Chapter - 2

Communication Task Layer

(i) Content layer (Where, What)

(ii) Rules layer (Process)

(iii) Physical Layer (Outcome)

#Benefits

(i) To find out the fault easily

(ii) Changes in 1 layer don't effect other layers.

(iii) Have defined information; that they act upon

De facto

Standards that have not been approved by an organized body but have been adopted as standards through widespread use

De Jure

Standards that have been legislated by an officially recognized body

All People Seem To Need Data Processing

Standard Organization

ISO, IEEE, ANSI, TIA, IETF, ITU-T

OSI Model

Consist of 7 level

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

	Layers	CISCO
7.	Application	All
6.	Presentation	People
5.	Session	Seen
4.	Transport	To
3.	Network	Need
2.	Data Link	Data
1.	Physical	Processing

Communication between Application

Moving raw data cross the network

Application Layer

(i) Used by network Applications

(ii) Network Applications means that use internet → Chrome, firefox, web browser

(iii) Responsible for providing service to the user

(iv) Application Protocols → http, dns, smtp, ftp, pop, dhcp

(v) Provides services for network applications with the help of protocols to platform user activities

Presentation Layer

(i) Receives data from Application Layer

(ii) These data stays in the form of ~~data~~ connectors and numbers. Presentation layer convert these to machine understandable binary format

Ex : ASCII → EBCDIC } Translation.

(iii) Before data is ~~tha~~ transmitted this layer reduce number of bits } Compression of data

Reduce amount of space to use the original file

(iv) Encryption of data

Session Layer

(i) Helps setting up and managing connections.

(ii) Responsible for dialog control and synchronization

(iii) Handle the exchange of information
→ to initiate dialogs
→ keep them active, and
→ to restart sessions that are disrupted or idle for a long period of time

(iv) Checkpoints are created

Transport Layer

(i) Is responsible for the delivery of a message from one ~~person~~ process to another.

(ii) Functions
→ Segmentation and Reassembly
→ Adds port address and sequence number
→ Connection Control
→ Flow and Error Control
→ Multiplexing

PDU → Protocol Data Unit

(iii) Transport layer PDU is called Segments

(iv) Common Protocol used here → TCP

(v) Segments data received from Application layer into small parts.

segmentation → a. Segments into small parts

b. Add number to identify the Application

c. Add a number sequence the segmented parts.

Port number and sequence number

→ a. Port numbers helps to direct each segments to the correct Application

b. Sequence number helps to reassemble segments in the correct order to form correct message to the receiver.

~~Connection Control~~

Flow and Error Control

→ a. To maintain the flow while trasferring data

b. To find out the error (Automatic Repeat Request)

Connection Control

→

Services	Protocols
Connection-oriented Transmission	Transmission Control Protocol (TCP)
Connectionless Transmission	User datagram Protocol

Q. UDP → TCP

1. Faster	Slower relatively
2. Provide No feedback	Provide feedback

So lost data can be ~~been~~ re transmitted

3. Ex → Songs, Movies (online Streaming)

Ex → WWW., Email, FTP

4. Used where doesn't matter if we received all data

Every data matters.

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Packet → [Segment] + [IP1 . IP2]

Network Layer

(i) Transport layer passes data segments to Network Layer.

(ii) Network layer functions

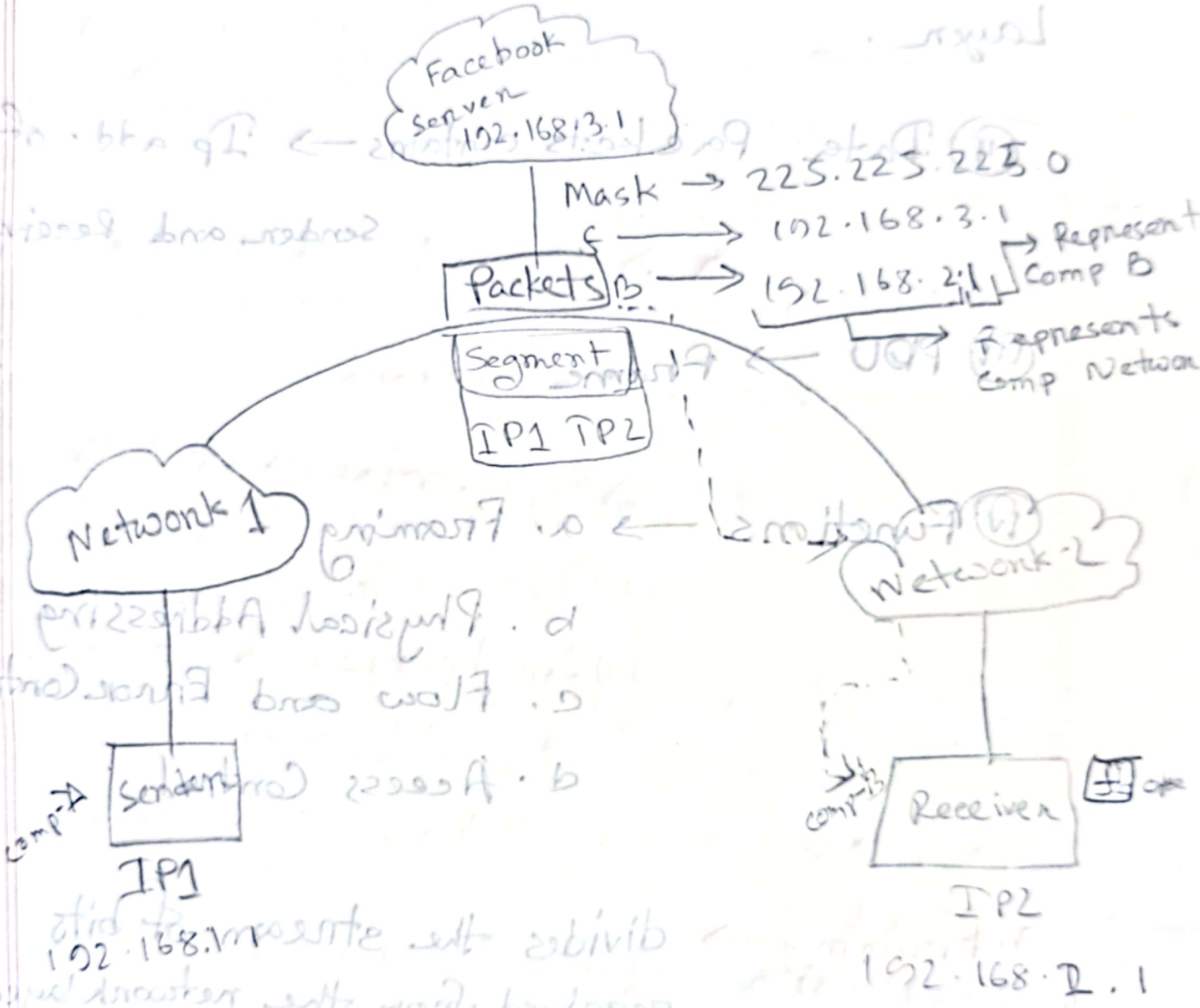
a. Logical Addressing → Ip address
IPv4 & IPv6

b. Path Determination → Choosing the best possible path for data delivery

c. Routing → Moving data package from source to destiny
IPv4 & IPv6
+
Mask

(III) Network layer OP' PDU → Packet

(IV) Packets → [Segment] + [IP1, IP2]



Data Link Layer

(i) Receives Data Packets from Network Layer.

(ii) Data Packets contains → IP add. of Sender and Receiver

(iii) PDU → Frame

(iv) Functions → a. Framing
b. Physical Addressing
c. Flow and Error Control
d. Access Control

a. Framing → divides the stream of bits received from the network layer into managable data units called frames.

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b. Physical Addressing

~~If frames are to~~

MAC address → Consist of 48 bits long, 12 hexadecimal digits.

#Physical Layer

Physical layer is responsible for movement of individual bits from one hop (node) to the next.

Functions → (i) Physical characteristics of interfaces and medium

(ii) Representation of bits

(iii) Data rate

(iv) Synchronization of bits

Physical Layer → Bus, Ring etc.

Transmission Modes → Simplex, half duplex, Full duplex

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Summary

* Application

To allow access to network resources

* Presentation

To translate, encrypt, and compress data

* Session

To establish, manage, and terminate session.

* Transport

To provide reliable process-to-process message delivery and error recovery.

* Network

To move packets from source to destination; to provide internetworking.

* Data Link

To organize bits into frames; to provide hop-to-hop delivery.

* Physical

To transmit bits over a medium; to provide mechanical and electrical specification.

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Application $\xleftrightarrow{\text{Data}}$ Application

Presentation $\xleftrightarrow{\text{Data}}$ Presentation

Session $\xleftrightarrow{\text{Data}}$ Session

Transport $\xleftrightarrow{\text{Segments}}$ Transport

Network $\xleftrightarrow{\text{Packets}}$ Network

Data Link $\xleftrightarrow{\text{Frames}}$ Data Link

Physical $\xleftrightarrow{\text{Bits}}$ Physical

De Facto Standard TCP/IP

OSI		TCP
Application Presentation Session	→	Application
Transport	→	Transport
Network	→	Internet
Datalink Physical	→	Network Access

Basics of IP Addressing

* IP : Internet Protocol

* Every node in the computer network is identified with the help of IP addresses.

IPV4

* logical Address → Since we can change ip address.

① Can change based on the location of the device.

② Assigned by manually or dynamically.

* Represented in decimal and has 4 octets (x.x.x.x)

* 0.0.0.0 to 255.255.255.255 (32 bits).

MAC Address

MAC = Media Access Control

* Every node in the LAN is identified with the help of MAC Address.

IP address = Location of a person

MAC " = Name of the person

IP	MAC
Changable	Not Changable
Routen friendly Address	Switch friendly Add.

* Physical or Hardware Add.
* Unique.
* Cannot be changed.
* Represented in Hexa-decimal
* Ex → 70-20-89-00-ED-F5

(48 bits)

* Separator → (-), (.), (:)
* Designed by manufacturer

IP	MAC
(i) Needed for Communication	(i) Needed for Communication
(ii) 32 bits	(ii) 48 bits
(iii) Represented in Decimal	(iii) Hexadecimal
(iv) Router needs IP Addresses to forward data	(iv) Switch needs MAC Add. to ~~forward~~ forward data
(v) Ex 10.10.23.56	(vi) Ex 70-20-84-00-ED-FC

Port Addressing

Lets Understand How this works with a delivery analogy.

Reaching our city = Reaching our network (IP)

Reaching our apartment = Reaching the host (MAC)

Reaching the right person = Reaching the right process (port)

* In a node, many process will be running. Data which are sent/received must reach the right process. Every process in a node is uniquely identified using port numbers.

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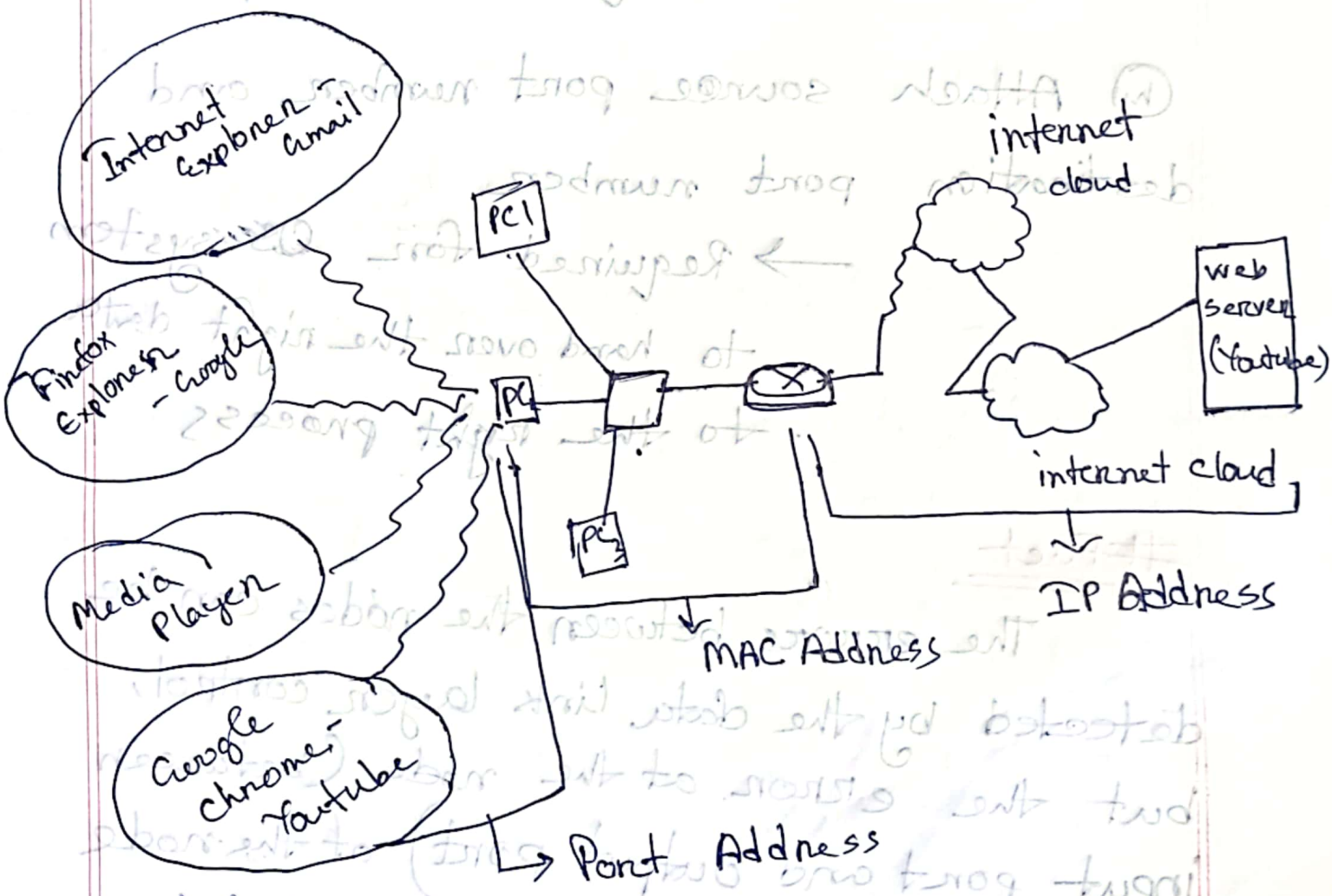
* Port = Communication End point

* Fixed port numbers and dynamic port numbers.

Ex → (i) Fixed Port numbers : 25, 80 etc

(ii) OS assigned dynamic port numbers : 62414



3 key points to Ponder

Before sending the data, any node must,

(i) Attach source IP address and destination IP address → Required for Router

(ii) Attach source MAC address and destination MAC address → Required for LAN/Switch

(iii) Attach source port number and destination port number

→ Required for OS system to hand over the right data to the right process

Fact

The errors between the nodes can be detected by the data link layer control, but the error at the node (between input port and output port) of the node cannot be detected by the data link layer.