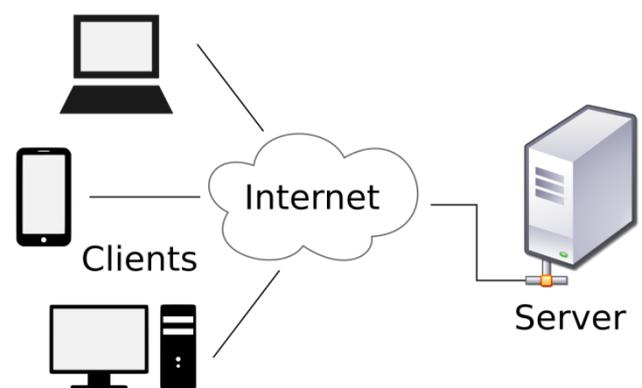


Paper Code: CSCS351 WEB TECHNOLOGY

MODULE – I Web Essentials: Clients, Servers, and Communication - Internet - Basic Internet Protocols - The World Wide Web - World Wide Web - HTTP Request Message - HTTP Response Message - Web Clients - Web Servers

Client

A client is a piece of computer hardware or software that accesses a service made available by a server. The server is often (but not always) on another computer system, in which case the client accesses the service by way of a network.



For example, web browsers are clients that connect to web servers and retrieve web pages for display. Email clients retrieve email from mail servers. Online chat uses a variety of clients, which vary depending on the chat protocol being used. Multiplayer video games or online video games may run as a client on each computer. The term "client" may also be applied to computers or devices that run the client software or users that use the client software.

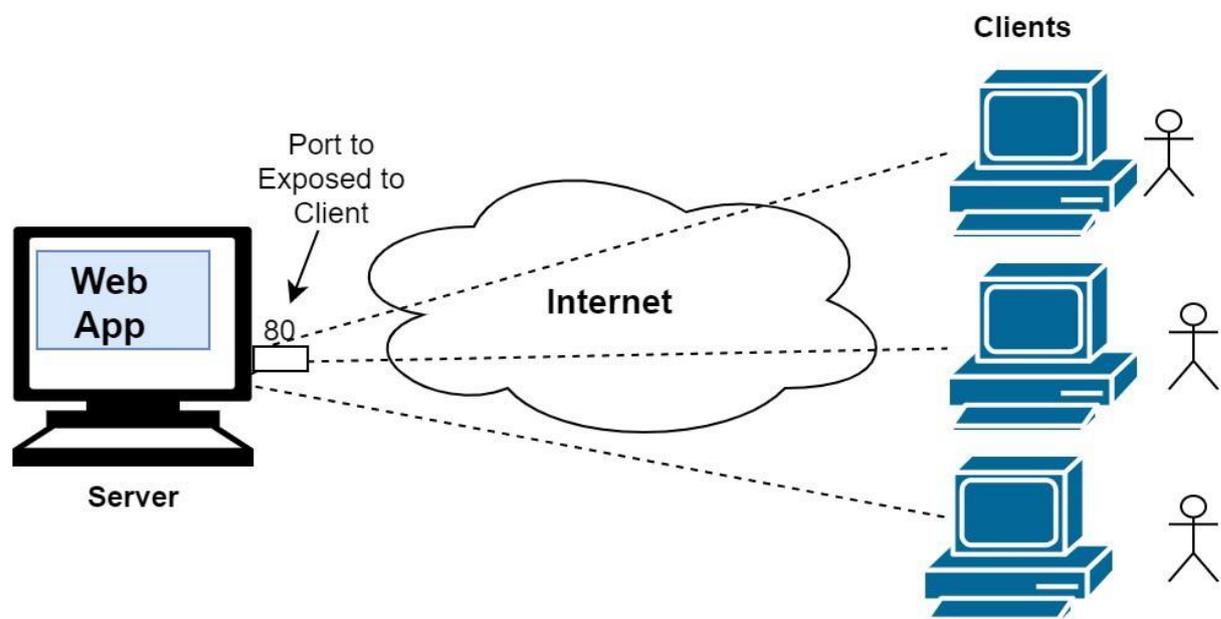
Server

A **server** is a physical computer dedicated to run services to serve the needs of other computers. Depending on the service that is running, it could be a file server, database server, home media server, print server, or web server.

The client-server relationship describes the relation between the client and how it makes a service request to the server, and how the server can accept these requests, process them, and return the requested information to the client

Clients characteristics

- Always initiates requests to servers.
- Waits for replies.
- Receives replies.
- Usually connects to a small number of servers at one time.
- Usually interacts directly with end-users using any user interface such as graphical user interface.



Server characteristics

- Always wait for a request from one of the clients.
- Serves clients' requests then replies to the clients with the requested data (Response).
- A server may communicate with other servers in order to serve a client request.
- If additional information is required to process a request (or security is implemented), a server may request additional data (passwords) from a client before processing a request.
- End users typically do not interact directly with a server, but use a client.

What is The Internet?



The Internet is a massive network of networks, a networking infrastructure. It connects millions of computers together globally, forming a network in which any computer can communicate with any other computer as long as they are both connected to the Internet. Information that travels over the Internet does so via a variety of languages known as protocols.

Quick Points about The Internet:

- It is a global network connecting millions of computers.
- The Internet is decentralized.
- Each Internet computer is independent.
- There are a variety of ways to access the Internet.
- There are more than 3,700,000,000 Internet Users in the world.

What is The Web (World Wide Web)?



The World Wide Web, or simply Web, is a way of accessing information over the medium of the Internet. It is an information-sharing model that is built on top of the Internet. The Web uses the HTTP protocol, only one of the languages spoken over the Internet, to transmit data. Web services, which use HTTP to allow applications to communicate in order to exchange business logic, use the the Web to share information. The Web also utilizes browsers, such as Internet Explorer or Firefox, to access Web documents called Web pages that are linked to each other via hyperlinks. Web documents also contain graphics, sounds, text and video.

Quick Points about The Web:

- It is a system of Internet servers that support specially formatted documents.
- Documents are formatted in a markup language that supports links to other documents.
- You can jump from one document to another simply by clicking on hot spots (hyperlinks).
- Applications called Web browsers that make it easy to access the World Wide Web.
- There are more than 1,275,000,000 Websites.

Transmission Control Protocol (TCP)

TCP is a connection oriented protocol and offers end-to-end packet delivery. It acts as back bone for connection.It exhibits the following key features:

Transmission Control Protocol (TCP) corresponds to the Transport Layer of OSI(Open System Interconnection) Model.

TCP is a reliable and connection oriented protocol.

TCP offers:

- Stream Data Transfer.
- Reliability.
- Efficient Flow Control
- Full-duplex operation.

Multiplexing.

TCP offers connection oriented end-to-end packet delivery.

TCP ensures reliability by sequencing bytes with a forwarding acknowledgement number that indicates to the destination the next byte the source expect to receive.

It retransmits the bytes not acknowledged with in specified time period.

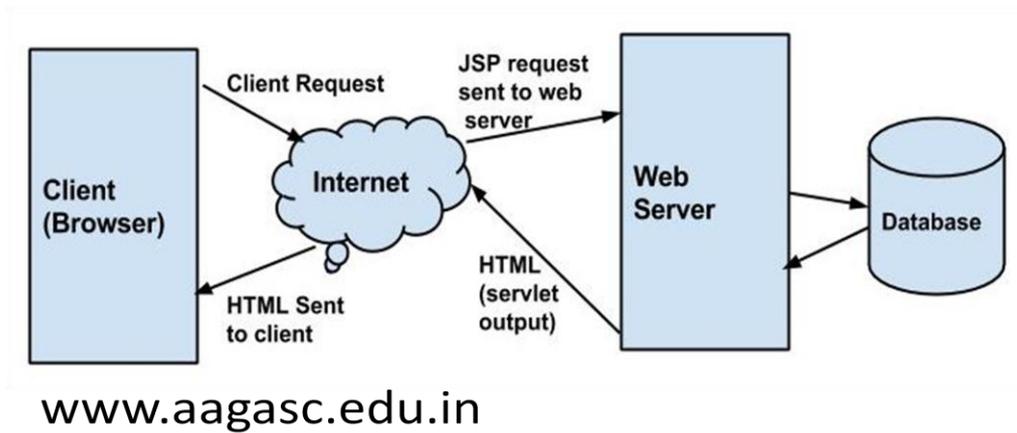
Internet Protocol (IP)

Internet Protocol is connectionless and unreliable protocol. It ensures no guarantee of successfully transmission of data.

In order to make it reliable, it must be paired with reliable protocol such as TCP at the transport layer.

4	8	16	32 bits
VER	HLEN	D.S. type of service	Total length of 16 bits
Identification of 16 bits		Flags 3 bits	Fragmentation Offset (13 bits)
Time to live	Protocol	Header checksum (16 bits)	
Source IP address			
Destination IP address			
Option + Padding			

HTTP Request Message - HTTP Response Message



Web Browser

HTML

CSS-Cascading Style Sheet

Java Script

Web Server

HTML

PHP Hypertext Preprocessor

JSP Java Server Pages

ASP Active Server Pages

Cold Fusion - ColdFusion Markup language

HTML

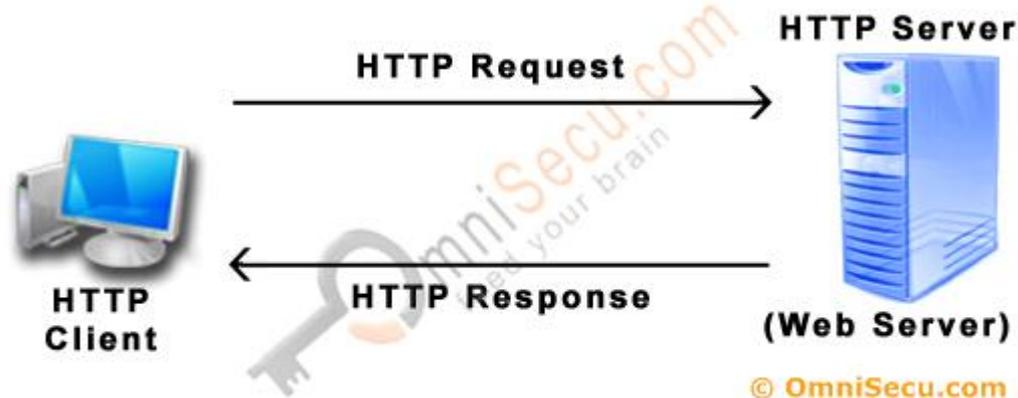
Database

MySQL, Oracle, NoSQL, SQL Server

What is HTTP?

HTTP stands for **H**yper**T**ext **T**ransfer **P**rotocol. This is a basis for data communication in the internet. The data communication starts with a request sent from a client and ends with the response received from a web server.

- A website URL starting with “http://” is entered in a web browser from a computer (client). The browser can be a Chrome, Firefox, Edge, Safari, Opera or anything else.
- Browser sends a request sent to the web server that **hosts** the website.
- The web server then returns a response as a **HTML** page or any other document format to the browser.
- Browser displays the response from the server to the user.



1) HTTP Client Request: Hypertext Transfer Protocol (HTTP) client sends an Hypertext Transfer Protocol (HTTP) Request to the Hypertext Transfer Protocol (HTTP) Server according to the HTTP standard, specifying the information the client like to retrieve from the Hypertext Transfer Protocol (HTTP) Server.

2) HTTP Server Response: Once the Hypertext Transfer Protocol (HTTP) Request arrived at the Hypertext Transfer Protocol (HTTP) server, it will process the request and creates an Hypertext Transfer Protocol (HTTP) Response message. The Hypertext Transfer Protocol (HTTP) response message may contain the resource the Hypertext Transfer Protocol (HTTP) Client requested or information why the Hypertext Transfer Protocol (HTTP) request failed.

Web server

Web server is a computer where the web content is stored. Basically web server is used to host the web sites but there exists other web servers also such as gaming, storage, FTP, email etc.

Server Features

The primary feature of every web server is to accept HTTP requests from web clients and return an appropriate resource (if available) in the HTTP response. Even this basic functionality involves a number of steps (the quoted terms used in this list are defined in subsequent paragraphs):

1. The server calls on TCP software and waits for connection requests to one or more ports.
2. When a connection request is received, the server dedicates a “subtask” to handling this connection.
3. The subtask establishes the TCP connection and receives an HTTP request.
4. The subtask examines the Host header field of the request to determine which “virtual host” should receive this request and invokes software for this host.
5. The virtual host software maps the Request-URI field of the HTTP request start line to a resource on the server.
6. If the resource is a file, the host software determines the MIME type of the file (usually by a mapping from the file-name extension portion of the Request-URI), and creates an HTTP response that contains the file in the body of the response message.
7. If the resource is a program, the host software runs the program, providing it with information from the request and returning the output from the program as the body of an HTTP response message.
8. The server normally logs information about the request and response—such as the IP address of the requester and the status code of the response—in a plain-text file.

Web Server Architecture follows the following two approaches:

- Concurrent Approach
- Multi-process-Event-Driven Approach.

Concurrent Approach

Concurrent approach allows the web server to handle multiple client requests at the same time. It can be achieved by following methods:

Multi-process

- Multi-threaded
- Hybrid method.
- Multi-processing

Multi-threaded : Unlike Multi-process, it creates multiple single-threaded process.

Hybrid : It is combination of above two approaches. In this approach multiple process are created and each process initiates multiple threads. Each of the threads handles one connection. Using multiple threads in single process results in less load on system resources.

Multi-processing : In this a single process (parent process) initiates several single-threaded child processes and distribute incoming requests to these child processes. Each of the child processes are responsible for handling single request. It is the responsibility of parent process to monitor the load and decide if processes should be killed or forked.

Server Configuration and Tuning

- IP addresses and TCP ports that may be used to connect to this server.
- Number of subtasks (called threads in Java) that will be created when the server is initialized. This many TCP connections can be established simultaneously with minimal overhead.
- Maximum number of threads that will be allowed to exist simultaneously. If this is larger than the previous value, then the number of threads maintained by the server may change, either up or down, over time.
- Maximum number of TCP connection requests that will be queued if the server is already running its maximum number of threads. Connection requests received if the queue is full will be refused.
- Length of time the server will wait after serving an HTTP request over a TCP connection before closing the connection if another request is not received