# UNIT-4: JSP (Java Server Pages)

**JSP** technology is used to create web application just like Servlet technology. It can be thought of as an extension to Servlet because it provides more functionality than servlet such as expression language, JSTL, etc.

A JSP page consists of HTML tags and JSP tags. The JSP pages are easier to maintain than Servlet because we can separate designing and development. It provides some additional features such as Expression Language, Custom Tags, etc.

- **JSP is Server-side scripting language**: Server-side scripting means that the JSP code is processed on the web server rather than the client machine.
- JSP page is a file with a **.JSP** extension that contains could be the combination of HTML Tags and JSP codes.
- JSP is used to build dynamic web applications.
- JSP is an improved extended version of Servlet technology.

## Advantages of JSP over Servlet

There are many advantages of JSP over the Servlet. They are as follows:

### *1) Extension to Servlet*

JSP technology is the extension to Servlet technology. We can use all the features of the Servlet in JSP. In addition to, we can use implicit objects, predefined tags, expression language and Custom tags in JSP, that makes JSP development easy.

### *2) Easy to maintain*

JSP can be easily managed because we can easily separate our business logic with presentation logic. In Servlet technology, we mix our business logic with the presentation logic.

### *3) Fast Development: No need to recompile and redeploy*

If JSP page is modified, we don't need to recompile and redeploy the project. The Servlet code needs to be updated and recompiled if we have to change the look and feel of the application.

### *4) Less code than Servlet*

In JSP, we can use many tags such as action tags, JSTL, custom tags, etc. that reduces the code. Moreover, we can use EL, implicit objects, etc.

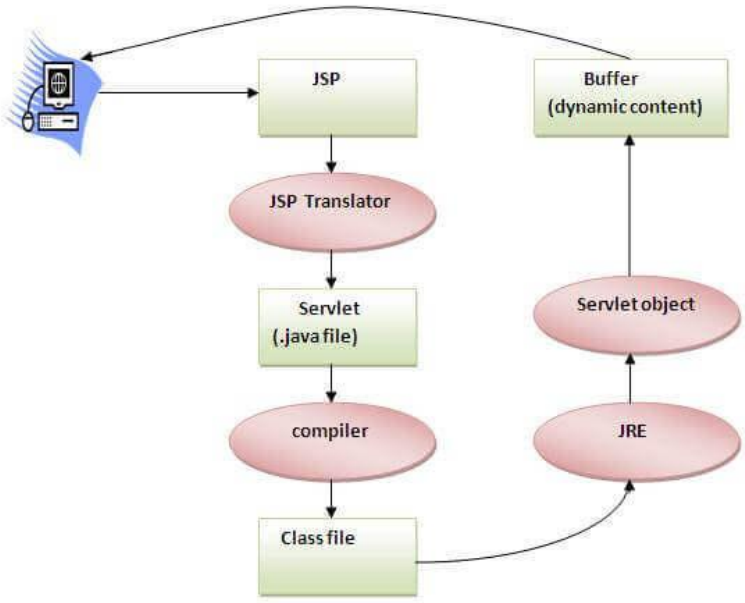
## The Lifecycle of a JSP Page

The JSP pages follow these phases:

- Translation of JSP Page
- Compilation of JSP Page
- Classloading (the classloader loads class file)

- Instantiation (Object of the Generated Servlet is created).
- Initialization ( the container invokes jspInit() method).
- Request processing ( the container invokes _jspService() method).
- Destroy ( the container invokes jspDestroy() method).

*Note: jspInit(), _jspService() and jspDestroy() are the life cycle methods of JSP*




As depicted in the above diagram, JSP page is translated into Servlet by the help of JSP translator. The JSP translator is a part of the web server which is responsible for translating the JSP page into Servlet. After that, Servlet page is compiled by the compiler and gets converted into the class file. Moreover, all the processes that happen in Servlet are performed on JSP later like initialization, committing response to the browser and destroy.

## Creating a simple JSP Page

To create the first JSP page, write some HTML code as given below, and save it by .jsp extension. We have saved this file as index.jsp. Put it in a folder and paste the folder in the web-apps directory in apache tomcat to run the JSP page.

**index.jsp**

Let's see the simple example of JSP where we are using the scriptlet tag to put Java code in the JSP page. We will learn scriptlet tag later.

```
<html>
<body>
<% out.print(2*5); %>
</body>
</html>
```

It will print **10** on the browser.

# The JSP API

The JSP API consists of two packages:

1. javax.servlet.jsp
2. javax.servlet.jsp.tagext

## javax.servlet.jsp package

The javax.servlet.jsp package has two interfaces and 6 classes. The two interfaces are as follows:

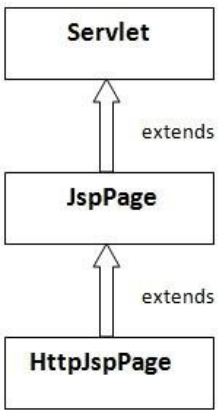
1. JspPage
2. HttpJspPage

The classes are as follows:

- JspWriter
- PageContext
- JspFactory
- JspEngineInfo
- JspException
- JspError

## The JspPage interface

According to the JSP specification, all the generated servlet classes must implement the JspPage interface. It extends the Servlet interface. It provides two life cycle methods.




### Methods of JspPage interface

1. **public void jspInit():** It is invoked only once during the life cycle of the JSP when JSP page is requested firstly. It is used to perform initialization. It is same as the init() method of Servlet interface.
2. **public void jspDestroy():** It is invoked only once during the life cycle of the JSP before the JSP page is destroyed. It can be used to perform some cleanup operation.

## The HttpJspPage interface

The HttpJspPage interface provides the one life cycle method of JSP. It extends the JspPage interface.

### Method of HttpJspPage interface:

1. **public void _jspService():** It is invoked each time when request for the JSP page comes to the container. It is used to process the request. The underscore _ signifies that you cannot override this method.

# Creating JSP in Eclipse IDE with Tomcat server

1. Create a Dynamic web project
2. create a jsp
3. start tomcat server and deploy the project

### 1) Create the dynamic web project

For creating a dynamic web project click on File Menu -> New -> dynamic web project -> write your project name e.g. first -> Finish.

### 2) Create the JSP file in eclipse IDE

For creating a jsp file explore the project by clicking the src->main-> WebApp-> right click on WebApp -> New -> jsp -> write your jsp file name e.g. index -> next -> Finish.

### 3) Start the server and deploy the project:

For starting the server and deploying the project in one step Right click on your project -> Run As -> Run on Server -> choose tomcat server -> next -> addAll -> finish.

# JSP Scriptlet tag (Scripting elements)

In JSP, java code can be written inside the jsp page using the scriptlet tag. The scripting elements provides the ability to insert java code inside the jsp.

There are three types of scripting elements:

1. scriptlet tag
2. expression tag
3. declaration tag

### JSP scriptlet tag

A scriptlet tag is used to execute java source code in JSP. Syntax is as follows: <% java source code %>

### Example of JSP scriptlet tag

In this example, we are displaying a welcome message.

```
<html>
<body>
<% out.print("welcome to jsp"); %>
</body>
</html>
```

## Example of JSP scriptlet tag that prints the user name

In this example, we have created two files index.html and welcome.jsp. The index.html file gets the username from the user and the welcome.jsp file prints the username with the welcome message.

*File: index.html*

```
<form action="welcome.jsp">
<input type="text" name="uname">
<input type="submit" value="go"><br/>
</form>
```

*File: welcome.jsp*

```
<%
String name=request.getParameter("uname");
out.print("welcome "+name);
%>
```

# JSP expression tag

The code placed within **JSP expression tag** is *written to the output stream of the response*. So you need not write out.print() to write data. It is mainly used to print the values of variable or method.

### Syntax of JSP expression tag

```
<%=  statement %>
```

### Example of JSP expression tag: we are simply displaying a welcome message.

```
<%= "welcome to jsp" %>
<%= (10+30) %>
```

Note: Do not end your statement with semicolon in case of expression tag.

### Example of JSP expression tag that prints current time

To display the current time, we have used the getTime() method of Calendar class. The getTime() is an instance method of Calendar class, so we have called it after getting the instance of Calendar class by the getInstance() method.

*index.jsp*

```
<html>
<body>
Current Time: <%= java.util.Calendar.getInstance().getTime() %>
</body>
</html>
```

## Example of JSP expression tag that prints the user name

In this example, we are printing the username using the expression tag. The index.html file gets the username and sends the request to the welcome.jsp file, which displays the username.

*File: index.jsp*

```
<form action="welcome.jsp">
<input type="text" name="uname"><br/>
<input type="submit" value="go">  </form>
```

*File: welcome.jsp*

```
<%= "Welcome "+request.getParameter("uname") %>
```

# JSP Declaration Tag

The **JSP declaration tag** is used *to declare variables and methods*.

The code written inside the jsp declaration tag is placed outside the service() method of auto generated servlet. So it doesn't get memory at each request.

*Syntax of JSP declaration tag*

```
<%!  variable or method declaration %>
```

### Difference between JSP Scriptlet tag and Declaration tag

| Jsp Scriptlet Tag | Jsp Declaration Tag |
|---|---|
| The jsp scriptlet tag can only declare variables not methods. | The jsp declaration tag can declare variables as well as methods. |

| | |
|---|---|
| The declaration of scriptlet tag is placed inside the _jspService() method. | The declaration of jsp declaration tag is placed outside the _jspService() method. |

## Example of JSP declaration tag that declares field

In this example of JSP declaration tag, we are declaring the field and printing the value of the declared field using the jsp expression tag.

index.jsp

```
<%! int data=50; %>
<%= "Value of the variable is:"+data %>
```

### Example of JSP declaration tag that declares method

In this example of JSP declaration tag, we are defining the method which returns the cube of given number and calling this method from the jsp expression tag. But we can also use jsp scriptlet tag to call the declared method.

index.jsp

```
<%!
int cube(int n){
return n*n*n;
}
%>
<%= "Cube of 3 is:"+cube(3) %>
```

# JSP Implicit Objects

There are **9 jsp implicit objects**.
These objects are *created by the web container* that are available to all the jsp pages.

| S.No. | Object | Type/Class Name |
|---|---|---|
| 1 | out | JspWriter |
| 2 | request | HttpServletRequest |
| 3 | response | HttpServletResponse |
| 4 | config | ServletConfig |
| 5 | application | ServletContext |
| 6 | session | HttpSession |
| 7 | pageContext | PageContext |
| 8 | page | Object |
| 9 | exception | Throwable |

# 1) JSP out implicit object

For writing any data to the buffer, JSP provides an implicit object named out. It is the object of JspWriter.

In case of servlet you need to write:

```
PrintWriter out=response.getWriter();    <!-- But in JSP, you don't need to write this code.-->
```

## Example of out implicit object

In this example we are simply displaying date and time.

### index.jsp

```
<html>
<body>
<% out.print("Today is:"+java.util.Calendar.getInstance().getTime()); %>
</body>
</html>
```

# 2) JSP request implicit object

The **JSP request** is an implicit object of type HttpServletRequest i.e. created for each jsp request by the web container. It can be used to get request information such as parameter, header information, remote address, server name, server port, content type, character encoding etc.

It can also be used to set, get and remove attributes from the jsp request scope.

Let's see the simple example of request implicit object where we are printing the name of the user with welcome message.

# Example of JSP request implicit object

### index.html

```
<form action="welcome.jsp">
<input type="text" name="uname">
<input type="submit" value="go"><br/>
</form>
```

### welcome.jsp

```
<%
String name=request.getParameter("uname");
out.print("welcome "+name);
%>
```

# 3) JSP response implicit object

In JSP, response is an implicit object of type HttpServletResponse.
The instance of HttpServletResponse is created by the web container for each jsp request.
It can be used to add or manipulate response such as redirect response to another resource, send error etc.

Let's see the example of response implicit object where we are redirecting the response to the Google.

## Example of response implicit object

**index.html**

```
<form action="welcome.jsp">
<input type="text" name="uname">
<input type="submit" value="go"><br/>
</form>
```

**welcome.jsp**

```
<%
response.sendRedirect("http://www.google.com");
%>
```

# 4) JSP config implicit object

In JSP, config is an implicit object of type *ServletConfig*. This object can be used to get initialization parameter for a particular JSP page. The config object is created by the web container for each jsp page.

Generally, it is used to get initialization parameter from the web.xml file.

## Example of config implicit object:

**index.html**

```
<form action="welcome">
<input type="text" name="uname">
<input type="submit" value="go"><br/>
</form>
```

**web.xml file**

```
<web-app>

<servlet>
<servlet-name>sonoojaiswal</servlet-name>
<jsp-file>/welcome.jsp</jsp-file>

<init-param>
<param-name>dname</param-name>
<param-value>sun.jdbc.odbc.JdbcOdbcDriver</param-value>
</init-param>

</servlet>

<servlet-mapping>
<servlet-name>sonoojaiswal</servlet-name>
<url-pattern>/welcome</url-pattern>
</servlet-mapping>

</web-app>
```

**welcome.jsp**

```
<%
out.print("Welcome "+request.getParameter("uname"));
```

```
String driver=config.getInitParameter("dname");
out.print("driver name is="+driver);
%>
```

# 5) JSP application implicit object

In JSP, application is an implicit object of type *ServletContext*.

The instance of ServletContext is created only once by the web container when application or project is deployed on the server.

This object can be used to get initialization parameter from configuaration file (web.xml). It can also be used to get, set or remove attribute from the application scope.

This initialization parameter can be used by all jsp pages.

# Example of application implicit object:

**index.html**

```
<form action="welcome">
<input type="text" name="uname">
<input type="submit" value="go"><br/>
</form>
```

**web.xml file**

```
<web-app>

<servlet>
<servlet-name>sonoojaiswal</servlet-name>
<jsp-file>/welcome.jsp</jsp-file>
</servlet>

<servlet-mapping>
<servlet-name>sonoojaiswal</servlet-name>
<url-pattern>/welcome</url-pattern>
</servlet-mapping>

<context-param>
<param-name>dname</param-name>
<param-value>sun.jdbc.odbc.JdbcOdbcDriver</param-value>
</context-param>

</web-app>
```

**welcome.jsp**

```
<%

out.print("Welcome "+request.getParameter("uname"));

String driver=application.getInitParameter("dname");
```

```
out.print("driver name is="+driver);

%>
```

## 6) session implicit object

In JSP, session is an implicit object of type HttpSession.

The Java developer can use this object to set,get or remove attribute or to get session information.

### Example of session implicit object

**index.html**

```
<html>  <body>
<form action="welcome.jsp">
<input type="text" name="uname">
<input type="submit" value="go"><br/>
</form></body>  </html>
```

**welcome.jsp**

```
<%
String name=request.getParameter("uname");
out.print("Welcome "+name);

session.setAttribute("user",name);

<a href="second.jsp">second jsp page</a>
 %>
```

**second.jsp**

```
<%
String name=(String)session.getAttribute("user");
out.print("Hello "+name);
 %>
```

## 7) pageContext implicit object

In JSP, pageContext is an implicit object of type PageContext class.The pageContext object can be used to set,get or remove attribute from one of the following scopes:

- page
- request
- session
- application

In JSP, page scope is the default scope.

## Example of pageContext implicit object

**index.html**

```
<html>
<body>
<form action="welcome.jsp">
<input type="text" name="uname">
<input type="submit" value="go"><br/>
</form>
</body>
</html>
```

**welcome.jsp**

```
<html>
<body>
<%

String name=request.getParameter("uname");
out.print("Welcome "+name);

pageContext.setAttribute("user",name,PageContext.SESSION_SCOPE);

<a href="second.jsp">second jsp page</a>

%>
</body>
</html>
```

**second.jsp**

```
<html>
<body>
<%

String name=(String)pageContext.getAttribute("user",PageContext.SESSION_SCOPE);
out.print("Hello "+name);

%>
</body>
</html>
```

# 8) page implicit object:

In JSP, page is an implicit object of type Object class.

This object is assigned to the reference of auto generated servlet class. It is written as:  Object page=this;

For using this object it must be cast to Servlet type.

For example: <% (HttpServlet)page.log("message"); %>

Since, it is of type Object it is less used because you can use this object directly in jsp.

For example: <% this.log("message"); %>

# 9) exception implicit object

In JSP, exception is an implicit object of type java.lang.Throwable class. This object can be used to print the exception. But it can only be used in error pages.It is better to learn it after page directive. Let's see a simple example:

## Example of exception implicit object:

**error.jsp**

```
<%@ page isErrorPage="true" %>
Sorry following exception occured:
<%= exception %>
```

Note: To get the full example of exception handling in jsp. But, it will be better to learn it after the JSP Directives.

**Write a JSP application to demonstrate the expression tag by using arithmetic operations.**

There are multiple checkbox in html page to perform different mathematical operations. By default, Addition is checked and its add the given number in text box. At the time of division operation when we enter any invalid data in text box, it generates error message from **"error.jsp"** page.

*input.html*

```
<html>
   <title>Sample Example </title>
   <body>
      <form method="post" action="index.jsp">
         <fieldset style="width:30%; background-color:#b3d1ff">
            <h2><center> Mathematical Operation</center></h2>
            <hr>
            <font size=5 face="Times New Roman">
               <input type="radio" name="a1" value="add" checked>Addition</input><br>
               <input type="radio" name="a1" value="sub">Subtraction</input><br>
               <input type="radio" name="a1" value="mul" >Multiplication</input><br>
               <input type="radio" name="a1" value="div" >Division</input><br>
            </font>
            <table>
            <tr>
               <td>Enter first Value:</td>
```

```
            <td> <input type="text" name="t1" value=""></td>
          </tr>
          <tr>
            <td>Enter second Value: </td>
            <td><input type="text" name="t2" value=""></td>
          </tr><br>
          <tr>
            <td></td>
            <td><input type="submit" name="result" value="Check result!"></td>
          </tr>
          </table>
        </fieldset>
      </form>
   </body>
</html>
```

*index.jsp*

```
<%@ page errorPage="error.jsp" %>
<html>
   <body>
      <H1><center>Result for <%=request.getParameter("a1")%></center></H1>
      <%
         String num1=request.getParameter("t1");
         String num2=request.getParameter("t2");

         int i=Integer.parseInt(num1);
         int j=Integer.parseInt(num2);

         int k=0;
         String str=request.getParameter("a1");
         if(str.equals("add"))
            k=i+j;
         if(str.equals("sub"))
            k=i-j;
         if(str.equals("mul"))
            k=i*j;
         if(str.equals("div"))
            k=i/j;
      %>
      Result is: <%=k%>
   </body>
</html>
```

*error.jsp*

```
<%@ page isErrorPage="true" %>

<h3>Sorry an exception occured!</h3>

Exception is: <%= exception %>
```

***Example 2***

Write a JSP program to calculate the factorial value for an integer number, while the input is taken from an HTML form.

**input.html**

```
<html>
<body>
<form action="Factorial.jsp">
Enter a value for n: <input type="text" name="val">
<input type="submit" value="Submit">
</form>
</body>
</html>
```

**Factorial.jsp**

```
<html>  <body>
<%!
   long n, result;
   String str;
   long fact(long n) {
      if(n==0)
         return 1;
      else
         return n*fact(n-1);
   }
%>
<%
    str = request.getParameter("val");
    n = Long.parseLong(str);
    result = fact(n);
%>  <b>Factorial value: </b> <%= result %>
</body>  </html>
```

***Example 2***

**The following JSP program shows the Fibonacci series up to a particular term, while the input is taken from an HTML form.**

**input.html**

```
<html>
<body>
<form action="Fibonacci.jsp">
   Enter a value for n: <input type="text" name="val">
   <input type="submit" value="Submit">
</form>
</body>
</html>
```

**Fibonacci.jsp**

```
<html>
<body>
<%!
   int n;
   String str;

   int fibo(int n) {
      if(n<2)
         return n;
      else
         return fibo(n-1) + fibo(n-2);
   }
%>
<b>Fibonacci series: </b><br>
<%
   str = request.getParameter("val");
   n = Integer.parseInt(str);

   for(int i=0; i<=n; i++) {
      out.print(fibo(i) + " ");
   }
%>
</body>
</html>
```

# JSP directives

The **jsp directives** are messages that tell the web container how to translate a JSP page into the corresponding servlet.

There are three types of directives:

- page directive
- include directive
- taglib directive

## Syntax of JSP Directive

<%@ directive_name attribute_name="value" %>

### Attributes of JSP page directive

- import
- contentType
- extends

- info
- buffer
- language
- isELIgnored
- isThreadSafe
- autoFlush
- session
- pageEncoding
- errorPage
- isErrorPage

## JSP page directive

The page directive defines attributes that apply to an entire JSP page.

### Syntax of JSP page directive

<%@ page attribute="value" %>

## 1)import

The import attribute is used to import class, interface or all the members of a package.
It is similar to import keyword in java class or interface.

### Example of import attribute

```
<html>  <body>

<%@ page import="java.util.Date" %>
Today is: <%= new Date() %>

</body>  </html>
```

## 2)contentType

The contentType attribute defines the MIME(Multipurpose Internet Mail Extension) type of the HTTP response.The default value is "text/html;charset=ISO-8859-1".

## Example of contentType attribute

```
<html>
<body>

<%@ page contentType=”application/msword” %>
Today is: <%= new java.util.Date() %>

</body>
</html>
```

### 3)extends

The extends attribute defines the parent class that will be inherited by the generated servlet.It is rarely used.

### 4)info

This attribute simply sets the information of the JSP page which is retrieved later by using getServletInfo() method of Servlet interface.

## Example of info attribute

```
<html>
<body>

<%@ page info="composed by Raju" %>
Today is: <%= new java.util.Date() %>

</body>
</html>
```

The web container will create a method getServletInfo() in the resulting servlet.For example:

```
public String getServletInfo() {
  return "composed by Raju";
}
```

### 5)buffer

The buffer attribute sets the buffer size in kilobytes to handle output generated by the JSP page.The default size of the buffer is 8Kb.

## Example of buffer attribute

```
<html>
<body>

<%@ page buffer="16kb" %>
Today is: <%= new java.util.Date() %>

</body>
</html>
```

### 6)language

The language attribute specifies the scripting language used in the JSP page. The default value is "java".

### 7)isELIgnored

We can ignore the Expression Language (EL) in jsp by the isELIgnored attribute. By default its value is false i.e. Expression Language is enabled by default. We see Expression Language later.

```
<%@ page isELIgnored="true" %>//Now EL will be ignored
```

### 8)isThreadSafe

Servlet and JSP both are multithreaded.If you want to control this behaviour of JSP page, you can use isThreadSafe attribute of page directive.The value of isThreadSafe value is true.If you make it false, the web container will serialize the multiple requests, i.e. it will wait until the JSP finishes responding to a request before passing another request to it.If you make the value of isThreadSafe attribute like:

```
<%@ page isThreadSafe="false" %>
```

The web container in such a case, will generate the servlet as:

```
public class SimplePage_jsp extends HttpJspBase
```

```
implements SingleThreadModel{
.....
}
```

## 9)errorPage

The errorPage attribute is used to define the error page, if exception occurs in the current page, it will be redirected to the error page.

## Example of errorPage attribute

```
//index.jsp
<html>
<body>

<%@ page errorPage="myerrorpage.jsp" %>
  <%= 100/0 %>
   <!  - -If exception occurs then it redirects to myerrorpage.jsp page -- >
</body>
</html>
```

## 10)isErrorPage

The isErrorPage attribute is used to declare that the current page is the error page.

*Note: The exception object can only be used in the error page.*

## Example of isErrorPage attribute

```
//myerrorpage.jsp
<html>  <body>

<%@ page isErrorPage="true" %>

 Sorry an exception occured!<br/>
The exception is: <%= exception %>

</body>  </html>
```

## Jsp Include Directive

The include directive is used to include the contents of any resource it may be jsp file, html file or text file. The include directive includes the original content of the included resource at page translation time (the jsp page is translated only once so it will be better to include static resource).

### Syntax of include directive

```
<%@ include file="resourceName" %>
```

### Example of include directive

In this example, we are including the content of the header.html file. To run this example you must create an header.html file.

```
<html>  <body>
 <%@ include file="header.html" %>

Today is: <%= java.util.Calendar.getInstance().getTime() %>

</body>  </html>
```

*Note: The include directive includes the original content, so the actual page size grows at runtime.*

## JSP Taglib directive

The JSP taglib directive is used to define a tag library that defines many tags. We use the TLD (Tag Library Descriptor) file to define the tags. In the custom tag section we will use this tag so it will be better to learn it in custom tag.

### *Syntax JSP Taglib directive*

```
<%@ taglib uri="uriofthetaglibrary" prefix="prefixoftaglibrary" %>
```

### Example of JSP Taglib directive

In this example, we are using our tag named currentDate. To use this tag we must specify the taglib directive so the container may get information about the tag.

```
<html>
<body>

<%@ taglib uri="http://www.mrec.ac.in/tags" prefix="mytag" %>

<mytag:currentDate/>

</body>
</html>
```

## Exception Handling in JSP

The exception is normally an object that is thrown at runtime. Exception Handling is the process to handle the runtime errors. There may occur exception any time in your web application. So handling exceptions is a safer side for the web developer.

In JSP, there are two ways to perform exception handling:

1. By **errorPage** and **isErrorPage** attributes of page directive
2. By **<error-page>** element in web.xml file

## Example of exception handling in jsp by the elements of page directive

In this case, you must define and create a page to handle the exceptions, as in the error.jsp page. The pages where may occur exception, define the errorPage attribute of page directive, as in the process.jsp page.

There are 3 files:

- index.jsp for input values
- process.jsp for dividing the two numbers and displaying the result
- error.jsp for handling the exception

*index.jsp*

```
<form action="process.jsp">
No1:<input type="text" name="n1" /><br/><br/>
No1:<input type="text" name="n2" /><br/><br/>
<input type="submit" value="divide"/>
</form>
```

*process.jsp*

```
<%@ page errorPage="error.jsp" %>
<%

String num1=request.getParameter("n1");
String num2=request.getParameter("n2");

int a=Integer.parseInt(num1);
int b=Integer.parseInt(num2);
int c=a/b;
out.print("division of numbers is: "+c);

%>
```

*error.jsp*

```
<%@ page isErrorPage="true" %>
 <h3>Sorry an exception occured!</h3>
 Exception is: <%= exception %>
```

## JSP Action Tags

There are many JSP action tags or elements. Each JSP action tag is used to perform some specific tasks. The action tags are used to control the flow between pages and to use Java Bean. The Jsp action tags are given below.

| JSP Action Tags | Description |
|---|---|
| jsp:forward | forwards the request and response to another resource. |
| jsp:include | includes another resource. |

| | |
|---|---|
| jsp:param | sets the parameter value. It is used in forward and include mostly. |
| jsp:useBean | creates or locates bean object. |
| jsp:setProperty | sets the value of property in bean object. |
| jsp:getProperty | prints the value of property of the bean. |

The jsp:useBean, jsp:setProperty and jsp:getProperty tags are used for bean development. So we will see these tags in bean development.

## jsp:forward action tag

The jsp:forward action tag is used to forward the request to another resource it may be jsp, html or another resource.

### Syntax of jsp:forward action tag without parameter

```
<jsp:forward page="relativeURL | <%= expression %>" />
```

### Syntax of jsp:forward action tag with parameter

```
<jsp:forward page="relativeURL | <%= expression %>">
<jsp:param name="parametername"
        value="parametervalue | <%=expression%>" />
</jsp:forward>
```

#### Example of jsp:forward action tag without parameter

In this example, we are simply forwarding the request to the printdate.jsp file.

index.jsp

```
<html>  <body>
<h2>this is index page</h2>
  <jsp:forward page="printdate.jsp" />
</body>  </html>
```

printdate.jsp

```
<html>  <body>
<% out.print("Today is:"+java.util.Calendar.getInstance().getTime()); %>
</body>  </html>
```

### Example of jsp:forward action tag with parameter

In this example, we are forwarding the request to the printdate.jsp file with parameter and printdate.jsp file prints the parameter value with date and time.

index.jsp

```
html>  <body>
<h2>this is index page</h2>

<jsp:forward page="printdate.jsp" >
<jsp:param name="name" value="www.google.com" />
</jsp:forward>
```

```
</body>  </html>
```

printdate.jsp

```
<html>  <body>

<% out.print("Today is:"+java.util.Calendar.getInstance().getTime()); %>
<%= request.getParameter("name") %>

</body>  </html>
```

## jsp:include action tag

The **jsp:include action tag** is used to include the content of another resource it may be jsp, html or servlet.

The jsp include action tag includes the resource at request time so it is **better for dynamic pages**

because there might be changes in future.

## The jsp:include tag can be used to include static as well as dynamic pages.

### Advantage of jsp:include action tag

**Code reusability** : We can use a page many times such as including header and footer pages in all pages. So it saves a lot of time.

### Difference between jsp include directive and include action

| JSP include directive | JSP include action |
|---|---|
| includes resource at translation time. | includes resource at request time. |
| better for static pages. | better for dynamic pages. |
| includes the original content in the generated servlet. | calls the include method. |

### Syntax of jsp:include action tag without parameter

```
<jsp:include page="relativeURL | <%= expression %>" />
```

Syntax of jsp:include action tag with parameter

```
<jsp:include page="relativeURL | <%= expression %>">
<jsp:param name="parametername" value="parametervalue | <%=expression%>" />
</jsp:include>
```

### Example of jsp:include action tag without parameter

In this example, index.jsp file includes the content of the printdate.jsp file.

*File: index.jsp*

```
<h2>this is index page</h2>
  <jsp:include page="printdate.jsp" />
<h2>end section of index page</h2>
```

*File: printdate.jsp*

```
<% out.print("Today is:"+java.util.Calendar.getInstance().getTime()); %>
```

**JSP Forward Example 1 – without passing parameters**

index.jsp

```
<html> <body>
<p align="center">My main JSP page</p>
<jsp:forward page="display.jsp" />
</body> </html>
```

display.jsp

```
<html> <body>
Hello this is a display.jsp Page
</body> </html>
```

**JSP Forward Example 2 – with parameters**

index.jsp

```
<html> <body>
<jsp:forward page="display.jsp">
<jsp:param name="name" value="Chaitanya" />
<jsp:param name="site" value="BeginnersBook.com" />
<jsp:param name="tutorialname" value="jsp forward action" />
<jsp:param name="reqcamefrom" value="index.jsp" />
</jsp:forward> </body> </html>
```

display.jsp

```
<html> <body>
<h2>Hello this is a display.jsp Page</h2>
My name is: <%=request.getParameter("name") %><br>
Website: <%=request.getParameter("site") %><br>
Topic: <%=request.getParameter("tutorialname") %><br>
Forward Request came from the page: <%=request.getParameter("reqcamefrom") %>
</body> </html>
```

## JavaBean  POJO-Plain Old Java Object

A JavaBean is a Java class that should follow the following conventions:

- It should have a no-arg constructor.
- It should provide methods to set and get the values of the properties, known as getter and setter methods.

### JavaBean?

According to Java white paper, it is a reusable software component. A bean encapsulates many objects into one object so that we can access this object from multiple places.

Moreover, it provides easy maintenance.

### Simple example of JavaBean class

```
//Employee.java

package mypack;
public class Employee   {
private int id;
private String name;
public Employee(){}
public void setId(int id){this.id=id;}
public int getId(){return id;}
public void setName(String name){this.name=name;}
public String getName(){return name;}
}
```

### How to access the JavaBean class?

To access the JavaBean class, we should use getter and setter methods.

```
package mypack;
public class Test{
public static void main(String args[]){
Employee e=new Employee();//object is created
e.setName("Arjun");//setting value to the object
System.out.println(e.getName());
}}
```

> *Note: There are two ways to provide values to the object. One way is by constructor and second is by setter method.*

## JavaBean Properties

A JavaBean property is a named feature that can be accessed by the user of the object.

The feature can be of any Java data type, containing the classes that you define.

A JavaBean property may be read, write, read-only, or write-only.

JavaBean features are accessed through two methods in the JavaBean's implementation class:

**1. getPropertyName ()**

For example, if the property name is firstName, the method name would be getFirstName() to read that property. This method is called the accessor.

**2. setPropertyName ()**

For example, if the property name is firstName, the method name would be setFirstName() to write that property. This method is called the mutator.

### Advantages of JavaBean

The following are the advantages of JavaBean

- The JavaBean properties and methods can be exposed to another application.
- It provides an easiness to reuse the software components.

### Disadvantages of JavaBean

The following are the disadvantages of JavaBean:

- JavaBeans are mutable. So, it can't take advantages of immutable objects.
- Creating the setter and getter method for each property separately may lead to the boilerplate code.

## jsp:useBean action tag

The jsp:useBean action tag is used to locate or instantiate a bean class. If bean object of the Bean class is already created, it doesn't create the bean depending on the scope. But if object of bean is not created, it instantiates the bean.

### Syntax of jsp:useBean action tag

```
<jsp:useBean id= "instanceName" scope= "page | request | session | application"
class= "packageName.className" type= "packageName.className"
beanName="packageName.className | <%= expression >" >
</jsp:useBean>
```

### Attributes and Usage of jsp:useBean action tag

1. **id:** is used to identify the bean in the specified scope.
2. **scope:** represents the scope of the bean. It may be page, request, session or application. The default scope is page.
    - **page:** specifies that you can use this bean within the JSP page. The default scope is page.
    - **request:** specifies that you can use this bean from any JSP page that processes the same request. It has wider scope than page.
    - **session:** specifies that you can use this bean from any JSP page in the same session whether processes the same request or not. It has wider scope than request.
    - **application:** specifies that you can use this bean from any JSP page in the same application. It has wider scope than session.
3. **class:** instantiates the specified bean class (i.e. creates an object of the bean class) but it must have no-arg or no constructor and must not be abstract.
4. **type:** provides the bean a data type if the bean already exists in the scope. It is mainly used with class or beanName attribute. If you use it without class or beanName, no bean is instantiated.
5. **beanName:** instantiates the bean using the java.beans.Beans.instantiate() method.

### Simple example of jsp:useBean action tag

In this example, we are simply invoking the method of the Bean class.

*For the example of setProperty, getProperty and useBean tags, visit next page.*

Calculator.java (a simple Bean class)

```
package bean;
public class Calculator{
public int cube(int n){return n*n*n;}
 }
```

index.jsp file

```
<jsp:useBean id="obj" class="bean.Calculator"/>
<%
        int m=obj.cube(5);
        out.print("cube of 5 is "+m);
%>
```

## jsp:setProperty and jsp:getProperty action tags

The setProperty and getProperty action tags are used for developing web application with Java Bean. In web devlopment, bean class is mostly used because it is a reusable software component that represents data.

The jsp:setProperty action tag sets a property value or values in a bean using the setter method.

### Syntax of jsp:setProperty action tag

```
<jsp:setProperty name="instanceOfBean" property= "*"   |
property="propertyName" param="parameterName"  |
property="propertyName" value="{ string | <%= expression %>}"
/>
```

### Example of jsp:setProperty action tag if you have to set all the values of incoming request in the bean

```
<jsp:setProperty name="bean" property="*" />
```

### Example of jsp:setProperty action tag if you have to set value of the incoming specific property

```
<jsp:setProperty name="bean" property="username" />
```

### Example of jsp:setProperty action tag if you have to set a specific value in the property

```
<jsp:setProperty name="bean" property="username" value="Kumar" />
```

## jsp:getProperty action tag: **The jsp:getProperty action tag returns the value of the property.**

Syntax: **<jsp:getProperty name="instanceOfBean" property="propertyName" />**

Example: **<jsp:getProperty name="beanobj" property="username" />**

## Example of bean development in JSP

In this example there are 3 pages:

- Userform.html for input of values
- UserProcess.jsp file that sets the incoming values to the bean object and prints the one value
- User.java bean class that have setter and getter methods

*Userform.html*

```
<form action="UserProcess.jsp">
Name:<input type="text" name="name"><br>
Password:<input type="password" name="password"><br>
Email:<input type="text" name="email"><br>
<input type="submit" value="register">
</form>
```

*UserProcess.jsp*

```
<jsp:useBean id="u" class="org.mrec.User"/>
<jsp:setProperty property="*" name="u"/>

Record:<br>
<jsp:getProperty property="name" name="u"/><br>
<jsp:getProperty property="password" name="u"/><br>
<jsp:getProperty property="email" name="u" /><br>
```

*User.java*

```
package org.mrec;

public class User {
private String name,password,email;
//setters and getters
}
```

## *Reusing Bean in Multiple Jsp Pages*

Let's see the simple example, that prints the data of bean object in two jsp pages.

*index.jsp* ***Same as above.***

*User.java* ***Same as above.***

### *Process1.jsp*

```
<jsp:useBean id="u" class="org.mrec.User" scope="session"/>
<jsp:setProperty property="*" name="u"/>

Record:<br>
<jsp:getProperty property="name" name="u"/><br>
<jsp:getProperty property="password" name="u"/><br>
<jsp:getProperty property="email" name="u" /><br>
```

```
<a href="process2.jsp">Visit Page</a>
```

*Process2.jsp*

```
<jsp:useBean id="u" class="org.mrec.User" scope="session"/>
Record:<br>
<jsp:getProperty property="name" name="u"/><br>
<jsp:getProperty property="password" name="u"/><br>
<jsp:getProperty property="email" name="u" /><br>
```

*Using variable value in setProperty tag*

In some case, you may get some value from the database, that is to be set in the bean object, in such case, you need to use expression tag. For example:

*Process3.jsp*

```
<jsp:useBean id="u" class="org.mrec.User"></jsp:useBean>
<%
String username="arjun";
%>
<jsp:setProperty property="username" name="u" value="<%=username %>"/>

Record:<br>
<jsp:getProperty property="name" name="u"/><br>
```

## Student.java

```
public class Student {

    private String firstName;
    private String lastName;
    private String emailId;
    private String password;
    public String getFirstName() {
        return firstName;
    }
    public void setFirstName(String firstName) {
        this.firstName = firstName;
    }
    public String getLastName() {
        return lastName;
    }
    public void setLastName(String lastName) {
        this.lastName = lastName;
    }
    public String getEmailId() {
        return emailId;
    }
    public void setEmailId(String emailId) {
        this.emailId = emailId;
    }
    public String getPassword() {
```

```
        return password;
    }
    public void setPassword(String password) {
        this.password = password;
    }
}
```

### student.jsp

```
<%@ page language="java" contentType="text/html; charset=ISO-8859-1"
 pageEncoding="ISO-8859-1"%>
<html>
<
<body>

     <h1> Student Registration Page</h1>
       <form action="studentdetails.jsp ">
         First Name: <input type="text" name="firstName">          <br> <br>

         Last Name: <input type="text" name="lastName">         <br> <br>

         Email ID: <input type="email" name="emailId">         <br> <br>

         Password: <input type="password" name="password"><br>            <br>
         <input type="submit" value="register">        </form>
</body>
</html>
```

### studentdetails.jsp

```
<%@ page language="java" contentType="text/html; charset=ISO-8859-1"
 pageEncoding="ISO-8859-1"%>
<html>
<body>

    <jsp:useBean id="stu" class="Student"></jsp:useBean>
    <jsp:setProperty property="*" name="stu" />
    <h1>Student Registered with Following Details</h1>
    <b>First Name:</b> <jsp:getProperty property="firstName" name="stu" /><br><br>
    <b>Last Name:</b> <jsp:getProperty property="lastName" name="stu" /><br><br>
    <b>Email ID:</b><jsp:getProperty property="emailId" name="stu" /><br><br>
    <b>Password:</b> <jsp:getProperty property="password" name="stu" />
</body>
</html>
```

## Model View and Controller Architecture

**MVC** stands for Model View and Controller. It is a **design pattern** that separates the business logic, presentation logic and data.

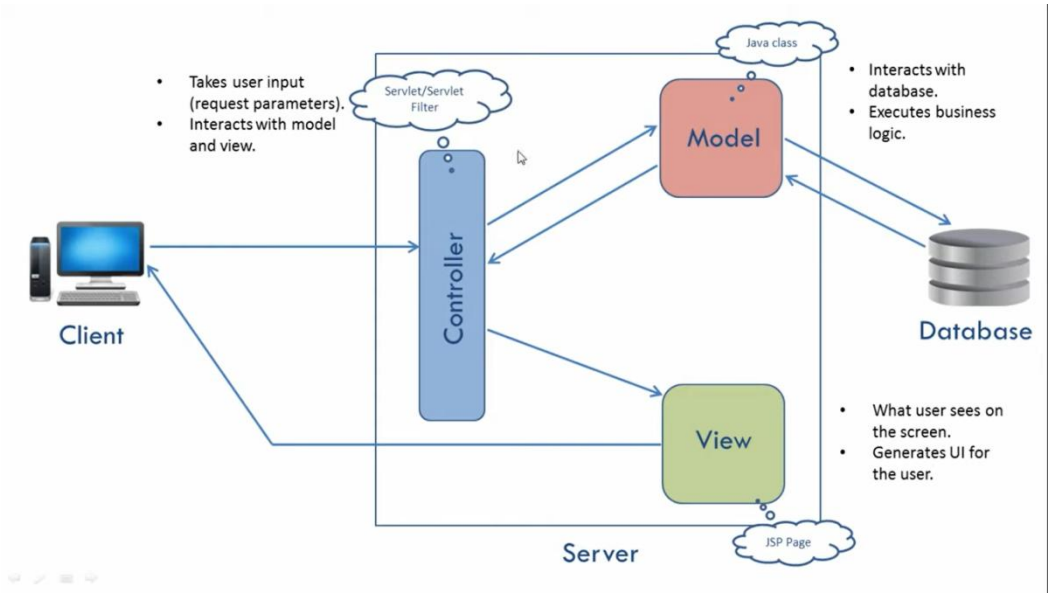
**Controller** acts as an interface between View and Model. Controller intercepts all the incoming requests.

**Model** represents the state of the application i.e. data. It can also have business logic.

**View** represents the presentaion i.e. UI(User Interface).

*Advantage of MVC (Model 2) Architecture*

1. Navigation Control is centralized
2. Easy to maintain the large application




## MVC Example in JSP

In this example, we are using servlet as a controller, jsp as a view component, Java Bean class as a model.

In this example, we have created 4 pages:

- **index.jsp** a page that gets input from the user.
- **ControllerServlet.java** a servlet that acts as a controller.
- **login-success.jsp** and **login-error.jsp** files acts as view components.

*File: index.jsp*

```
<form action="ControllerServlet" method="post">
Name:<input type="text" name="username"><br>
Password:<input type="password" name="password"><br>
<input type="submit" value="login">
</form>
```

*File: ControllerServlet.java*

```
import java.io.IOException;
```

```
import java.io.PrintWriter;
import javax.servlet.RequestDispatcher;
import javax.servlet.ServletException;
import javax.servlet.http.HttpServlet;
import javax.servlet.http.HttpServletRequest;
import javax.servlet.http.HttpServletResponse;
public class ControllerServlet extends HttpServlet {
   protected void doPost(HttpServletRequest request, HttpServletResponse response)
         throws ServletException, IOException {
      response.setContentType("text/html");
      PrintWriter out=response.getWriter();

      String username=request.getParameter("username");
      String password=request.getParameter("password");

      LoginBean bean=new LoginBean();
      bean.setUsername(username);
      bean.setPassword(password);
      request.setAttribute("bean",bean);


       boolean status=bean.validate();
       if(status){
            RequestDispatcher rd=request.getRequestDispatcher("login-success.jsp");
           rd.forward(request, response);
       }
      else{
        RequestDispatcher rd=request.getRequestDispatcher("login-error.jsp");
        rd.forward(request, response);
      }
    }
}
```

*File: LoginBean.java*

```
public class LoginBean {
private String username,password;
  //getter and setter methods
public String getUsername() {
   return username;
}
public void setUsername(String username) {
   this.username = username;
}
public String getPassword() {
   return password;
}
public void setPassword(String password) {
   this.password = password;
}
```

```
    public boolean validate(){
      if(password.equals("admin")){
        return true;
      }
      else{
        return false;
      }
    }
    }  //LoginBean class end
```

*File: login-success.jsp*

```
    <%@page import="bean.LoginBean"%>

    <p>You are successfully logged in!</p>
    <%
    LoginBean bean=(LoginBean)request.getAttribute("bean");
    out.print("Welcome, "+bean.getName());
    %>
```

*File: login-error.jsp*

```
    <p>Sorry! username or password error</p>
    <%@ include file="index.jsp" %>
```