



**We are on a mission to address the digital skills gap for 10 Million+ young professionals, train and empower them to forge a career path into future tech**

# Fundamentals of Web Application Development

JULY, 2024





# Application Types

They are **many application types** are as follows:

- Console Based Applications
- Windows / Desktop / GUI Based Applications
- Web Based Applications
- Enterprise Based Applications
- Mobile Based Applications
- Web Service Based Applications
- Cloud Based Applications
- Etc.,

# Application Types

## Console Based Applications

- An application that uses the **command line for input and output** rather than a graphical interface (GUI).
- **For example**, utility programs that perform a single function or that run in the background are often written as console apps.

```
F:\Personal\Training\Example>javac StringExample2.java

F:\Personal\Training\Example>java StringExample2
String: Hello,
StringBuilder: Hello, Raj
StringBuffer: Hello, Ravi

F:\Personal\Training\Example>
```

# Application Types

### Windows / Desktop / GUI Based Applications

- An application that runs stand-alone in a desktop or laptop computer.
- This type of applications allows users to interact with electronic devices through **graphical icons**.
- Desktop applications are **good for single user application** where data synchronization is not so crucial.
- **For Example:** Microsoft Windows, macOS, Ubuntu Unity, and GNOME Shell for desktop environments, etc.,.

# Application Types

### Pros of Windows / Desktop / GUI Based Applications

**It offers,**

- Offline capabilities
- More security
- Rely on your computer speed
- Cheaper from a long-term perspective

# Application Types

### Cons of Windows / Desktop / GUI Based Applications

- Not portable
- Need to install an app
- Maintenance is the responsibility of the end user
- Cross-platform functionality
- Extra storage needed
- Etc.,

# Application Types

## Web Based Applications

- In simple terms a program residing on **server** and end user accessing it via web clients (**web browsers**) are known as web application.
- **Example:** Common web applications include **email**, online retail sales, wikis, instant messaging services and more.





# Origin of Internet and World Wide Web

## Internet

- The Internet is a global, interconnected computer network in which **every computer connected to it can exchange data** with any other connected computer.



# Origin of Internet and World Wide Web

## Internet

- The Internet is a global system of interconnected computer networks that uses(TCP/IP) to **serve billions of users worldwide.**
- It is a **network of networks** that consists of millions of private, public, academic, business, and government networks of local to global scope, linked by a broad array of electronic, wireless, and optical networking technologies.
- We can exchange **Data graphics, sound, software, text and etc.,** to people through a variety of services and tools for communications.

# Origin of Internet and World Wide Web

## ARPANET

- The origins of the Internet date back to research commissioned by the United States government in the 1960s to build robust, fault-tolerant communication via computer networks
- Research Project of MIT funded by ARPA ( Advanced Research Projects Agency of the department of Defense).

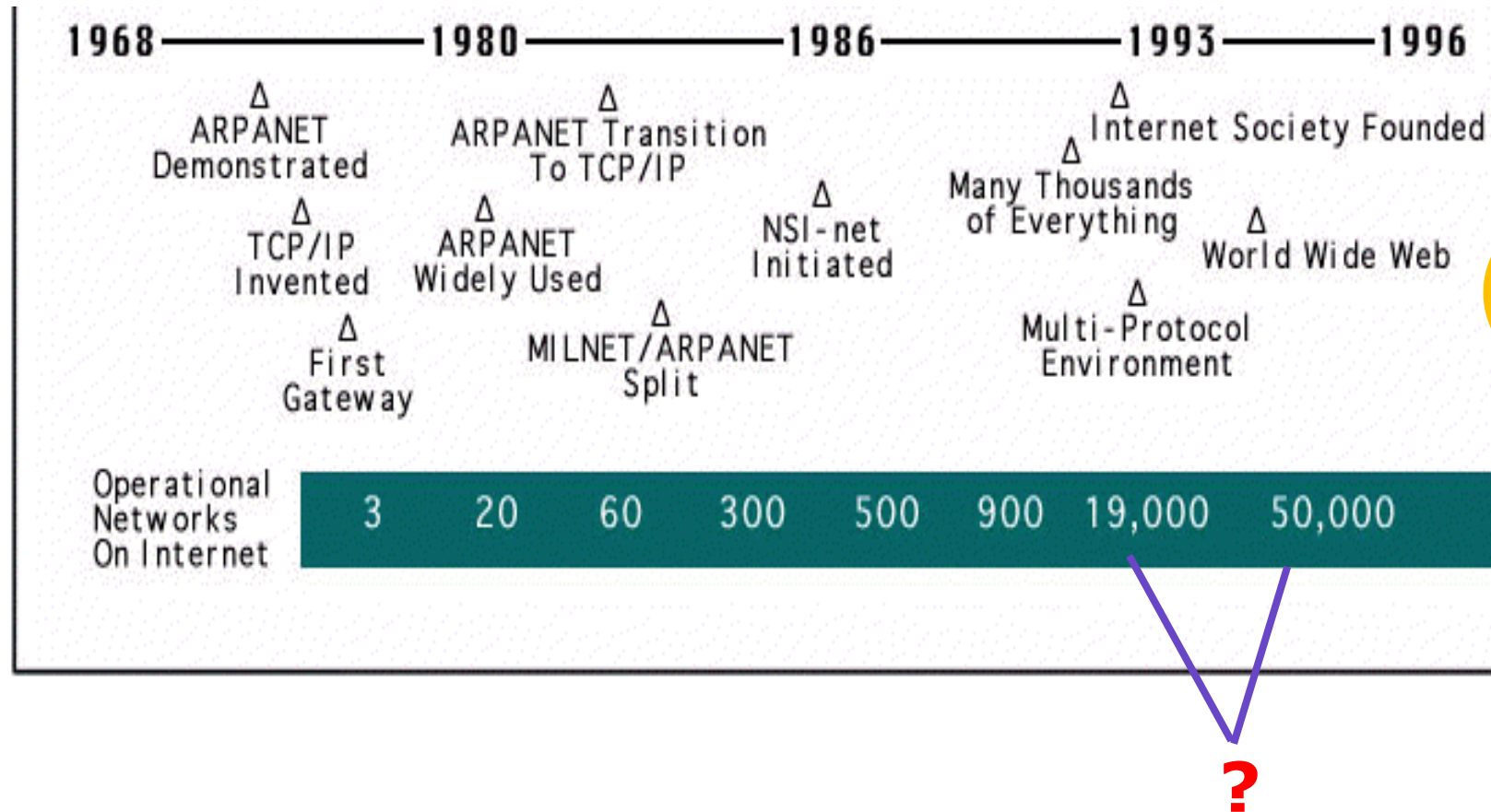
## Goal

- To **allow multiple users to send and receive information simultaneously** over the same communication paths.

**History of Internet:** [https://en.wikipedia.org/wiki/History\\_of\\_the\\_Internet](https://en.wikipedia.org/wiki/History_of_the_Internet)

# Origin of Internet and World Wide Web

## Internet Timeline



Why after WWW the internet usage is increase in exponential manner?

## Origin of Internet and World Wide Web



WWW?

# Origin of Internet and World Wide Web

- **World Wide Web (WWW):** It is a kind of **Internet based Service**.
- It allows users to **locate and view multimedia-based documents** on almost **any subject over the Internet**.
- In 1989, **Tim Berners-Lee** of CERN( the European organization for Nuclear Research) to develop a technology for sharing information via hyperlinked text documents.
- He developed HTML, URLs, and HTTP.

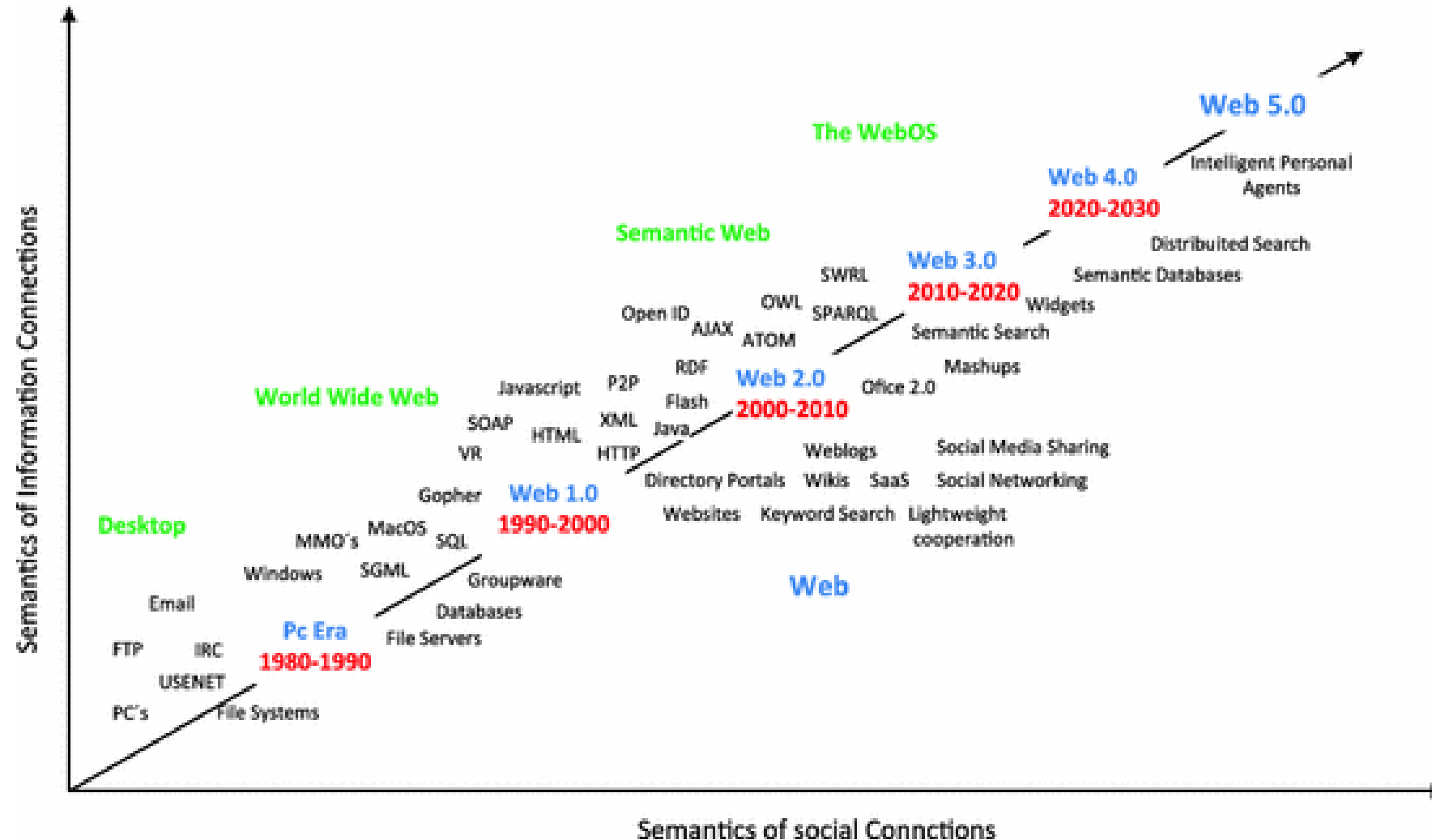


Tim Berners-Lee, the father of the World Wide Web.



## Fundamentals of Web application development

# Evolution of Web



# Web 1.0 : Static Web (1990-2000)

- 1990s & early 2000s.
- **“read-only web.”**
- Limited interaction between sites and web users.
- Supports only **static pages**.
- The first shopping cart applications, which most e-commerce website owners use in some shape or form, basically fall under the category of Web 1.0.
- The goal was to present products to potential customers, much like a catalog or a brochure.

# Web 2.0: Dynamic web (2000 – 2010)

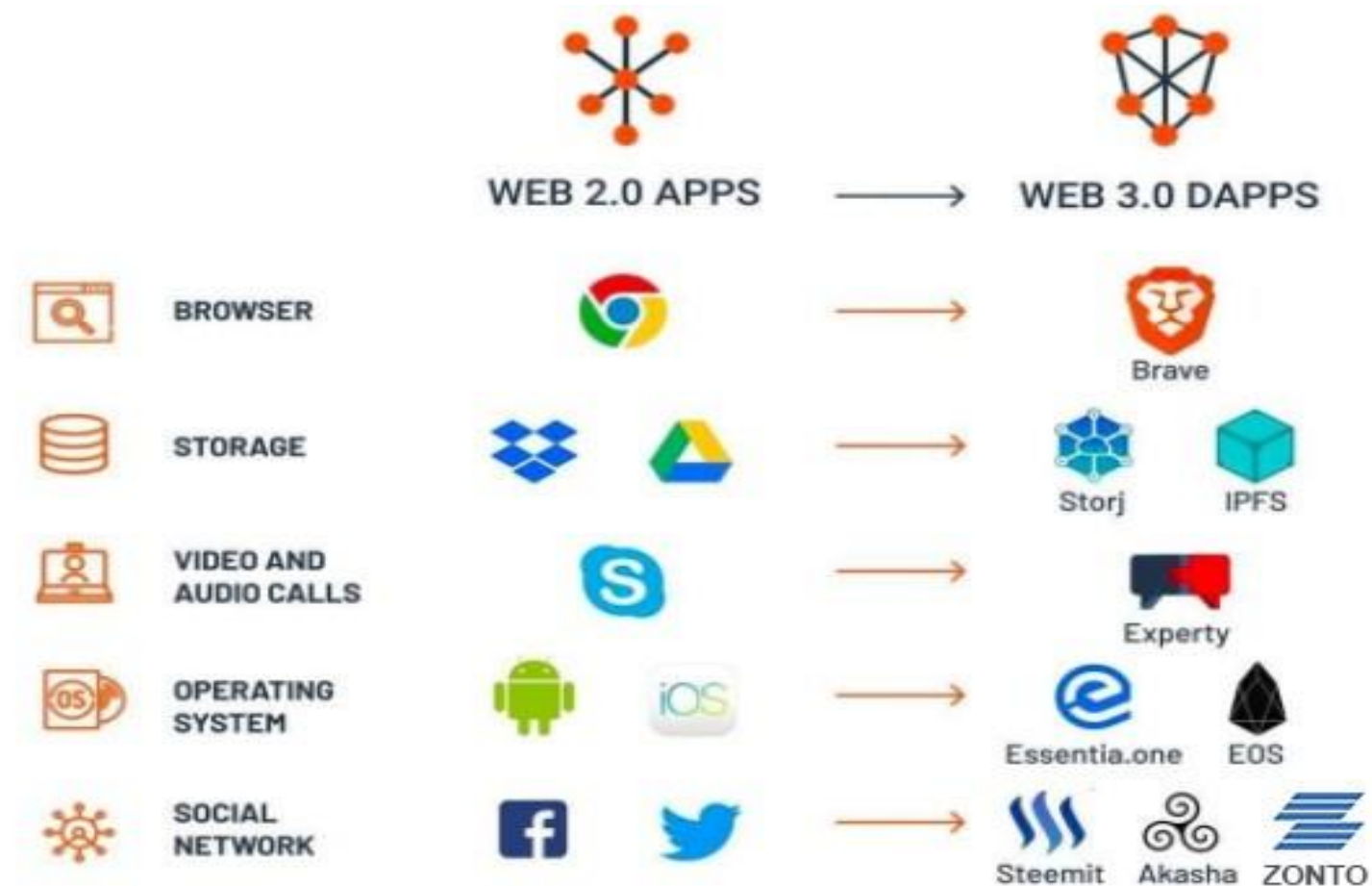
- **“read-write” web**
- The change from **static web pages to dynamic** or user-generated content and the **growth of social media**.
- It has the ability to contribute content and interact with other web users.
- It allows user to use the web as platform to create collaborative, community based sites like social networking sites, blogs, etc
- Few remarkable developments of Web 2.0 are Twitter, YouTube, eZineArticles, Flickr and Facebook.
- It introduced Rich Internet Applications(RIAs).
- Added rich features & functionality.
- Provided Look & Feel and Responsiveness

# Web 3.0: The semantic executing web (2010 – 2020)

- “**read-write-execute**” web
- It supports interactive services and machine-to-machine interactions.
- The **Semantic Web** is a developing extension of the World Wide Web in which the semantics of web information and services are defined, allowing the web to comprehend and respond to requests from humans and computers to use web content.
- A **web service** is a software system designed to support computer-to-computer interaction over the Internet.
- By combining a semantic markup and web services, Web 3.0 promises the potential for applications that can speak to each other directly, and for broader searches for information through simpler interfaces.

# Fundamentals of Web application development

## Web 2.0 to Web 3.0



### Web 4.0: IOT (2020 – 2030)

- **Intelligence + Self Learning + Self Organizing Web**
- Web 4.0 is also known as the **symbiotic web**.
- The goal of the symbiotic web is the **interaction between humans and machines** in symbiosis (a mutually beneficial relationship between different people or groups).
- The line between human and device will blur.
- Web 4.0 will **interact** with users in the same way that humans communicate with each other.
- Web 4.0 environment will be an “**always on**,” connected world.



# Web 5.0: Open, Linked, and Intelligent Web = Emotional Web (2030 – 2040)

- **read-write-execution-concurrency web.**
- Web 5.0 still is in **developing mode**
- Web 5.0 will be about the **(emotional) interaction between humans and computers.**
- The interaction will become a daily habit for a lot of people based on **neurotechnology.**
- With headphones on, users will interact with content that interacts with their emotions or changes in facial recognition.

## Fundamentals of Web application development

### Basic terminologies

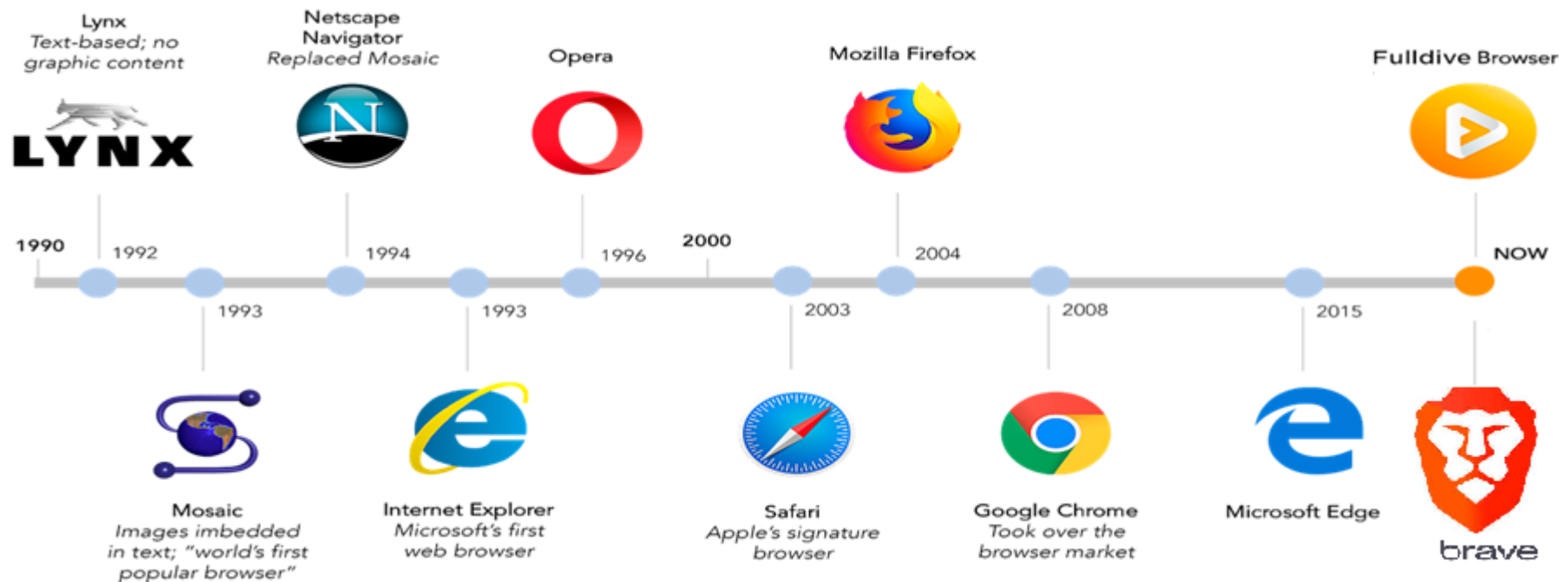
- Web Browser and Web Server
- Website and Webpage
- Website and Web Application
- Website and Portal
- Online and offline
- Intranet and Internet
- IP Address and DNS
- URI or URL
- HTTP
- Etc,.

## Fundamentals of Web application development

# Basic terminologies: Web Browser

## Web Browser

- The primary purpose is to bring information resources to the user.
- An application for retrieving, presenting, and traversing information resources to the client.



# Basic terminologies

## Web Server

- The term **web server** or **webserver** can mean one of two things:
- A computer program that accepts HTTP requests and returns HTTP responses with optional data content.
- A computer that runs a computer program as described above.
- A Web server typically serves static content residing on a file system (HTML Pages, images, audio and video files).
- Web servers route requests for dynamic content (Non-Web Content) using “Web Gateways”.



# Basic terminologies

### Online & Offline

- When you are connected to the internet with your computer, laptop or mobile device you are said to be **online**.
- Once your device or system gets disconnected with internet, you are said to be **offline**.

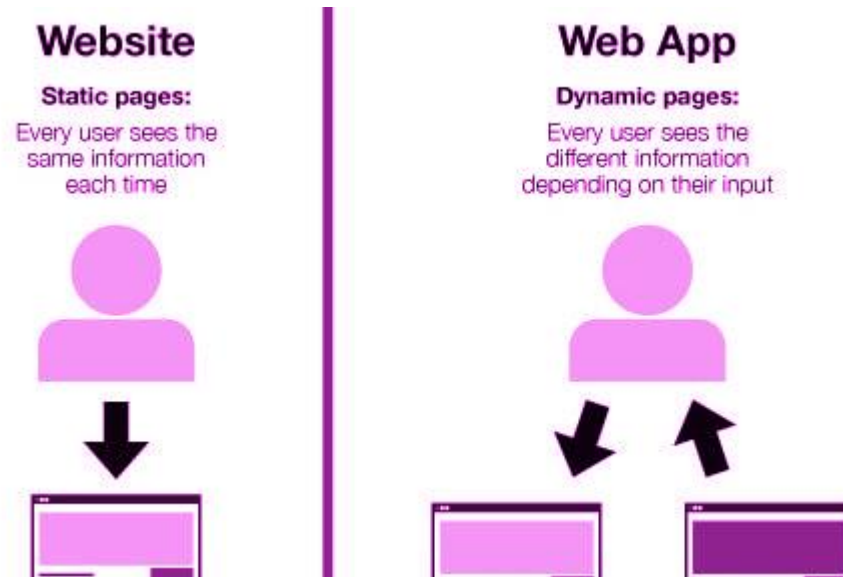
### Webpage and Website

- HTML documents are referred to as **Web Pages**.
- Collection of interlinked web pages with related information is referred to as **website**.

# Basic terminologies

## Website and Web Application (Web App)

- There is **a thin line between websites and web applications**. A **Website** is a group of interlinked web pages that can be accessed globally using a domain name and a **Web application** is a software or program which can be accessed by the web browser.





# Basic terminologies

### Website and Portal

- A website is a set of **interlinked web pages** hosted from the same domain, which can be accessed through a web address.
- A portal is usually **user-centric** whereas a website is owned by an organization or company etc.
- Websites are for **driving traffic**, whereas web portals are for **limiting traffic** to a specific group of users.
- Most web portals require a user to log in, which allows the site to deliver **more specific content and services** based on who that user is.
- **Websites are destinations** that everyone can get to, and are generally designed for a broader audience.

# Basic terminologies

### Internet and Intranet

- The **Internet** is a **globally-connected network of computers** that enables people to share information and communicate with each other.
- An **intranet**, on the other hand, is a **local or restricted network** that enables people to store, organize, and share information within an organization.

# Basic terminologies

### IP Address

- Any computer that is connected to the Internet has an Internet Protocol (IP) address. This unique address, or number, is in the form of **xxx.xxx.xxx.xxx**, where xxx is an integer between 1 and 255. This number identifies the computer and the network to which it is connected.
- **Example:** 165.165.100.2
- Since humans have trouble remembering numbers like this, these addresses are mapped to names like "www.google.com" .

# Basic terminologies

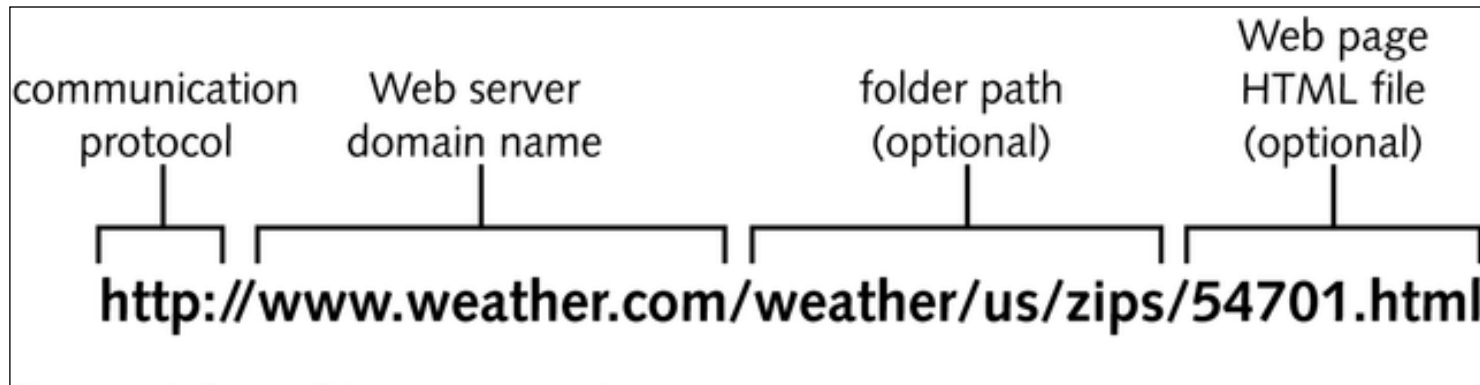
### Domain Name Systems (DNS)

- It is the phonebook of the Internet. Humans access information online through domain names, like google.com or espn.com.
- Web browsers interact through Internet Protocol (IP) addresses.
- DNS translates **domain names to IP addresses** so browsers can load Internet resources.
- **Example:** 165.165.100.2
- Since humans have trouble remembering numbers like this, these addresses are mapped to names like "www.google.com" .

# Basic terminologies

## URL or URI (Uniform Resource Locator / Indicator)

- URLs are location dependent
- It contains four distinct parts: the protocol type, the machine name, the directory path and the file name.
- There are several kinds of URLs: file URLs, FTP URLs, and HTTP URLs.



# Basic terminologies

## HTTP (Hyper Text Transfer Protocol)

- HTTP is a web communication protocol.
- HTTP is a request/response standard of a client and a server.
- Typically, an HTTP client initiates a request.
- Resources to be accessed by HTTP are identified using Uniform Resource Identifiers (URIs).
- HTTP defines various methods indicating the desired action to be performed on the identified resource.

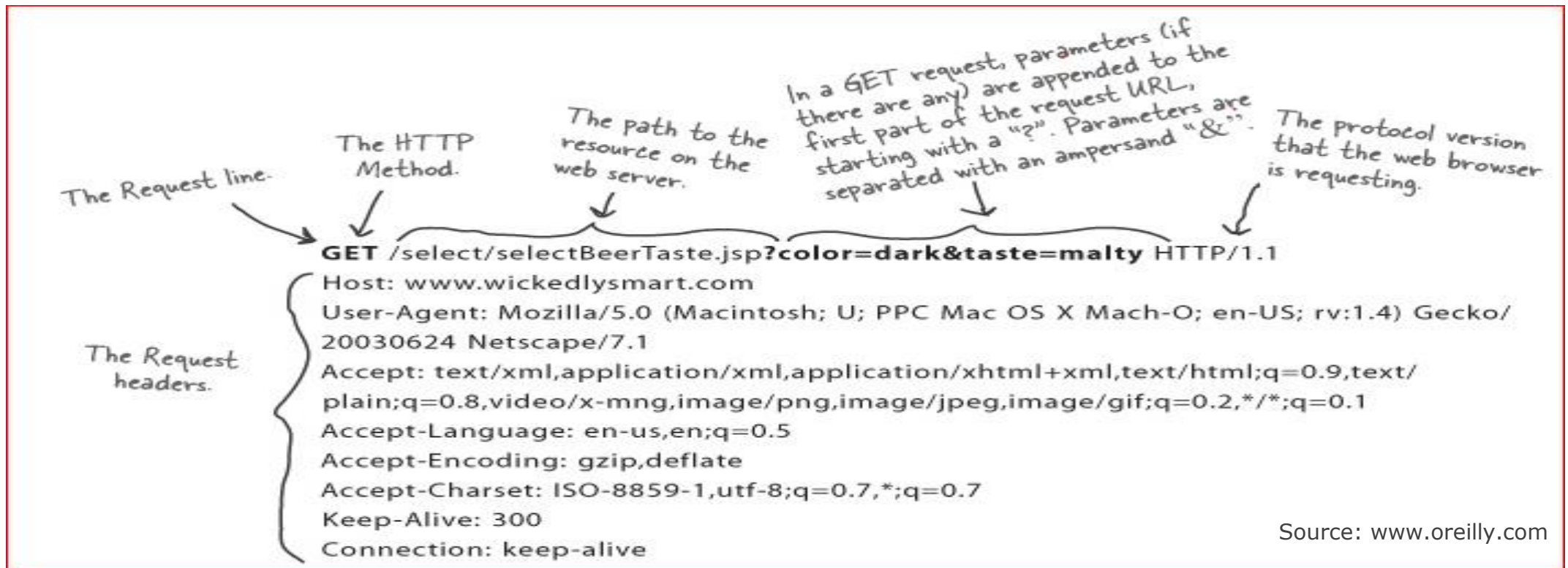


# HTTP Methods

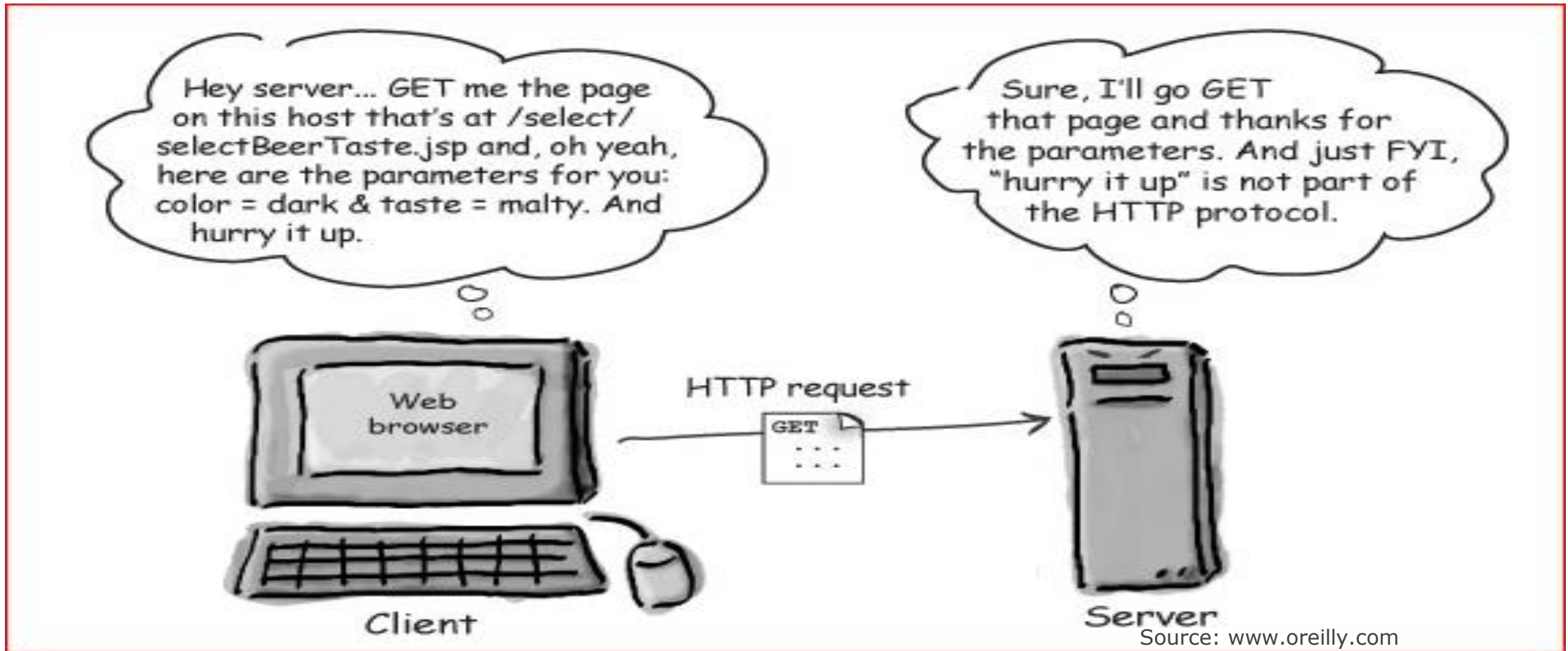
- HTTP defines eight important methods (sometimes referred to as "verbs") indicating the desired action to be performed on the identified resource.
- **HEAD** - it mirrors some functionality of another METHOD
- **GET** - to retrieve information
- **POST** - to submit an attribute or entity to a given resource
- **PUT** - is somewhat the polar opposite of GET. It places that resource in the remote directory.
- **DELETE** - deletes a targeted resource
- **TRACE** - carries out a message loop-back test.
- **OPTIONS** - requests permitted communication options for a given URL or server.
- **CONNECT** - creates communication with a resource rather than directly interacting with said resource.

## Anatomy of an HTTP GET request

- The path to the resource, and any parameters added to the URL are all included on the “request line”.



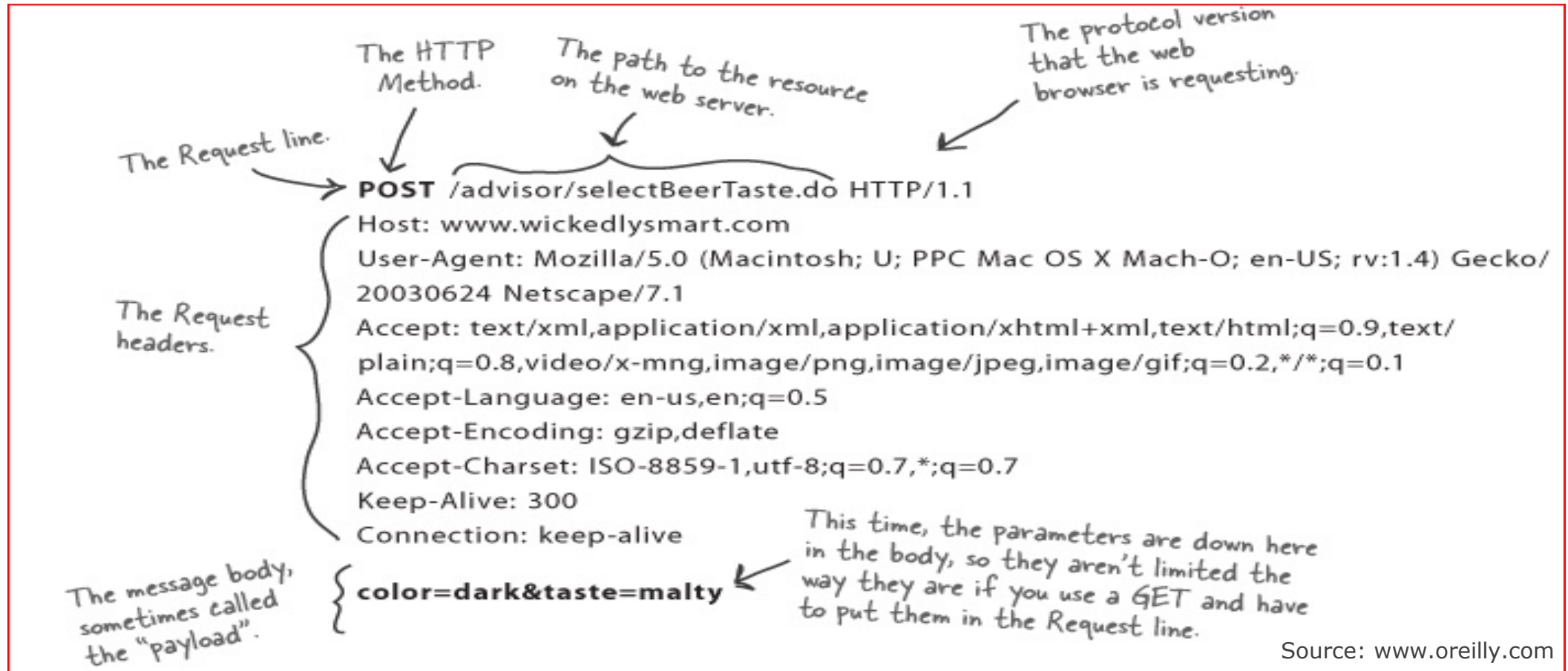
## Anatomy of an HTTP GET request



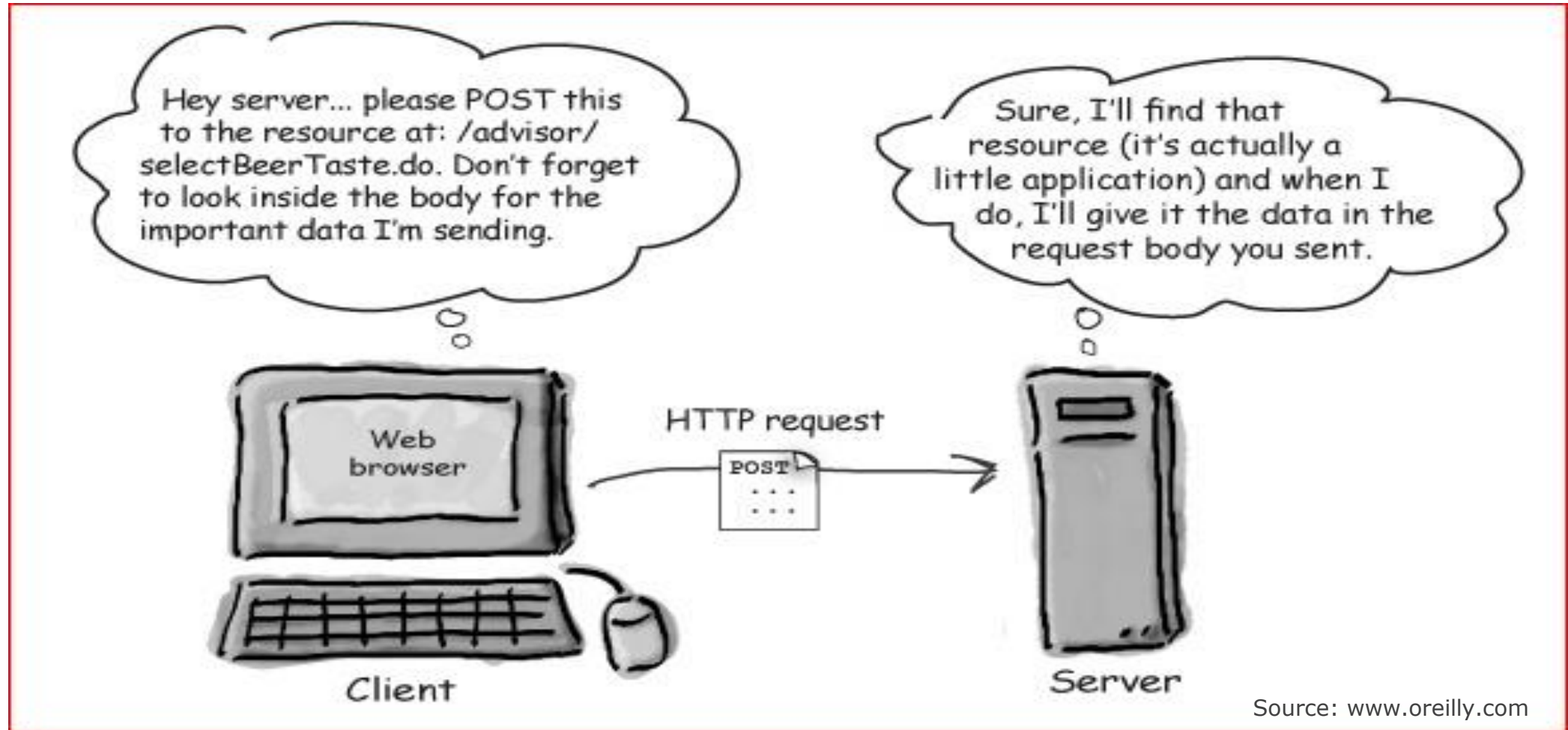
# Anatomy of an HTTP POST request

- HTTP POST requests are designed to be used by the browser to make complex requests on the server.
- For instance, if a user has just completed a long form, the application might want all of the form's data to be added to a database.
- The data to be sent back to the server is known as the “message body” or “payload” and can be quite large.

## Anatomy of an HTTP POST request



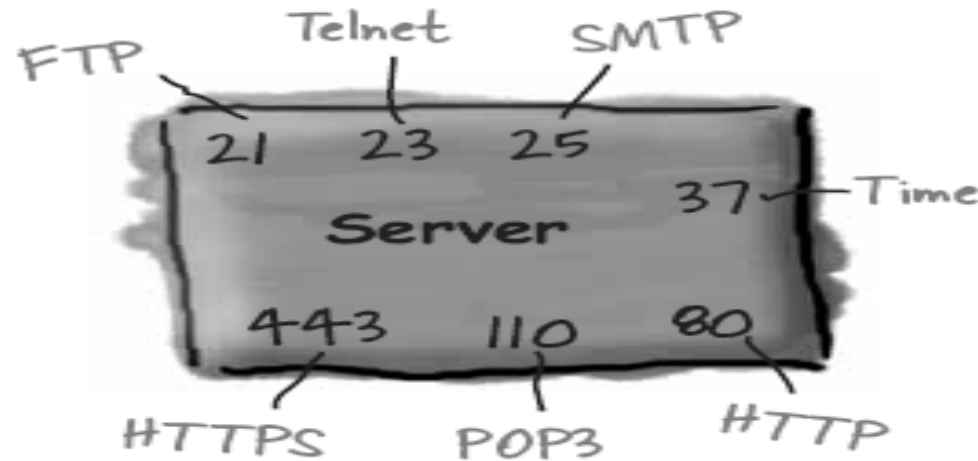
## Anatomy of an HTTP POST request



## Port

- **Port is a 16-bit number** that identifies a specific software program on the server hardware.

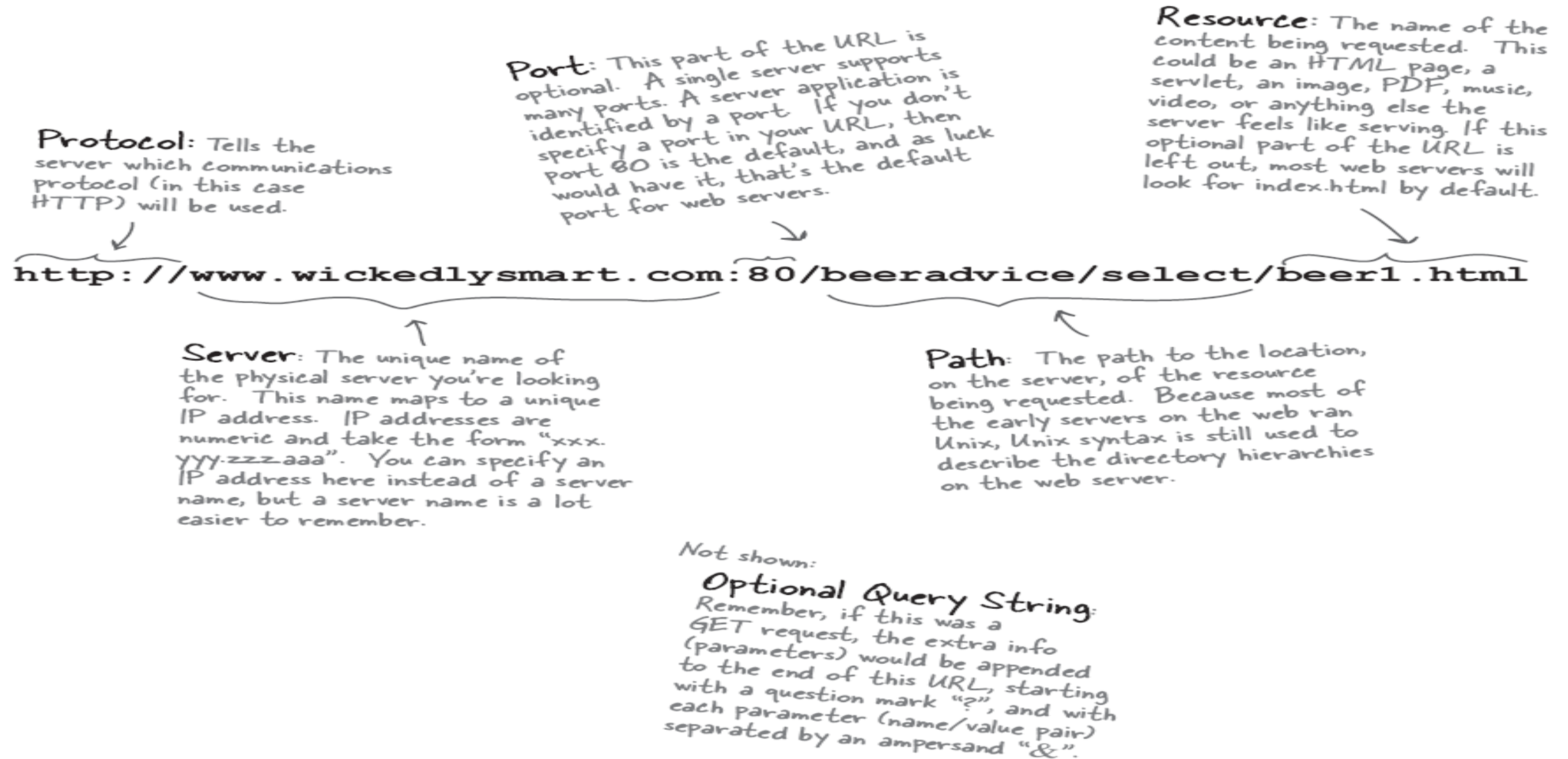
Well-known TCP port numbers  
for common server applications



Using one server app per port, a server can have up to 65536 different server apps running (although it's possible to run more than one app on the same port if the apps use different protocols).



## Web Address or URL

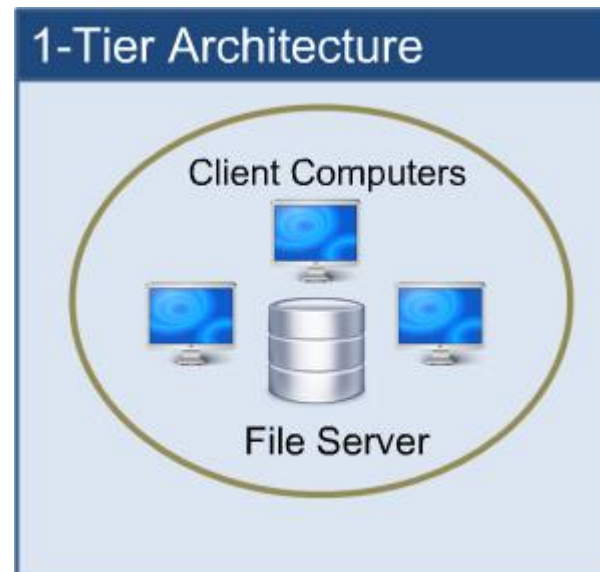




# Basic Web System Architecture

## Single Tier Architecture

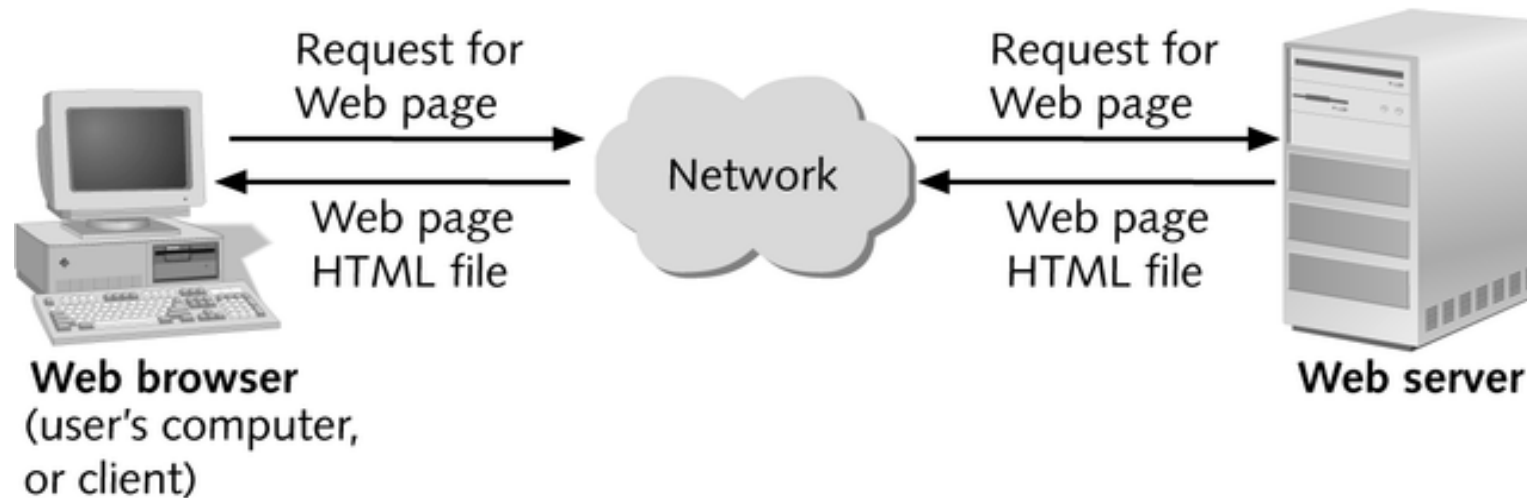
- One-tier architecture involves **putting all of the required components** for a software application or technology on a single server or platform.



# Basic Web System Architecture

### Client – Server Model

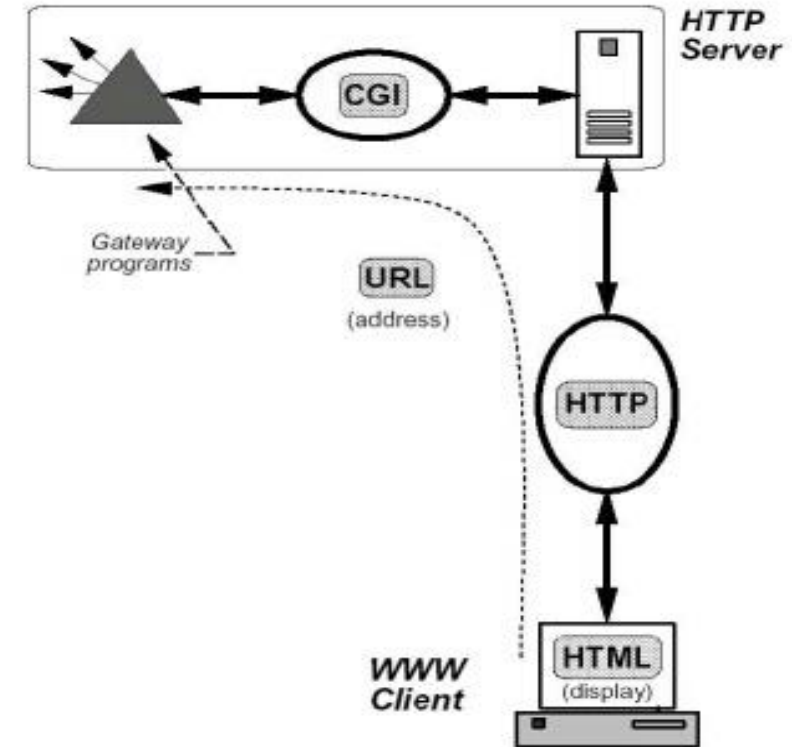
- The web is a **two-tiered architecture**.
- A web browser displays information content,
- and a web server that transfers information to the client.



# Basic Web System Architecture

## Web Architecture Extension

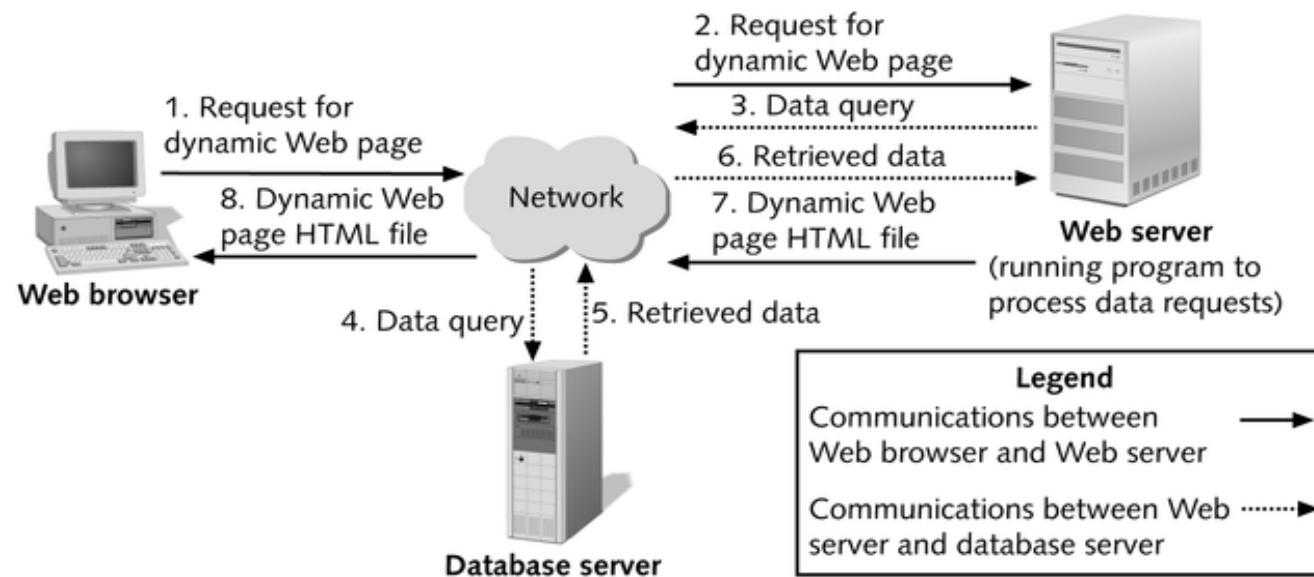
- This basic web architecture is fast evolving to serve a wider variety of needs beyond static document access and browsing. The Common Gateway Interface (CGI) extends the architecture to three-tiers by adding a back-end server that provides services to the Web server on behalf of the Web client, permitting dynamic composition of web pages. Helpers/plugin-ins and Java/JavaScript provide other interesting Web architecture extensions.



# Basic Web System Architecture

## Database-driven Web Architecture

- One of the most common types of dynamic web pages is the database driven type. It means that you have a web page that grabs information from a database (the web page is connected to the database by programming,) and inserts that information into the web page each time it is loaded.



# Basic Web System Architecture

## Application Server

- Application servers are software that help enterprises develop, deploy and manage large numbers of applications that are mostly distributed in nature.
- From a developer's point of view, the central difference that an application server brings about is the separation of business logic from the presentation logic and the database logic.
- Essentially, application servers help us build true 3-tier applications where the database is logically separated (sometimes physically separated too) from the business logic.

# Basic Web System Architecture

Developing a server involves dealing with **many complicated issues**:

- Concurrency
- Providing access to all possible production databases
- Network connection management
- database connection pooling

# Basic Web System Architecture

### Examples:

- BEA's Weblogic (J2EE)
- IBM's Websphere (J2EE)
- Microsoft's IIS (ISAPI)
- Microsoft's MTS (Microsoft Transaction Server)
- iPlanet (Formerly Netscape) (NSAPI, J2EE)
- TOMCAT

# Web server vs. Application server

## The Web server

- A Web server handles the HTTP protocol. When the Web server receives an HTTP request, it responds with an HTTP response, such as sending back an HTML page.
- To process a request, a Web server may respond with a static HTML page or image, send a redirect, or delegate the dynamic response generation to some other program such as CGI script, JSP, Servlet, ASP or some other server-side technology.
- Whatever their purpose, such server-side programs generate a response, most often in HTML, for viewing in a Web browser.



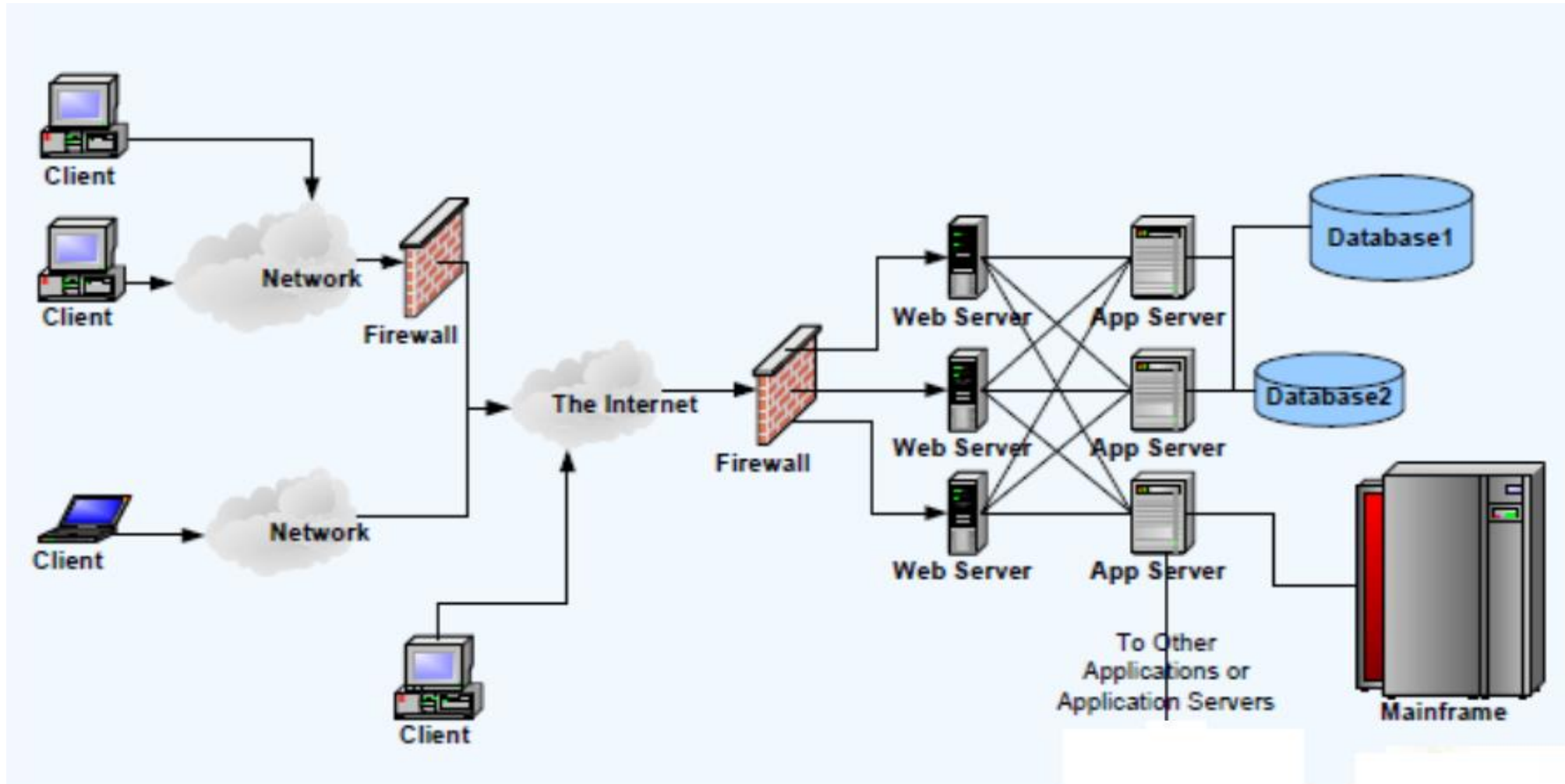
# Web server vs. Application server

## The application server

- Application server exposes business logic to client applications through various protocols, possibly including HTTP.
- While a Web server mainly deals with sending HTML for display in a Web browser, an application server provides access to business logic for use by client application programs.
- The application program can use this logic just as it would call a method on an object (or a function in the procedural world).

## Fundamentals of Web application development

### Sample Real World Scenario



# Static vs Dynamic websites

- A **static web site** is a web site where the content, the HTML and graphics, are always static—it is served up to any visitor the same, unless the person who created the web site decides to manually change the copy of it on the server.
- On a **dynamic web site** on the other hand, the content on the server is the same, but instead of just being HTML, it also contains dynamic code, which may display different data depending on information you feed to the web site. Another thing to note is that special software must be installed on the server to create a dynamic web site.  
  
e.g., Javascript, JQuery, PHP, ASP.Net etc.,

# Client-side Processing

- Some processing needs to be “executed” by the browser, either to form the request for the dynamic Web page or to create or display the dynamic Web page.
- The client-side environment used to run scripts is usually a browser.
- The processing takes place on the end users computer.
- The source code is transferred from the web server to the users computer over the internet and run directly in the browser.

# Server-side Processing

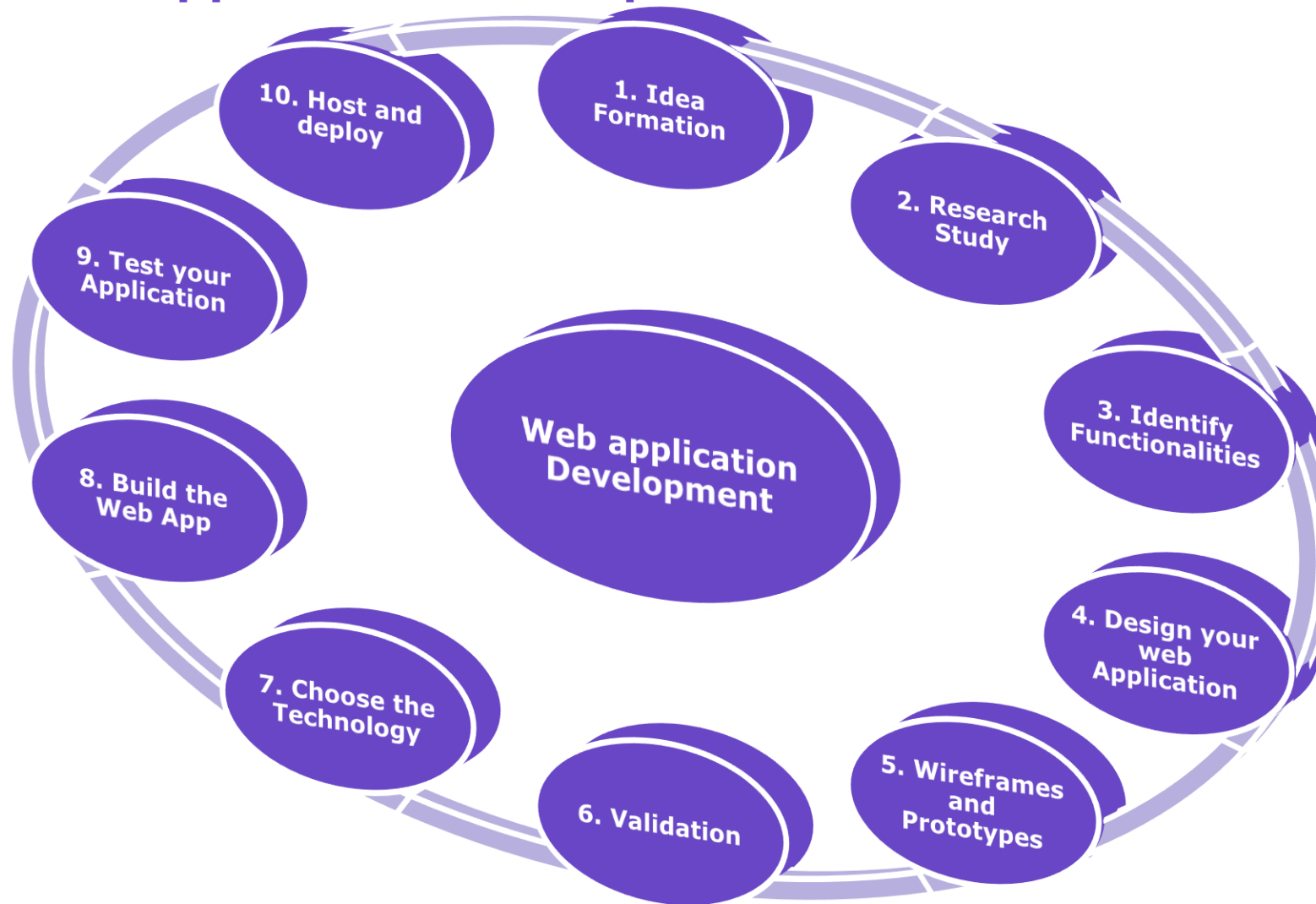
In **server-side processing**, the Web server:

- Receives the dynamic Web page request
  - Performs all of the processing necessary to create the dynamic Web page
  - Sends the finished Web page to the client for display in the client's browser
- 
- The server-side environment that runs a scripting language is a web server. A user's request is fulfilled by running a script directly on the web server to generate dynamic HTML pages.

# Client-side and Server-side Script

Client Side Script	Server Side Script
Scripts that runs on the client machines browser.	Scripts on the web server to produce a response that is customized for each client's request to the website.
Executed in the client side or web browser	Executed in the back end or the web server
Provides less security for the data	Provides more security for the data
<b>Ex:</b> HTML, CSS, JavaScript, JQuery, AJAX, Angular JS Framework, Bootstrap Framework	<b>Ex:</b> PHP and Python Web Framework, JSP, ASP, Ruby, Perl, Node JS Framework

# Guide to Web Application Development



# Guide to Web Application Development

## Technologies

- There are two main categories of coding, scripting and programming for creating Web Applications:
  - 1. Client-Side Scripting / Coding**
  - 2. Server-Side Scripting / Coding**



# Guide to Web Application Development

## Program Libraries

- Program libraries are a collection of commonly used functions, classes or subroutines which provide ease of development and maintenance.

## Web Application Frameworks

- Web Application Frameworks are sets of program libraries, components and tools organized in an architecture system allowing developers to build and maintain complex web application projects using a fast and efficient approach.
- These are designed to streamline programming and promote code reuse.

## Web Application Frameworks



## Quiz



1. An icon or image or text on a web page associated with another webpage is called

a) URL

b) Hyperlink

c) Plug-in

d) None of the above

**Ans: b) Hyperlink**

## Quiz



2. Dynamic web page \_\_\_\_\_

a) is same every time whenever it displays

b) generates on demand by a program or a request from browser

a) Both a & b

d) None of the above

**Ans: b) generates on demand by a program or a request from browser**

## Quiz



3. Web browser is \_\_\_\_\_

a) a program that can display a web page

b) a program used to view html documents

c) it enables users to access the resources through internet

d) All the above

**Ans: d) All the above**

## Quiz



5. URL stands for

a) Unique Reference Label

b) Uniform Reference Label

c) Uniform Resource  
Locator

d) Unique Resource  
Locator

**Ans: c) Uniform Resource  
Locator**

## Quiz



6. \_\_\_\_\_ is a repository of information linked together from points all over the world.

a) The www

b) HTTP

c) HTML

d) None of the above

**Ans: a) The www**

## Quiz



**7. www is based on which model?**

a) Local - Server

b) Client-Server

c) 3 tier

d) None of these

**Ans: b) Client-Server**



## Quiz



8. A \_\_\_\_\_ is typically a database containing information about domain names and their correspondence IP address

a) Telnet

b) FTP

c) TCP

d) DNS

**Ans: d) DNS**

## Quiz



9. ISP stands for

a) International Server Protocol

b) Internal Storage Protocol

c) Internet Service Provider

d) Internet Storage Provider

**Ans: c) Internet Service Provider**

## Quiz



10. .... is a 32-bit number, normally expressed as four octets between the periods.

a) Port

b) Domain name

c) IP address

d) None of these

**Ans: c) IP address**

# THANK YOU