Slide 1 (Chapter 1)

[1] What is Data communication? [1]

=> Data communications are the exchange of data between two devices via transmission medium.

Q:

[1]

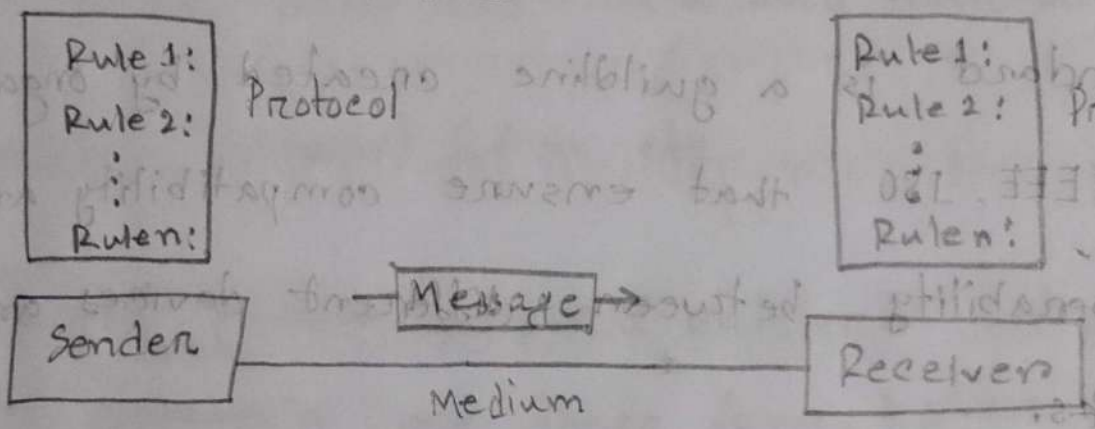

Fig: Components of Data communication

(i) Sender : Sends data to the receiver.

(ii) Receiver : Receive data from the sender

~~(iii) Message : The sendable or receivable data.~~

~~(iv) Protocol :~~

(iii) Message : The data or information to be ~~set~~ sent or received.

(iv) Protocol : Rules that how data is sent and received

(v) Transmission Medium : The physical path through which data travels

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(2) Defines Protocol and standard in computer Network [2]

A protocol is a set of rules and formats that defines how data is exchanged between devices in a network.

A standard is a guildline created by organization like IEEE, ISO that ensure compatibility and interoperability between different devices and networks.

(3) Why protocol is needed? [2]

Protocol is needed,

(i) To make sure sender and receiver understand's each other data.

(ii) To ensure error-free, secure and reliable communication.

(iii) To allow ~~def~~ different devices and system to comunicate properly.

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4. What is computer Network? Describe the Network Crieteria? [3]

Answer: A computer network is a system where two or more computers are connected together to share resources, data and information.

Example: Internet, LANs, etc.

There are several network crietecia but the main crietecia are these four, & given below:

1. Performance: The performance shows how fast and effieiently it works. It is measured by transit time and response time. A good network should provide high throughput and low delay.

2. Reliability: Reliability means the network delivers data accurately with minimal failures. A reliable network can handles unexpected problems without

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completely shutting down.

3. Security: Security ensure that the data traveling through the network is safe from unauthorized access and damage. Strong security involves proven authentication, encryption and policies for safe transmission of data.

4. Scalability: Scalability refers to how a network can expand when more devices are added. A scalable network can add more users without slowdown the network.

※ যখন Question এ থাকবে what are the three network criteria তখন শুধু performance, security and reliability লিখবেন। তবে এ সময় আমরা উপর depend করে 3-4টা লিখব।

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What do you mean by ARPANET? Describe the physical topology of computer network. [4]

Answer: ARPANET is the ancestor of today's internet, created for communications and research ~~in military~~ for U.S. defense.

There are four main physical topologies. Their are,

1. Bus Topology: All devices are connected to a single central cable (called bus). If the main cable fails, the whole network goes down.

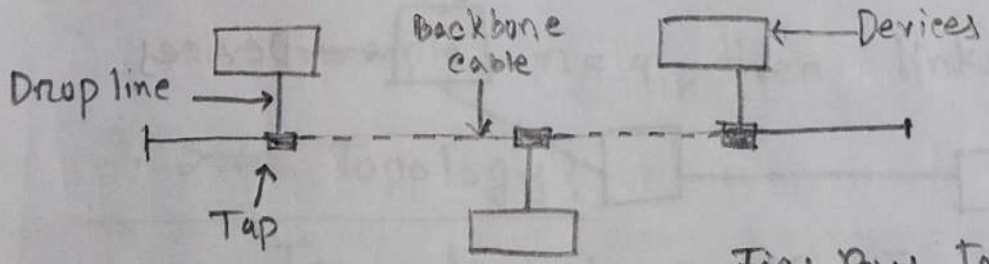

Fig: Bus Topology

2. Star Topology: All devices are connected with a central hub or switch. Easy to manage, but if the hub fails, the whole network stop.

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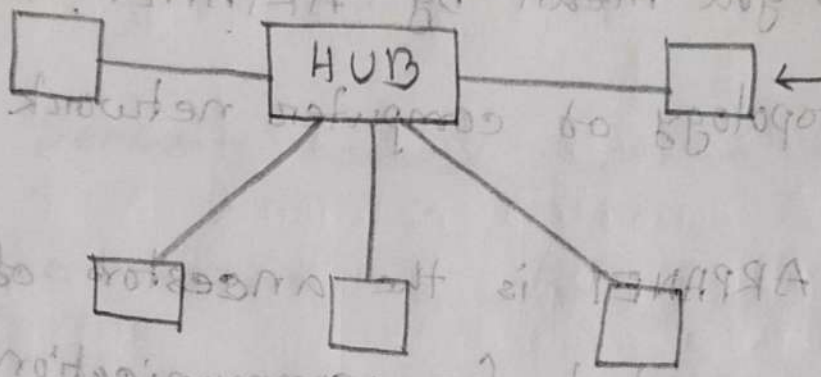

Fig: Star Topology.

3. Ring Topology: Devices are connected in circular path data moves in one direction. If one device fails the network stop down.

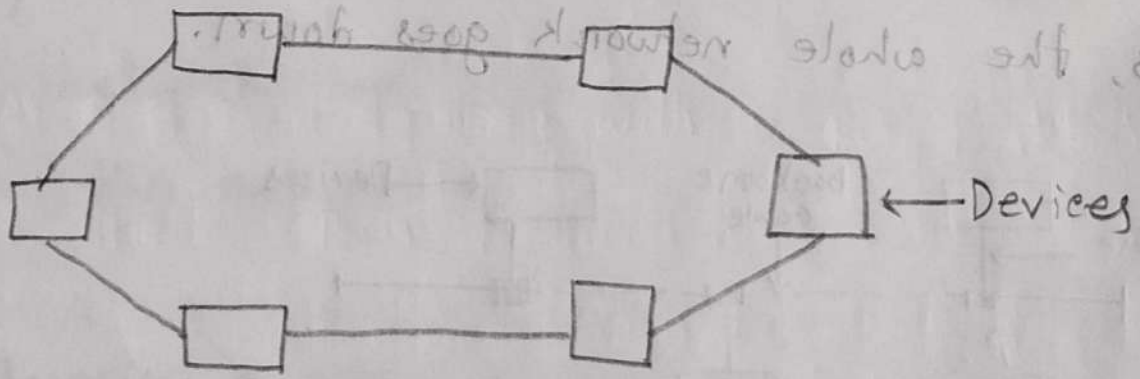

Fig: Ring Topology

4. Mesh Topology: Every device is connected to every other devices directly. Provides high reliability but very costly to install.

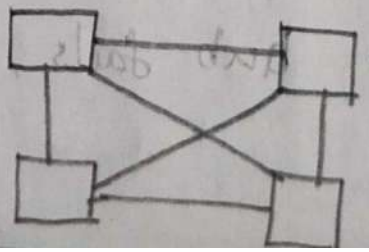

Fig: Megh Topology

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For n devices in a network, what is the number of cables links required for a mesh, ring, bus and star topology? [4]

Ans:

1. Mesh Topology:

Formula:

$$\text{Number of links} = \frac{n(n-1)}{n}$$

Example: $n = 4$, then links $= \frac{4(4-1)}{4} = 6$

2. Ring Topology:

Formula:

Number of links = n

Example: $n = 4$, then links = 4

3. Star Topology:

Formula: Number of links = n

Example: $n = 4$, then links = 4

4. Bus Topology:

Formula: Number of links = n-1

Because taps divides the backbone into n-1 segments.

Example: $n = 4$, then links = 4-1 = 3.

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[d] Draw a hybrid topology with a ring backbone and three bus network. [2]

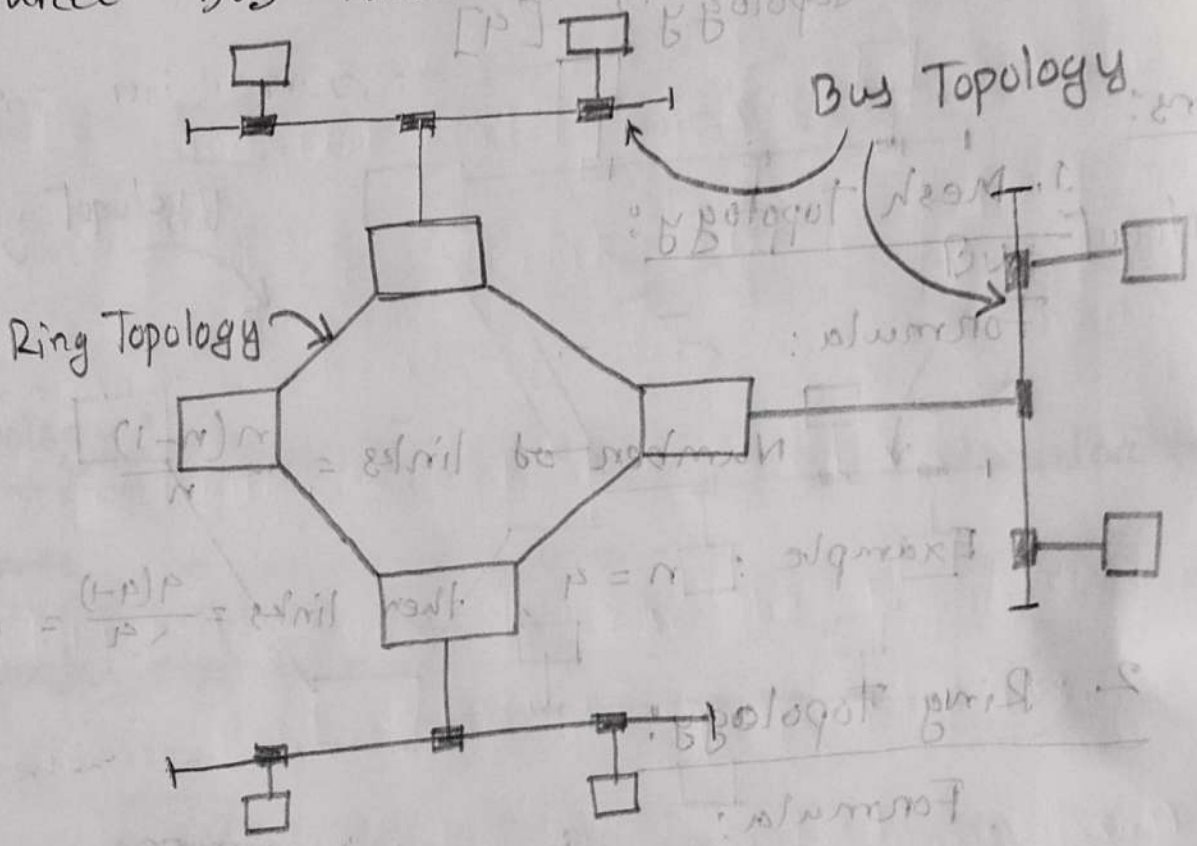

Fig: A Hybrid Topology with a Ring Backbone and Three Bus Network.

[e] What is heterogeneous network? Draw a heterogeneous network with ~~three~~ four WANs and Two LANs.

Ans: A heterogenous network is a network where different types of devices, operating System or network technologies ~~or~~ are connected together.

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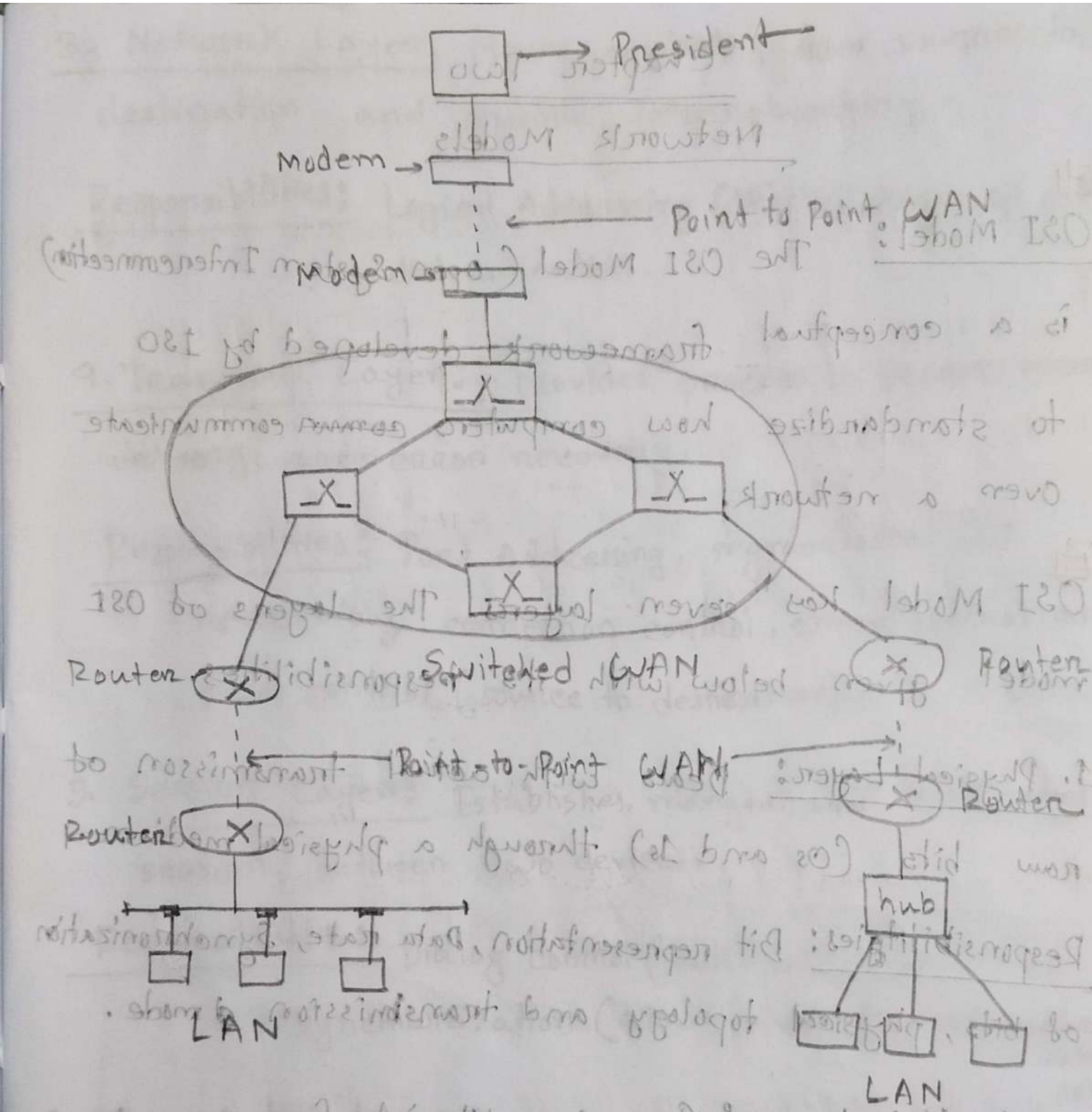

Fig: Heterogenous Network with 4 WANs and 2 LANs.

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Chapter Two

Network Models

OSI Model: The OSI Model (Open System Interconnection) is a conceptual framework developed by ISO to standardize how computers communicate over a network.

OSI Model has seven layers. The layers of OSI model given below with its responsibilities.

1. **Physical Layer:** Deals with actual transmisson of raw bits (0s and 1s) through a physical medium.

Responsibilities: Bit representation, Data rate, Synchronizati of bits, physical topology and transmission mode.

2. **Data Link Layer:** Organizes bits into frames and provide hop to hop delivery.

Responsibilities: Framing, Physical Addressing (MAC), Error detection, Access control, and Flow control (Hop-to-Hop)

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3. Network Layer: Moves packets from source to destination and provide internetworking.

Responsibilities: Logical Addressing (IP), routing and path determination.

4. Transport Layer: Provides process to process message delivery and error recovery.

Responsibilities: Port Addressing, segmentation and reassembly connection control, error control and flow control (source to destination).

5. Session Layer: Establishes, manges and terminates session between two devices.

Responsibilities: Dialog control (Full/half-duplex), synchronization (allows checkpoints or synchronization point)

6. Presentation Layer: Translates data between application and network formats.

Responsibilities: Translation, Encryption/decryption and Compression.

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7. Application Layer: Allows the access of network resources.

Responsibilities: User Interface, Protocols like HTTP, DNS

Limitations of the OSI Model:

1. Too Complex: The OSI Model is more conceptual than practical, so it is difficult to implement in real system.

2. Not a Protocol: OSI is just a refernece framework, not an actual protocol.

3. Redundancy: some activities like error control and flow control appear in more than one layer.

4. Highly Expensive: Implementation of OSI model is very expensive than other alternatives.

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[4] What are the responsibilities of the network and transport layer in the Internet model. [9]

Ans:

The Network layer and the Transport layer both are the layers of OSI model. They have some specific responsibilities. Such as,

Responsibilities of Network layer:

1. Logical Addressing → Assign IP addresses to identify deviees across networks.
2. Routing → Finds the best path for data transmission.
3. Packet Forwarding → Deliver individual packets from source host to destination host.

Responsibilities of Transport layer:

1. Port Addressing → Uses port number to deliver data.
2. Segmentation and Reassebly → Breaks data into segments at sender side and reassembly at receive side.
3. Message Forwarding → Delivers a message from process to process.

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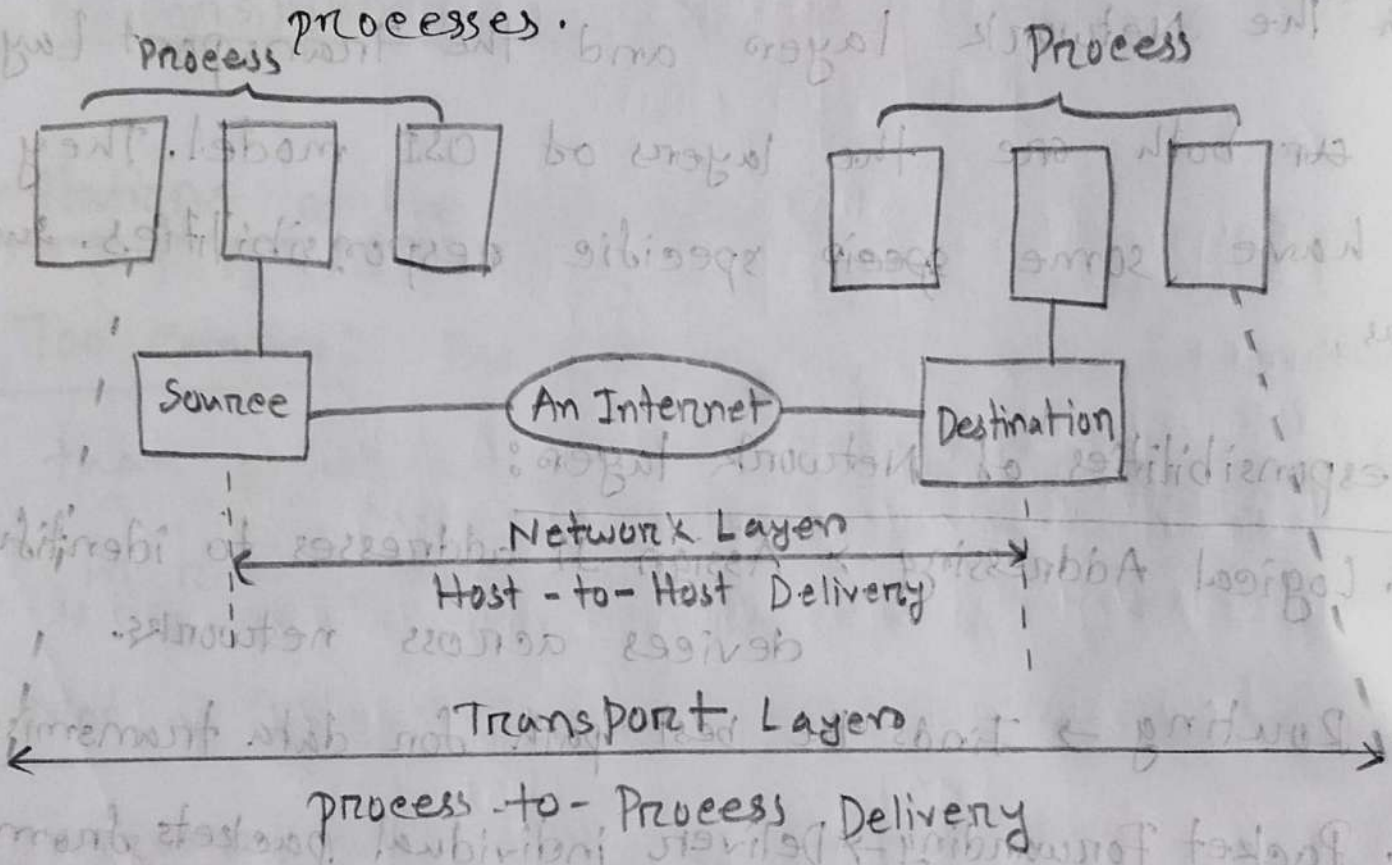
9. Flow Control & Error Control :→ Control the data flow and error from source to destination processes.



[1] What is peer - to - peer process? [2]

Ans: In networking, peer-to-peer process means each layer on one device talks to the same layer on another device as equal partners. They use protocols to exchange data through the layers, across the medium.

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If the data link layer can detect errors between hops, why do you think we need another checking mechanism at the transport layer in OSI model? [3]

Ans: The Data Link layer checks error only between two directly connected nodes, but errors may still happen on later hops.

To solve this ~~T~~ransport layer adds an another level of checking where ~~data~~ verifying the data from sender ~~and~~ to the final receiver. This end-to-end checking makes sure the delivered message ~~is same as~~ at the receiver side ~~as t~~ is as same as sender side. This makes the transmission of data accurate and reliable.

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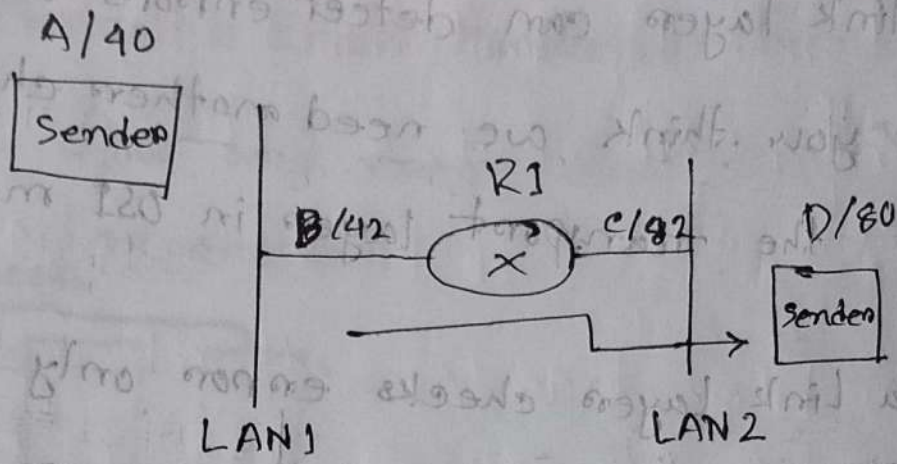
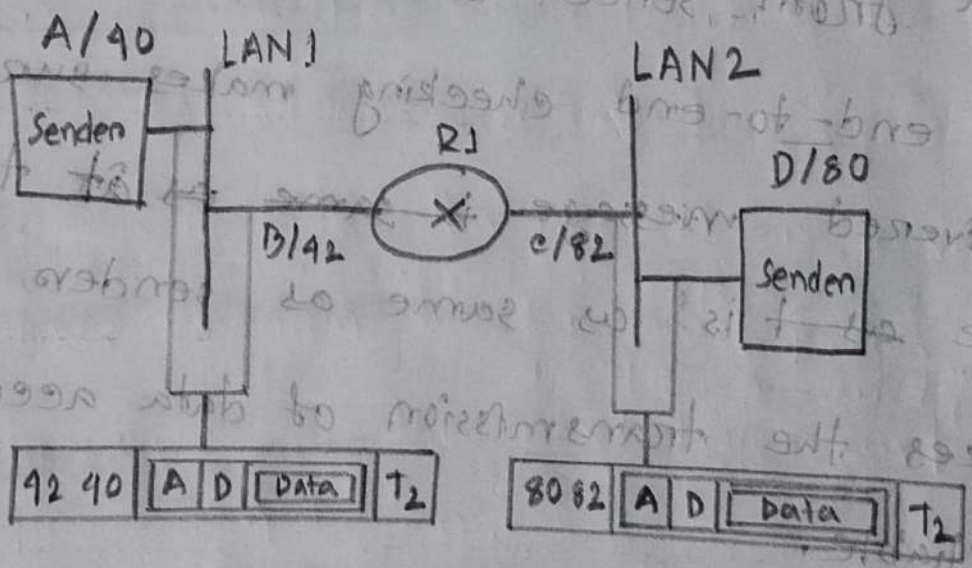


Fig: 1

In Fig: 1 Computer A sends a message to computer D via L
Router R1 and LAN2. Show the contents of the packet
and frames at the network and data link layers for
each hop interface.

Ans:



In fig: 1 assume that the communication is betw
a process running at computer A with port address m
at computer D with port address n. Show the content
of packets and frames at the network, data link an
transport layer for each hop.

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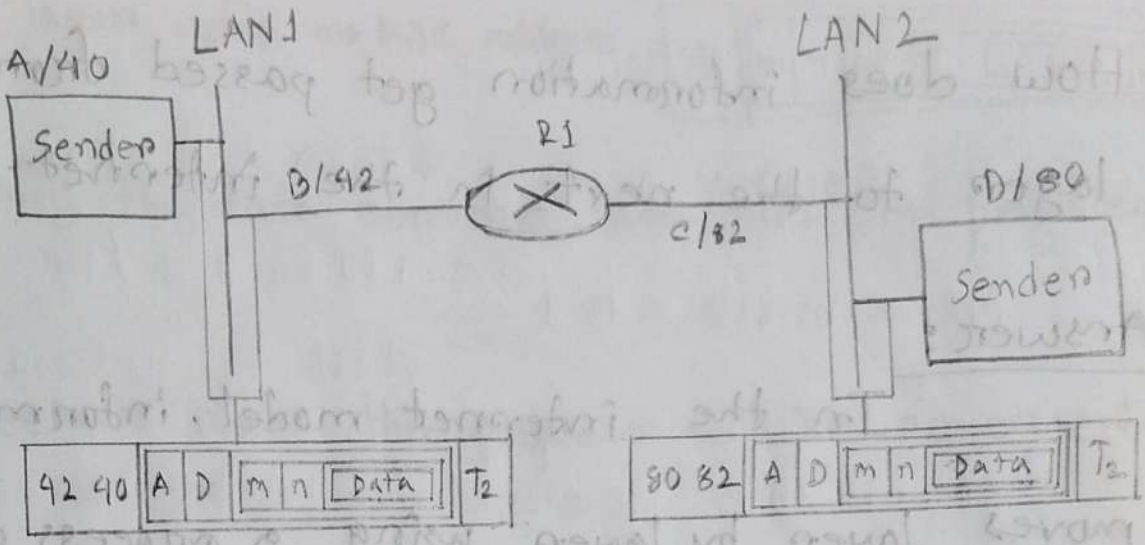
Ans:



Q What are the difference between physical address, logical address, port address, ~~and~~ Specific address, and socket address.

Address Type	OSI Layer	Purpose	Example.
Physical Address	Data Link Layer	Local node address, used for delivery inside the same network.	MAC: 3A:42:7F:8D:2A:10
Logical Address	Network Layer	Global address, used to deliver data across networks	IP: 192.168.1.10
Port Address	Transport Layer	Identifies the application process on a device	Port 80 = HTTP
Socket Address	(Network + Transport)	IP + Port, uniquely identifies a process on the network	(192.168.1.10, 80)
specific Address	Application Layer	Identifies the actual service name for the user	URL: www.exaple.com

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Q How does information get passed from one layer to the next in the internet model. [3]

Answer:

In the internet model, information moves layer by layer using a process called encapsulation and decapsulation.

at sender side

Each layer of the model adds its own header to the data. This header contains control information for better data flow to the specific layers.

At the receiver side, this process is reversed. Each layers removes its own header and passes the remaining part to the next layer until it goes to application layer.

Example: → Application layer sends data. [data]

→ Transport layer adds transport header (TCP/UDP). [a|b|data]

→ Network layers adds an IP header. [m|n|a|b|data]

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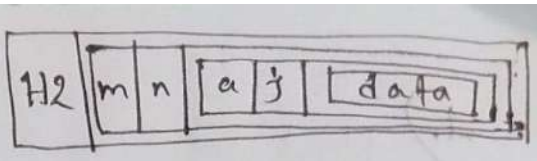
→ Data link layer adds an MAC address.



→ Then finally the data converts into bits in physical layer.

In the receiver side this process will be reversed.

Chapter 19

Q1 What is subnetting? An organization is granted the block 130.56.0.0/16. The administor wants to create 512 subnets.

1. Find the subnet mask
2. Find the num. of address in each subnet
3. " " 1st and last " of subnet 1
4. " " " " " " 512.

Answer: Subnetting means dividing a big network into small networks.

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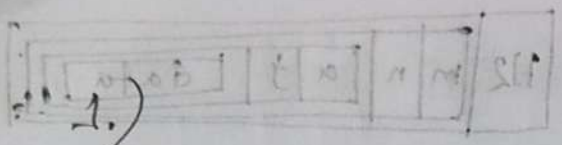

1.)

~~need = log 2 (512) = 9~~

~~∴ New mask = 16+~~

Given that, 130.56.0.0./16. so it is class B network and it has 16 bit reserve for network. id.

need bit for subnet = log 2 (512) = 9

∴ New mask = 16 + 9 = 25. So we ~~cla~~ can say, mask = 255.255.255.128 /25

2) number of address per subnet = $2^{32-25} = 2^7 = 128$

3.) First address of subnet 1 : 130.56.0.0 /25

last " " 1 : 130.56.0.127 /25

4. First address of subnet 512 : 130.56.255.128 /25

last " " 512 : 130.56.255.255 /25

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1. A block of address

You have network address and subnet mask

Network address : 192.168.10.0

Subnet mask : 255.255.255.252

(1) How many subnets?

subnet mask : 255.255.255.252

In binary : 11111111.11111111.11111111.11111100
(mask / subnetmask)

So the new mask = 24 + 6 = 30.

∴ new subnet mask = 255.255.255.252/30.

∴ Number of subnets = $2^{(30-24)} = 2^6 = 64$ subnets.

(2.) ~~Number of host per subnet~~

Host bit = 32 - 30 = 2

~~Number of~~ Unusable host id = 2

So, Number of hosts per subnet = $2^n - 2 = 2$ hosts.

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(iii)

= Host bit = 2

so incremental value is $2^2 = 4$.

So valid subnets:

Subnet 1: 192.168.10.0

subnet 2: 192.168.10.4

subnet 3: 192.168.10.8

Subnet 4: 192.168.10.12

subnet 5: 192.168.10.16

subnet 6: 192.168.10.20

.
.
.
.
.

Subnet 64: 192.168.10.252

Meaning	Subnet1	subnet2	subnet3	subn 4	...
Subnet Add	192.168.10.0	192.168.10.4	192.168.10.8	...12	...16
First valid host	192.168.10.1	192.168.10.5	9	.13	.17
Last valid host	192.168.10.2	6	10	.14	.18
Broad cast	192.168.10.3	7	11	.15	.19

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Find nth subnet address first address:

Subnet n = (n-1) x incremental value.

Subnet 64 = (64-1) x 4 = 252.

So subnet 64 = 192.168.10.252.

[4] One of the address we knew that 205.16.37.39/25. Find First address, last address and number of address in the block

Ans: Given address is a class c network.

~~That~~ Here mask is /25,

that means subnet is = 255.255.255.128

So, ~~kot~~ number of address per subnet,

$2^{32-25} = 2^7 = 128$.

So, ~~Subnet~~ incremental value is 128.

Since 39 < 128, so the First address ~~is~~ is

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205.16.37.0 and the last address is 205.16.37.127.

Number of address in block = 128 (usable 126)

[4] Class c network range 200.50.1.0 ——— break into ——— at least 50 client per network.

Ans:

$50 = 00\,110010$ (6 bits)

default mask in class c = 255.255.255.0

= 11111111.11111111.11111111.00000000

0s ← 8bit

New mask = 11111111.11111111.11111111.11000000

∴ = 255.255.255.192

incremental value = $2^6 = 64$.

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So subnets are,

209.50.1.0 – 209.50.1.63

209.50.1.64 – 209.50.1.127

209.50.1.128 – 209.50.1.191

209.50.1.192 – 209.50.1.255.

[4] class c network range 209.50.1.0 – –

– = – at least 20 ~~client per network~~ seperate network.

Ans : 20 → 00010100
5 bits.

default mask in class c = 255.255.255.0

= 11111111.11111111.11111111.00000000

New mask = 11111111.11111111.11111111.11111000
(5 bits → 1s)

= 255.255.255.248.

∴ incremental value = $2^{(8-5)}$ = 8

∴ Network = 209.50.1.0.

Subnets: 209.50.1.0 – 209.50.1.7

209.50.1.8 – 209.50.1.15

209.50.1.152 – 209.50.1.159.

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[1] IP = 172.16.0.0 ——— at least 320 client per subnet.

~~de~~ Ans: Given ~~ip~~ address is class B network

~~So default mask = 255.255.0.0~~

~~= 11111111.11111111.00000000.00000000~~

~~New~~ 320 = 101000000
9 bits.

default mask = 255.255.0.0

= 11111111.11111111.0000000.00000000

new mask = 11111111.11111111.1111110.00000000
(0s ← 9 bits)

= 255.255.254.0

incremental value = 2^1 = 2

(যেই ঘরে কোনো 1 নেই সেই ঘর has incremental value হবে বসানর সময় নিবে না। সেই ঘরে 1 ও 0 উল্লেখ আছে যে অক্ষরের 0s থেকে বসানো আছে সেগুলো নিবে,

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∴ Subnets →

172.16.0.0 — 172.16.1.255 → sub-1

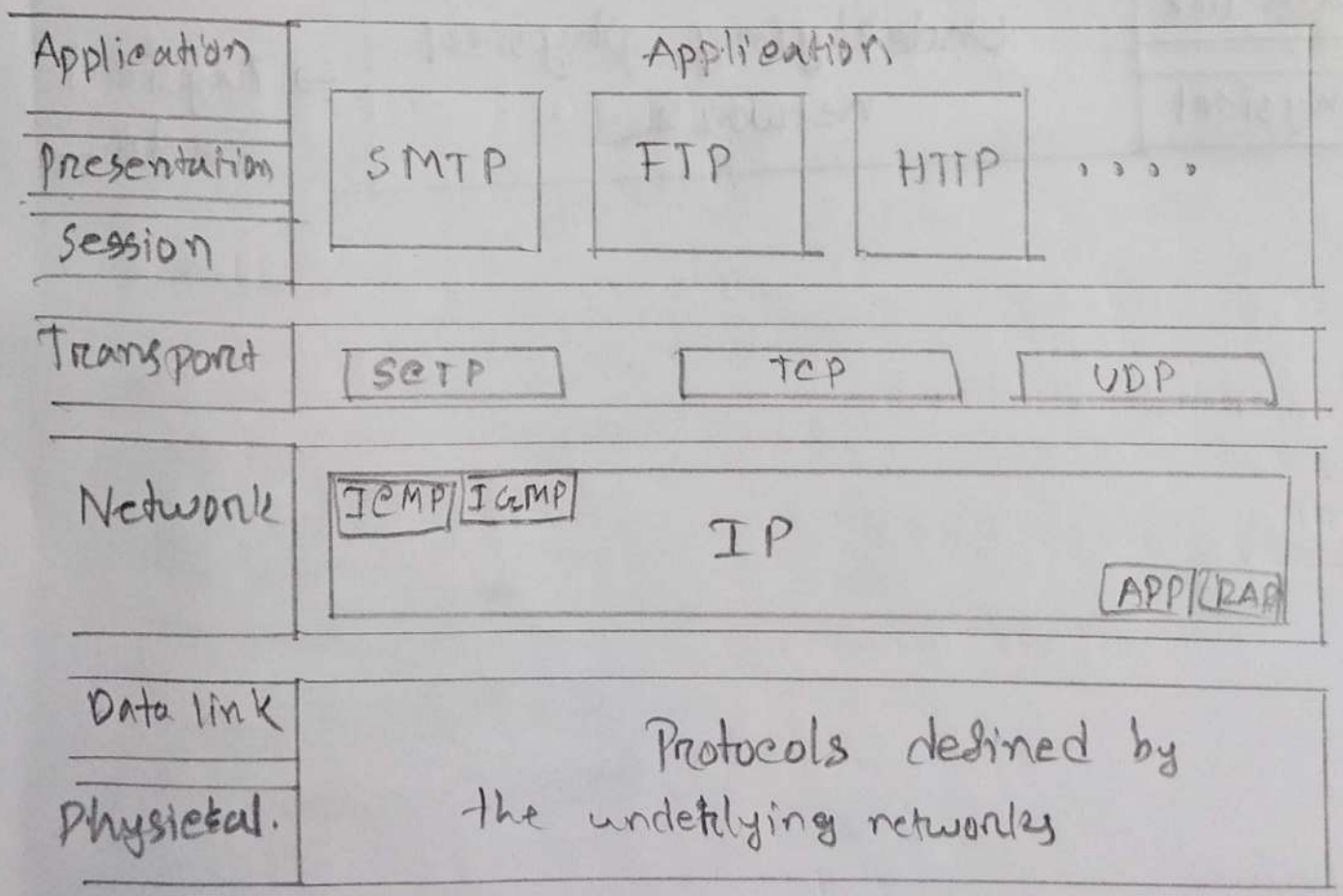
172.16.2.0 — 172.16.3.255 → sub 2

172.16.4.0 — 172.16.5.255 → sub 3

⋮

172.16.254.0 — 172.16.255.255 → sub — 128.

TCP/IP and OSI model relationship.



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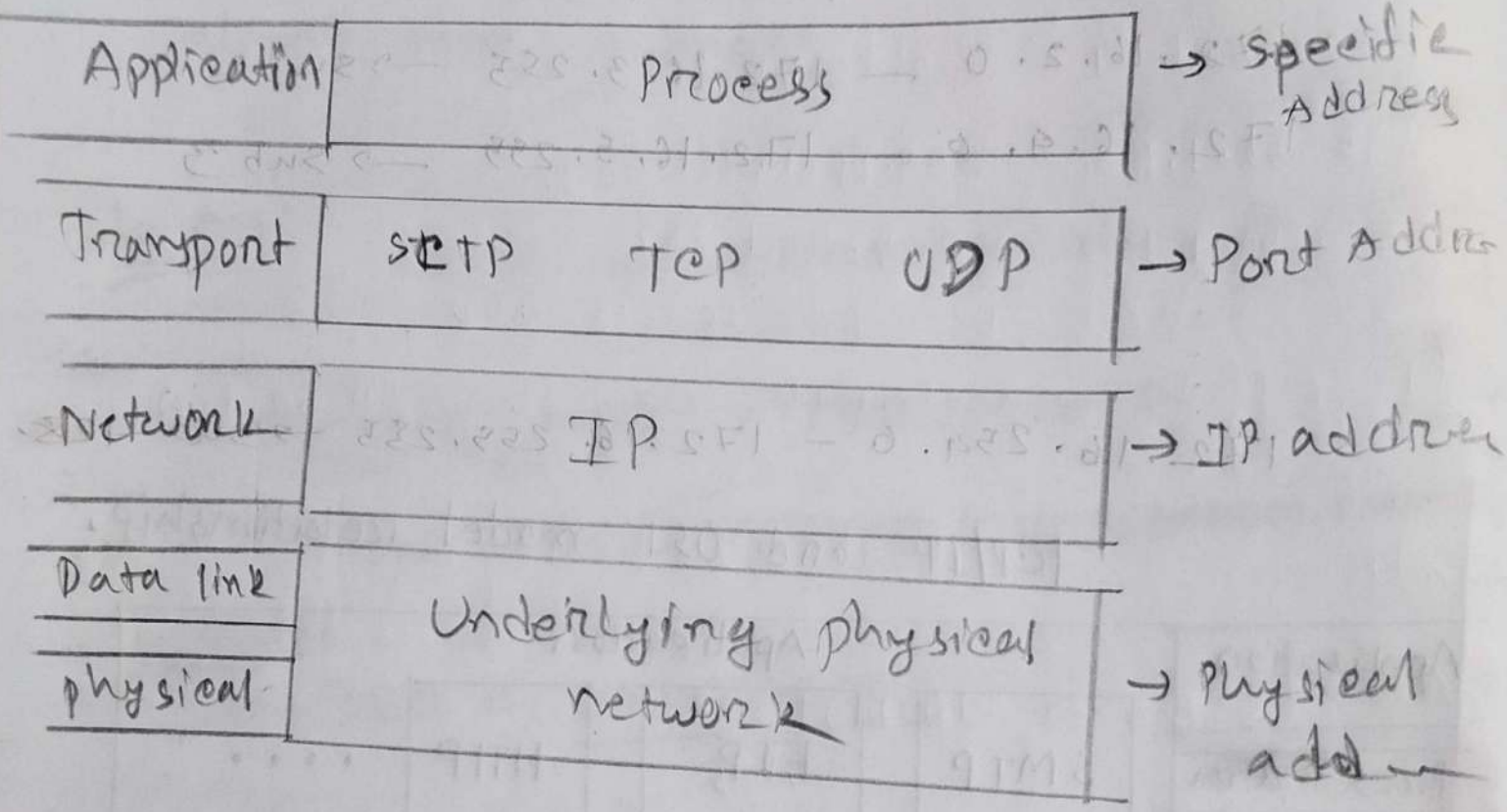
Relationship of layer and addresses in TCP/IP.



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