Computer Fundamentals

Session 2

Number System

- **Binary Number System**
- Base 2. Digits used : 0, 1
- **Octal Number System**
- Base 8. Digits used : 0 to 7
- **Hexa Decimal Number System**
- Base 16. Digits used: 0 to 9,
- Letters used : A- F

- Convert 21 to binary ,octal and hex
- Convert $(25)_8$ to decimal

21_{10} = Binary Number : 10101_{2}

Octal Number	Decimal Number
25_8	$((2 \times 8^1) + (5 \times 8^0))_{10}$
25_8	$(16 + 5)_{10}$
25_8	21_{10}

Data

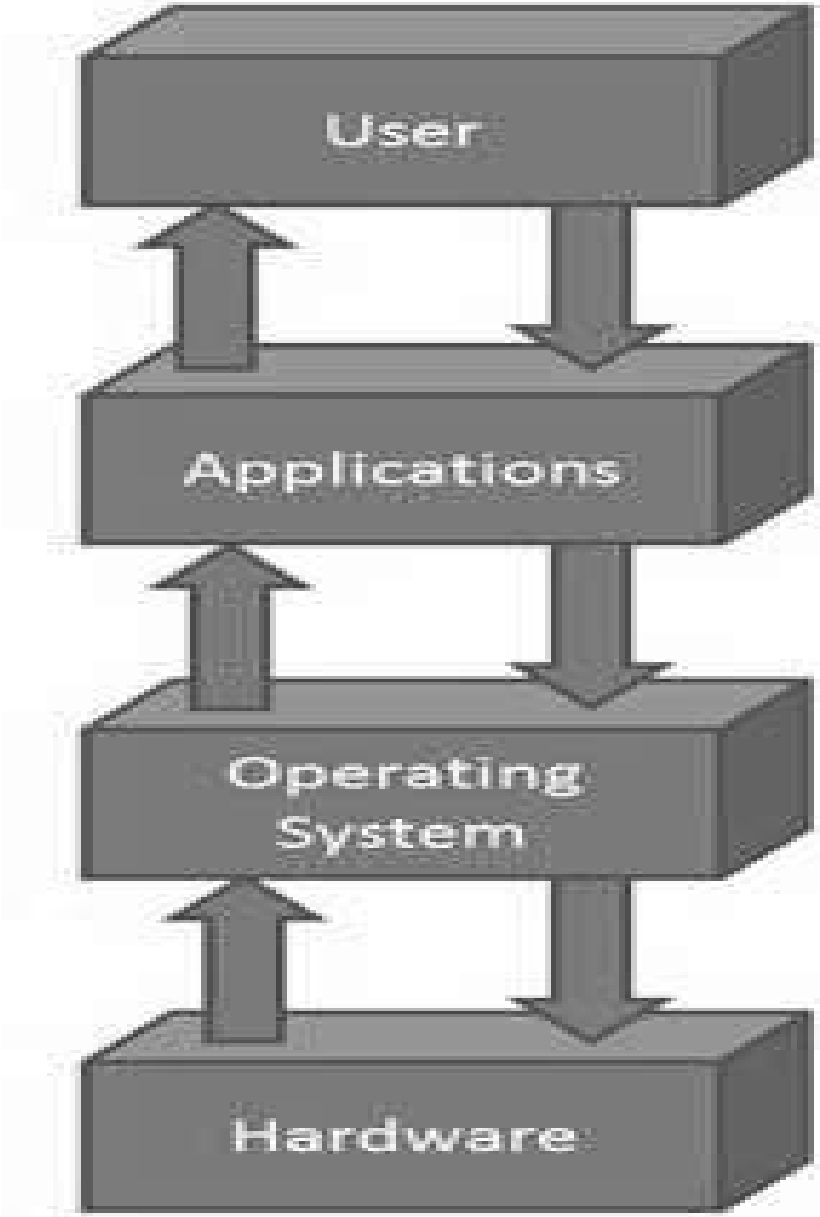
- Data can be defined as a **representation of facts, concepts, or instructions in a formalized manner, which should be suitable for communication, interpretation, or processing by human or electronic machine**

Information

- Information is organized or classified data, which has some meaningful values for the receiver.
- Information is the processed data on which decisions and actions are based.
- For the decision to be meaningful, the processed data must qualify for the following characteristics:
- **Timely - Information should be available when required.**
- **Accuracy - Information should be accurate.**
- **Completeness - Information should be complete.**

Operating System

- The Operating System is a program with the following features:
- An operating system is a program that acts as an **interface between the software and the computer hardware.**
- It is an integrated set of **specialized programs used to manage overall resources and operations of the computer.**
- It is a specialized software that **controls and monitors the execution of all other programs that reside in the computer, including application programs and other system software.**


User
Applications
Operating System
Hardware

Objectives of Operating System

 To make the computer system convenient to use in an efficient manner.

 To hide the details of the hardware resources from the users.

 To provide users a convenient interface to use the computer system.

- To act as an intermediary between the hardware and its users, making it easier for
- the users to access and use other resources.
- To manage the resources of a computer system.
- To keep track of who is using which resource, granting resource requests, and
- mediating conflicting requests from different programs and users.
- To provide efficient and fair sharing of resources among users and programs.

Characteristics of Operating System

- **Memory Management** - Keeps track of the primary memory, i.e. what part of it is in use by whom, what part is not in use, etc. and allocates the memory when a
- process or program requests it.
- **Processor Management** - Allocates the processor (CPU) to a process and deallocates the processor when it is no longer required.
- **Device Management** - Keeps track of all the devices. This is also called I/O controller that decides which process gets the device, when, and for how much
- time.
- **File Management** - Allocates and de-allocates the resources and decides who gets the resources.

Characteristics of Operating System

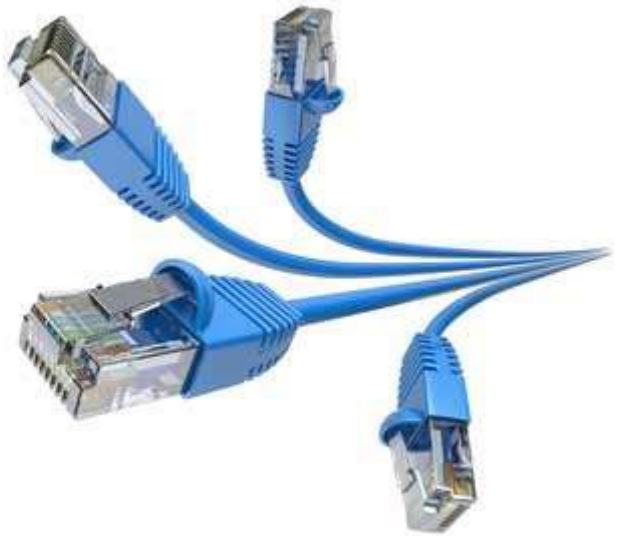
- **Security** - Prevents unauthorized access to programs and data by means of
- passwords and other similar techniques.
- **Job Accounting** - Keeps track of time and resources used by various jobs and/or users.
- **Control Over System Performance** - Records delays between the request for a service and from the system.
- **Interaction with the Operators** - Interaction may take place via the console of the computer in the form of instructions. The Operating System acknowledges the same, does the corresponding action, and informs the operation by a display screen.
- **Error-detecting Aids** - Production of dumps, traces, error messages, and other debugging and error-detecting methods.
- **Coordination Between Other Software and Users** - Coordination and
- assignment of compilers, interpreters, assemblers, and other software to the
- various users of the computer systems.

Computer Network

- A computer network is a system in which multiple computers are connected to each other to share information and resources.

Network Cables

- Network cables are used to connect computers. The most commonly used cable is
- Category 5 cable RJ-45.



Router

- A **router** is a type of device which acts as the central point among computers and other

devices that are a part of the network. It is equipped with holes called ports.

- Computers and other devices are connected to a router using network cables.
- Router comes in wireless modes using which computers can be con out any physical cable.

Network Card

- **Network card** is a necessary component of a computer without which a computer cannot
- be connected over a network. It is also known as the network adapter or Network Interface
- **Card (NIC).** Most branded computers have network card pre-installed.
- Network cards are of two types: Internal and External Network Cards.

Internal Network Cards

- Motherboard has a slot for internal network card where it is to be inserted. Internal
- network cards are of two types in which the first type uses Peripheral Component
- Interconnect (PCI) connection, while the second type uses Industry Standard Architecture(ISA).
- Network cables are required to provide network access.

External Network Cards

- External network cards are of two types: Wireless and USB based. Wireless network card
- needs to be inserted into the motherboard, however no network cable is required to
- connect to the network.

Universal Serial Bus (USB)

- USB card is easy to use and connects via USB port.
- Computers automatically detect USB

card and can install the drivers required to support the USB network card automatically

Internet

- It is a worldwide/global system of interconnected computer networks. It uses the standard
- Internet Protocol (TCP/IP). Every computer in Internet is identified by a unique IP address.
- IP Address is a unique set of numbers (such as 110.22.33.114) which identifies a computer’s location.
- A special computer DNS (Domain Name Server) is used to provide a name to the IP Address so that the user can locate a computer by a name.
- For example, a DNS server

will resolve a name http://www.amrita.edu to a particular IP address to uniquely identify the computer on which this website is hosted.

Intranet

- Intranet is the system in which multiple PCs are connected to each other. PCs in intranet
- are not available to the world outside the intranet. Usually each organization has its own
- Intranet network and members/employees of that organization can access the computers
  in their intranet.

Computer Networks

- Computer network connects two or more autonomous computers.

- The computers can be geographically located anywhere.

LAN, MAN & WAN

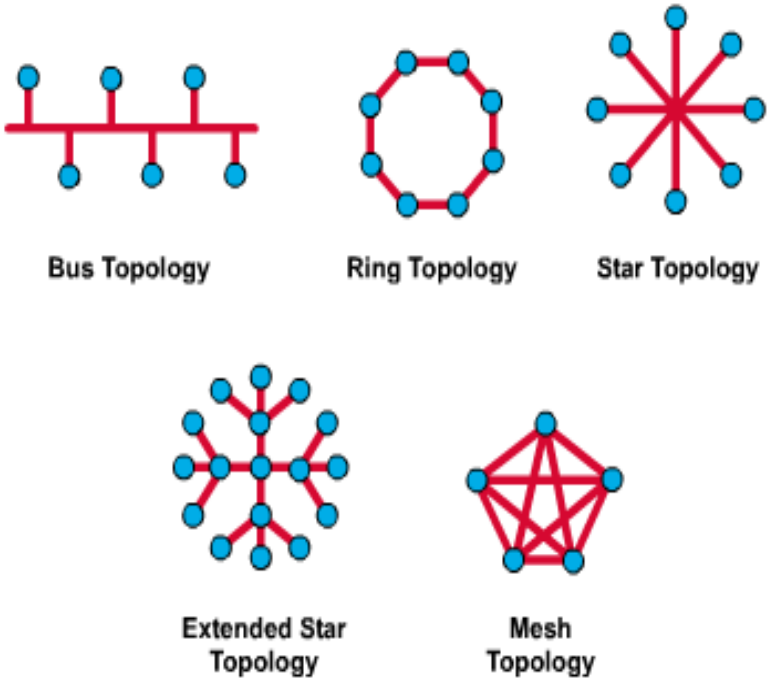
- Network in small geographical Area (Room, Building or a Campus) is called LAN (Local Area Network)
- Network in a City is call MAN (Metropolitan Area Network)
- Network spread geographically (Country or across Globe) is called WAN (Wide Area Network)

Applications of Networks

- **Resource Sharing**
  - Hardware (computing resources, disks, printers)
  - Software (application software)
- **Information Sharing**
  - Easy accessibility from anywhere (files, databases)
  - Search Capability (WWW)
- **Communication**
  - Email
  - Message broadcast
- **Remote computing**
- **Distributed processing (GRID Computing)**

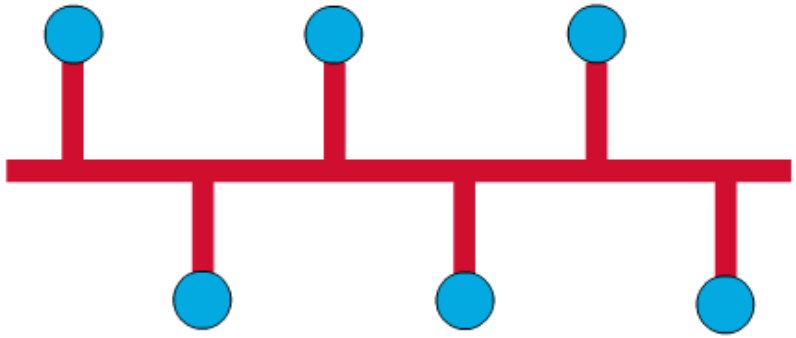
Network Topology

- The network topology defines the way in which computers, printers, and other devices are connected. A network topology describes the layout of the wire and devices as well as the paths used by data transmissions.



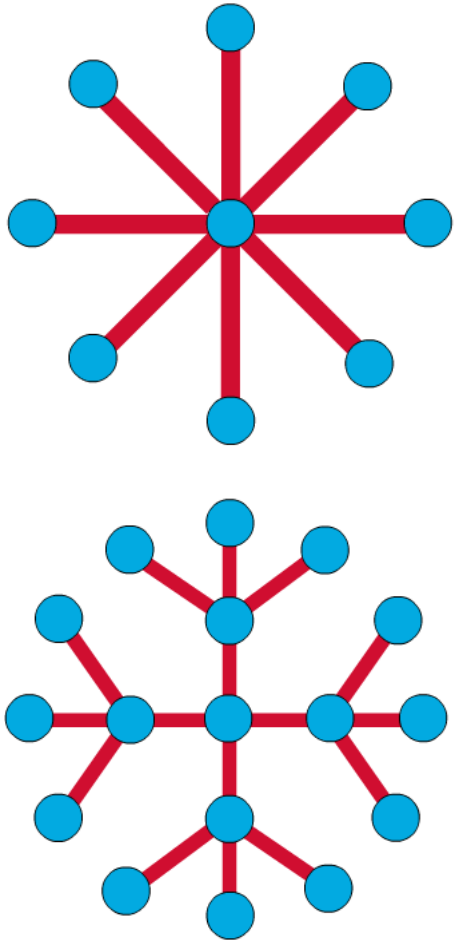
Bus Topology

- Commonly referred to as a linear bus, all the devices on a bus topology are connected by one single cable.



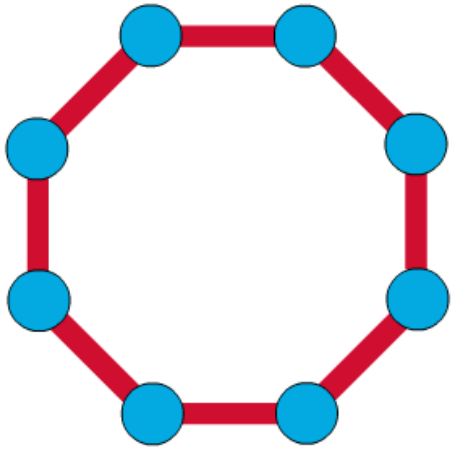
Star & Tree Topology

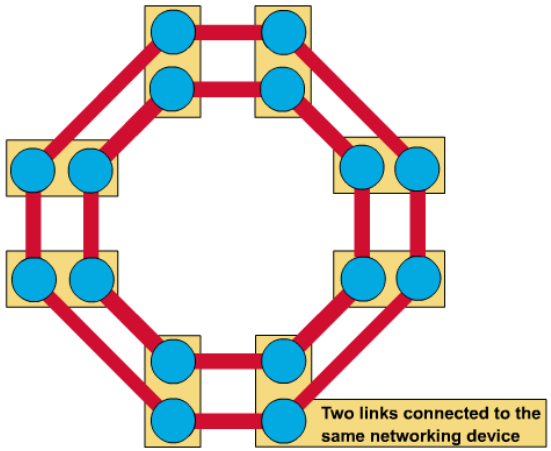
- The star topology is the most commonly used architecture in Ethernet LANs.
- When installed, the star topology resembles spokes in a bicycle wheel.
- Larger networks use the extended star topology also called tree topology. When used with network devices that filter frames or packets, like bridges, switches, and routers, this topology significantly reduces the traffic on the wires by sending packets only to the wires of the destination host.



Ring Topology

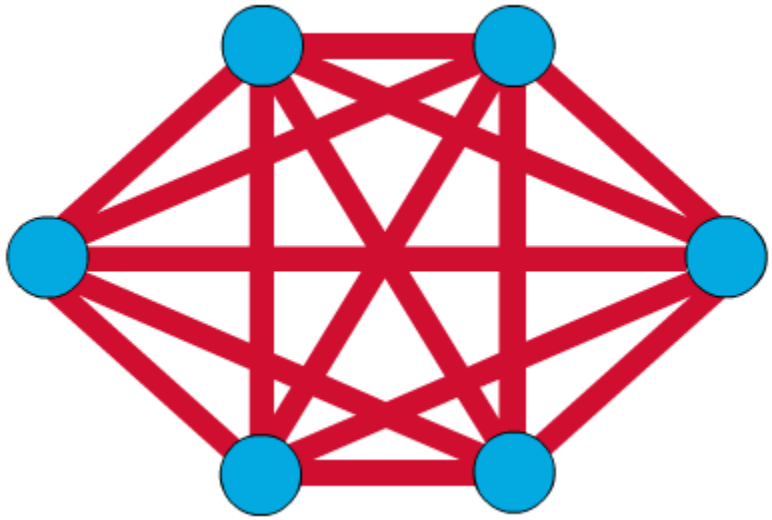
- **A frame travels around the ring, stopping at each node. If a node wants to transmit data, it adds the data as well as the destination address to the frame.**
- **The frame then continues around the ring until it finds the destination node, which takes the data out of the frame.**
  - Single ring – All the devices on the network share a single cable
  - Dual ring – The dual ring topology allows data to be sent in both directions.





Mesh Topology

- The mesh topology connects all devices (nodes) to each other for redundancy and fault tolerance.
- It is used in WANs to interconnect LANs and for mission critical networks like those used by banks and financial institutions.
- Implementing the

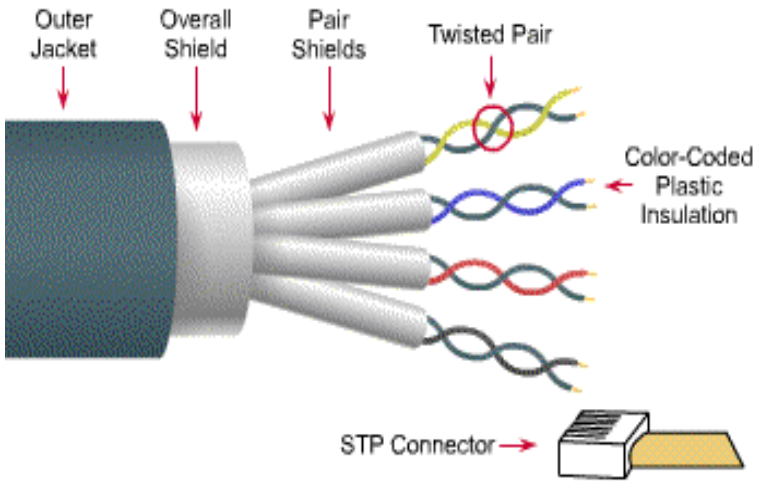


Network Components

- Physical Media
- Interconnecting Devices
- Computers
- Networking Software
- Applications

Networking Media

- **Networking media can be defined simply as the means by which signals (data) are sent from one computer to another (either by cable or wireless means).**



- Speed and throughput: 10-100 Mbps
- Cost per node: Moderately expensive
- Media and connector size: Medium to Large
- Maximum cable length: 100m (short)

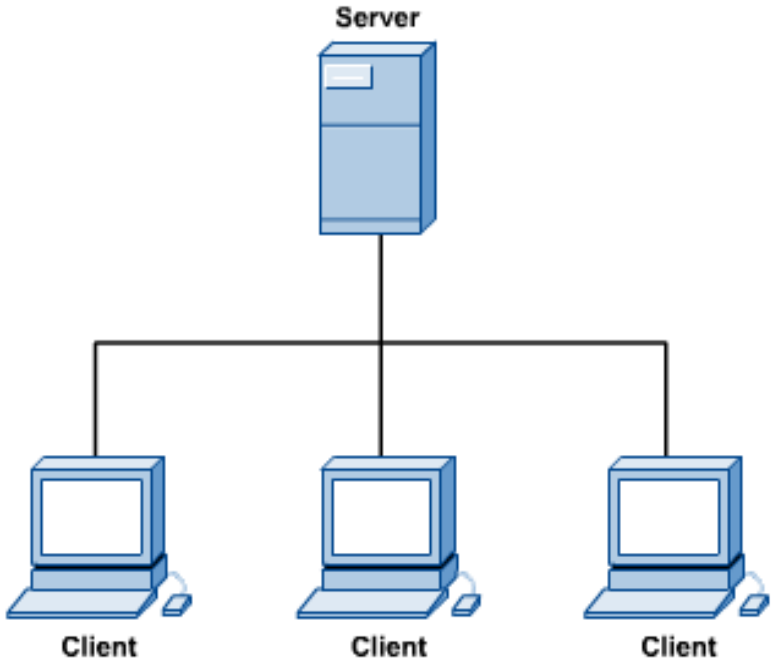
Networking Devices

- HUB, Switches, Routers, Wireless Access Points, Modems etc.

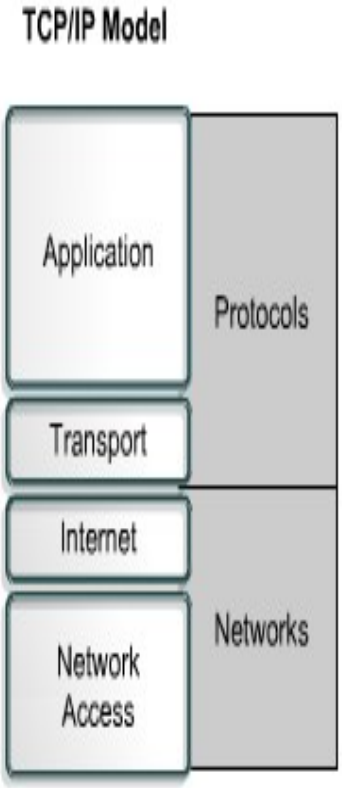
Computers: Clients and Servers

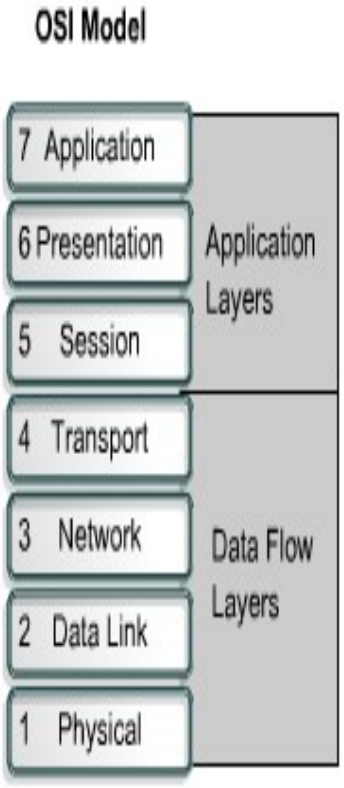
- In a client/server network arrangement, network services are located in a dedicated computer whose only function is to respond to the requests of clients.

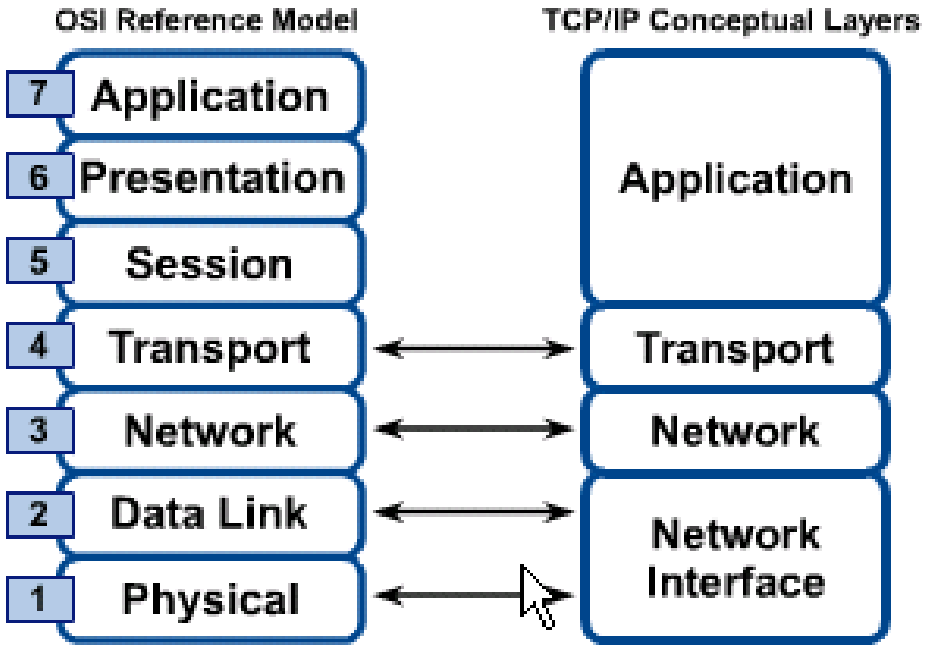
- The server contains the file, print, application, security, and other services in a central computer that is continuously



OSI & TCP/IP Models







TCP/IP Model

Application Layer
Application programs using the network

Transport Layer (TCP/UDP)
Management of end-to-end message transmission, error detection and error correction

Network Layer (IP)
Handling of datagrams : routing and congestion

Data Link Layer
Management of cost effective and reliable data delivery, access to physical networks

Physical Layer
Physical Media

Networking Protocol: TCP/IP