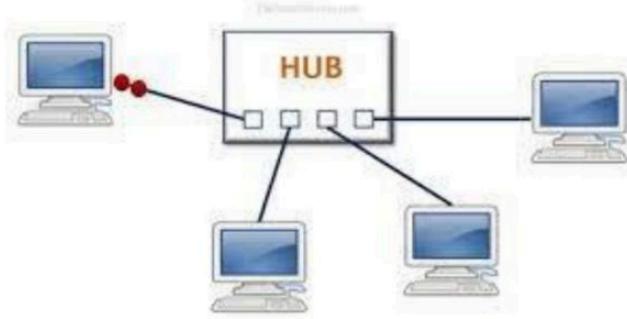
Gateway



Network connecting media or devices

Hub

Hub is used to receive incoming data, amplify and distribute. Hub is used as a central component of star topology.



Network connecting media or devices

Modem

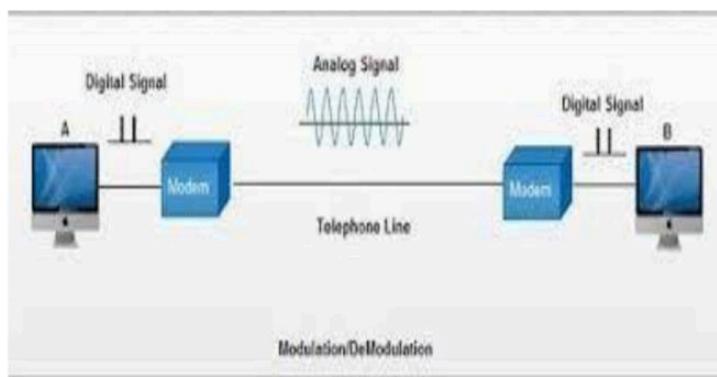
The modem stands for modulator/demodulator. A modem is a device which translates data from digital or binary code(0 or 1) to analog data that can be transmitted over the telephone network.

Transfer speeds

The speed at which the modems can transfer data is measured in bits per second(bps).Internet transfer rates range 14.4kbps,28.8kbps,33.6kbps & 56 kbps etc. are available.

Network connecting media or devices

Modem



Types of Network

Network can be divided into two types.

1. On the basis of its geographical locations

- LAN
- WAN
- MAN

2. On the basis of its architecture

- Peer to peer network
- Client server network

Types of Network

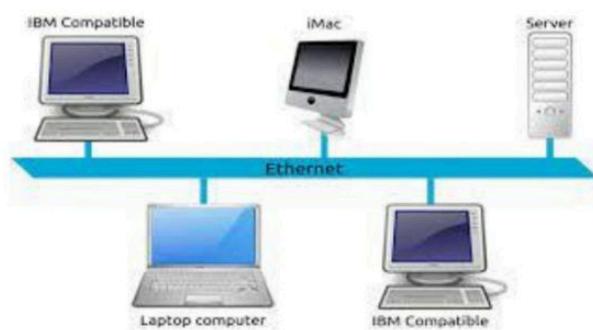
1. On the basis of geographic locations

- LAN(Local Area Network)

LAN is relatively small. It contains within department, building or college . Its range is 1 km (up to 5 km).

Types of Network

LAN



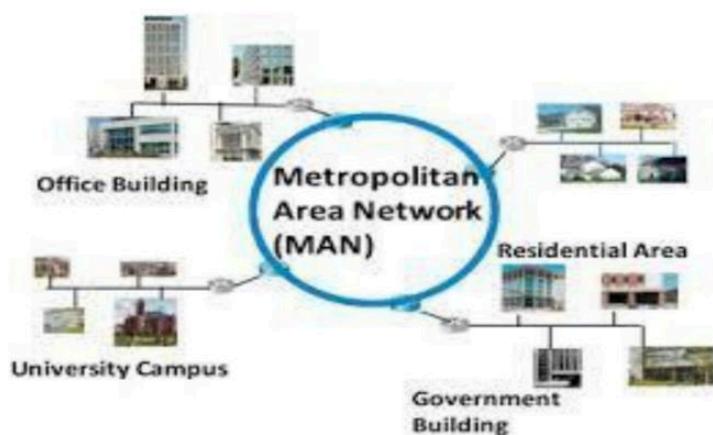
Types of Network

- **MAN(Metropolitan Area Network)**

MAN is a network that is large than a LAN. MAN is a network that share some characteristics of both LAN and MAN. MAN usually cover a wider geographical area (up to 50 km) than LAN. It is located in city or metropolitan area.

Types of Network

MAN



Types of Network

- **WAN(Wide Area Network)**

A WAN includes all networks larger than a MAN. It has wide spread everywhere. Internet is example of WAN. Its range is unlimited.

Types of Network

WAN



Types of Network

2.On the basis of its Architecture

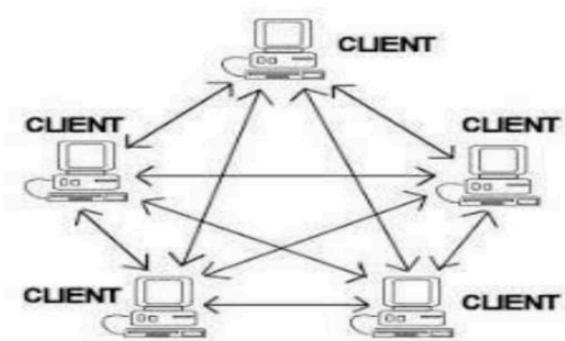
Network architecture: is a design & organization of a network or computer system. Architecture can be broadly classified into two ways.

1 . Peer to peer architecture

This is a type of network in which each work station has equivalent capabilities & responsibilities. It is simpler & less expensive but they do not offer the same performance under heavy load.

Types of Network

1. Peer to Peer Architecture



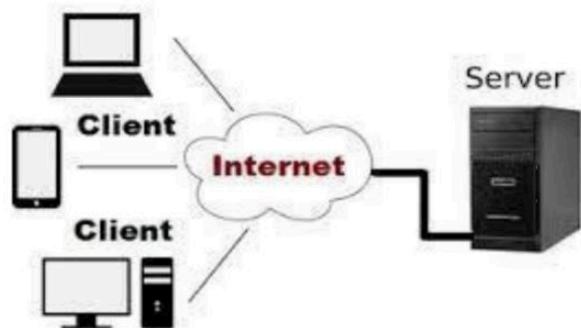
Types of Network

2. Client Server Architecture

This is a network architecture in which each computer on the network is either a client or a server. Servers are powerful computers which manage files, servers, network server etc. clients are less powerful work stations or pc on which users run applications. Clients rely on servers for resources such as files, devices etc.

Types of Network

2. Client Server Architecture



Data Transmission Media or Communication Media

Channels are also called communication lines or links are the means by which data is transmitted between the sending & receiving devices in a network. A channels are twisted pair wire, coaxial cable & fiber optics which physically link the devices in a network.

Two types of data transmission media or communication media are

1. Bounded media or guided media
2. Unbounded media or unguided media

Data Transmission Media or Communication Media

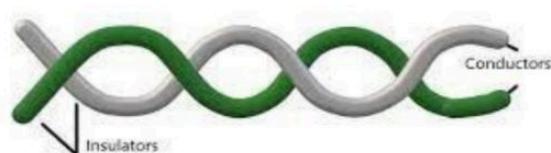
1.Bounded Media

- Twisted Pair

This is the oldest & still common transmission line consists of copper wires twisted into pairs. It is also called UTP(unshielded twisted pair). UTP cables are used commonly in local telecommunication & short distance digital data transmission. UTP cables are inexpensive, easy to install & use.

Data Transmission Media or Communication Media

Twisted Pair wire



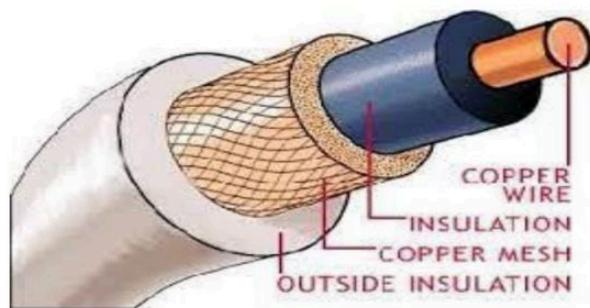
Data Transmission Media or Communication Media

- **Coaxial Cable**

It is a groups of specially wrapped & insulated wire lines capable of transmitting data at high rates. coaxial cables offer much higher band width(Signal processing(frequency ,radio etc.) than UTP cables & can transmit digital signals at rates up to 10 Mbps.

Data Transmission Media or Communication Media

Coaxial Cable



Data Transmission Media or Communication Media

Fiber optics or optical fiber

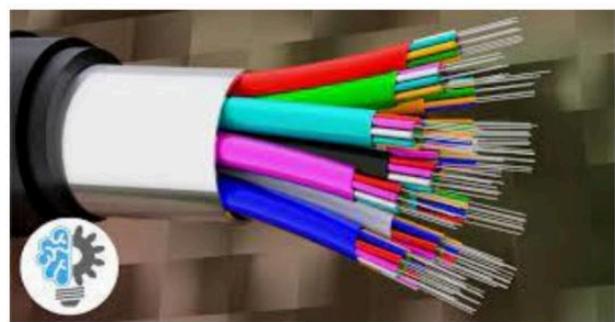
Optical fibers are thin threads of glass or plastic used as data transmission medium like copper wires or coaxial cables they transmit light signals instead of electrical signals. So, light travels much faster than electricity. Optical fibers can transmit data at much higher speed than coaxial cables.

Advantages of Optical fiber

- Large band width
- Low loss
- Small size & light weight

Data Transmission Media or Communication Media

Fiber Optics or Optical Fiber



Data Transmission Media or Communication Media

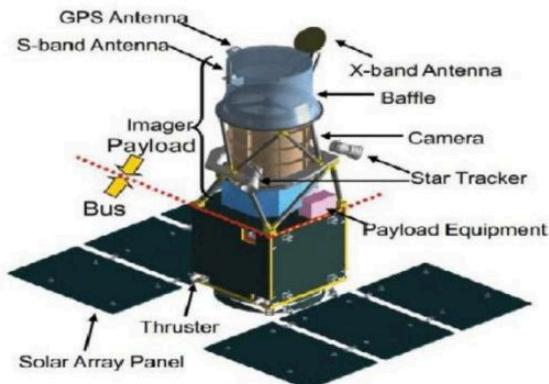
Unbounded media are satellite, microwave, Wi - Fi , Bluetooth etc.

Satellite Transmission

Satellite is space orbiting 2200 miles above the earth ,are also used as microwave relay stations. It is also suitable for long distance communications. They are powered by solar panels and carry different types of signals ,such as standard television broadcasting, telephone transmissions and high speed data.

Data Transmission Media or Communication Media

Satellite



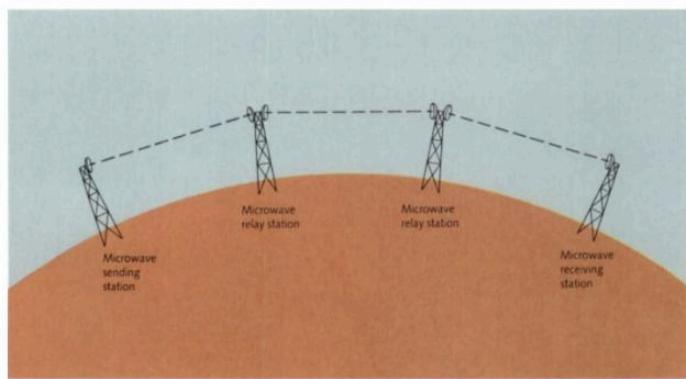
Data Transmission Media or Communication Media

Microwave Transmission

Earth bound microwave systems transmit high speed radio signals in a line of sight path between relays stations spaced approximately 25 to 35 miles apart. They are consists of antennas usually placed on the top of buildings, towers & hills etc. Microwave radios are useful for connecting networks that are only short distances apart.

Data Transmission Media or Communication Media

Microwave



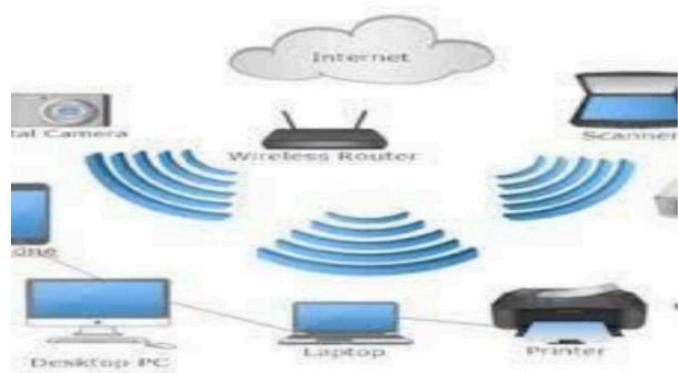
Data Transmission Media or Communication Media

Wi-Fi

Wi-Fi stands for wireless fidelity. It is a world wide. Wi-Fi technology uses radio for communication, typically operating at a frequency of 2.4 GHZ. PDA ,laptops and various accessories are designed to be Wi-Fi.

Data Transmission Media or Communication Media

Wi - fi



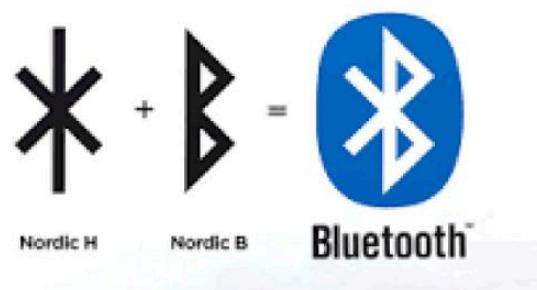
Data Transmission Media or Communication Media

Bluetooth

A proposed radio frequency specification that many portable devices will use for short – range wireless communication is called Bluetooth. With Bluetooth , devices such as laptop computers, handheld computers, cellular machines and printers can wirelessly communicate with each other ,desktop computers ,a network or the internet.

Data Transmission Media or Communication Media

Bluetooth



Data Transmission Media

Radio Transmission

The electromagnetic radio waves that operate at the audio frequency are also used to transmit computer data. This transmission is also known as Radio Frequency (RF) transmission. The computers using RF transmission do not require a direct physical connection like wires or cable. Each computer attaches to an antenna that can both send and receive radio transmission.

Data Transmission Media

Radio Transmission



Data Transmission Across Media

Transmitting data across media implies sending bits through the transmission medium. Physically, the data is sent as electric signals, radio waves or as light signals. Let's now discuss the use of electric current to transfer digital information. For this, the bits are encoded and sent as characters.

Data Transmission Across Media

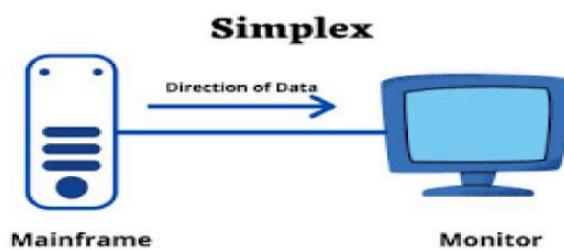
Transmission Modes

The direction in which data can be transmitted between any two linked devices is of three types—

1. Simplex
2. Half-duplex &
3. Full-duplex or duplex

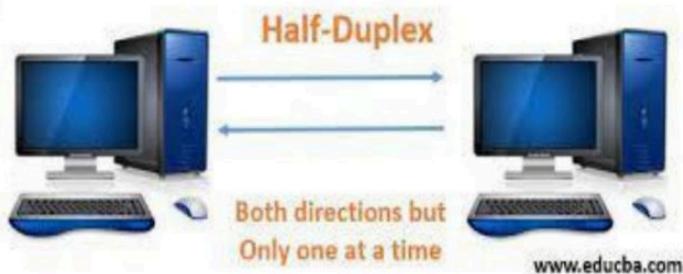
Data Transmission Across Media

1.Simplex transmission is unidirectional data transmission. Of the two linked devices, only one of them can send data and the other one can only receive data.



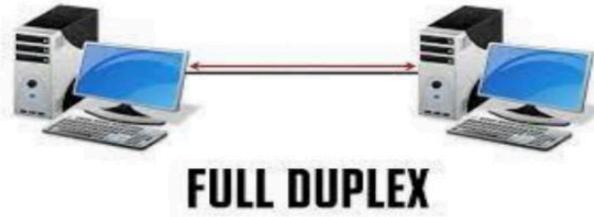
Data Transmission Across Media

2.Half-duplex transmission is bi-directional data transmission but the linked devices cannot send and receive at the same time. When one device is sending data the



Data Transmission Across Media

3. Full-duplex transmission is bi-directional and the linked devices can send and receive data simultaneously. The linked devices can send data and at the same time receive



Data Transmission Across Media

Transmission Speed

When the signals are transmitted between two computers, two factors need to be considered— (1) Bandwidth and (2) Distance.

Bandwidth is the amount of data that can be transferred through the underlying hardware i.e. the communication medium, in a fixed amount of time. Bandwidth is measured in cycles per second (cps) or Hertz (Hz). The bandwidth of the transmission medium determines the data transfer rate.

Data Transmission Across Media

Distance

- The signal is broadcasted **through** air.
- Less Secure.
- Used for larger **distances**.

Throughput

is the amount of data that is actually transmitted between the two computers. Throughput is specified in bits per second (bps). The throughput capability of the communication medium is also called bandwidth.

Data Transmission Across Media

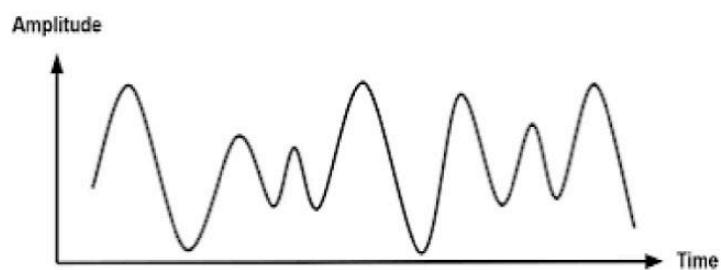
Analog and Digital signals

Analog Signal

An analog signal is a wave that continuously changes its information carrying properties over time. The wave may vary in amplitude or frequency in response to changes in sound, light, heat, position or pressure etc. For example a telephone voice signal is analog. The intensity of the voice causes electric current variations. At the receiving end, the signal is reproduced in the same proportion.

Data Transmission Across Media

Analog Signals



Data Transmission Across Media

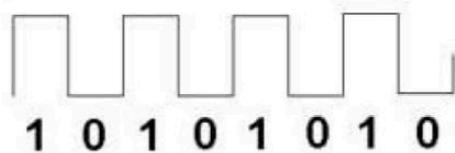
Digital Signals

A digital signal is a wave that takes limited number of values at discrete intervals of time. Digital signals are non-continuous, they change in individual steps. They consist of pulses or digits with discrete levels or values. The value of each pulse is constant but there is an abrupt change from one digit to the next. Digital signals have two amplitude levels called nodes. The value of which are specified as one of two possibilities such as 1 or 0, HIGH or LOW, TRUE or FALSE and so on.

Data Transmission Across Media

Digital Signals

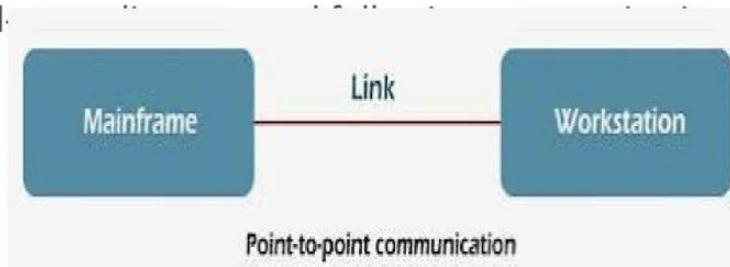
digital



Data Transmission and Data Networking

Point to Point Communication

A point-to-point connection is a permanent direct communication link between two parties. Unlike a dial-up connection, it does not need to be established via dial-



Data Transmission and Data Networking

Switching

A network cannot allow or deny access to a shared communication facility. All computers attached to the network can use it to send and receive data. Networks allow sharing of communication medium using switching. Switching routes the traffic (data traffic) on the network. It sets up temporary connections between the network nodes to facilitate sending of data. Switching allows different users, fair access to the shared communication medium.

Switching

There are three kinds of switching techniques—

1. Packet switching
2. Circuit switching
3. Message switching

Data Transmission and Data Networking

Switching

Computer networks generally use packet switching, occasionally use circuit switching but do not use message switching.

Data Transmission and Data Networking

1. Circuit switching

is connection oriented that means a path is established between source & destination before the transmission occurs.

Circuit switching is always implemented at physical layer whereas packet switching is implemented on the network layer.

Data Transmission and Data Networking

Difference between Circuit Switching & Packet Switching

- In circuit switching, physical path between source to destination. In packet switching, no physical path between source to destination.
- In circuit switching, All packets use same path. In packet switching packets travel independently.
- Bandwidth wastage in circuit switching where as no bandwidth wastage in packet switching.
- Reserve the entire bandwidth in advanced in circuit switching where as in packet switching does not reserve bandwidth.
- No store and forward transmission in circuit switching where as in packet switching supports store and forward transmission.

Communication Protocol

A communications protocol is a set of formal rules describing how to transmit or exchange data, especially across a network. A standardized communications protocol is one that has been codified as a standard.

A **communication protocol** is a system of rules that allows two or more entities of a communication system to transmit information via any variation of a physical quantity. The protocol defines the rules, syntax, semantics, and synchronization of communication and possible error recovery methods. Protocols may be implemented by hardware , software or a combination of both

Communication Protocol

OSI Layer or Model

The International Standards Organization (ISO) has developed a seven-layer reference model for data networks, known as Open System Interconnection (OSI) model. The OSI model specifies the functions of each layer. It does not specify how the protocol needs to be implemented. It is independent of the underlying architecture of the system and is thus an open system.

Communication Protocol

The seven layers of the OSI model are

1. Physical layer
2. Data link layer
3. Network layer
4. Transport layer
5. Session layer
6. Presentation layer &
7. Application layer.

Communication Protocol

The functions of the different layers are as follows:

1. Physical Layer—This layer specifies the basic network hardware. Some of the characteristics defined in the specification are—interface between transmission media and device, encoding of bits, bit rate, error detection parameters, network topology and the mode of transmission(duplex, half-duplex or simplex).

Communication Protocol

2. Data Link Layer—This layer specifies the functions required for node-to-node transmission without errors. It specifies the organization of data into frames, error detection in frames during transmission and how to transmit frames over a network.

Communication Protocol

3.Network Layer—The network layer specifies the assignment of addresses (address structure, length of address etc.) to the packets and forwarding of packets to the destination i.e. routing.

4.Transport Layer—It specifies the details to handle reliable transfer of data. It handles end-to end error control and flow control, breaking up data into frames and reassembling the frames.

Communication Protocol

5.Session layer—The communicating devices. It includes specifications for password and authentication, and maintaining synchronization between the sender and the receiver.

6. Presentation Layer—This layer specifies the presentation and representation of data. Its functions include translation of the representation of the data into an identifiable format at the receiver end, encryption and decryption of data etc.

Communication Protocol

7. Application Layer—This layer specifies how an application uses a network. It deals with the services attached to the data. It contains the protocols used by users like HTTP, protocol for file transfer and electronic mail.

Network Topology

The geometrical arrangement of a computer system is called topology. In other words, topology of a network refers to the way in which the networks nodes are linked together. Topology can be divided into six ways.

1. Bus topology
2. Star topology
3. Ring topology
4. Mesh topology
5. Hybrid topology
6. Tree topology

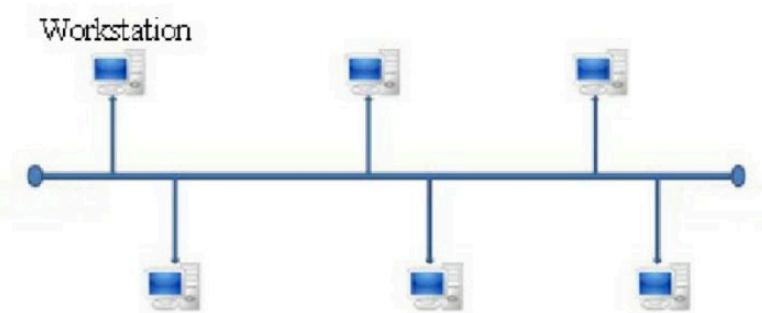
Network Topology

1. Bus topology

In bus topology, all the nodes share a single transmission medium. That is ,all nodes are attached to the same communication line or channel. This type of network is also known as multipoint network or broadcast network. It is appropriate for LAN where a high speed communication channel is used.

Network Topology

Bus topology



Network Topology

Advantages of Bus Topology

- It reduces the number of physical lines.
- Failure of a node does not affect communication among other nodes in the network.
- Addition of new nodes to the network is easy.

Disadvantages of Bus Topology

- If the shared communication line fails then network fails.
- All nodes in a network must have good communication & decision making capabilities.

Network Topology

2. Star Topology

The nodes in the network are linked to each other through the host node & can communicate only the host node.

Advantages of Star Topology

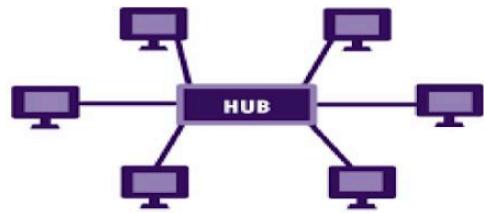
- If any node other than the host node fails, remaining nodes are unaffected.

Disadvantages of Star Topology

- The system depends on host node if it fails then network also fails.

Network Topology

Star Topology



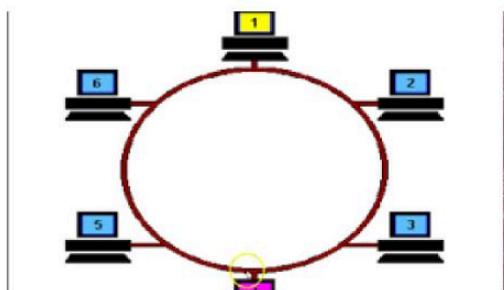
Network Topology

3. Ring Topology

It is also known as circular topology. In ring topology ,each node has two communicating adjacent nodes with which it can communicate directly ,but there is no master node for controlling other nodes.

Network Topology

Ring Topology



Network Topology

Advantages of Ring Topology

- It works well where there is no central nodes for making routing decisions.

Disadvantages of Ring Topology

- It requires more complicated control software than star topology.

Network Topology

4. Mesh topology

is a completely connected network. It has a separate physical link for connecting each node to any other node.

Advantages of Mesh Topology

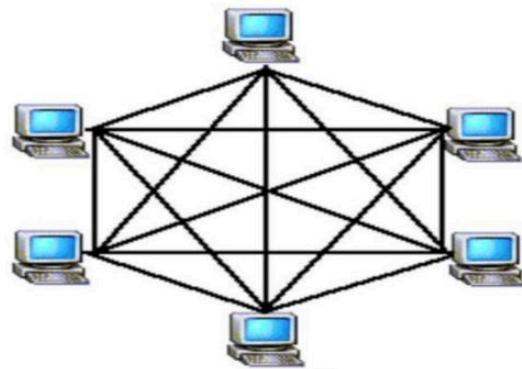
- Each node of the network need not have individual routing capability.
- Communication is very fast between any two nodes.

Disadvantages of Mesh Topology

- It is the most expensive network from the point of view of link cost.

Network Topology

Mesh Topology



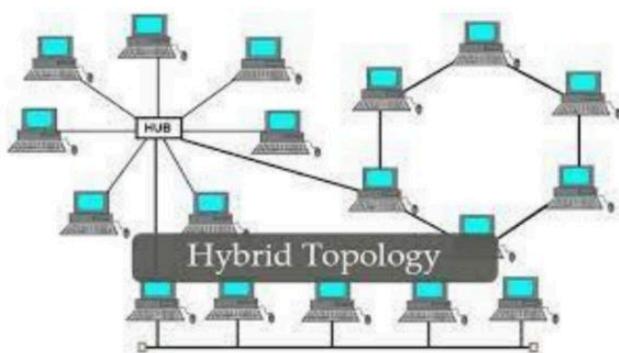
Network Topology

5. Hybrid topology

Hybrid network is a combination of two or more different network topologies. Exact configuration of a network depends needs & structure of the organization. It is the combination of multiple network.

Network Topology

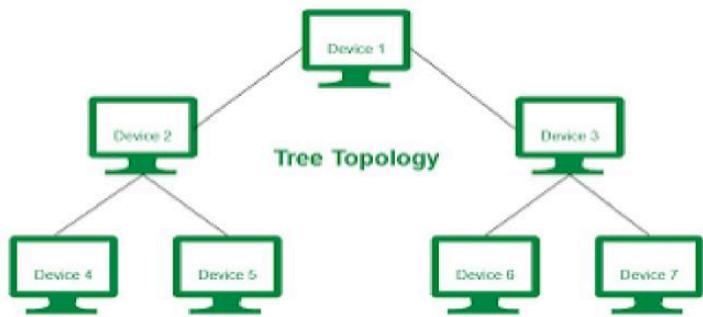
Hybrid Topology



Network Topology

6. Tree topology

is a type of network topology that resembles a tree. In a tree topology, there is one central node (the “trunk”), and each node is connected to the central node through a single path. Nodes can be thought of as branches coming off of the trunk.



Network Topology

Advantages of Tree Topology

- Scalability
- Hierarchical structure
- Improved performance
- Reduced costs

Network Topology

Disadvantages of Tree Topology

- Single point of failure
- Limited flexibility
- Increased complexity
- Limited bandwidth.

Wireless Networking

A **wireless network** is a computer network that uses wireless data connections between network nodes.

Wireless networking is a method by which homes, telecommunications networks and business installations avoid the costly process of introducing cables into a building, or as a connection between various equipment locations. Admin telecommunications networks are generally implemented and administered using radio communication. This implementation takes place at the physical level (layer) of the OSI model network structure.

Wireless Networking

Examples of wireless networks include cell phone networks, wireless local area networks(WLANs), wireless sensor networks, satellite communication networks, and terrestrial microwave networks.

Wireless Network



Uses or Features of Wireless Network

- High Capacity Load Balancing.
- Scalability.
- Network Management System.
- Role Based Access Control.
- Indoor as well as Outdoor coverage options.
- The Ability to Measure Performance.
- Network Access Control.
- Ability to communicate with both 2.4 GHz devices and 5 GHz devices.

Wireless Network

A **wireless LAN (WLAN)** is a wireless computer network that links two or more devices using wireless communication to form a local area network (LAN) within a limited area such as a home, school, computer laboratory, campus, or office building. This gives users the ability to move around within the area and remain connected to the network. Through a gateway, a WLAN can also provide a connection to the wider Internet.

Wireless LANs based on the IEEE 802.11 standards are the most widely used computer networks in the world. These are commonly called Wi-Fi which is a trademark belonging to the Wi-Fi Alliance.

Wireless Network



Wireless Network

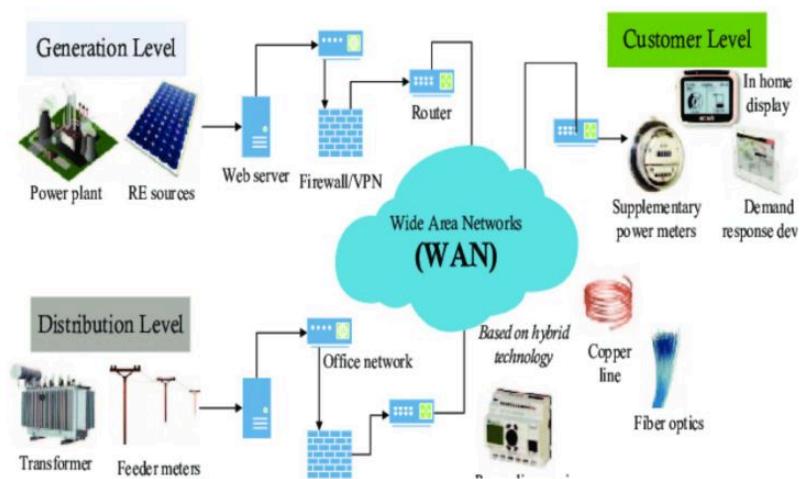
Wide area network (WWAN)

is a form of wireless network. The larger size of a wide area network compared to a local area network requires differences in technology. Wireless networks of different sizes deliver data in the form of telephone calls, web pages, and video streaming.

A WWAN often differs from wireless local area network (WLAN) by using mobile telecommunication cellular network technologies such as 2G,3G,4G LTE and 5G to transfer data. It is sometimes referred as Mobile Broadband.

Wireless Network

WWAN



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- Internet Address
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- Introduction to E-commerce, E-governance, Smart City and GIS

Introduction to Internet

The internet is a network of computers linking many different types of computers all over the world.

- Physically interconnected.
- Capable of communicating & sharing data with each other.

Uses of Internet

- Online communication.
- Online shopping ,education & banking.
- Online journals & magazines.
- Customer support service.
- Posting of information.
- Software sharing
- WWW
- World wide video conferencing.
- Remote login

History of Internet

The history of the internet begin with electronic computers in the 1950's. Initial concepts of packet networking originated in several computer science laboratories in the United States, United Kingdom and France. The US department of Defense awarded contracts as early as the 1960's for packet network systems, including the development of the ARPANET. The first message was sent over the ARPANET from computer science Professor Leonard Klein rock's laboratory at University of California, Los Angels(UCLA) to the second network at Stanford Research Institute(SRI).

Contd.

Packet switching network such as ARPANET ,NPL NETWORK ,TELNET were developed in the late 1960s and early 1970 using a variety of communications protocols.

In short Internet has root in the Arpanet system of ARPA of the U.S. department of Defense. Arpanet was the first WAN & had only four sites in 1969.

Concept of Protocols

A protocol is a set of rules that govern a given process. A protocol describes rules to govern transmission of data over communication networks.

Internet protocols are

1. TCP/IP(Transmission control protocol/Internet protocol)
2. FTP(File transfer protocol)
3. HTTP(Hyper Text transfer protocol)
4. Telnet

Internet Protocols

TCP/IP

It is a collection of protocols that govern the way that data travels from one machine to another across network.

IP component does the following:

- Envelopes & addresses the data.
- Enables the network to read the envelopes & forward the data to its destination.
- Defines how much data can fit in a single envelope(a packet).
- The relationship between data ,IP & networks is often compared to the letter, its addressed envelope & the postal system

Internet Protocols

TCP component does the following.

Breaks data up into packets that the network can handle efficiently.

Verifies whether all the packets have arrived at their destination.

Internet Protocols

FTP

FTP enables an internet user to move a file from one computer to another on the internet. A file may contain any type of digital information.

HTTP

The www uses client server model & an internet protocol called HTTP for interaction on the internet. Any computer on the internet using the http protocol , is called web server & any computer accessing that server is called web clients.

Internet Protocols

Telnet

Telnet service enables an internet user to log into another computer on the internet from his/her computer to start a login session on a remote login.

The Internet Architecture

Internet is a network of interconnected networks and is designed to operate without a central control. If a portion of the network fails, connection is made through alternative paths available. The architecture of Internet is hierarchical in nature. A brief description of the architecture of Internet is as follows:

Client(user of computer) at home or in a LAN network is at the lowest level in hierarchy.

Local Internet Service Provider (ISP)is at the next higher level. an organization that has its own computers connected to the Internet and provides facility to individual users to connect to Internet through their computers.

The Internet Architecture

Local ISP is the local telephone company located in the telephone switching office, where the telephone of client terminates. Examples of local ISP in Nepal are Nepal Telecom, World Link.

The client calls local ISP using a modem or Network Interface Card.

Regional ISP is next in the hierarchy. The local ISP is connected to regional ISP

The Internet Architecture

A router is a special hardware system consisting of a processor, memory, and an I/O interface, used for the purpose of interconnecting networks. A router can interconnect networks having different technologies, different media, and physical addressing schemes or frame formats.

The regional ISP connects the local ISP's located in various cities via routers.

Managing the Internet

Internet is not controlled by any one person or an organization. A number of organizations manage the Internet. Some of the governing bodies of the Internet and their functions are shown here.

Connecting to Internet

To be able to connect your computer to the Internet, you require—(1) a TCP/IP enabled computer, (2) web browser software, (3) an account with an ISP, (4) a telephone line, and (5) a modem or Network Interface Card (NIC) to connect the telephone line to the computer.

A modem is a device that connects a computer to Internet. A Network Interface Card or NIC is a device that is required to connect a computer to Internet via a LAN or high-speed Internet connection like cable modem or Digital Subscriber Line (DSL).

Connecting to Internet

A web browser is a software that allows the user to view information on WWW. WWW is a large-scale, on-line repository of information that the users search using the web browser. Internet Explorer and Netscape Navigator,Mozilla,firefox are examples of web browser.

Internet Connections

The ISPs provide Internet connections of different types. Bandwidth and cost are the two factors that help you (the user) in deciding which Internet connection to use. Bandwidth is the amount of data that can be transferred through a communication medium in a fixed amount of time. The speed of Internet access depends on the bandwidth. The speed of Internet access increases with the increase in bandwidth. ISPs offer low speed Internet connection like Dial-up connection, and high-speed Internet connection called broadband connection. Broadband are the services with more bandwidth than standard telephone service. DSL, Cable modem, and Integrated Services Digital Network are some of the existing broadband connections.

Internet Connections

Dial-up Access

Dial-up access is a method of connecting to the Internet using an existing telephone line. When your computer is connected to the Internet, you cannot receive voice telephone calls on this telephone line during that time.

In Dial-up access, you are assigned an account on the server of ISP along with some storage space on the disk of server. For example agoel@vsnl.com is an account with an ISP named VSNL. You are also assigned a user-id and password.

Internet Connections

You connect to Internet by dialing-up one of the computers of ISP. For this, you use a telephone number provided by ISP and connect via a 56 Kbps modem. The computer that dials-up is the client or remote machine, and the computer of ISP is the server or host.

The client enters the user-id and password.

Internet Connections

Integrated Services Digital Network (ISDN)

ISDN is a digital telephone service that can transmit voice, data and control information over an existing single telephone line.

Internet access is faster using ISDN than Dial-up access.

ISDN is commonly used for business purposes. You are able to connect a computer, a fax machine or a telephone to a single ISDN line, and also use them simultaneously.

ISDN is costlier than Dial-up connection. It requires a special phone service and modem.

Nowadays, ISDN services are largely being replaced by high speed broadband connection.

Internet Connections

Digital Subscriber Line (DSL)

DSL is a broadband connection that allows connecting to Internet over the existing telephone lines. It does not affect your telephone voice services. DSL uses the modem provided by ISP.

The data transmission speed of DSL ranges from 128 Kbps to 8.448 Mbps.

Originally, telephone lines were designed for carrying human voice and the whole system worked according to this requirement. All frequencies less than 300 Hz and above 3.4kHz were attenuated, since 300Hz to 3.4kHz is the range for human speech to be clearly audible. When using DSL, a different kind of switch is used that does not filter the frequencies, thus making entire frequency available. DSL uses frequency beyond 3.4kHz for Internet access.

Internet Connections

Asymmetric DSL (ADSL), a variant of DSL, provides high-speed delivery of download data (from Internet to user), than that for upload (from user to Internet), since most users download much more than they upload.

The bandwidth of connecting wire is divided into three bands—(1) 0–25kHz for regular telephone, (2) 25kHz–200kHz for user to Internet (upload), and (3) 250kHz–1MHz for Internet to the user (download). The available bandwidth for each direction for Internet is divided into channels of 4 kHz.

DSL is almost ten times faster than Dial-up access and is an always-on connection.

Internet Connections

Cable Modem

The user can connect to the Internet via a cable modem through cable television. The cable modem provides two connections—one for television and other for computer.

The cable modem sends and receives data through the coaxial cable which connects the cable modem to the cable service provider. Coaxial cables allow transmission of Internet data, audio, and video, and control over its several channels simultaneously. The user can access the Internet and watch television at the same time.

Internet Address

A computer connected to the Internet must have a unique address in order to communicate across the Internet. Internet Protocol (IP) address is assigned uniquely to every computer connected to the Internet. IP address is provided by the ISP whose services you use to connect your computer to the Internet. IP address is a string of numbers consisting of four parts, where each part is a number between 0 and 255. An IP address looks like 201.54.122.107. Since IP addresses are numeric, it is difficult to remember everyone's IP address. So, instead of numeric IP address, domain name is used.

Domain Name

Domain name is a text name (string of words) corresponding to the numeric IP address of a computer on the Internet. A domain name combines a group of hosts on the Internet (e.g. Yahoo, Google, MSN etc.), and a top level domain. Some examples of top-level domain are as follows:

com—for commercial organizations

edu—for educational institutions

net—for gateways and administrative hosts

org—for non-profit organizations

co—for companies and

ac—for academics

Some examples of domain name are google.com, isoc.org, center.edu and vsnl.net.

Internet Services

Internet is a huge de-centralized network that connects computers. Every computer connected to the Internet has a unique address, which helps to identify the computer on the Internet uniquely. Some of the important services provided by Internet are—World Wide Web, electronic mail, news, chat, and discussion groups.

Internet Services

WWW (also called as Web) is a large scale, online store of information. It is a system of creating, organizing, and linking of documents. Information is stored on WWW as a collection of documents that are interconnected with each other via links. The interconnected documents may be located on one or more than one computer, worldwide, thus, the name world wide web. The features of WWW and terms linked to WWW are given below

Web Browser

Web Browser (or browser) is a software program that extracts information on user request from the Internet and presents it as a web page to the user. It is also referred to as the user interface of the web. Some of the popular web browsers are—Internet Explorer from Microsoft, Mosaic browser, Google's chrome etc.

Browsers are of two types—graphical browser and text-based browser.

Graphical Browser

Graphical browsers provide a graphical user interface where the user can jump from one web page to the other by clicking on the hyperlink (displayed in blue color with underline) on a web page. Internet Explorer, Chrome and Mosaic are examples of graphical browsers.

Text-based Browser

A **text-based web browser** is a web browser that renders only the text of web pages, and ignores most graphic content. Under small bandwidth connections, usually, they render pages faster than graphical web browsers due to lowered bandwidth demands. As for example, Lynx

Uniform Resource Locator (URL)

A web page on the Internet is uniquely identified by its address, called URL. URL is the address on the Internet at which the web page resides. The user uses this address to get a web page from the Internet. The general form of URL is protocol://address/path where,

protocol defines the method used to access the web page, e.g., http, ftp, news etc.

address is the Internet address of the server where the web page resides. It contains the service (e.g. www) and the domain name (e.g.google.com), and

path is the location of web page on the server.

Uniform Resource Locator (URL)

To access documents on WWW, the HTTP protocol is used. An example of a URL is,

<http://www.dsc.com/mainpage>

where, http is the protocol, www.dsc.com is the address, and main page is the path.

Internet Search Engines

One of the most exciting things a user can do on the Internet is to search for information from multiple sources. There are hundreds of millions of web pages available, containing information on a wide variety of topics. There is no single catalog maintained (similar to a library) that lists all the web pages and their information. The user needs to search the Internet to find the information relevant to his/her requirement. Internet Search engines or Search engines are specific web sites that help the users to find information stored on the Internet.

Some of the common and well-known search engines are www.google.com, www.lycos.com and www.yahoo.com

Electronic Mail

Electronic mail (E-mail) is an electronic message transmitted over a network from one user to another. E-mail is a text-based mail consisting of lines of text and can include attachments such as audio messages, pictures and documents.

Features of e-mail

The features of e-mail are as follows:

E-mail can be sent to one person or more than one person at the same time.

Communicating via e-mail does not require physical presence of the recipient. The recipient can open the e-mail at his/her convenience.

Since messages are transmitted electronically, e-mail is a fast way to communicate with the people in your office or to people located in a distant country, as compared to postal system.

E-mail messages can be sent at any time of the day.

Types of Email

1) Client-based Email

Client-Based Email means you need a program on your computer and configures properly in order to read the email. Examples of email clients are Outlook Express, Microsoft Outlook, Pegasus Mail etc.

No matter which client program you use, some basic information you need to gather before you can configure your email program. You can get the information needed from the ISP (Internet Service Provider).

Types of Email

Here is the information needed:

Username - this is usually just the first part of your email address, but not always. Sometimes you have a different one and sometimes it is your entire email address. It depends on your ISP.

Types of Email

Password - your password corresponding with your Username.

Email Address - a valid email address look like this:
support@GoComputerTraining.com

POP3 Server Address - this is the address we need to configure to get your incoming mail. It typically looks like this: mail.your-isp.net

SMTP Server Address - this is the address we need to configure to get your outgoing mail. It typically looks like this: smtp.your-isp.net or mail.your-isp.net

Types of Email

2) Web-based Email

To utilize the web-based email services, first you need to register to get a free account. To start the process, you have to log-in with a USERNAME/LOGIN ID and PASSWORD. Then you have full control to send, receive, forward, reply and delete your email files.

Some of the well-known free web-based email services are:

Yahoo.com

Gmail.com

MSN.com

Internet of Things(IOT)

Introduction

IOT stands for Internet of Things. It refers to the interconnectedness of physical devices, such as appliances and vehicles, that are embedded with software, sensors, and connectivity which enables these objects to connect and exchange data. This technology allows for the collection and sharing of data from a vast network of devices, creating opportunities for more efficient and automated systems.

Internet of Things(IOT)

Internet of Things (IOT) is the networking of physical objects that contain electronics embedded within their architecture in order to communicate and sense interactions amongst each other or with respect to the external environment. In the upcoming years, IOT-based technology will offer advanced levels of services and practically change the way people lead their daily lives. Advancements in medicine, power, gene therapies, agriculture, smart cities, and smart homes are just a few of the categorical examples where IOT is strongly established.

IOT is a system of interrelated things, computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers. And the ability to transfer the data over a network requiring human-to-human or human-to-computer interaction.

Internet of Things(IOT)



Applications of Internet of Things(IOT)

- Smart surveillance
- Automated transportation
- Water distribution
- Smarter energy management systems
- Urban security and environmental monitoring

All are examples of internet of things applications for smart cities.

Wearable Computing

A wearable computer is any small technological device capable of storing and processing data that can be worn on the body. Wearable computers are designed for accessibility and convenience as well as improvements to workplaces by making information quickly and readily available to the wearer.

Wearable Computing



Cloud computing

Cloud computing, also on-demand computing, is a kind of Internet-based computing that provides shared processing resources and data to computers and other devices on demand. It is a model for enabling ubiquitous, on-demand access to a shared pool of configurable computing resources(e.g. networks, servers, storage, applications and services).Cloud computing and storage solutions provide users and enterprises with various capabilities to store and process their data in third-party data centers.

Cloud computing

The present availability of high-capacity networks, low-cost computers and storage devices as well as the widespread adoption of hardware virtualization, service-oriented architecture, and autonomic and utility computing have led to a growth in cloud computing. Companies can scale up as computing needs increase and then scale down again as demands decrease.

Cloud Computing



Features of Cloud Computing

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- **Resources Pooling.** It means that the Cloud provider pulled the computing resources to provide services to multiple customers with the help of a multi-tenant model.
 - **On-Demand Self-Service**
 - **Easy Maintenance**
 - **Large Network Access**
 - **Availability**
 - **Automatic System**
 - **Economical**
 - **Security**

Benefits of cloud computing

- Highly scalable
- More flexible
- Reduced infrastructure costs
- Higher security
- Back up and disaster recovery
- No location constraints

Cloud Reference Model

Service models

- SAAS(Software as a service)
- PAAS(Platform as a service)
- IAAS(Infrastructure as a service)

Cloud Reference Model

SAAS(Software as a service)

A service provider delivers software and applications through the internet. Users subscribe to the software and access it via the web or vendor APIs.

- Replaces traditional on device software.
- Thousands of applications in the cloud.
- CRM,Email,Virtual desktop, Games etc.

Cloud Reference Model

PAAS(Platform as a service)

A service provider offers access to a cloud-based environment in which users can build and deliver applications. The provider supplies underlying infrastructure.

- Small number of cloud platforms.
- Increases developer productivity while decreasing applications time to market.
- Database, web server, development tools
- As for example Red Hat, VMware etc.

Cloud Reference Model

IAAS(Infrastructure as a service)

A vendor provides clients pay-as-you-go access to storage, networking, servers and other computing resources in the cloud.

- Extends data center infrastructure for temporary workloads.
- Virtual machines,servers,storage,network etc.
- As for example Amazon Aws,Backspace open cloud, Firewall etc.

Search Engine

A **search engine** is a software system designed to carry out web searches. They search the World Wide Web in a systematic way for particular information specified in a textual web search query. The search results are generally presented in a line of results, often referred to as search engine results pages (SERPs). The information may be a mix of links to web pages, images, videos, info graphics, articles, research papers, and other types of files. Examples of search engines are Google, Bing, Yahoo etc.

E-commerce

E-commerce (electronic commerce) is **the buying and selling of goods and services, or the transmitting of funds or data, over an electronic network, primarily the internet.** These business transactions occur either as business-to-business (B2B), business-to-consumer (B2C), consumer-to-consumer or consumer-to-business.

Advantages of E-commerce

- 24*7 operation
- Global reach
- Cost of acquiring ,serving & retaining customers
- Improved customer service to your clients.
- Improved service quality
- Quick decision making

Disadvantages of E-commerce

- Less man power consume.
- Trained manpower is require.
- Difficult in pricing & currency conversions.
- Business often calculate the return on investment.

Types of E-commerce

Six types of ecommerce:

- Business-to-Business (B2B) with its Business-to-Government (B2G)
- Business-to-Consumer (B2C)
- Consumer-to-Business (C2B)
- Consumer-to-Consumer(C2C)
- Government-to-Business (G2B) and
- Government-to-Consumer (G2C).

Types of E-commerce

Business-to-Business (B2B)

At first sight, it seems that the name explicitly suggests that both participants in B2B ecommerce are businesses, for example a manufacturer or a wholesale supplier selling to a retailer. However, B2B ecommerce has one more face – multi-vendor marketplaces. Though end buyers are individual consumers, a marketplace owner sells digital space to business vendors, thus conducting B2B transactions.

Types of E-commerce

Business-to-Consumer

The B2C type is the most widespread in ecommerce, thus the market in each product line is really competitive. Here, focusing on smaller, yet profit-generating, target audience is business-critical. This goes without saying that in our practice we frame B2C projects around the target audience.

Types of E-commerce

Consumer-to-Business

In the C2B model, individuals – entrepreneurs or freelancers – offer goods or services to companies. For example:

A web designer building a company's website.

A photographer picturing product catalogs.

A caterer working on corporate events, conferences or business meetings.

Types of E-commerce

Consumer-to-Consumer

Within the C2C type, consumers sell assets or services to other consumers online. To place sales advertisements and connect to potential buyers, individuals use a third-party business (an ecommerce website or an online marketplace). Ebay and Amazon are two prominent C2C ecommerce providers.

Types of E-commerce

Government-to-Consumer

Online transactions can streamline communication between governmental organizations and citizens. Possible activities may include information sharing, paying fees (for education, rent, consulting services etc.), renewing licenses and more.

Internet and Intranet

Intranet:

An intranet is a company wide network run along the lines of the www. Many school & colleges have intranets & selected information is downloaded from the internet for students to access .

Extranet:

An extranet is a business to business intranet that allows limited ,controlled ,secure access between a company's intranet & designated ,authenticated users from remote locations.

E-governance

Electronic governance or **e-governance** is the application of information technology for delivering government services, exchange of information, communication transactions, integration of various stand-alone systems between government to citizen (G2C), government-to-business (G2B), government-to-government (G2G), government-to-employees (G2E) and interactions within the entire governance framework. Through e-governance, government services are made available to citizens through IT.

The three main target groups that can be distinguished in governance concepts are government, citizens, and businesses/interest groups.

Advantages of E-Governance

- Speed. Technology makes communication swifter.
- Saving Costs.
- Transparency.
- Accountability.

Disadvantages of E-governance

- Lack of Confidentiality
- Cybercrimes
- Technical Failures are concerning disadvantages of e governance
- Inadequate Training
- Illiteracy
- Loss of Interpersonal Communication.
- High Setup Cost Cybercrime/Leakage of Personal Information.

Web 2.0

Web 2.0 describes the current state of the internet which has more user-generated content and usability for end-users compared to its earlier incarnation, Web 1.0. Web 2.0 generally refers to the 21st-century internet applications that have transformed the digital era.

Smart City

A **smart city** is a technologically modern urban area that uses different types of electronic methods methods, voice activation methods and sensors to collect specific data. Information gained from that data is used to manage assets, resources and services efficiently. This includes data collected from citizens, devices, buildings and assets that is processed and analyzed to monitor and manage traffic and transportation systems, power plants, utilities, water supply networks, waste, crime detection, information systems, schools, libraries, hospitals, and other community services. Smart cities are defined as smart both in the ways in which their governments harness technology as well as in how they monitor, analyze, plan and govern the city.

Case Study

ISP in Nepal and Their services

- Nepal Telecom
- World Link
- Subisu
- Dish Home etc.