Study and Analysis Of "OSI, TCP-IP AND IPX-SPX" Models

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Abstract:
The purpose of this paper is to analyze and compare the models of OSI, TCP-IP and IPX-SPX layers and to identify the types of protocols used in these models and their applications. Moreover, this paper will explain the functions of each layer and mechanisms of data transfer.

Keywords: OSI Layer, TCP-IP Layer, IPX-SPX Layer, Application of Internet Protocol

1. Open System:
Initially, computer systems were classified into open systems, which we could deal with while closed systems were the systems that were reserved to the manufacturer, but there had to be standards that allow the devices to be compatible with each other. The standards are grouped into two groups.

- OSI "Open System Interconnection" or "Seven layer model";
- Project 802 model, a modified OSI model.

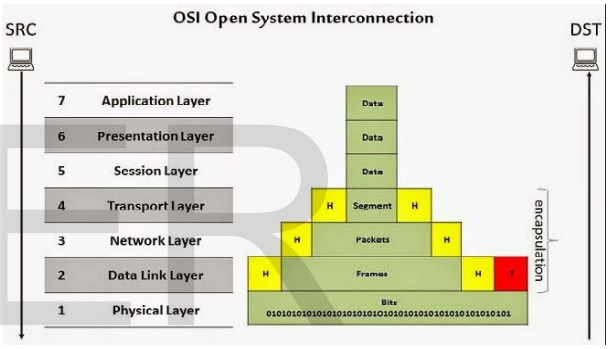
It is imperative for the beginners in the science of networks and learn the basics of computer networks through the knowledge and understanding of (OSI Model), which is the ABCs of computer network science. OSI Model is a classification of the computer network into imaginary layers so that each layer has its own advantages and functions that differ from each other. I would to repeat that layers are imaginary and invisible and developed to facilitate understanding of network science and to facilitate the development of computer networks to become able to accept any future updates without having to completely change the network , a computer network is the infrastructure through which data is transmitted between the parties, the process of transferring data occurs between a data source and a destination(s). The source must add other information to the sent data, such as adding source and destination addresses, data type, data size, service source, and much more.
This additional information is inherently diverse, so layers-based classification has to be done so that each layer adds the information that suit its function, which facilitates the development of networks as well as the tracking of technical faults. This is the advantage of layers in computer networks so all related to the network has its result to a specific layer.
In 1977, the International Organization for Standards and Metrology (ISO) developed the open model.

1.1 Reasons for the emergence of the open model:

1. Clarifying and simplifying the theoretical structure of computer networks;
2. Identifying the elements and parts of the construction of networks and the relationship between each part of these parts;
3. Reference for people who produce and design networks;
4. Setting a standard for job rules to be followed in networks and data transmission;
5. Describing communications and designing computer network protocols.

To build a network, you must provide key parts such as Workstation, Network Devices, and Transmission Media. OSI Model consists of seven layers and is described as follows:

1.2 Analysis of Seven Layer
Now, we can ask "**what are the seven layers and what are the functions of each layer?)**



Layer (7): "Application Layer"
It represents the **user interface** and can perform the following:

1. Using applications implemented on networks;
2. Allowing the use of network services that support applications;
3. Directly representing services that support user applications;
4. Controlling data link as well as controlling over data flow and error control;
5. Examples of applications are file transfer, e-mail, etc.

Layer (6): "Presentation Layer"
It represents translation and can perform the following:

1. To represent the data in a particular way until it is transferred over the network at the source point and then return the data to its original form at the destination point.
2. To translate between different protocols, character conversion, data encryption and data compression.
3. To convert all different data formats such as images and other non-readable formats to be transferred over the network.

Layer (5): "Session Layer"
It represents synchronization and can perform the following:

1. Allowing application programs to communicate over the network.
2. Bearing the responsibility of identify the devices on the network through its names

3. Issuing reports when devices are connected.
4. Re-sending packets again when an error occurs.
5. Insuring **Synchronization**, which is the control of packet resynchronization when an error occurs.

Layer (4): "Transport Layer"

It represents Packets, data flow control and error handling.

1. Managing data flow control between the parties across the network.
2. Dividing sent data or files into numbered packages, where they are reassembled at the destination in the transport layer.
3. Creating communication between source and destination.
4. Ensuring the arrival of the transferred data.
5. Stopping the transmission process in case of congestion in the transmission.

Layer (3): "Network Layer"

It represents "Addressing" and "Routing" and can perform the following:

1. Translating the logical network address and names into physical ones.
2. If Router cannot send a large data frame as sent by the source computer, the network layer compensates by segmenting the data into small units in order to be received by the destination.
3. This layer stamps the addresses on each string of data.
4. Specifying the path that the packet data will take and its size towards the sender's destination.
5. In the sender's destination, the source and destination address is placed on the sent data.

Layer (2): "Data Link"

It represents the conversion of "frames" to bits and can perform the following: -

1. Converting data packets into bits and from bits to packets at the destination.
2. Receiving the information from the third layer and adding control information, specifying the quality of the frames, determining the sender/source and the traffic path that will be followed by frames and the method used to divide the frames.
3. Setting frames start and end points.
4. Maintaining a copy of the information frames and do not free or cancel them until the signal is received by the destination and making sure that it has been received in correct and proper manner.
5. Delivering the frames to the physical layer to be sent.

Layer (1): "Physical Layer"

It represents raw devices and bits and can perform the following:

1. Transforming binary symbols into electrical signals and impulses to be transferred.
2. Sending raw bits over wires.
3. Defining the network card and how to connect the wire.
4. Defining the technology by which data is sent to the network.

1.3 Characteristics determined by the physical layer:

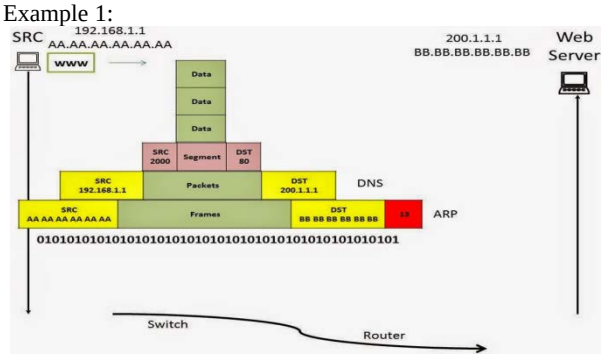
The connection quality to the network is determined where there is a "point to point" method where the connection between the two computers, and the "Multipoint" method that depends on connecting all the devices via a central device that handles sending process to all the devices.

The method of connecting the network is determined by the order of devices, for example, stellar, linear, ring, retina, etc. It also determines the method of transmission of the signal, sending the baseband, sending the "Boradband", and creating compatibility between the source and the destination when transmitting the data.

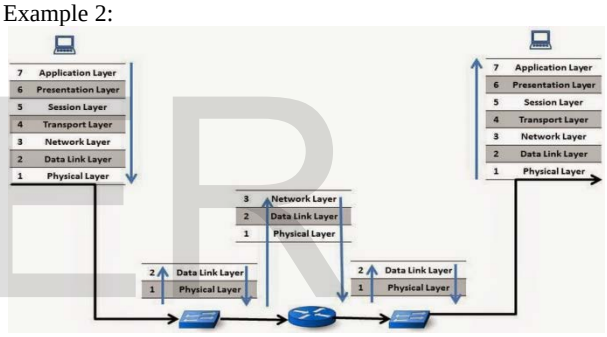
1.4 Data transfer using open model:

The user will initially enter the data that he wants to send through the application layer in order to compile it and divide it into segments so that it can be sent over the network as the network address is added to the data, physical address and special control information on the data (e.g. Error handling information).

Example 1:

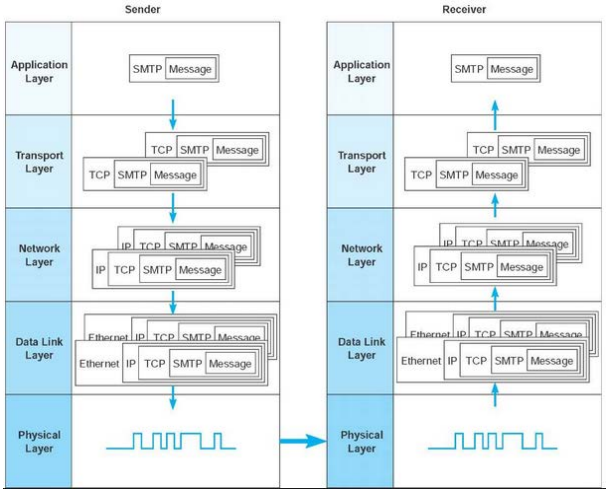


Example 2:



2. Transmission Control Protocol - Internet Protocol "TCP-IP"

This system describes the communications network where technology has been developed in order to create homogeneity between the different networks to be connected to a single network, which is the Internet. The TCP-IP model consists of four layers and is from top to bottom as shown below:



concept of layers in networks (In the context of the TCI-IP)

Layer (4): "Process Layer or Application Layer"
This layer corresponds, in term of the seven-layer system, the application, presentation and session layers. In this layer, the High Level Protocol are used.

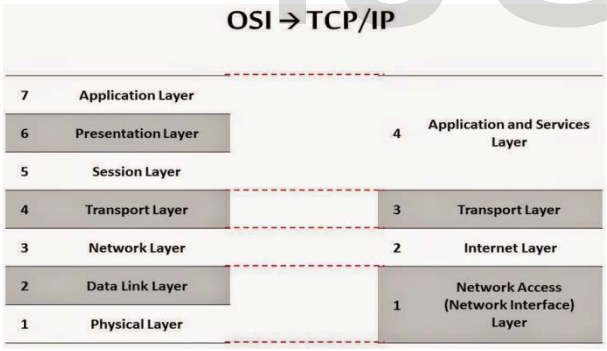
- "Simple mail transfer protocol - SMTP".
- File Transfer Protocol (FTP).
- Security shell- SS.
- "Hypertext transfer protocol-HTTP".

Layer (3): "Transport Layer"
This layer corresponds, in terms of the seven-layer system "open system", the transport layer. In this layer, Data Flow control protocols are used as well as communication protocols such as the transfer control system "TCP" , this layer is responsible for opening and maintaining communication as well as ensuring the arrival of packets where the transfer control protocols shall be responsible for the following: -

- Configuring connections between one point and another.
- Ensuring reliability in data delivery from source to destination.
- Ensuring multiple connection for concurrent applications.
- Supporting most of the application protocols for the Internet.

Layer (2): "Internet or Internetworking Layer"
This layer corresponds, in terms of the seven layers, the network layer. This layer identifies the IP addresses to direct packets from one address to another, as this address is unique. There are two types of addresses "old IPv4 and IPv6 addresses".

Layer (1): "Data link Layer"
This layer corresponds, in terms of the seven-layer system, the data link layer and the physical layer. This layer describes the physical devices necessary for communication such as cables as well as describing signals used in those devices and dealing with the low-level protocols.



Seven layers system and the four-layer system "TCP-IP"

3. IPX-SPX Packet .

3.1 Protocols:
Network protocols are defined as the set of rules and regulations that must be complied with when conducting data transmissions between computers in the network. There are many protocols that are connected to computer networks, these protocols varies widely in their basic function. The process of transferring the data in the network depends on dividing the transfer process into several fixed steps. At each step, a set of specific tasks are carried out that cannot be carried out in another stage of transport where the process is subject to a set of rules or protocols.

3.1 Protocol Stack
It is a set of protocols integrated in its work together where each layer contains a set of protocols where each protocol has a specific function.

The layers of the "Protocol Stack" can be classified into two layers: -

1. The lower layer contains a set of protocols "where you determine how to equate different devices"
2. The upper layer contains a set of protocols "where you determine how to organize the connection".

3.2 Application of internet protocol:
The TCP / IP system is also called Internet Protocol and has many applications

- Simple Mail Transfer Protocol (SMPTP) provides the mechanism for transferring messages between different computers.
- File Transfer Protocol (FTP), a protocol used to transfer the file from one system to another using user orders. This protocol also provides specification to control user access. When the user requests a file transfer, this protocol configures TCP to exchange SMS messages. So, the user is allowed to specify the file. Then, it is followed by the data transmission process and when the transfer process is completed, the other file is configured.
- TELNET provides automatic access that allows the user to access the computer directly or remotely.

3.3 Types of protocols: -
There are many standards on which the protocols are classified:

1. Standard by field of work;
2. Standard by work style;
3. Standard by Function.
   - Application Protocols;
   - Transport Protocol;
   - Network Protocols.

3.3.1 Network Protocols: -
The network protocols provide connectivity services, such as addressing, information routing, searching for errors in the transmission process, handling requests for re-transmission, and determining the rules of communication for specific networks such as Internet or Token Ring. example:-

- IP - "Internet Protocol"
- IPX - "Internet Protocol Exchange"
- SPX "Sequence Protocol Exchange"

3.4 IPX-SPX protocol Package: -
It is a set of protocols for the exchange of data packets over the Internet designed to work with Novell networks.

- For the IPX protocol, the IP protocol is compatible with TCP-IP the IPX protocol is one of the non-connected protocols because it does not notify the destination in advance.
- For the SPX protocol ,the TCP protocol is compatible with TCP-IP ,the SPX protocol rearranges data from the receiver and controls over data flow.

3.4.1 IPX-SPX packet layers: -
It is composed of four layers with the open model "OSI"

Application Layer : This layer corresponds to the fifth, sixth and seventh layer in the open system. There are many protocols that work in this layer, for example the Routing Information Protocol, which is used to determine the best rout

Network Layer : This layer corresponds to the third and fourth layer in the open system. This layer uses IPX and SPX protocol.

Data Link Layer : This layer corresponds to the second layer in an open model where this layer is provided by protocol

Media Access Layer : This layer corresponds to the first layer of the open model.

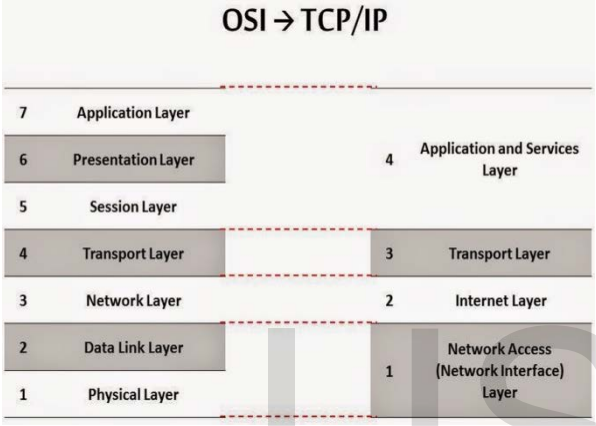
Address in IPX-SPX protocol: Addressing is performed through an IP protocol with an address length of 80 bits divided into two sections where 32 bits are assigned to the network and 48 bits are assigned to the device number.

4. Summary:
At the beginning, the user will enter the data that he wants to send through the application layer in order to compile it and divide it into segments so that it can be sent over the network as the network address is added to the data, physical address and special control information on the data.

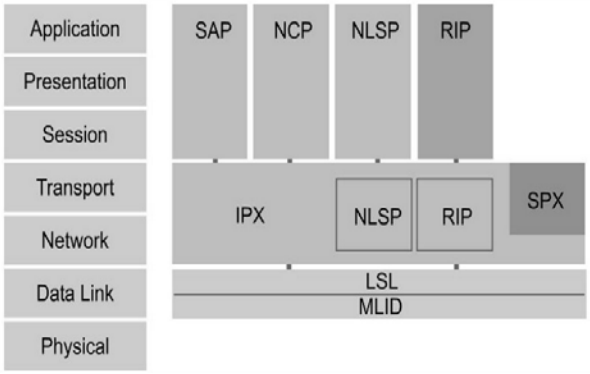
For the IPX-SPX protocol, the IP protocol is compatible with the TCP-IP system while the IPX protocol is considered of the non-connected protocols as it does not notify the receiver in advance.

The SPX protocol rearranges data from the receiver and controls over data flow.

Each layer in the open-layer system corresponds to a layer in the TCP-IP system.



The IPX-SPX protocol consists of four layers comparable with the open model "OSI".



Basic IPX/SPX on OSI Model

Understanding OSI Model, which is the ABCs of computer network science is a computer network classification ito imaginary layers so that each layer has advantages and functions of its own that differs from each other.

Tracing technical faults is a characteristic of the existence of layers. For example, if it appears that the computer is unable to connect to the network, we limit the causes of the problem in (Layer 1) or (Layer 2). This is the advantage of layers in computer networks so all related to the network has its result to a specific layer.

layers/ advantages	OSI Model	TCP-IP	IPX-SPX
One	It represents devices and bits	It handles low level protocols	It handles low level protocols
Two	It represents conversion of frames to bits	It defines IP addresses.	It works on providing protocols compatibility
Three	It represents "Addressing" and "Routing"	It handles data flow control protocols and communication protocols such as TCP,	It handles IPX and SPX protocols
Four	It represents Packets, data flow control and error handling	High-level protocols are used in this layer	It handles the Routing Information Protocol, as it is used to determine the best rout
Five	Securing Synchronization, the control of packet resynchronization when an error occurs.	-	-
Six	It is represented by translation between different protocols, character conversion, data encryption and data compression	-	-
Seven	It represents the User	-	-

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