CLIENT

- A Client is: Any device or application that sends a request to a server to get some information or service.
- The client always asks, and the server answers.

"If you ask for something, you become the client."

Examples:

- You ask a shopkeeper → You are the client
- You ask a teacher a question → You are the client
- You ask Swiggy to bring food → Your phone is the client
- The one who requests is always the client.

In computers:

A client can be:

- A browser (Chrome, Firefox)
- A mobile app (Instagram, WhatsApp)
- A laptop or phone
- A desktop application (Zoom, Teams)
- A smart device (Smart TV)

When a client needs something from a server, it sends a request.

Examples:

- When Chrome opens Google → Chrome is the client
- When Instagram loads feed → Instagram app is the client
- When WhatsApp sends a message → WhatsApp is the client

The server receives these requests and responds with data.

Types of Clients (Simple Categories)

1. Web Clients
   - Chrome
   - Firefox
   - Edge

2. Mobile Clients
    - Instagram app
    - Amazon app
    - YouTube app

3. API Clients
    - Postman
    - Hoppscotch

4. IoT Clients
    - Smart bulbs
    - Alexa
    - Smart TV

All of these send requests to servers.

A client = The one who STARTS the conversation.

Servers NEVER start the talk.

Example:

- Instagram server will never contact you first.
- You must open the app → client starts the communication.

SERVER

- Whenever two people communicate, one asks and the other answers.
- The same happens in technology.
- When you ask your friend a doubt → You are the client, your friend is the server.
- When you ask your teacher a question → You become the client, teacher becomes the server.

- A server is simply the “one who answers.”
- **Definition** - A Server is a powerful computer or software that receives requests and sends responses.

SERVER IN STUDENTS POINT OF VIEW

Ask them:

“What do you do when you forget a subject definition during study?”

- You open Google → You send a request
- Google sends back the answer → Google acts as server

“How do you check your exam results?”

- You enter register number → Request
- Server returns marks → Response

“How does Instagram know your follower count?”

- Your app asks server →
- Server checks database →
- Sends follower number →
- Your app shows it.

The server is the source of truth.

HOW A SERVER REALLY WORKS

Step 1: Server waits

- It doesn’t talk unless someone asks.

Step 2: Client sends request

- Example: “Give me my Instagram feed.”

Step 3: Server processes

It checks:

- Is the user logged in?
- What posts should be shown?

- What data is relevant?

Step 4: Server sends response

Usually JSON, like:

```
{
  "posts": [
    "image1.jpg",
    "image2.jpg"
  ]
}
```

Step 5: Client displays it

- Your phone shows the images beautifully.

TYPES OF SERVERS

Application Server

- Runs your backend code (Spring Boot).

Database Server

Stores data like:

- Users
- Orders
- Photos
- Messages

Authentication Server

- Manages logins and tokens.

Game Server

- Manages multiplayer gaming.

Cloud Servers

- AWS, Google Cloud, Azure — where companies run everything.

HOW SERVER LOOKS IN REAL LIFE

Servers are:

- Not normal computers
- Not laptops
- They look like big black boxes in racks
- But your laptop can become a server while developing.

Protocol

A protocol is a set of rules that decides how two systems talk to each other.

Like:

- Rules in a classroom
- Rules in a game
- Rules in traffic

Similarly, computers also need rules to communicate.

Those rules = HTTP.

HTTP

HTTP is the language or rule that clients and servers use to communicate over the internet.

- Your phone → speaks HTTP
- Instagram server → understands HTTP
- Chrome browser → speaks HTTP
- Google server → understands HTTP

Without HTTP, they cannot talk.

Why Do We Need HTTP?

Because without rules:

- Your phone won’t know how to request data
- Server won’t know what you want
- No website would load
- No Instagram feed
- No login
- No YouTube

HTTP gives structure to communication.

HTTP Request Contain

A request has 3 important parts:

- HTTP Method
- URL
- Headers + Body

HTTP METHOD

HTTP methods tell the server WHAT ACTION the client wants to perform.

Think of methods as verbs in a sentence:

- GET → fetch
- POST → create
- PUT → update
- DELETE → remove

URL

A URL (Uniform Resource Locator) is the address of the resource you want to access on the server.

Just like:

- Home has an address
- College has an address

- A shop has an address
- A website or API resource also needs an address.

Without a URL, the server won’t know what you want.

The URL Has Two Main Parts

1. Base URL (Domain — where the server lives)
2. Path (Which exact resource you want)

1. Base URL (Domain)

This is the location of the server on the internet.

Examples:

- https://google.com
- https://instagram.com
- https://college.edu
- https://api.amazon.com

This only tells the browser where the server is, not what to fetch.

2. Path (The exact resource you want)

Examples that students understand:

- Profile page: - /profile
- List of students: - /students
- One specific student: - /students/101
- Posts feed: - /feed
- Login API: - /api/login

This tells the server exactly what data or service the client needs.

Combine Both: Full URL - https://instagram.com/my-feed

Meaning:

- Connect to the Instagram server

- Get the resource called /my-feed (posts)

URL Can Also Contain Query Parameters

Used when you want to send extra information inside the URL.

Examples:

- **Searching on YouTube: -** https://youtube.com/search?q=java
- q=java → search keyword
- **Filtering Amazon products: -** /products?brand=Nike&price=under5000

HEADERS

Headers are additional details sent along with the request to help the server understand the request better.

Think of headers like labels on a parcel:

- Who sent it?
- What type of content is inside?
- What is the priority?
- What language?
- Is this user logged in?

Without headers, the server will not know how to process the request correctly.

IMPORTANT HEADERS

1. Content-Type

Tells the server what format your request body is in.

Examples:

- application/json → Sending JSON
- application/xml → Sending XML
- multipart/form-data → Sending files (images, videos)
- text/plain → Sending plain text

Student-friendly example:

Instagram upload: - Content-Type: multipart/form-data

2. User-Agent

Tells the server which device/browser is sending the request.

Examples:

- Chrome on Windows
- Safari on iPhone
- Instagram app on Android

Real example:

User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64)

Why needed?

Servers optimize responses based on device.

BODY

The request body is the main data you send to the server.

Think of body as:

- The content of the message
- The main information
- The actual data the server needs

When Do We Send a Body?

Body is used only for methods that send data:

- POST
- PUT
- PATCH
- GET does NOT send a body

Because GET only asks for data — it does not send any.

WHAT DOES THE BODY CONTAIN?

The body depends on what the user is doing.

Login → Body contains credentials

```
{
  "email": "student@gmail.com",
  "password": "123456"
}
```

Registration → Body contains user data

```
{
  "name": "Arun",
  "email": "arun@gmail.com",
  "password": "abcd123"
}
```

Uploading a photo → Body contains file data

Format:

multipart/form-data

Updating profile → Body contains new values

```
{
  "bio": "Future software engineer",
  "location": "Chennai"
}
```

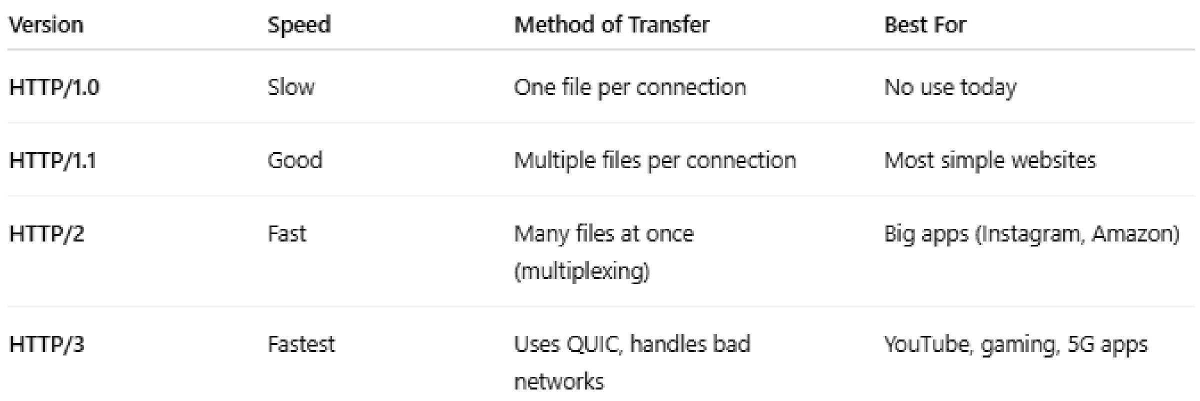
HTTP RULES

- RULE 1 — Client Must Always Start the Communication
- RULE 2 — Every HTTP Communication Has 2 Parts
- RULE 3 — HTTP Follows a Fixed Request Structure – Request line, header, body
- RULE 4 — The Server Must Send a Status Code in Every Response
- RULE 5 — HTTP Uses Standard Methods
- RULE 6 — URLs Must Identify What You Want
- RULE 7 — HTTP Is Stateless
- RULE 8 — Everything Must Be in Text Format
- RULE 9 — The Client Must Specify Data Type
- RULE 10 — HTTP Response Must Follow Structure
- RULE 11 — Use of HTTP Versions
- RULE 12 — Communication Must Follow ASCII Text Encoding
- RULE 13 — HTTP Can Work Over Any Media Layer
- RULE 14 — HTTP Does Not Care About the Device

HTTP Versions

There are 4 major versions you should teach:

- HTTP/1.0
- HTTP/1.1
- HTTP/2
- HTTP/3



Version	Speed	Method of Transfer	Best For
HTTP/1.0	Slow	One file per connection	No use today
HTTP/1.1	Good	Multiple files per connection	Most simple websites
HTTP/2	Fast	Many files at once (multiplexing)	Big apps (Instagram, Amazon)
HTTP/3	Fastest	Uses QUIC, handles bad networks	YouTube, gaming, 5G apps

JSON - JavaScript Object Notation

- JSON is a lightweight, easy-to-read text format used for sending data between client and server.
- It is the language of data in the web world.

Why JSON?

- **Easy to read -** Looks like a simple note.
- **Easy to write -** Simple key–value pairs.
- **Lightweight** - Doesn't take much space.
- **Works in ALL programming languages -** Java, Python, C#, JavaScript, Go, Kotlin — all support JSON.
- **Perfect for API communication**
    - Spring Boot → React
    - Node → Android
    - Server → Browser

JSON STRUCTURE

```
{
 "name": "Selva",
 "age": 22
}
```

JSON Format Rules

- Must start with { } → JSON Object
- Keys must be in "double quotes"
- Values can be:
    - String → "Arun"
    - Number → 20
    - Boolean → true / false
    - Array → [ ]
    - Object → { }
    - Null → null
- Data separated by commas
- Last item should NOT have a trailing comma

EXAMPLE

```
{
  "username": "selvaraj_001",
  "followers": 1200,
  "isVerified": false,
  "posts": [
    "photo1.jpg",
    "photo2.jpg"
  ],
  "bio": {
    "text": "Coder | Guitarist",
    "location": "Chennai"
  }
}
```

XML = Extensible Markup Language

- XML is a structured way of storing data using tags.
- Just like HTML uses tags like <p>, <h1>,
- XML also uses tags — but you create your own tags.

Example:

```
<name>Selva</name>
```

Before JSON existed, XML was used because:

- It is structured
- It is readable
- It supports nested data
- It works in all programming languages
- It was perfect for data exchange between systems

Even today:

- Banks
- Insurance systems
- Railways
- Government portals
- SOAP APIs

still rely on XML.

Example

```
<student>
  <name>Arun</name>
  <age>20</age>
  <department>CSE</department>
</student>
```

XML Must Have a Root Element

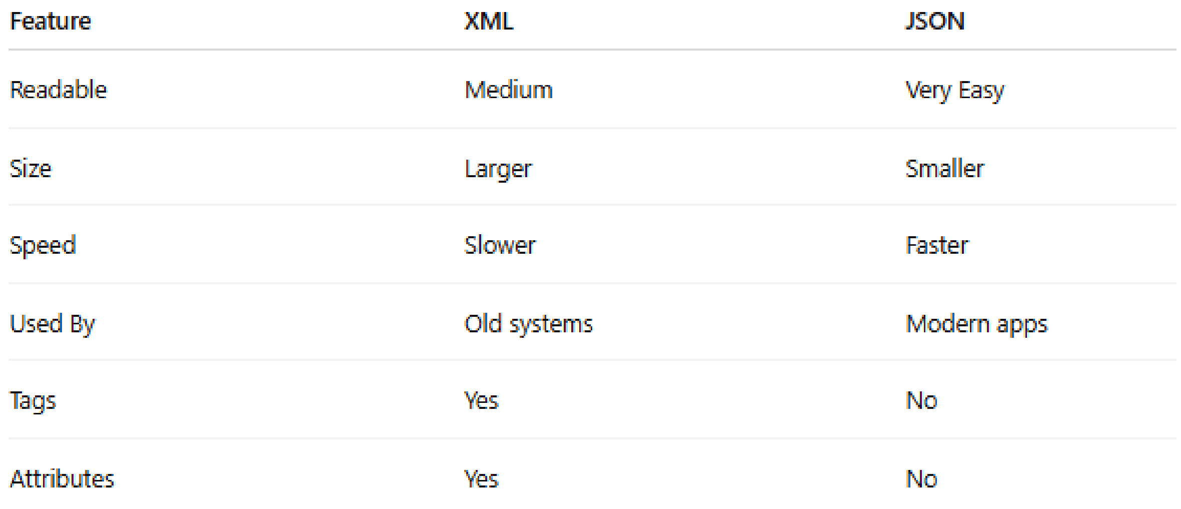
Every XML file MUST start with a single root element that wraps all data.

Example:

```
<students>
   <student>...</student>
   <student>...</student>
</students>
```

Here:

- <students> = root element
- <student> = child elements
- This rule is very important.



Feature	XML	JSON
Readable	Medium	Very Easy
Size	Larger	Smaller
Speed	Slower	Faster
Used By	Old systems	Modern apps
Tags	Yes	No
Attributes	Yes	No

TOMCAT

Tomcat is a web server + Java servlet container that runs Java web applications.

Think of Tomcat as the engine where your Java-based website or API runs.

- It accepts HTTP requests

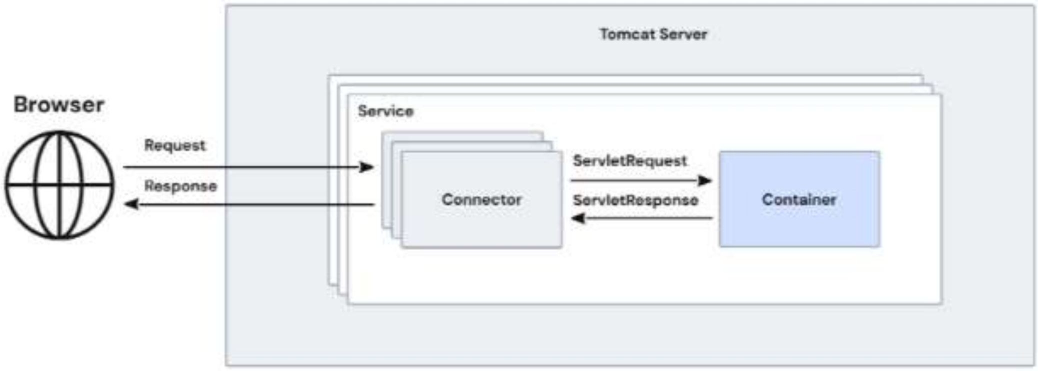
- Runs your Java code (Servlet / JSP)
- Sends back HTTP responses

Without Tomcat:

- A browser cannot talk to your Java program
- You cannot build login systems
- No backend APIs
- No data processing

Why TOMCAT?

- Browsers speak HTTP
- Java applications speak Java code
- They cannot talk directly.
- Tomcat acts like a translator.
- Client (browser/app)
- → speaks HTTP
- Tomcat
- → converts HTTP into Java calls
- Your Java Code (Servlet)
- → runs logic and sends data back
- So Tomcat is the middleman that connects web requests with Java programs.



Deployment means placing your web application inside the Tomcat server so users can access it through a browser.

Just like:

- You write a project → but until you submit it, no one can see it
- You write code → but until it is deployed, users cannot use it

Deployment makes your web app “go live”.

JSP

JSP = Java Server Pages

JSP is a type of webpage that can contain:

- HTML
- CSS
- JavaScript
- Java code

Example:

- <h1>Hello!</h1>
- <% out.println("Today is: " + new java.util.Date()); %>

Why JSP Exists?

Because pure Servlets are hard to write.

Without JSP, we must generate HTML like this:

- out.println("<html>");
- out.println("<h1>Hello</h1>");
- out.println("</html>");

JSP makes it easier because we write HTML normally, and add Java only when needed.

TOMCAT FOLDER STRUCTURE

When you download and extract Tomcat, you will see folders like this:

apache-tomcat-9.x.x/

├── bin

├── conf

├── lib

├── logs

├── temp

├── webapps

└── work

Let’s explain each folder clearly in simple language.

1.bin — Startup & Shutdown Scripts

This folder contains files that START and STOP Tomcat.

Important files:

- startup.bat → Start Tomcat (Windows)

- shutdown.bat → Stop Tomcat (Windows)
- startup.sh → Start (Linux/Mac)
- shutdown.sh → Stop (Linux/Mac)
- catalina.bat/catalina.sh → internal scripts

Real-Time Meaning:

- Whenever you want users to access your website, you must start Tomcat using startup.bat.

2.conf — Configuration Files (The Brain of Tomcat)

This folder contains ALL the important configuration files.

Most important files:

server.xml

Controls:

- Port number (default 8080)
- Connectors
- Hosts
- Context paths

web.xml

- Default servlet configurations for Tomcat.

tomcat-users.xml

- Defines users & roles for Tomcat Manager login.

context.xml

- Application-level settings.

Real-Time Meaning:

- When a college application needs to change port, or add multiple apps, or configure security, IT team edits files here.

3.lib — All Required JAR Files for Tomcat

Contains:

- Servlet API
- JSP API
- JDBC drivers (if added)
- Internal Tomcat libraries

Real-Time Meaning:

Without these JAR files, Tomcat cannot run Java web apps.

Developers DO NOT edit this folder; Tomcat uses it internally.

4. logs — All Tomcat Logs (Very Important for Debugging)

Contains:

- Server startup logs
- Errors
- Access logs
- Application logs

Files like:

- catalina.out
- localhost.log

Real-Time Meaning:

If your project is not loading or throwing errors, you CHECK LOGS to find the root cause.

Example:

SEVERE: Servlet failed to load

This tells you exactly what's wrong.

5.temp — Temporary Files

Tomcat stores temporary data here:

- Session data
- Cache files
- Uploaded temporary data

Real-Time Meaning:

Mostly ignored, but safe to clear when Tomcat is off.

6. webapps — MOST IMPORTANT Folder (Deployment Happens Here)

This is where your web applications go.

Inside webapps, you will see:

- examples
- docs
- manager
- ROOT (default homepage)

When you deploy your own app, it goes here: webapps/StudentPortal/

OR you place:

StudentPortal.war

Tomcat automatically extracts the WAR into a folder.

Real-Time Meaning:

Every deployed project students see in browser is stored here.

7. work — Compiled JSP Files

When Tomcat runs JSP files:

- It converts them into Java Servlet files
- Compiles them into .class files
- Stores them here

Real-Time Meaning:

This folder helps Tomcat run JSP pages faster.

Naming Rules Inside a Tomcat Project

Project Folder Name (Context Path)

- Must be simple
- No spaces
- Lowercase preferred

Examples:

- myapp
- studentportal
- feeapp

NOT allowed:

- My App
- My-App#
- 123app

JSP File Naming Rules

- lowercase
- no spaces
- no special characters

Examples:

- index.jsp
- login.jsp
- home.jsp

WEB-INF Folder

- MUST be named exactly: WEB-INF
- Cannot rename
- Case-sensitive.

web.xml

- MUST be named exactly web.xml
- Must be in WEB-INF folder
- Not Web.xml
- Not web.XML

Servlet Class Naming (for future learning)

- Start with uppercase
- Use CamelCase

Example:

- LoginServlet
- StudentController

```
<web-app xmlns="http://xmlns.jcp.org/xml/ns/javaee" version="3.1">

  <welcome-file-list>

    <welcome-file>index.jsp</welcome-file>

  </welcome-file-list>

</web-app>
```

Creating a Simple JSP Project for Tomcat

```
MyFirstApp/

 ├── index.jsp

 └── WEB-INF/

     └── web.xml
```

index.jsp

```
<!DOCTYPE html>

<html>

<body>

   <h1>Welcome to My First Tomcat Application!</h1>

</body>

</html>
```

web.xml

```
<web-app xmlns="http://xmlns.jcp.org/xml/ns/javaee" version="3.1">

   <welcome-file-list>

       <welcome-file>index.jsp</welcome-file>

   </welcome-file-list>

</web-app>
```