

Application Layer:

STANDARD APPLICATION LAYER PROTOCOL

Two very widely used standardized application layer protocols:

SMTP : Simple Mail Transfer Protocol which is used to exchange electronic mail.

HTTP : Hyper Text Transport protocol. which is used to communicate between web browser and web servers

NON STANDARD APPLICATION LAYER PROTOCOL
If a programmer can write two programs that provide service to user by interacting with transport layer

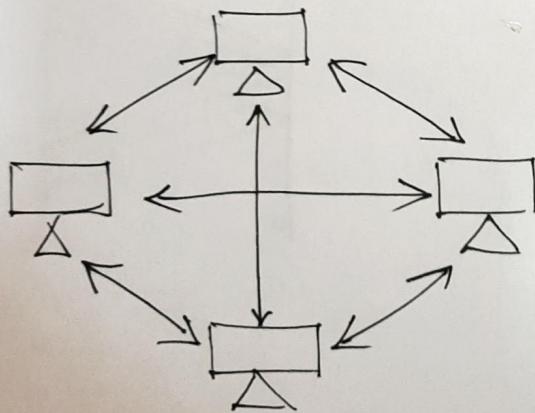
APPLICATION LAYER PARADIGMS

1. Peer to Peer

In this paradigm there is no need for a server process to be running all the time and wait for client process to connect.

The responsibilities are shared by peers.

A computer connected to internet can provide service one time and receive service another time & can also do it simultaneously.

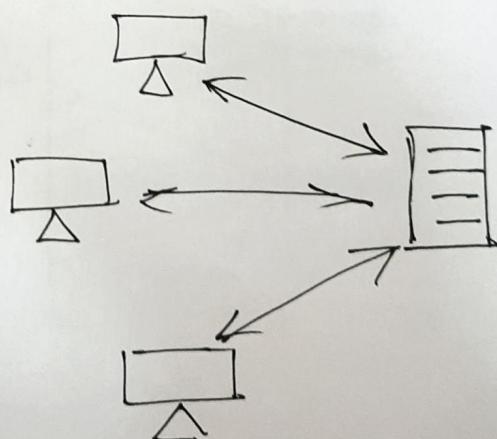


2. Client - Server

In this paradigm there is a client process that requests a server program on remote host and the remote host/server responds to that request.

The server process runs all the time and is on listen mode.

There can be specific servers responding to specific requests.



MIXED PARADIGM :

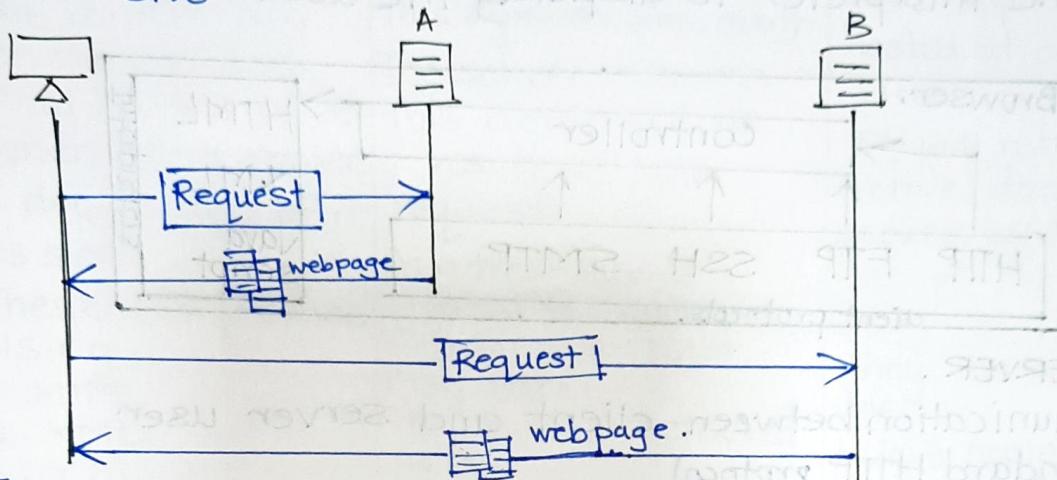
An application may choose to use a mix of both paradigm

example : A light load client-server communication can be used to locate the peer who has the necessary data.

WWW (WORLD WIDE WEB)

It is a distributed client /server service, in which a client (browser) can access a server (web)

The service provided is distributed over many locations called site



This system allows document search and retrieval from any part of the internet

The documents were having hypertext as the content.

The units of information on the web can be referred to as pages, documents or resources.

A document containing img, vid or sound can be called hypermedia.

COMPONENTS OF WEB.

Structural

Web client / Browser

Web server

Web caches

Internet.

Semantic

Hyper text transfer Protocol (HTTP)

Hypertext Markup language (HTML)

Extensible Markup language (XML)

Uniform Resource Identifier (URI)

WEB CLIENT :

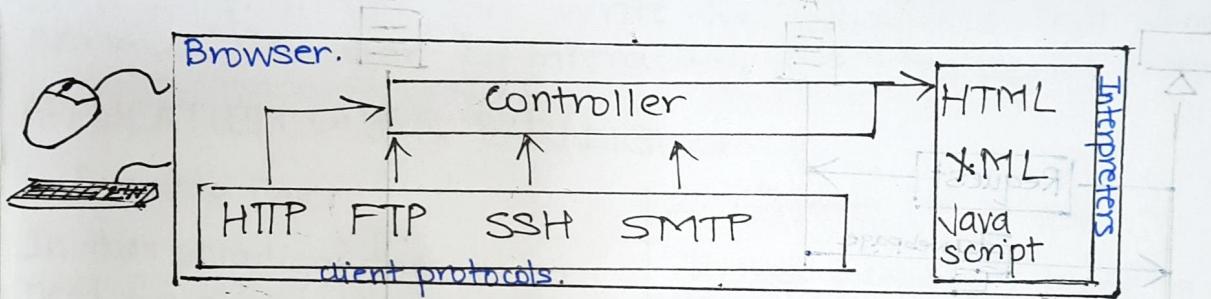
Web client is a software on client which initiates the communication with the server.

Each browser usually consists of 3 parts.

- a controller
- client protocol
- interpreter

A controller receives input from the keyboard or the mouse and uses client program to access documents.

After document has been accessed, the controller uses one of the interpreter to display the document on screen.



WEB SERVER :

All communication between client and server uses the standard HTTP protocol.

Web server informs OS to accept incoming network by using specific port on machine.

The server always runs as a background process.

HTTP commands URL specifying host machine.

The URL received is then converted into filename/program name, accordingly the requested file or output program is executed.

PROXY SERVER :

A proxy server is a computer which keeps copies of responses to recent request.

If the client sends request to proxy server if request matches the document is returned else the request forwarded to server.

WEB DOCUMENTS

- static

fixed content doc that are created and stored in server

i.e content is determined when it is written not when it is used.

The content can be changed but only by the server when client requests a doc, a copy of it is sent.

These are prepared using

1. HTML
2. XML
3. XSL
4. XHTML

- dynamic

A dynamic doc is created by web server when browser requests the doc

When request arrives the server runs a application program or a script which creates this dynamic document

The server returns this document as a result of the request.

As a fresh doc is created for each request the result may vary.

They can be retrieved using

1. CGI
2. JSP
3. ASP

- active

For many programs we need scripts to be run at client site

These are called active doc.

For example

A UI application hosted at client side

It will return active doc to server by running scripts or programs

They can be created by

1. Java Applet
2. Java Script.

URL - Uniform Resource Locator

uniquely identify resources on the internet.

URL provides information about its location on the web.

When a user enters URL, browser forms a request message and sends it to the server

Web server retrieves the requested URL and sends back a response message

Web browser renders the response HTML or appropriate format.

Format : `http://www.domain-name/filename`

Protocol:// host : port / path.

HTTP :

It is used to define how client server programs can be written to retrieve web pages from the web.

It is a protocol used to access data on www

It can transfer data in form of plain text, hypertext, audio, video etc.

HTTP is a stateless request / response protocol that governs client server paradigm.

It is a text oriented protocol. It contains embedded URL known as links.

Request

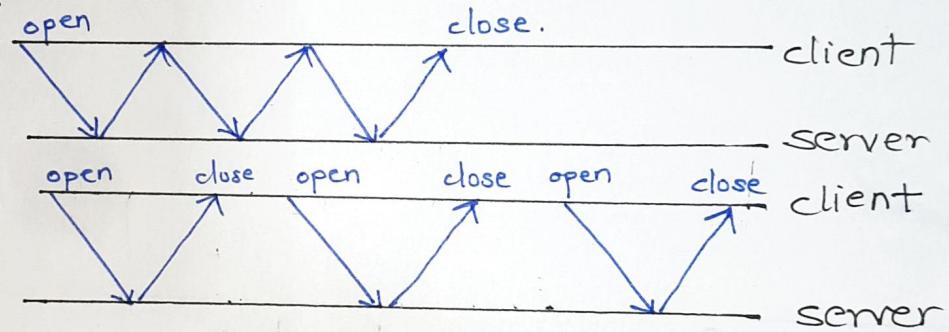
Request line
Request header : Value
Body (optional)

Response

Status Line
Response header
Body

CONNECTIONS .

Persistent



CACHING :

HTTP caching enables the client to retrieve document faster and reduces load on the server

It is implemented at Proxy server, ISP router & Browser
Server sets expiration date for each page beyond which it is not cached.

If ~~the~~ cache document is out of date then request is forwarded to server and response is cached along the way.

A web page will not be cached if no-cache directive is specified.

SECURITY:

HTTP doesn't provide security. However if HTTP is run over Secure Socket Layer (SSL) then it is referred to as HTTPS. HTTPS provides confidentiality, authentication and data integrity.

FTP - File Transfer protocol.

It is standard internet protocol for transmitting file from one host to another.

It is mainly used for sending webpage file from server to client.

Also used for downloading files from server.

We can use HTTP for this but FTP is better for larger files and different format.

It is reliable and efficient.

FTP can transfer following file types.

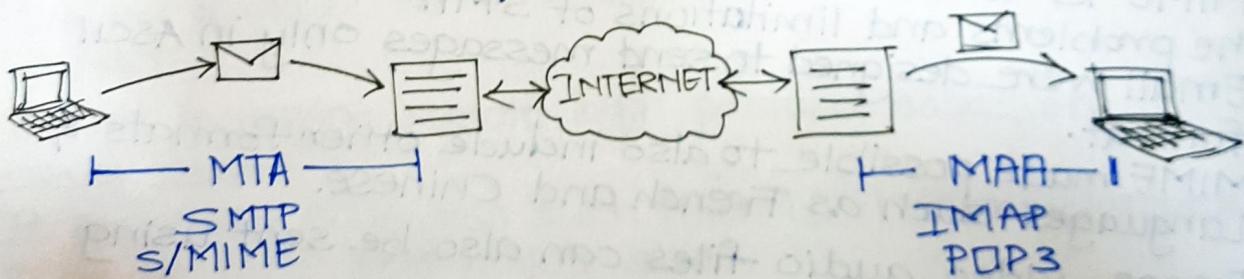
1. ASCII
2. EBCDIC
3. Image

EMAIL

one of the most popular internet service is E-mail. Electronic mail.

The three components of Email are.

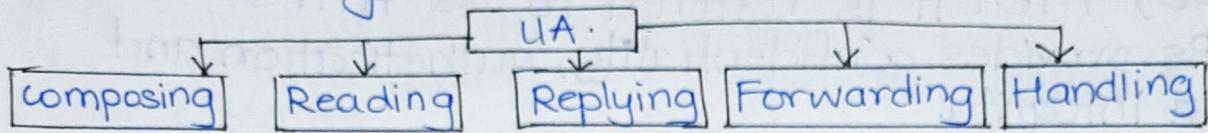
- USER AGENT (UA)
- MESSAGE TRANSFER AGENT (MTA)
- MESSAGE ACCESS AGENT (MAAA)



headers	body
MIME	
upload	download

UA:

It provides service to user so its easier to send & receive message



MTA:

The actual mail transfer is done through MTA
We need a client MTA on sender & server MTA on receiver.

The Formal protocol for MTA is SMTP and its extention MIME

MAA:

It is a software that pulls message out of mail box
POP3 and IMAP4 are example of MAA.

Address format : Local part @ Domain name.

SMTP - SIMPLE MAIL TRANSFER PROTOCOL

It is standard protocol

It is not concerned with format or content of mail.

It uses information written on the envelope of the mail (Message header) but doesn't look at the contents (Message body) of the envelope.

MIME - MULTIPURPOSE INTERNET MAIL EXTENSION :

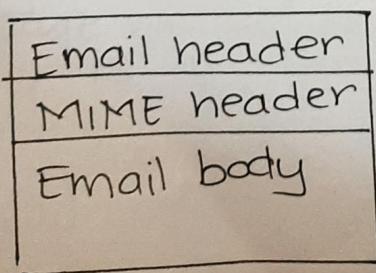
SMTP provides basic email services while MIME adds multimedia capabilities to SMTP

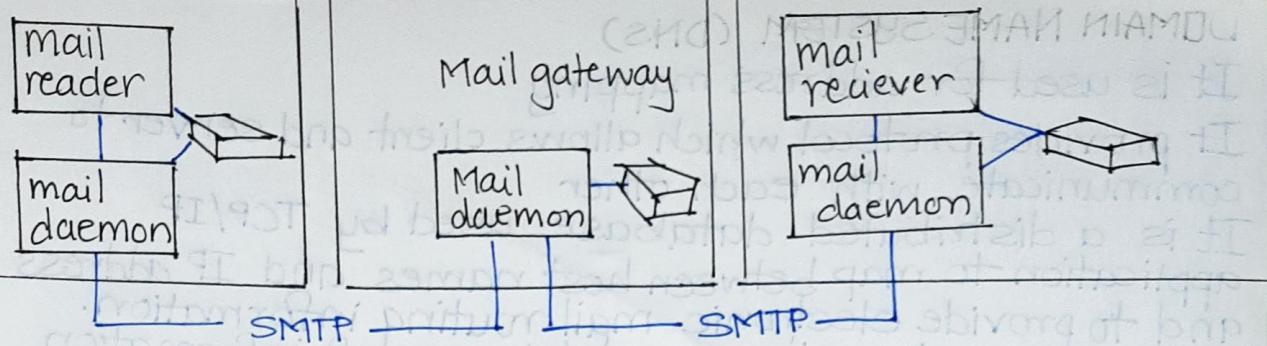
MIME is an extention of SMTP and is used to overcome the problems and limitations of SMTP

Email were designed to send messages only in ASCII format.

MIME made possible to also include other formats & Languages such as French and Chinese.

Image, video, audio files can also be sent using MIME





IMAP4 - INTERNET MAIL ACCESS PROTOCOL

It is an application layer protocol that allows an email client to access e-mail on a remote server. It is a method of accessing electronic mail kept on a possible shared mail server.

IMAP is more capable wire protocol.

IMAP is similar to SMTP in many ways

IMAP is client/server protocol running over TCP port 143

POP3 - POST OFFICE PROTOCOL

It is a standard application layer protocol used by local email clients to retrieve email from remote server over TCP/IP connection.

Pop3 uses port 110 & can be used with or without SMTP

Pop is much simpler protocol

Pop supports offline access to the message thus less internet usage.

It allows only one mail box to be created on server

It is not suitable for accessing non mail data.

TELNET

TELNET is original remote login protocol based on client server

It provides connection such that local terminal appears to be at ~~local side~~ remote side

It also allows us to explain issues & challenge of remote logging

Network administrator often use TELNET for diagnostic and debugging purpose

TELNET requires login name & password for security purpose.

DOMAIN NAME SYSTEM (DNS)

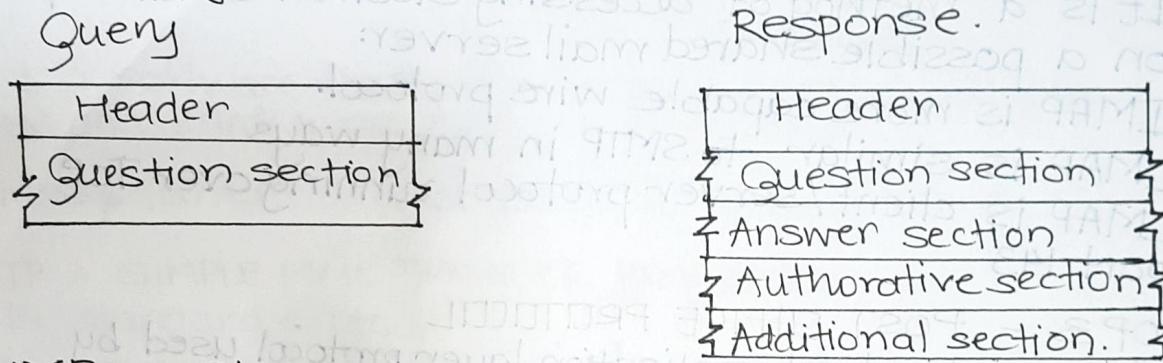
It is used for address mapping

It provides protocol which allows client and server to communicate with each other

It is a distributed database used by TCP/IP application to map between host names and IP address and to provide electronic mail routing information.

Each site maintains its own database of information and runs a server program that other system across the internet can query.

DNS message



SNMP - SIMPLE NETWORK MANAGEMENT PROTOCOL

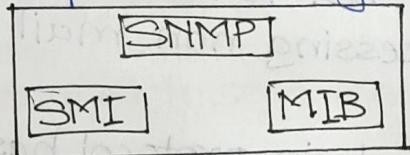
The Simple Network Management Protocol is a framework for managing devices in a internet network using TCP/IP protocol suit

SNMP is an application layer protocol that monitors and manages routers over distributed networks

It provides set of operations for monitoring & managing

SNMP uses concept of Manager & Agent.

SMI
Structure of Management Information



It is used to define rules
It is a guideline for SNMP

It is a collection of object which are to be managed

MIB
Management Information Base.

DHCP - DYNAMIC HOST CONFIGURATION PROTOCOL

It is used in TCP/IP for Network management

It is used in client server architecture

This protocol automatically assigns IP to a device in its network.

It has a DHCP server which keeps track of IPs assigned.