ARCHITECTURAL STYLES

Introduction:

The software needs the architectural design to represents the design of software. IEEE defines architectural design as “the process of defining a collection of hardware and software components and their interfaces to establish the framework for the development of a computer system.” The software that is built for computer-based systems can exhibit one of these many architectural styles.

Each style will describe a system category that consists of :

- A set of components(eg: a database, computational modules) that will perform a function required by the system.
- The set of connectors will help in coordination, communication, and cooperation between the components.
- Conditions that how components can be integrated to form the system.
- Semantic models that help the designer to understand the overall properties of the system.

The use of architectural styles is to establish a structure for all the components of the system.

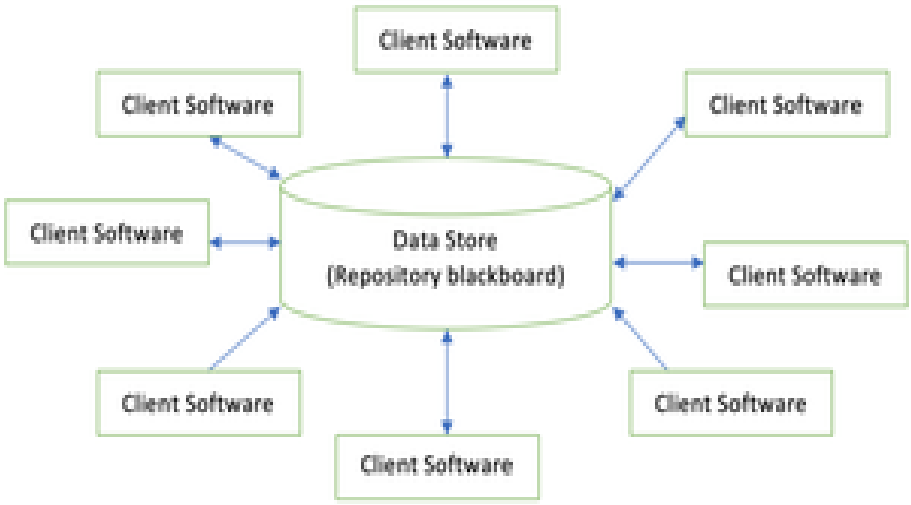
Taxonomy of Architectural styles:

1] Data centered architectures:

- A data store will reside at the center of this architecture and is accessed frequently by the other components that update, add, delete or modify the data present within the store.
- The figure illustrates a typical data centered style. The client software access a central repository. Variation of this approach are used to transform the repository into a blackboard when data related to client or data of interest for the client change the notifications to client software.
- This data-centered architecture will promote integrability. This means that the existing components can be changed and new client components can be added to the architecture without the permission or concern of other clients.
- Data can be passed among clients using blackboard mechanism.

Advantage of Data centered architecture

- Repository of data is independent of clients
- Client work independent of each other
- It may be simple to add additional clients.
- Modification can be very easy



Data centered architecture

2] DATA FLOW ARCHITECTURES:

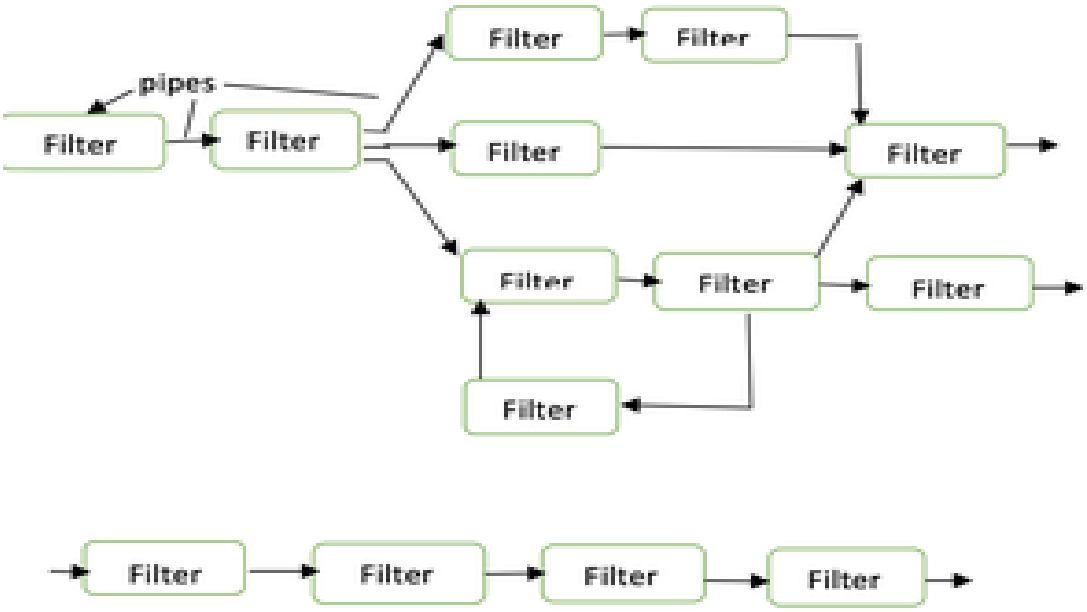
- This kind of architecture is used when input data is transformed into output data through a series of computational manipulative components.
- The figure represents pipe-and-filter architecture since it uses both pipe and filter and it has a set of components called filters connected by lines.
- Pipes are used to transmitting data from one component to the next.
- Each filter will work independently and is designed to take data input of a certain form and produces data output to the next filter of a specified form. The filters don't require any knowledge of the working of neighboring filters.
- If the data flow degenerates into a single line of transforms, then it is termed as batch sequential. This structure accepts the batch of data and then applies a series of sequential components to transform it.

Advantages of Data Flow architecture

- It encourages upkeep, repurposing, and modification.
- With this design, concurrent execution is supported.

The disadvantage of Data Flow architecture

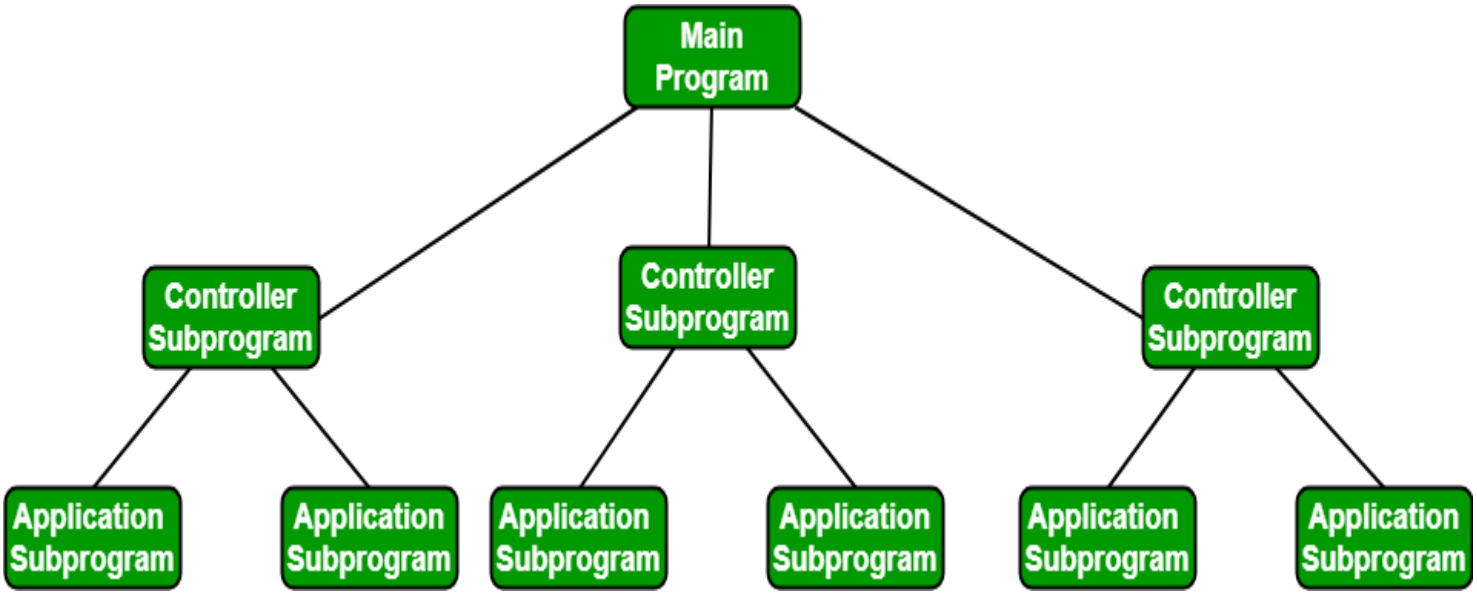
- It frequently degenerates to batch sequential system
- Data flow architecture does not allow applications that require greater user engagement.
- It is not easy to coordinate two different but related streams



Data Flow architecture

3] Call and Return architectures: It is used to create a program that is easy to scale and modify. Many sub-styles exist within this category. Two of them are explained below.

- **Remote procedure call architecture:** This components is used to present in a main program or sub program architecture distributed among multiple computers on a network.
- **Main program or Subprogram architectures:** The main program structure decomposes into number of subprograms or function into a control hierarchy. Main program contains number of subprograms that can invoke other components.



4] Object Oriented architecture: The components of a system encapsulate data and the operations that must be applied to manipulate the data. The coordination and communication between the components are established via the message passing.

Characteristics of Object Oriented architecture

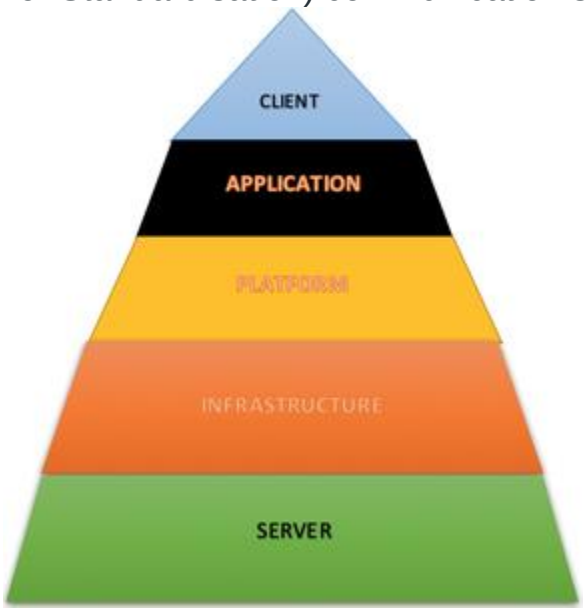
- Object protect the system's integrity.
- An object is unaware of the depiction of other items.

Advantage of Object Oriented architecture

- It enables the designer to separate a challenge into a collection of autonomous objects.
- Other objects are aware of the implementation details of the object, allowing changes to be made without having an impact on other objects.

5] Layered architecture:

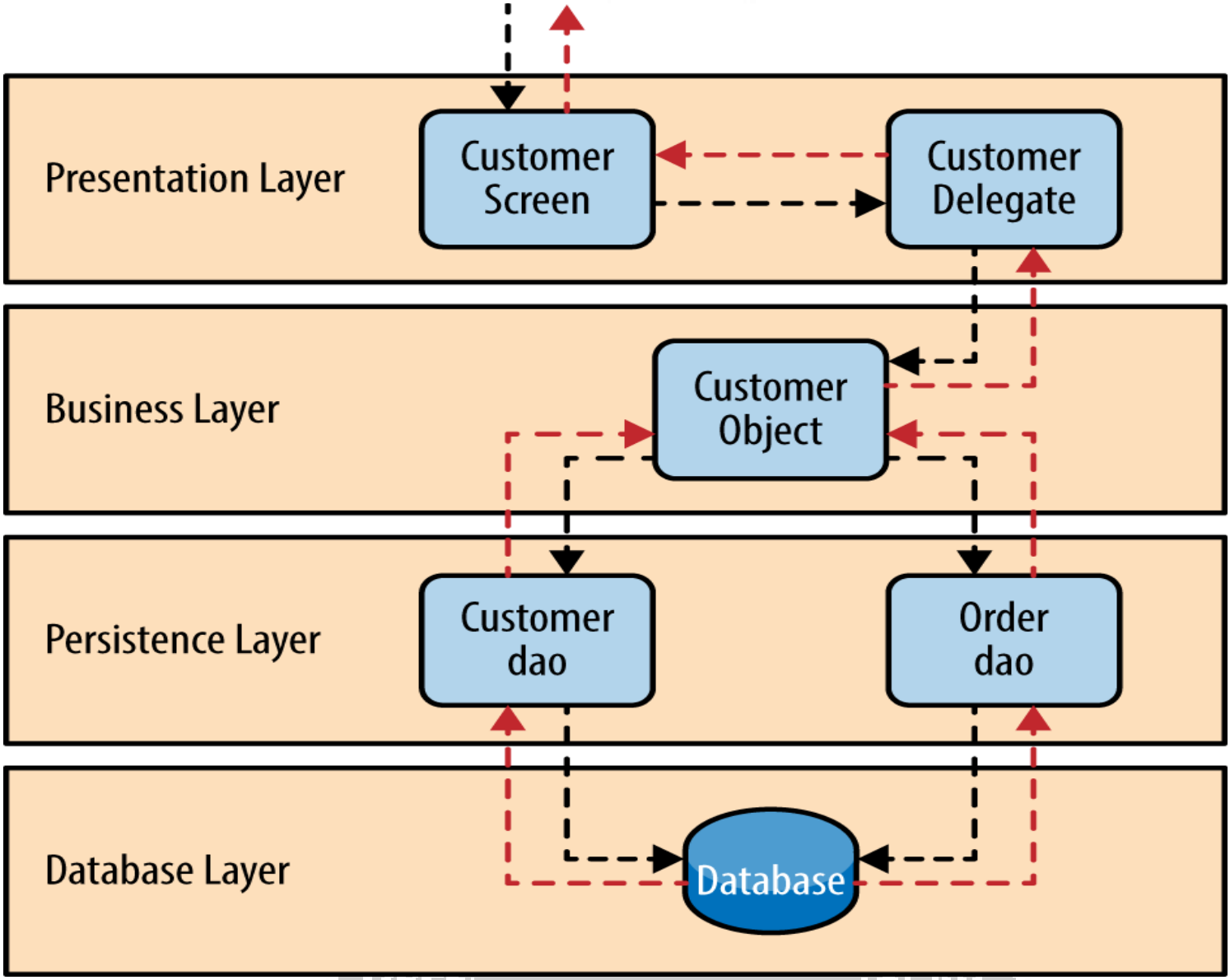
- A number of different layers are defined with each layer performing a well-defined set of operations. Each layer will do some operations that becomes closer to machine instruction set progressively.
- At the outer layer, components will receive the user interface operations and at the inner layers, components will perform the operating system interfacing(communication and coordination with OS)
- Intermediate layers to utility services and application software functions.
- One common example of this architectural style is OSI-ISO (Open Systems Interconnection-International Organisation for Standardisation) communication system.



Layered architecture:

The most common architecture pattern is the layered architecture pattern, otherwise known as the n-tier architecture pattern. This pattern is the de facto standard for most Java EE applications and therefore is widely known by most architects, designers, and developers.

The layered architecture pattern closely matches the traditional IT communication and organizational structures found in most companies, making it a natural choice for most business application development efforts.



Layered architectures are widely used in software development and are considered to be the most prevalent and commonly **utilized architectural framework**.

It is an **architectural pattern** made up of numerous **independent horizontal layers** that work together to form a **single software unit**. This pattern is also known as n-tier architecture.

A layer is a logical division of parts or programme code. This architecture typically places related or comparable components on the same tiers. Every layer is unique and affects a different aspect of the entire system.

Pattern Description

- Within the application, each layer of the **layered architecture pattern** is responsible for a particular task.
- For instance, the user interface and browser communication logic would be handled by the presentation layer, whilst the **business layer** would be in charge of carrying out the specific business rules related to the request.
- Each layer of the architecture creates an **abstraction** around the work required to complete a specific business requirement.
- For instance, the presentation layer just needs to display customer data on a screen in a specific way; it is not required to understand or worry about how to obtain **customer data**.
- The business layer only needs to obtain the data from the **persistence layer, apply business logic to the data** (e.g., calculate values or aggregate data), and then pass that information up to the presentation layer.
- In a similar manner, the business layer need not worry about how to format customer data for **display on a screen** or even where the customer data is coming from.
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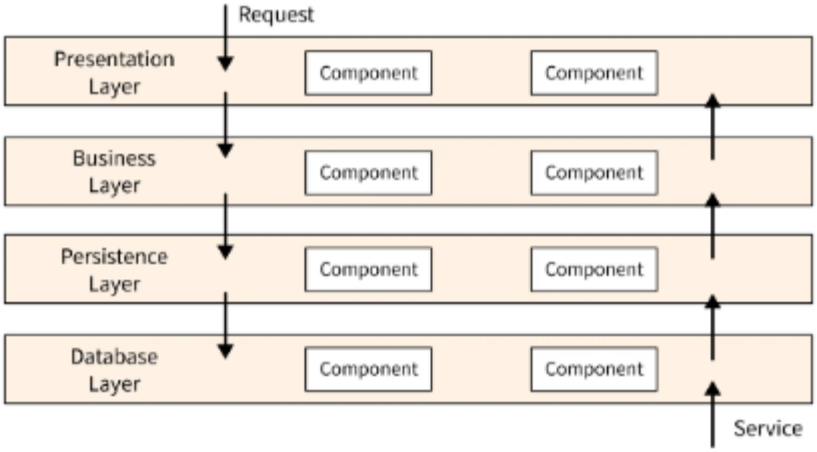


- **Separating** concerns among components is one of the layered architecture pattern's strong points. Components inside that layer deal with only logic specific to a certain layer.
- For instance, the presentation layer's components only deal with **presentation logic**, whereas the business layer's components only deal with business logic. Due to the clearly defined component interfaces and constrained component scope, this type of component classification makes it simple to **incorporate efficient roles** and responsibility models into your architecture. It also makes it simple to develop, test, govern, and maintain applications using this **architecture pattern**.

CLIENT-SERVER MODEL

The Client-server model is a distributed application structure that partitions task or workload between the providers of a resource or service, called servers, and service requesters called clients. In the client-server architecture, when the client computer sends a request for data to the server through the internet, the server accepts the requested process and deliver the data packets requested back to the client.

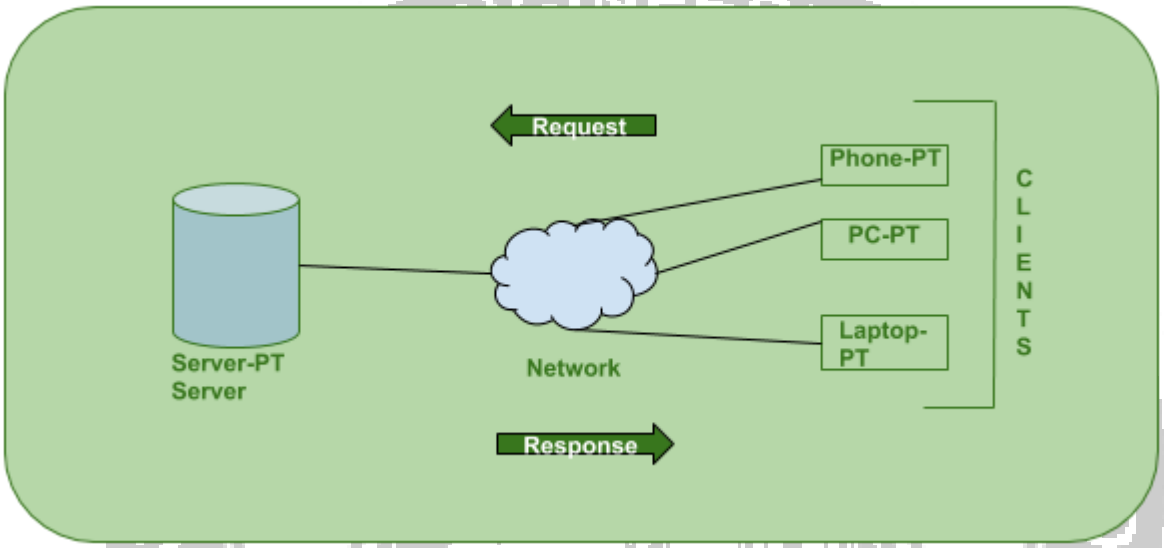
How the Client-Server Model works ?

In this article we are going to take a dive into the **Client-Server** model and have a look at how the **Internet** works via, web browsers. This article will help us in having a solid foundation of the WEB and help in working with WEB technologies with ease.

- **Client:** When we talk the word **Client**, it mean to talk of a person or an organization using a particular service. Similarly in the digital world a **Client** is a computer (**Host**) i.e. capable of receiving information or using a particular service from the service providers (**Servers**).

- **Servers:** Similarly, when we talk the word **Servers**, It mean a person or medium that serves something. Similarly in this digital world a **Server** is a remote computer which provides information (data) or access to particular services.

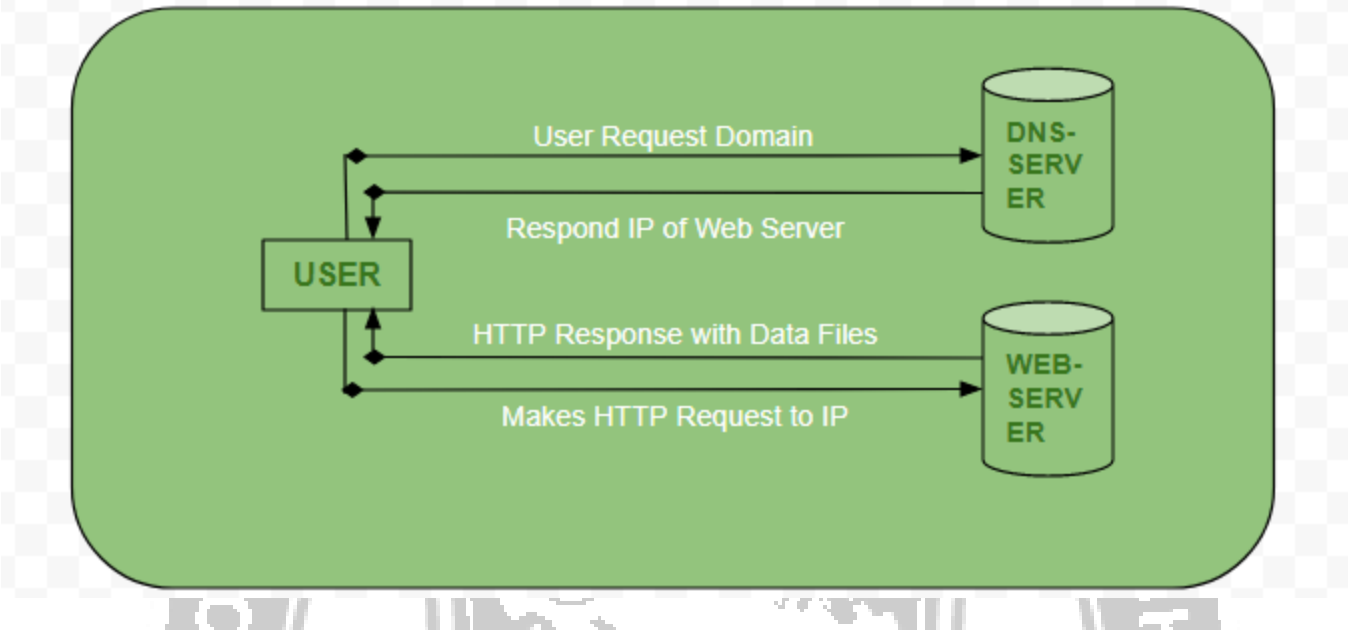
So, its basically the **Client** requesting something and the **Server** serving it as long as its present in the database.



How the browser interacts with the servers ?

There are few steps to follow to interacts with the servers a client.

- User enters the **URL**(Uniform Resource Locator) of the website or file. The Browser then requests the **DNS**(DOMAIN NAME SYSTEM) Server.
- **DNS Server** lookup for the address of the **WEB Server**.
- **DNS Server** responds with the **IP address** of the **WEB Server**.
- Browser sends over an **HTTP/HTTPS** request to **WEB Server's IP** (provided by **DNS server**).
- Server sends over the necessary files of the website.
- Browser then renders the files and the website is displayed. This rendering is done with the help of **DOM** (Document Object Model) interpreter, **CSS** interpreter and **JS Engine** collectively known as the **JIT** or (Just in Time) Compilers.



Advantages of Client-Server model:

- Centralized system with all data in a single place.
- Cost efficient requires less maintenance cost and Data recovery is possible.
- The capacity of the Client and Servers can be changed separately.

Disadvantages of Client-Server model:

- Clients are prone to viruses, Trojans and worms if present in the Server or uploaded into the Server.
- Server are prone to Denial of Service (DOS) attacks.
- Data packets may be spoofed or modified during transmission.
- Phishing or capturing login credentials or other useful information of the user are common and MITM(Man in the Middle) attacks are common.