Computer Networks

Pokhara Engineering College

Lecture -2

Computer Network

Unit -2: Reference Model

- Protocols and Standards
- Interfaces and Services
- OSI layers
- TCP/IP layer
- Comparison of OSI and TCP/IP
- Networking Hardware: NIC, Hub, Repeater, Switches, Bridge, Router

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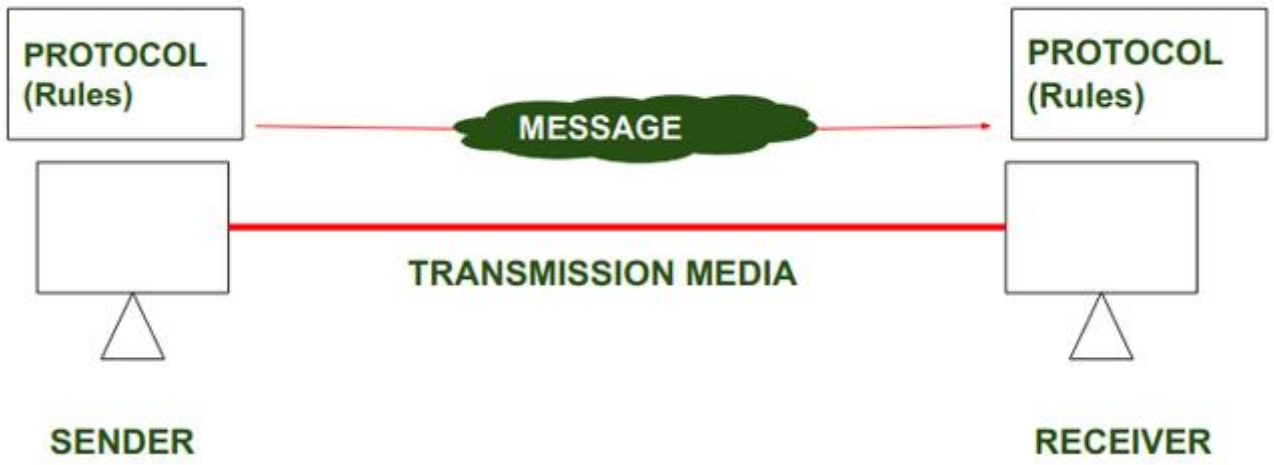
Protocols ,Standards, Interface and Services

- **Protocols: set of rules or agreement that determines the format and transmission of data.**

For example : While flying and airplane. pilots obey very specific rules for communication with other airplanes and with traffic control.



Protocols ,Standards, Interface and Services

- **Standards: are the set of rules for data communication that are needed for exchange of information among devices.**
- **It is important to follow standards which are created by various standard organization like IEEE , ISO , ANSI etc.**
- **Types of Standards :**

- **De Facto Standard.**
- **De Jure Standard.**

Protocols ,Standards, Interface and Services

De Facto Standard:

- The meaning of the work *" De Facto "* is " By Fact " or "By Convention".
- the standards that have not been approved by any organization , but have been adopted as standards because of it's widespread use.
- **For example :** Apple and Google are two companies which established their own rules on their products which are different. Also they use some same standard rules for manufacturing for their products.

Protocols ,Standards, Interface and Services

De Jure Standard:

- The meaning of the word *"De Jure"* is "By Law" or "By Regulations" .
- standards that have been approved by officially recognized body like ANSI , ISO , IEEE etc.
- **For example :** All the data communication standard protocols like SMTP , TCP , IP , UDP etc. are important to follow the same when we needed them.

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Protocols ,Standards, Interface and Services

- **Interfaces and Services :** a process that generally provides and gives a common technique for each layer to communicate with each other.
- Standard terminology basically required for layered networks to request and aim for the services are provided.
- Service is defined as a set of primitive operations.
- Services are provided by layer to each of layers above it.
- Below is diagram showing relation between layers at an interface. In diagram, layers N+1, N, and N-1 are involved and engaged in process of communication among each other.

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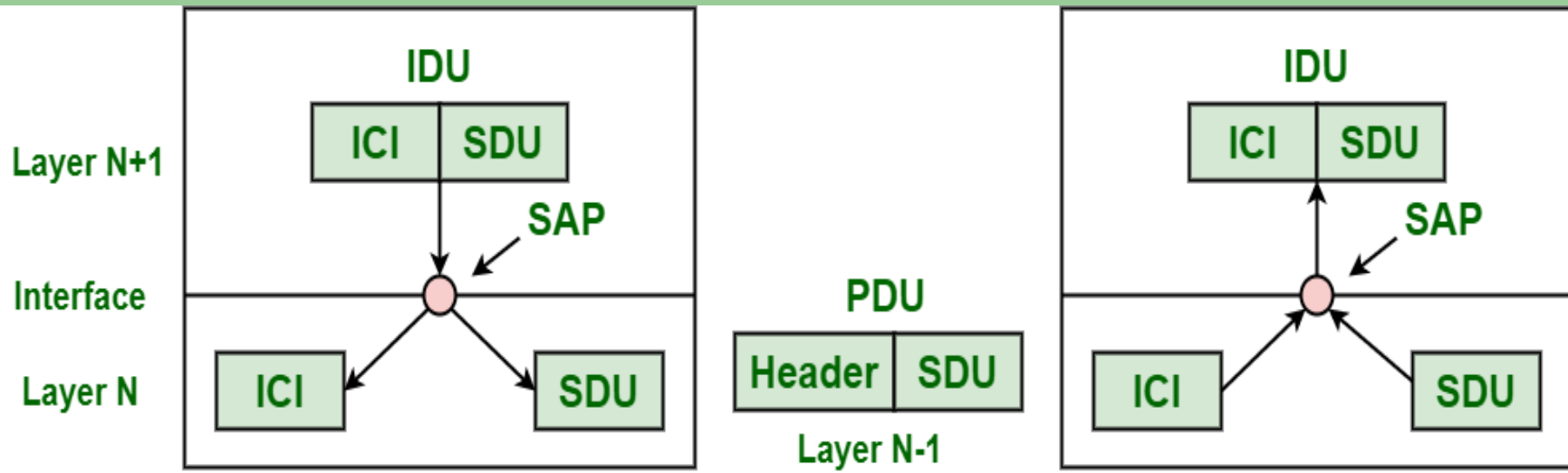
Protocols ,Standards, Interface and Services



Relationship Between Layers at an Interface

ICI :interface control information

SDU :Service data Unit

IDU :Interface data unit

SAP :Service access point

Protocols ,Standards, Interface and Services

- **Types of services:**
- **Connection oriented service**
- **Connectionless service**

Reference Model

- Two popular reference model.
- OSI and TCP/IP.
- OSI are not used anymore but provides better picture of function of each layer.
- TCP/IP models protocol are widely used.

Open System Interconnection(OSI)

- Introduced in 1978 and revised in 1984.
- Formulates the communication process into structured layers.
- There are seven layers in the model, hence the name “The 7-Layer model”.
- The model acts as a frame of reference in the design of communications and networking.

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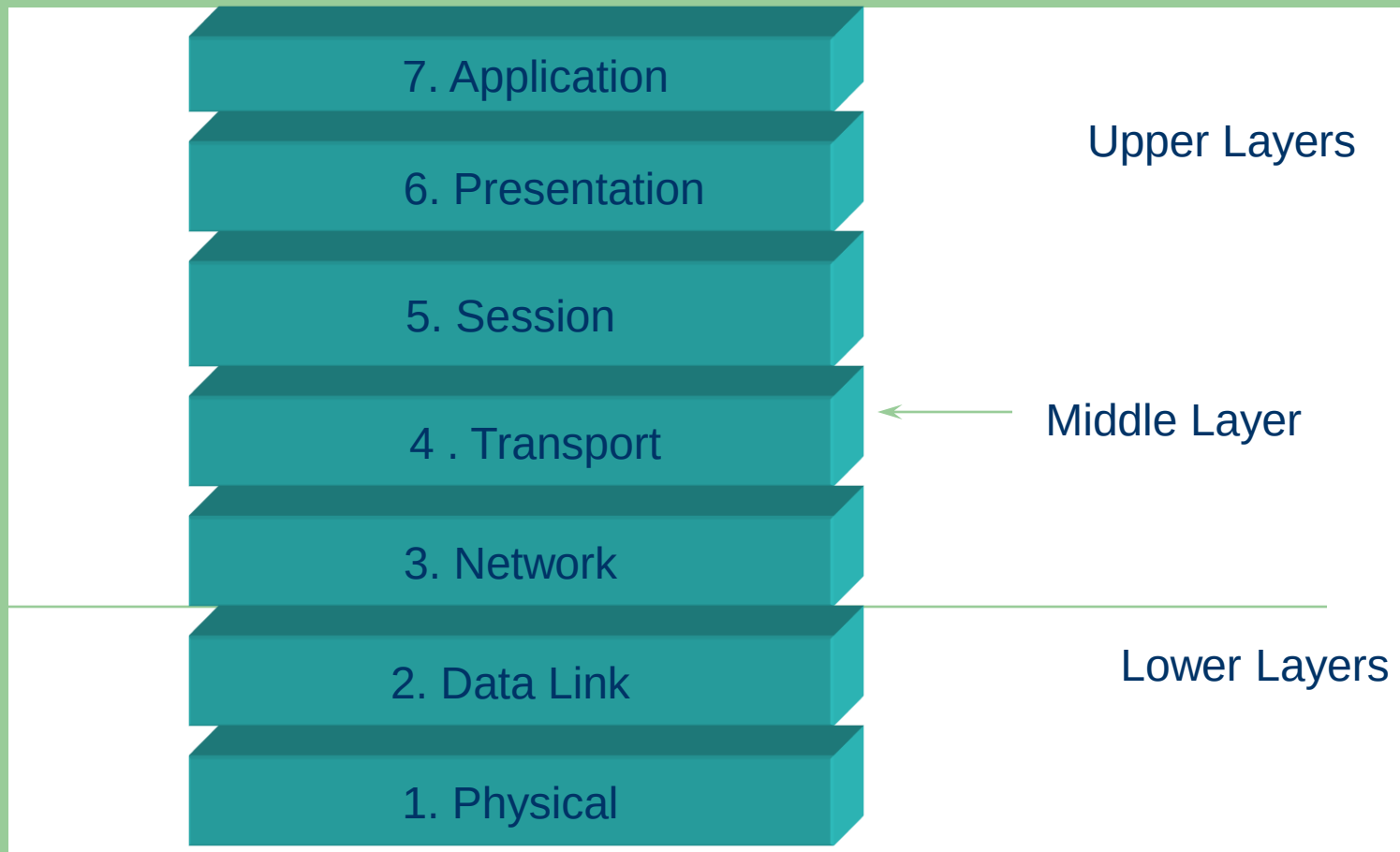
Open System Interconnection(OSI)

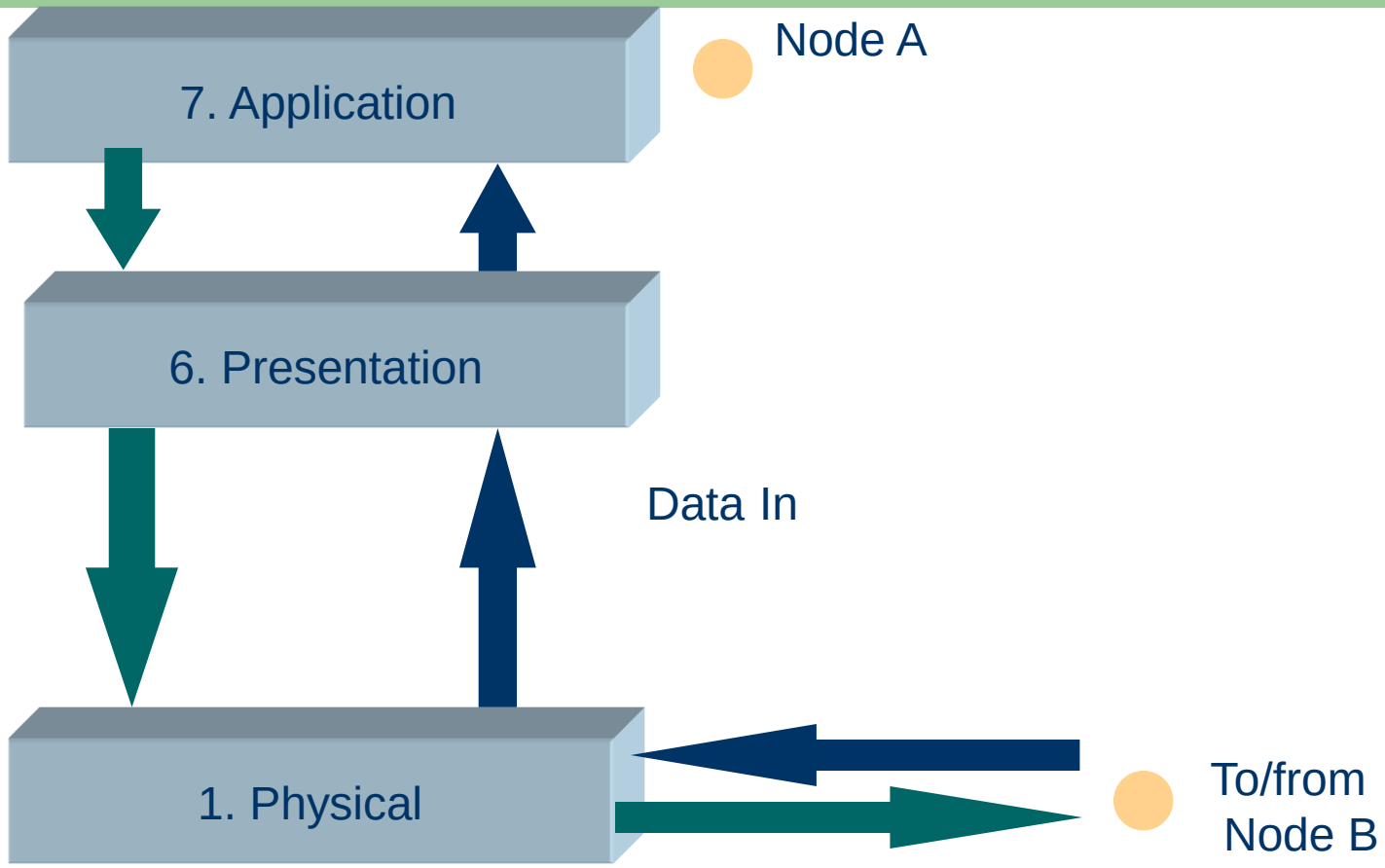


Function of Layers

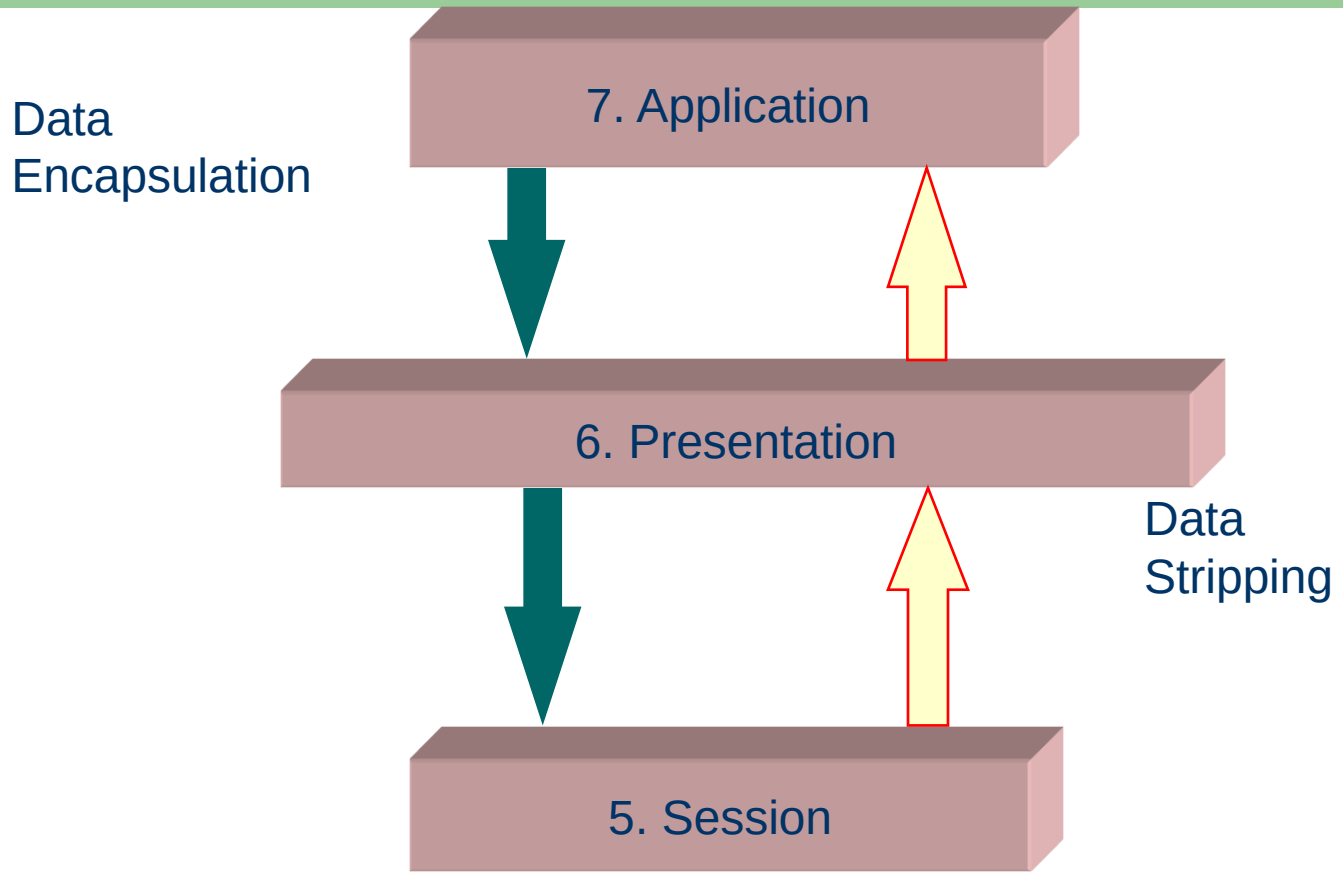
- Each layer deals with one aspect of networking.
- Each layer communicates with the adjacent layers in both direction.
- Each layer formats the data packet.

  eg:- Adds or Deletes addresses which is topped up in each layer.

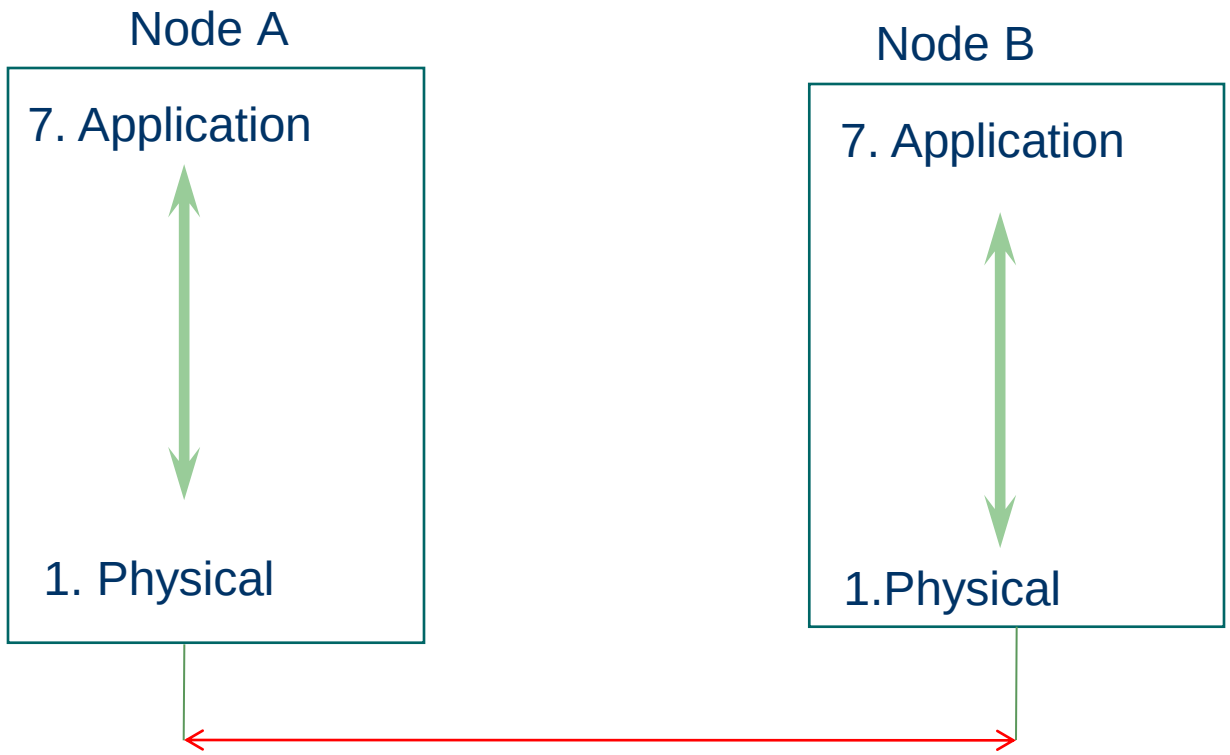
Role of Layers



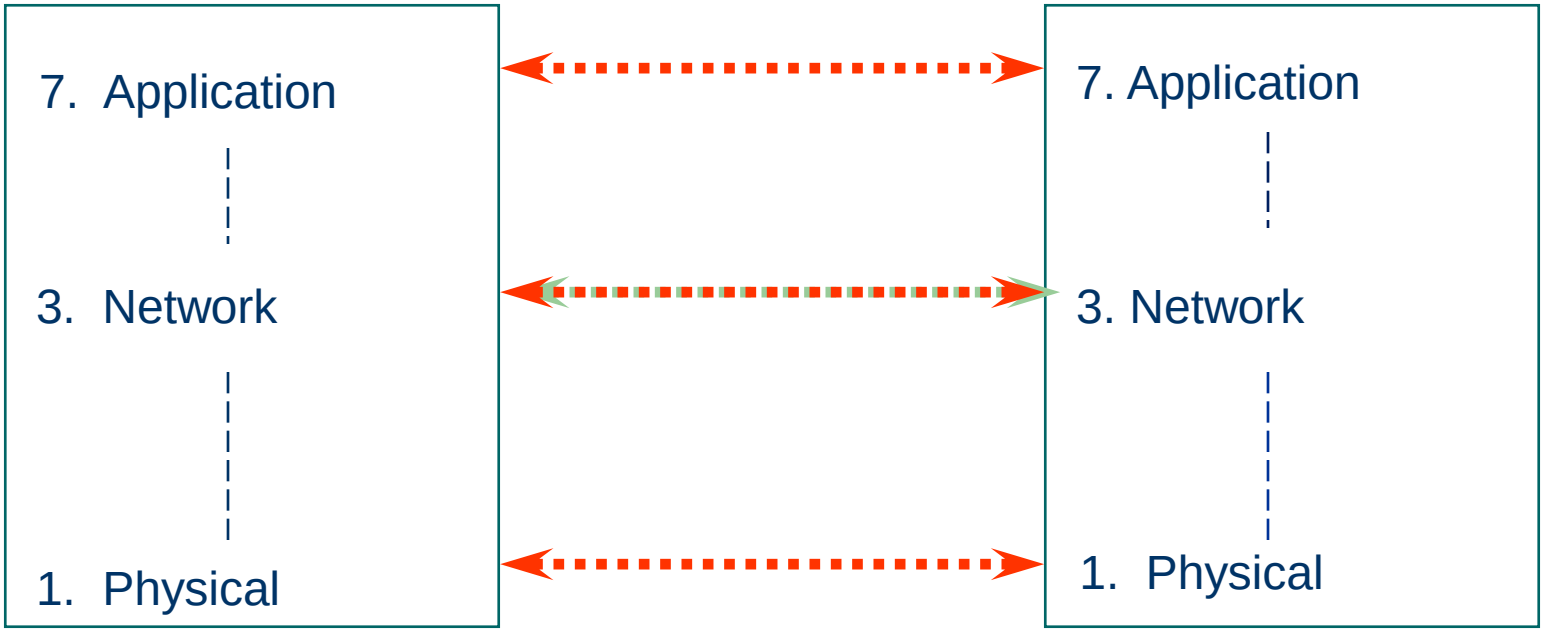
Communication of Layers



Role of Layer: Point to Point Communication



Virtual Communication of Layers



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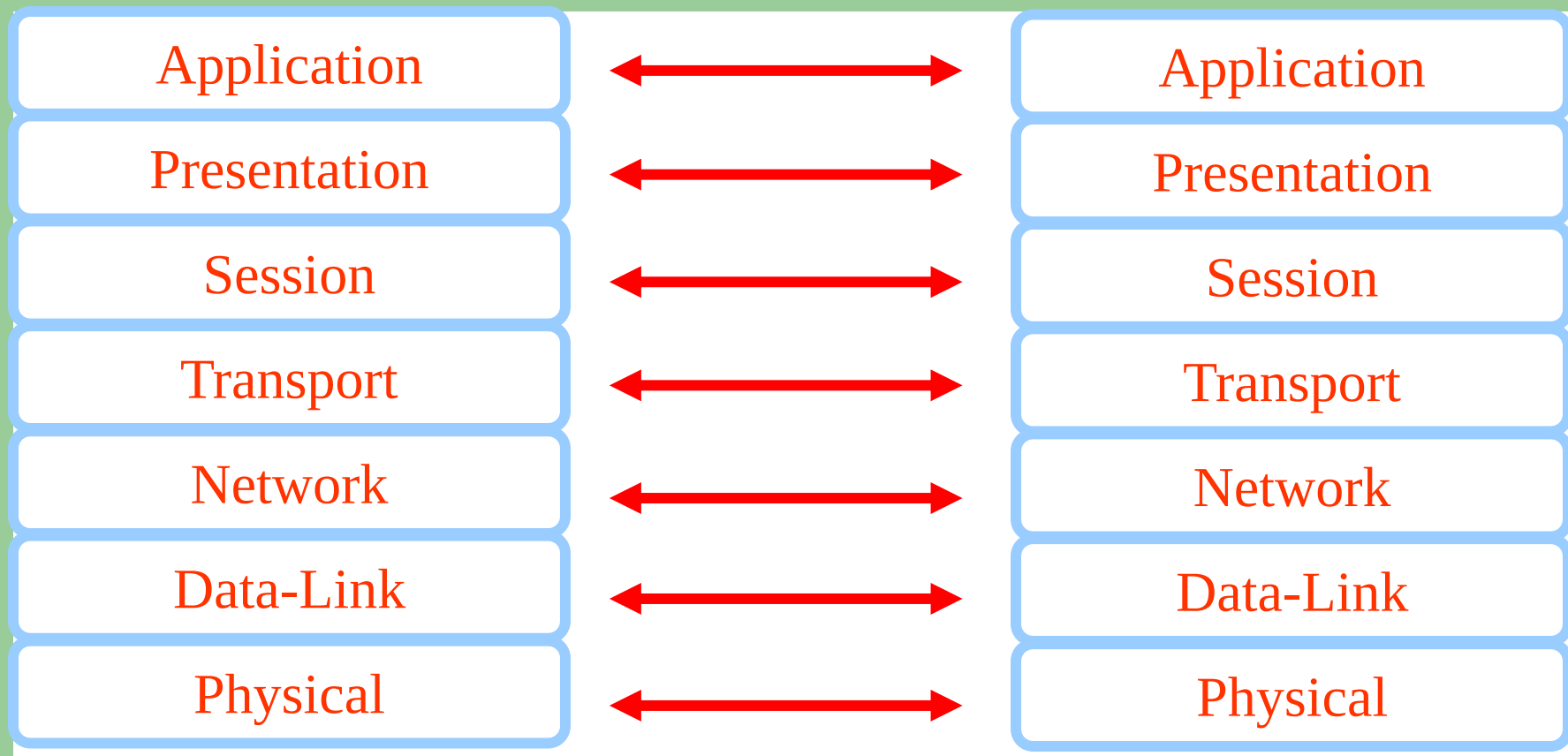
Virtual Communication of Layers



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Open System Interconnection(OSI)

Application Layer

- Provides network access.
- Gives end-user applications access to network resources.
- Contains variety of protocols needed by the users.
- Flow Control.
- Eg :- FTP,HTTP, Electronic mail , Telnet etc.

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Open System Interconnection(OSI)

Presentation Layer

- Main task is to representation of data.
- Protocol Conversion.
- Data Translation.
- Encryption.
- Concerned with the syntax and semantics of the information to be transmitted .

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Open System Interconnection(OSI)

Session Layer

- Concerned with inter host Communication.
- Allows application to maintain ongoing session.
- Establishes, Manages and Terminates session between application.
- Session Layer allows user on different machines to establish session between them.
- Session also offers services like Synchronization.

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Open System Interconnection(OSI)

Transport Layer

- Provides End to End Connection.
- Concerned with transportation issues between host.
- Receives information from upper layer and segment(divide)it into packets .
- Transport layer can be either connection oriented or connection less oriented.
- Assures that the entire message is correctly delivered at the receiving side.

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Open System Interconnection(OSI)

Transport Layer

- Transport layer at the destination re-assembles the packets.
- Fault detection and recovery.
- Information flow control.
- Protocol used are TCP and UDP.

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Open System Interconnection(OSI)

Network Layer

- Provides network-wide addressing and a mechanism to move packets between networks(Routing).
- Provides connectivity and path selection between two end points.
- It also handles congestion of the network.

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Open System Interconnection(OSI)

Network Layer

- Quality Of Service(QOS) issues like delay, transient time, jitter is deal with.
- It translates logical network address into physical machine address.
- Breaks larger packet to smaller ones if necessary.
- It is concerned with switching.

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Open System Interconnection(OSI)

Network Layer

- Provides network layer flow control, error control and packet sequence control.

- Routers and Gateways operate in this Layer.

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Open System Interconnection(OSI)

Data Link Layer

- Provides Access to media .
- Provides Reliable transfer of data.
- Places data and retrieves with physical Layer.
- Provides Error Detection capabilities.

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Open System Interconnection(OSI)

Data Link Layer

- Provides Physical Addressing, Network Topology, Error Notification, Flow Control.

- Data link layers breaks up the data into data frame and transmit the frame sequentially.

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Open System Interconnection(OSI)

Physical Layer

- This Layer is responsible for sending bits from one computer to another.
- Defines the encoding.
- Defines the transmission rate.
- Deals with Synchronization of Tx and Rx.
- Network Connection type: Point to point and multipoint.

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Open System Interconnection(OSI)

Physical Layer

- Defines Various Topology: Bus, Ring ,Star, Mesh and Tree.
- Multiplexing: Combining several data channels into one.
- Defines characteristics of device and medium.
- Define Transmission mode: Simplex Half Duplex and Full Duplex.

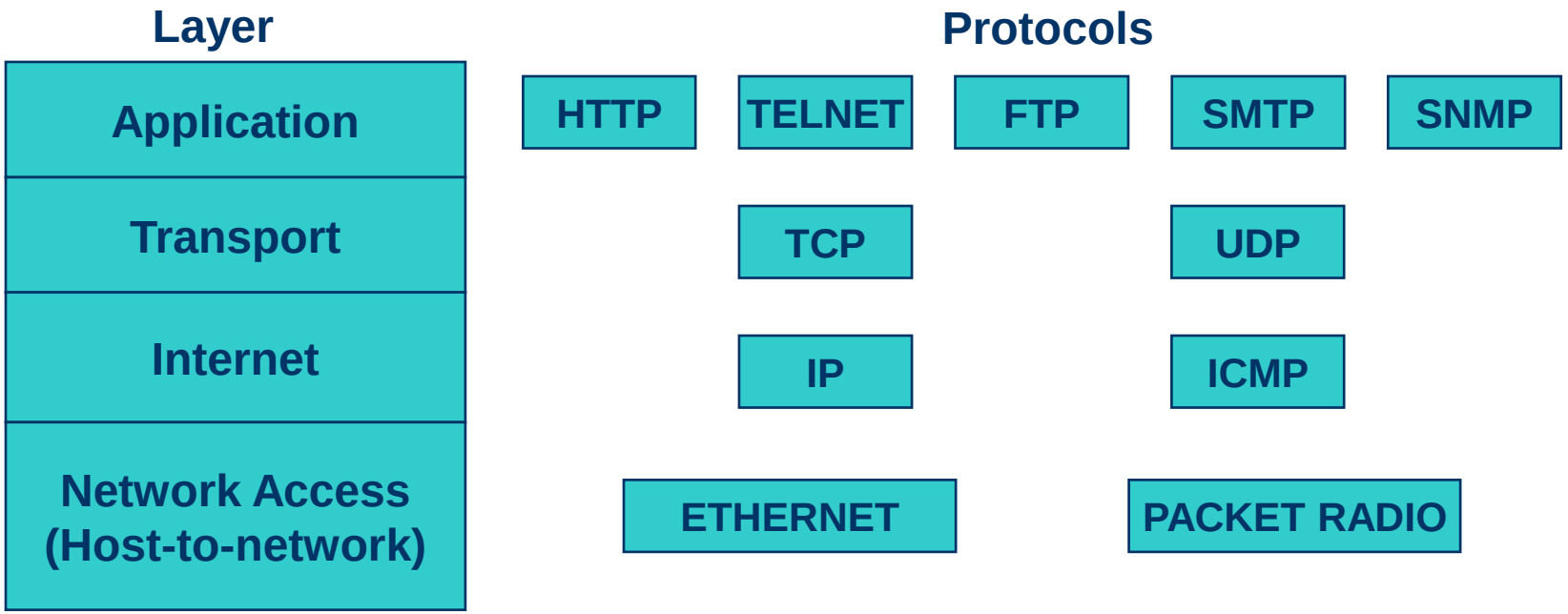
Background: TCP/IP

- Started with the ARPANET Project
- ARPANET was a Research sponsored by DOD (U.S Department of Defense)
- Connected universities and government offices using leased Telephone lines.
- Introduction of satellite and radio network introduced trouble of interworking in existing protocol.

TCP/IP: Reference Model

- Reference model used in the Internet.
- Ability to connect multiple network.
- Ability to transfer files and speech transmission in seamless way.
- Flexible model or Architecture with four layers.

TCP/IP: Reference Model



TCP/IP: Reference Model

Application Layer

- Contains all higher level protocols.
- Higher level protocols are Virtual Terminal(TELNET), File Transfer(FTP) ,electronic mail(SMTP).
- Domain Name System(DNS) for mapping host name onto their network address.

TCP/IP: Reference Model

Application Layer

- Hyper Text Transfer Protocol(HTTP) used for fetching page on the World Wide Web(WWW).
- Real Time Transport Protocol(RTP) for delivering real time signal such as voice, video.

TCP/IP: Reference Model

Transport Layer

- Function is same as transport layer of OSI model.
- Provides End to End Connection.
- TCP and UDP are two end to end protocols used in this layer.
- TCP is connection oriented protocols which sends and receives the byte without error.

TCP/IP: Reference Model

Transport Layer

- User Datagram Protocol(UDP) is connectionless protocol.
- It is unreliable than Transmission Control Protocol(TCP).
- UDP is used in the system which needs prompt delivery rather than accurate.

example:- Transmitting Video

TCP/IP: Reference Model

Internet Layer

- Internet Layer delivers IP packet to right destination where it is supposed to be delivered.
- Internet layer provides permit to travel data independently to the destination.
- IP and Internet Control Message Protocol(ICMP) are two protocols.

TCP/IP: Reference Model

Internet Layer

- Internet Protocol(IP) delivers the data in packet form.
- ICMP is used by network device like router to send error message if exist.

TCP/IP: Reference Model

Network Access: Host- to -Network

- Lowest Layer of TCP/IP Reference model.
- Connects Host to the network using protocols to send IP packets over it.
- It is the interface between the host and transmission link or medium.

Critique: OSI Reference Model

OSI Could not take the whole world because of

- **Bad Timing.**
- **Bad Politics.**
- **Bad Technology.**
- **Bad Implementations.**

Critique: TCP/IP Reference Model

- Called as Implementation model not a General model.
- Service, Interface and protocol are not distinguished as OSI Reference Model.
- No mention of Physical and Data Link Layer.
- Protocols are fixed and deep rooted, hard to be replaced.

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Comparison of OSI and TCP/IP model

TCP/IP	OSI
Implementation of OSI model	Reference model
Model around which Internet is developed	This is a theoretical model
Has only 4 layers	Has 7 layers
Considered more reliable	Considered a reference tool
Protocols are not strictly defined	Stricter boundaries for the protocols
Horizontal approach	Vertical approach
Combines the session and presentation layer in the application layer	Has separate session and presentation layer
Protocols were developed first and then the model was developed	Model was developed before the development of protocols
Supports only connectionless communication in the network layer	Supports connectionless and connection-oriented communication in the network layer
Protocol dependent standard	Protocol independent standard

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End of Lecture 2