Unit- 7

The Application Layer

✚ Content:

1. Domain Name System

2. E-mail Services

3. SMTP/POP protocols

4. File transfer protocols

5. WWW Service and HTTP

6. SNMP Protocol

1. Domain Name System (DNS):

An application layer protocol defines how the application processes running on different systems, pass the messages to each other.

- DNS stands for Domain Name System.
- DNS is a directory service that provides a mapping between the name of a host on the network and its numerical address.
- DNS is required for the functioning of the internet.
- Each node in a tree has a domain name, and a full domain name is a sequence of symbols specified by dots.
- DNS is a service that translates the domain name into IP addresses. This allows the users of networks to utilize user-friendly names when looking for other hosts instead of remembering the IP addresses.
- For example, suppose the FTP site at EduSoft had an IP address of 132.147.165.50, most people would reach this site by specifying ftp.EduSoft.com. Therefore, the domain name is more reliable than IP address.

DNS is a TCP/IP protocol used on different platforms. The domain name space is divided into three different sections: generic domains, country domains, and inverse domain.
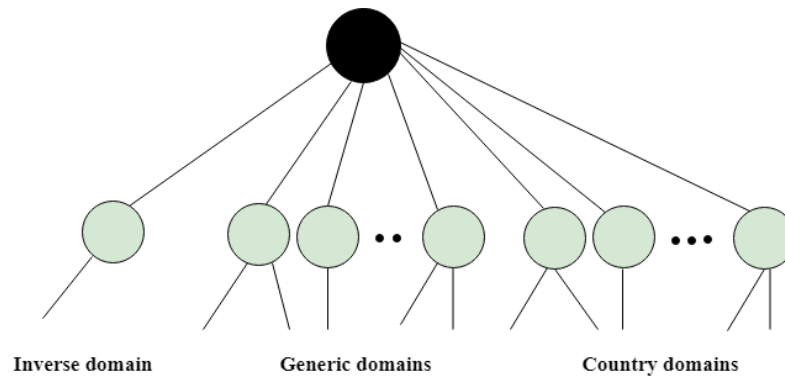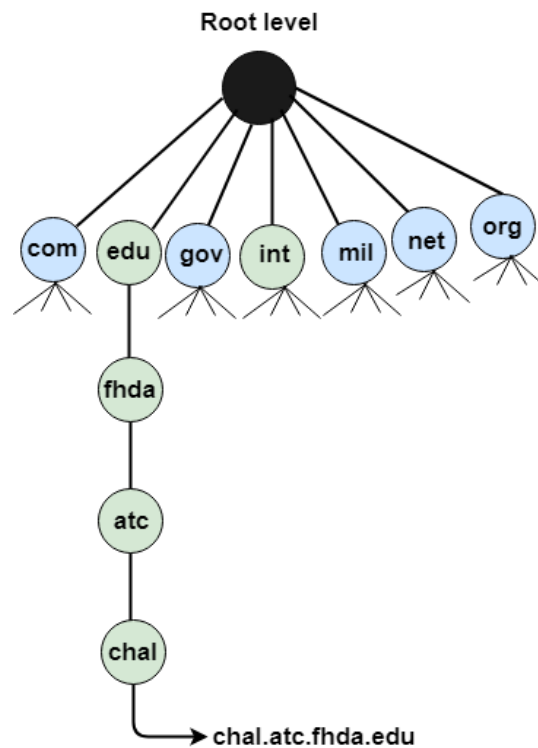

Generic Domains

o It defines the registered hosts according to their generic behavior.

o Each node in a tree defines the domain name, which is an index to the DNS database.

o It uses three-character labels, and these labels describe the organization type.

Label	Description
aero	Airlines and aerospace companies
biz	Businesses or firms
com	Commercial Organizations
coop	Cooperative business Organizations
edu	Educational institutions
gov	Government institutions
info	Information service providers

int	International Organizations
mil	Military groups
museum	Museum & other nonprofit organizations
name	Personal names
net	Network Support centers
org	Nonprofit Organizations
pro	Professional individual Organizations

Root level

chal.atc.fhda.edu

Country Domain

The format of country domain is same as a generic domain, but it uses two-character country abbreviations (e.g., us for the United States) in place of three character organizational abbreviations.

Inverse Domain

The inverse domain is used for mapping an address to a name. When the server has received a request from the client, and the server contains the files of only authorized clients. To determine whether the client is on the authorized list or not, it sends a query to the DNS server and ask for mapping an address to the name.

Working of DNS

- o DNS is a client/server network communication protocol. DNS clients send requests to the. server while DNS servers send responses to the client.
- o Client requests contain a name which is converted into an IP address known as a forward DNS lookup while requests containing an IP address which is converted into a name known as reverse DNS lookups.
- o DNS implements a distributed database to store the name of all the hosts available on the internet.
- o If a client like a web browser sends a request containing a hostname, then a piece of software such as DNS resolver sends a request to the DNS server to obtain the IP address of a hostname. If DNS server does not contain the IP address associated with a hostname, then it forwards the request to another DNS server. If IP address has arrived at the resolver, which in turn completes the request over the internet protocol.

2. E-mail Services:

Email is a service which allows us to send the message in electronic mode over the internet. It offers an efficient, inexpensive and real time mean of distributing information among people.
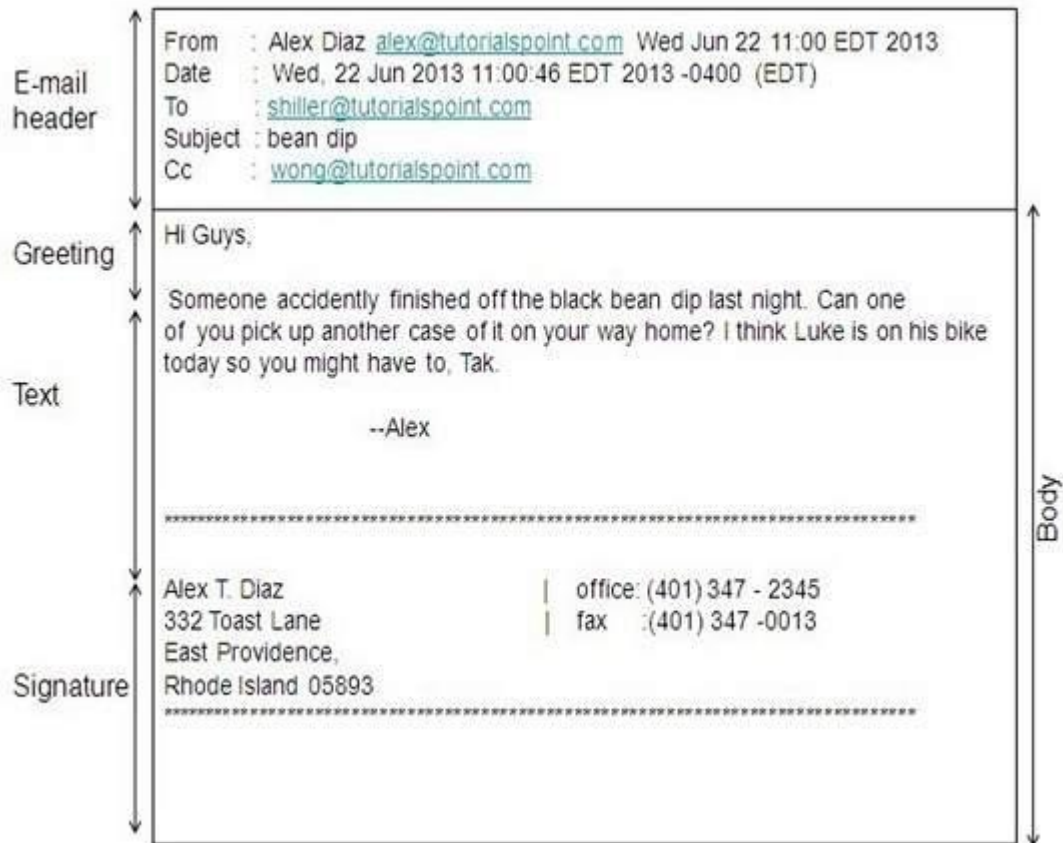
E-Mail Address

Each user of email is assigned a unique name for his email account. This name is known as E-mail address. Different users can send and receive messages according to the e-mail address.

E-mail is generally of the form username@domainname. For example, webmaster@tutorialspoint.com is an e-mail address where webmaster is username and tutorialspoint.com is domain name.

- The username and the domain name are separated by **@ (at)** symbol.
- E-mail addresses are not case sensitive.
- Spaces are not allowed in e-mail address.

E-mail Message Components:

E-mail message comprises of different components: E-mail Header, Greeting, Text, and Signature. These components are described in the following diagram:

E-mail Header:

The first five lines of an E-mail message is called E-mail header. The header part comprises of following fields:

- From
- Date
- To
- Subject
- CC
- BCC

- From-

  The **From** field indicates the sender's address i.e. who sent the e-mail.
- Date-

  The **Date** field indicates the date when the e-mail was sent.
- To-

  The **To** field indicates the recipient's address i.e. to whom the e-mail is sent.
- Subject-

  The **Subject** field indicates the purpose of e-mail. It should be precise and to the point.
- CC-

  CC stands for Carbon copy. It includes those recipient addresses whom we want to keep informed but not exactly the intended recipient.
- BCC-

  BCC stands for Black Carbon Copy. It is used when we do not want one or more of the recipients to know that someone else was copied on the message.
- Greeting-

  Greeting is the opening of the actual message. Eg. Hi Sir or Hi Guys etc.
- Text-

  It represents the actual content of the message.
- Signature-

  This is the final part of an e-mail message. It includes Name of Sender, Address, and Contact Number.

Advantages:

E-mail has prooved to be powerful and reliable medium of commmunication. Here are the benefits of **E-mail:**

- Reliable

  Many of the mail systems notify the sender if e-mail message was undeliverable.
- Convenience

  There is no requirement of stationary and stamps. One does not have to go to post office. But all these things are not required for sending or receiving an mail.
- Speed

  E-mail is very fast. However, the speed also depends upon the underlying network.
- Inexpensive

  The cost of sending e-mail is very low.
- Printable

  It is easy to obtain a hardcopy of an e-mail. Also an electronic copy of an e-mail can also be saved for records.
- Global

E-mail can be sent and received by a person sitting across the globe.

- Generality

  It is also possible to send graphics, programs and sounds with an e-mail.

Disadvantages:

Apart from several benefits of E-mail, there also exists some disadvantages as discussed below:

- Forgery

  E-mail doesn't prevent from forgery, that is, someone impersonating the sender, since sender is usually not authenticated in any way.

- Overload

  Convenience of E-mail may result in a flood of mail.

- Misdirection

  It is possible that you may send e-mail to an unintended recipient.

- Junk

  Junk emails are undesirable and inappropriate emails. Junk emails are sometimes referred to as spam.

- No Response

  It may be frustrating when the recipient does not read the e-mail and respond on a regular basis.

  E-mail System

  E-mail system comprises of the following three components:

  - **Mailer:**

    It is also called **mail program, mail application** or **mail client.** It allows us to manage, read and compose e-mail.

  - **Mail Server:**

    The function of mail server is to receive, store and deliver the email. It is must for mail servers to be Running all the time because if it crashes or is down, email can be lost.

  - **Mailboxes:**

    Mailbox is generally a folder that contains emails and information about them.

Working of E-mail:

Email working follows the client server approach. In this client is the mailer i.e. the mail application or mail program and server is a device that manages emails.

Following example will take you through the basic steps involved in sending and receiving emails and will give you a better understanding of working of email system:

- Suppose person A wants to send an email message to person B.
- Person A composes the messages using a mailer program i.e. mail client and then select Send option.
- The message is routed to **Simple Mail Transfer Protocol** to person B's mail server.
- The mail server stores the email message on disk in an area designated for person B.
- The disk space area on mail server is called mail spool.
- Now, suppose person B is running a POP client and knows how to communicate with B's mail server.
- It will periodically poll the POP server to check if any new email has arrived for B.As in this case, person B has sent an email for person B, so email is forwarded over the network to B's PC. This is message is now stored on person B's PC.

The following diagram gives pictorial representation of the steps discussed above:
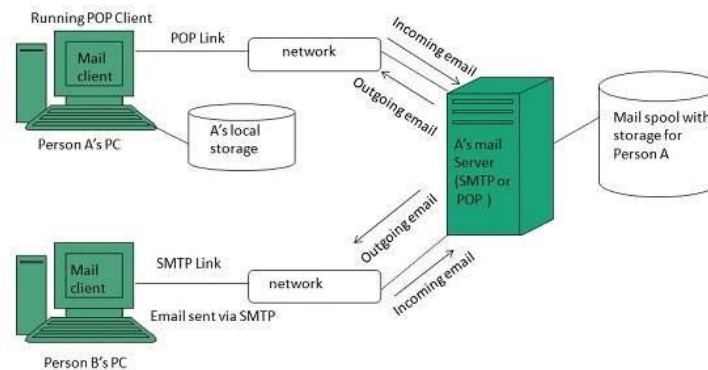
Composing and Sending Email:

Before sending an email, we need to compose a message. When we are composing an email message, we specify the following things:

- Sender's address in To field
- Cc (if required)
- Bcc (if required)
- Subject of email message
- Text
- Signature

You should specify the correct email address; otherwise it will send an error back to the sender.

Once you have specified all the above parameters, It's time to send the email. The mailer program provides a Send button to send email, when you click Send, it is sent to the mail server and a message **mail sent successfully** is shown at the above.

Reading Email:

Every email program offers you an interface to access email messages. Like in Gmail, emails are stored under different tabs such as primary, social, and promotion. When you click one of tab, it displays a list of emails under that tab.

In order to read an email, you just have to click on that email. Once you click a particular email, it gets opened. The opened email may have some file attached with it. The attachments are shown at the bottom of the opened email with an option called **download attachment.**

Replying Email:

After reading an email, you may have to reply that email. To reply an email, click **Reply** option shown at the bottom of the opened email.

Once you click on Reply, it will automatically copy the sender's address in to the To field. Below the To field, there is a text box where you can type the message.

Once you are done with entering message, click Send button. It's that easy. Your email is sent.

Forwarding Email:

It is also possible to send a copy of the message that you have received along with your own comments if you want. This can be done using **forward** button available in mail client software.

The difference between replying and forwarding an email is that when you reply a message to a person who has send the mail but while forwarding you can send it to anyone.

When you receive a forwarded message, the message is marked with a > character in front of each line and **Subject:** field is prefixed with **Fw.**

Deleting Email:

If you don't want to keep email into your inbox, you can delete it by simply selecting the message from the message list and clicking **delete** or pressing the appropriate command.

Some mail clients offers the deleted mails to be stored in a folder called deleted items or trash from where you can recover a deleted email.

Email Features:

Now a day, the mail client comes with enhanced features such as attachment, address book, and MIME support. Here in this chapter we will discuss all of these features which will give you a better understanding of added feature of a mail client program.

Attachment:

Ability to attach file(s) along with the message is one of the most useful features of email. The attachment may be a word document, PowerPoint presentation, audio/video files, or images.

- In order to attach file(s) to an email, click the attach button. As a result, a dialog box appears asking for specifying the name and location of the file you want to attach.
- Once you have selected the appropriate file, it is attached to the mail.
- Usually a paper clip icon appears in the email which indicates that it has an attachment.
- When adding an attachment it is better to compress the attached files so as to reduce the file size and save transmission time as sending and downloading large files consumes a lot of space and time.

Address Book:

Address book feature of a mail program allows the users to store information about the people whom they communicate regularly by sending emails. Here are some of the key features of an Address book:

- Address book includes the nick names, email addresses, phone number etc. of the people.
- Using address book allows us not to memorize email of address of a person, you just have to select recipient name from the list.
- When you select a particular name from the list, the corresponding email address link automatically get inserted in to the To: field.
- Address book also allows creating a group so that you can send a email to very member of the group at once instead of giving each person email address one by one.

MIME Types:

MIME is acronym of Multipurpose Internet Mail Extensions. MIME compliant mailer allows us to send files other than simple text i.e. It allows us to send audio, video, images, document, and pdf files as an attachment to an email.

Suppose if you want to send a word processor document that has a group of tabular columns with complex formatting.

If we transfer the file as text, all the formatting may be lost. MIME compliant mailer takes care of messy details and the message arrives as desired.

The following table describes commonly used MIME Types:

1.	Type	Subtype	Description	File extension(s)
2.	Application	postscript tex troff	Printable postscript document TEX document Printable troff document	.eps, .ps .tex .t, .tr, .roff
3.	Audio	aiff au midi real audio	Apple sound Sun Microsystems sound Musical Instrument Digital Interface Progressive Network sound	.aif, .aiff,.aifc .au, .snd .midi, .mid .ra, .ram
4.	image	gif jpeg png triff	Graphics Interchange Format Joint Photographic Experts Group Portable Network Graphics Tagged Image Modeling Language	.gif .jpeg, .jpg, .jpe .png .tiff, .tif
5.	Model	vrml	Virual reality Modelling Language	.wrl
6.	Text	html plain sgml	Hyper Text Markup Language Unformatted text Standard Generalized Markup language	.html, .htm .txt .sgml
7.	Video	avi mpeg quicktime sgi-movie	Microsoft Audio Video Interleaved Moving Pictures Expert Group Apple QuickTime movie silicon graphic movie	.avi .mpeg, .mpg .qt, .mov .movie

The Email service providers:

There are several email service providers available in the market with their enabled features such as sending, receiving, drafting, storing an email and much more.

The following table shows the popular email service providers:

S.N.	Service and Description
1.	**Gmail** Gmail is an email service that allows users to collect all the messages. It also offers approx 7 GB of free storage.
2.	**Hotmail** Hotmail offers free email and practically unlimited storage accessible on web.
3.	**Yahoo Mail** Yahoo Mail offers unlimited storage, SMS texting, social networking and instant messaging to boot.
4.	**iCloud Mail** iCloud Mail offers ample storage, IMAP access, and an elegantly functional web application.
5.	**ATM Mail** ATM Mail is a free email service with good spam protection.
6.	**Mail.com** and **GMX Mail** Mail.com and GMX Mail offers reliable mail service with unlimited online storage.
7.	**Shortmail** Shortmail offers easy and fast email service but with limited 500 characters per message.
8.	**Inbox.com** Inbox.com offers 5 GB of free online storage. IMAP is not supported by Inbox.com
9.	**Facebook Messages** Facebook Messages includes the message conversation.
10.	**My Way Mail** My Way Mail offers clean and fast free email service but lacks in secure messaging.

3. SMTP/POP Protocols:

E-mail Protocols are set of rules that help the client to properly transmit the information to or from the mail server. Here in this tutorial, we will discuss various protocols such as **SMTP, POP,** and **IMAP.**

SMPTP:

SMTP stands for **Simple Mail Transfer Protocol**. It was first proposed in 1982. It is a standard protocol used for sending e-mail efficiently and reliably over the internet.

Key Points:

- SMTP is application level protocol.

- SMTP is connection oriented protocol.

- SMTP is text based protocol.

- It handles exchange of messages between e-mail servers over TCP/IP network.

- Apart from transferring e-mail, SMPT also provides notification regarding incoming mail.

- When you send e-mail, your e-mail client sends it to your e-mail server which further contacts the recipient mail server using SMTP client.

- These SMTP commands specify the sender's and receiver's e-mail address, along with the message to be send.

- The exchange of commands between servers is carried out without intervention of any user.

- In case, message cannot be delivered, an error report is sent to the sender which makes SMTP a reliable protocol.

SMTP Commands:

The following table describes some of the SMTP commands:

S.N.	Command Description
1	**HELLO** This command initiates the SMTP conversation.
2	**EHELLO** This is an alternative command to initiate the conversation. ESMTP indicates that the sender server wants to use extended SMTP protocol.
3	**MAIL FROM** This indicates the sender's address.
4	**RCPT TO** It identifies the recipient of the mail. In order to deliver similar message to multiple users this command can be repeated multiple times.
5	**SIZE** This command let the server know the size of attached message in bytes.
6	**DATA** The **DATA** command signifies that a stream of data will follow. Here stream of data refers to the body of the message.
7	**QUIT** This commands is used to terminate the SMTP connection.
8	**VERFY** This command is used by the receiving server in order to verify whether the given username is valid or not.
9	**EXPN** It is same as VRFY, except it will list all the users name when it used with a distribution list.

IMAP:

IMAP stands for **Internet Message Access Protocol.** It was first proposed in 1986. There exist five versions of IMAP as follows:

1. Original IMAP
2. IMAP2
3. IMAP3
4. IMAP2bis
5. IMAP4

Key Points:

- IMAP allows the client program to manipulate the e-mail message on the server without downloading them on the local computer.
- The e-mail is hold and maintained by the remote server.
- It enables us to take any action such as downloading, delete the mail without reading the mail.It enables us to create, manipulate and delete remote message folders called mail boxes.
- IMAP enables the users to search the e-mails.
- It allows concurrent access to multiple mailboxes on multiple mail servers.

IMAP Commands

The following table describes some of the IMAP commands:

S.N.	Command Description
1	**IMAP_LOGIN** This command opens the connection.
2	**CAPABILITY** This command requests for listing the capabilities that the server supports.
3	**NOOP** This command is used as a periodic poll for new messages or message status updates during a period of inactivity.
4	**SELECT** This command helps to select a mailbox to access the messages.
5	**EXAMINE** It is same as SELECT command except no change to the mailbox is permitted.
6	**CREATE** It is used to create mailbox with a specified name.
7	**DELETE** It is used to permanently delete a mailbox with a given name.
8	**RENAME** It is used to change the name of a mailbox.
9	**LOGOUT** This command informs the server that client is done with the session. The server must send BYE untagged response before the OK response and then close the network connection.

POP:

POP stands for Post Office Protocol. It is generally used to support a single client. There are several versions of POP but the POP 3 is the current standard.

Key Points

• POP is an application layer internet standard protocol.

• Since POP supports offline access to the messages, thus requires less internet usage time.

• POP does not allow search facility.

• In order to access the messaged, it is necessary to download them.

• It allows only one mailbox to be created on server.

• It is not suitable for accessing non mail data.

• POP commands are generally abbreviated into codes of three or four letters. Eg. STAT.

POP Commands

The following table describes some of the POP commands:

S.N.	Command Description
1	**LOGIN** This command opens the connection.
2	**STAT** It is used to display number of messages currently in the mailbox.
3	**LIST** It is used to get the summary of messages where each message summary is shown.
4	**RETR** This command helps to select a mailbox to access the messages.
5	**DELE** It is used to delete a message.
6	**RSET** It is used to reset the session to its initial state.
7	**QUIT** It is used to log off the session.

4. File transfer protocol (FTP):

File Transfer Protocol (FTP) is an application layer protocol which moves files between local and remote file systems. It runs on the top of TCP, like HTTP. To transfer a file, 2 TCP connections are used by FTP in parallel: control connection and data connection.
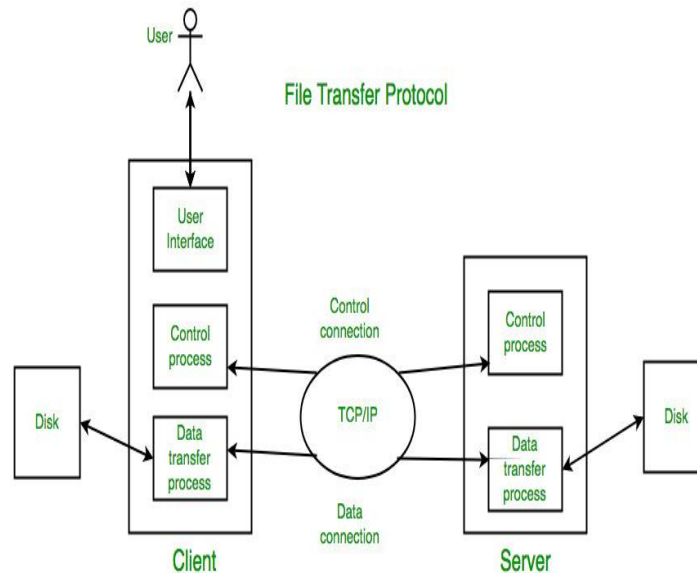
What is control connection?

For sending control information like user identification, password, commands to change the remote directory, commands to retrieve and store files, etc., FTP makes use of control connection. The control connection is initiated on port number 21.

What is data connection?

For sending the actual file, FTP makes use of data connection. A data connection is initiated on port number 20.
FTP sends the control information out-of-band as it uses a separate control connection. Some protocols send their request and response header lines and the data in the same TCP connection. For this reason, they are said to send their control information in-band. HTTP and SMTP are such examples.

FTP Session:

When a FTP session is started between a client and a server, the client initiates a control TCP connection with the server side. The client sends control information over this. When the server receives this, it initiates a data connection to the client side. Only one file can be sent over one data connection. But the control connection remains active throughout the user session. As we know HTTP is stateless i.e. it does not have to keep track of any user state. But FTP needs to maintain a state about its user throughout the session.

Data Structures: FTP allows three types of data structures :

1. **File Structure –** In file-structure there is no internal structure and the file is considered to be a continuous sequence of data bytes.
2. **Record Structure –** In record-structure the file is made up of sequential records.
3. **Page Structure –** In page-structure the file is made up of independent indexed pages.

5. The WWW & HTTP:

Overview

WWW stands for **World Wide Web.** A technical definition of the World Wide Web is : all the resources and users on the Internet that are using the Hypertext Transfer Protocol (HTTP).

A broader definition comes from the organization that Web inventor **Tim Berners-Lee** helped found, the **World Wide Web Consortium (W3C).**

The World Wide Web is the universe of network-accessible information, an embodiment of human knowledge.

In simple terms, The World Wide Web is a way of exchanging information between computers on the Internet, tying them together into a vast collection of interactive multimedia resources.

Internet and **Web** is not the same thing: Web uses internet to pass over the information.
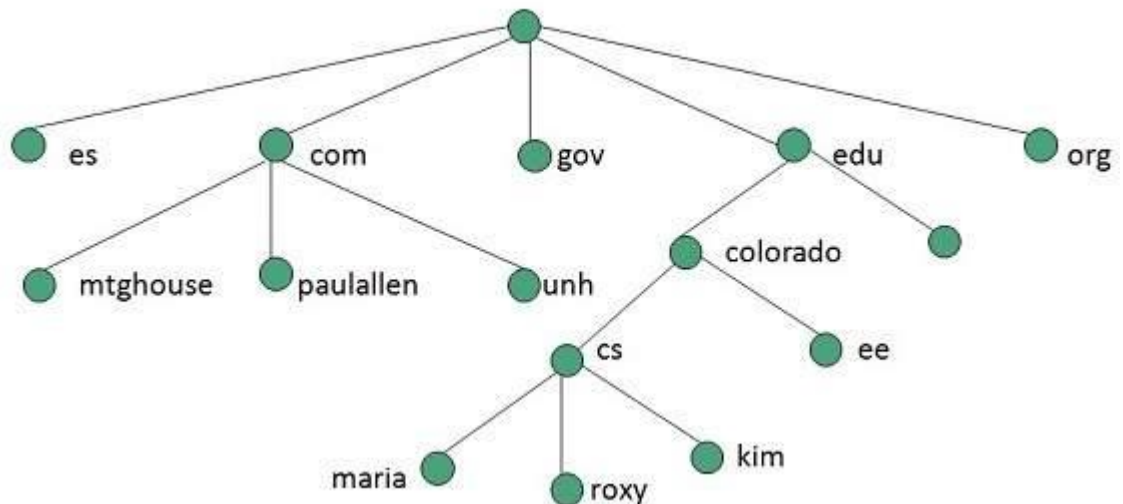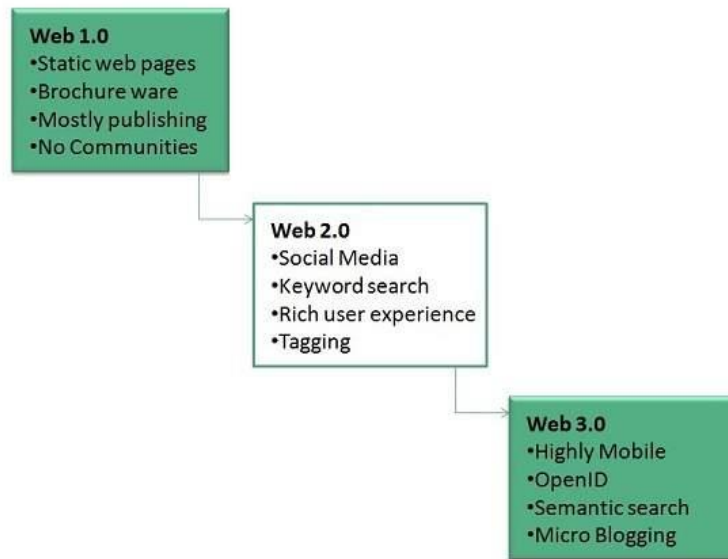

Evolution

World Wide Web was created by **Timothy Berners Lee** in 1989 at **CERN** in **Geneva.** World Wide Web came into existence as a proposal by him, to allow researchers to work together effectively and efficiently at **CERN.** Eventually it became **World Wide Web.**
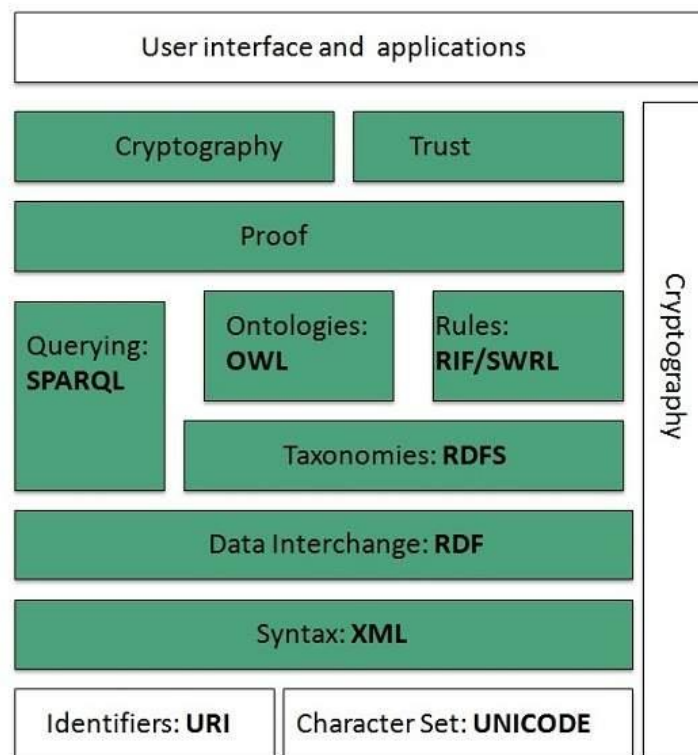
The following diagram briefly defines evolution of World Wide Web:

Web 1.0
- Static web pages
- Brochure ware
- Mostly publishing
- No Communities

Web 2.0
- Social Media
- Keyword search
- Rich user experience
- Tagging

Web 3.0
- Highly Mobile
- OpenID
- Semantic search
- Micro Blogging

WWW Architecture:

WWW architecture is divided into several layers as shown in the following diagram:

User interface and applications

Cryptography | Trust

Proof

Querying: **SPARQL** | Ontologies: **OWL** | Rules: **RIF/SWRL**

Taxonomies: **RDFS**

Data Interchange: **RDF**

Syntax: **XML**

Identifiers: **URI** | Character Set: **UNICODE**

Cryptography

Identifiers and Character Set:

Uniform Resource Identifier (URI) is used to uniquely identify resources on the web and **UNICODE** makes it possible to built web pages that can be read and write in human languages.

Syntax:

XML (Extensible Markup Language) helps to define common syntax in semantic web.
Data Interchange

Resource Description Framework (RDF) framework helps in defining core representation of data for web. RDF represents data about resource in graph form.
Taxonomies

RDF Schema (RDFS) allows more standardized description of **taxonomies** and other **ontological** constructs.

Ontologies:

Web Ontology Language (OWL) offers more constructs over RDFS. It comes in following three versions:

- OWL Lite for taxonomies and simple constraints.
- OWL DL for full description logic support.
- OWL for more syntactic freedom of RDF

Rules

RIF and **SWRL** offers rules beyond the constructs that are available from **RDFs** and **OWL.** Simple Protocol and **RDF Query Language (SPARQL)** is SQL like language used for querying RDF data and OWL Ontologies.

Proof

All semantic and rules that are executed at layers below Proof and their result will be used to prove deductions.

Cryptography

Cryptography means such as digital signature for verification of the origin of sources is used.

User Interface and Applications

On the top of layer **User interface and Applications** layer is built for user interaction.

WWW Operation

WWW works on client- server approach. Following steps explains how the web works:

1. User enters the URL (say, **http://www.tutorialspoint.com**) of the web page in the address bar of web browser.
2. Then browser requests the Domain Name Server for the IP address corresponding to www.tutorialspoint.com.
3. After receiving IP address, browser sends the request for web page to the web server using HTTP protocol which specifies the way the browser and web server communicates.
4. Then web server receives request using HTTP protocol and checks its search for the requested web page. If found it returns it back to the web browser and close the HTTP connection.

5. Now the web browser receives the web page, It interprets it and display the contents of web page in web browser's window.
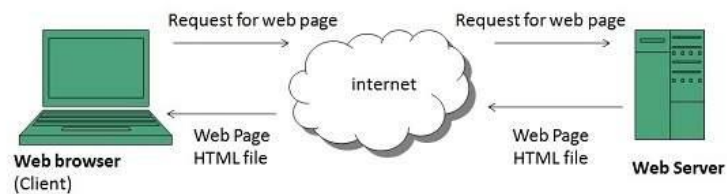
Future:

There had been a rapid development in field of web. It has its impact in almost every area such as education, research, technology, commerce, marketing etc. So the future of web is almost unpredictable.

Apart from huge development in field of WWW, there are also some technical issues that W3 consortium has to cope up with.

User Interface

Work on higher quality presentation of 3-D information is under deveopment. The W3 Consortium is also looking forward to enhance the web to full fill requirements of global communities which would include all regional languages and writing systems.

Technology

Work on privacy and security is under way. This would include hiding information, accounting, access control, integrity and risk management.

Architecture

There has been huge growth in field of web which may lead to overload the internet and degrade its performance. Hence more better protocol are required to be developed.

Web Page:

web page is a document available on world wide web. Web Pages are stored on web server and can be viewed using a web browser.

A web page can cotain huge information including text, graphics, audio, video and hyper links. These hyper links are the link to other web pages.

Collection of linked web pages on a web server is known as **website.** There is unique **Uniform Resource Locator (URL)** is associated with each web page.

Static Web page

Static web pages are also known as flat or stationary web page. They are loaded on the client's browser as exactly they are stored on the web server. Such web pages contain only static information. User can only read the information but can't do any modification or interact with the information.

Static web pages are created using only HTML. Static web pages are only used when the information is no more required to be modified.
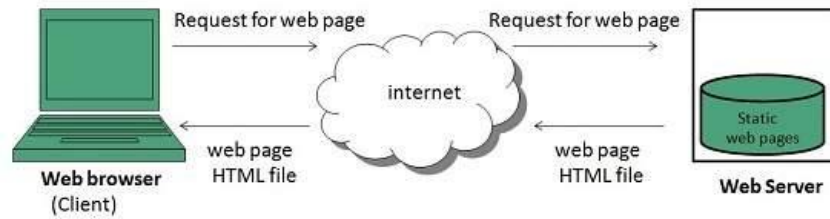

Dynamic Web page:
Dynamic web page shows different information at different point of time. It is possible to change a portaion of a web page without loading the entire web page. It has been made possible using **Ajax** technology.

Server-side dynamic web page
It is created by using server-side scripting. There are server-side scripting parameters that determine how to assemble a new web page which also include setting up of more client-side processing.

Client-side dynamic web page
It is processed using client side scripting such as JavaScript. And then passed in to **Document Object Model (DOM).**
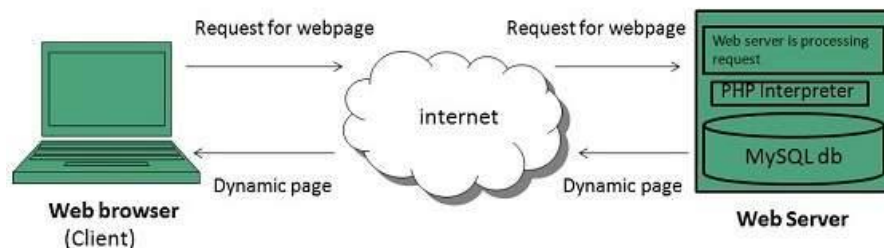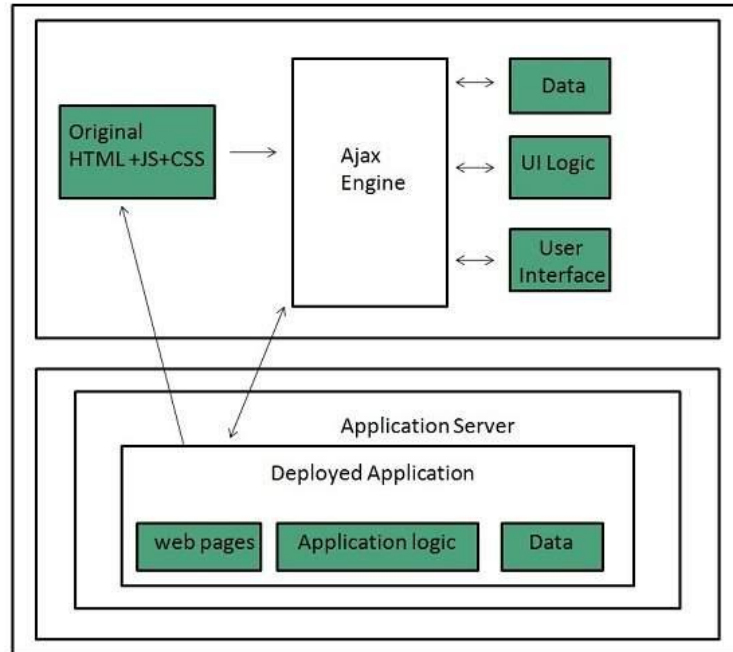

Scripting Languages:
Scripting languages are like programming languages that allow us to write programs in form of script. These scripts are interpreted not compiled and executed line by line. Scripting language is used to create dynamic web pages.

Client-side Scripting
Client-side scripting refers to the programs that are executed on client-side. Client-side scripts contains the instruction for the browser to be executed in response to certain user's action.

Client-side scripting programs can be embedded into HTML files or also can be kept as separate files.
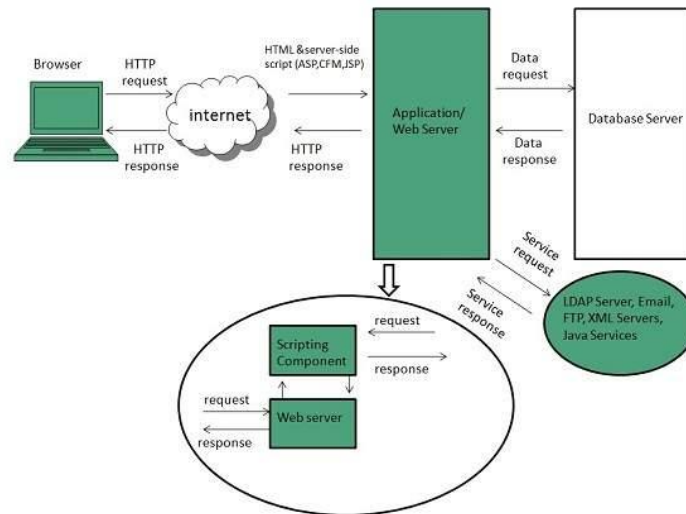
Following table describes commonly used Client-Side scripting languages:

S.N.	Scripting Language Description
1.	**JavaScript** It is a prototype based scripting language. It inherits its naming conventions from java. All java script files are stored in file having **.js** extension.
2.	**ActionScript** It is an object oriented programming language used for the development of websites and software targeting Adobe flash player.
3.	**Dart** It is an open source web programming language developed by Google. It relies on source-to-source compiler to JavaScript.
4.	**VBScript** It is an open source web programming language developed by Microsoft. It is superset of JavaScript and adds optional static typing class-based object oriented programming.

Server-side Scripting:

Sever-side scripting acts as an interface for the client and also limit the user access the resources on web server. It can also collects the user's characteristics in order to customize response.

Following table describes commonly used Server-Side scripting languages:

S.N.	Scripting Language Description
1.	**ASP** Active Server Pages (ASP)is server-side script engine to create dynamic web pages. It supports **Component Object Model (COM)** which enables ASP web sites to access functionality of libraries such as DLL.
2.	**ActiveVFP** It is similar to PHP and also used for creating dynamic web pages. It uses native **Visual Foxpro** language and database.
3.	**ASP.net** It is used to develop dynamic websites, web applications, and web services.
4.	**Java** Java Server Pages are used for creating dynamic web applications. The Java code is compiled into byte code and run by **Java Virtual Machine (JVM).**
5.	**Python** It supports multiple programming paradigms such as object-oriented, and functional programming. It can also be used as non-scripting language using third party tools such as **Py2exe** or **Pyinstaller.**
6.	**WebDNA** It is also a server-side scripting language with an embedded database system.

6. The SNMP Protocol:

Simple Network Management Protocol (SNMP):
If an organization has 1000 of devices then to check all devices, one by one every day, are working properly or not is a hectic task. To ease these up, Simple Network Management Protocol (SNMP) is used.
Simple Network Management Protocol (SNMP) –
SNMP is an application layer protocol which uses UDP port number 161/162.SNMP is

used to monitor the network, detect network faults and sometimes even used to configure remote devices.

SNMP components –

There are 3 components of SNMP:

1. **SNMP Manager –**

   It is a centralised system used to monitor network.It is also known as Network Management Station (NMS)

2. **SNMP agent –**

   It is a software management software module installed on a managed device. Managed devices can be network devices like PC, router, switches, servers etc.

3. **Management Information Base –**

   MIB consists of information of resources that are to be managed. These information is organised hierarchically. It consists of objects instances which are essentially variables.