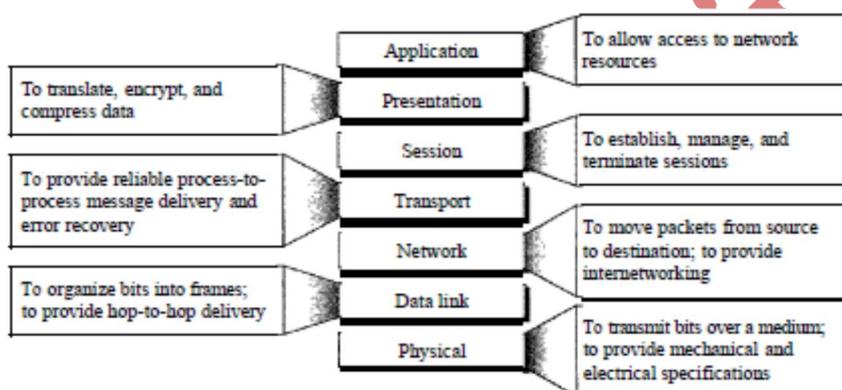


## CHAPTER 2:- NETWORK MODELS

### 1. Explain ISO OSIRM model?

Ans.

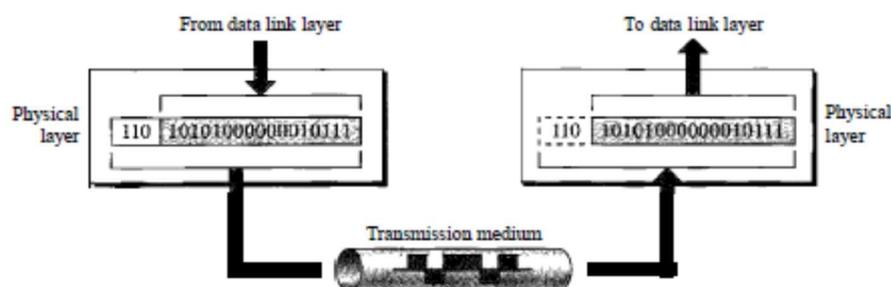
- I. An ISO (International Standards Organization) standard that covers all aspects of network communications is the Open Systems Interconnection Reference Model (OSIRM).
- II. An open system is a set of protocols that allows any two different systems to communicate regardless of their underlying architecture.
- III. 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.
- IV. The OSI model is not a Protocol, it is a model for understanding and designing a network architecture that is flexible, robust, and interoperable.
- V. The OSI model is a layered framework for the design of network systems that allows communication between all types of computer systems.
- VI. It consists of seven separate but related layers, each of which defines a part of the process of moving information across a network.



### 2.What are the responsibilities of PHYSICAL layer?

Ans. 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. It also defines the procedures and functions that physical devices and interfaces have to perform for transmission to occur.



The physical layer also concerned with the following responsibilities:-

#### I. Physical characteristics of interfaces and medium-

The physical layer defines the characteristics of the interface between the devices and the transmission medium.

It also defines the type of transmission medium.

II. **Representation of bits-**

The physical layer data consists of a stream of bits (sequence of 0s or 1s) with no interpretation.

To be transmitted, bits must be encoded into signals--electrical or optical.

The physical layer defines the type of encoding (how 0s and 1s are changed to signals).

III. **Data rate-**

The physical layer defines the duration of a bit, which is how long it lasts.

IV. **Synchronization of bits-**

The sender and receiver not only must use the same bit rate but also must be synchronized at the bit level.

The sender and the receiver clocks must be synchronized.

V. **Line configuration-**

The physical layer is concerned with the connection of devices to the media.

In a point-to-point configuration, two devices are connected through a dedicated link.

In a multipoint configuration, a link is shared among several devices.

VI. **Physical topology-**

The physical topology defines how devices are connected to make a network.

Devices can be connected by using a *mesh topology*, *star topology*, *ring topology*, *bus topology* or *hybrid topology*.

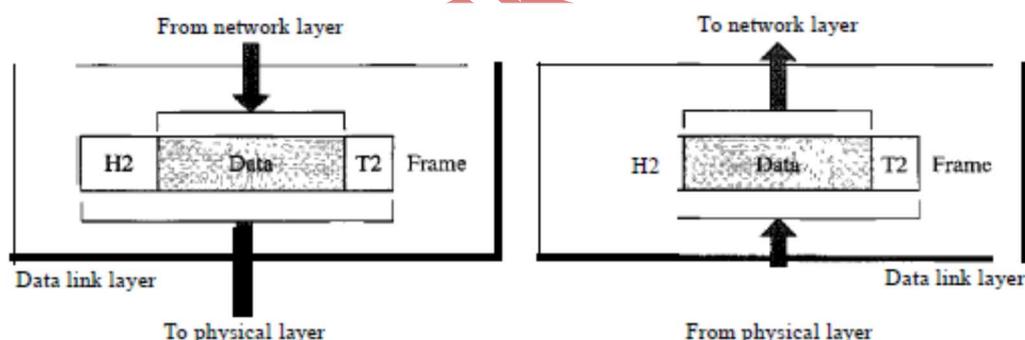
VII. **Transmission mode -**

The physical layer also defines the direction of transmission between two devices: *simplex*, *half-duplex*, or *full-duplex*.

### 3.What are the responsibilities of DATA LINK layer?

Ans. The data link layer makes the physical layer appear error-free to the upper layer (network layer).

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

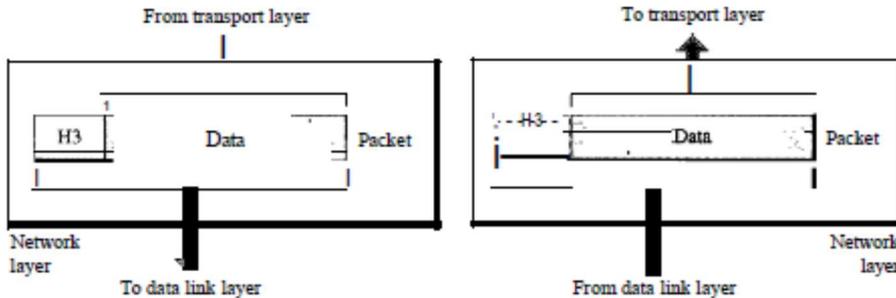


Other responsibilities of the data link layer include the following:-

- I. **Framing-** The data link layer divides the stream of bits received from the network layer into manageable data units called frames.
- II. **Physical addressing-** If frames are to be distributed to different systems on the network, the data link layer adds a header to the frame to define the sender and/or receiver of the frame.
- III. **Flow control -** If the rate at which the data are absorbed by the receiver is less than the rate at which data are produced in the sender, the data link layer imposes a flow control mechanism to avoid overwhelming the receiver.
- IV. **Error control-** The data link layer adds reliability by adding mechanisms to detect and retransmit damaged or lost frames.  
It also uses a mechanism to recognize duplicate frames. Error control is normally achieved through a trailer added to the end of the frame.
- V. **Access control -** When two or more devices are connected to the same link, data link layer protocols are necessary to determine which device has control over the link at any given time.

**4.What are the responsibilities of NETWORK layer?**

Ans.The network layer is responsible for the source-to-destination delivery of a packet, possibly across multiple networks (links).there is often a need for the network layer to accomplish source-to-destination delivery.

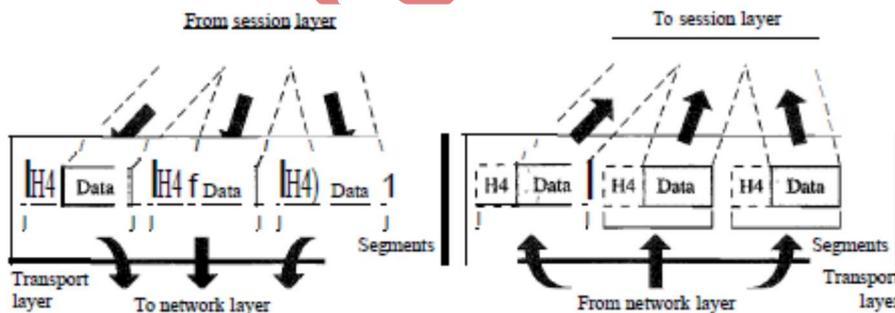


Other responsibilities of the network layer include the following:-

- I. **Delivery** :The network layer is responsible for the delivery of individual packets from the source host to the destination host.
- II. **Logical addressing**.  
The network layer adds a header to the packet coming from the upper layer that, includes the logical addresses of the sender and receiver.
- III. **Routing**. When independent networks or links are connected to create *inter-networks* (network of networks) or a large network, the connecting devices (called *routers* or *switches*) route or switch the packets to their final destination.  
Routing is performed at network layer.

**5.What are the responsibilities of TRANSPORT layer?**

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



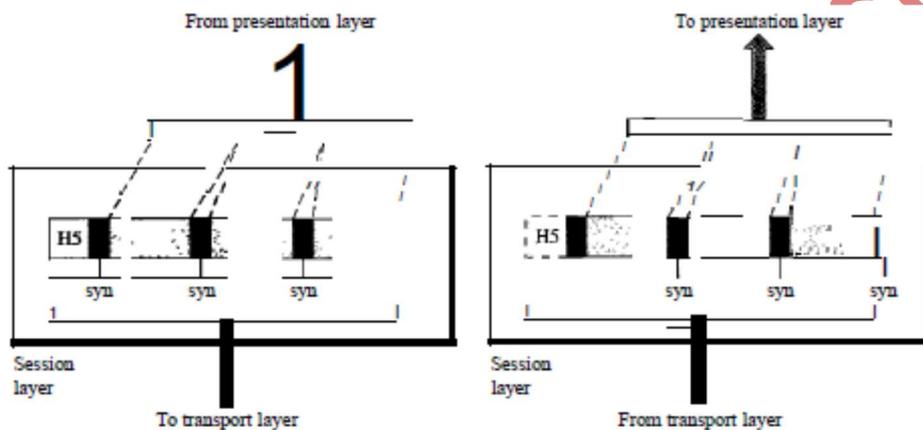
Other responsibilities of the transport layer include the following:-

- I. **Service-point addressing**- Computers often run several programs at the same time. Transport layer delivery means delivery from a specific process (running program) on one computer to a specific process (running program) on the other.  
The transport layer header include a address called a *service-point address* (or port address).  
The transport layer gets the entire message to the correct process on that computer.
- II. **Segmentation and reassembly**- A message is divided into transmittable segments, with each segment containing a sequence number. These numbers enable the transport layer to reassemble the message correctly upon arriving at the destination and to identify and replace packets that were lost in transmission.

- III. **Connection control-** The transport layer can be either connectionless or connection-oriented. A connectionless transport layer treats each segment as an independent packet and delivers it to the transport layer at the destination machine.  
A connection-oriented transport layer makes a connection with the transport layer at the destination machine first before delivering the packets.  
After all the data are transferred, the connection is terminated.
- IV. **Flow control.** Like the data link layer, the transport layer is responsible for flow control. However, flow control at this layer is performed end to end rather than across a single link.
- V. **Error control.** Like the data link layer, the transport layer is responsible for error control. Error control at this layer is performed process-to-process rather than across a single link.

**6.What are the responsibilities of SESSION layer?**

Ans. 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.



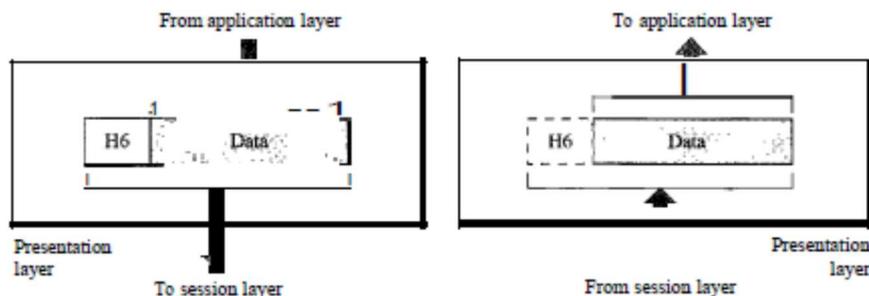
Specific responsibilities of the session layer include the following:-

The session layer is responsible for dialog control and synchronization.

- I. **Dialog control-** The session layer allows two systems to enter into a dialog. It allows the communication between two processes to take place in either half duplex (one way at a time) or full-duplex (two ways at a time) mode.
- II. **Synchronization-** The session layer allows a process to add checkpoints, or synchronization points, to a stream of data. For example, if a system is sending a file of 2000 pages, it is advisable to insert checkpoints after every 100 pages to ensure that each 100-page unit is received and acknowledged independently.

**7.What are the responsibilities of PESENTATION layer?**

Ans. The presentation layer is concerned with the syntax and semantics of the information exchanged between two systems.



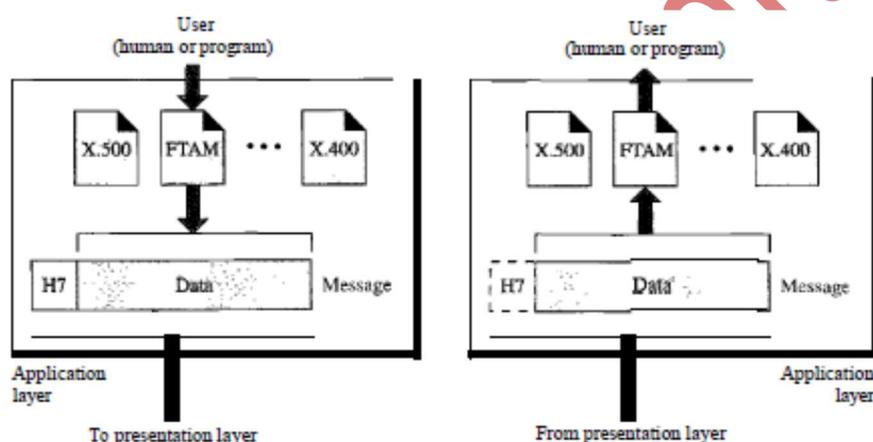
Specific responsibilities of the presentation layer include the following:

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

- I. **Translation-** Different computers use different encoding systems, the presentation layer is responsible for interoperability between these different encoding methods. The presentation layer at the sender changes the information from its sender-dependent format into a common format. The presentation layer at the receiving machine changes the common format into its receiver-dependent format.
- II. **Encryption-** To carry sensitive information, a system must be able to ensure privacy. Encryption means that the sender transforms the original information to another form and sends the resulting message out over the network. Decryption reverses the original process to transform the message back to its original form.
- III. **Compression-** Data compression reduces the number of bits contained in their formation. Data compression becomes particularly important in the transmission of multimedia such as text, audio, and video.

### 8.What are the responsibilities of APPLICATION layer?

*Ans.* 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.



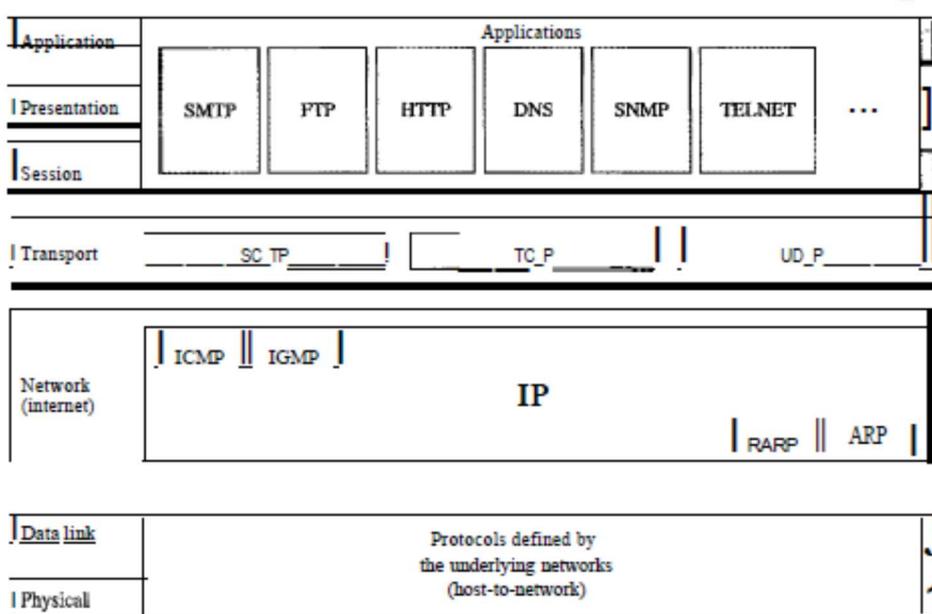
Specific services provided by the application layer include the following:

- I. **Network virtual terminal-** A network virtual terminal is a software version of a physical terminal, and it allows a user to log on to a remote host. To do so, the application creates a software emulation of a terminal at the remote host. The user's computer talks to the software terminal which, in turn, talks to the host, and vice versa. The remote host believes it is communicating with one of its own terminals and allows the user to log on.
- II. **File transfer, access, and management-** This application allows a user to access files in a remote host (to make changes or read data), to retrieve files from a remote computer for use in the local computer, and to manage or control files in a remote computer locally.
- III. **Mail services-** This application provides the basis for e-mail forwarding and storage.
- IV. **Directory services-** This application provides distributed database sources and access for global information about various objects and services.

### 9. Explain TCP/IP Protocol suite?

Ans.

- I. The layers in the TCP/IP protocol suite do not exactly match those in the OSI model.
- II. When TCP/IP is compared to OSI, we can say that the host-to-network layer is equivalent to the combination of the physical and data link layers. The internet layer is equivalent to the network layer, and the application layer is roughly doing the job of the session, presentation, and application layers with the transport layer in TCPIIP taking care of part of the duties of the session layer.
- III. The TCPIIP protocol suite is made of five layers: **physical, data link, network, transport, and application**. The first four layers provide physical standards, network interfaces, internetworking, and transport functions that correspond to the first four layers of the OSI model. The three topmost layers in the OSI model, however, are represented in TCP/IP by a single layer called the *application layer*.
- IV. *TCP/IP* is a hierarchical protocol made up of interactive modules, each of which provides a specific functionality.



TCPIIP and OSI model

### 10. List & Explain the Protocols used in Network Layer?

Ans. At the network layer, *TCP/IP* supports the Internetworking Protocol(IP), in turn, uses **four** supporting protocols: **ARP, RARP, ICMP, and IGMP**.

#### **Internetworking Protocol (IP):-**

- i. The Internetworking Protocol (IP) is the transmission mechanism used by the TCP/IP protocols.
- ii. IP transports data in packets called *datagrams*, each of which is transported separately. The limited functionality of IP should not be considered a weakness, however. IP provides bare-bones transmission functions that free the user to add only those facilities necessary for a given application and thereby allows for maximum efficiency.

#### **Address Resolution Protocol:-**

The Address Resolution Protocol (ARP) is used to associate a logical address with a physical address. On a typical physical network, such as a LAN, each device on a link is identified by a physical or station address, usually imprinted on the network interface card (NIC). ARP is used to find the physical address of the node when its Internet address is known.

#### **Reverse Address Resolution Protocol:-**

The Reverse Address Resolution Protocol (RARP) allows a host to discover its Internet address when it knows only its physical address. It is used when a computer is connected to a network for the first time or when a diskless computer is booted.

**Internet Control Message Protocol:-**

The Internet Control Message Protocol (ICMP) is a mechanism used by hosts and gateways to send notification of datagram problems back to the sender. ICMP sends query and error reporting messages.

**Internet Group Message Protocol:-**

The Internet Group Message Protocol (IGMP) is used to facilitate the simultaneous transmission of a message to a group of recipients.

**11. List & Explain the Protocols used in Transport Layer?**

*Ans.* The Transport layer mainly consists of three protocols which help at transport level of a data packet. Protocols included in this layer are as follows:-

**User Datagram Protocol:-**

The User Datagram Protocol (UDP) is the simpler of the two standard TCPIIP transport protocols. It is a process-to-process protocol that adds only port addresses, checksum error control, and length information to the data from the upper layer.

**Transmission Control Protocol:-**

The Transmission Control Protocol (TCP) provides full transport-layer services to applications. TCP is a reliable stream transport protocol. The term *stream*, in this context, means connection-oriented: A connection must be established between both ends of a transmission before either can transmit data.

**Stream Control Transmission Protocol:-**

The Stream Control Transmission Protocol (SCTP) provides support for newer applications such as voice over the Internet. It is a transport layer protocol that combines the best features of UDP and TCP.

**12. List and explain the 4 level of address used in TCP/IP Protocol?**

*Ans.* Four levels of addresses are used in an internet employing the *TCP/IP* protocols: physical (link) addresses, logical (IP) addresses, port addresses, and specific addresses.

**1. Physical Addresses (MAC address):-**

The physical address, also known as the link address, is the address of a node as defined by its LAN or WAN. It is included in the frame used by the data link layer. It is the lowest-level address.

**2. Logical Addresses (IP address):-**

Logical addresses are necessary for universal communications that are independent of underlying physical networks. Physical addresses are not adequate in an internetwork environment where different networks can have different address formats. A universal addressing system is needed in which each host can be identified uniquely, regardless of the underlying physical network.

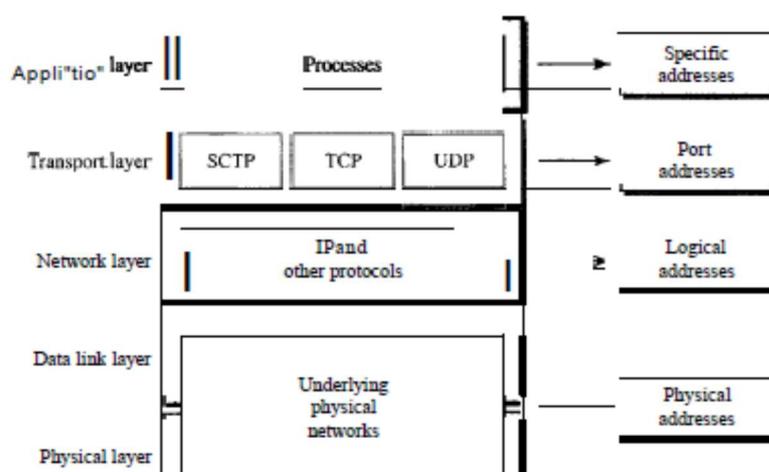
**3. Port Addresses:-**

In the TCPIIP architecture, the label assigned to a process is called a port address. A port address in TCPIIP is 16 bits in length. For example, computer A can communicate with computer C by using TELNET. At the same time, computer A communicates with computer B by using the File Transfer Protocol (FTP). For these processes to receive data simultaneously, we need a method to label the different processes. In other words, they need addresses.

**4. Specific Addresses:-**

Some applications have user-friendly addresses that are designed for that specific address. Examples include the e-mail address (for example, forouzan@fhda.edu) and the Universal Resource Locator (URL) (for example, www.mhhe.com). The first defines the recipient of an

e-mail, the second is used to find a document on the World Wide Web. These addresses, however, get changed to the corresponding port and logical addresses by the sending computer.



13. Match the following to one or more layers of the OSI model:

- a. Communicates directly with user's application program- Application layer.
- b. Error correction and retransmission- Data-link layer and Transport layer.
- c. Mechanical, electrical, and functional interface- Physical layer.
- d. Responsibility for carrying frames between adjacent nodes- Data-link layer.

14. Match the following to one or more layers of the OSI model:

- a. Establishes, manages, and terminates sessions- Session layer.
- b. Format and code conversion services- Presentation layer.
- c. Ensures reliable transmission of data- Transport layer.
- d. Log-in and log-out procedures- Session layer.
- e. Provides independence from differences in data representation- Presentation layer.

15. Match the following to one or more layers of the OSI model:

- a. Flow control- Data-link layer and Transport layer.
- b. Route determination- Network layer.
- c. Provides access for the end user- Application layer.
- d. Interface to transmission data- Data-link layer.

16. Match the following to one or more layers of the OSI model:

- a. Transmission of bit stream across physical medium- Physical layer.
- b. Defines frames- Data-link layer.
- c. Reliable process-to-process message delivery- Transport layer.
- d. Route selection- Network layer.
- e. Provides user services such as e-mail and file transfer- Application layer.