

01. Introduction to computer Networks

Computer Networks: Computer Networks is formed by two or more devices connected together. These devices might be connected to share data to do some computation together or to share the resources.

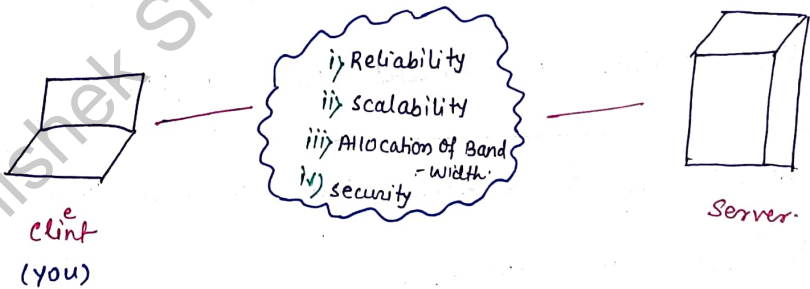
Ex: A simple network where 2 computers are connected and a printer is connected and these both computers want to give commands to the printer. So resource sharing is happening due to computer networks.

* There are many - many networks that exist. In this course we are mainly going to focus on Internet. The largest network.

* Almost ~~at~~ half of the world's population is connected to the Internet. Most of our home devices, our office devices they are also connected to Internet.

Q How all this magic happens ??

Solⁿ



Key challenges.
(There are many more).

You are there in your office and you can browse a website which is there in some other corner of the world (server).

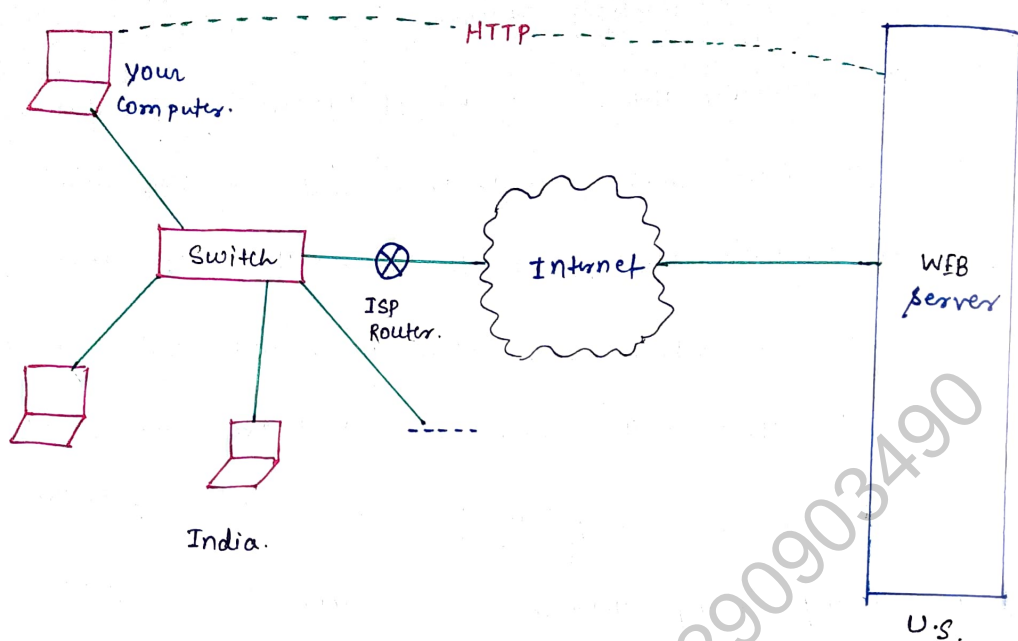
There are many many intensity challenges arises when all this happening.

- i) Reliability: How to insure that your request reaches the server reliably and data that comes to you that also reaches to you reliably.
- ii) Scalability: Every device has proper address. There are no address collision.
- iii) Allocation of Bandwidth: How to ensure the Bandwidth.
- iv) Security: Data reaches to the server and server to you securely.

30/09.

Abhishek Sharma Notes.

02. OSI and TCP/IP Model (part -1)



Let's Assume you are in office and your computer is connected with a device called "switch".

Switch: switch is a device which is used to form Local Area Network. It connects computer in a small network. Like your office is a Local Network.

Then this switch is connected with a Router.

Router: Router (rtr) is a device that connects your network to some other Networks.

and this Router is connected with internet. And internet is connect with web server. This is how you connect with the web server.

So There are lots of Things Happen when you Browse a website.

Abhishek Sharma Notes

* When you browse a website we use HTTP Protocol.

Protocol: protocols are set of rules which are used by 2 devices to communicate.

These set of rules are decided by the Headers.

These Headers specify the content of the message and how these message to be processed.

Examples of protocols are: IP, TCP, UDP, HTTP, SMTP, and etc.

Q How do we manage these protocols?

A: Your browser implement HTTP, Your Server implement HTTP.
and That's how we connect both of them. We will study later.

Q Why do we need layers?

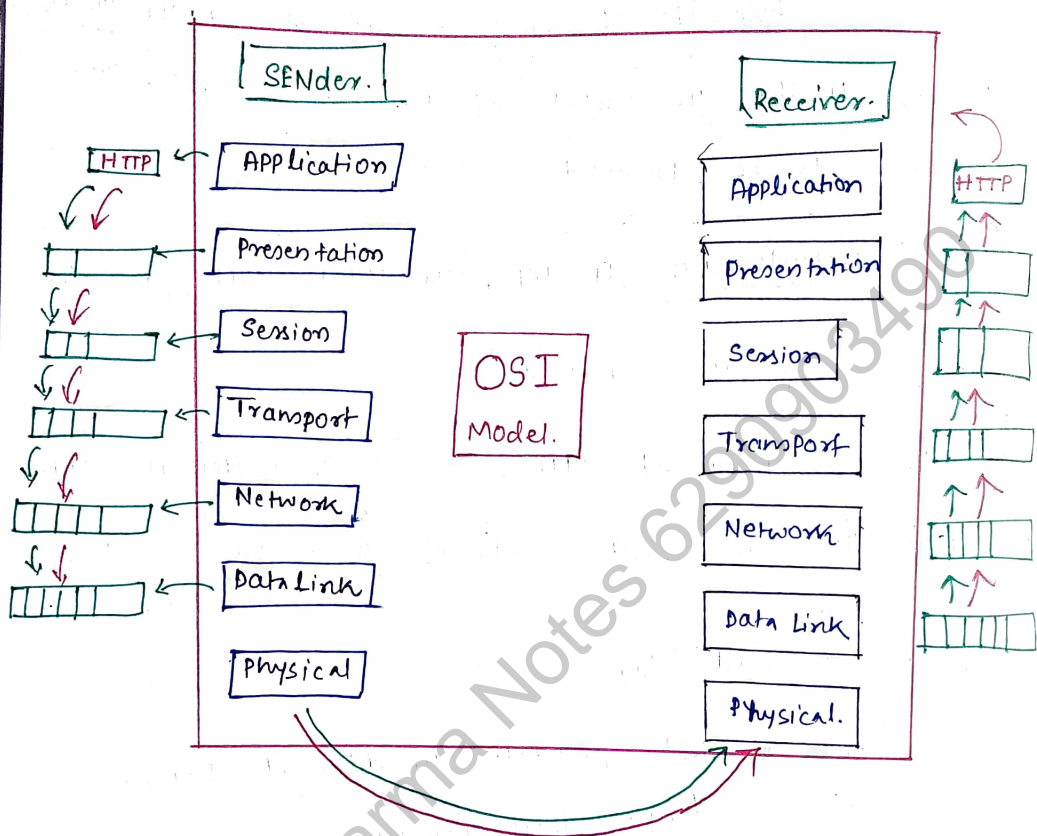
A to organise different protocols in different Layers.

↳ Like HTTP, TCP, UDP, IP etc.

* Our All \downarrow Networker and whole Internet, They can all be considered as connection of protocols and Layers. You have certain Layers and Every Layer has some certain protocols. and devices communicate each other using these protocols.

* Every Protocol has its own Header, which is attached by the Sender. The Receiver removes the Header, processes it and forward the message to the upper Layer. All the protocols are the part of certain layer.

This Model says that we can divide the Network into 7 Layers.



Application Layer has one Header, Presentation layer has one more Header; Session Layer has one more header, Transport Layer has one more header, Network layer has one more Header of its own, Data Link Layer has its one more Header and These headers are now is sent over to the Receiver through the physical medium. (physical medium has only binary 0, 1)

Now Receiver's end \Rightarrow This physical medium processes and passes the data to the upper layer (Data Link) and now Data Link Layer (Receiver's end) processes the data

of Sender's Data Link Data Only. It processes that Header and Removes it and Send the Remaining Headers to its upper Layer (Network).

It processes the Data of Sender's Network Layer and Removes it and Send the Remaining Headers to its upper Layer i.e. Transport Layer. Transport Layer processes the Data of only Sender's Transport Layer and Send Remaining Headers to its upper Layer i.e. Session Layer. Session Layer processes the Data of Sender's Session Layer and Send the Remaining ~~Layer~~ data to its upper Layer i.e. Presentation Layer. Header

Presentation Layer receives the Header and processes the Data of Sender's presentation Layer Data only and send the Remaining Data to its upper Layer i.e. Application Layer. That's How Application Layer receives only the HTTP Message send by the Sender's end. That's How Sender and Receiver communicate with each other.

This is the OSI Model. (where we divide the Network into 7 Layers). You got the advantage of encapsulation. (One message is encapsulated into another and so on).

* OSI (7 Layer) Model is more about Theoretical Model. It is not implemented accepted as implementation.

* The most widely used Model is TCP/IP Model.

This Model has Four (4) Layers.

Physical Media:

Layer

It is the last layer in OSI model.

It is the simple media which is in 0,1, binary.

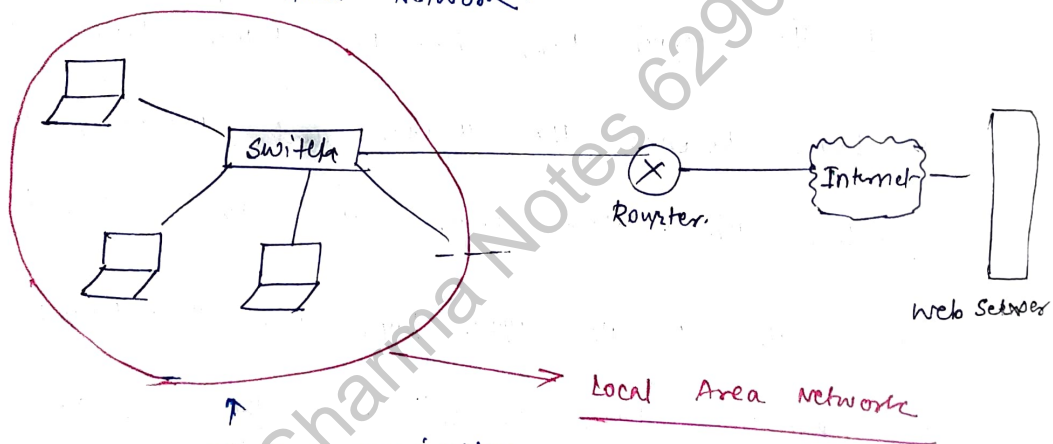
Whether it is using fiber optic, or wireless or

Copper wire. It is all about signals and wires.

Data Link Layer:

Data Link Layer uses physical Medium

for communication. It is mainly responsible for one to one connection. It is responsible for the communication in your Local Area network.



all the communication here is done by Data Link Layer.

(mainly one device to one device communication)

No intermediate layer like Router, Internet and so on.

* There are many things happen in Data Link Layer

Such as

- i) Error Handling.
- ii) Flow Control Handling,
- iii) Collision Handling
- iv) Access control Handling.

→ All these things happen in Data Link Layer.

03. OSI and TCP / IP Model (Part - 2).

Abhishek Sharma Notes.

7 Layer (Theoretical)

4 Layers (Practical Implementation).

Network Layer:

Data Link Layer provides one device to other

Device communication may be either using switch or a shared media or a wireless media.

But if we want to connect to a device which is not directly connected to us, may be some server in some other country. we need to have services of Network Layer.

Network Layer Routes your messages or data from your Local Network to some distant Network.

There are multiple Routers. That do this Routing. from one end to other end. (From Sender's end to Receiver's End).

All this Routing is a part of Network Layer.

* Network Layer is actually implemented by IP Protocol.

IP Protocol is the part of TCP Protocol Model. Which is a Practical Model. OSI is a Theoretical Model.

Network Layer Sends you data from one Network to other Networks.

* Transport Layer: Transport Layer does End to End Delivery.

* Session Layer: TCP / IP Model doesn't have Session Layer.

Session Layer of OSI Model is for Session Management.

It does Session Management. It does Authentication. It also

does combining of multiple streams. (If you are using a

Video Application. \Rightarrow They might be images, There might

be voice.) \Rightarrow Session Layer combine them together.

* Presentation Layer: This is also not part of TCP/IP model.

It is also a Theoretical Layer in OSI model. This Layer is responsible for data compression on the sender side and uncompressing the data on the Receiver's side.

This Layer also does encoding of the data according to the format which can be sent over the network and decoding of data on the receiver's side.

This also does Encryption and Decryption.

* Application Layer: This is the Layer where user

Application works. Like ex: web browser, Email client, Skype etc. Real world ex- of Application Layers are

- i) HTTP for web browsing.
- ii) SMTP for Email.
- iii) DNS for Domain Name System Like binding the IP Address or URL.
- iv) FTP for File Transfer.
- v) SSH for Secured Login on Server.

etc.

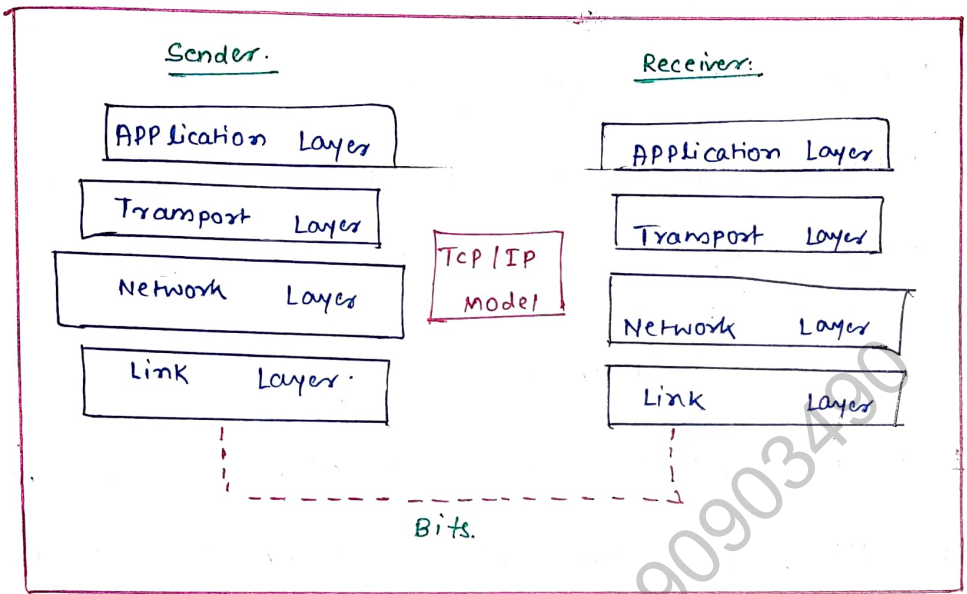
We have talked about 7 Layer OSI Model.

Now we will talk about TCP/IP Model.

TCP/IP Model has 4 Layer. we will see now.

TCP / IP Model. (4 Layer Model) Abhishek Sharma Notes

TCP / IP Model: It has 4 Layer. We can divide the Network in 4 layers.



Link Layer: In TCP / IP Model Link layer does both Physical Layer and Data Link layer. It provides all the functionality of the Data Link Layer and physical Layer.

Network Layer: It is unreliable in TCP / IP Protocol Model, It is connectionless and uses IP protocol.

Transport Layer: All the functionality provided in OSI Model. Same all provided here also. i.e. end to end connection, Error control, Error Handling,

Transport layer in TCP / IP model has 2 protocols, UDP and TCP. UDP is connectionless. (No flow control, no Error control.) TCP provides everything (Error control, flow control,)

Ex of TCP: HTTP, FTP

Ex of UDP: DNS, DSCP

Application Layer: Same as discussed in OSI model.

* Units used by Protocol Data Units

- i) Application Layer uses Message unit for communication.
- ii) Transport Layer uses Segment " " " "
- iii) Network Layer uses packet " " " "
- iv) Link Layer uses Frame " " " "

Q Why we use Layering ??

A If you are browsing a website. You are using ~~HTTP~~ HTTP, Then you need not worry for other things. They all are interconnected. Ex. HTTP → connected with TCP (i.e. Transport Layer) → TCP connected with IP (i.e. Network Layer) → and it is connected with Link Layer (i.e. Wifi, Ethernet, cable) etc.

Your HTTP (Application Layer) Protocol only need to worry about Application Layer protocol only. It doesn't need to worry about Transport Layer, Network Layer or Link Layer protocol, and so on.

That's why we use Layering and we need Layering.