

CS & IT ENGINEERING



Computer Network

Introduction

Lecture No. - 03

By - Abhishek Sir





Recap of Previous Lecture



Topic

Transport Layer

Topic

Network Layer



Topics to be Covered



Topic

Data Link Layer

Topic

Physical Layer

Topic

Switching technique

ABOUT ME



Hello, I'm **Abhishek**

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- M.Tech (CS) - IIT Kharagpur
- 12 years of GATE CS teaching experience

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Topic : Data Link Layer



-> Provide **node-to-node connectivity**



Topic : Node-to-Node Connectivity



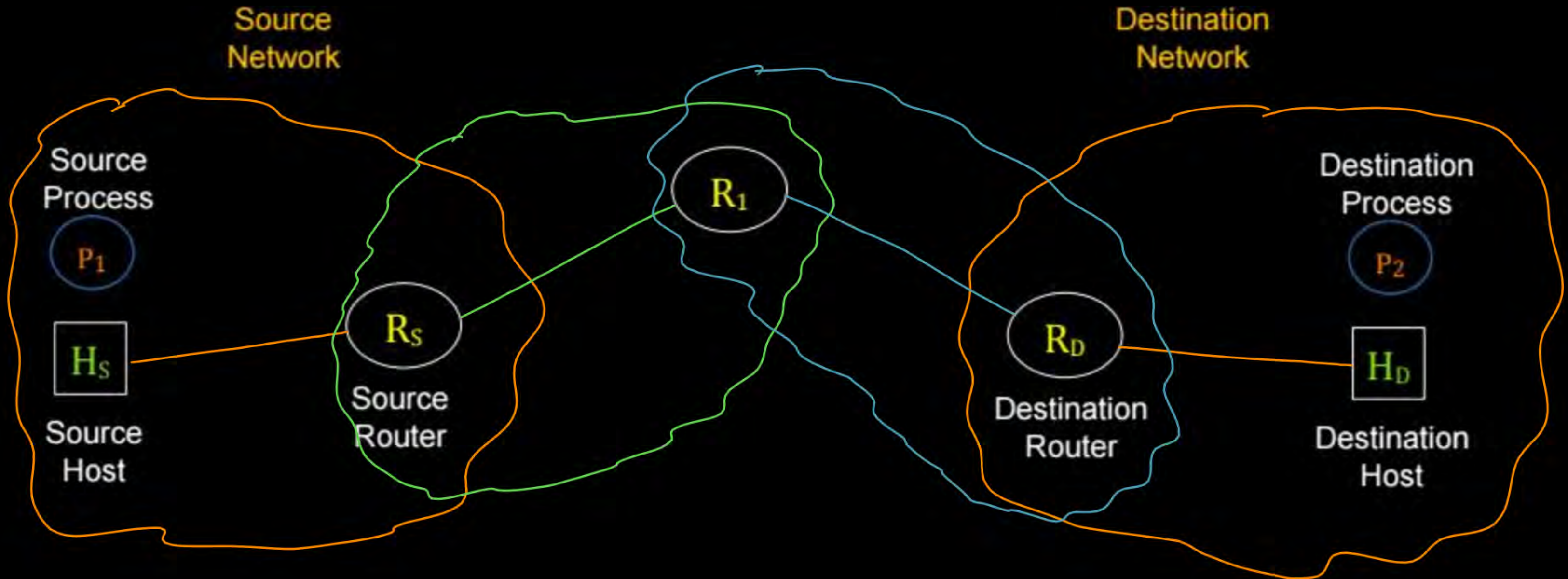
Intra-network : Sender & Receiver belongs to same network (within a network)

Node : Host or Router (Any Layer-3 device and above) or Gateway.

Network Node



Topic : Node-to-Node Connectivity





Topic : Data Link Layer



Data Link Layer PDU : **“Frame”**

- Sender : Encapsulate (datagram into frame,
Frames passes to physical layer for transmission) } Framing
- Receiver : Extract (datagram from frame,
Datagrams passes to network layer) } Extraction

IP Datagram

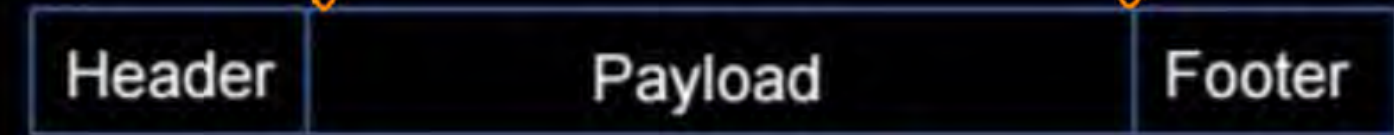
Network Layer PDU
"Datagram"



Data Link Layer SDU = Datagram



(Data Link Layer PDU)
"Frame"

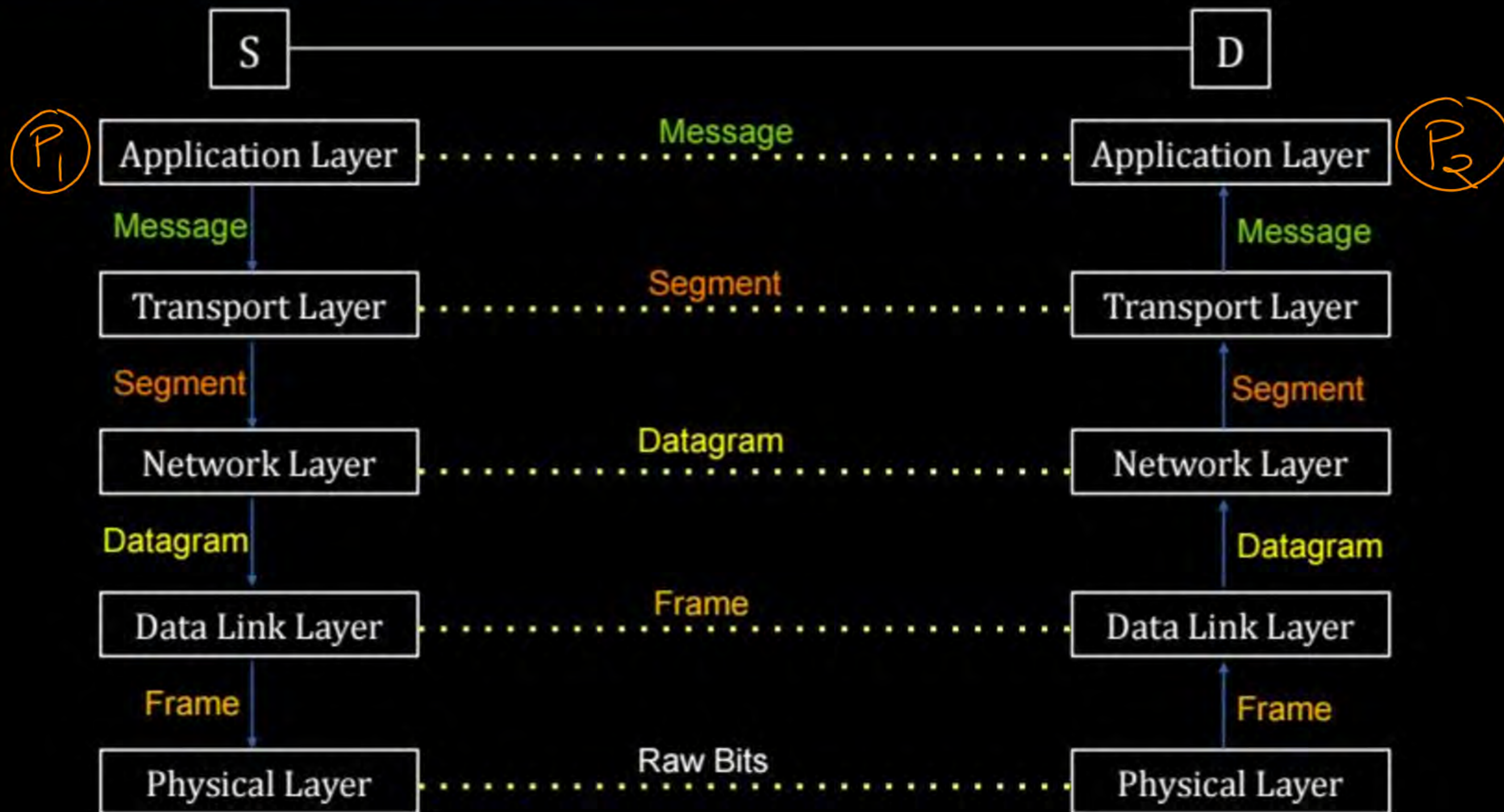


Frame





Topic : Protocol Data Unit





Topic : Data Link Layer



Data Link layer services :-

1. Framing → Frame Synchronization
2. Error Control → [Bit stuffing]
3. Flow Control
4. Access Control → MAC sublayer



Topic : Data Link Layer



-> Data Link Layer Networking Device : **"Switch"**

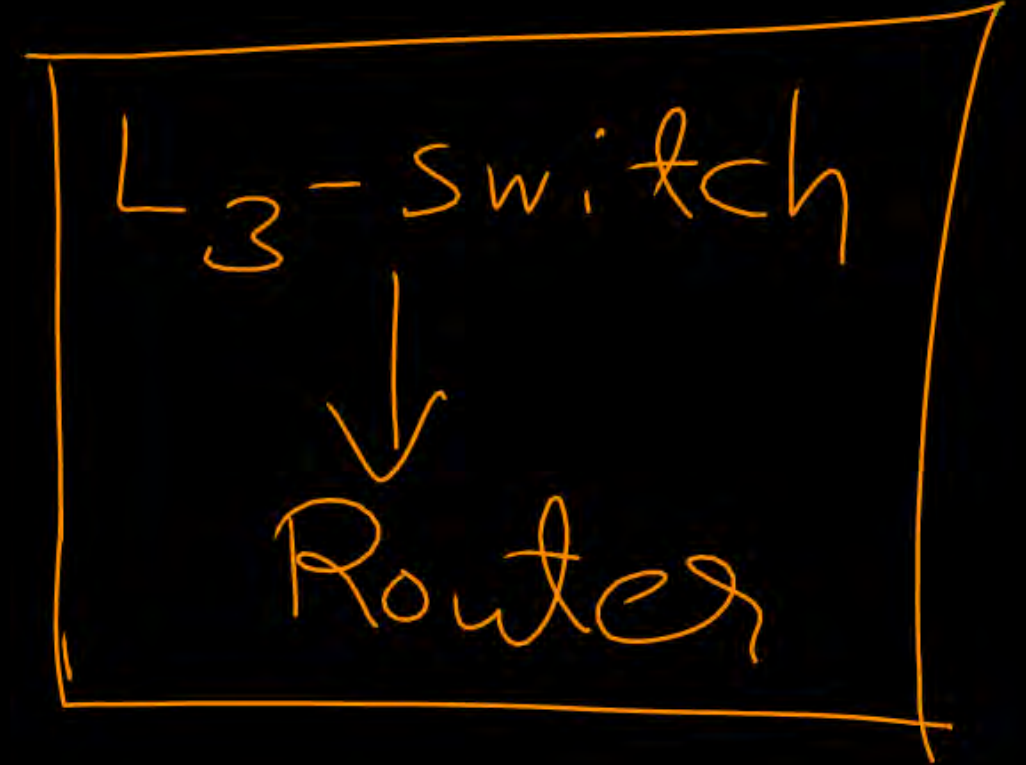
[Layer - 2 device, Old name : **"Bridge"**]



-> Store and Forward device

[Store, Process and Forward]

-> Forwarding based on MAC Address





Topic : Physical Layer



=> Responsible for transmission of "bit"

* [Bit synchronization between transmitter and receiver]

→ Copper Cable

→ Fiber Cable

→ Wireless

=> Encoding / Signaling





Topic : Physical Layer



- Physical Layer Networking Device : "**Repeater** and **Hub**"
[Layer - 1 device]
- **Hub** : Multi-port **Repeater**

[MCQ]

[ISRO-2015] [1 Mark]



#Q. Which layers of the OSI reference model are (host-to-host layers)?

☒ A (Transport, session, presentation, application) → host layers

☐ B Session, presentation, application

☐ C Datalink, transport, presentation, application

☐ D Physical, datalink, network, ~~transport~~

↓
Media Layer

Ans: A

[MCQ]

[GATE-2025][1 Mark]



#Q. Identify the ONE CORRECT matching between the OSI layers and their corresponding functionalities as shown.

OSI Layers	Functionalities
(a) Network layer →	(I) [Packet routing]
(b) [Transport layer]	(II) [Framing and error handling]
(c) Datalink layer ↗	(III) [Host to host communication]

→ Network Layer

A (a)-(I), (b)-(II), (c)-(III)

B (a)-(I), (b)-(III), (c)-(II)

C (a)-(II), (b)-(I), (c)-(III)

D (a)-(III), (b)-(II), (c)-(I)

Ans: B



Topic : Layer Services



Layer	Provide Services (to its upper layer)
Transport	Process-to-Process [end-to-end] Connectivity
Network	Host-to-Host Connectivity
Data Link	Node-to-Node Connectivity



Topic : Protocol Data Unit



Layer	PDU
Application	Message
Transport	Segment
Network	Datagram
Data Link	Frame
Physical	Bit



Topic : Networking Devices



Layer	Networking Device
Application	→ Gateway
Network	→ Router
Data Link	→ Switch or Bridge
Physical	→ Hub, Repeater

→ Routing

→ between different type of network

→ Protocol conversion

→ Routing

→ between similar type of network



Topic : Syllabus



Concept of layering : OSI and TCP/IP Protocol Stacks; ✓

Basics of packet, circuit and [virtual circuit] switching;

↓ ↑
✓



Topic : Switching



→ Process to move data (or packets) towards destination over the network

→ Types of switching techniques :

1. Circuit Switching →

2. Packet Switching



Topic : Circuit Switching

⇒ Physical Devices



→ Establishes dedicated circuit between sender and receiver, before transmission
[Over the links of the network]

→ Phases of Circuit Switching :

1. Circuit establishment
2. Data transfer
3. Circuit disconnect

→ Example : Telephone Networks
[PSTN : Public Switched Telephone Network]



Topic : Circuit Switching



=> Circuit in a link implemented with

1. Frequency Division Multiplexing [FDM]

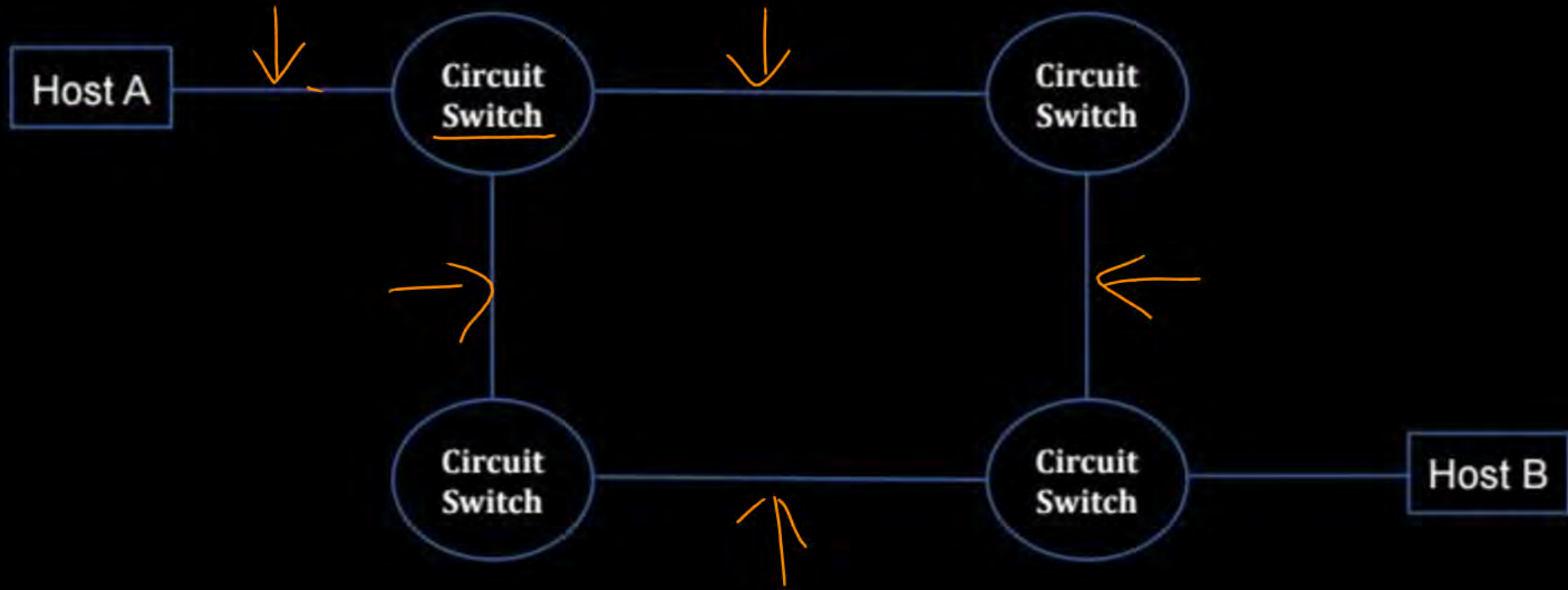
2. Time Division Multiplexing [TDM]

3. Code Division Multiplexing

=> Each link contains n "circuits" [TDM or FDM]



Topic : Circuit Switching





Topic : FDM



→ Frequency spectrum of a link

→ [Analog circuit switching] ✓



Topic : TDM



- Time is divided into frames of fixed duration
- Each frame is divided into fixed number of time slots
- [Digital circuit switching] ✓



Topic : Circuit Switching *



Advantage :-

→ Congestion may occur during circuit establishment
[No any congestion occur, during data transfer] → ✓

→ All data (or packets) follow each other on reserved path
[Data (or packets) having same end-to-end delay]



Topic : Circuit Switching



Disadvantage :-

- Inefficient utilization of network resources
- Expensive





Topic : Message Switching

→ TCP/IP Model



→ Application processes doing communication by exchanging "messages"

Advantage :-

- No any dedicated path required between sender and receiver
- Store and Forward (Internet)

Disadvantage :-

- Entire message is transmitted as single unit



Topic : Packet Switching



→ Message is divided into smaller size packets

[Packets may be same or different size]

→ Example : Internet is a packet-switched network

* optimum packet size

TCP/IP Model : Packet Switched Network



2 mins Summary



Topic

Data Link Layer

Topic

Physical Layer

Topic

Switching technique

* Packet switching



THANK - YOU

