When client requests for a webpage which is not present on the side of server, the server has to create the page dynamically. Server has a “Helper Application” called “Web Container” (Apache Tomcat, GlassFish, WebSphere –these are web servers) to do this task.

Web Container has Servlets.

Servlet is a java file, which can take request from the client on the internet and gives response to the user in the form of .html file.

Deployment Descriptor (web.xml) – contains mapping of servelt name to the url. i.e, for which url, which servlet has to be called.

A servlet extends HttpServlet (takes request, processes request, sends response).

Response can be .html, .xml or .json file.

Instead of web.xml file, we can use Annotations to perform mapping.

Client -> Server -> Web Container -> web.xml -> look for servlet and run it -> response back to client

**Configure Tomcat Server in Eclipse:**

Download Tomcat latest version.

Click on “servers” tab in eclipse.

Select “Apache”.

Browse for the Tomcat folder.

Right click on servers tab and start the server. (8080)

**Creating a web project in Eclipse:**

File -> New -> Dynamic Web Project -> Check runtime is selected as Apache Tomcat or not -> Give Project name -> Next -> Next -> check the box showing deployment descriptor -> Finish.

Locating web.xml file : Project folder -> src -> main -> webapp -> WEB-INF -> web.xml

**Creating a simple page printing Hello World:**

Right click on project -> New -> HTML file -> give html file name -> Finish (This html file will be dumped in webapp folder of src.)

***Example:***

***Index.html***

<!**DOCTYPE** html>

<**html**>

<**head**>

<**meta** charset=*"UTF-8"*>

<**title**>DemoApp</**title**>

</**head**>

<**body**>

<**form** action=*'add' method=’post’*>

Enter 1st number : <**input** type=*'text'* name=*'num1'*><**br**>

Enter 2nd number : <**input** type=*'text'* name=*'num2'*><**br**>

<**input** type=*'submit'* value=*'submit query'*>

</**form**>

</**body**>

</**html**>

***AddServlet.java***

package com.basics;

import java.io.IOException;

import java.io.PrintWriter;

import javax.servlet.http.HttpServlet;

import javax.servlet.http.HttpServletRequest;

import javax.servlet.http.HttpServletResponse;

public class AddServlet extends HttpServlet {

public void service(HttpServletRequest req, HttpServletResponse res) throws IOException {

int i = Integer.*parseInt*(req.getParameter("num1"));

int j = Integer.*parseInt*(req.getParameter("num2"));

int k = i+j;

PrintWriter out = res.getWriter();

out.println("Result = "+k);

}

}

***Web.xml***

<?**xml** version=*"1.0"* encoding=*"UTF-8"*?>

<**web-app** xmlns:xsi=*"http://www.w3.org/2001/XMLSchema-instance"* xmlns=*"http://xmlns.jcp.org/xml/ns/javaee"* xsi:schemaLocation=*"http://xmlns.jcp.org/xml/ns/javaee http://xmlns.jcp.org/xml/ns/javaee/web-app\_4\_0.xsd"* id=*"WebApp\_ID"* version=*"4.0"*>

<**servlet**>

<**servlet-name**>Add</**servlet-name**>

<**servlet-class**>com.basics.AddServlet</**servlet-class**>

</**servlet**>

<**servlet-mapping**>

<**servlet-name**>Add</**servlet-name**>

<**url-pattern**>/add</**url-pattern**>

</**servlet-mapping**>

</**web-app**>

Instead of service() method, we can use doGet() , doPost() methods also.

Default method is get(). // it shows the data in the query string of the url in browser.

<form action=’’ method=’post’> // to change it to post method.

The post method DOESN’T show the data in the query string of the url in browser.

**Calling one servlet from another using RequestDispatcher:**

package com.basics;

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 AddServlet extends HttpServlet {

public void doPost(HttpServletRequest req, HttpServletResponse res) throws IOException, ServletException {

int i = Integer.*parseInt*(req.getParameter("num1"));

int j = Integer.*parseInt*(req.getParameter("num2"));

int k = i+j;

req.setAttribute("k", k);

RequestDispatcher rd = req.getRequestDispatcher("square");

rd.forward(req, res);

}

}

package com.basics;

import java.io.IOException;

import java.io.PrintWriter;

import javax.servlet.http.HttpServlet;

import javax.servlet.http.HttpServletRequest;

import javax.servlet.http.HttpServletResponse;

public class SquareServlet extends HttpServlet {

public void doPost(HttpServletRequest req, HttpServletResponse res) throws IOException{

PrintWriter out = res.getWriter();

int k = (int)req.getAttribute("k");

k = k\*k;

out.println("Square is : "+k);

}

}

**Calling one servlet from another using sendRedirect():**

**Using URL Rewriting**

package com.basics;

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 **AddServlet** extends HttpServlet {

public void doGet(HttpServletRequest req, HttpServletResponse res) throws IOException, ServletException {

int i = Integer.parseInt(req.getParameter("num1"));

int j = Integer.parseInt(req.getParameter("num2"));

int k = i+j;

**res.sendRedirect("square?k="+k); //URL Rewriting**

}

}

package com.basics;

import java.io.IOException;

import java.io.PrintWriter;

import javax.servlet.http.HttpServlet;

import javax.servlet.http.HttpServletRequest;

import javax.servlet.http.HttpServletResponse;

public class **SquareServlet** extends HttpServlet {

public void doGet(HttpServletRequest req, HttpServletResponse res) throws IOException{

PrintWriter out = res.getWriter();

int k = Integer.parseInt(req.getParameter("k"));

k = k\*k;

out.println("Square is : "+k);

}

}

**Using Session Handling**

package com.basics;

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;

import javax.servlet.http.HttpSession;

public class AddServlet extends HttpServlet {

public void doGet(HttpServletRequest req, HttpServletResponse res) throws IOException, ServletException {

int i = Integer.*parseInt*(req.getParameter("num1"));

int j = Integer.*parseInt*(req.getParameter("num2"));

int k = i+j;

HttpSession session = req.getSession();

session.setAttribute("k", k);

res.sendRedirect("square");

}

}

package com.basics;

import java.io.IOException;

import java.io.PrintWriter;

import javax.servlet.http.HttpServlet;

import javax.servlet.http.HttpServletRequest;

import javax.servlet.http.HttpServletResponse;

import javax.servlet.http.HttpSession;

public class SquareServlet extends HttpServlet {

public void doGet(HttpServletRequest req, HttpServletResponse res) throws IOException{

PrintWriter out = res.getWriter();

HttpSession session = req.getSession();

int k = (int)session.getAttribute("k");

k = k\*k;

out.println("Square is : "+k);

}

}

**Using Cookies**

package com.basics;

import java.io.IOException;

import java.io.PrintWriter;

import javax.servlet.RequestDispatcher;

import javax.servlet.ServletException;

import javax.servlet.http.Cookie;

import javax.servlet.http.HttpServlet;

import javax.servlet.http.HttpServletRequest;

import javax.servlet.http.HttpServletResponse;

import javax.servlet.http.HttpSession;

public class AddServlet extends HttpServlet {

public void doGet(HttpServletRequest req, HttpServletResponse res) throws IOException, ServletException {

int i = Integer.*parseInt*(req.getParameter("num1"));

int j = Integer.*parseInt*(req.getParameter("num2"));

int k = i+j;

Cookie cookie = new Cookie("k", k+"");

res.addCookie(cookie);

res.sendRedirect("square");

}

}

package com.basics;

import java.io.IOException;

import java.io.PrintWriter;

import javax.servlet.http.Cookie;

import javax.servlet.http.HttpServlet;

import javax.servlet.http.HttpServletRequest;

import javax.servlet.http.HttpServletResponse;

import javax.servlet.http.HttpSession;

public class SquareServlet extends HttpServlet {

public void doGet(HttpServletRequest req, HttpServletResponse res) throws IOException{

PrintWriter out = res.getWriter();

int k = 0;

Cookie cookies[] = req.getCookies();

for(Cookie c : cookies) {

if(c.getName().equals("k")) {

k = Integer.*parseInt*(c.getValue());

}

}

k = k\*k;

out.println("Square is : "+k);

}

}

**ServletConfig & ServletContext**

Are used to get initial values of the servlet or the application.

Such initial parameters are mentioned in the web.xml file.

ServletConfig will be specific to a servlet, whereas ServletContext is available to all the servlets of an application.

**How to configure servlets with the help of Annotations**

No need to write in web.xml

*@WebServlet*("/add")

public class AddServlet extends HttpServlet {}

*@WebServlet*("/square")

public class SquareServlet extends HttpServlet {}

**JSP (Java Server Pages) :** Java code inside html. It easier for programmers to write.

Separates Html and Java code.

JSP in turn gets converted into Servlet.

JSP provides implicit objects like **out, request, response** etc… Whereas in case of servlets, out is created using PrintWriter class, request and response objects are created using HttpServlet class.

The script within <% %> goes into the service() method.

<% %> is **scriptlet**.

<%! %> is for **declaration** of variables and methods.

<%@ page import = “java.util.Date” %> is **directive** (to mention imports).

<% = k %> is **expression** tag (goes into out.println()).

***Web.xml***

<?**xml** version=*"1.0"* encoding=*"UTF-8"*?>

<**web-app** xmlns:xsi=*"http://www.w3.org/2001/XMLSchema-instance"* xmlns=*"http://xmlns.jcp.org/xml/ns/javaee"* xsi:schemaLocation=*"http://xmlns.jcp.org/xml/ns/javaee http://xmlns.jcp.org/xml/ns/javaee/web-app\_4\_0.xsd"* id=*"WebApp\_ID"* version=*"4.0"* metadata-complete=*"false"*>

<**display-name**>DemoApp</**display-name**>

<**context-param**>

<**param-name**>name</**param-name**>

<**param-value**>Bhavana</**param-value**>

</**context-param**>

<**context-param**>

<**param-name**>phone</**param-name**>

<**param-value**>Realme</**param-value**>

</**context-param**>

</**web-app**>

***index.html***

<!**DOCTYPE** html>

<**html**>

<**head**>

<**meta** charset=*"UTF-8"*>

<**title**>DemoApp</**title**>

</**head**>

<**body**>

<**form** action=*'add.jsp'* method=*'get'*>

Enter 1st number : <**input** type=*'text'* name=*'num1'*><**br**>

Enter 2nd number : <**input** type=*'text'* name=*'num2'*><**br**>

<**input** type=*'submit'* value=*'submit query'*>

</**form**>

</**body**>

</**html**>

***add.jsp***

<%@ **page** language=*"java"* contentType=*"text/html; charset=UTF-8"*

pageEncoding=*"UTF-8"*%>

<!**DOCTYPE** html>

<**html**>

<**head**>

<**meta** charset=*"UTF-8"*>

<**title**>Insert title here</**title**>

</**head**>

<**body** bgcolor=*"cyan"*>

<%

int i = Integer.parseInt(request.getParameter("num1"));

int j = Integer.parseInt(request.getParameter("num2"));

int k = i+j;

out.println("Output : "+k);

%>

</**body**>

</**html**>

**Usage of Expressions, Declaratives, Directives and Scriptlets**

<%@ **page** language=*"java"* contentType=*"text/html; charset=UTF-8"*

pageEncoding=*"UTF-8"* import=*"java.util.Scanner"*%>

<!**DOCTYPE** html>

<**html**>

<**head**>

<**meta** charset=*"UTF-8"*>

<**title**>Insert title here</**title**>

</**head**>

<**body** bgcolor=*"cyan"*>

<%!

int a = 10;

int b = 20;

%>

<%

int i = Integer.parseInt(request.getParameter("num1"));

int j = Integer.parseInt(request.getParameter("num2"));

int k = i+j;

%>

<%="Output is "+k%>

<**br**>

Value of a is : <%=a %>

</**body**>

</**html**>

**Types of Directives:**

**@page**

**@include**

**@taglib**

**@page attributes:**

language = “scripting language” (java)

extends = “className”

import = “importList”

session = “true|false”

autoFlush = “true|false”

contentType = “text/html/..” (response to client can be html file/a pdf…)

errorPage = “error\_url” (specifies the page name that handles exception)

isErrorPage = “true|false” (specifies whether the current page is error page or not)

info = “information\_about\_page”

isThreadSafe = “true|false”

**@include attributes:**

Ex : <%@ include file=”header.jsp” %>

**@taglib attributes: (To specify external tags)**

<%@ taglib uri=”uri” prefix=”fx” %>

**Implicit objects in JSP:**

Builtin objects (can be used in Scriptlet and Expression)

request (HttpServletRequest)

response (HttpServletResponse)

pageContext (PageContext)

out (JspWriter) i.e, PrintWriter object

session (HttpSession)

application (ServletContext)

config (ServletConfig)

**error.jsp**

isErrorPage = “true”, only then we can use exception object.

<%@ **page** language=*"java"* contentType=*"text/html; charset=UTF-8"*

pageEncoding=*"UTF-8"* isErrorPage=*"true"*%>

<!**DOCTYPE** html>

<**html**>

<**head**>

<**meta** charset=*"UTF-8"*>

<**title**>Insert title here</**title**>

</**head**>

<**body** bgcolor=*"red"*>

Error

<%= exception.getMessage() %>

</**body**>

</**html**>

<%@ **page** language=*"java"* contentType=*"text/html; charset=UTF-8"*

pageEncoding=*"UTF-8"* errorPage=*"error.jsp"*%>

<!**DOCTYPE** html>

<**html**>

<**head**>

<**meta** charset=*"UTF-8"*>

<**title**>Insert title here</**title**>

</**head**>

<**body**>

<%

int k = 10/0;

%>

</**body**>

</**html**>

errorPage = “error.jsp” indicates which page is handling the exceptions raised from this page.

**Using JDBC in JSP file:**

<%@ **page** language=*"java"* contentType=*"text/html; charset=UTF-8"*

pageEncoding=*"UTF-8"*%>

<%@ **page** import=*"java.sql.\*"* %>

<!**DOCTYPE** html>

<**html**>

<**head**>

<**meta** charset=*"UTF-8"*>

<**title**>Insert title here</**title**>

</**head**>

<**body**>

<%

String url = "jdbc:mysql://localhost:3306/college";

String userName = "root";

String password = "1234";

String sql = "select \* from student";

Class.forName("com.mysql.cj.jdbc.Driver");

Connection con = DriverManager.getConnection(url,userName,password);

Statement st = con.createStatement();

ResultSet rs = st.executeQuery(sql);

while(rs.next()){

out.print("Roll Number : "+rs.getInt(1)+"<br>");

out.print("Name : "+rs.getString(2)+"<br>");

}

%>

</**body**>

</**html**>

**Model, View, Controller (MVC) architecture**

When a client sends a request, it goes to the **controller**, which calls **view** by sending the **model** object.

Model object contains the required data. Blank text of the view is replaced by data in the model object.

Controller is created using Servlets – write business logic / processing., Controllers accept request and

call the methods from service class. This Service class gives the object, by taking help from DAO

(Database Access Object) class to fetch data from database.

Views are created using JSPs.

Models are created in POJO (Plain Old Java Object) format, (by controller fetching data from database).

**JSTL (JSP Standard Tag Library)**

**DemoServlet.java**

import javax.servlet.RequestDispatcher;

import javax.servlet.ServletException;

import javax.servlet.annotation.WebServlet;

import javax.servlet.http.\*;

import java.io.\*;

*@WebServlet*("/DemoServlet")

public class DemoServlet extends HttpServlet {

protected void doGet(HttpServletRequest req, HttpServletResponse res)throws ServletException, IOException {

String name = "Bhavana";

req.setAttribute("label", name);

RequestDispatcher rd = req.getRequestDispatcher("display.jsp");

rd.forward(req, res);

}

}

**display.jsp**

<%@ **page** language=*"java"* contentType=*"text/html; charset=UTF-8"*

pageEncoding=*"UTF-8"*%>

<!**DOCTYPE** html>

<**html**>

<**head**>

<**meta** charset=*"UTF-8"*>

<**title**>Insert title here</**title**>

</**head**>

<**body**>

<%

String name = request.getAttribute("label").toString();

out.println(name);

%>

${label}

</**body**>

</**html**>

Download jstl-1.1.2.jar and standard-1.1.2.jar files, and add them to the “build path”.

<%@ **page** language=*"java"* contentType=*"text/html; charset=UTF-8"*

pageEncoding=*"UTF-8"*%>

<%@ **taglib** prefix=*"c"* uri=*"http://java.sun.com/jsp/jstl/core"* %>

<!**DOCTYPE** html>

<**html**>

<**head**>

<**meta** charset=*"UTF-8"*>

<**title**>Insert title here</**title**>

</**head**>

<**body**>

<%

String name = request.getAttribute("label").toString();

out.println(name);

%>

${label}

<**c:out** value=*"*${label}*"*/> <%--Expression Language --%>

</**body**>

</**html**>

**DemoServlet.java**

import javax.servlet.RequestDispatcher;

import javax.servlet.ServletException;

import javax.servlet.annotation.WebServlet;

import javax.servlet.http.\*;

import java.io.\*;

import java.util.Arrays;

import java.util.List;

@WebServlet("/DemoServlet")

public class DemoServlet extends HttpServlet {

protected void doGet(HttpServletRequest req, HttpServletResponse res)throws ServletException, IOException {

List<Student> studs = Arrays.asList(new Student(1201, "Aastha"),new Student(1203, "Aishwarya"), new Student(1205, "Akhil"));

req.setAttribute("students", studs);

RequestDispatcher rd = req.getRequestDispatcher("display.jsp");

rd.forward(req, res);

}

}

**Display.jsp**

<%@ **page** language=*"java"* contentType=*"text/html; charset=UTF-8"*

pageEncoding=*"UTF-8"*%>

<%@ **taglib** prefix=*"c"* uri=*"http://java.sun.com/jsp/jstl/core"* %>

<!**DOCTYPE** html>

<**html**>

<**head**>

<**meta** charset=*"UTF-8"*>

<**title**>Insert title here</**title**>

</**head**>

<**body**>

${label}

<**c:out** value=*"*${label}*"*/> <%--Expression Language --%>

<**c:import** url=*"https://www.google.com"*></**c:import**>

${students}

<**br**/>

<**c:forEach** items=*"*${students}*"* var=*"s"*>

${s.name}<**br**/>

</**c:forEach**>

</**body**>

</**html**>

**Student.java**

public class Student {

int rollNo;

String name;

public Student(int rollNo, String name) {

this.rollNo = rollNo;

this.name = name;

}

public int getRollNo() {

return rollNo;

}

public void setRollNo(int rollNo) {

this.rollNo = rollNo;

}

public String getName() {

return name;

}

public void setName(String name) {

this.name = name;

}

*@Override*

public String toString() {

return "Student [rollNo=" + rollNo + ", name=" + name + "]";

}

}

**SQL Tags**

<%@ **taglib** prefix=*"c"* uri=*"http://java.sun.com/jsp/jstl/sql"* %>