LAYERING:

Layering means decomposing the problem into more manageable components (Layers). The main advantage of layering is that troubleshooting becomes easy.

LAYERED ARCHITECHTURES:

There are 2 layered architechtures:

- The OSI Reference Model
- The TCP/IP Model

THE OSI MODEL:

★ OSI stands for Open System Interconnection.
★ It is a model for understanding and designing a network architecture that is flexible, robust, and interoperable (Communication between different operating systems/that describes the ability of a system to communicate with another system).
★ Developed by the International Standards for Organizations (ISO).
★ It is only a guideline and hence it is referred as OSI reference model.
★ It is just for understanding purposes as it provides a universal language for computer networing.
★ It has 7 layers.
★ Created to standardize communication.

PURPOSE OF OSI MODEL:

★ The purpose of the OSI model is to show how to facilitate communication between different systems without requiring changes to the logic of the underlying hardware and software.
★ The OSI model was never fully implemented.
★ OSI Model helps network device manufacturers and networking software vendors to create devices and softwares that can communicate with the products from any other vendors allowing interoperable.
★ It has 7 layers.

LAYERS OF OSI REFERENCE MODEL:

QUESTION:

Identify the correct order of layers.

A	B	C	D
Application Layer	Application Layer	Application Layer	Application Layer
Session Layer	Presentation Layer	Presentation Layer	Presentation Layer
Presentation Layer	Session Layer	Session Layer	Transport Layer
Transport Layer	Network Layer	Transport Layer	Session Layer
Network Layer	Transport Layer	Network Layer	Network Layer
Data Link Layer	Data Link Layer	Data Link Layer	Data Link Layer
Physical Layer	Physical Layer	Physical Layer	Physical Layer

SOLUTION:

OSI Reference model has 7 layers:

• Application Layer	Away
• Presentation Layer	Pizza
• Session Layer	Sausage
• Transport Layer	Throw
• Network Layer	Not
• Data Link Layer	Do
• Physical Layer	Please

So the correct option is C.

APPLICATION LAYER:

The application layer is the top layer of the Open Systems Interconnection (OSI) model, providing an interface between you and a web application. This layer connects software applications and user experiences, allowing you to access network services and data, such as when you check your email or browse the web.

SERVICES OFFERED BY APPLICATION LAYER:

☐ The application layer allows the users to access network resources through application. So the user opens the application and interacts with the network resources.
☐ Application Layer deals with interface of the application.
☐ The main function of application layer is it allows you to send and receive data in the network.
☐ Through application layer we can share files.

☐ We can use it for sending mails.
☐ The application layer provides critical functions like directory services and website browsing.

PRESENTATION LAYER:

This layer is concerned with the syntax and the semantics of the information exchanged between systems.
Syntax is the grammar and structure of the language, while semantics is the meaning and interpretation of the statements.
Syntax: The structure of bits.
Semantics: The meaning of bits.

SERVICES OFFERED BY PRESENTATION LAYER:

1. TRANSLATION:

Converting the data into a common format in which the sender and receiver can easily communicate.
If sender is sending some data, so it has to ensure that the same format or structure is understandable by the receiver, this is translation. It is concerned with the syntax because translation just change the structure, not the meaning, just convert it into a common format.

2. ENCRYPTION AND DECRYPTION:

Converting the data into unreadable form, except for sender and receiver who can understand the data. Deals with the semantics because it change meaning, also deals with the syntax part. On receiving the receiver will decrypt the message to bring it to the original form to understand its meaning.

3. COMPRESSION:

Compression is reducing the number if bits. It can affect the file but is primarily concerned with the syntax because which bit should be reduced and then their organization and all that stuff, without having bigger impact on the real data or the meaning.

SESSION LAYER:

This layer establishes, maintains and synchronizes the connection among the communicating devices.

SERVICES OFFERED BY SESSION LAYER:

1. DIALOG CONTROL:

Session layer allows 2 systems to enter into a dialog.
Dialog:It is the coomunication between 2 processes to take place either in simplex, half duplex or full duplex.
This activity is called dialog control.

2. SESSION CREATION:

Session means a time dedicated to a particular activity. So here it means making connection between systems by sending syn, syn+ack and ack packets for session to be created, now communicationcan happen.

3. AUTHENTICATION:

If the session of a person is created, and he enter the correct credentials, then he will be allowed access or simply logged in based on the session. Session is mainly created when the person signs up.

4. AUTHORIZATION:

After authentication, the user is allowed to certain acts to which he can have access. Shortly, the acts he is authorized to do, not more than that.

5. SYNCHRONIZATION:

Synchroniztion means operation of 2 or more processess at the same time or rate. In networking it refers to the action of causing a set of data or files to remain identical in more than one location. Now here in session layer means creating checkpoints or synchronization points. Checkpoints are created when data is communicated and acknowledgement of each data upto the checkpoint is send back to sender independently so that in case of any failure the data need not to be sent all again. So here when one segment upto checkpoint is sent, it is synced in the device also. So no need to send all data, rather send it from that checkpoint at which the communication encountered any failure.

TRANSPORT LAYER:

This layer is responsible for process-to-process delivery of the entire message.

SERVICES OFFERERED BY TRANSPORT LAYER:

1. PORT ADDRESSING:

Port addressing means handovering the data to the right process.

2. SEGMENTATION AND REASSEMBLY:

Divding the big data into smaller parts and numbering it on the sender side to send it easily on the link. Reassembling is done on the receiver side to make the parts or the data again in the order to contruct the original message back.

3. END-TO-END FLOW CONTROL:

Speed matching mechanism between the sender and receiver.

4. CONNECTION CONTROL:

Desicion that whether the communicaton between the sender and the receiver will be connection oriented, i.e : connection will be established before sending the data or connectionless oriented, i.e : no connection will be formed before sending the data and data will be send. No connection actually means no preplanned route will be established.

5. ERROR CONTROL:

Checking whether the data encountered any error during transmission.

NETWORK LAYER:

This layer is responsible for delivery of data from source to destination network.

SERVICES OFFERED BY NETWORK LAYER:

1. ROUTING:

Finding a path for data transmission, especially the best path by the use of routing protocols.

2. LOGICAL ADDRESSING:

Attaching the IP Address to the data. Using the IP address routers will forward the data to the destination network.

DATA LINK LAYER:

This layer is responsible for moving the data (frames) from one node to another node. Here the header and trailer part is added to the data receivede from network layer. Header contains source and destination MAC address while trailer contain error related stuff.

SERVICES OFFERED BY DATA LINK LAYER:

1. FRAMING:

The data which is received from network layer is in the form of bits. Data link layer make groups of these bits of zeros and ones. This grouping is called framing and each individual group of zeros and ones is called framing.

2. PHYSICAL ADDRESSING:

It is the responsibility of the data link layer to add source and destination to the frames so that it can also help routes take decision in forwarding the frames.

3. ACCESS CONTROL:

If two devices are connected to a common link then data link layer protocols are necessary to determine which device has control over that link at that time but in case if the link is common one. This is called access control. Due to this service the physical address is called MAC address also.

4. FLOW AND ERROR CONTROL:

Flow control and error control sevices are also dealt by this layer.

PHYSICAL LAYER:

This layer is responsible for transmitting the bits over the medium. It also provide electrical and mechanical specifications. Deals with the harware devices and media that make up the network. Also converts the data link layer PDU to bits and then place it on the medium.

SERVICES OFFERED BY PHYSICAL LAYER:

1. PHYSICAL CHARACTERISTICS OF THE MEDIA:

Defines the type of media according that what kind of media is being used whethret it is wired or wireless to which it converts the data whether to electrical or light signals or waves etc.

2. ENCODING:

How the bits are going to be converted into signals or waves according to the media to which it is attached.

3. TRANSMISSION RATE:

How many bits per unit time are being sent over the media that what is the speed of bits moving in the media. It is also called data rate is also dealt by the physical layer.

4. SYNCHRONIZATION OF BITS:

It means the bits send first should be received 1st for example if someone send a message "Hi" and then he send "How are you", then the clock between the sender and the receiver must be synchronized in such a way that the message "Hi" get received first and then "How are you" and not the reverse.

5. PHYSICAL TOPOLOGY:

In physical topology, how devices are connected to make a network. So the topology is also identified by the physical layer. For example if the topology is mesh, it knows that the system can send data to all the other system through separate link for every node, likewise if it is bus, it foundsthat it can send data in two directions. So these physical topologies are addressed by the physical layer.

6. TRANSMISSION MODE:

It means how the communication is going to happen (Simplex, Half or full duplex). In dialog control it is decided and in physical layer it is actually applied.

7. LINE CONFIGURATION:

★ It refers to the way devices are attached to a link.
★ In a network, two or more nodes are connected by a communication link.
★ The communication link can be wired or wireless.
★ For visualization purpose, links are imagined as a line drawn between two points.
★ For communication to happen, two nodes must be connected to the same link at the same time.
★ This is called as line configuration or connection.
★ Simply the configuration of line that whether it is a point to point connection or multipoint connection.

TYPES OF LINE CONFIGURATION:

Line configuration can be :

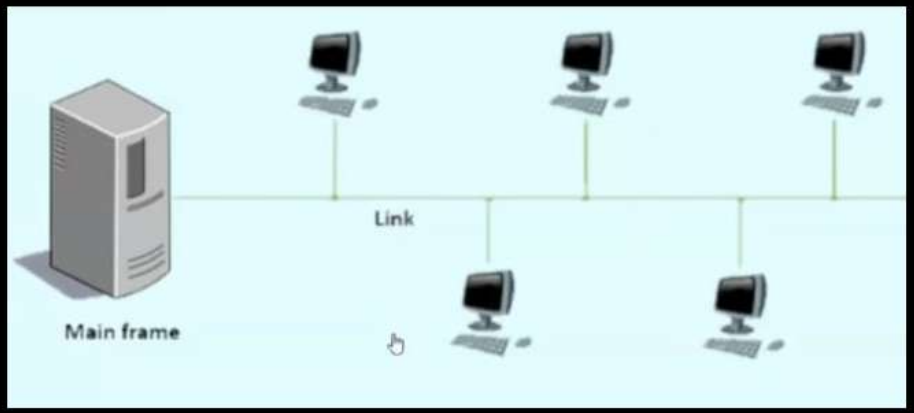
Point to point line configuration
Multipoint line configuration

a. POINT-TO-POINT CONNECTION:

★ A point-to-point connection provides a dedicated link between two devices.
★ The entire capacity of the link is reserved for transmission between those two devices.

b. MULTIPOINT CONNECTION:

★ It is also called Multidrop configuration or Broadcast connection.
★ In this connection, two or more devices share a single link.
★ Since more than two devices share the link, the capacity of the channel is shared now.
★ It can be spatial (All the nodes using the link at the same time) or temporal (every node uses the link on its own turn).



THE TCP/IP MODEL:

★ TCP/IP = Transmission Control Protocol/Internet Protocol.
★ The TCP/IP protocol suite was developed prior to the OSI model.
★ Therefore, the layers in the TCP/IP protocol suite do not exactly match those in the OSI model.
★ TCP/IP is a hierarchical protocol made up of interactive layers, each of which provides a specific functionality.
★ TCP/IP is the old version of OSI Model but today's TCP/IP is the updated version of OSI Model.
★ It has 4/5 Layers.
★ When the TCP/IP was implemented, it was found that the application, presentation and session layer of OSI Model does the functionality as to be compressed in one layer and same is the case with 1st layers in both the models.

LAYERS OF TCP/IP MODEL VS OSI MODEL:

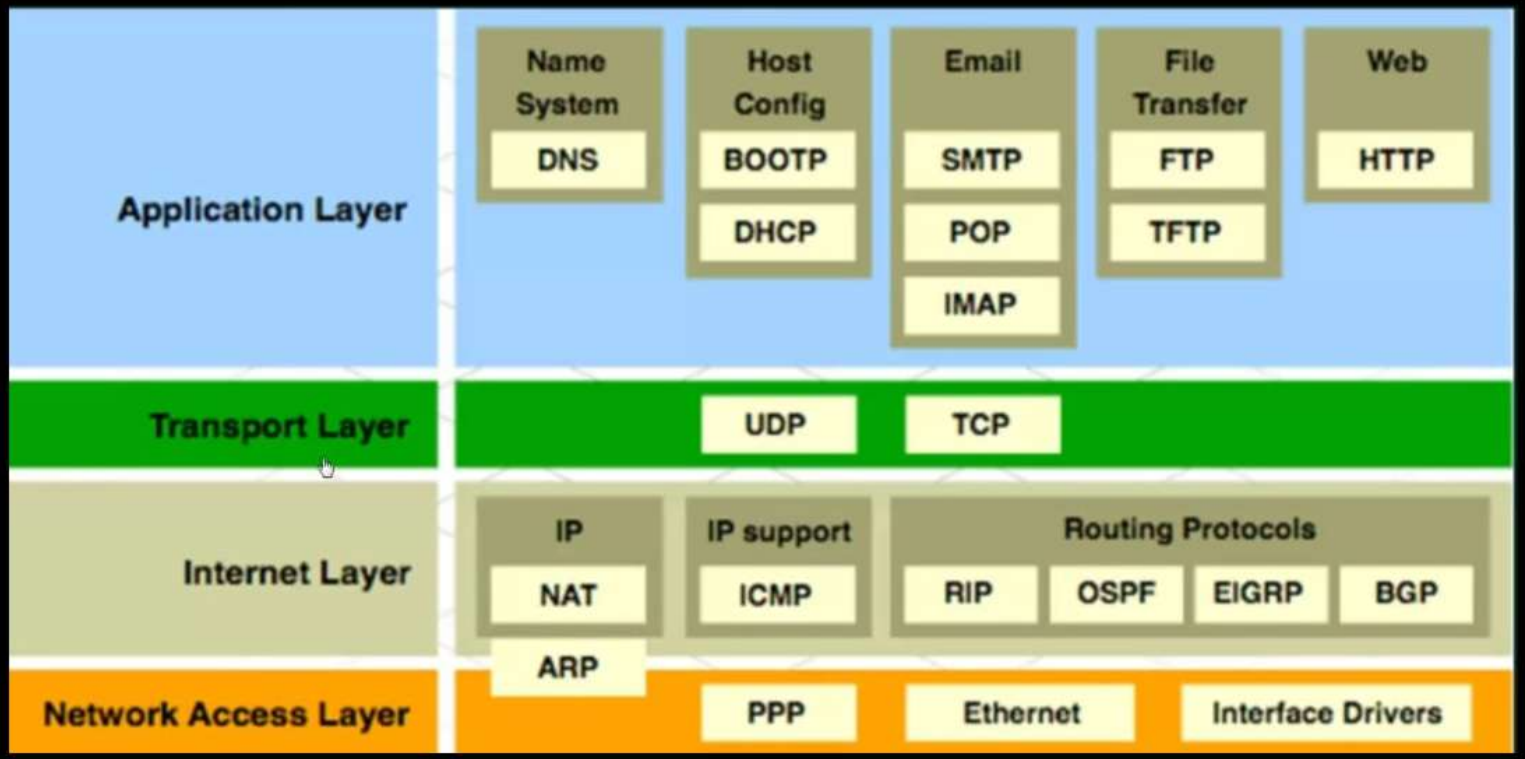
OSI Reference Model
Application Layer
Presentation Layer
Session Layer
Transport Layer
Network Layer
Data Link Layer
Physical Layer

TCP/IP 4 Layers Model
Application Layer
Transport Layer
Internet Layer
Network Access Layer

TCP/IP 5 Layers Model
Application Layer
Transport Layer
Internet Layer
Data Link Layer
Physical Layer

The functionality of TCP/IP and OSI Model are the same but just some layers are compressed because those layers have more related work.

IMPORTANT PROTOCOLS IN TCP/IP LAYERING:



PROTOCOL DATA UNIT (PDUs):

Protocol data units are named according to the protocols of the TCP/IP suite.

QUESTION:

Identify the correct LAYER-PDU pair in the following

A	B	C	D
Application - Data	Application - Data	Application - Data	Application - Data
Transport - Segment	Transport - Frame	Transport - Segment	Transport - Segment
Network - Frame	Network - Packet	Network - Frame	Network - Packet
Data Link - Packet	Data Link - Segement	Data Link - Packet	Data Link - Frame
Packet - Bit	Packet - Bit	Packet - Bit	Packet - Bit

SOLUTION:

NAMING OF PDUs OF DIFFERENT LAYERS:

- ☐ The application layer generates the data.
- ☐ It is then given to the transport layer where transport layer header is added to the data, The data wiith the transport layer header is now called as a Segment.
- ☐ Then after the addition of network layer information to the segment, the segment now becomes packet.
- ☐ After the addition of data link layer header and trailer to the packet, the packet is now called as frame
- ☐ Finally, at the physical layer the frames are converted into zeros and ones called bits.

So the correct option is D.

REALITY OF TCP/IP AND OSI MODEL:

Actually, the TCP/IP was created first. Then for understanding the network layers, OSI model was created so that people can create different applications according to the standard, to make them able to communicate with other applications or the same application that run on different operating systems. But it was not implemented and is used as reference model. It needed some updation which were made to it to make it a new TCP/IP and this TCP/IP is now used in the internet today.

BASIC NETWORKING COMMANDS:

- To see the IP configuration details, the command is "ipconfig". (Layer 3 information)
- To see the MAC Address, we can use the command "ipconfig/all". (Layer 2 information)
- To make dns reveal information for us, the command is "nslookup". Enter nslookup, hit enter, then name of the domain infront of > icon. By default it will convert the domain name to A record. i.e: IPV4 address.
- To see if the target is online or alive or reachable from our computer, the command is "ping" followed by domain name or IP address of the required target.
- To find details about the path that a packet takes from one device to another device. How many hops the packet takes or from how any routers the packet passes to reach the destination. We can use the command "tracert" in windows followed by target IP. This command takes maximum of 30 hops.