**✅ 1. With View (Using Presentation File like JSP)**

This is a very common way used in web applications with UI (like JSP files). Here's how it works step-by-step:

**🔁 When a client sends a request:**

1. The request URL (like /hello) comes to the Spring Boot application.
2. The @Controller class has a method (like display()).
3. This method processes the request.
4. It puts some **data into the Model object**.
5. It returns the name of the JSP file (like "index").
6. The data is then displayed in the JSP using ${key} format.

**📌 Model Object**

* The **Model** is like a container (or bag) to **carry data** from the controller to the view.
* Data is added using model.addAttribute("key", "value")
* The JSP file can then **access this key** using ${key} and show the value on screen.

**✅ Example Code**

**👨‍💻 Controller**

@Controller

public class HelloController {

@GetMapping("/hello")

public String display(Model model) {

model.addAttribute("message", "Welcome to Spring MVC!");

return "index"; // points to /WEB-INF/views/index.jsp

}

}

**🧾 JSP File (index.jsp)**

jsp

CopyEdit

<body>

<h1>${message}</h1> <!-- will print "Welcome to Spring MVC!" -->

</body>

**✅ Summary (With View):**

| **Step** | **What Happens** |
| --- | --- |
| 1 | Browser sends request to URL |
| 2 | Spring matches it to a method in controller |
| 3 | Controller method puts data into Model |
| 4 | Returns the name of the JSP page (view) |
| 5 | JSP uses ${key} to show the data on UI |

**✅ 2. Raw Response (Just an Outline for Now)**

**What is Raw Response?**

* It means sending back **pure data** instead of showing a UI.
* This is common in **APIs**, where data is returned in **JSON format**.

**Example:**

**👨‍💻 Controller with Raw Response**

@RestController

public class HelloRestController {

@GetMapping("/greet")

public String greet() {

return "Hello from Spring Boot!"; // plain text (raw)

}

}

This will directly return:

Hello from Spring Boot!

No JSP. No View. Just text or data sent to browser/postman.

**When will you learn this?**

* When your sir starts **RESTful web services**, you'll learn:
  + @RestController
  + JSON
  + @ResponseBody
  + APIs for frontend/backend

**🔚 Final Thoughts**

| **Method** | **Type** | **Uses JSP View?** | **Uses Model?** | **Best For** |
| --- | --- | --- | --- | --- |
| With View | Traditional | ✅ Yes | ✅ Yes | Web UI |
| Raw Response | REST API | ❌ No | ❌ No (or limited) | Mobile apps, APIs, frontend JS frameworks |

**📝 Notes: Why Use Model in Spring MVC Controller Instead of Just Passing Key-Value Pairs**

**✅ What is Model in Spring MVC?**

* Model is an interface provided by Spring.
* It is used to **send data** from the **Controller** to the **JSP/View** page.
* It works like a container that holds **attributes (data)** that we want to show in the view.

**🔄 Example (Using Model)**

@Controller

public class MyController {

@RequestMapping("/show")

public String showData(Model model) {

model.addAttribute("name", "Pavan");

model.addAttribute("age", 25);

return "myPage"; // this goes to myPage.jsp

}

}

In JSP:

Name: ${name}

Age: ${age}

**❓ Why use Model instead of passing raw data or key-value pairs manually?**

**💬 First, let's understand what "passing key-value pairs manually" means**

You might imagine doing something like this:

public String showData() {

String name = "Pavan";

int age = 25;

return "myPage.jsp"; // trying to go to JSP

}

But here’s the **problem**:  
There’s **no way to send name and age to the JSP** because:

* You only return a view name (myPage.jsp)
* But you’re **not telling Spring what data to send to the view**

So even if name and age exist inside this method, the JSP will **not receive them**.

**💡 How Spring MVC works under the hood**

When you return a view like this:

return "myPage";

Spring does two things:

1. Uses the ViewResolver to find the actual JSP file (/WEB-INF/views/myPage.jsp)
2. Looks at the Model object to find any data that needs to be shown on the JSP

**✅ That’s why we need Model**

Using Model lets you **formally add data** that should be sent to the view.

public String showData(Model model) {

model.addAttribute("name", "Pavan");

model.addAttribute("age", 25);

return "myPage";

}

Now Spring knows:

* View to render: myPage.jsp
* Data to show: name = Pavan, age = 25

In the JSP file, you can now easily write:

Name: ${name}

Age: ${age}

Behind the scenes:

* ${name} → calls model.getAttribute("name")
* The value "Pavan" is printed

**🔴 Why you can’t pass raw data directly without Model**

* Spring MVC follows a **framework pattern**: Controller → Model → View.
* It needs a **standard way** to pass data, and that’s what Model provides.
* You can't just return random values (like strings or numbers) and expect Spring to "guess" where and how to show them on a JSP.

**✅ Think of Model like a delivery box 📦**

Imagine:

* Controller = Restaurant chef 🍳
* Model = Food delivery box 📦
* View = Customer table 🍽️ (JSP)

If the chef cooks the food (data) but doesn’t put it in the box (Model), how will the food reach the table (View)?  
**Model** is the only standard way to "transport" that data.

**✅ Why Use a Model Class (JavaBean/POJO) and Pass Its Reference to JSP?**

**🔍 What We’re Comparing:**

| **Option 1** | **Option 2** |
| --- | --- |
| Add individual values to model using addAttribute("name", "Pavan") | Create an object like Student s = new Student(...) and do model.addAttribute("student", s) |
| Pass key-value pairs one by one | Pass one object with all the data inside |

**✅ Advantages of Using a Model Class Object**

**1. ✅ Groups Related Data Together (Object-Oriented Design)**

Instead of passing:

model.addAttribute("id", 101);

model.addAttribute("name", "Pavan");

model.addAttribute("marks", 90);

We do:

Student s = new Student();

s.setId(101);

s.setName("Pavan");

s.setMarks(90);

model.addAttribute("student", s);

📌 Now all related data is stored in **one object**, which is easier to manage, pass, and understand.

**2. ✅ Reduces Code Repetition**

Imagine a form with 10 fields — you would need 10 addAttribute() calls if you used individual values.  
But with a model object, you only need **one line**:

model.addAttribute("student", studentObject);

**3. ✅ Easier to Work With Forms and Binding**

Spring MVC supports automatic form data binding to model objects. Example:

In your form (JSP):

<form:form modelAttribute="student">

<form:input path="name" />

<form:input path="marks" />

</form:form>

When the form is submitted, Spring will automatically bind the form data into a Student object — this only works **if you use a model class**, not individual attributes.

**4. ✅ Cleaner JSP Access**

In JSP:

${student.name} // behind the scenes → student.getName()

${student.marks} // → student.getMarks()

This is more readable and structured than having:

${name}

${marks}

${id}

You always know all values are coming from student.

**5. ✅ Scales Well in Larger Applications**

In real-world apps, you deal with complex data like:

* List of students
* Student with nested objects (Address, Marks, etc.)
* Form submissions and validations

Model objects help you manage this easily. You can also reuse the same model class across many pages.

**6. ✅ Supports Framework Features Like Validation, Binding, etc.**

* You can use annotations like @Valid, @NotNull, etc., on your model class fields.
* Spring can automatically validate input and bind form values to the object.

**🔁 Summary**

| **Reason** | **Benefit** |
| --- | --- |
| Groups data logically | One object holds all related fields |
| Reduces code | Fewer addAttribute() calls |
| Enables data binding | Works with forms easily |
| Cleaner JSP syntax | Use ${student.name} instead of many separate keys |
| Easier maintenance | Change field once in class instead of everywhere |
| Supports validations | Use JSR-303 annotations (@NotNull, etc.) |

**✅ Real Example (Controller + Model + JSP)**

**Controller:**

@RequestMapping("/show")

public String showPage(Model model) {

Student s = new Student(101, "Pavan", 90);

model.addAttribute("student", s);

return "studentPage";

}

**Student.java (Model class):**

public class Student {

private int id;

private String name;

private int marks;

// constructor, getters, setters

}

**studentPage.jsp:**

<h2>Student Info</h2>

ID: ${student.id} <br/>

Name: ${student.name} <br/>

Marks: ${student.marks}

**✅ Advantages of Using Model**

**1. Clean separation between logic and view**

* Controller focuses only on processing and preparing data.
* View (JSP) handles displaying data.
* Model acts as a bridge between them.

**2. Stores multiple values in a structured way**

* You can store multiple values (strings, objects, collections) using model.addAttribute(key, value).
* It helps in passing complex data like Java objects to the view easily.

**3. Supports JavaBeans-style object binding**

* You can pass a full object (like Student, Course, etc.) to JSP.
* In JSP, you can access fields using ${student.name}, ${student.marks}, etc.
* No need to extract each field separately in the controller.

**4. Better integration with Spring’s internal mechanisms**

* Model works with ViewResolver to decide which JSP or page to load.
* It also works smoothly with form data and binding in Spring.

**5. Scales well for real projects**

* In larger apps, sending lots of individual values manually becomes hard.
* Model keeps things clean, reusable, and easy to maintain.

**🧠 Extra Learning Points (Very Useful to Know)**

**✅ Difference between Model, ModelMap, and ModelAndView**

| **Term** | **Description** |
| --- | --- |
| Model | Simple interface to pass data to the view. |
| ModelMap | Like a map, allows flexible handling of attributes. |
| ModelAndView | Combines both model data + view name in one object. |

✅ Best Practice: Use Model or ModelMap when you want cleaner code.

**✅ Common Mistake to Avoid**

* If you don't add your object or value to the model, the JSP **won’t be able to access it**.
* Just creating a Java object in the controller is not enough — you must pass it to the model using model.addAttribute().

**✅ JSP EL Syntax Recap**

* ${key} → Calls getKey() method internally if object is passed.
* Example: ${student.name} → internally calls student.getName().

**✅ Model Stores Data in Request Scope by Default**

* Data stored in Model is **only available for that request** (doesn't stay in memory after page reload).
* If you want to keep data for longer (like across pages), you can use **Session** or **ModelMap** + @SessionAttributes.

**✅ Summary**

| **Point** | **Why We Use Model** |
| --- | --- |
| 1 | To send data from Controller to View in a clean way |
| 2 | Helps pass both simple and complex data types (objects) |
| 3 | Works with JSP EL automatically |
| 4 | Scales well in real projects |
| 5 | Makes code readable and maintainable |

Eg: SpringWebMVCModelClassPOJO

# ✅ **How Data is Sent from UI to Controller in Spring**

In a Spring Web MVC application, when a **user performs an action on the UI (browser)** — like clicking a link, submitting a form, or entering something in the URL — that data is sent to the **Controller** on the server.

The Controller is like a **Java class that listens for requests** and processes them.

There are **3 main ways** to send data from the UI (browser) to the Controller:

## 📌 3 Common Methods to Send Data to Controller

| **Method** | **Description** | **When to Use** |
| --- | --- | --- |
| **1. Query Parameter** | Data is passed in the URL after a ?, in key-value format | For search, filters, small inputs |
| **2. Path Parameter** | Data is passed directly inside the URL path | When data is part of the resource |
| **3. Form Submission** | Data is sent through an HTML form using GET or POST methods | For submitting user inputs (e.g., login, registration) |

## 🔹 1. Query Parameter (Detailed)

### ✅ What is it?

A **query parameter** is a small piece of data that is sent in the **URL itself**, after a ? symbol.

It works like this:

http://localhost:9090/service?name=Najafi

Here:

* service is the endpoint
* ?name=Najafi is the query parameter
  + name is the key
  + Najafi is the value

You can also pass **multiple** parameters like this:

/service?name=Najafi&age=25

### 🧾 Controller Code Example:

@GetMapping("/service")

public String greet(@RequestParam String name) {

return name + ", Welcome to iNeuron .ai";

}

* @GetMapping("/service"): listens for requests at /service.
* @RequestParam String name: tells Spring to extract the name value from the URL.

### 🎯 Sample Inputs & Outputs:

**URL:**

http://localhost:9090/service?name=pavankalyan

**Output:**

pavankalyan, Welcome to iNeuron .ai

**URL:**

http://localhost:9090/service?name=pavan

**Output:**

pavan, Welcome to iNeuron .ai

**🔹 How to Send Multiple Query Parameters?**

**🧾 Syntax Format:**

?key1=value1&key2=value2&key3=value3

The & (ampersand) symbol is used to **separate each key-value pair**.

**✅ Example:**

http://localhost:9090/service?id=1&name=Najafi

Here:

* id is a query parameter with value 1
* name is another query parameter with value Najafi

**🔹 How to Receive Multiple Query Parameters in Controller?**

In Spring, we use the @RequestParam annotation for each parameter **individually** to receive its value.

**🧾 Example Controller Code:**

@GetMapping("/service")

public String getDetails(@RequestParam int id, @RequestParam String name) {

return "ID: " + id + ", Name: " + name;

}

**🎯 Sample Request and Output:**

**Request URL:**

http://localhost:9090/service?id=1&name=Najafi

**Output:**

ID: 1, Name: Najafi

**🔍 Notes on Using @RequestParam for Multiple Parameters:**

| **Point** | **Explanation** |
| --- | --- |
| ✅ **One annotation per parameter** | Each query parameter must have its own @RequestParam |
| ✅ **Type-safe** | Spring will convert the value to the required data type (like int, String) |
| ❗ **Missing parameter causes error** | If the parameter is not optional, and it's not present, Spring throws an error |
| ✅ **Make parameters optional** | Use required = false and/or defaultValue to avoid errors |

**🧪 Optional Parameters Example:**

@GetMapping("/service")

public String getDetails(

@RequestParam(required = false, defaultValue = "0") int id,

@RequestParam(required = false, defaultValue = "Guest") String name

) {

return "ID: " + id + ", Name: " + name;

}

**Request URL:**

bash

CopyEdit

http://localhost:9090/service

**Output:**

ID: 0, Name: Guest

**🧠 Summary:**

* You can pass **multiple query parameters** by separating them with & in the URL.
* Use @RequestParam for each key in the Controller.
* Handle optional values using required = false and defaultValue.

**✅ Real-Life Use Case:**

**URL:**

http://localhost:9090/search?category=books&page=2&limit=10

**Controller:**

@GetMapping("/search")

public String search(

@RequestParam String category,

@RequestParam int page,

@RequestParam int limit

) {

return "Category: " + category + ", Page: " + page + ", Limit: " + limit;

}

### 🧠 Notes:

* Query parameters are **publicly visible** in the browser URL.
* Use only for **small, safe, non-sensitive** data.
* You can make the parameter optional using:

@RequestParam(required = false, defaultValue = "Guest")

**✅ @RequestParam(required = false, defaultValue = "Guest")**

This annotation is used to **safely handle query parameters** when:

* The user **might not send the parameter** in the request.
* You want to set a **default value** if the parameter is missing.

**🔹 Problem Without It**

Let’s say you write:

@GetMapping("/service")

public String greet(@RequestParam String name) {

return name + ", Welcome to iNeuron .ai";

}

If someone opens this URL:

http://localhost:9090/service

➡️ It will throw an **error** like:

400 Bad Request: Required request parameter 'name' is not present

Because Spring is **expecting** the name parameter but it’s **missing**.

**🔹 Solution: required = false**

@RequestParam(required = false)

This tells Spring:

“It’s okay if the parameter is not sent. Don’t throw an error.”

But if the user doesn't send anything, the value will be null.

Example:

@GetMapping("/service")

public String greet(@RequestParam(required = false) String name) {

return name + ", Welcome to iNeuron .ai";

}

➡️ If the user skips the name:

http://localhost:9090/service

Output:

null, Welcome to iNeuron .ai

So it’s safe from errors, but **null is not a friendly response**.

**🔹 Solution: defaultValue = "Guest"**

To avoid showing null, we add a default value:

@RequestParam(required = false, defaultValue = "Guest")

Now:

* If the user sends ?name=Hyder, it uses Hyder
* If the user **skips name**, it uses "Guest"

**✅ Final Example:**

@GetMapping("/service")

public String greet(@RequestParam(required = false, defaultValue = "Guest") String name) {

return name + ", Welcome to iNeuron .ai";

}

| **URL** | **Output** |
| --- | --- |
| /service?name=Najafi | Najafi, Welcome to iNeuron .ai |
| /service | Guest, Welcome to iNeuron .ai |

**🧠 Summary:**

| **Property** | **Purpose** |
| --- | --- |
| required=false | Tells Spring not to throw error if missing |
| defaultValue | Provides a fallback value when input is null |

**🔍 Your Sir’s Version:**

@RequestParam("firstname") String fname

**✅ What it means:**

* It tells Spring:

“Take the value of the query parameter named firstname and put it into the variable fname.”

* This is **explicit mapping** between the **request parameter name** and the **Java variable name**.

**✅ When to use:**

* When your **Java variable name is different** from the parameter name in the URL.

**🌐 Example:**

**Request URL:**

http://localhost:9090/hello?firstname=Najafi

**Controller:**

@GetMapping("/hello")

public String greet(@RequestParam("firstname") String fname) {

return "Hello, " + fname;

}

**Output:**

Hello, Najafi

**🆚 Compared with:**

@RequestParam(required = false, defaultValue = "0") int id

**✅ What this means:**

* This version is more **robust**. It tells Spring:

“This id parameter is optional. If it’s not given, use the default value 0.”

* You are not changing the name; here, id is the same in the URL and the variable.

**🌐 Example:**

**Controller:**

@GetMapping("/service")

public String getId(@RequestParam(required = false, defaultValue = "0") int id) {

return "ID: " + id;

}

**Request 1:**

http://localhost:9090/service?id=5

**Output:**

ID: 5

**Request 2 (no parameter):**

http://localhost:9090/service

**Output:**

ID: 0

**✅ Side-by-side Comparison**

| **Aspect** | **Your Sir’s Version** | **required = false, defaultValue Version** |
| --- | --- | --- |
| **Purpose** | Map custom query param names | Handle optional/missing parameters |
| **Allows Renaming?** | ✅ Yes (firstname → fname) | ❌ No (name must match variable) |
| **Handles Missing Values?** | ❌ No, will throw error if missing | ✅ Yes, uses default |
| **Example Use** | @RequestParam("firstname") String fname | @RequestParam(required = false, defaultValue = "0") int id |

**💡 Can We Combine Both?**

Yes!

@RequestParam(value = "firstname", required = false, defaultValue = "Guest") String fname

* Maps firstname to fname
* Makes it optional
* Uses "Guest" if not provided

**🧠 Final Takeaway:**

* Use @RequestParam("paramName") to **rename or match differently named parameters**.
* Use required = false and defaultValue = "..." to **make parameters optional and safe**.
* Combine them if needed for **flexibility**.

Eg: SpringWebMvcUiToControllerDataTransfer