NIELIT GORAKHPUR

Course Name: O Level (2nd Sem) **Subject:** Introduction to ICT Resources
Topic: Computer Network – Network Model(Part 2) **Date:** 24-06-2020

Computer Network

Network Model

1. Open System Interconnection (OSI) Model

The OSI model was developed to standardize the procedures for exchange of information between processing systems. The OSI is a communication reference model that has been defined by the International Standards Organization (ISO). It is a seven layer communication protocol intended as a standard for the development of communications systems worldwide.

Most vendors and suppliers of computer communication equipment have agreed to support OSI in one form or another. Adherence to this standard is vital in order to achieve smooth universal communications. This model conceptually organizes the process of communications between computers in terms of seven layers, called **Protocol Stacks**. The seven layers of the OSI model provide a way for you to understand how communications across various protocols take place.

Protocol Stacks
"A protocol stack is a group of rules or procedures, called protocols, arranged on top of each other as part of a communication process. Each layer of the OSI model has different protocols associated with it. When more than one protocol is needed to complete a communication process, the protocols are grouped together in a stack. A popular protocol stack is TCP/IP, which is widely used for UNIX and the Internet. Each layer in the protocol stack receives services from the layer below it and provides services to the layer above it. That means, layer N uses the services of the layer below it (layer N-l) and provides services to the layer above it (layer N+l). For two computers to communicate, the same protocol stacks must be running on each computer. Each layer of the protocol stack on one computer communicates with its equivalent, or peer, on the other computer. The entities comprising the corresponding layers on different machines are called peers."

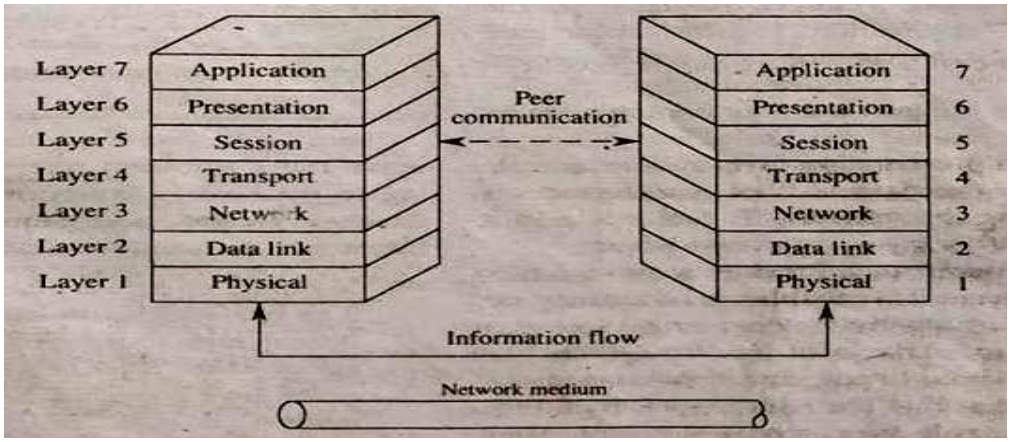

Figure: Peer to Peer communication between two computers

Let's describe these seven layers.

Layer 1 — Physical Layer

The physical layer defines the actual set of wires, plugs and electrical signals that connect the sending and receiving devices to the network. A physical layer makes a physical circuit with electrical, optical or radio signals, passive hubs, simplex active hubs, terminators, couplers, cables, connectors, repeaters, multiplexers, transmitters, receivers, and trans-receivers are devices associated with the physical layer.

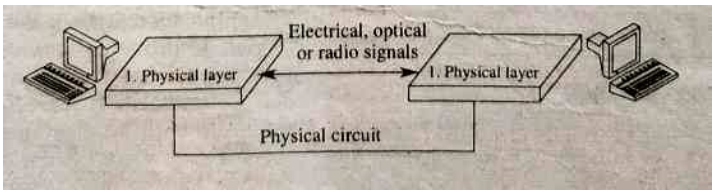

Figure: Physical layer

Layer 2 — Data link Layer

The data link layer is responsible for gaining access to the network and transmitting the physical block of data from one device to another. It includes the error checking necessary to ensure an accurate transmission. This layer uses the communications protocol that is most commonly referenced and often implies the specifications for Layer 1 as well.

Layer 3 — Network Layer

The network layer makes routing decisions and forwards packets for devices that are farther away than a single link. A link connects two network devices and is implemented by the data link layer. Two devices connected by a link communicate directly with each other and not through a third device. In larger networks, there may be intermediate systems between any two end-systems, and the network layer makes it possible for the transport layer and layers above it to send packets without being concerned about whether the end system is immediately adjacent or several hops away.

The network layer translates logical network addresses into physical machine addresses. This layer also determines the quality of service (namely, priority of the message) and the route a message will take out of the several ways a message can take to get to its destination.
The network layer may also break large packets into smaller chunks if the packet is larger than the largest data frame the data link layer will accept. The network reassembles the chunks into packets at the receiving end.

The network layer performs several important functions that enable data to arrive at its destination. The protocols at this layer may choose a specific route through an internetwork to avoid the excess traffic caused by sending data over networks and segments that do not need access to it. Routers and gateways operate in the network layer.

Layer 4 — Transport Layer

Layer 4 is the transport layer breaks large messages from the session layer into packets to be sent to the destination computer and reassembles packets into messages to be presented to the session layer. The transport layer typically sends an acknowledgment to the originator for messages received.

Layer 5 — Session Layer

Layer 5 establishes and terminates the session, queues of the incoming messages and is responsible for recovering from an abnormally terminated session. This layer allows applications on separate computers to share a connection called a session. This layer provides services, such as name lookup and security to allow two programs to find each other and establish the

communication link. The session layer also provides for data synchronization and check-points so that in the event of a network failure, only the data sent after the point of failure need be re-sent. The session layer also controls the dialog between two processes determining whom they can transmit and from whom can they receive at what point during the communication.
The session layer provides for dialog between application programs.

Layer 6- Presentation Layer

The presentation layer translates data between the formats the network requires and the formats the computer expects. The presentation layer does protocol conversion, data translation, compression and encryption, character set conversion, and the interpretation of graphics commands. A network redirector is what makes the files on a file server visible to the client computer. The network redirector also makes remote printers act as though they are attached to the local computer. It operates at the presentation layer. The presentation layer adapts information to the local environment.

Layer 7 - Application Layer

The application layer is the topmost layer of the OSI model. It provides services that directly support user applications, such as database access, e-mail, and file transfers. It also allows applications to communicate with applications on other computers as though they were on the same computer. When a programmer writes an application program that uses network services, it is this layer that the application program will access. Electronic mail and query languages are examples of this layer. The application layer provides for the connect ion of application programs on separate machines.

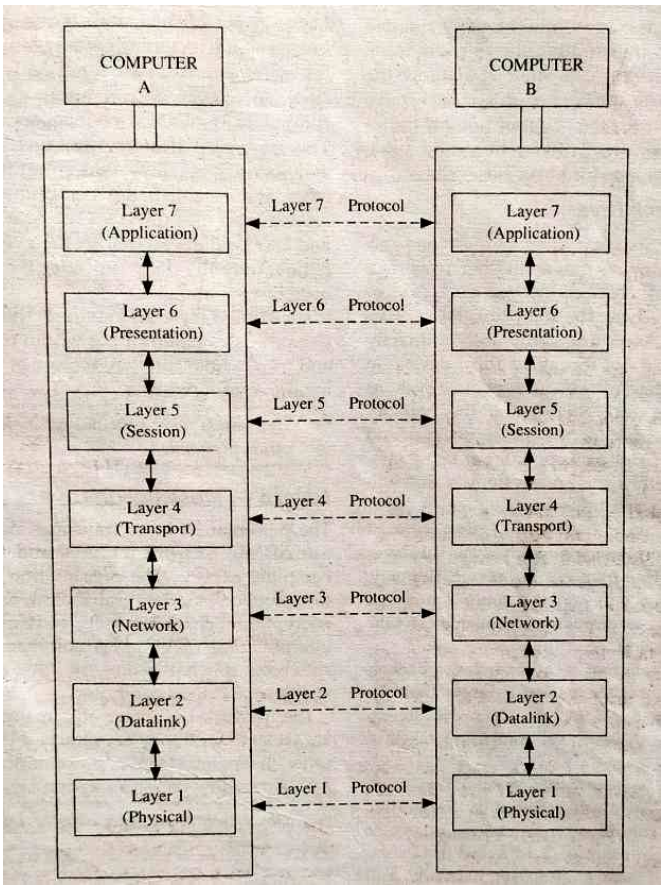

Figure: The International Standards Organization's (ISO) seven layers of control for open systems

A summary of functions performed by different layers in the OSI model is given in following Table

Layer Number	Layer Name	Description
7	Application layer	Interfaces user applications with network functionality, controls how applications access the network, and generates error messages. Protocols at this level include - HTTP, FTP, SMTP and NFS.

6	Presentation layer	Translates data to be transmitted by applications into a format suitable for transport over the network. Redirector software, such as the Workstation service for Microsoft Windows 2000, is located at this level. Network shells are also defined at this layer.
5	Session layer	Defines how connections can be established, maintained and terminated. Also performs name resolution functions.
4	Transport layer	Sequences packets so that they can be reassembled at the destination in' the proper order. Generates acknowledgments and retransmits packets. Assembles packets after they are received.
3	Network layer	Defines logical host addresses such as IP addresses, creates packet headers, and routes packets across an internetwork using routers and Layer 3 switches, strips the headers from the packets at the receiving end.
2	Data link layer	Specifies how data bits are grouped into frames, and specifies frame formats. Responsible for error correction, flow control, hardware addressing (such as MAC addresses), and how devices such as hubs, bridges, repeaters and Layer 2 switches operate. The Project 802 specifications divide this layer into two sub-layers, the logical link control (LLC) layer and the media access control (MAC) layer.
1	Physical layer	Defines network transmission media, signaling methods, bit synchronization, architecture (such as Ethernet or Token Ring), and cabling topologies. Defines how network interface cards (NICs) interact with the media (cabling). You can think of each layer as being logically connected to the same layer on a different computer on the network. For example, the application layer on one machine communicates with the application layer on another machine. But this communication is logical only; physical communication occurs when packets of data are sent down from the application layer of the transmitting computer, encapsulated with header information by each lower layer, and then put on the wire at the physical layer of the transmitting computer. After traveling along the wire, the packets are picked up by the physical layer of the receiving computer, passed up the seven layers while each layer strips off its associated header information and then passes to the application layer of the receiving computer, where the receiving application can process the data.

Exercise:

1: What is Open System Interconnection model?
2: How many layers in OSI model?
3: What is protocol stack?
4: Write Comparison between transport and network layer.
5: Write short note on physical layer responsibility in OSI model.