Basic Networking

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A **computer network** is a system in which multiple computers are connected to each other to share information and resources.

Characteristics of a Computer Network-

1. Share resources from one computer to another.
2. Create files and store them in one computer, access those files from the other computer(s) connected over the network.
3. Connect a printer, scanner, or a fax machine to one computer within the network and let other computers of the network use the machines available over the network.

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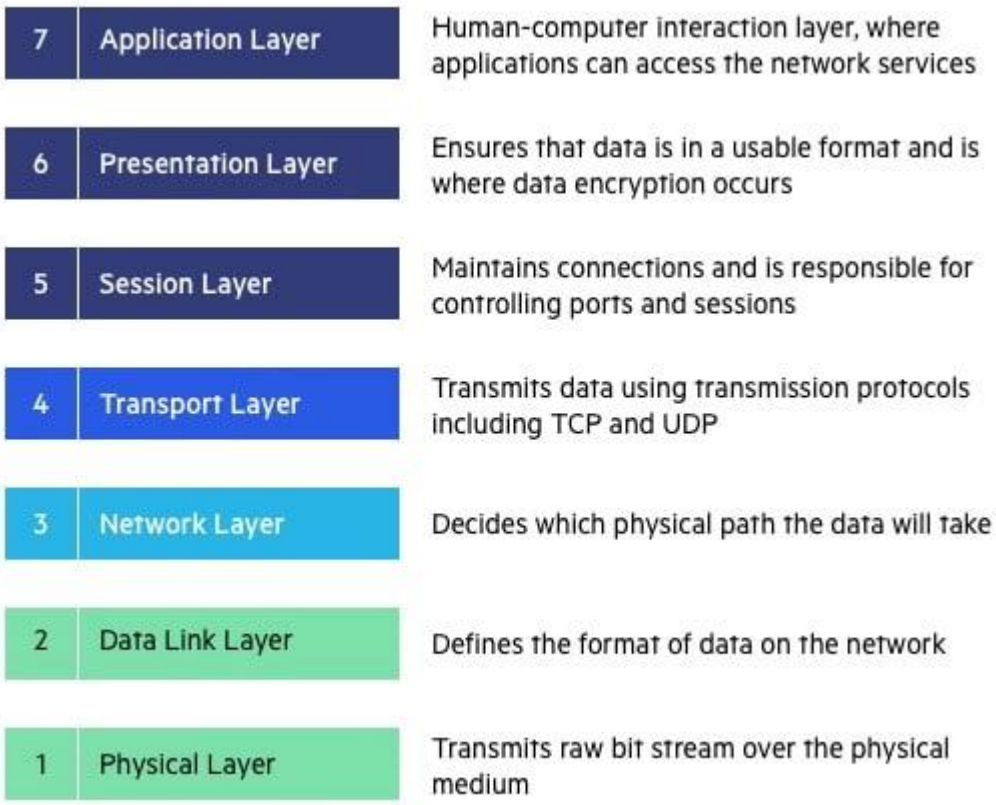
OSI Model:

The OSI 7 Layers-



How to remind OSI Layers-

Please **D**o **N**ot **T**hrow **S**ausage **P**izza **A**way

Advantages of OSI Model

The OSI model helps users and operators of computer networks:

1. Determine the required hardware and software to build their network.
2. Understand and communicate the process followed by components communicating across a network.
3. Perform troubleshooting, by identifying which network layer is causing an issue and focusing efforts on that layer.

The OSI model helps network device manufacturers and networking software vendors:

1. Create devices and software that can communicate with products from any other vendor, allowing open interoperability
2. Define which parts of the network their products should work with.
3. Communicate to users at which network layers their product operates – for example, only at the application layer, or across the stack.

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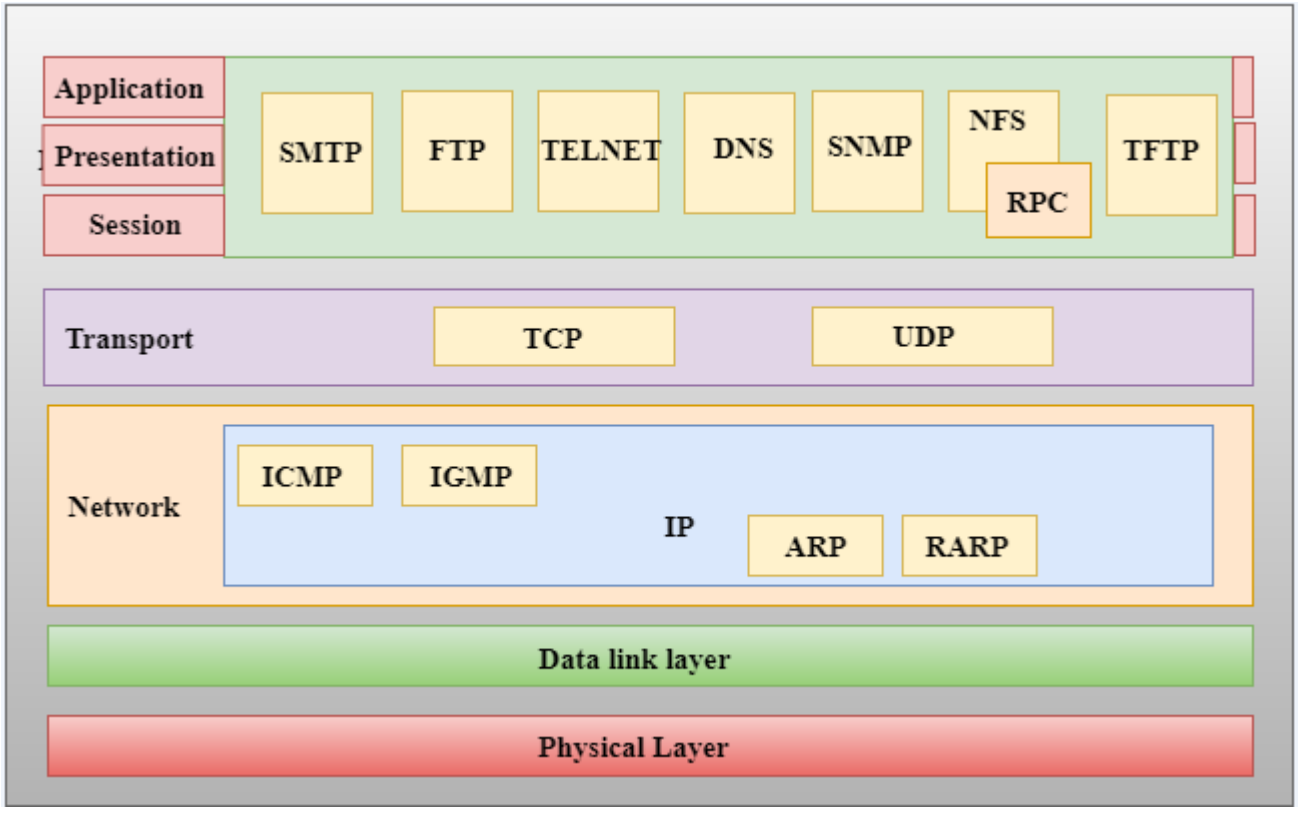
TCP/IP Model-

The purpose of TCP/IP model is to allow communication over large distances. TCP/IP stands for Transmission Control Protocol/ Internet Protocol. TCP/IP Stack is specifically designed as a model to offer highly reliable and end-to-end byte stream over an unreliable internetwork.

The TCP/IP model was developed prior to the OSI model.

The TCP/IP model consists of five layers: the application layer, transport layer, network layer, data link layer and physical layer.

TCP/IP is a hierarchical protocol made up of interactive modules, and each of them provides specific functionality.



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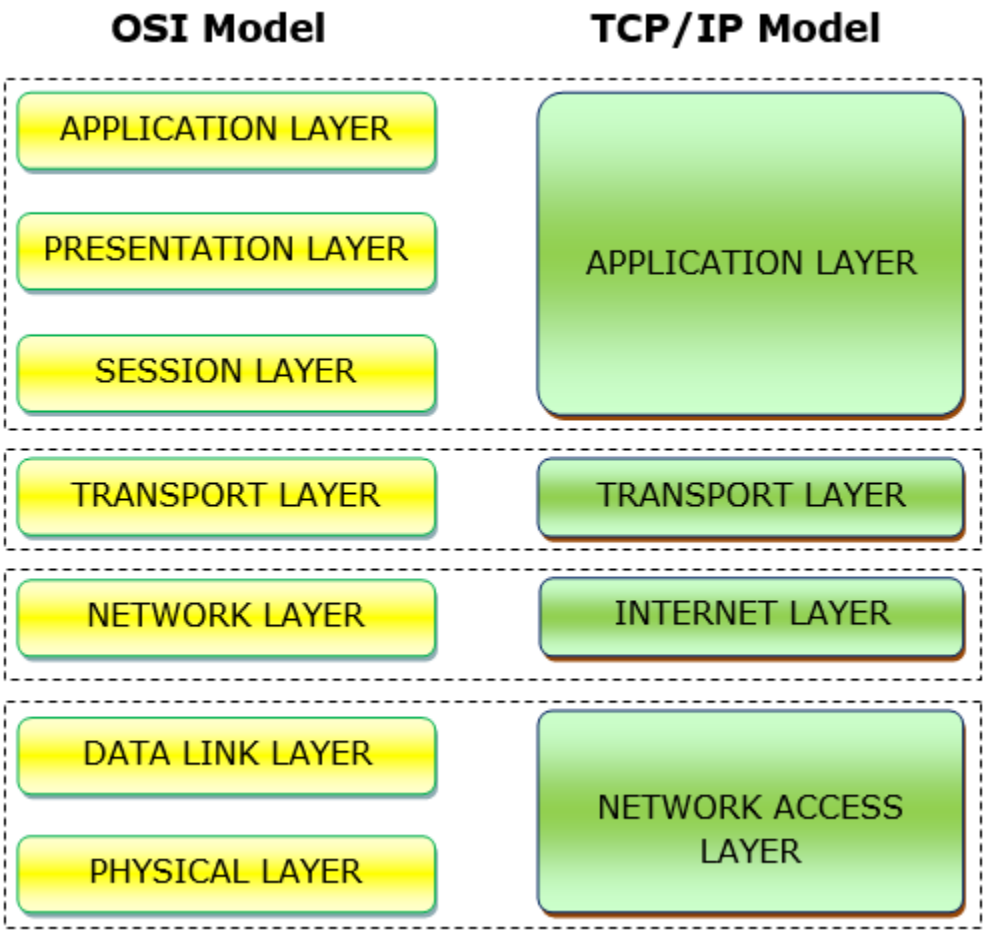
OSI vs. TCP/IP Model-



The Transfer Control Protocol/Internet Protocol (TCP/IP) is older than the OSI model and was created by the US Department of Défense (DoD). A key difference between the models is that TCP/IP is simpler, collapsing several OSI layers into one:

- OSI layers 5, 6, 7 are combined into one Application Layer in TCP/IP
- OSI layers 1, 2 are combined into one Network Access Layer in TCP/IP – however TCP/IP does not take responsibility for sequencing and acknowledgement functions, leaving these to the underlying transport layer.

Other important differences:

- TCP/IP is a functional model designed to solve specific communication problems, and which is based on specific, standard protocols. OSI is a generic, protocol-independent model intended to describe all forms of network communication.
- In TCP/IP, most applications use all the layers, while in OSI simple applications do not use all seven layers. Only layers 1, 2 and 3 are mandatory to enable any data communication.

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Protocols-

FTP (File Transfer Protocol) Port-21

It is used for file transmission between internetwork nodes.

SMTP (Simple Mail Transfer Protocol) Port-25

It can be used for exchanging email.

TELNET Port-23

TELNET represents Terminal Network. It allows the client to create host-based software by initiating one of the host terminals. It also supports connectivity between the diverse operating framework.

DNS (Domain Name Systems) Port-53

The DNS can change the domain name into IP addresses. The TCP/IP protocol needs the IP address that recognizes linking a host to the computer network.

HTTP (Hypertext Transfer Protocol) Port-80

HTTP is an internet protocol created for a particular software, the World Wide Web (WWW).

HTTPS (Hypertext Transfer Protocol Secure) Port-443

HTTPS is Hypertext Transfer Protocol Secure. The HTTP protocol does not provide the security of the data, while HTTPS ensures the security of the data. Therefore, we can say that HTTPS is a secure version of the HTTP protocol.

This protocol allows transferring the data in an encrypted form.

RDP Remote Desktop Protocol (3389)

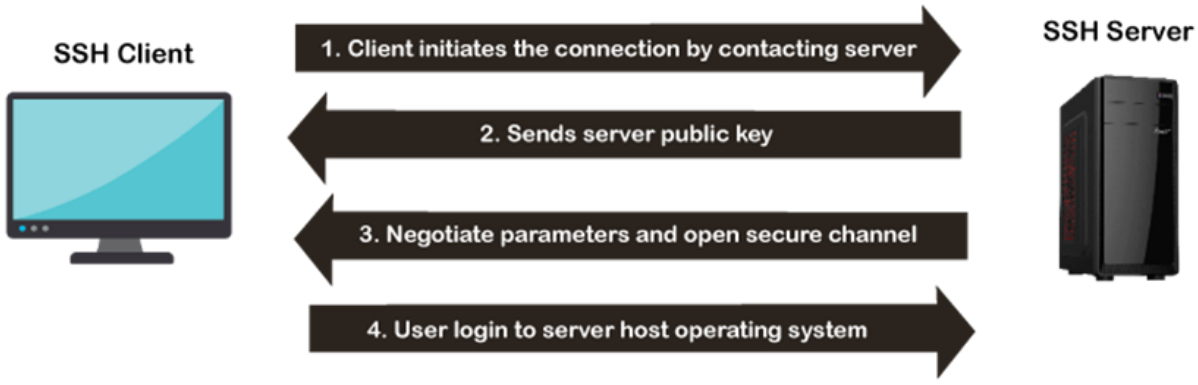
Remote Desktop Protocol is a proprietary protocol developed by Microsoft which provides a user with a graphical interface to connect to another computer over a network connection.

SSH (Secure Shell) Port- 22

It provides secure access to users and automated processes.

It is an easy and secure way to transfer files from one system to another over an insecure network.

ssh UserName@SSHserver.test.com



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What is an IP Address?

All the computers of the world in the Internet network communicate with each other with underground or underwater cables or wirelessly. If I want to download a file from the internet or load a web page or literally do anything related to the internet, my computer must have an address so that other computers can find and locate mine in order to deliver that particular file or webpage that I am requesting. In technical terms, that address is called IP Address or Internet Protocol Address.

IP Address is of two types:

1. IPv4:

Internet Protocol version 4. It consists of 4 numbers separated by the dots. Each number can be from 0-255 in decimal numbers. But computers do not understand decimal numbers, they instead change them to binary numbers which are only 0 and 1. Therefore, in binary, this (0-255) range can be written as (00000000 – 11111111). Since each number N can be represented by a group of 8 digit binary digits. So, a whole IPv4 binary address can be represented by 32-bits of binary digits. In IPv4, a unique sequence of bits is assigned to a computer, so a total of (2^32) devices approximately = 4,294,967,296 can be assigned with IPv4.

IPv4 can be written as:

189.123.123.90

Address Classes	RANGE	Bit Pattern of 1st byte	Decimal Range	Default Subnet Mask	Reserved for
				webeasyinfo.com	
A	1.0.0.0 to 126.255.255.255	0xxxxxxx	1 to 127	255.0.0.0	Governments
B	128.0.0.0 to 191.255.255.255	10xxxxxx	128-191	255.255.0.0	Medium Companies
C	192.0.0.0 to 223.255.255.255	110xxxxx	192-223	255.255.255.0	Small Companies
D	224.0.0.0 to 239.255.255.255	1110xxxx	224-239	Not Applicable	Reserved for Multicasting
E	240.0.0.0 to 255.255.255.255	11110xxx	240-255	Not Applicable	Experimental or future use

2. **IPv6**:

But, there is a problem with the IPv4 address. With IPv4, we can connect only the above number of 4 billion devices uniquely, and apparently, there are much more devices in the world to be connected to the internet. So, gradually we are making our way to **IPv6 Address** which is a 128-bit IP address. In human-friendly form, IPv6 is written as a group of 8 hexadecimal numbers separated with colons(:). But in the computer-friendly form, it can be written as 128 bits of 0s and 1s. Since, a unique sequence of binary digits is given to computers, smartphones, and other devices to be connected to the internet. So, via IPv6 a total of (2^128) devices can be assigned with unique addresses which are actually more than enough for upcoming future generations.

IPv6 can be written as:

2011:0bd9:75c5:0000:0000:6b3e:0170:8394

Classification of IP Address

An IP address is classified into the following types:

1. Public IP Address: This address is available publicly and it is assigned by your network provider to your router, which further divides it to your devices.

2**. Private IP Address:** This is an internal address of your device which are not routed to the internet and no exchange of data can take place between a private address and the internet.