NEW HORIZON COLLEGE

SUBJECT: DATA COMMUNICATION AND NETWORK

SEMESTER: V SEMESTER

COURSE: BCA

SUBJECT TEACHER: Dr.K.Chitra

Assistant Professor,

Department of Computer Science

Chapter - 2

Switching and Network Architecture

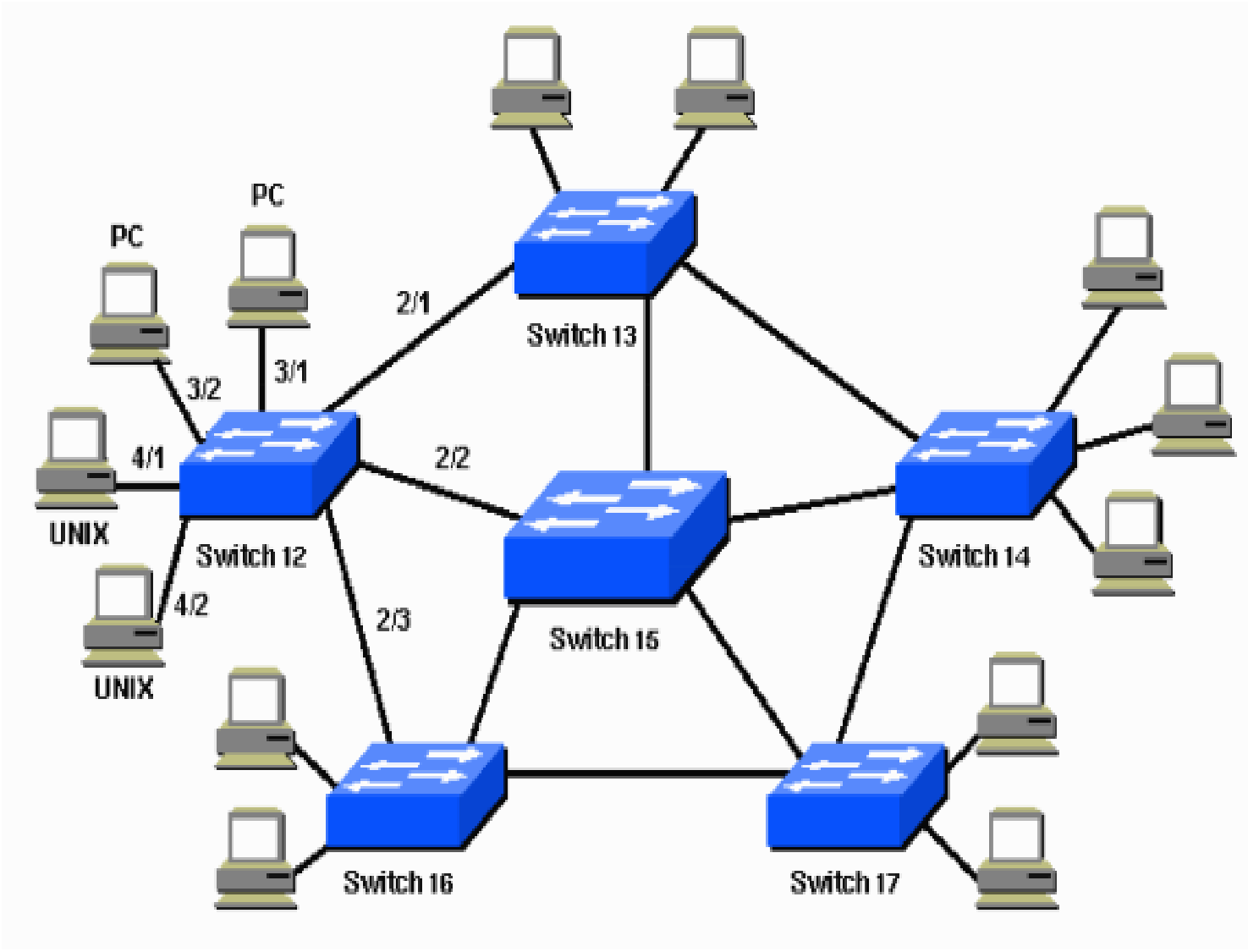
Network switch

- A network switch is a computer networking device that connects devices together on a computer network by using various switching techniques.

Switch with 5 ports

Switched network

- A switched network consists of several devices interlinked by a series of nodes called switches.


PC
PC
2/1
Switch 13
3/2
3/1
4/1
2/2
UNIX
Switch 12
Switch 14
4/2
2/3
Switch 15
UNIX
Switch 16
Switch 17

TYPES OF SWITCHING

- Circuit switching
- Packet switching
- Message switching

Circuit switching

- In circuit switching, a dedicated physical connection is established between source and destination and then data is transmitted.
- Three phases

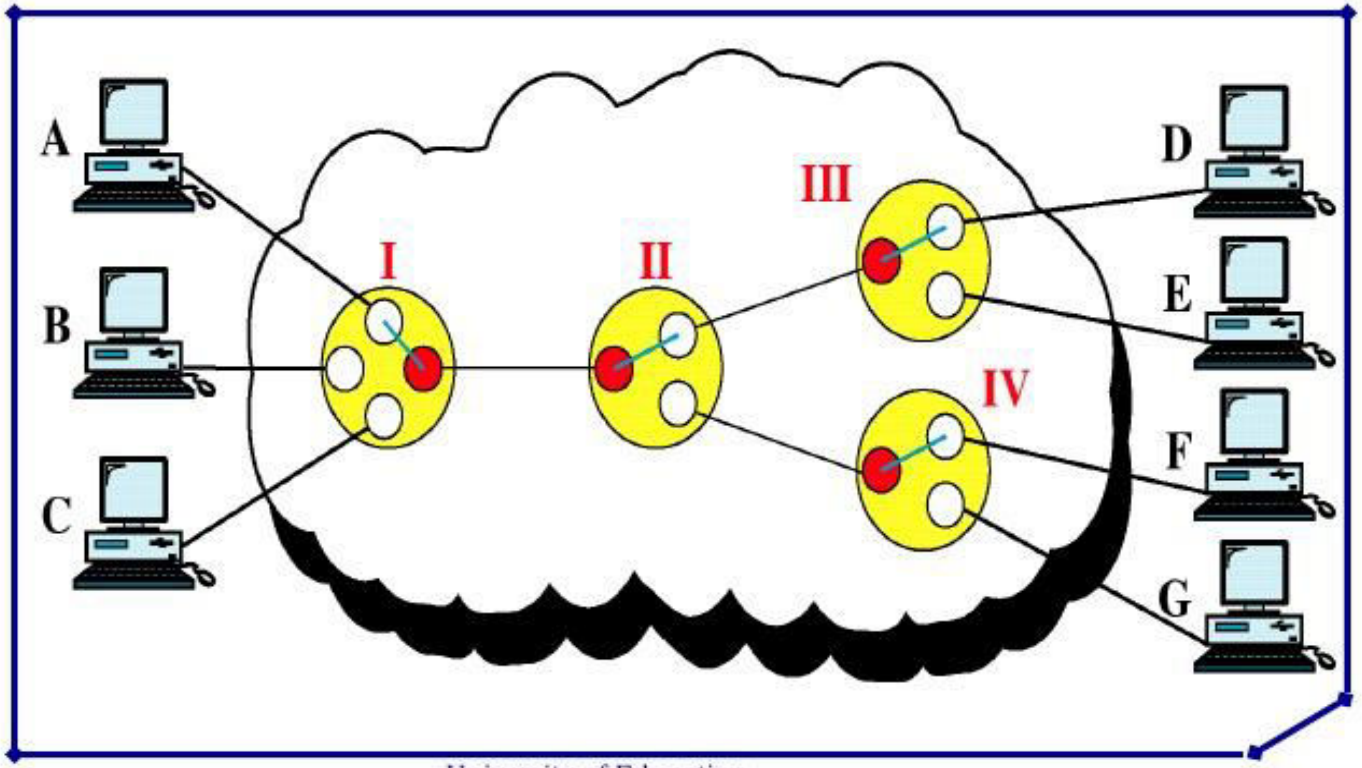
  (i) Circuit establishment

  (ii) Data transfer

  (iii) Circuit Disconnect

Example : Telephone

Circuit Switched Networks



Advantages

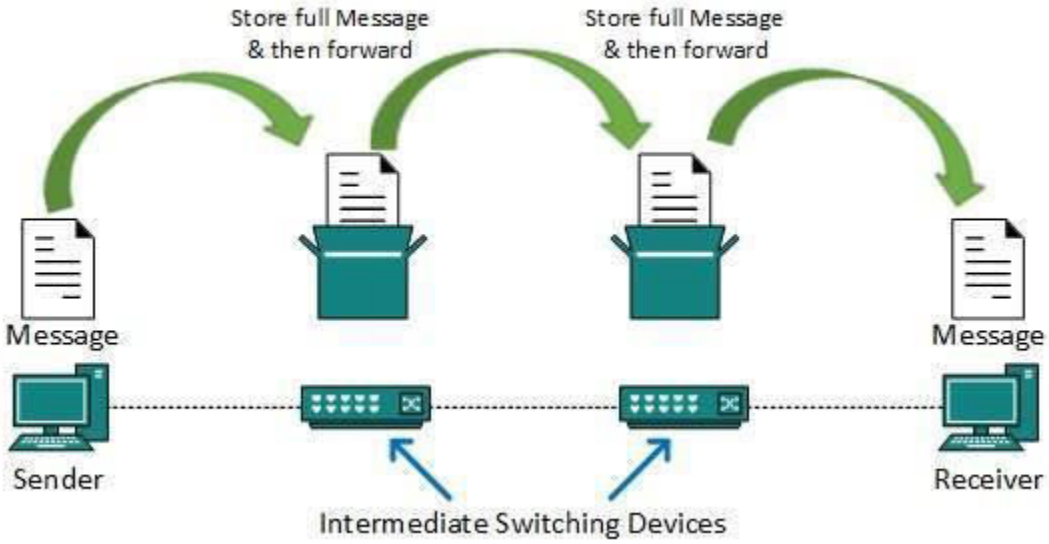
- Data is transmitted without delays
- This method is suitable for long continuous transmission.

Disadvantages

- Long connection establishment delay
- Network does not support error control
- More expensive
- Inefficient use of the communication channel when the connected systems are not using it.

Message switching

- Message switching uses store-and-forward method in which a block of data is forwarded from one node to another node.
- No dedicated physical path is established between sender and receiver.
- When a sender has a block of data to be sent ,it is stored in first switching node (router) and forwarded to another switching network.
- E-x Telegraph


Store full Message
& then forward
Store full Message
& then forward
Message
Message
Sender
Receiver
Intermediate Switching Devices

Advantages

- Data channels are shared among communication devices, improving the use of bandwidth.
- Inexpensive technique

Disadvantages

- Switches must have large storage capacities to store long messages.
- Transmission delay is there.
- Message switching does not support voice or video.

Packet switching

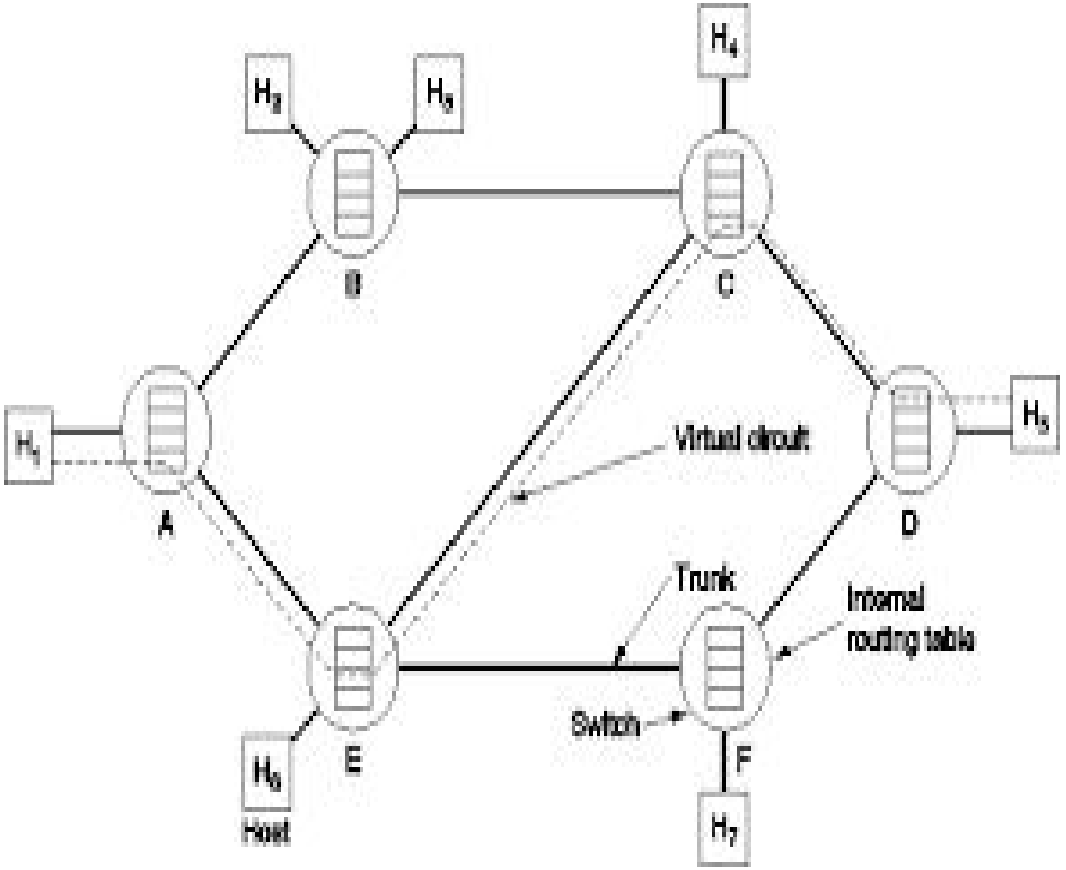
- It does not require dedicated links like circuit switching.
- It does not require large amount of buffer to store the message.
- The message is divided into small units called packets.
- The packets are sent from source to destination.

- Each packet contains data, header with control information like source and destination address, packet number, priortity codes.
- Each packet will take different routes to reach its destination.
- Two types of switching networks- datagram and virtual circuit.
- Example - internet

Difference between datagram and virtual circuit

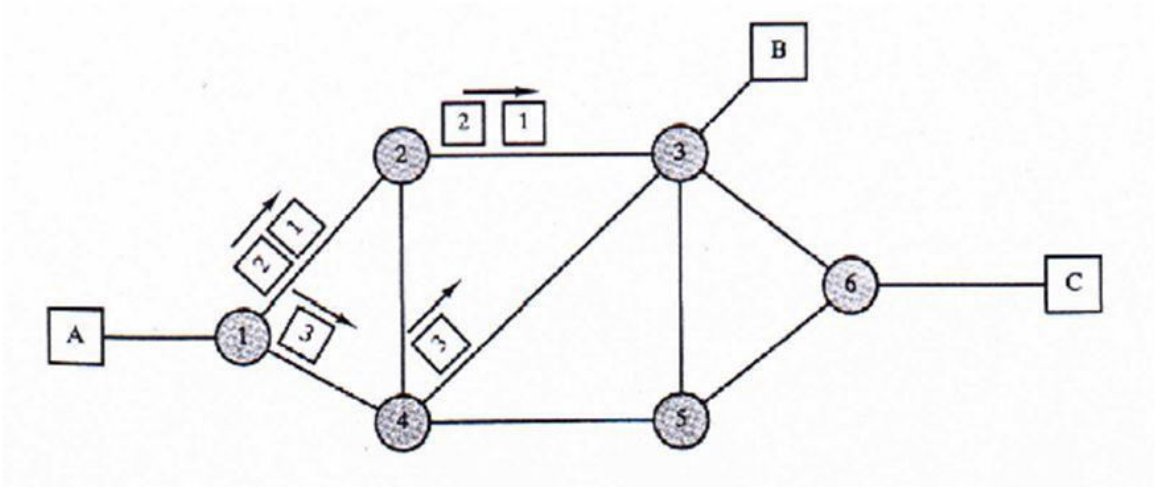
Virtual circuit	Datagram
Preplanned route is established	Routing decision made dynamically
Connection oriented service	Connectionless service
Call setup is required	No call setup is required
Router table is needed to store about the connections	Routers do not hold state information about connections
It is more reliable	It is not reliable

Virtual circuit



Datagram packet switching

Datagram Mode



Advantages of packet switching

- As switching devices do not require massive secondary storage, costs are minimized to great extent.
- Packets are rerouted in case of any problems
- With improved protocols, packet switching is widely used for video and voice calls using applications such as WhatsApp, Skype, Google Talk etc.

Disadvantages

- Protocols used in the packet switching are complex and require high initial implementation costs.
- If the network becomes overloaded, packets are delayed or discarded or dropped.
- It is not secured if security protocols (e.g. IPsec) are not used during packet transmission.

Difference between message, packet, circuit switching

Criteria	Circuit switching	Message switching	Packet switching
Dedicated copper cable	Yes	No	NO
Bandwidth	Fixed	Dynamic	Dynamic
Store and forward	no	yes	yes
Fault Tolerance	Less	medium	more
Transmission	Data streams	message	Packets
Advance circuit setup	yes	no	no

Comparison with Circuit Switching - Event Timing

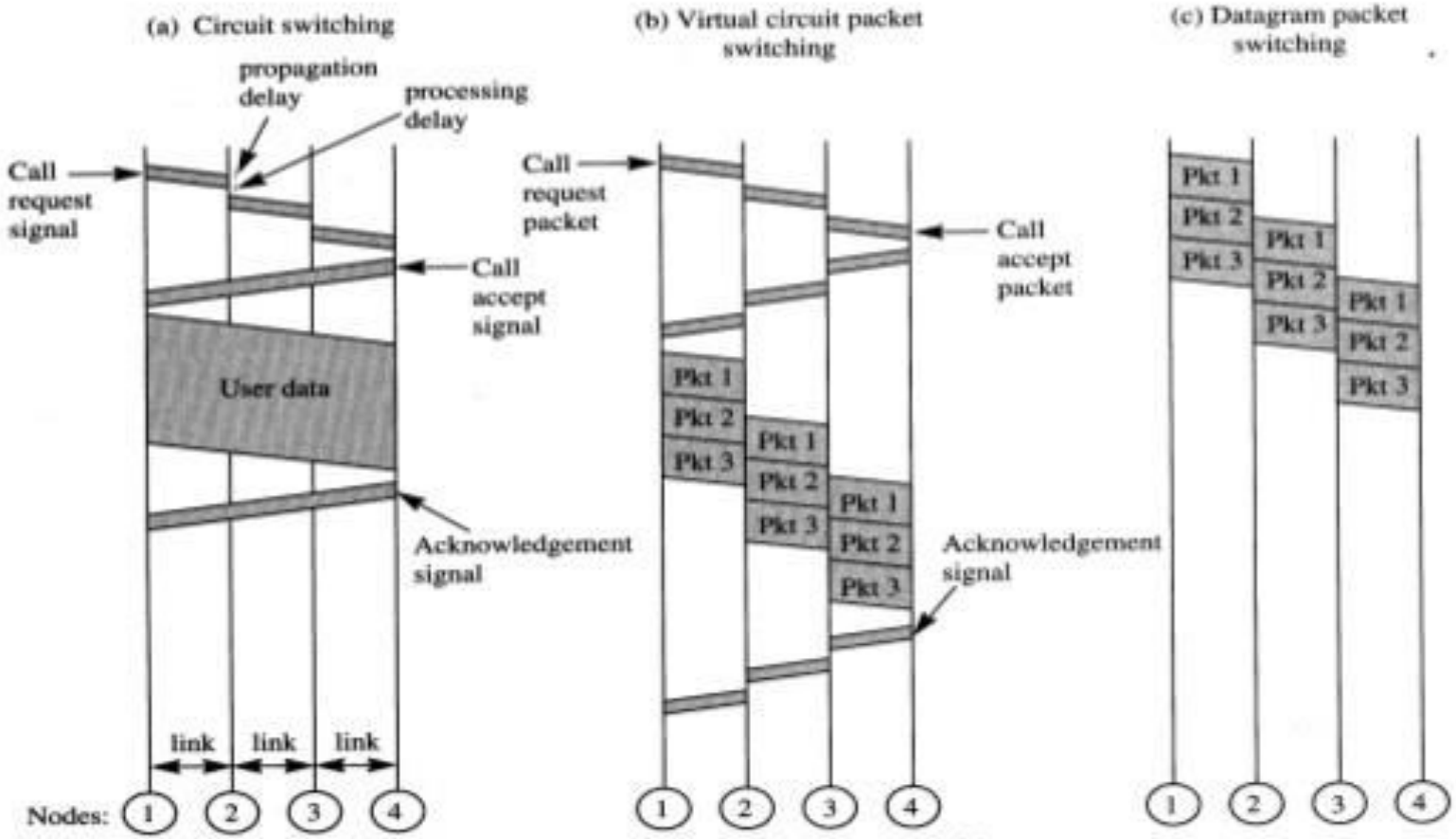


FIGURE 8.3. Event timing for circuit switching and packet switching.

INTERNET,COMPUTER NETWORK,PACKET SWITCHING

The types of network that the internet operates on are

(i) Terminal oriented networks

(ii) Computer to computer networks

(iii) Local Area Networks

(iv) Internetworks

Essential elements of modern network architecture

- High-speed digital transmission lines
- Routing table
- End-to-end congestion control mechanism
- Flow control methods
- Internetworking
- Segmentation and reassembly
- End-to-end recovery mechanism

Key factors in communication network evolution

- Technology
- Regulation
- Market
- Standards

Layered architecture and its applications – Chapter 3

Design issues

1.Overall communication problem is divided into set of layers

2.It uses the protocols.

3.It implements the error control mechanism

4.Flow control is important between fast sender and slow receiver.

5. Segmentation and re-assembly is important to transfer the long messages.

6.Multiplexing allows many communicating processes to use the same communication line.

7.Routing chooses a route from source to destination.

Layered models

- ISO-OSI reference model

  Indian Standard Organization and Open system Interconnection

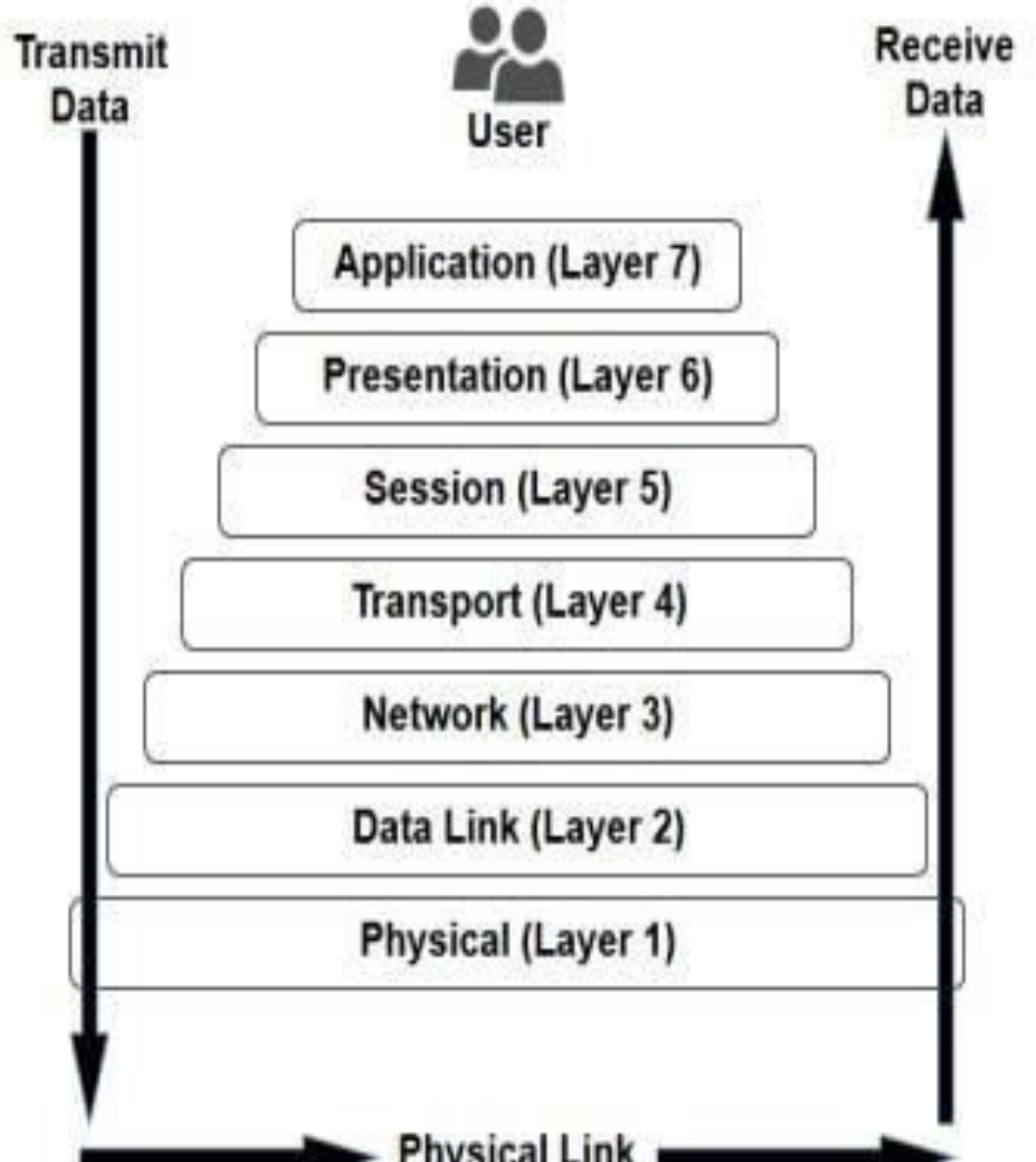
- TCP/IP reference model

  Transmission control Protocol/Internet protocol

OSI REFERENCE MODEL

- The Open System Interconnection (**OSI**) **model** defines a **networking** framework to implement protocols in seven **layers.**
- OSI model is a layered framework that allows communication between different types of computer systems.
- The communication functions are divided into seven layers

The 7 Layers of OSI



OSI Model Layer 1: The Physical Layer

- Physical Layer is the lowest layer of the OSI Model.
- It activates, maintains and deactivates the physical connection.
- It is responsible for transmission of bit stream over network.
- Voltages and data rates needed for transmission is defined in the physical layer.
- It converts the digital/analog bits into electro magnetic signals .

OSI Model Layer 2
The Data link Layer

- It is the responsible for delivering data units from sender to receiver without any errors.
- Input data is broken into frames.
- Frames are transmitted sequentially and the acknowledgement frames sent back by the receiver are processed.
- Special bits are added to the beginning and end of the frames.

Functions of data link layer

- Node-to-Node Delivery
- Flow control mechanism
- Error-control mechanism
- synchronization

OSI Model Layer 3
The Network Layer

- It divides the outgoing messages into packets
- Network Layer is the responsible for delivery of packets across the networks.
- It decides by which route packet should take.
- It acts as a network controller. It manages the Subnet traffic.

The functions of Network layer

- Data delivery
- Switching
- Routing
- Congestion control

Transport layer

- End-to-end message delivery
- Flow control
- Error detection and recovery
- Segmentation and reassembly

Session Layer

- Session management:

  It allows the users to different machines to establish the sessions between them.

- Dialog control

  Sessions allow the traffic in both the directions or either in one direction.

- Token management
- Synchronization
- Graceful close

Ensuring that the exchange has been completed appropriately before the session closed.

Presentation layer

- It is concerned with the syntax and semantics of the information transmitted.
- Different computers have different codes for representing character strings, integers.
- The functions of this layer

Translation

Compression

Encryption

Application layer

- It provides user interfaces and support for services such as email, remote file access and transfer, shared dbms.
- The responsibilities are

Network virtual terminal- software computer

File access ,transfer and management

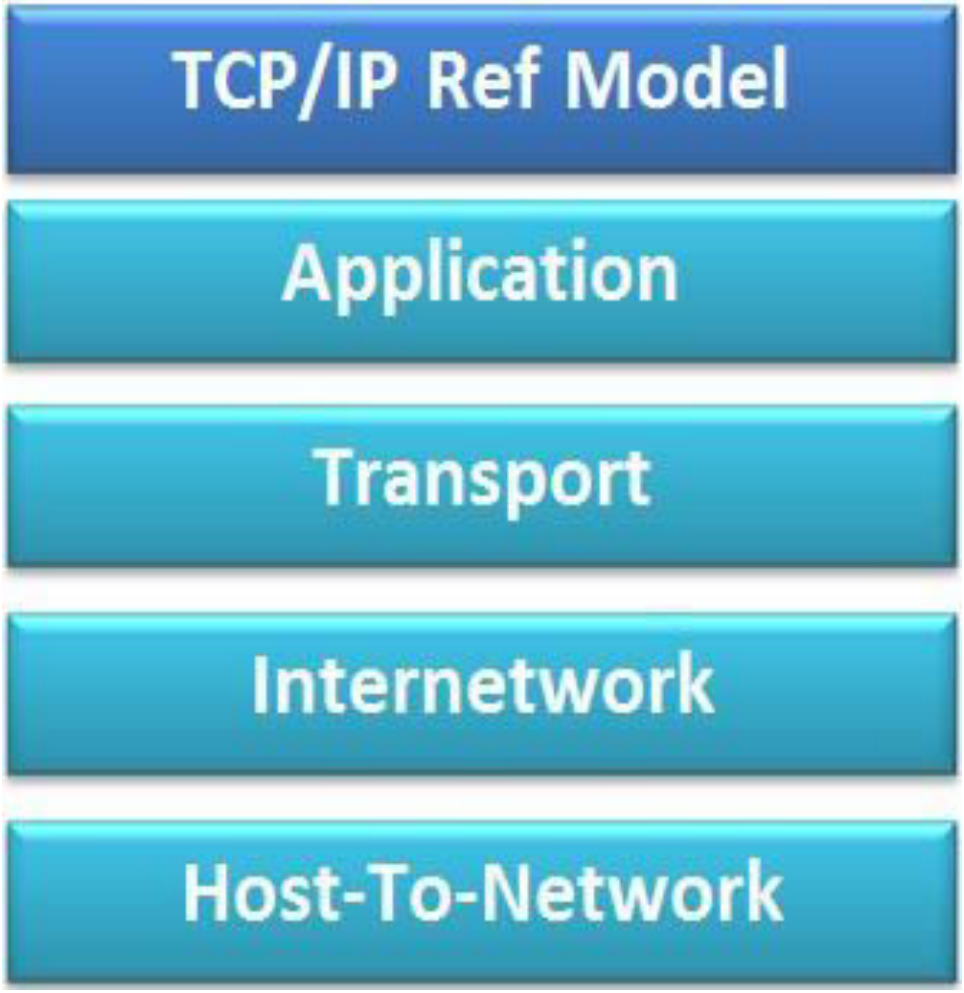
Mail services

Directory services

Distributed databases.

TCP/IP REFERENCE MODEL

- Tcp/ip architecture was developed by ARPANET(Advanced Research Project Agency NETwork).
- TCP/IP is a communication protocol for communication between heterogeneous computers.
- Various protocols are implemented at the different layers.


TCP/IP Ref Model
Application
Transport
Internetwork
Host-To-Network

Application Layer

- This Application layer is the highest layer of the TCP/IP model.
- Numerous protocols are implemented at the application layer.

Protocol	Function
FTP - File Transfer Protocol	Transmission of files between computers
SMTP – Simple Mail Transfer Protocol	Transmission of e-mails
HTTP – Hyper Text Transfer Protocol	Communication between web server and web browser
SNMP – Simple Network Management Protocol	Administration of computer networks
DHCP - Dynamic Host Configuration Protocol	Allocation of Dynamic IP addresses to computer
DNS – Domain Name Service	DNS servers are responsible for translating domain names into tcp/ip address

Transport layer

- It has the responsibility to exchange the data between computers without any errors.
- The transport layer uses two protocols

  TCP and UDP

TCP

- It is reliable connection –oriented protocol
- A connection must be established
- TCP divides a stream of data into smaller units called segments at sending end.
- TCP reassembles the segments at receiving end.

UDP(User Datagram Protocol)

- It is unreliable connectionless transport protocol).
- This service provides no mechanisms for error recovery and flow control.
- Segments are carried across the internet

Internet layer

- This layer deals with access to and routing data across a network between end systems.
- Internet protocol is used in this layer for routing across multiple networks.
- It is unreliable and connectionless protocol.

PROTOCOL	FUNCTIONS
Address Resolution Protocol (ARP)	To find physical address of a computer
Reverse Address Resolution Protocol (RARP)	Discover its internet address from its physical address
Internet Control Message Protocol(ICMP)	Send query and error messages
Internet Group Message Protocol(IGMP)	Used to send group messages.

Network Access Protocol

- This layer is concerned with specifying transmission medium and data rate.
- The following protocols are available in this layer.

  SLIP (Serial Line Internet Protocol)

  PPP (Point-to-point Protocol)

SLIP (Serial Line Internet Protocol)

- A very simple protocol that provides only basic framing for Internet

Point-to-Point protocol (PPP)

- A complex protocol that provides framing as well as many additional features.

TCP/IP REFERENCE MODEL

Application layer **(FTP,SMTP,HTTP,SNMP,DHCP,DNS)**
TRANSPORT LAYER **(TCP , UDP)**
INTERNET LAYER **(ARP,RARP,ICMP,IGMP)**
NETWORK – ACCESS LAYER **(SLIP,PPP)**