Computer Network

- A group of computers connected together/
- Interconnection of two or more computers
- With wire or wireless medium
- To share data and resources.

The first computer network was:

ARPANET(Advanced Research Project Agency Network)

Data Communication

- The process of transferring information or data from one entity to another with wire or wireless medium.
- Movement of data electronically from one point to another over a suitable transmission medium.
- In computer science, process of sending data one bit at a time, sequentially over a communication channel.

Smart InfoTech

Components of data communication

- Message:
  - Information to be shared.
- Source/Sender
  - Device that sends the message
- Destination/ Receiver
  - Device that receives the message
- Medium/Path
  - The mode that communicates message from sender to receiver
- Protocol
  - Rules or standards to control the network
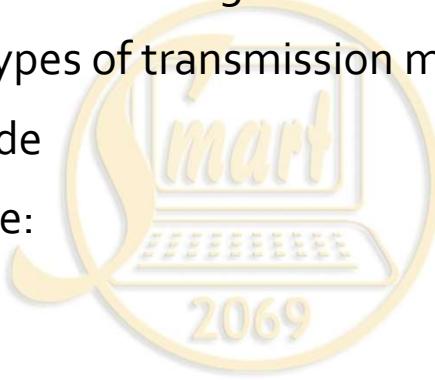
Data Transmission Mode

Refers to the direction of signal flow

There are two types of transmission mode:

1. Simplex Mode

2. Duplex Mode:

   a. Half Duplex

   b. Full Duplex

Data Transmission Mode

Simplex: Transmission Mode where communication is done only in one direction also known as unidirectional mode. e.g. TV Broadcasting.

Duplex: Transmission Mode where communication is done in both directions also known as bidirectional mode.
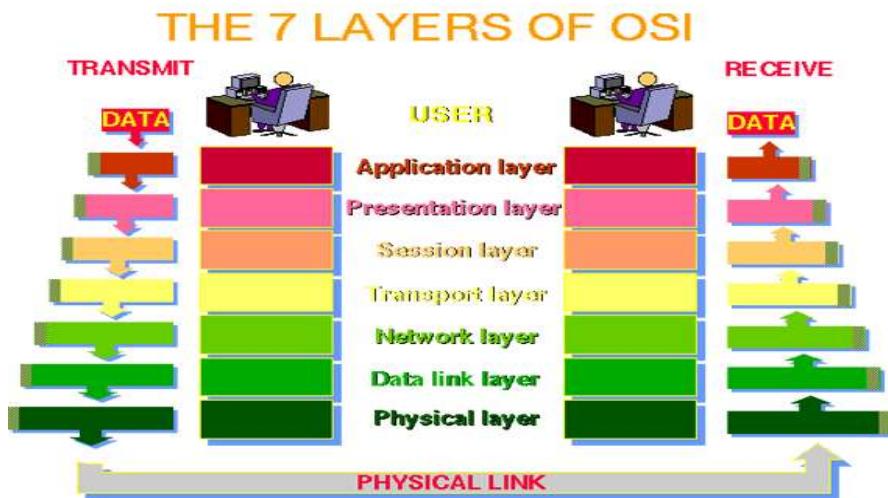
Half Duplex: Two way communication, but one direction at a time e.g. Walky Talky

Full Duplex: Two way simultaneous communication e.g. Telephone

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

Layers of OSI Model
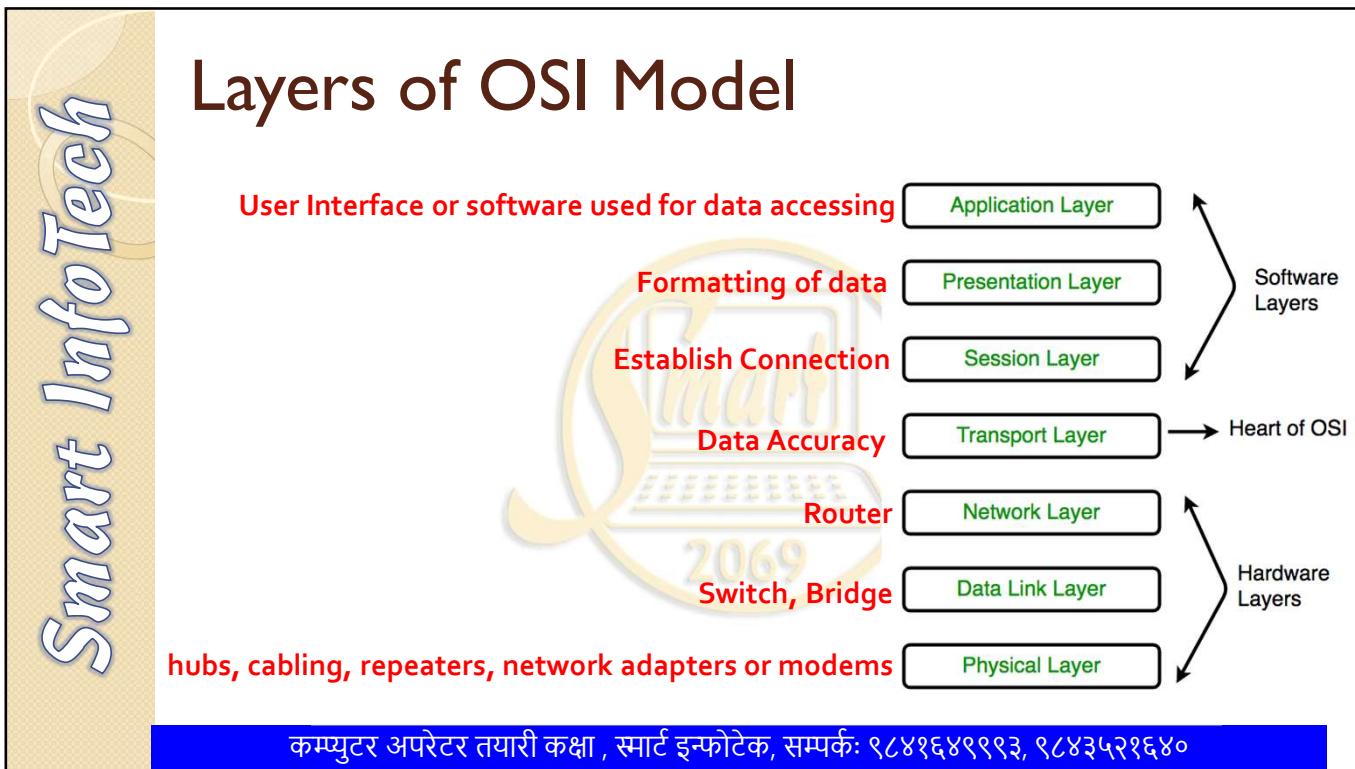
- OSI stands for Open Systems Interconnection

- Developed by ISO – 'International Organization of Standardization'

- All layers work together to transmit data from one person to another

friendlyniraj@gmail.com (9841649993)

Layers of OSI Model

Layers of OSI Model

4

Layers of OSI Model

Description	Layer	Group
User Interface or software used for data accessing	Application Layer	Software Layers
Formatting of data	Presentation Layer	
Establish Connection	Session Layer	
Data Accuracy	Transport Layer	Heart of OSI
Router	Network Layer	Hardware Layers
Switch, Bridge	Data Link Layer	
hubs, cabling, repeaters, network adapters or modems	Physical Layer	

Bandwidth

- Amount of data that can be transferred from one point to another within a network in a specific amount of time
- Also known as data transfer rate
- Measured in terms of bps (Bits Per Second), kbps, mbps, gbps

Types of Bandwidth

- **Narrow Band**: low capacity, 64 KBPS to 1.54 MBPS
- **Wide Band**: medium capacity, 1.54 MBPS to 45 MBPS
- **Broad Band**: high capacity, upto GBPS (cable tv, microwave, satellite etc.)

Smart InfoTech

Networking components

- Server/ File Server
- Work station
- NOS (Network Operating System)
- NIC (Network Interface Card)
- Transmission Media / Communication channel
- Network Devices

Smart InfoTech

Server/Host

- A computer or system that provides resources, data, services, or programs to other computers in network

- Has large storage and high processing capacity,

- Controls and manages the computer in network

- Has Network Operating System)

- It can be Physical or Virtual

Client/ Workstation

- Computer that is connected to server

- A client can also be another term used to describe a user

- An application program is known as a client program

NOS

- Operating System runs on a server
- Gives the server the capability to manage data, users, groups, security, applications, and other networking functions
- Microsoft Windows Server 2003, Microsoft Windows Server 2008, UNIX, Linux, Mac OS X, Novell NetWare
- They are Real Time Operating System (RTOS)

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

Smart InfoTech

NIC
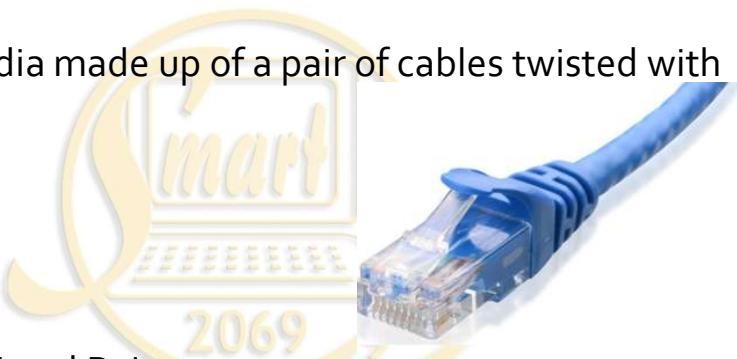
- Network Interface Card
- Used to establish physical connection between in computers and network
- Each NIC has physical address known as MAC (Media Access Control) Address

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

Smart InfoTech

कम्प्युटर अपरेटर तयारी कक्षा, स्मार्ट इन्फोटेक, कीर्तिपुर , काठमाडौं

Transmission Media

- Communication channel or path that carries the information from the sender to the receiver
- Physical path between transmitter and receiver
- Layer 1 component in OSI model
- Types
  a. Bound/wired/ guided: that use physical path
  b. Unbound/ wireless/unguided: that do not use physical path

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

Smart InfoTech

Guided Media

- **Twisted Pair**
  ◦ Physical media made up of a pair of cables twisted with each other
  ◦ Uses RJ-45
- Types
  ◦ Shielded Twisted Pair: Cable enclosed in foil or mesh shield
  ◦ Unshielded Twisted Pair

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

Smart InfoTech

Guided Media

Unshielded Twisted Pair
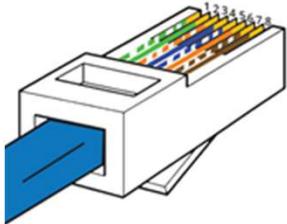
- **Category 1**: Category 1 is used for telephone lines that have low-speed data.
- **Category 2**: It can support upto 4 Mbps.
- **Category 3**: It can support upto 16 Mbps.
- **Category 4**: It can support upto 20 Mbps..
- **Category 5**: It can support upto 200 Mbps.

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

Ethernet Cable Color Coding

T568A And T568B Wiring Standard Basis

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

कम्प्युटर अपरेटर तयारी कक्षा, स्मार्ट इन्फोटेक, कीर्तिपुर , काठमाडौं
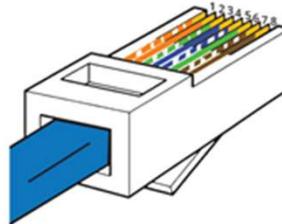
Ethernet Cable Color Coding

T568A And T568B Wiring Standard Basis

T-568A	**T-568B**
1. White Green	1. White Orange
2. Green	2. Orange
3. White Orange	3. White Green
4. Blue	4. Blue
5. White Blue	5. White Blue
6. Orange	6. Green
7. White Brown	7. White Brown
8. Brown	8. Brown

Cable Testing

- Networking cable testing is used to test if the networking cable is working properly
- **Cable Certification Testers**
  - Checks if the cabling system meets the standard of industry.
- **Cable Qualification Testers**
  - Determines if an existing cabling link can support certain network speed and technologies.
  - Used by network technician to troubleshoot existing network
- **Cable Verification Testers**
  - Verifies if the network cable is connected correctly

Smart InfoTech

Guided Media

Coaxial Cable
- Type of copper cable
- specially built with a metal shield and other components
- Primarily used for cable TV

Fiber Optics or Optical Fiber
- Technology of data transmission using light pulses travelling along with a long fiber which is usually made of plastic or glass.
- capable of transmitting more data over longer distances
- Fastest medium of data transmission

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०
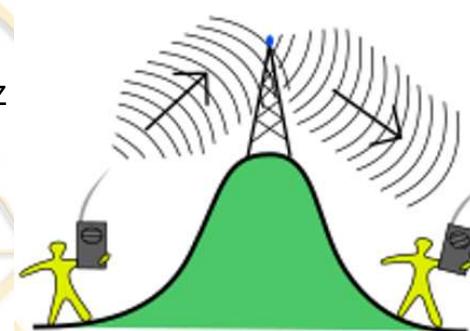
Unguided Media

- Unguided medium transport electromagnetic waves without using a physical conductor

- Unguided signals can travel from the source to the destination in several ways:
  - Ground propagation
  - Sky propagation
  - Line-of-sight propagation

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

कम्प्युटर अपरेटर तयारी कक्षा, स्मार्ट इन्फोटेक, कीर्तिपुर , काठमाडौं

Unguided Media

- Radio waves
  - Electromagnetic waves ranging in frequencies between 3 KHz and 1 GHz
  - Propagated in all directions
  - Useful for multicasting
  - Radio, television, cordless phones, paging are examples of multicasting.

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

Unguided Media

- Microwave
  - Electromagnetic waves having frequencies between 1 and 300 GHz
  - Limited to Line-of-Sight (LoS)
  - Used in cellular phones, satellite networks and wireless LANs

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

Unguided Media

- **Characteristics of Microwave:**
  - **Bandwidth**: from 1 to 10 Mbps.
  - **Short distance**: It is inexpensive for short distance.
  - **Long distance**: It is expensive as it requires a higher tower for a longer distance.
  - **Attenuation**: Attenuation means loss of signal. It is affected by environmental conditions and antenna size

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

Unguided Media

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

14

Unguided Media

Smart InfoTech

- **Satellite:**
  ◦ A satellite is a physical object that revolves around the earth at a known height
  ◦ Used in a wide variety of applications such as weather forecasting, radio/TV signal broadcasting, mobile communication, etc

Unguided Media

Smart InfoTech

- **Infrared**
- ◦ Frequencies from 300 GHz to 400 THz
- ◦ Used for short-range communication
- ◦ Used in TV remotes, wireless mouse, keyboard, printer
- **Bluetooth:**
- ◦ A short-range wireless communication technology
- ◦ Used in mobile phones, laptops
- **Wi-fi**
- ◦ Stands for Wireless Fidelity
- ◦ Allows electronic devices to exchange data (including high speed internet)

कम्प्युटर अपरेटर तयारी कक्षा, स्मार्ट इन्फोटेक, कीर्तिपुर , काठमाडौं

Wi-Fi Standards

IEEE Standard	802.11a	802.11b	802.11g	802.11n	802.11ac	802.11ax
Year Released	1999	1999	2003	2009	2014	2019
Frequency	5Ghz	2.4GHz	2.4GHz	2.4Ghz & 5GHz	2.4Ghz & 5GHz	2.4Ghz & 5GHz
Maximum Data Rate	54Mbps	11Mbps	54Mbps	600Mbps	1.3Gbps	10-12Gbps

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

Networking Devices

- Devices or hardware that is needed for communication and interaction between hardware on a network

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

16

Networking Devices

- Hub
  - Connects <u>multiple computers </u>to network
  - Also acts called <u>multiport repeater</u>
  - Do not perform filtering or addressing functions
  - Sends data packets to all connected devices
  - Called <u>dumb device</u>

Smart InfoTech
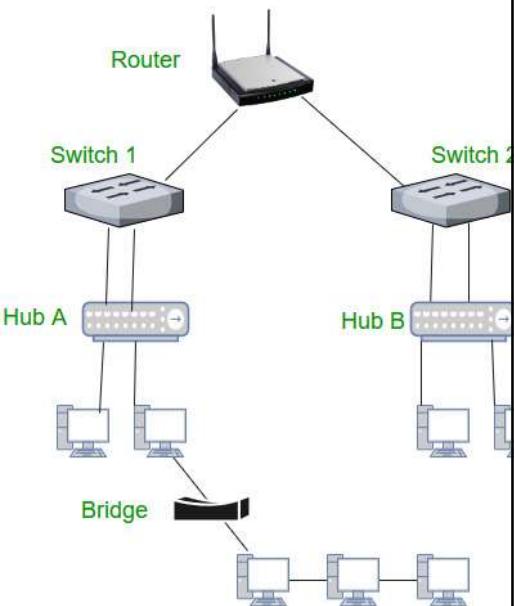
Networking Devices

- **Switch**
  - Connects multiple computers in a network
  - Used for filtering & forwarding the data.
  - More intelligent than hub
- **Router**
  - Connect LANs and WANs together or multiple networks
  - Routes data packets based on their IP addresses

Smart InfoTech

Networking Devices

- Bridge
  - Connects <u>similar network</u> or networks with same protocol
  - Filters and forwards packets by physical address (<u>MAC Address</u>)
  - As a <u>single input</u> and <u>single output</u> port, thus making it a <u>2 port device</u>

Networking Devices
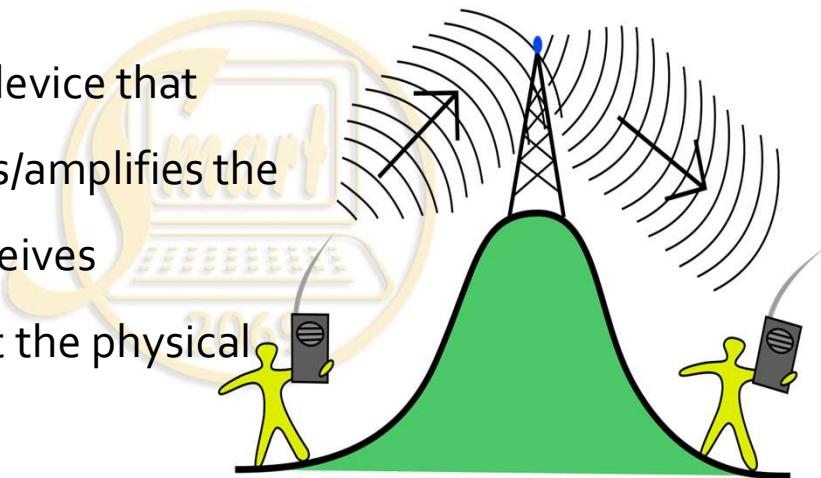
- Gateway
  - Connects two <u>dissimilar network</u> or networks with different protocol
  - Also called protocol converter
- Brouter
  - Also known as bridging router
  - Combines features of both bridge and router

Networking Devices

- Repeater
  - Electronic device that regenerates/amplifies the signal it receives
  - Operates at the physical layer

Networking Devices

- Modem
  - Stands for Modulator-Demodulator
  - Converts analog signal to digital and vice versa
  - Used to transmit digital signals over analog telephone lines
  - Used in dial up internet connection

19

Hub vs Switch

Hub

- Cheaper
- Dumb device. It broadcasts data packet to all computers
- Wastage of bandwidth
- Network is less secured
- Half duplex

Switch

- More expensive
- Intelligent device. It transmit data packet to intended computer
- Bandwidth wastage is minimal
- Network is more secured
- Full duplex

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

Smart InfoTech

Switch vs Router

Switch

- Connects multiple devices in single network
- Less intelligent
- Works on MAC address
- 'Ready to use' device
- Used in LAN
- Cannot perform NAT

Router

- Connects multiple networks together
- More intelligent
- Works on IP address
- Need to configure before use
- Used in LAN, MAN, WAN
- Can perform NAT

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

Smart InfoTech

कम्प्युटर अपरेटर तयारी कक्षा, स्मार्ट इन्फोटेक, कीर्तिपुर , काठमाडौं
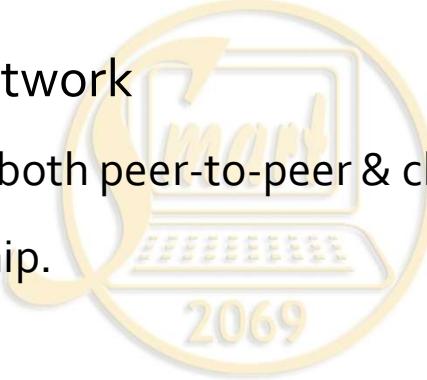
Types of Network

- **Based on architecture**
  - Peer to Peer Network
    - All computers in network has same role
    - Single computer can act as both server and client
    - No need of NOS
    - Can be setup within the home, business or over the internet

Types of Network

- **Based on architecture**
  - Client server Network
    - Networks that use a dedicated computer (server) to store data, manage/provide resources and control user access
    - Server acts as a central point on the network
    - A computer that connects to the server is called a client

Types of Network

- **Based on architecture**

  ◦ Hybrid Network

    · Based on both peer-to-peer & client-server

    relationship.

Types of Network

- **Based on Geographical Area**

  ◦ LAN

    · Network devices connected together, usually

    within the same building (within 5 km)

    · Secure connection and Faster

    · Medium used is twisted pair

Types of Network

- **Based on Geographical Area**
  - MAN
    - Network that spans several buildings in the same city or town (upto 100 ktm)
    - Medium is optical fibers, cables

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

Types of Network

- **Based on Geographical Area**
  - WAN
    - Network that covers entire world
    - Collection of several local-area networks (LANs)
    - Termed as Internet

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

कम्प्युटर अपरेटर तयारी कक्षा, स्मार्ट इन्फोटेक, कीर्तिपुर , काठमाडौं

Network Topology

- Network arrangement, connecting various nodes (sender and receiver) through lines of connection.

- arrangement of the physical and logical elements of a communication network

- Methods in which all the elements of a network are mapped

Network Topology

- Physical Topology
  - An actual layout of the computer cables and other network devices
- Logical Topology
  - Manner in which data travels through the network between devices, independent of physical connection of the devices

Smart InfoTech

24
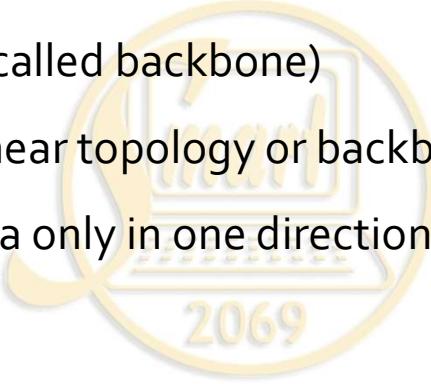
Network Topology

- Bus Topology
- Ring Topology
- Star Topology
- Tree Topology
- Mesh Topology
- Hybrid Topology
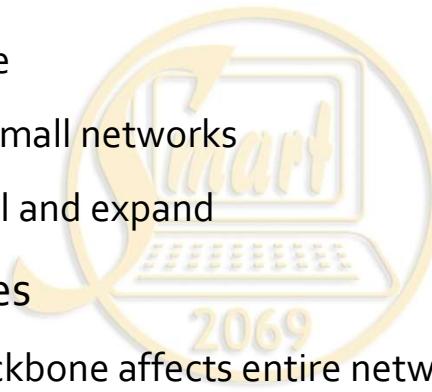
Bus Topology

- Every computer and network device is connected to single cable (called backbone)
- Also called linear topology or backbone topology
- transmits data only in one direction.

Smart InfoTech
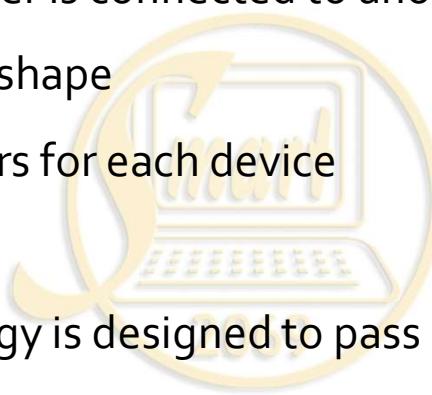
Bus Topology

- Advantages
  - Cost effective
  - Suitable for small networks
  - Easy to install and expand
- Disadvantages
  - Failure of backbone affects entire network
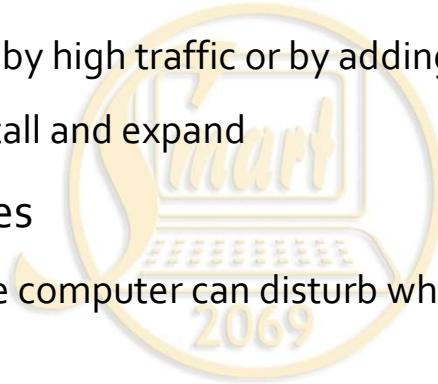
Ring Topology

- Each computer is connected to another computer forming ring shape
- Two neighbors for each device

- If ring topology is designed to pass data in both direction then it is called **dual ring topology**
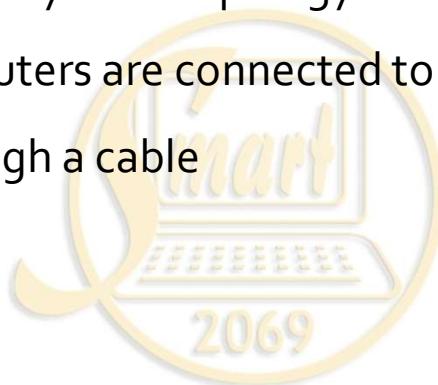
Ring Topology

- Advantages
  - Not affected by high traffic or by adding more nodes
  - Cheap to install and expand
- Disadvantages
  - Failure of one computer can disturb whole network

Star Topology

- Most commonly used topology in home/office network
- All the computers are connected to a central hub (or switch) through a cable

Star Topology

- Advantages
  - Easy to manage
  - Easy to add/remove nodes
  - Durable
- Disadvantages
  - Finite number of switch ports limits the network's size
  - Whole network fails if central hub fails

Tree Topology

- Has a root node and all other nodes are connected to it forming a hierarchy
- Also called hierarchical topology
- Has at least 3 levels

Smart InfoTech
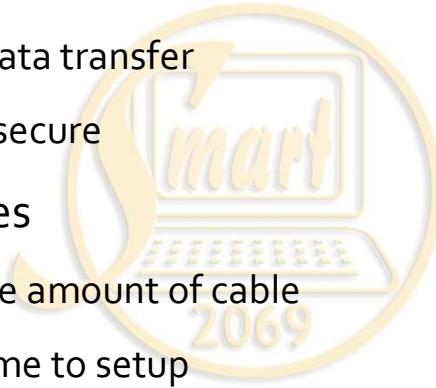
Tree Topology

- Advantages
  - Can combine bus and star topology
  - Error detection is easy
  - Failure of one node does not affect network
- Disadvantages
  - Costly

Smart InfoTech

Mesh Topology

- Most reliable topology
- Point to point connection as all nodes are connected to each other
- For n devices $n(n-1)/2$ physical connection needed
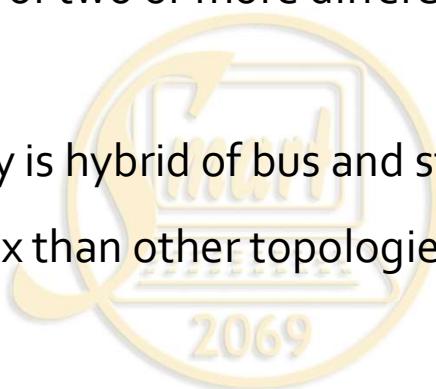
Mesh Topology

- Advantages
  - ◦ High speed data transfer
  - ◦ Durable and secure
- Disadvantages
  - ◦ Requires large amount of cable
  - ◦ Takes long time to setup

Smart InfoTech

Hybrid Topology

- Combination of two or more different topology structure
- Tree topology is hybrid of bus and star topology
- More complex than other topologies

Smart InfoTech

30
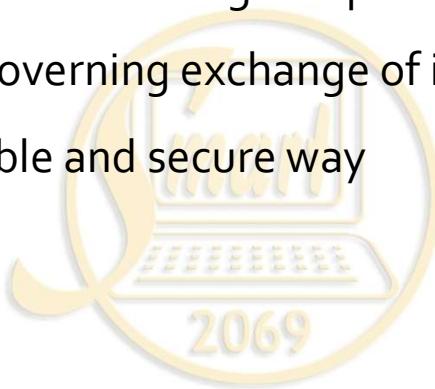
Hybrid Topology

- Advantages
  - Flexible
  - Infinitely expandable
- Disadvantages
  - Requires professional management
  - Equipment costs are high
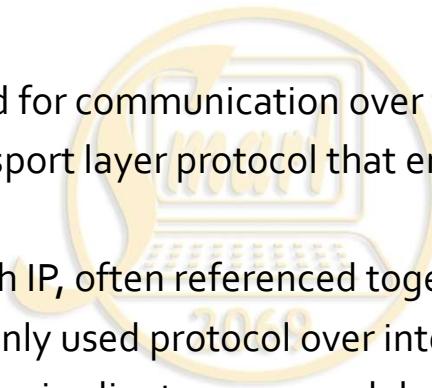
Network Protocol

- Set of rules for formatting and processing data
- Set of rules governing exchange of information in an easy, reliable and secure way

Network Protocol

- **TCP/IP (Transmission Control Protocol/ Internet Protocol)**
  - Protocol used for communication over the Internet
  - TCP is a transport layer protocol that ensures reliable data delivery
  - TCP used with IP, often referenced together as TCP/IP
  - Most commonly used protocol over internet
  - Communicates in client-server model

Network Protocol

- **TCP/IP has four layers**

Layer	Function
Application	• To allow access to network resources
Transport	• To provide reliable process to process message delivery and error delivery
Internet	• To move packets from source to destination • To provide internetworking
Network Interface	Responsible for the transmission for the between two device on the same network.

Network Protocol

- **HTTP (Hyper Text Transfer Protocol)**

  ◦ It is the rules for transferring multimedia files on the Word Wide Web

  ◦ It works on a client-server model, where the web browser acts as the client

  ◦ Data such as text, images, and other multimedia files are shared over the World Wide Web using HTTP

Network Protocol

- **FTP (File Transfer Protocol)**

  ◦ Protocol used to transfer data from a particular computer to another over world wide web

  ◦ Enables file sharing between hosts, both local and remote, and runs on top of TCP

33

Network Protocol

- **SMTP (Simple Mail Transfer Protocol)**
  - Designed to transfer (<u>send</u>) electronic mail reliably and efficiently
- **Pop (Post Office Protocol)**
  - Allows end user to download (<u>receive</u>) emails from the mail server to their own email client

Network Protocol

- **TELNET (Telecommunication Network/ Terminal Emulation)**
  - Enables a user to communicate with a remote device
  - Mostly used by network administrators for <u>remote log in </u>and remote <u>control</u>)

Network Protocol

- **DNS (Domain Name System Protocol):**
  - Translates domain name to IP address

- **DHCP (Dynamic Host Configuration Protocol)**
  - Enables a server to automatically assign an IP address to a computer in network

Network Protocol

- **IMAP (Internet Message Access Protocol):**
  - Lets end users access and manipulate messages stored on a mail server from their email client
- **UDP (User Datagram Protocol):**
  - Connection-less transport layer protocol
  - Faster but less reliable alternative to TCP at the transport layer
  - Used in services like video streaming, gaming

Smart InfoTech

Network Protocol

- **RIP (Routing Information Protocol)**
  - Older routing protocol that identifies distances between routers
- **SNMP (Simple Network Management Protocol)**
  - Protocol used to manage nodes, like servers, workstations, routers, switches, etc
- **PPP (Point to Point Protocol)**
  - Used to transmit multiprotocol data between two directly connected (point-to-point) computers.

Smart InfoTech
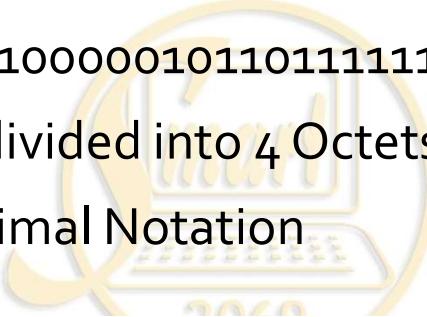
IP Addressing

- IP Addressing is Logical Addressing

- It works on Network Layer (Layer 3)

- Two Versions of Addressing Scheme

  - IP version 4 – 32 bit addressing

  - IP version 6 – 128 bit addressing

Smart InfoTech

IP Addressing : IPv4

- 32-bit IP address

    01010101000001011011111100000001

- 32 bits are divided into 4 Octets known as Dotted Decimal Notation

First Octet	Second Octet	Third Octet	Forth Octet
01010101.	00000101.	10111111.	00000001

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

IP Addressing : Range

Taking Example for First Octet :
Total 8 bits, Value will be 0's and 1's
i.e. 2^8 = 256 combination

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0		
0	0	0	0	0	0	0	0	=	0
0	0	0	0	0	0	0	1	=	1
0	0	0	0	0	0	1	0	=	2
0	0	0	0	0	0	1	1	=	3
0	0	0	0	0	1	0	0	=	4

Total IP Address Range

0 . 0 . 0 . 0
to
255.255.255.255

1 1 1 1 1 1 1 1 = 255

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

IP Addressing : Class

- **Total IP Addressing Scheme is divided into 5 Classes**

- **CLASS A**
- **CLASS B**   **LAN & WAN**
- **CLASS C**

- **CLASS D**   **Multicasting**

- **CLASS E**   **Research & Development**

IP Addressing : Range

Class A Range
0 . 0 . 0 . 0 to
127.255.255.255
Exception
0.X.X.X and 127.X.X.X
network are reserved

Class C Range
192. 0 . 0 . 0
to
223.255.255.255

Class E Range
240. 0 . 0 . 0
to
255.255.255.255

Class B Range
128. 0 . 0 . 0
to
191.255.255.255

Class D Range
224. 0 . 0 . 0
to
239.255.255.255

38

कम्प्युटर अपरेटर तयारी कक्षा, स्मार्ट इन्फोटेक, कीर्तिपुर , काठमाडौं

IP Addressing : Priority Bit

- To identify the range of each class a bit called priority bit is used.

- Priority Bit is the left most bits in the First Octet

- CLASS A priority bit is   **0**

- CLASS B priority bit is   **10**

- CLASS C priority bit is   **110**

- CLASS D priority bit is   **1110**

- CLASS E priority bit is   **1111**

Smart InfoTech

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

IP Addressing : Octet Format

- **IP address is divided into Network & Host Portion**

- **CLASS A is written as**   **N.H.H.H**

- **CLASS B is written as**   **N.N.H.H**

- **CLASS C is written as**   **N.N.N.H**

Smart InfoTech

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

कम्प्युटर अपरेटर तयारी कक्षा, स्मार्ट इन्फोटेक, कीर्तिपुर , काठमाडौं

IP Addressing : No. of Network & Host

- Class A Octet Format is N.H.H.H
- Network bits : 8   Host bits : 24

- No. of Networks
  - $=$ 2^{8-1} (-1 is Priority Bit for Class A)
  - $=$ 2^7
  - $=$ 128 − 2 (-2 is for 0 & 127 Network)
  - $=$ 126 Networks

- No. of Host
  - $=$ $2^{24} - 2$ (-2 is for Network ID & Broadcast ID)
  - $=$ 16777216 - 2
  - $=$ 16777214 Hosts/Network

CLASS A
126 Networks
&
16777214 Hosts/Nw

CLASS B
16384 Networks
&
65534 Hosts/Nw

CLASS C
Networks
&
Hosts/Nw

IP Addressing: Private IP Address

- IP addresses in each class of IP reserved for LAN
- Used for: home & office networks, networks not connected to Internet.

Class A
10.0.0.0 to 10.255.255.255
Class B
172.16.0.0 to 172.31.255.255
Class C
192.168.0.0 to 192.168.255.255

Subnet Mask

Class A : N.H.H.H
11111111.00000000.00000000.00000000
Default Subnet Mask for Class A is 255.0.0.0

Class B : N.N.H.H
11111111.11111111.00000000.00000000
Default Subnet Mask for Class B is 255.255.0.0

Class C : N.N.N.H
11111111.11111111.11111111.00000000
Default Subnet Mask for Class C is 255.255.255.0

Network Utilities

- Network utilities are basic software tools designed for analyzing and configuring various aspects of computer networks.
- Network utilities helps network functioning properly by allowing you to check the various aspects of your network, such as connections between devices, packet loss, and latency between connections.

Network Utilities

- **Ping**: Packet Internet or Inter-Network Groper- Used to test whether a particular host is reachable across an IP network.
- **Ipconfig**: used to display all current TCP/IP network configuration Used without parameters, ipconfig displays Internet Protocol version 4 (IPv4) and IPv6 addresses, subnet mask, and default gateway for all adapters. With ipconfig/all it displays full configuration information.

Network Utilities

- **Tracert**: Also known as traceroute provides details on all the "hops" the packet went through to get to the destination, including switches and routers, along with the IP address and DNS information of each.
- **Nslookup**: Stands for "name server lookup," is used to query the domain name system (DNS) for domain name or IP address mapping, or to obtain other kinds of DNS records.

42

Network Utilities

- **ARP**: Address Resolution Protocol." It's used to determine the MAC address associated with a particular IP address

- **Netstat:** short for "network statistics," allows to check whether the connections exist, and provides statistics to show how the connection is performing.

Internet

- Defined as the International Network, that is Internet is a worldwide system of computer networks.
- Internet is the interconnection of millions of computer together with a common protocol called TCP/IP.
- Internet is the largest public global network that connects millions of computer networks all over the world.
- Known as network of networks.

43

History of Internet

The foundation of internet is <u>ARPANET</u> (Advanced Research Project Agency Network), the project started in 1969 by <u>DOD</u> (Department of Defense) of US to allow researchers and military personals to communicate with each other.

▪ Till 1960's this internet was only limited within the US.

▪ Internet became worldwide in early 1970's after it was distributed in Europe and Japan.

Internet Connection Requirements

- **Computer System**: Computers or other devices like mobile, laptop , PDA (Personal Digital Assistant)
- **ISP (Internet Services Provider)**: Which provides internet services
- **Modem/ Router**: Communication Medium (Wired/ Wireless)
- **Web Browser**: Internet Explorer, Mozilla Firefox, Google Chrome, Opera

Internet Connection Technology (Types)

- **Dial-up Connection**
  ◦ Uses modem, telephone
  ◦ An analog connection as data is sent over an analog network (PSTN)
  ◦ Uses modem, telephone
  ◦ Limited speed (2400 bps to 56 Kbps)
  ◦ Phone line busy

Internet Connection Technology (Types)

- **ISDN (Integrated Service Digital Network)**
  ◦ Digital network for sending voice, video, and data over digital telephone lines or normal telephone wires.
  ◦ Speeds range from 64 Kbps to 128 Kbps

Internet Connection Technology (Types)

- **B-ISDN (Broadband ISDN)**

  ◦ Transfers data over fiber optic telephone lines, not normal telephone wires

  ◦ SONET is physical transport backbone of B-ISDN

  [SONET=Synchronous optical networking]

Internet Connection Technology (Types)

- **DSL (Digital Subscriber Line)**

  ◦ Uses existing 2-wire copper telephone lines

  ◦ 'Always on' technology

  ◦ Speed range from 128 Kbps to 9 Mbps

46

Internet Connection Technology (Types)

- **DSL types**
  - SDSL - Symmetric Digital Subscriber Line: data rates up to 3 Mbps
  - ADSL - Asymmetric Digital Subscriber Line: download speed-1.5 to 9 Mbps, upload speed-16 to 640 Kbps

  [ADSL2+ is a newer version of ADSL]

Internet Connection Technology (Types)

- **Cable – Broadband Internet Connection**
  - An internet connection through a cable modem
  - Operates over cable TV lines
  - Cable speeds range from 512K to 20 Mbps
- **Wireless Internet**
  - Uses radio frequency
  - Speed varies from 5 mbps to 20 mbps

Internet Connection Technology (Types)

- **Satellite**
  - Provides a delayed connection compared to cable and DSL.
  - Speed is around 512K to 2.0 Mbps.
- **Cellular**
  - Wireless internet through cell phones
  - Most common speeds are 3G (around 2.0 Mbps) and 4G (goal of 100 Mbps but currently 21 Mbps)

Internet services

1. WWW
2. E-Fax (Electronic Facsimile)
3. E-Phone(Internet Telephone)
4. E-commerce
5. IRC
6. Video Conferencing
7. Telnet
8. FTP
9. Newsgroup

Internet services

- **WWW:**
  - Collection of websites or web pages stored in web servers
  - Allows end users to access data through web address or URL (Uniform Resource Locator).

Internet services

- **E-fax:**
  - Also called Electronic fax or internet fax
  - Use of the internet and internet protocols to send a fax (facsimile)
  - Does not use standard telephone line

49

Internet services

- **E-phone/Internet Telephony**
  - Enables people to use the Internet as the transmission medium for telephone calls
  - Transmits the human voice (real time or close to real time) over the internet
  - Uses protocol VOIP (Voice Over Internet Protocol)
  - **Types**: PC-to-PC, PC to Phone, and Phone to Phone.

Internet services

- **E-commerce:**
  - Stand for Electronic Commerce
  - buying and selling of goods, products, or services over the internet.
  - Transaction of money, funds, and data

Smart InfoTech

Internet services

- **E-commerce Types:**

  ◦ Business to Business (B2B)

  ◦ Business to Consumer (B2C)

  ◦ Consumer to Consumer (C2C)

  ◦ Consumer to Business (C2B)

Internet services

- **Telnet**
  ◦ Can log in remote computer through internet
- **IRC**
  ◦ Stands for Internet Relay Chart
  ◦ Service to exchange message or information simultaneously (messenger, viber)
- **Video Conferencing**
  ◦ It transmits audio and video and enables face to face conference.

Internet services

- **FTP (File Transfer Protocol)**
  - Allows transferring (uploading and downloading) files between remote computers.
- **Newsgroup**
  - Online Forum where people can post article and message on particular topic and participate in discussion.
  - E.g. Netscape News, Usenet etc.

Internet services

- **E-mail**
  - E-mail is short form of Electronic mail
  - Allows to transfer text message, image from one computer to another via internet.

For e.g.

friendlyniraj@gmail.com

[user-id]   [divider]   [domain-name]

Advantages of E-mail

- Cheapest and fastest means of communication
- More reliable
- Access from anywhere
- Easy to send voice, video and other kind of data
- Sending mail to different persons at same time

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

Disadvantages of E-mail
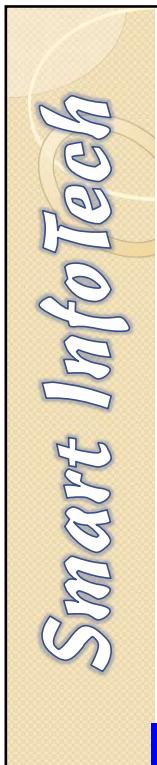
- Minor mistake on email address may deliver the email wrong address
- No guarantee that message will be same as the sender has sent.

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

Facts

- First email system: MAILBOX
- First person to send email: Raymond Tomlinson
- Today email system: Store and Forward
- First domain: Symbolics.com
- Hotmail was founded by Sabeer Bhatia and Jack Smith
- Hotmail turned to outlook in 2012

Some Important Terms

- **World Wide Web (WWW)**
  - Allows end users to access data stored on the computer in networks through web address or URL (Uniform Resource Locator).

Some Important Terms

- **Website**
  - ◦ Collection of information stored in internet in different files is known as website.

Some Important Terms

- **Web Page**
  - ◦ Single page of a website that contains information in specific topic or subject is called a webpage.
- **URL (Uniform Resource Locator)**
  - ◦ Naming convention for addressing documents accessible over the internet
  - ◦ address of a given unique resource on the Web
  - ◦ URL is a form of URI (Uniform Resource Identifier)

Some Important Terms

- **Home Page**
  - The first page of each website
  - Contains the brief introduction of website.
- **Download**
  - The process of transferring file from remote computer to user's computer
- **Upload**
  - The process of transferring file from user's computer to remote computer (server)
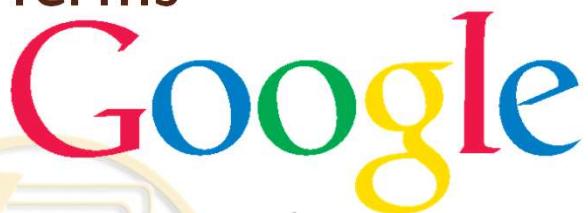
Some Important Terms

- **CC and BCC**
  - CC: Carbon Copy
  - BCC: Blind Carbon Copy
  - Ways of sending copies of an email to additional people
  - CC list is visible to all other recipients
  - BCC list is secret—no one can see this list except the sender

Some Important Terms

Smart InfoTech

- **Search Engine**
  - A website which allows users to search information about any subject based on the keyword
  - E.g. Google, Bing, Yahoo etc

Some Important Terms

Smart InfoTech

- **Browser**
  - A software that allows user to view the content on the internet or world wide web
  - Software required for browsing or surfing websites.
  - E.g. Internet Explorer, Mozilla Firefox, Opera, Safari, Google Chrome, Netscape Navigator

Some Important Terms

- **Hypertext**
  - The text or link that jumps to another page
- **ISP (Internet Service Provider)**
  - An organization that provides the internet service to different users
  - Eg. Mercantile, World Link, Web Surfer, Vianet

Some Important Terms

Intranet	Extranet
Private computer network serving a single organization	Private network extended to users outside the company
Little or no access to outside users	Branches of organization, customer, vendors can have access
No need internet	Needs Internet
Used in to get employee information, telephone directory	To check status, access data, send mail, place order etc

58
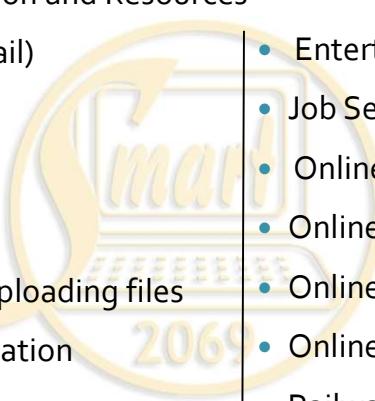
Internet Related Organizations

- Organizations are working for the development of the internet, new technology, devices, protocols and standards.
  - W3C: World Wide Web Consortium
  - IETF: Internet Engineering Task Force
  - IRTF: Internet Research Task Force
  - ISOC: Internet Society
  - IAB: Internet Architecture Board
  - ISO: International Standard Organization
  - IEEE: Institute of Electrical and Electronic Engineers

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

Uses/Advantages of Internet

- Sharing of Information and Resources
- Electronic Mail (Email)
- World Wide Web
- Newsgroups
- E-commerce
- Downloading and Uploading files
- Business Communication
- Advertisement
- Discussion and Chat

- Entertainment
- Job Search
- Online Education / E-learning
- Online Results
- Online Medical Advice
- Online Airlines and
- Railway Schedules

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

कम्प्युटर अपरेटर तयारी कक्षा, स्मार्ट इन्फोटेक, कीर्तिपुर , काठमाडौं

Uses/Advantages of Internet

- Sharing of Information and Resources
- Electronic Mail (Email)
- World Wide Web
- Newsgroups
- E-commerce
- Downloading and Uploading files
- Business Communication
- Advertisement
- Discussion and Chat

- Entertainment
- Job Search
- Online Education / E-learning
- Online Results
- Online Medical Advice
- Online Airlines and
- Railway Schedules

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

Disadvantages of Internet

- Viruses
- Security Problems
- Immorality
- Filtration of Information
- Accuracy
- Time consuming
- Language Problem
- Privacy Leakage

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

60

Logical Ports

- Also known as software or network port
- Location where information is sent.
- A number assigned to a "logical" connection
- The endpoint to a logical connection that describes a service in TCP/IP and UDP
- Port numbers range from 0 to 65535
- Ports numbers 0 to 1023 are designated as well-known ports

Logical Ports

- Well-Known Ports (0-1023)

- Registered Ports (1024 - 49,151)

- Dynamic / Private Ports (49,152 - 65,535)

Well-known port numbers

- *20 & 21*: File Transfer Protocol (FTP)
- *23*: Telnet remote login service
- *25*: Simple Mail Transfer Protocol (SMTP)
- *53*: Domain Name System (DNS) service
- *80*: Hypertext Transfer Protocol (HTTP)
- *110*: Post Office Protocol (POP3)
- *143*: Internet Message Access Protocol (IMAP)
- *443*: HTTP Secure (HTTPS)
- *465*: SMTP Secure (SMTPS)

Cloud Services

- Cloud services refers to a wide range of services delivered on demand to companies and customers over the internet
- Cloud services are infrastructure, platforms, or software that are hosted by third-party providers and made available to users through the internet.
- Designed to provide easy, affordable access to applications and resources, without the need for internal infrastructure or hardware.

Smart InfoTech

Types of Cloud Services (based on services)

Infrastructure as a service (IaaS)
- Provides infrastructure - actual servers, network, virtualization

Platform as a service (PaaS)
- Provides hardware and an application-software platform used by developers to build cloud apps

Software as a service (SaaS)
- Applications are hosted by a vendor or service provider and made available to customers over a network.
- Used by end users

Smart InfoTech

Types of Cloud Services (based on deployment)

Private Cloud
- Owned by single company
- Dedicated infrastructure not shared by any other individual/organization
- Expensive
- Suitable for larger business

## Types of Cloud Services (based on deployment)
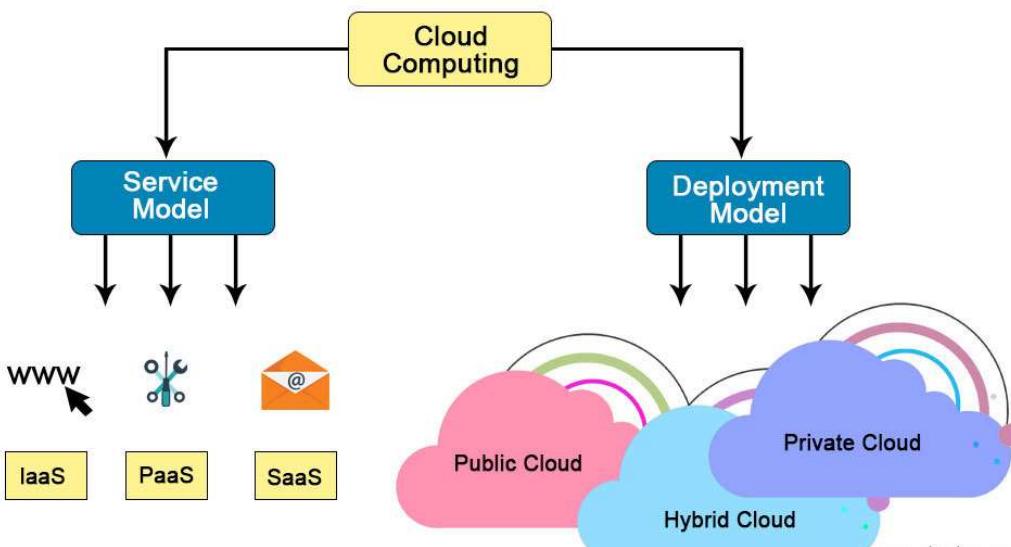
Public Cloud
- Owned by an outsourced cloud provider and is accessible to many businesses through the internet on a pay-per-use model.
- Provides services and infrastructure to businesses who want to save money on IT operational costs
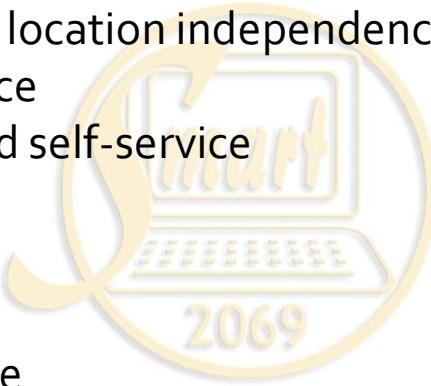
Hybrid Cloud
- Have combined benefits of both Public and Private Cloud

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

Types of Cloud Services

कम्प्युटर अपरेटर तयारी कक्षा , स्मार्ट इन्फोटेक, सम्पर्कः ९८४१६४९९९३, ९८४३५२१६४०

कम्प्युटर अपरेटर तयारी कक्षा, स्मार्ट इन्फोटेक, कीर्तिपुर , काठमाडौं
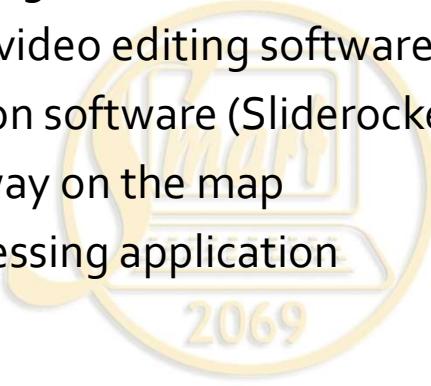
Benefits of cloud services

- Cost reductions
- Device and location independence
- Maintenance
- On-demand self-service
- Security
- Reliability
- Speed
- Global Scale

Smart InfoTech

Application of cloud services

- Online storage
- Photo and video editing software
- Presentation software (Sliderocket)
- Finding a way on the map
- Word processing application

Smart InfoTech

Example of cloud services

- Dropbox: online storage
- Google Cloud
  - Online storage-> Google drive, google photos
  - Online application-> gmail, google docs, google sheets, google slides
- icloud
  - Cloud storage and cloud computing services by Apple Inc.
  - Can be managed & accessed photos, videos, documents, notes, contacts, and more
- One drive: Online storage by Microsoft

Smart InfoTech