Web Technology

CSE 4004

Introduction to Internet

- Internet is a global communication system that links together thousands of individual networks.
- It allows exchange of information between two or more computers on a network.
- Thus internet helps in transfer of messages through mail, chat, video & audio conference, etc.
- Internet was evolved in 1969, under the project called Advanced Research Projects Agency Network(ARPANET) to connect computers at different universities and U.S. defense.
- Soon after the people from different backgrounds such as engineers, scientists, students and researchers started using the network for exchanging information and messages.
- Therefore, Internet is a global network of computer networks.

World wide web

- World Wide Web(WWW) is a collection of software and corresponding protocols used to access the resources over the network.
- The Web gives users access to a vast array of documents that are connected to each other by means of hypertext or hypermedia links.

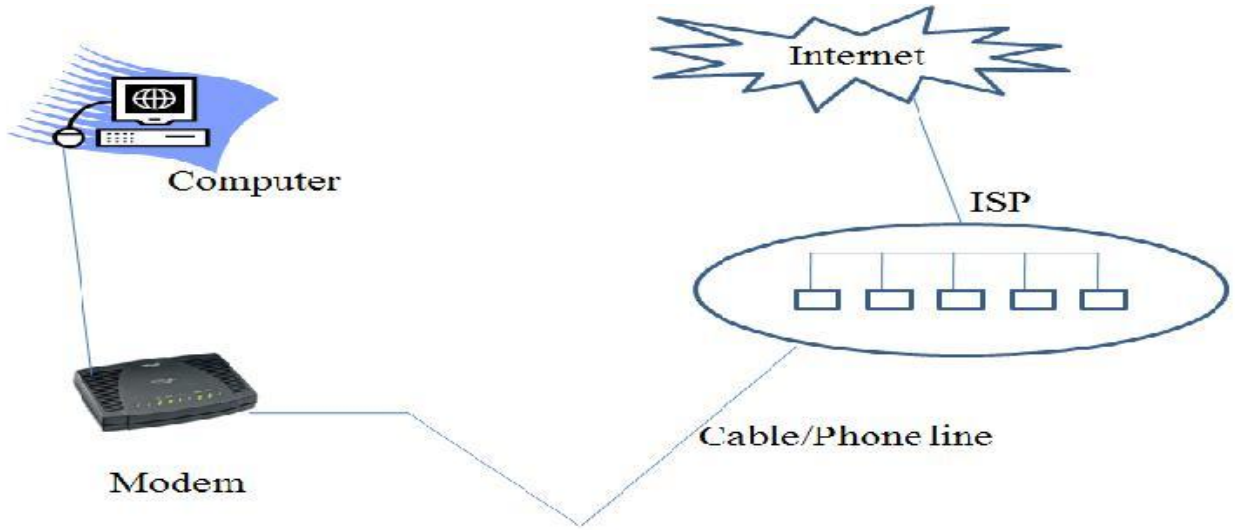
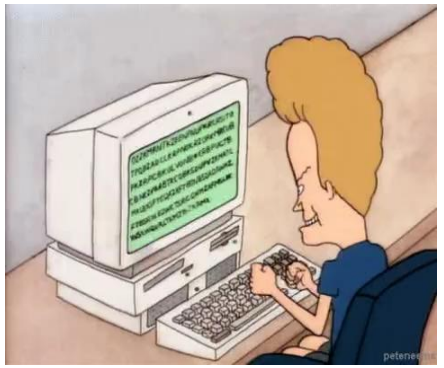


Fig: Setup required for Internet

History of WWW

- WWW was invented by Tim Berners-Lee at CERN an European Organization for Nuclear Research in 1989.
- Developed to meet the demand for automated information-sharing between scientists in universities and institutes around the world.
- Allows user anywhere on the internet to search and retrieve documents.
- The basic idea of the WWW was to merge the evolving technologies of computers, data networks and hypertext into a powerful and easy to use global information system.
- First implemented in 1990 on NeXT computer at CERN
- In 1991, the system was ported to other computer platforms.
- Built first website http://info.cern.ch/



Web vs Internet

Internet	Web
The **Internet** is a global **network** of networks.	The **Web**, (www) is collection of information which is accessed via the **Internet.**
While the Internet has its roots in the 1960s.	The World Wide Web was first accessed in 1991.
Internet is just the connection between different devices.	We connect to internet to access the web.

Client

- Client is a computer (Host) i.e. capable of receiving information or using a particular service from the service providers (Servers).
- Client computing is classified as Thick, Thin, or Hybrid.
- **Thick Client**: a client that provides rich functionality, performs the majority of data processing itself, and relies very lightly upon the server.
- **Thin Client**: a thin-client server is a lightweight computer that relies heavily on the resources of the host computer -- an application server performs the majority of any required data processing.
- **Hybrid Client**: possessing a combination of thin client and thick client characteristics, a hybrid client relies on the server to store persistent data, but is capable of local processing.

Server

- Servers: Server is a device or computer program which provides information (data) or access to particular services.
- Any computerized process that can be used or called upon by a client to share resources and distribute work is a server. Some common examples of servers include:
- **Application Server**: hosts web applications that users in the network can use without needing their own copy.
- **Computing Server**: shares an enormous amount of computer resources with networked computers that require more CPU power and RAM than is typically available for a personal computer.
- **Database Server:** maintains and shares databases for any computer program that ingests well-organized data, such as accounting software and spreadsheets.
- **Web Server**: hosts web pages and facilitates the existence of the World Wide Web.

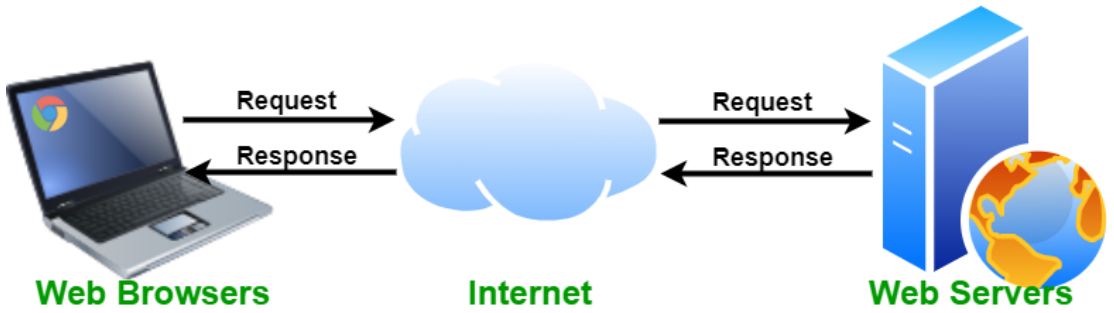
Web browsers

- A web browser (commonly referred to as a browser) is a software application for accessing information on the World Wide Web.
- Documents provided by servers on the web are requested by *browsers*.
- A ***browser*** is a *client* on the web because it initiates communication with a *server*.
- Allows users to browse resources on servers.
- At first, browsers were test based.
- In 1993,Mosaic was the first browser with GUI, developed at National Center for Supercomputer Applications(NCSA) at the university of Illinois.
- Popular Browsers: Google chrome, Mozilla Firefox, Internet Explorer, Opera etc.



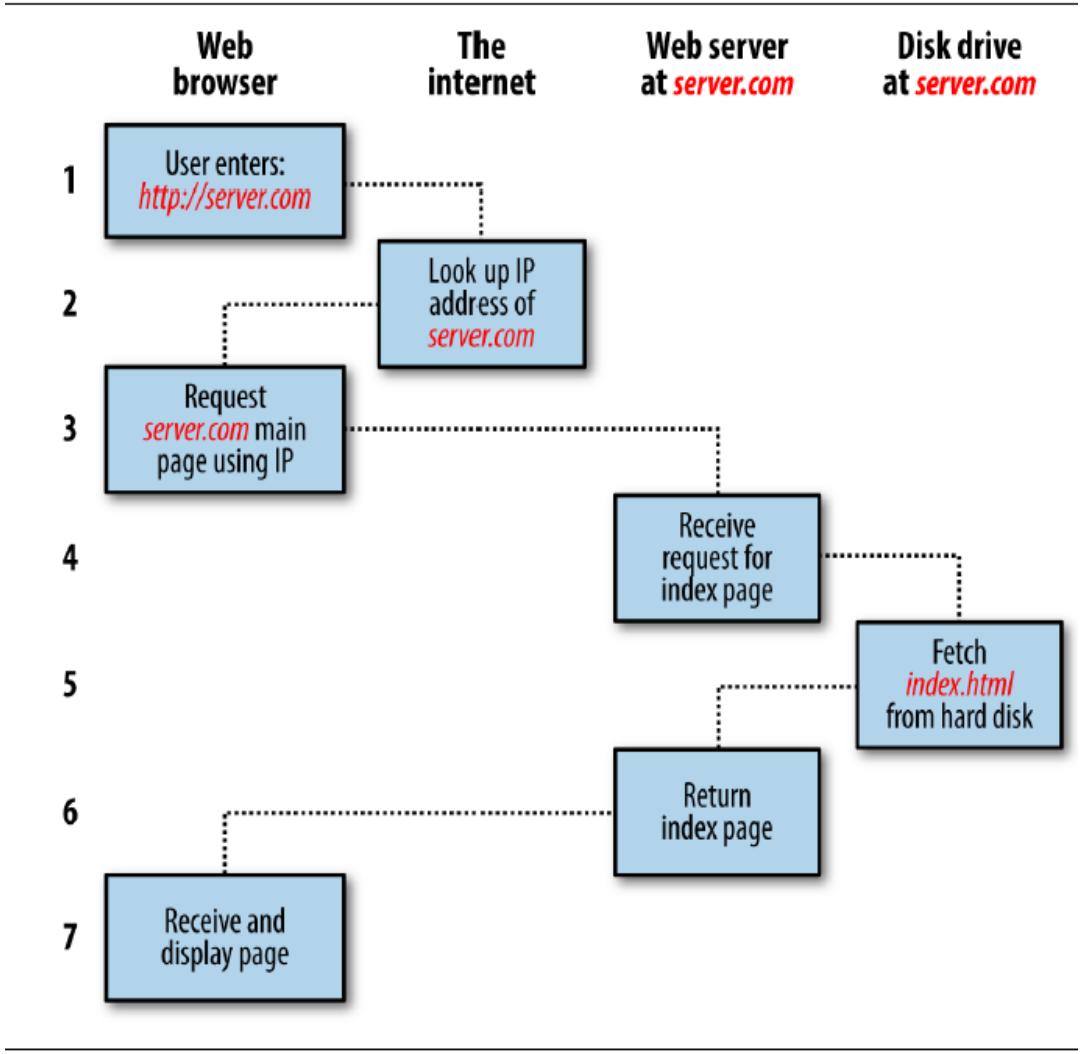

Web servers

- Web servers are programs that provide documents to requesting browsers.
- Servers are slave programs.
- Most commonly used web servers are Apache and Microsoft's Internet Information Server(IIS) .
- All the communications between a web server and a web client use the standard protocol Hyper Text Transfer Protocol(HTTP).
- Primary Tasks: Monitor communications, Accept Http commands, perform operations.



The request/response procedure

- At its most basic level, the request/response process consists of a web browser asking the web server to send it a web page and the server sending back the page.
- The browser then takes care of displaying the page.



Domain name service

- Every machine attached to the internet has an IP address.
- But we generally access web servers by name, such as google.com.
- The browser consults an additional internet service called the Domain Name Service (DNS) to find the server's associated IP address and then uses it to communicate with the computer.

Dynamic request/ response

- For dynamic web pages, the procedure is a little more involved, because it may bring both PHP and MySQL into the mix.
- For instance, you may click on a picture of a raincoat.
- Then PHP will put together a request using the standard database language, SQL and send the request to the MySQL server.
- The MySQL server will return information about the raincoat you selected, and the PHP code will wrap it all up in some HTML, which the server will send to your browser.

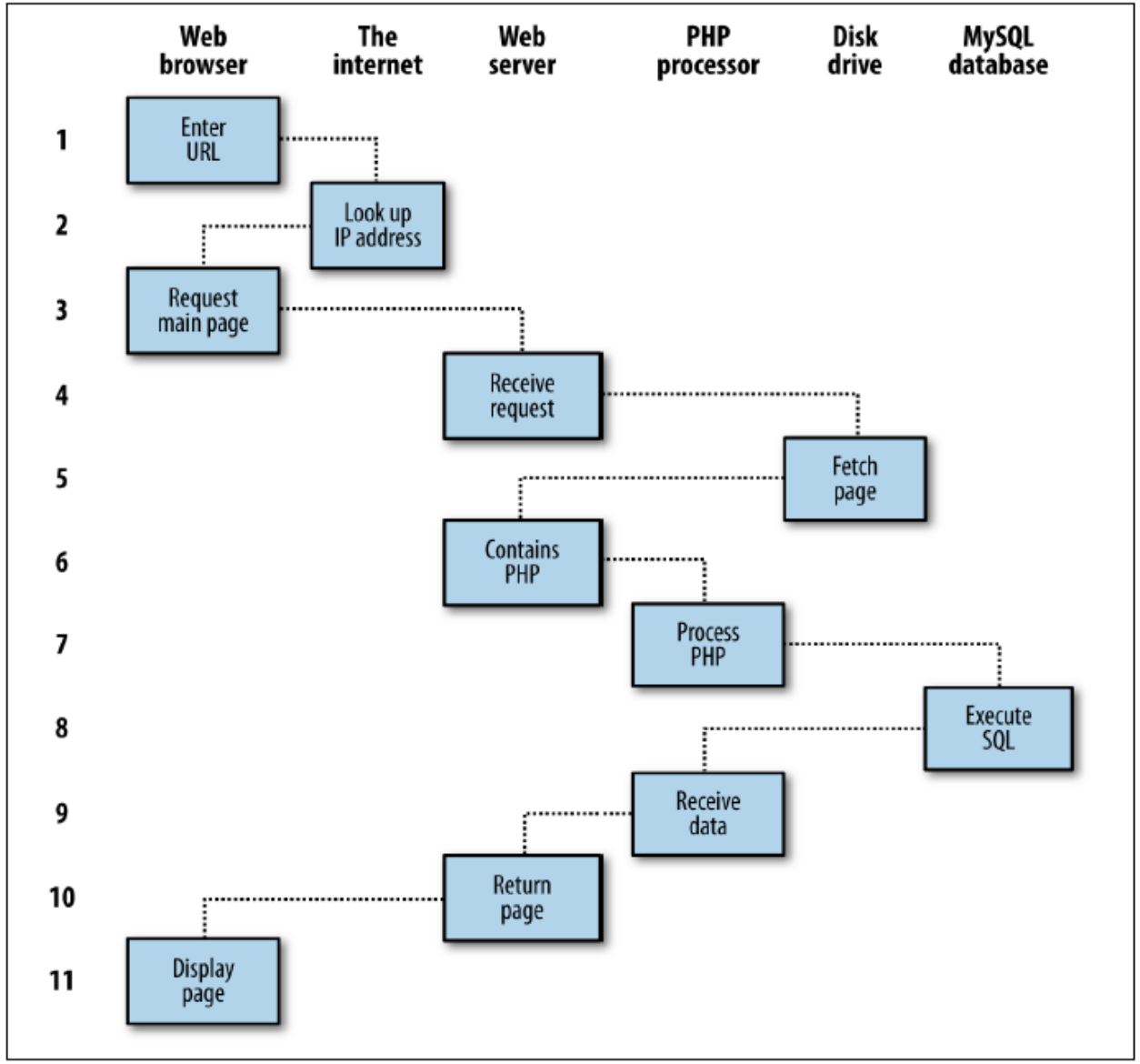


Figure 1-2. A dynamic client/server request/response sequence

Web standards

- Web standards ensure the accessibility and interoperability of websites. These are set by organizations like the W3C (World Wide Web Consortium) and include:
- **HTML5**: The latest version of HTML.
- **CSS3**: The latest standard for CSS.
- **JavaScript ES6**: An updated standard for JavaScript.
- **Accessibility Standards**: E.g., WCAG (Web Content Accessibility Guidelines).
- **HTTP/HTTPS**: Protocols for communication between clients and servers.
- **DOM (Document Object Model)**: A standard for accessing and manipulating documents.

Web Programming Languages

- Web programming languages are used to develop websites and web applications. Common languages include:
- **HTML** (HyperText Markup Language): The standard markup language for creating web pages.
- **CSS** (Cascading Style Sheets): Used to style and format HTML documents.
- **JavaScript**: A programming language to make web pages interactive.
- **PHP**: A server-side scripting language for dynamic content.
- **Python**: Popular for backend development using frameworks like Django and Flask.
- **Ruby**: Known for web development with the Ruby on Rails framework.
- **Java**: Used for building server-side applications.
- **SQL**: Essential for managing and querying databases.

Categories of Web Applications

- Web applications can be classified into several categories:
- **Static Web Applications**: Display fixed content and do not require server-side processing.
- **Dynamic Web Applications**: Feature content that changes dynamically based on user interaction.
- **E-commerce Applications**: Online stores and shopping platforms. e.g. Amazon
- **Content Management Systems (CMS)**: Platforms like WordPress and Joomla.
- **Social Networking Applications**: Platforms like Facebook and LinkedIn.
- **Single Page Applications (SPA)**: Web applications that load a single HTML page. e.g. Gmail
- **Progressive Web Applications (PWA)**: Combine features of web and mobile apps. e.g. Uber, Twitter Lite, OLX.in

Characteristics of Web Applications

- Key characteristics of web applications include:
- **Accessibility**: Accessible from any device with an internet connection.
- **Scalability**: Can handle an increasing number of users or requests.
- **Interactivity**: Provides interactive interfaces for user engagement.
- **Cross-Platform Compatibility**: Works across different devices and browsers.
- **Security**: Ensures data protection through encryption and authentication.
- **Performance**: Fast response times and minimal loading delays.

Tiered Architecture

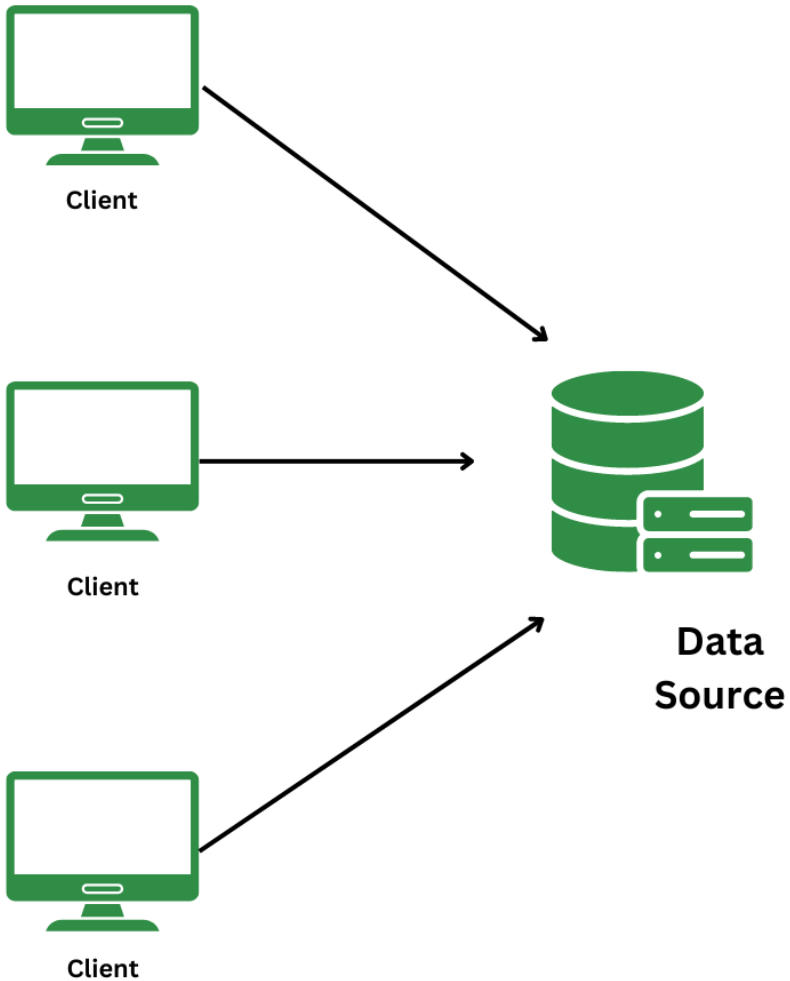
- Tiered architecture organizes the structure of a web application into layers for better functionality and maintainability:
- **1-Tier Architecture**: Combines all functions into a single layer (e.g., simple desktop applications).
- **2-Tier Architecture**: Divides the application into client and server layers.
- **3-Tier Architecture**: Includes a presentation layer (UI), business logic layer (server), and data layer (database).
- **N-Tier Architecture**: Adds more layers for specific functionalities, improving scalability and modularity.

- **Visual Example of 3-Tier Architecture:**
- **Presentation Layer**: Frontend (HTML, CSS, JavaScript).
- **Business Logic Layer**: Backend (Python, Java, PHP).
- **Data Layer**: Database (MySQL, MongoDB).

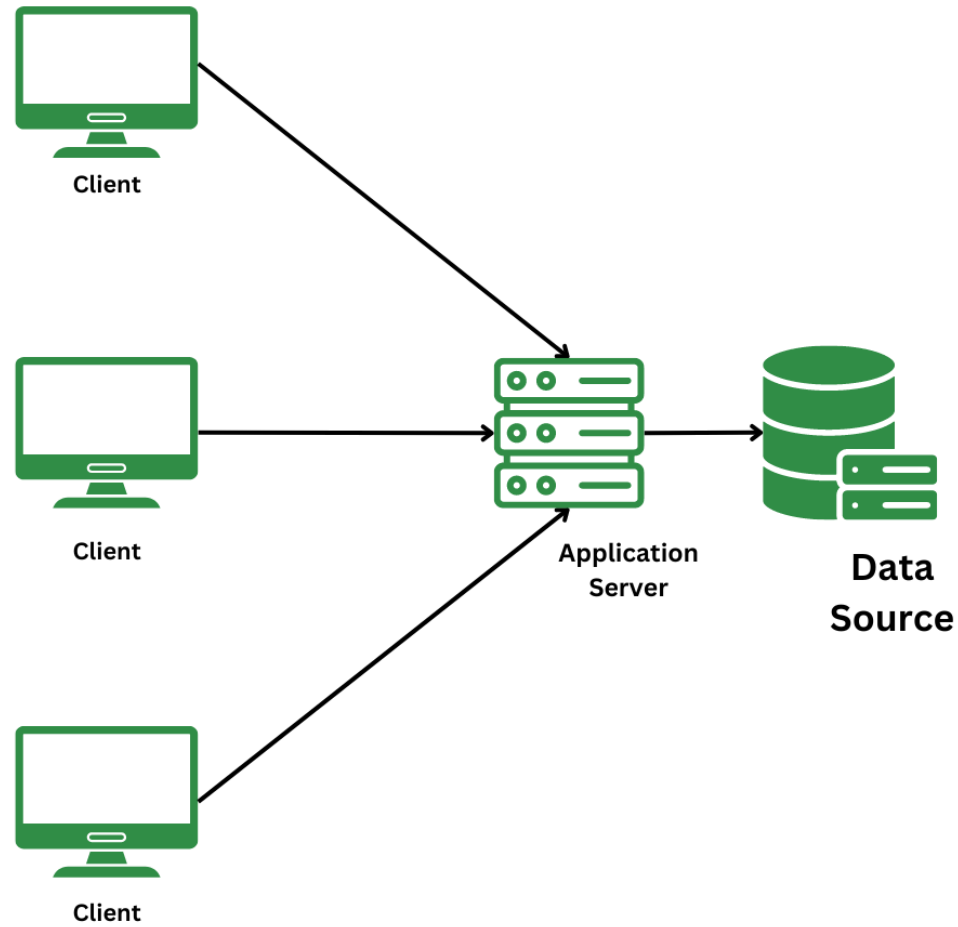
Difference Between Two-Tier And Three-Tier Database Architecture

Two-Tier Database Architecture	Three-Tier Database Architecture
It is a Client-Server Architecture.	It is a Web-based application.
In two-tier, the application logic is either inside the user interface on the client or within the database on the server (or both).	In three-tier, the application logic or process resides in the middle-tier, it is separated from the data and the user interface.
Two-tier architecture consists of two layers : Client Tier and Database (Data Tier).	Three-tier architecture consists of three layers : Client Layer, Business Layer and Data Layer.
It is easy to build and maintain.	It is complex to build and maintain.
Two-tier architecture runs slower.	Three-tier architecture runs faster.
It is less secured as client can communicate with database directly.	It is secured as client is not allowed to communicate with database directly.

Two Tier Architecture

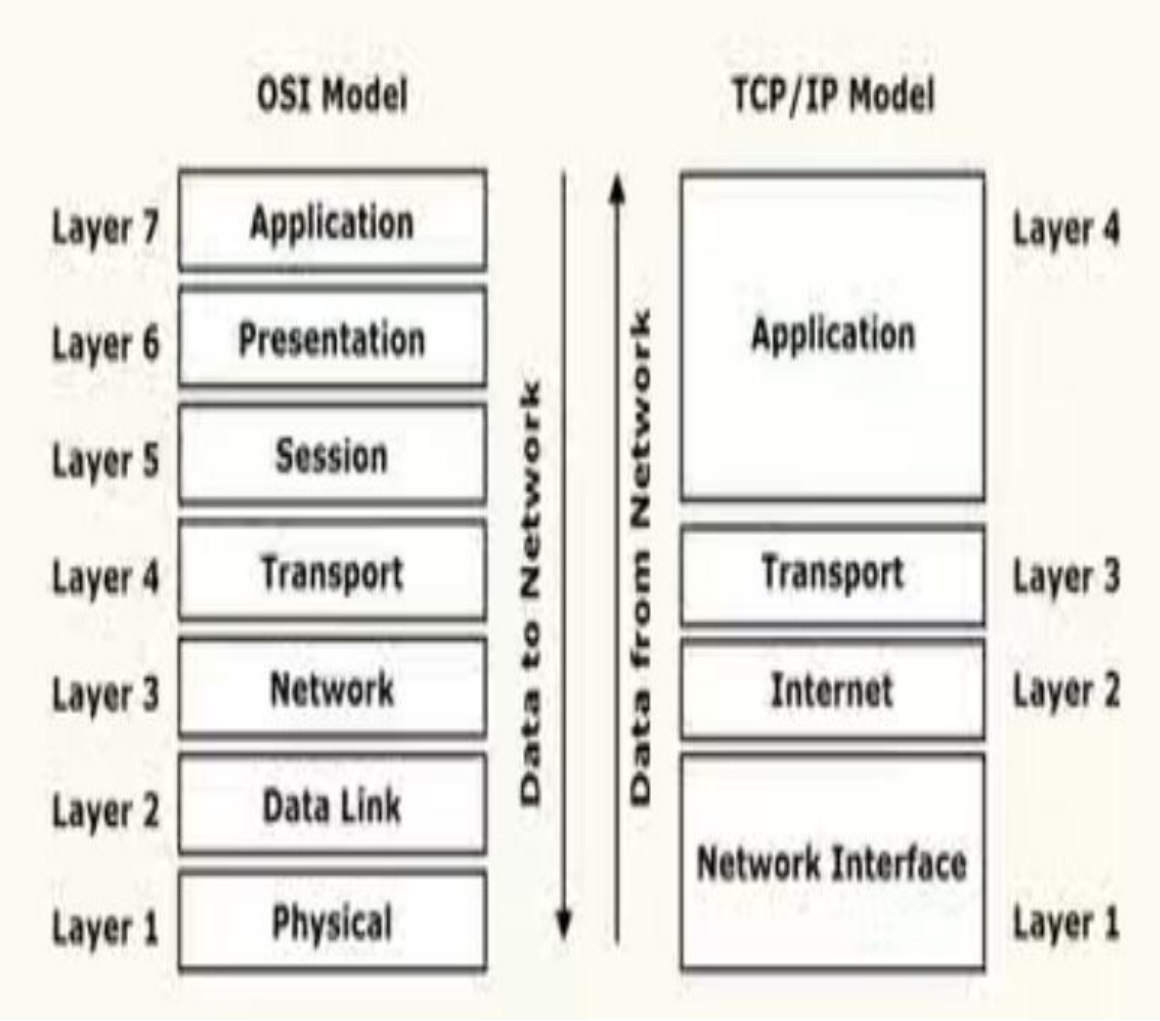


Three Tier Architecture



Application layer protocols

- An application layer is an abstraction layer that specifies the shared communications protocols and interface methods that host in network use.
- It is the layer closest to the end user, implying that both the application layer and the end user can interact with the software application directly.
- Application layer protocols define how application processes (clients and servers) running on different end systems, pass messages to each other.
- In particular, an application layer is an abstract layer that handles the sharing protocol of the TCP/IP and OSI model.

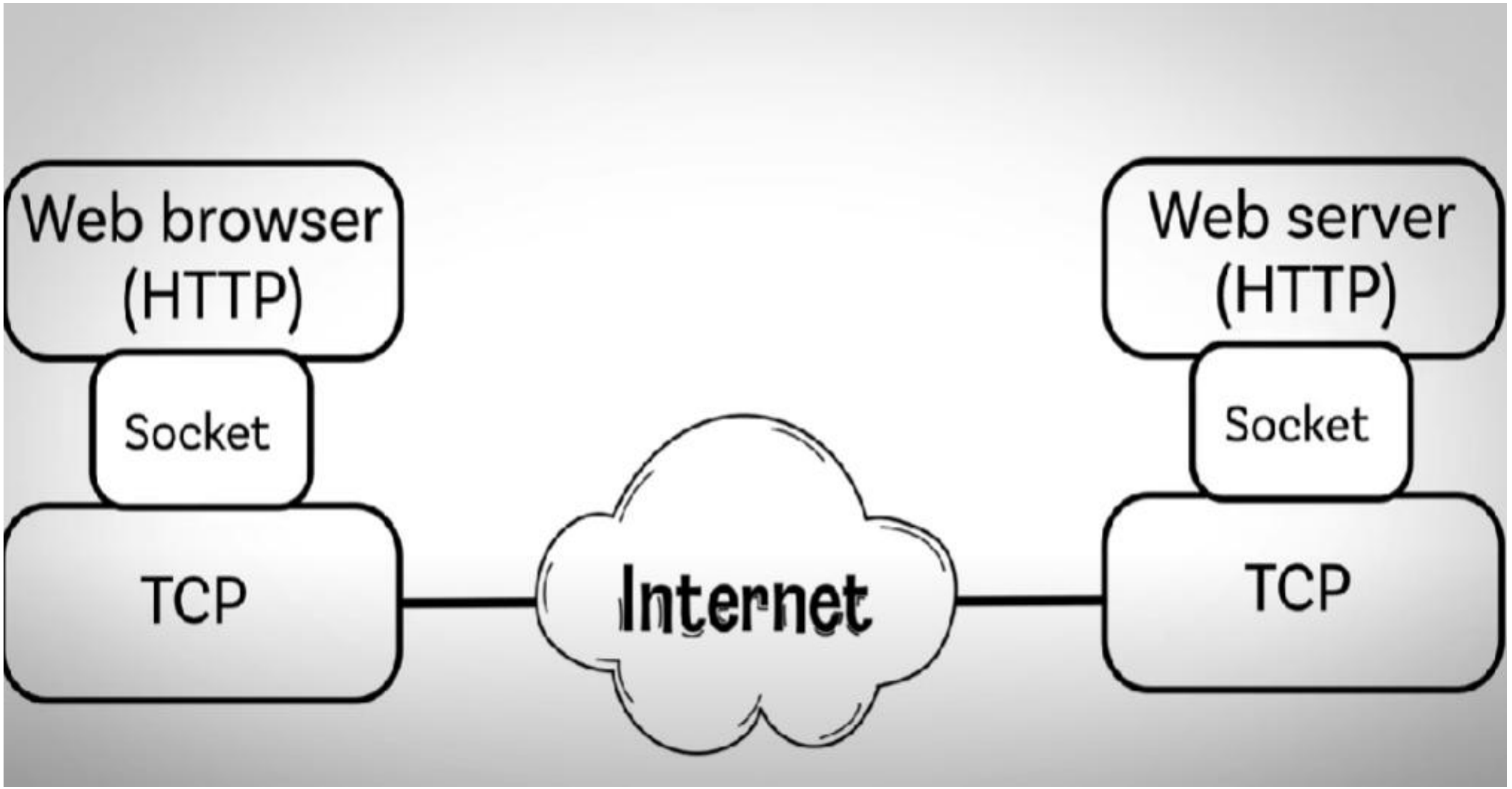


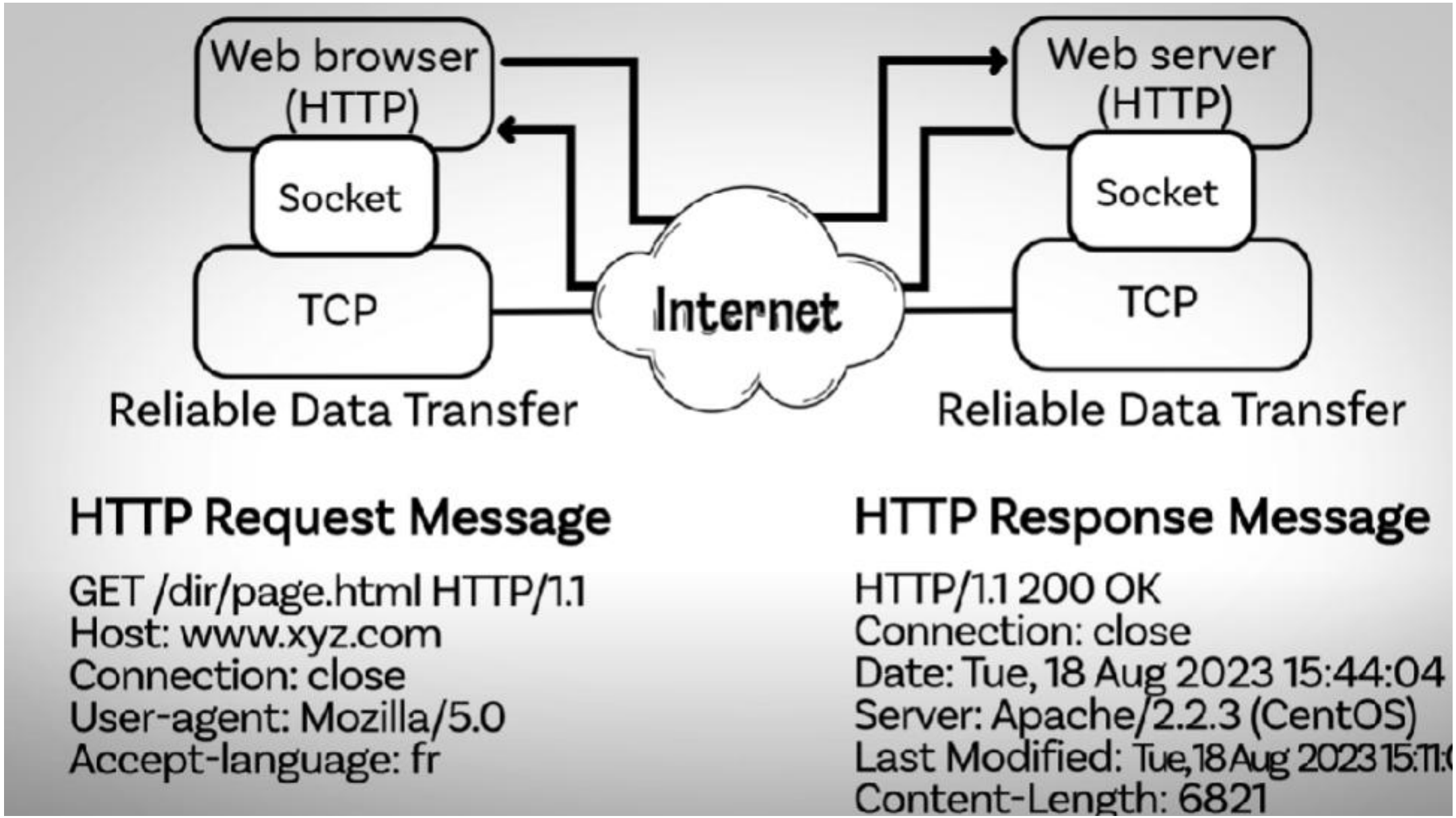
Applications:

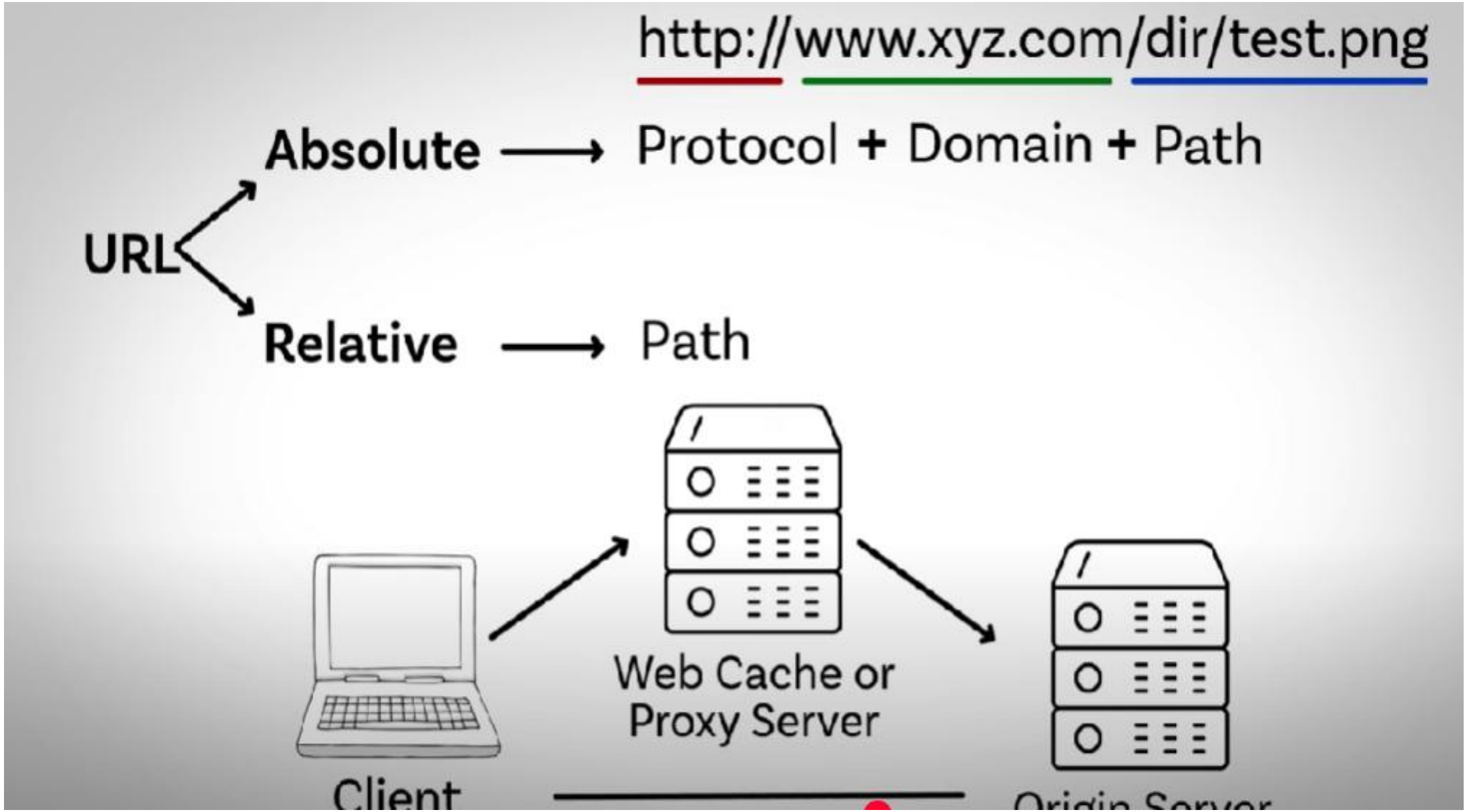
1. Email
2. Usenet
3. WWW
4. Multimedia
5. FTP

Hyper Text Transfer Protocol (HTTP)

- The Hypertext Transfer protocol(HTTP) is an application layer protocol that allows web based applications to communicate and exchange data.
- The HTTP protocol transfers data in plain text, hypertext, audio, video, etc.
- When a user wants to access a web page, a browser sends an HTTP Request message to the web server. The server responds with the requested web page.
- It is a TCP/IP based protocol.
- TCP is a connection-oriented protocol.
- One of the service of TCP is reliable data transfer.
- HTTP is designed mainly to fetch HTML documents and sends it to the client.
- All HTTP commands include a URL.


Web browser
(HTTP)
Socket
TCP
Internet
Web server
(HTTP)
Socket
TCP


Web browser (HTTP)
Socket
TCP
Internet
Web server (HTTP)
Socket
TCP
Reliable Data Transfer
Reliable Data Transfer
HTTP Request Message
GET /dir/page.html HTTP/1.1
Host: www.xyz.com
Connection: close
User-agent: Mozilla/5.0
Accept-language: fr
HTTP Response Message
HTTP/1.1 200 OK
Connection: close
Date: Tue, 18 Aug 2023 15:44:04
Server: Apache/2.2.3 (CentOS)
Last Modified: Tue,18 Aug 2023 15:11:
Content-Length: 6821

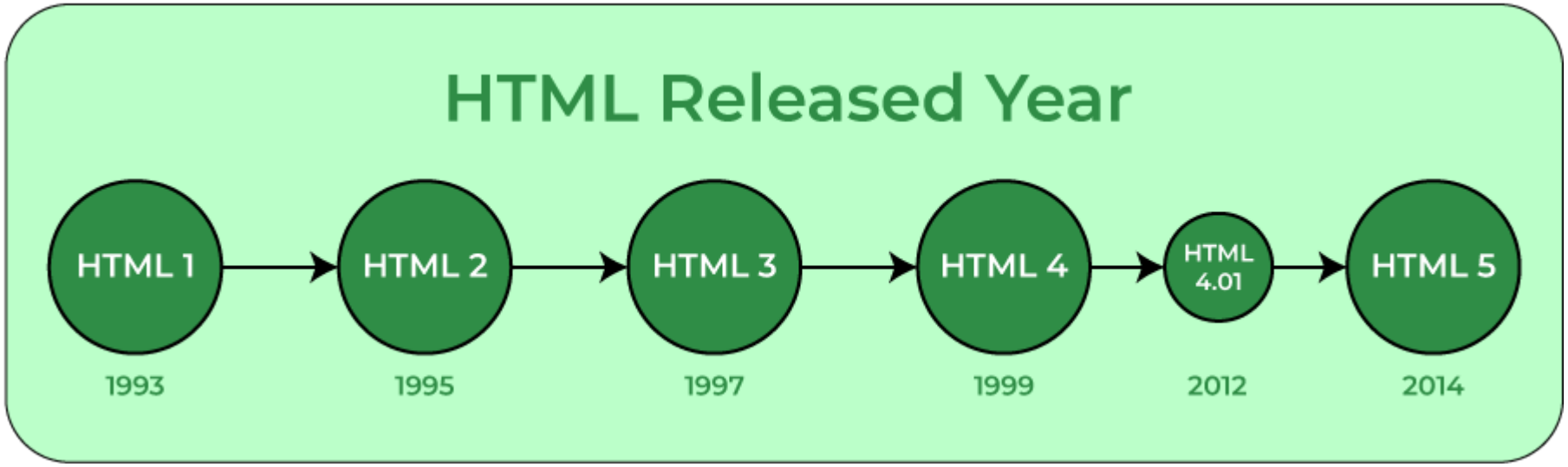

http://www.xyz.com/dir/test.png
Absolute
Protocol + Domain + Path
URL
Relative
Path
Web Cache or
Proxy Server
Client

HTML

- Hypertext Markup Language-HTML is a widely used programming language to develop web pages.
- HyperText stands for Link between web pages.
- Markup Language means Text between tags that define the structure.
- It defines how the web page looks and how to display content with the help of elements.
- It forms or defines the structure of a Web Page.

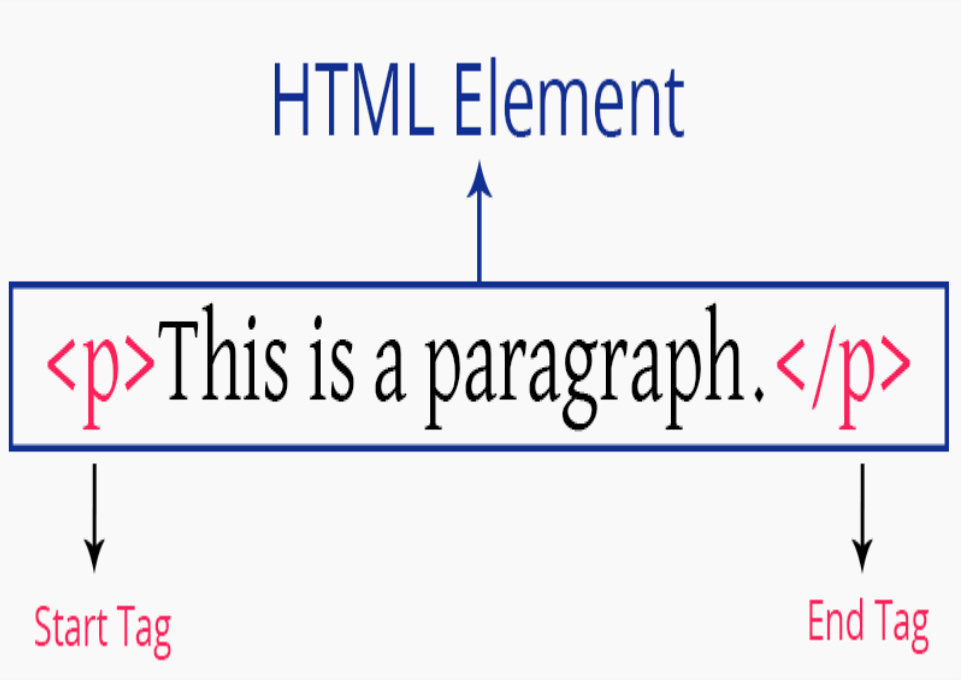
History of HTML

- HTML was created by Tim Berners-Lee in 1991.
- The first-ever version of HTML was HTML 1.0, but the first standard version was HTML 2.0, published in 1995.

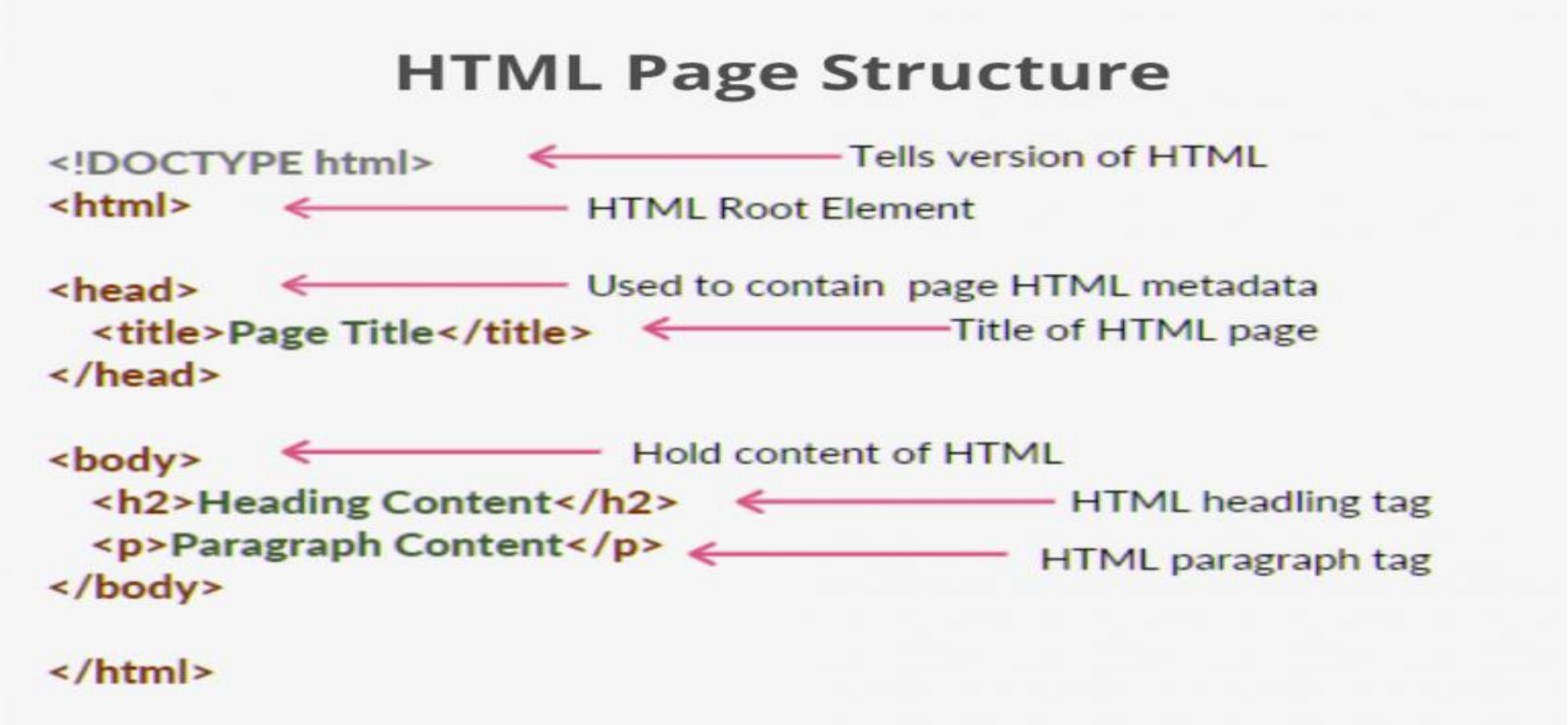


HTML Tags and Elements

- HTML Tags are building blocks of HTML Page.
- They tell the browser how it should display content to the user.
- A tag starts with a < bracket and ends with a > bracket.
- Most tags exist in pairs in HTML.
- Tags have an opening and closing part.
- They are similar, except the closing part has a / sign after the opening bracket.
- `Opening tag: <TagName>`
- `Closing tag: </TagName>`
- HTML Element includes a start tag, content, and an end tag.
- HTML Elements are components of the web page.



Basic structure of HTML



<!DOCTYPE>

- This is the document type declaration (not technically a tag).
- It declares a document as being an HTML document.
- The doctype declaration is not case-sensitive.
- Common Declarations:

HTML5

<! DOCTYPE html>

HTML 4.01

<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN" "http://www.w3.org/TR/html4/loose.dtd">

XHTML 1.0

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

Html tags

- **<html>:** This is called the HTML root element. All other elements are contained within it.
- **<head>:** The head tag contains the “behind the scenes” elements for a webpage. Elements within the head aren’t visible on the front-end of a webpage.
- HTML elements used inside the <head> element include:

  <style> This html tag allows to insert styling into webpages and make them appealing to look at with the help of CSS.

  <title> The title is what is displayed on the top of your browser when you visit a website and contains the title of the webpage that you are viewing.

  <base> It specifies the base URL for all relative URL’s in a document.

  <noscript> Defines a section of HTML that is inserted when the scripting has been turned off in the users browser.

  <script> This tag is used to add functionality in the website with the help of JavaScript.

  <meta> This tag encloses the meta data of the website that must be loaded every time the website is visited. For eg:- the metadata charset allows you to use the standard UTF-8 encoding in your website. This in turn allows the users to view your webpage in the language of their choice. It is a self closing tag.

  <link> The ‘link’ tag is used to tie together HTML, CSS, and JavaScript. It is self closing.

  ```
  <link rel="stylesheet" type="text/css" href="">
  ```

<meta>

```
<!DOCTYPE html>
<html>
<head>
  <meta charset="UTF-8">
  <meta name="description" content="Free Web tutorials">
  <meta name="keywords" content="HTML,CSS,XML,JavaScript">
  <meta name="author" content="John Doe">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
</head>
<body>

<p>All meta information goes in the head section...</p>

</body>
</html>
```

Output:

All meta information goes in the head section...

<body>

<body>: The body tag is used to enclose all the visible content of a webpage.

- In other words, the body content is what the browser will show on the front-end.
- <body tag> Contains many tags that are used to display the content of the web page.

1. Heading tags : <h1> </h1> to <h6> </h6>
2. Paragraph tag:
3. Image tag : <img>