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Question: 1 (a) The Open System Interconnect (OSI) model is a conceptual framework that organizes the functionalities of any type of communication in a layered structure. The Data Link Layer transforms bit streams into data streams, and handles the sequential transmission of these frames by regulating flows and handling errors. Or if the Higher layers use services provided by lower layers, and interface with them via Protocol Data Units (PDUs). What if the Foregoing several of the intermediate layers, we encounter in order from top to bottom the Presentation Layer, Transport Layer, Data Link Layer, and Physical Layer. If none of the above then there is a case that OSI model was

introduced by the International Standards Organization (ISO). Argue the above case study and give your reasoning.

Answer 1 (a): A. The Data Link Layer transforms bit streams into data streams, and handles the sequential transmission of these frames by regulating flows and handling errors.

1 The Data link layer

The Data link layer describes the logical organization of data bits transmitted on a particular medium. **This layer defines the framing, addressing, and check-summing of Ethernet packets.** The main task of the Data link layer is to transform a raw transmission facility into a line that appears free of transmission errors in the Network layer. It accomplishes this task by having the sender break the input data up into data frames (typically, a few hundred bytes), transmit the frames sequentially, and process the acknowledgment frames sent back by the receiver.

2 Higher layers use services provided by lower layers, and interface with them via Protocol Data Units (PDUs).

In telecommunications, a **protocol data unit** (**PDU**) is a single unit of information transmitted among peer entities of a computer network. A PDU is composed of protocol-specific control information and user data. In the layered architectures of communication protocol stacks, each layer implements protocols tailored to the specific type or mode of data exchange.

For example, the Transmission Control Protocol (TCP) implements a connection-oriented transfer mode, and the PDU of this protocol is called a *segment*, while the User Datagram Protocol (UDP) uses datagrams as protocol data units for connectionless communication.

3 Foregoing several of the intermediate layers, we encounter in order from top to bottom the Presentation Layer, Transport Layer, Data Link Layer, and Physical Layer.

Data Link Layer

At the data link layer, directly connected nodes are used to perform node-to-node data transfer where data is packaged into frames. The data link layer also corrects errors that may have occurred at the physical layer.

The data link layer encompasses two sub-layers of its own. The first, media access control (MAC), provides flow control and multiplexing for device transmissions over a network. The second, the logical link control (LLC), provides flow and error control over the physical medium as well as identifies line protocol.

Network Layer

The network layer is responsible for receiving frames from the data link layer, and delivering them to their intended destinations among based on the addresses contained inside the frame. The network layer finds the destination by using logical addresses, such as IP (internet protocol). At this layer, routers are a crucial component used to quite literally route information where it needs to go between networks.

Transport Layer

The transport layer manages the delivery and error checking of data packets. It regulates the size, sequencing, and ultimately the transfer of data between systems and hosts. One of the most common examples of the transport layer is TCP or the Transmission Control Protocol.

Session Layer

The session layer controls the conversations between different computers. A session or connection between machines is set up, managed, and terminal at layer 5. Session layer services also include authentication and reconnections.

Presentation Layer

The presentation layer formats or translates data for the application layer based on the syntax or semantics that the application accepts. Because of this, it at times also called the syntax layer. This layer can also handle the encryption and decryption required by the application layer.

Application Layer

At this layer, both the end user and the application layer interact directly with the software application. This layer sees network services provided to end-user applications such as a web browser or Office 365. The application layer identifies communication partners, resource availability, and synchronizes communication.

4 The OSI model was introduced by the International Standards Organization (ISO).

Osi model:

Established in 1947, the International Standards Organization (ISO) is a multinational body dedicated to worldwide agreement on international standards. An ISO standard that covers all aspects of network communications is the Open Systems Interconnection (OSI) model. It was first introduced in the late 1970s

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Question 1 (b): Argue the advantages and disadvantages of combining the session, presentation, and application layer in the OSI model into one single application layer in the Internet model.

Answer: 1 (b)

The Advantages are:

- 1. Single layer to study as all the functionalities is provided at this layer.
- 2. Higher Bandwidth as number of layers is reduced.
- 3. It reflects the real-life separation of application from the TCP-downward sections of the OSI model.

- **The Disadvantages are :-**
- 1. Can make reasoning about the architecture of network systems less effective.
- 2). There will be security issues as the Network security and Application Security will open at a single point which may expose our network open to our threat.
- 3). It makes troubleshooting hard as multiple errors may reside at a single...

Explanation:

Combining of these layers will not affect their working capability as application layer will interact with the user requests, presentation layer works on encapsulation at sender side and DE capsulation at receiver side and session layer keep on eye on the amount of time spent to send the packet if connection drops in middle it indicates for the next time where exactly the session has been ended so these are all operation performed by these layer either in osi or in TCP/IP model in order to remember the layer they did only 4 layers where application layer holds presentation and session layer .

Question: 2 (a) There are several network layer models proposed in the OSI model. Find all of them. Explain the differences between them.

Answer: 2 (a):

All of the necessary and desirable operations required are grouped together in a logical sequence at each of the layers. Each layer is responsible for specific functions:

Layer 7 – **application**: This layer works with the application software to provide communications functions as required. It verifies the availability of a communications partner

and the resources to support any data transfer. It also works with end applications such as domain name service (DNS), file transfer protocol (FTP), hypertext transfer protocol (HTTP), Internet message access protocol (IMAP), post office protocol (POP), simple mail transfer protocol (SMTP), Tele net, and terminal emulation.

• Layer 6 – **presentation**: This layer checks the data to ensure that it is compatible with the communications resources. It ensures compatibility between the data formats at the applications level and the lower levels. It also handles any needed data formatting or code conversion, as well as data compression and encryption.

• Layer 5 – **session**: Layer 5 software handles authentication and authorization functions. It also manages the connection between the two communicating devices, establishing a connection, maintaining the connection, and ultimately terminating it. This layer verifies that the data is delivered as well.

• Layer 4 – **transport**: This layer provides quality of service (QoS) functions and ensures the complete delivery of the data. The integrity of the data is guaranteed at this layer via error correction and similar functions.

• Layer 3 – **network**: The network layer handles packet routing via logical addressing and switching functions.

• Layer 2 – **data link**: Layer 2 operations package and unpack the data in frames.

• Layer 1 – **physical**: This layer defines the logic levels, data rate, physical media, and data conversion functions that make up the bit stream of packets from one device to another.

There are two key points to make about the OSI model. First, the OSI model is just that, a model. Its use is not mandated for networking, yet most protocols and systems adhere to it quite closely. It is mainly useful for discussing, describing, and understanding individual network functions.

Second, not all layers are used in some simpler applications. While layers 1, 2, and 3 are mandatory for any data transmission, the application may use some unique interface layer to the application instead of the usual upper layers of the model.

TCP/IP

TCP/IP was developed during the 1960s as part of the Department of Defense's (DoD) Advanced Research Projects Agency (ARPA) effort to build a nationwide packet data network. It was first used in UNIX-based computers in universities and government installations. Today, it is the main protocol used in all Internet operations.

TCP/IP also is a layered protocol but does not use all of the OSI layers, though the layers are equivalent in operation and function. The network access layer is equivalent to OSI layers 1 and 2. The Internet Protocol layer is comparable to layer 3 in the OSI model. The host-to-host layer is equivalent to OSI layer 4. These are the TCP and UDP (user datagram protocol) functions. Finally, the application layer is similar to OSI layers 5, 6, and 7 combined.

Question: 2 (b) If a signal does not change at all, its frequency is zero. If a signal changes instantaneously, its frequency is infinite. Three components of a sine wave are amplitude, frequency and phase of a signal. The change in a signal shows the relation between signal's amplitude w.r.t to time whereas the phase is not shown. Explain your answer why we cannot explicitly show phase in a time-phase plot?

Answer: 2 (b): we cannot explicitly show phase in a time-phase plot because of Phase describes the position of the waveform relative to time 0. The **phase** involves the relationship between the position of the amplitude crests and troughs of two waveforms.

Question: 3 (a) four connections (10 Kbps, 100 Kbps, 1 Mbps and 10 Mbps) are multiplexed together. A unit is 1 byte or 8 bits. Find (a) the duration of 1 bit before multiplexing (b) the transmission rate of the link (c) the duration of a time slot and (d) the duration of a frame.

Solution:-

1. The duration of 1 bit is 1/1 Kbps, or 0.001 s (1 ms).

2. The rate of the link is 4 Kbps.

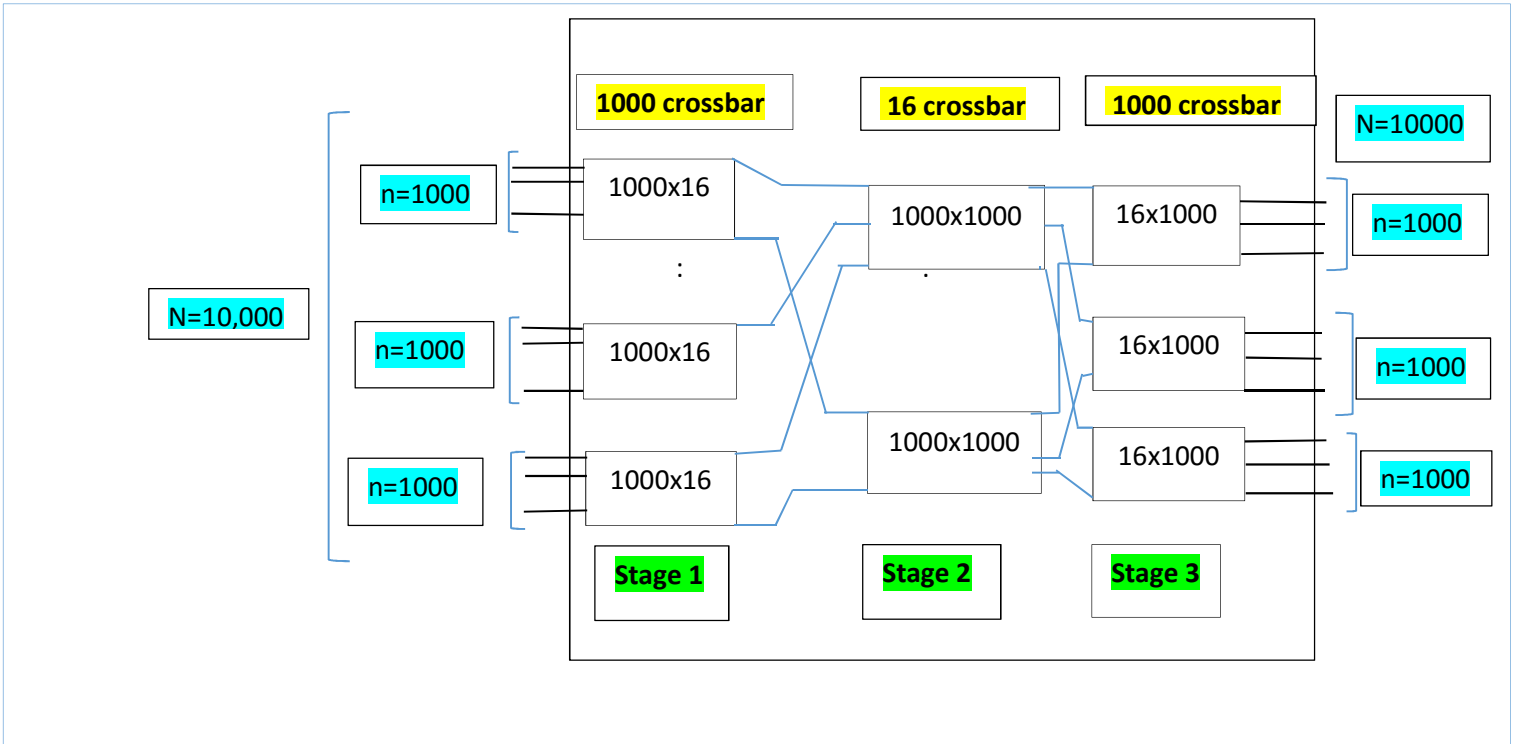
3. The duration of each time slot = 1/rate of Link = 1/4 ms or 250 m s.

4. The duration of a frame = 1/ frame rate = 1 ms.

Question: 3 (b) We need a three-stage space-division switch with total inputs of 10,000. We use 1000 crossbars at the first and third stages and 16 crossbars at the middle stage. a. Draw the configuration diagram. b. Calculate the total number of cross-points. c. Find the possible number of simultaneous connections. d. Find the possible number of simultaneous connections if we use one single crossbar (1000 x 1000). e. Find the blocking factor and the ratio of the number of connections in c and in d.

Solution:

a. Draw the configuration diagram.



b: **Calculate the total number of cross-point**

Total-cross- points are : -
=1000(1000*16)+16(1000*1000)+1000(16*1000)=

⇨ 16000000+16000000+16000000

⇨ 48000000

Total number of cross-point=48000000

c. Find the possible number of simultaneous connections.

Only 16 simultaneously connection are possible for each cross bar at the first stage. This means that the total number of connection is 16x1000=16000.

d. Find the possible number of simultaneous connections if we use one single crossbar (1000 x 1000).

If we use one cross bar (1000 x 1000), all input lines have the connection at the same time, which means 1000 simultaneous connections.

e. Find the blocking factor and the ratio of the number of connections in c and in d.

The blocking factor is 16000/1000=16% (percent)

Ratio of the number of connections in c and in d.

The ratio of connection of c and d is

c:d= 16:1

****** *The End* ******