

INSTRUCTOR:

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Question # 1 :-

The open system interconnect (OSI) model is a conceptual framework that organizes the functionalities of any type of

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Answer 01 :-

⇒ The Data link layer is responsible for moving frames from one hop (node) to next.

⇒ Data link layer performs the most reliable node to node delivery of data. it forms frames from the packets that are received from network layer and gives it to physical layer. it also synchronise the information which is to be transmitted

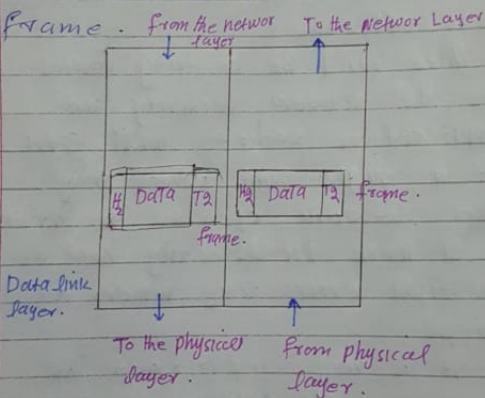
Function of Data link Layers:-

* Framing:- frames are the streams of Bits received from the network layer into manageable

data link units. This Division of stream of Bits is done by data link layer.

⇒ Physical Addressing :-

The data link layer adds a header to the frames in order to define physical address of the sender or Receiver of the frame.



⇒ Design issues with Data link Layer:-

→ The issue that arises in the data link layer is how to keep a fast transmitter from drawing a slow receiver in data.

→ Broadcast networks have an additional issue in the data link layer. How to control access to the shared channel. A special sublayer of the data link layer the modern Access Control (MAC).

Question # 1 (b)

b) Argue the advantage and disadvantage of combining the session, presentation and Application layer in the OSI model into one single application layer in the internet model.

ANSWER # 1 (b):-

⇒ Advantages:-

- single layer to study as all the functionalities provided at this layer.
- Higher Bandwidth as number of layers is reduced.
- mostly it simplifies the conceptual problem of having to deal with those things in the network

stack itself.

- The session and presentation layer are use might pop up But you should keep in it up.

⇒ Disadvantages :-

- Make reasoning about the architecture of network systems less effective.
- There will be security issues as the Network Security and Application. security will open at a single point which may our network open to ~~our~~ threat.
- It make troubleshooting hard as multiple errors may resides at single.
- It is very complex, and the initial implementation of OSI model is very complex and slow.

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Question # 2 (a).

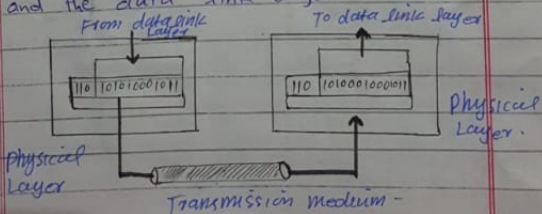
There are several network layer models proposed in the OSI model. Find all of them. Explain the difference between them.

ANSWER 2/ (a) :-

Different LAYERS in OSI Model:-

Physical Layer:-

The physical layer coordinates the functions required to carry a bit stream over a physical medium. It deals with the mechanical and electrical specifications of the interface and transmission medium. Shows the position of the physical layer with respect to the transmission medium and the data link layer.



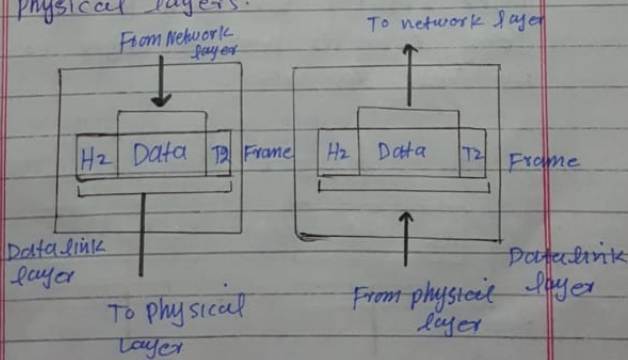
Physical Layer Performance :-

The Physical layer is responsible for movements of individual bits from one hop (node) to the next. Data rate, synchronization, line configuration, physical topology etc.

Data Link Layer :-

The data link layer transforms the physical layer, a raw transmission facility, to a reliable link. It makes the physical layer appear error-free to the upper layer (network layer).

Shows the relationship of the data link layer to the network and physical layers.



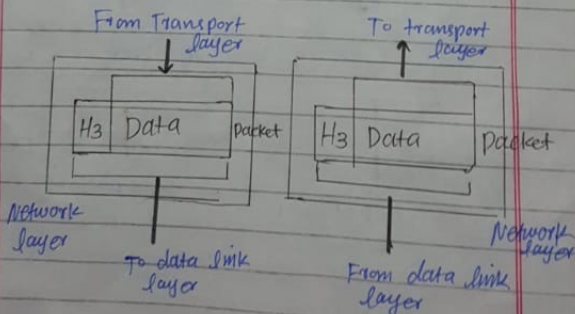
Data Link layer performance:-

The data link layer is responsible for moving frames from one hop (node) to the next.

- Framing, physical Addressing
- Flow control.
- Error control.
- Access control.

NETWORK layer:-

The network layer is responsible for the source-to-destination delivery of a packet, possibly across multiple networks (links). The network layer ensures that each packet gets from its point of origin to its final destination.



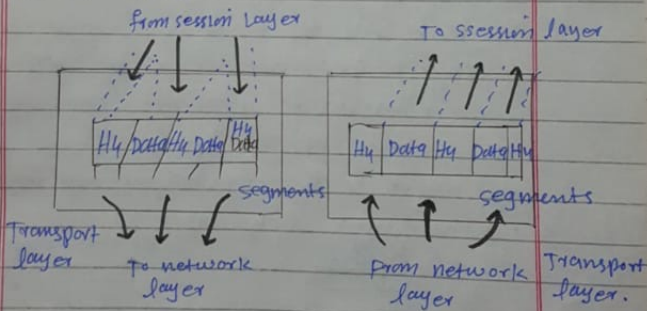
Network layer performance:-

The network layer is responsible for the delivery of individual packets from the source host to the destination host.

- Logical addressing
- Routing.

TRANSPORT Layer:-

The transport layer is responsible for process-to-process delivery of the entire message. A process is an application program running on a host.



TRANSPORT Layer performance:-

The transport layer is responsible for the delivery of a message from one process to another. Other responsibilities of the transport layer include:-

- service-point-addressing.
- segmentation and reassembly.
- connection control.
- Flow control.
- Error control.

SESSION Layer:-

The services provided by the first three layers (physical, data link and network) are not sufficient for some processes. The session layer is the network dialog controller. It establishes, maintains and synchronizes the interaction among communicating systems.

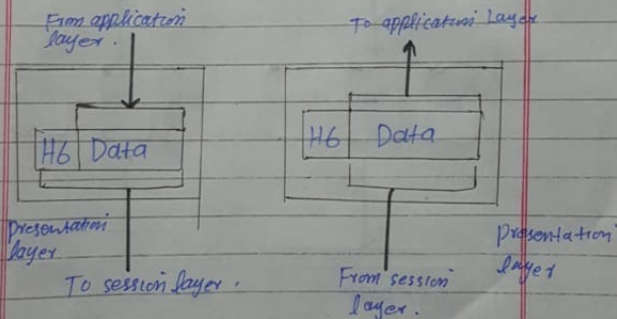
Session Layer performance:-

- The session layer is responsible for dialog control and synchronization.
- Dialog control.

- Synchronization.
- session Layer allows to check a process to add check point.

PRESENTATION Layer:-

The presentation layer is concerned with the syntax and semantics of the information exchanged b/w two systems. Shows the relationship between the presentation layer and the application and session layers.



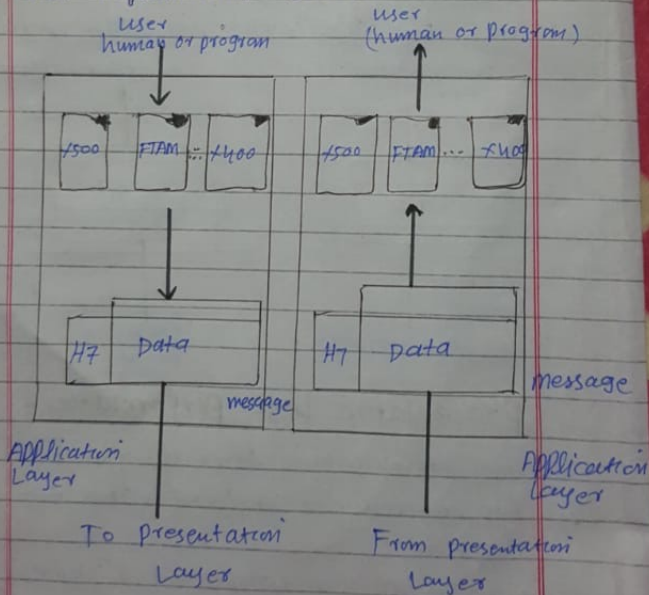
Presentation Layer performance:-

The presentation layer is responsible for translation, compression and encryption.

- Translation, compression & encryption

APPLICATION Layer:-

The application layer enables the user, whether human or software, to access the network. It provides user interfaces and support for services such as electronic mail, remote file access and transfer, shared, database management and other types of distributed information services.



Application Layer performance:-

The application layer is responsible for providing services to the user.

- Network virtual terminal.
- File transfer.
- mail services.
- Directory services.

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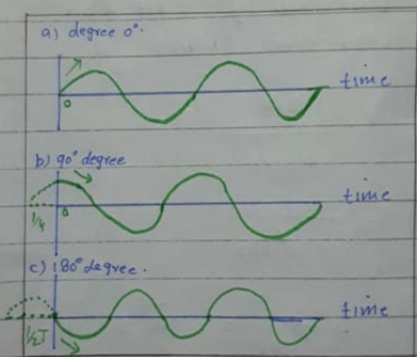
Question # 2 (b):-

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 b/w signals amplitude w.r.t to time where as the phase is not shown. Explain your answer why are we not explicitly show phase in a time-phase plot?

ANSWER # 2 (b): -

- Phase describes the position of the waveform relative to time 0.
- Phase time-plot show the wave as something that can be shifted backward or forward along the time axis, phase describes the amount of that shift.
- It indicates the status of the first cycle.

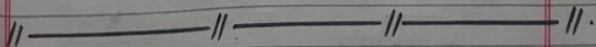


Three sine wave with the same amplitude and frequency, but different phases.

- ① A sine wave with a phase of 0° starts at time 0 with a zero amplitude. The amplitude is increasing.
- ② A sine wave with a phase of 90° starts at time 0 with a peak amplitude. The amplitude is decreasing.
- ③ A sine wave with a phase of 180° starts at time 0 with a zero amplitude. The amplitude is decreasing.

Some characteristic of phase plot: -

- phase is measured in degrees or radian [360° is 2π rad; 1° is $2\pi/360$ rad, and 1 rad is $360/2\pi$].
- A phase shift of 360° corresponds to a shift of a complete period:
- A phase shift of 180° corresponds to a shift of one-half of a period.
- phase shift of 90° corresponds to a shift of one-quarter of a period.



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

- The duration of 1 bit before multiplexing.
- The transmission rate of the link.
- The duration of a time slot.
- The duration of a frame.

ANSWER # 3 (a):-

- The duration of 1 bit before multiplexing:-

The duration of 1 bit as for 10 kbps as follow:

$$\frac{\text{Unit bit}}{\text{individual connection}} = \text{multiplexing}$$

So,

$$= \frac{1}{10 \text{ kbps}}$$

$$= \frac{1}{10,000 \text{ bps}} = \boxed{0.0001 \text{ s}}$$

$$= \boxed{1 \text{ ms}} \quad \text{(OR) Ans}$$

The duration of 1 bit for connection 100kbps as :

$$= \frac{1 \text{ bit}}{100 \text{ kbps}}$$

$$= \frac{1 \text{ bit}}{100,000 \text{ bps}}$$

$$= \boxed{0.00001 \text{ s}} \text{ Ans:}$$

The duration of 1 bit for connection 1mbps as :

$$= \frac{1 \text{ bit}}{1 \text{ mbps}}$$

$$= \frac{1}{1 \times 10^6 \text{ bps}}$$

$$= \frac{1}{10^6 \text{ bps}} = 10^{-6} \text{ s}$$

$$= \boxed{1 \mu\text{s}} \text{ Ans:}$$

The duration of 1 bit for connection 10 mbps as :

$$= \frac{1 \text{ bit}}{10 \text{ mbps}}$$

$$= \frac{1}{10 \times 10^6 \text{ bps}}$$

$$= \frac{1}{1 \times 10^7 \text{ bps}}$$

$$= 1 \times 10^{-7} \text{ s}$$

$$= \boxed{10 \times 10^{-8} \text{ s}} \text{ } \xrightarrow{\text{Ans}} \text{ (OR)}$$

(b) The transmission rate of link as :

The rate of the link is 4-times
The rate of a connection or 4kbps.

(c) The duration of a time slot as :

The duration of each time slot is one-fourth of the duration of each bit before multiplexing, or $\frac{1}{4} \mu\text{s}$ or 250 ns . NOTE that we can also calculate this

from the data rate of the link, 4 kbps. The bit duration is the inverse of the data rate or $\frac{1}{4 \text{ kbps}}$ or 250 μs .

d) The duration of a frame:

The duration of a frame is always the same as the duration of a unit before multiplexing. or 1 ms. we can also calculate this in another way. Each frame in this case has four (4) time slots, so the duration of a frame is 4-times 250 μs or 1 ms.

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Question #03 (b): -

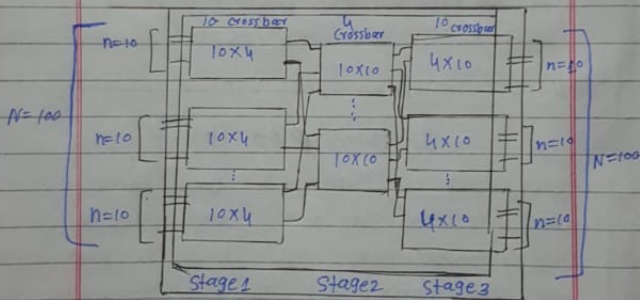
We need a three-stage space-division switch with total inputs of 10,000. We use 1000 crossbars at the first and third stages and 16 crossbars at the middle stage.

- (a) Draw the configuration diagram.
- (b) calculate the total number of crosspoints.

- (c) Find the possible number of simultaneous connections.
- (d) Find the possible number of simultaneous connection if we use one single crossbar (1000x1000).
- (e) Find the blocking factor and the ratio of the number of connections in (c) and in (d).

ANSWER # 3 (b) :-

- (a) Draw the configuration diagram:



- (b) The total number of crosspoints
 $= 10(10 \times 4) + 4(10 \times 10) + 10(4 \times 10)$
 $= 1200$

(c) only four simultaneous connections are possible for each crossbar at the first stage. This means that the total number of simultaneous connections is $4 \times 10 = 40$.

(d) If we use one crossbar (100x100) all inputs lines can have a connections at the same time, which means 100 simultaneous connections.

(e) The blocking factor is $40/100$ or 40 percent
(OR) 40%.