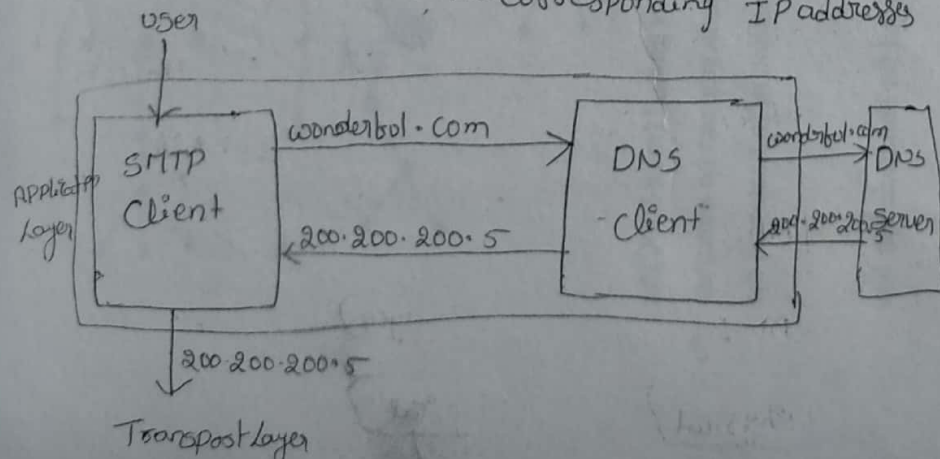


UNIT-V

Application Layer

DNS :- ^{translation from name to computer} ^{for mapping domain name with ip address} (Domain Name System)

- The Domain Name System (DNS) is a supporting program that is used by other programs such as e-mail. DNS client/server program can support an e-mail program to find the IP address of an e-mail recipient. A user of an e-mail program may know the e-mail address of the recipient. The IP protocol needs the IP address. The DNS client program sends a request to a DNS server to map the e-mail address to the corresponding IP addresses.



To identify an entity TCP/IP Protocol uses the IP address, which uniquely identifies the connection of a host to the Internet. People prefer to use names instead of numeric addresses. We need a system that can map a name to an address (or) an address to a name. When the Internet was small, mapping was done by using a host file. The host file had only two columns: name & address.

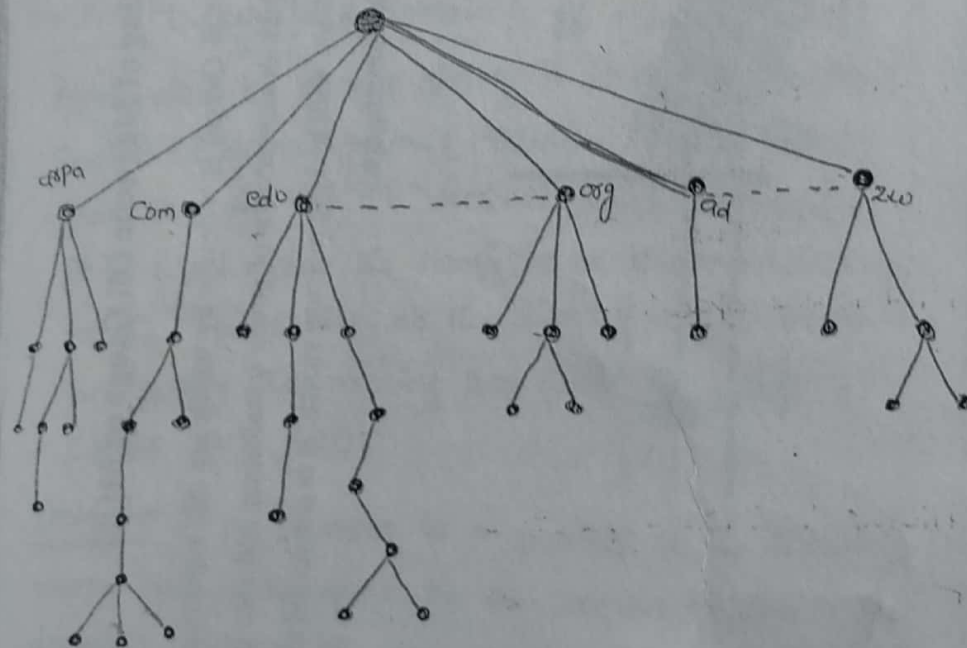
Name Space :- A name space that maps each address to a unique name can be organized in two ways: flat (or) hierarchical.

Flat Name Space :- In a flat name space a name is assigned to an address. A name in this space is a sequence of characters with out structure.

Hierarchical Name Space :- In a Hierarchical name space each name is made of several parts. The first part can define the nature of the organization, the second part can define the name of an organization, the third part can define departments in the organization.

Domain Name space:-

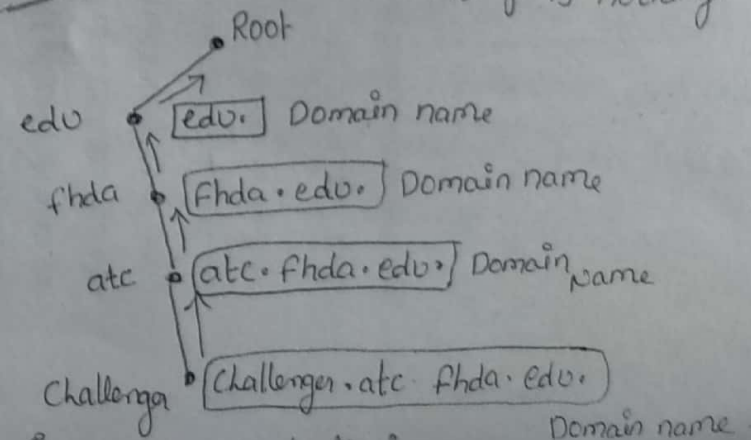
To have a hierarchical name space, a domain name space was designed. In this design the names are defined in an inverted tree structure with the root at the top. The tree can have only 128 levels: level 0 (root) to level 127.



Label:- Each node in a tree has a label, which is a string with a maximum 63 characters. The root label is a null string (empty). DNS requires that children of a node have different labels which guarantee the uniqueness of the domain name.

Domain name:- Each node in the tree has a domain name. A full domain name is a sequence of labels separated by dots (.). The domain names are always read from the node up to the root. The last label is the label of the root (null).

This means that a full domain name always ends in a null label, which means the last character is a dot because the null string is nothing.



Fully qualified Domain name :-

If a label is terminated by a null string it is called a fully qualified domain name.

An FQDN is a domain name that contains the full name of the host.

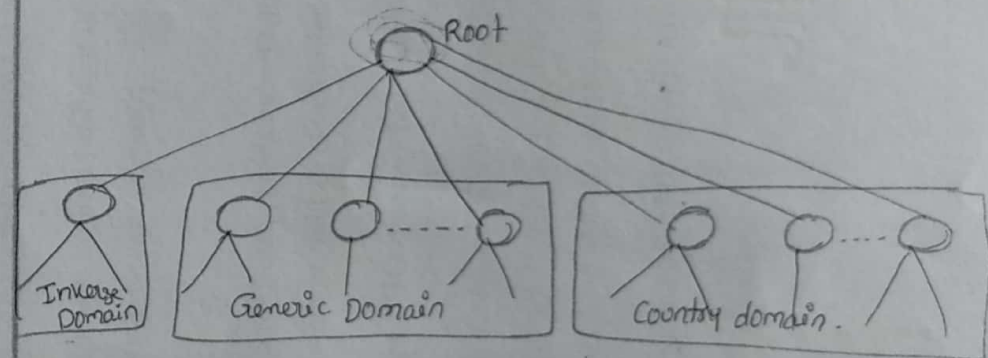
eg: challenger.atc.phda.edu.

Partially qualified domain :- If a label is not terminated by a null string it is called a partially qualified domain name (PQDN). A PQDN starts from a node, but it does not reach the root. It is used when the name to be resolved belongs to the same site as the client. Here the resolver can supply the missing part called the suffix, to create an FQDN.

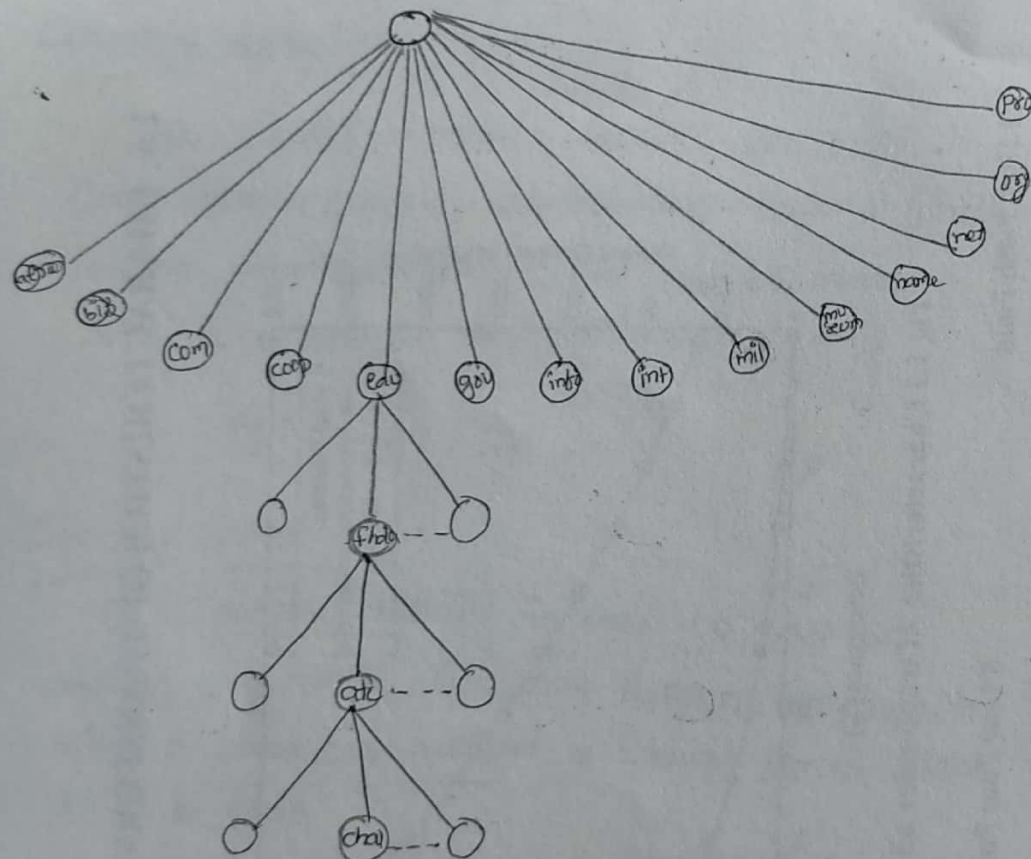
Domain :- A Domain is a subtree of the domain name space. The name of the domain is the domain name of the node at the top of the subtree.

DNS in The Internet :-

DNS is a protocol that can be used in different platforms. In the Internet the Domain name space (tree) is divided into three different sections: Generic domain, Country domain, and the inverse domain.



Generic Domain :- The Generic domain defines registered hosts according to their Generic behaviour. Each node in the tree defines a domain, which is an index to the domain name space database.



Chal.atc.fhda.edu.

Index to addresses

Label

Description

aero	Airlines & aerospace Companies
biz	Business & firms
com	Commercial organisation
coop	co-operative business organisation
edu	Educational institutions
gov	Government organisations
info	Information Service providers
int	International organization
mil	Military Groups
museum	museums & other non profit organization
name	Personal names
net	Network support centers
org	non-profit organizations
pro	Professional individual organizations.

Country domain:-

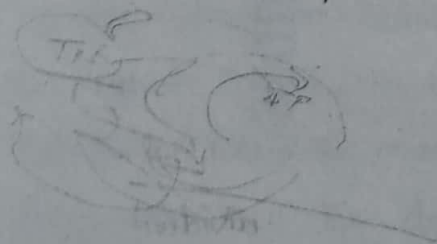
The Country domains section uses two - characters country abbreviations. Second labels can be organizational or they can be more specific, national designations.

eg: ca.us, .in

Inverse Domain:-

The Inverse domain is used to map an address to a name. This may happen, for example, when a server has received a request from a client to do a task.

This type of query is called an inverse or pointer (PTR) query.

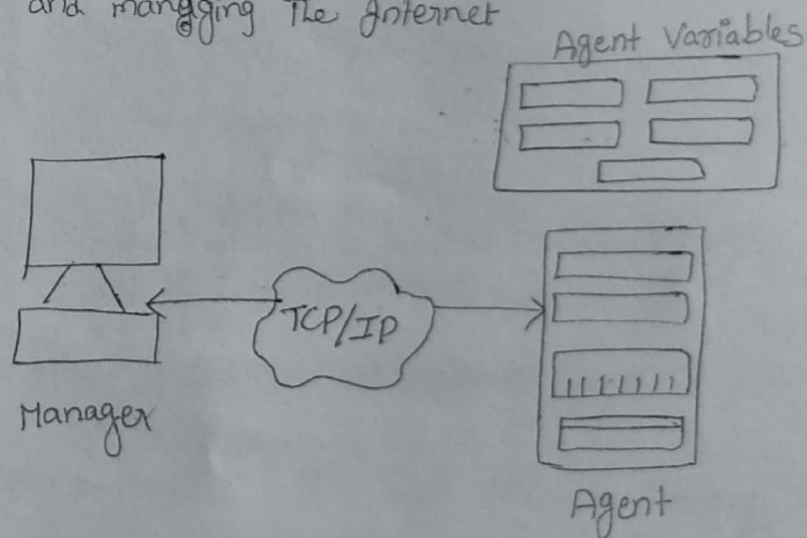


SNMP:-

SNMP stands for Simple Network Management Protocol.

SNMP is a framework used for managing devices on the Internet.

It provides a set of operations for monitoring and managing the Internet.



SNMP has two components: Manager and Agent. The manager is a host that controls and monitors a set of agents such as routers.

It is an application layer protocol in which a few manager stations can handle a set of agents.

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The protocol designed at the application level can monitor the devices made by different manufacturers and installed on different physical networks.

It is used in a heterogeneous network made of different LANs and WANs connected by routers or gateways.

Managers & Agents :-

- A Manager is a host that runs the SNMP client program while the agent is a router that runs the SNMP server program.
 - Management of the internet is achieved through simple interaction between a manager and agent.
 - The Agent is used to keep the information in a database while the manager is used to access the values in the database.
- For example a router can store the appropriate variables such as a number of packets received.

and forwarded while the manager can compare these variables to determine whether the router is congested or not.

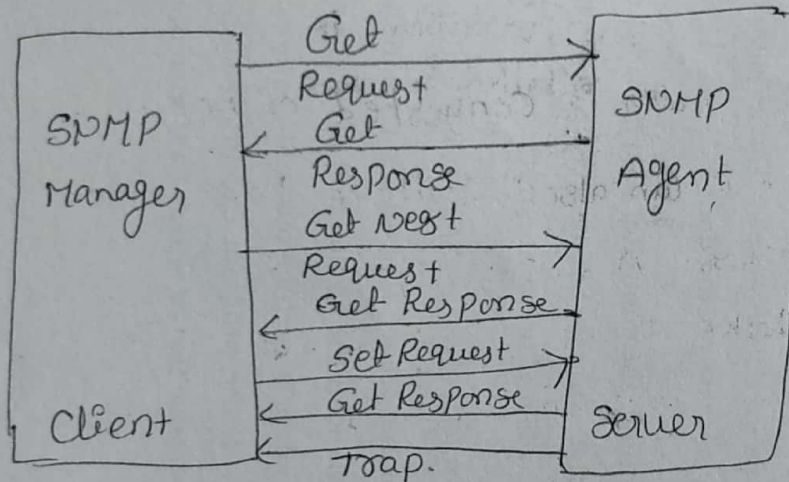
- Agent can also contribute to the management process. A server program on the agent checks the environment, if something goes wrong, the agent sends a warning message to the manager.

SNMP defines five types of messages.

Get Request, Get Next Request, Set Request, Get Response and trap.

Get Request :- The Get Request message is sent from a manager (client) to the Agent (server) to retrieve the value of a variable.

UDP connections



Get Next Request :-

The Get Next Request message is sent from the manager to agent to retrieve the value of a variable. This type of message is used to retrieve the values of the entries in a table.

As the manager does not know the indexes of the entries, then it will not be able to retrieve the values. In such situations Get Next Request message is used to define an object.

Get Response :- The Get Response message is sent from an agent to the manager in response to the Get Request or Get Next Request Message. This message contains the value of a variable requested by the manager.

Set Request :- The Set Request message is sent from a manager to the agent to set a value in a variable.

Trap :- The trap message is sent from an agent to the manager to report an event. For example if the agent is rebooted, then it informs the manager as well as sends the time of rebooting.

E-MAIL:-

E-Mail stands for electronic mail.

E-Mail is an application layer service in which a user can transfer the messages or information with another user. E-Mail is the most popular service of the Internet. Message in mail not only contains text, but it also contains images, audio and video data. The person who is sending mail is called sender and person who receives mail is called recipient. It is just like postal mail service.

Components of E-Mail system:-

The basic components of an email system are: User Agent (UA), Message transfer Agent (MTA), Mail Box, and Spool file.

User Agent:-

- The user agent is normally a program which is used to send and receive mail. Sometimes it is called as mail reader. It accepts variety of commands for composing, receiving or replying to message as well as for manipulation of the mail box.

Message transfer Agent (MTA):-

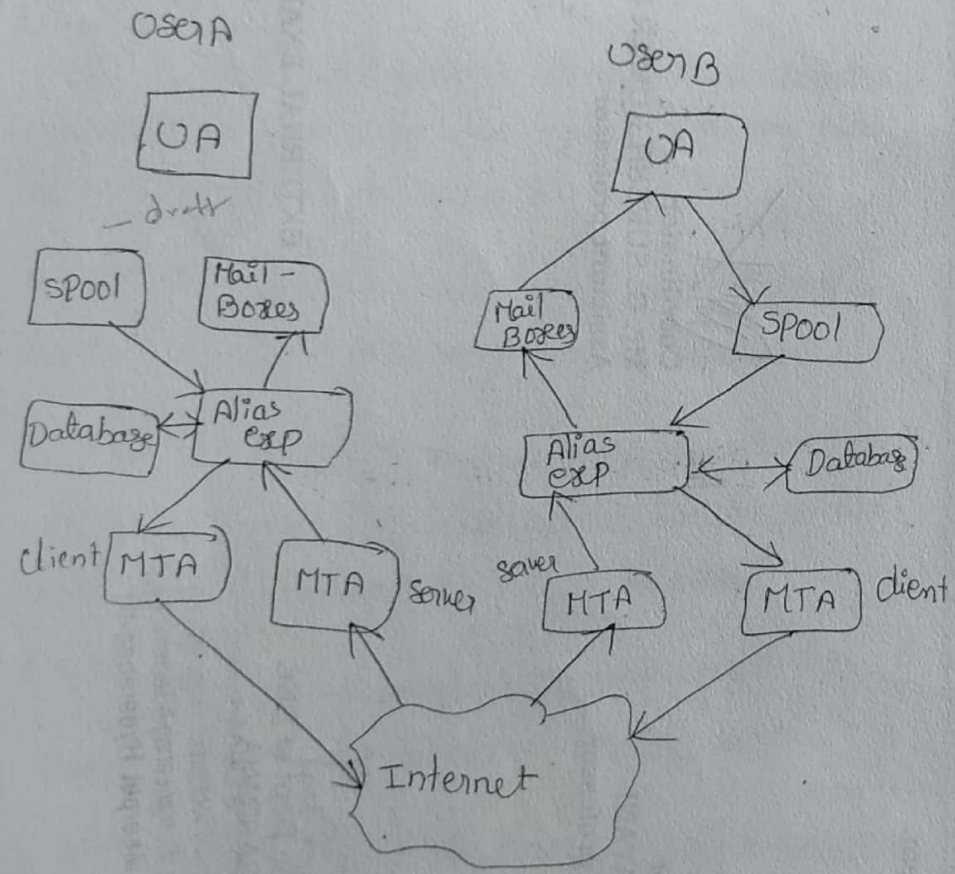
MTA is actually responsible for transfer of mail from one system to another. To send a mail, a system must have client MTA and system MTA. It transfers mail to mailboxes of recipients if they are connected in the same machine. It delivers mail to peer MTA if destination mailbox is in another machine. The delivery from one MTA to another MTA is done by SMTP.

Mail Box :-

It is a file on local hard drive to collect mails. Delivered mails are present in this file. The user can read it delete it according to his/her requirement. To use e-mail system each user must have a mail box. Access to mail box is only to owner of mail box.

SPool file :-

This file contains mails that are to be sent. User Agent Appends outgoing mails in this file using SMTP. MTA extracts pending mail from spool file for their delivery. E-Mail allows one name, an alias, to represent several different e-mail addresses. It is known as mailing list whenever users have to send a message system checks recipients name against alias database. If mailing list is present for defined alias, separate messages, one for each entry in the list must be prepared and handed to MTA.



Services provided by E-Mail system:-

Composition:-

The Composition refers to process that creates messages and answers. For composition any kind of text editor can be used.

Transfer:- Transfer means sending procedure of mail. i.e. from the sender to recipient.

Reporting:- Reporting refers to Confirmation for delivery of mail. It helps user to check whether their mail is delivered, lost or rejected.

Displaying:- It refers to present mail in form that is understood by the user.

Disposition:- This step concerns with recipient that what will recipient do after receiving mail. i.e. save mail, delete before reading or delete after reading.

SMTP:- (Simple Mail Transfer Protocol)

- SMTP is a set of communication guidelines that allow software to transmit an electronic mail over the internet is called simple mail transfer protocol.

- It is a program used for sending messages to other computer users based on e-mail addresses.

It provides a mail exchange between users on the same or different computers and it also supports to send a single message to one or more recipients.

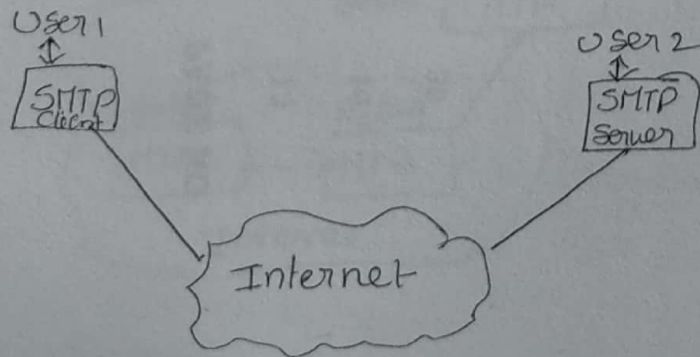
Sending messages can include text, voice, video or graphics.

It can also send the messages on network outside the internet.

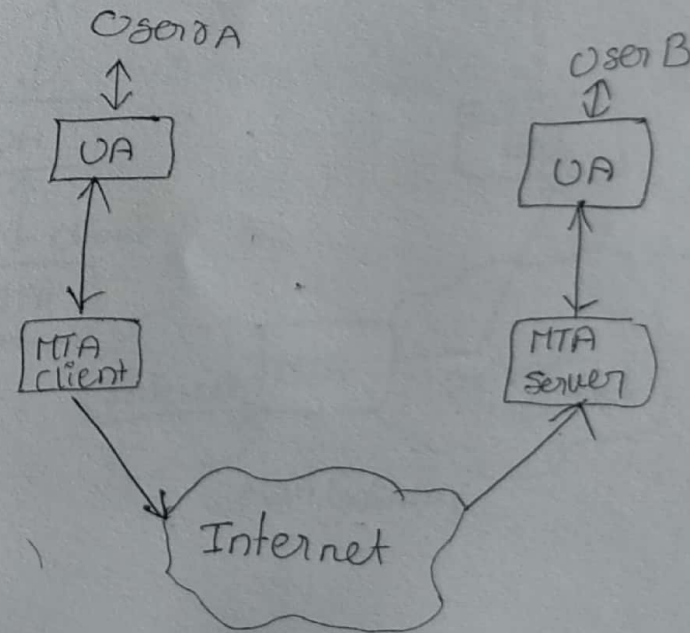
The main purpose of SMTP is used to set up communication rules between servers.

The server have a way of identifying themselves and announcing what kind of communications they are trying to perform. They also have a way of handling the errors such as incorrect email address. For example if the recipient address is wrong then receiving server reply with an error message of some kind.

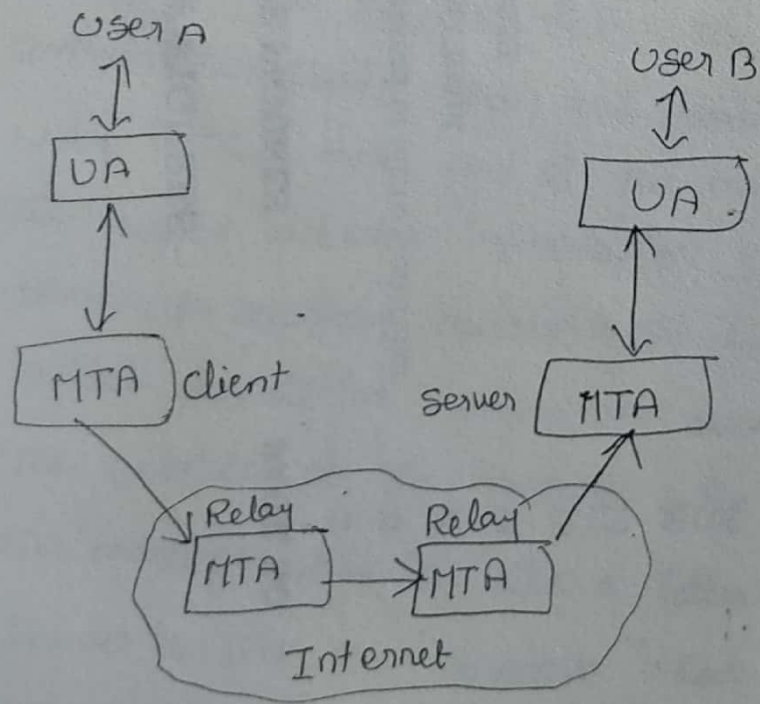
Components of SMTP :-



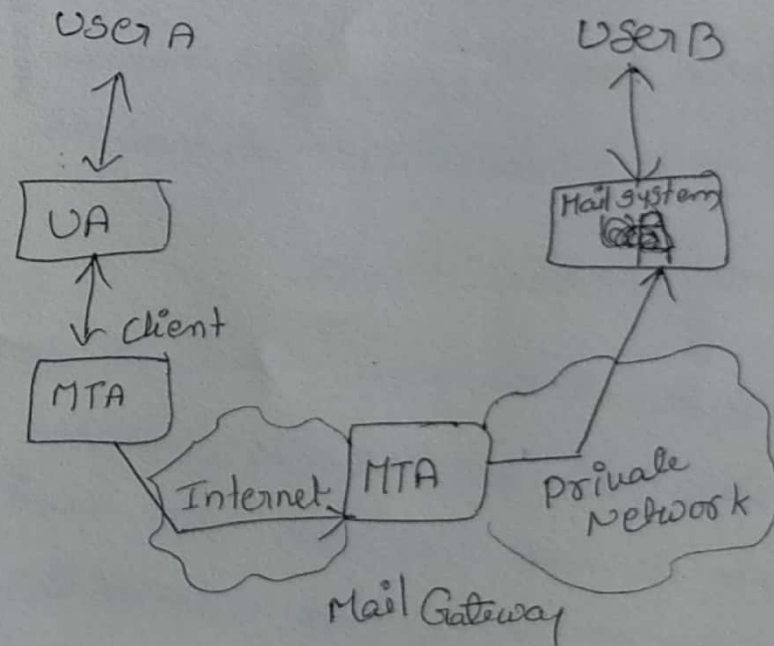
we will break the SMTP Client and SMTP server into two components such as User Agent (UA) and mail transfer Agent (MTA). The User Agent (UA) prepares the message create the envelope and then puts the message into the envelope. The MTA transfers this mail across the internet.



SMTP allows a more complex system by adding a relaying system. Instead of just having one MTA at sending side and one at receiving side, more MTAs can be added acting either as a client or server to relay the email.



- The relaying system without TCP/IP Protocol can also be used to send the emails to users, and this is achieved by the use of the mail gateway. The mail gateway is a relay MTA that can be used to receive an e-mail.



Working of SMTP:

1. Composition of Mail: A user sends an e-mail by composing an electronic-mail message using a Mail User Agent. Mail User Agent is a program which is used to send and receive mail. The message contains two parts, body and header. The body is the main part of the message while the header includes information such as the sender & recipient address. The header also includes descriptive information such as the subject of the message. In this case the message body is like a letter and header is like an envelope that contains the recipient's address.

2. Submission of mail:

After composing an email, the mail client then submits the completed e-mail to the SMTP server by using SMTP on TCP Port 25.

3. Delivery of Mail:

E-Mail addresses contain two parts: username of the recipient and domain name.

For example: TKRCET@gmail.com

↓ ↓
Username Domain name

If the domain name of the recipient's email address is different from the sender's domain name, then MUA will send the mail to the Mail Transfer Agent (MTA). To relay the email the MTA will find the target domain.

4. Receipt & Processing of Mail:-

once the incoming message is received, the exchange server delivers it to the incoming server (mail delivery Agent) which stores the e-mail where it waits for the user to retrieve it.

5. Access & Retrieval of Mail:-

The stored e-mail in MDA can be retrieved by using MUA (Mail User Agent). MUA can be accessed by using login and password.

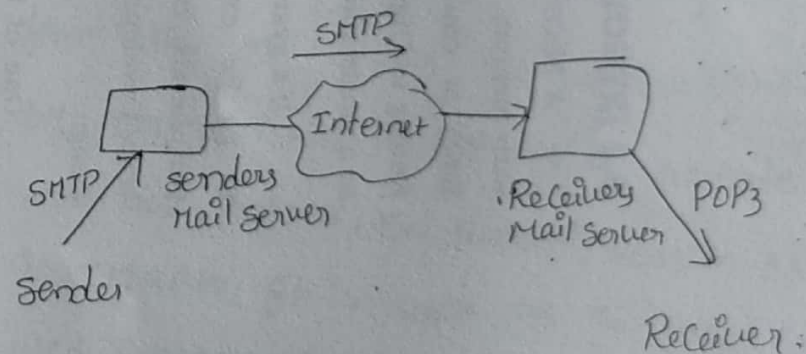
POP3 :-

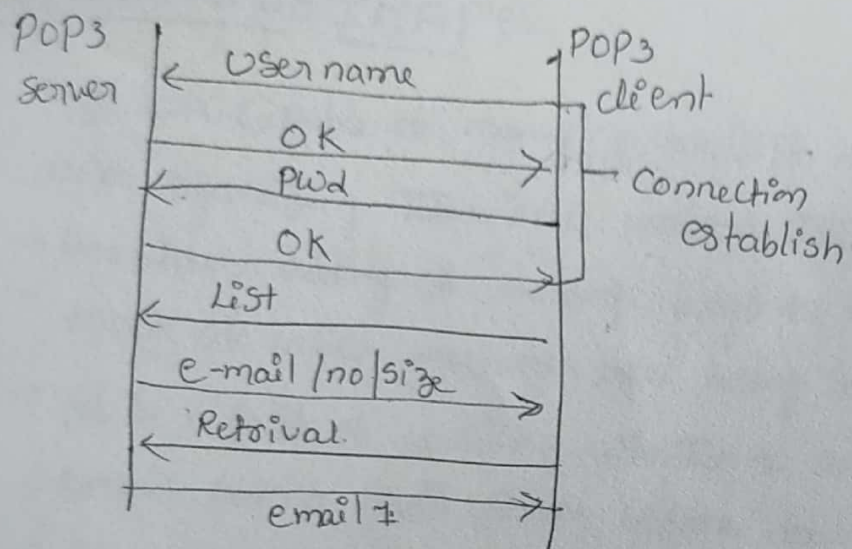
POP3 stands for Post Office Protocol 3

The POP3 is a simple protocol and having very limited functionalities

POP3 is used to receive emails from a remote server to a local e-mail client.

POP3 allows you to download email messages on your local computer and read them even when you are offline.





To establish the connection between the POP3 server and the POP3 client, the POP3 server asks for the user name to the POP3 client. If the user name is found in the POP3 server then it sends OK message. Then it asks for password from POP3 client. Then the client sends password to POP3 server. If the password matched then the POP3 server sends OK message and the connection gets established.

After the establishment of a connection, the client can see the list of mails on the POP3 mail server. In the list of mails the user will get the email numbers and sizes from the server. Out of this list, the user can start the retrieval of mail.

IMAP: (Internet Message Access Protocol)

IMAP is an application layer protocol that operates as a contract for receiving emails from the mail server. It was designed by Mark Crispin in 1986 as a remote access mail box protocol. The current version of IMAP is IMAP4. It is used as the most commonly used protocols for retrieving emails.

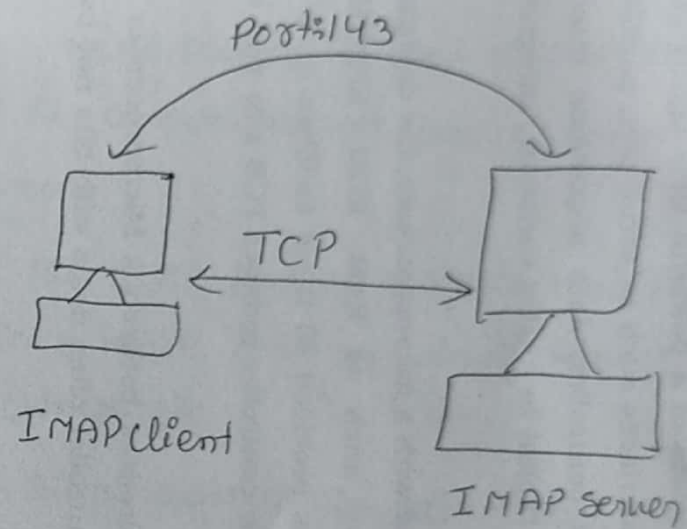
This term is also known as Internet mail access protocol, Interactive mail access protocol.

Features of IMAP:-

- It is Capable of managing multiple mailboxes and organizing them into various categories.
- Provides adding of message flags to keep track of which messages are being seen.
- It is Capable of deciding whether to retrieve email from a mail server before downloading.
- It makes it easy to download media when multiple files are attached.

Working of IMAP:-

IMAP follows Client-Server Architecture and is the most commonly used email protocol. It is a combination of client and server processes running on other computers that are connected through a network. This protocol resides over the TCP/IP protocol for communication. Port-143 is used for IMAP connection.



IMAP

Advantages:- It offers synchronization across across all the maintained sessions by the user.

- It provides security over POP3 protocol as the e-mail only exists on the IMAP server.
- Users have remote access to all the contents.
- There is no need to physically allocate any storage.

MIME:-

MIME Represents Multi-Purpose Internet Mail Extensions. It is a development to the Internet email protocol that enables its users to exchange several kinds of data files over the Internet including images, audio and video.

The MIME is required if the text in character sets other than the ASCII. virtually all human written Internet email and a fairly large proportion of automated email is transmitted via simple Mail transfer Protocol (SMTP) in MIME format.

MIME was designed mainly for SMTP, but the content types defined by MIME standards are important also in communication protocols outside of email, such as HTTP.

Need of MIME:-

MIME protocol is used to transfer e-mail in the computer network for the following reasons.

1. The MIME protocol supports multiple languages in e-mail, such as Hindi, French, Japanese, Chinese etc.
2. Simple protocol can reject mail that exceeds a certain size, but there is no word limit in MIME.
3. Images, audio, and video cannot be sent using simple e-mail protocols such as SMTP. These require MIME protocol.
4. Many times, emails are designed using code such as HTML and CSS, they are mainly used by companies for marketing their products. This type of code uses MIME to send email created from HTML and CSS.

MIME Header:-

MIME add five additional fields to the header portion of the actual e-mail to extend the properties of the simple e-mail protocol. These fields are

(i) MIME version:-

It defines the version of the MIME protocol. This header usually has a parameter value 1.0 indicating that the message is formatted using MIME.

(ii) Content type:-

It describes the type and subtype of information to be sent in the message. These messages can be of many types such as text, image, audio, video and they also have many subtypes.

(iii) Content type Encoding:-

In this field it is told which method has been used to convert mail information into ASCII or Binary number, such as 7-bit encoding, 8-bit encoding etc.

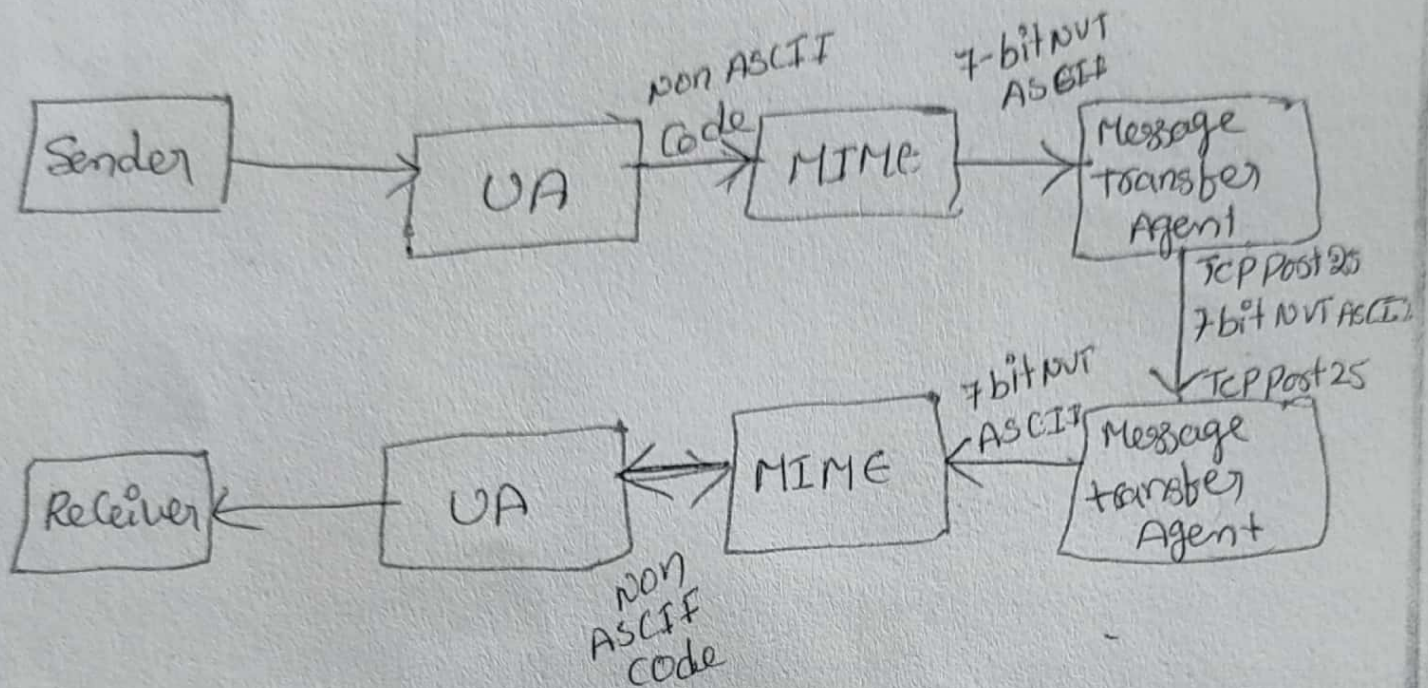
(iv) Content ID:-

In this field a unique "ContentId" number is appended to all email messages so that they can be uniquely identified.

(v) Content description:-

This field contains a brief description of the content within the e-mail. This means that information about whatever is being sent in the mail is clearly in the "Content description". This field also provides information of name, creation date and modification date of the file.

Working diagram of MIME Protocol:-



Features of MIME Protocol:-

1. It supports multiple attachments in a single e-mail.
2. It supports the non-ASCII characters.
3. It supports unlimited e-mail length.
4. It supports multiple languages.