Fpt University

The Servlet Model

HTTP Methods

Form Parameters

Requests

Responses

Servlet Life Cycle

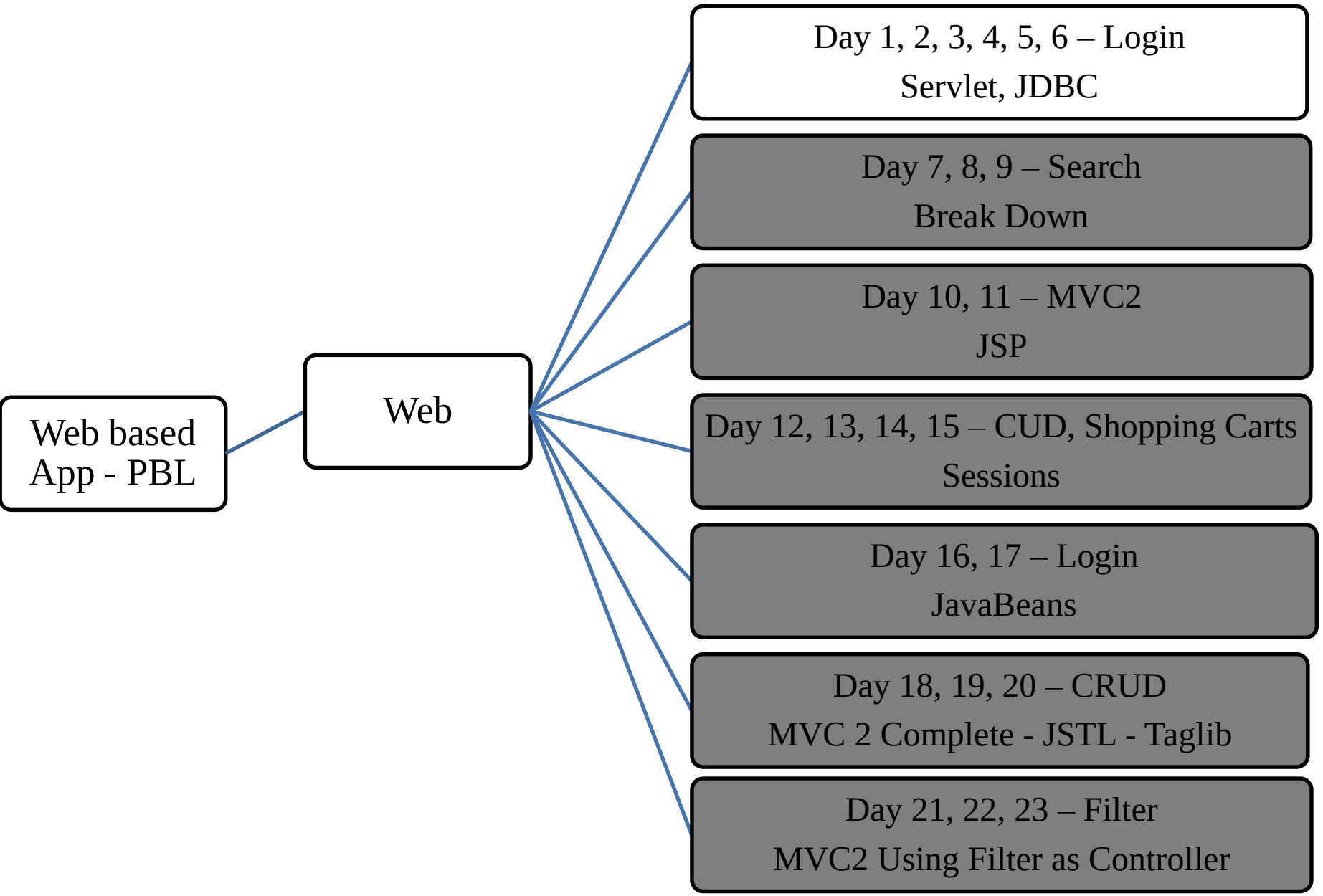
#Servlet #Video_Servlet

#JavaEE #MVC #MVC2

Objectives

- **How to build the simple web site combining html and servlet?**
  - Http Protocol and Methods
  - What is Servlet?
  - Parameters vs. Variables
  - Servlet Life Cycle
  - Break down structure component in building web application

Objectives

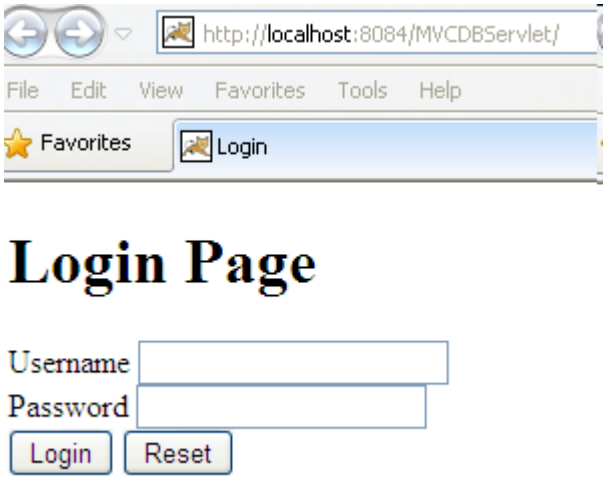

Web based App - PBL
Web
Day 1, 2, 3, 4, 5, 6 – Login
Servlet, JDBC
Day 7, 8, 9 – Search
Break Down
Day 10, 11 – MVC2
JSP
Day 12, 13, 14, 15 – CUD, Shopping Carts
Sessions
Day 16, 17 – Login
JavaBeans
Day 18, 19, 20 – CRUD
MVC 2 Complete - JSTL - Taglib
Day 21, 22, 23 – Filter
MVC2 Using Filter as Controller

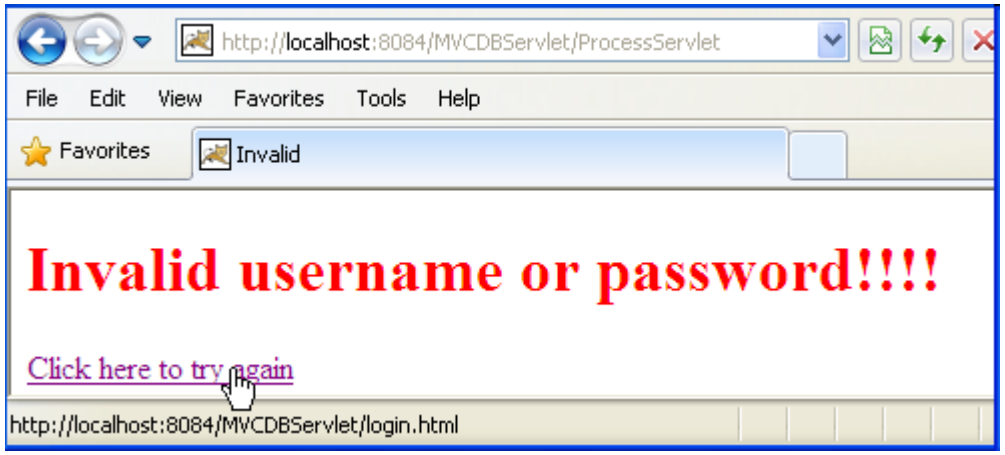
Build The Simple Web Requirements

- Building the web application can do some following functions as
  - The user **must be authenticated** before they want to use this web site **using the DB**
  - If the user is invalid, the **message "Invalid username and password" is presented**, then the **link "Click here to try again" is shown** that **redirect the user to the login page**
  - Otherwise, **the search page** is redirected.
  - The GUI of web application is present as following

Build The Simple Web

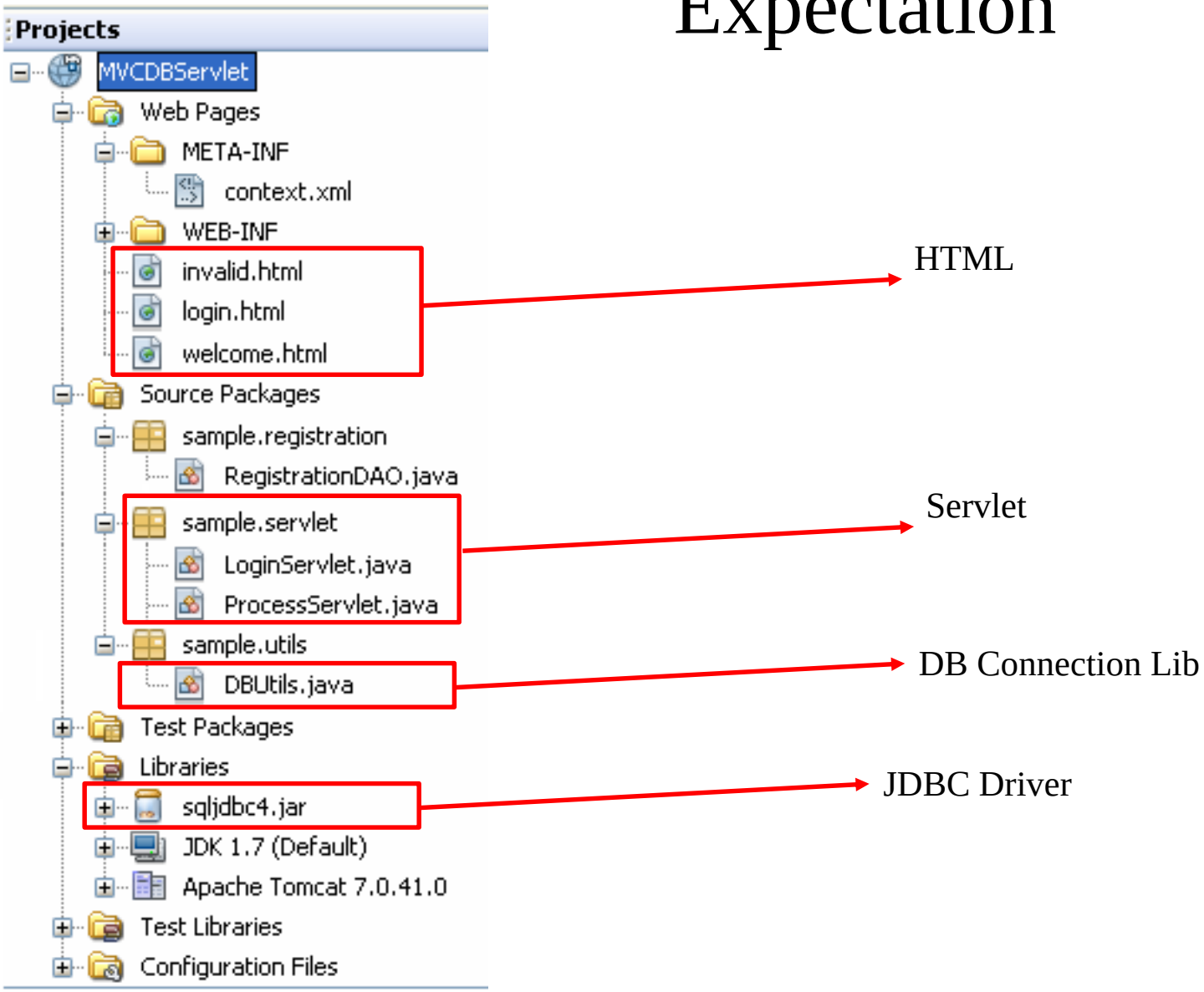
Expectation





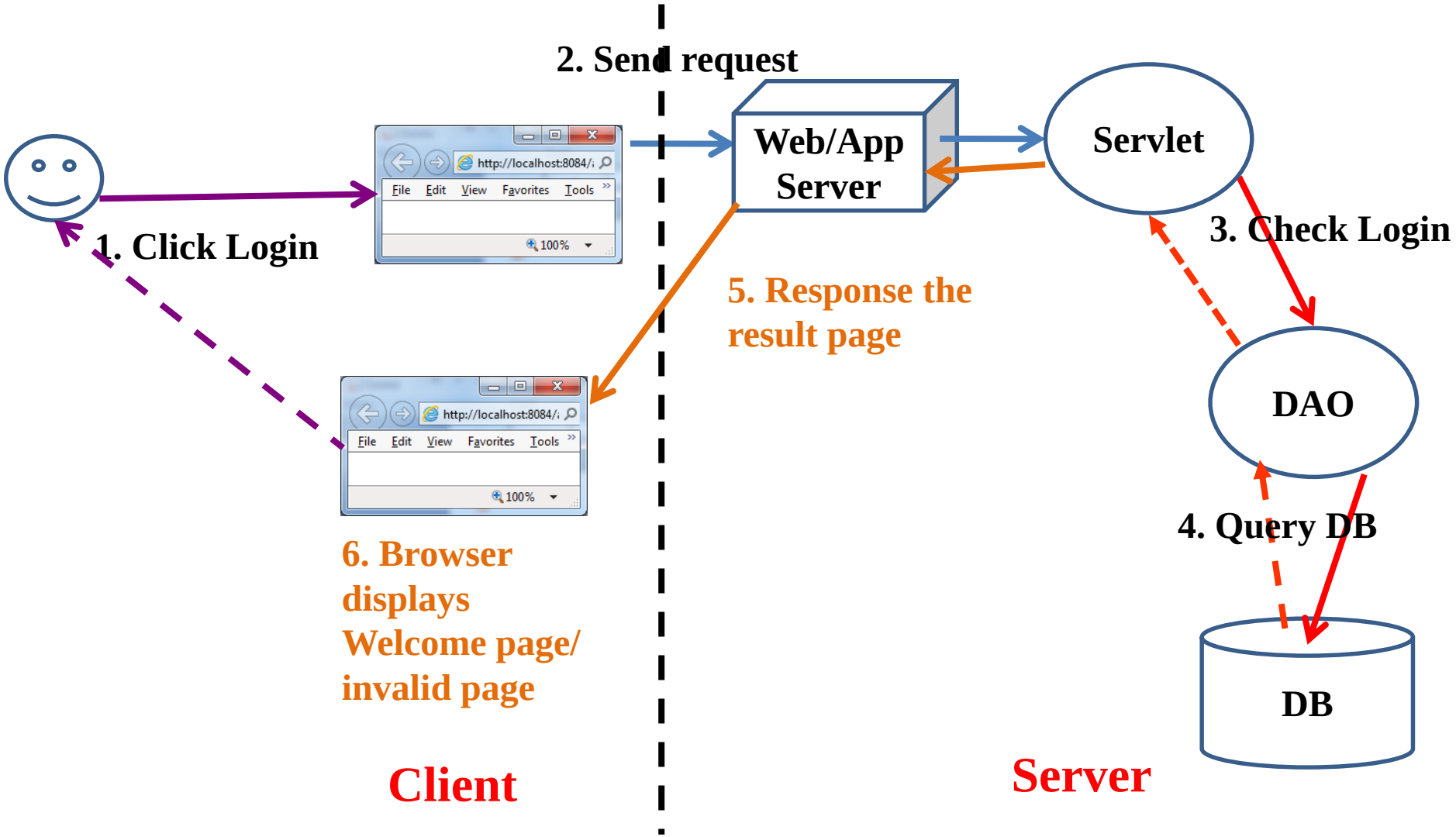
Build The Simple Web

Expectation



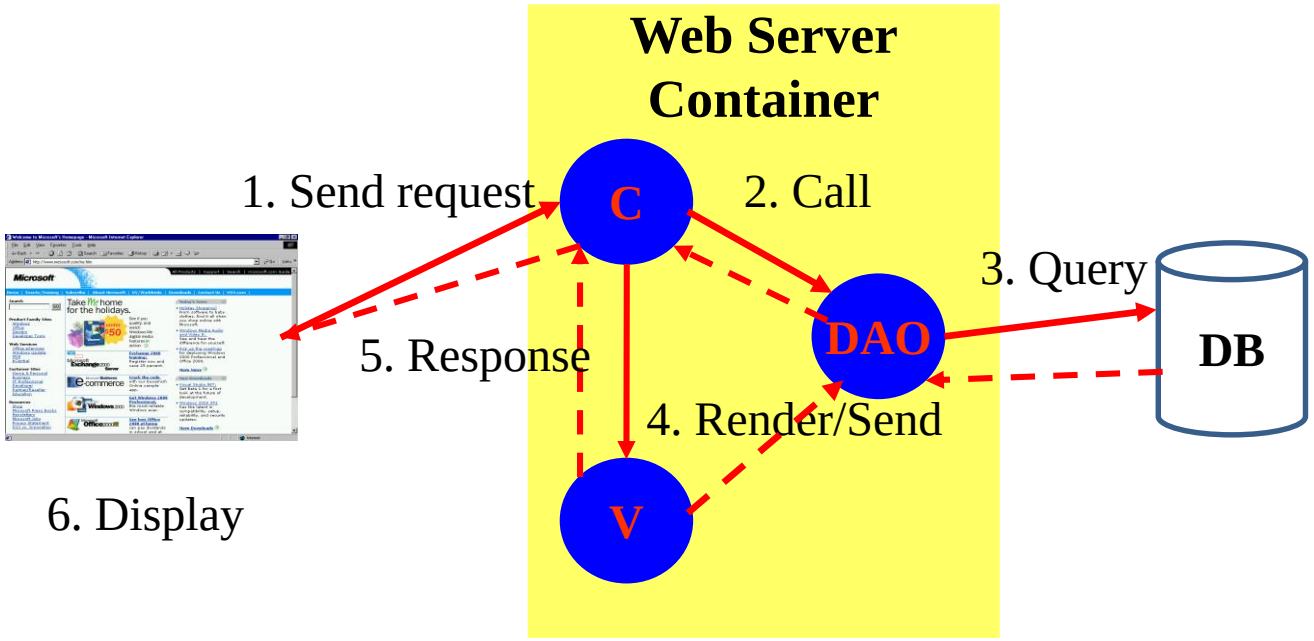
Build The Simple Web

Interactive Server Model



Build The Simple Web

Abstraction



Build The Simple Web

How to Create Web Application Project

- **Requirement tools: NetBeans IDE 7.4/8.0.2/8.1**
- Create a new Web application project
  - ***Using Tomcat Server***
  - ***JavaEE 6***
  - ***Uncheck Deploy on Save***

HTML Introduction

What is HTML?

- **HTML** is a **presentation language** for **describing web pages**.
  - HTML stands for **H**yper **T**ext **M**arkup **L**anguage
  - HTML is **not** a **programming language**, it is a **markup language**
  - A markup language is a set of **markup tags**
  - HTML **uses markup tags** to describe web pages
- **HTML Documents = Web Pages**
  - HTML documents **describe web pages**
  - HTML documents **contain HTML tags** and **plain text**
  - HTML documents are also **called web pages**

HTML Introduction

HTML Tags

- HTML markup tags are usually called **HTML tags**
  - HTML tags are keywords surrounded by **angle brackets, that begin "<"** and **finish with ">",** like <html>
  - HTML tags normally **come in pairs** like and
    - The first tag in a pair is the **start tag,** the second tag is the **end tag**
    - Start and end tags are also called **opening tags** and **closing tags**.
- **Web Browser**
  - The **purpose** of a web browser (like Internet Explorer, or Firefox, etc) is to **read HTML documents and display** them as web pages.
  - The browser **does not display** the HTML tags, but uses the tags to **interpret** the content of the page

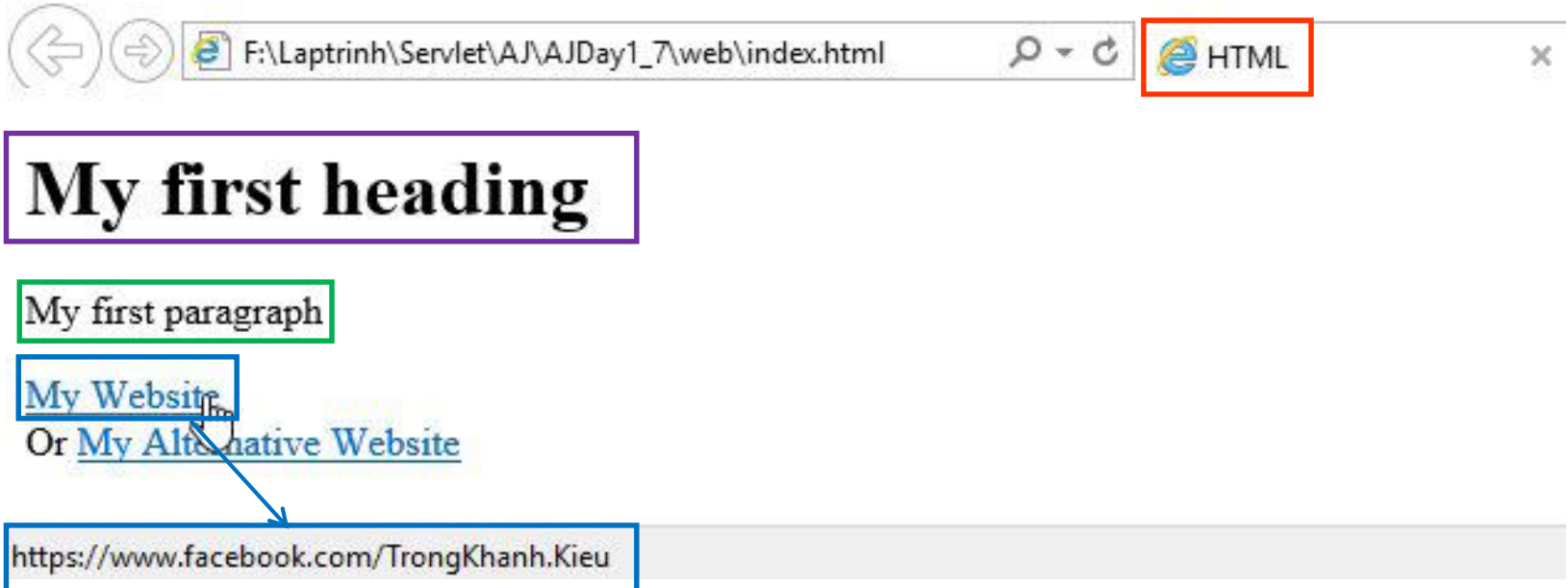
HTML Introduction

Example

index.html

Source | History

```
1  <!--
2  To change this template, choose Tools | Templates
3  and open the template in the editor.
4  -->
5  <!DOCTYPE html>
6  <html>
7      <head>
8          <title>HTML</title>
9          <meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
10     </head>
11     <body>
12         <h1>My first heading</h1>
13         <p>My first paragraph</p>
14         <a href="https://www.facebook.com/TrongKhanh.Kieu">My Website</a> <br/>
15         Or <a href="http://www.kieutrongkhanh.net">My Alternative Website</a>
16     </body>
17 </html>
```



Form Parameters

HTML Form

- A form is defined on a web page **starting** with the opening tag **<form>** and **ending** with closing tag **</form>**
- **Syntax**: <form action="target" [method="HTTP method"]>
  - **action** attribute **presents value** that **contains** some **target resource** in the web application (e.g. Servlet or JSP)
  - **method** attribute **denotes** the **HTTP method** to **execute**. The **default** is to execute **HTTP GET** when the **form is submitted**
  - **Notes**: the **action** parameter **obeys** the **rules**
    - **action="targetServlet":** the browser will **assume** that targetServlet resides in the **same place the default page** as index.jsp or index.html
    - **action="/targetServlet":** the browser will **asume** the the **path at** the **root location** for specified host (http://host:port).
      - **Ex**: http://localhost:8086/targetServlet
    - **action="target?queryString"**:the request **send the data in queryString** to the URL

Form Parameters

Input Tag

- Is used to input data
- **Syntax**: **<input type="…" [value="…" name="…"] />**
  - **type** attribute
    - Dedicates to holding a single line of text (**text**).
      - The **size** attribute specifies the width of text field in characters
      - The **maxlength** attribute controls the maximum number of characters that a user can type into the text field
    - A browser should mask the character typed in by the user (**password**)
    - Being a hidden field – is invisible (**hidden**)
    - Put one or more small boxes that can be clicked to tick or check the corresponding value denote (**checkbox**)
      - **checked="checked"** sets up the checkbox as already selected
    - The choice made is mutual exclusive (**radio**)
      - The **name attribute is crucial** to tying together a group of radio buttons
    - **Send the form data** to the URL designated by the action attribute (**submit**)
    - A request to the client browser to **reset all the values** within the form (**reset**)
    - Defining the "**custom button**" which is **connected** to **some soft of script** (**button**)
  - **name** attribute supplies the **parameter name**
  - **value** attribute supplies the **parameter value**

Form Parameters

Select & Text Area Tag

- HTML Forms – select tag
  - Sets up a **list of values to choose** (combo box or pop-up menu, or list box)
  - **Syntax**: **<select name="…" [size="…" multiple] >**
    <option value="…" [selected]>…</option>
    …
    </select>
    - **option** tag
      - The user-visible text goes between opening and closing option tag
      - The value attribute passes the value in the parameter
    - multiple attribute presents the control that can choose more than one
- HTML Forms – textarea tag
  - Presents **multiple line of text**
  - **Syntax: <textarea name="…" rows="…" cols="…">**
    …
    </textarea>
    - The text value put in opening and closing tag is passed as the parameter value to server
    - **rows** present the number of visible lines
    - **cols** present the number of characters to displayed across the width of the area

Form Parameters

Examples

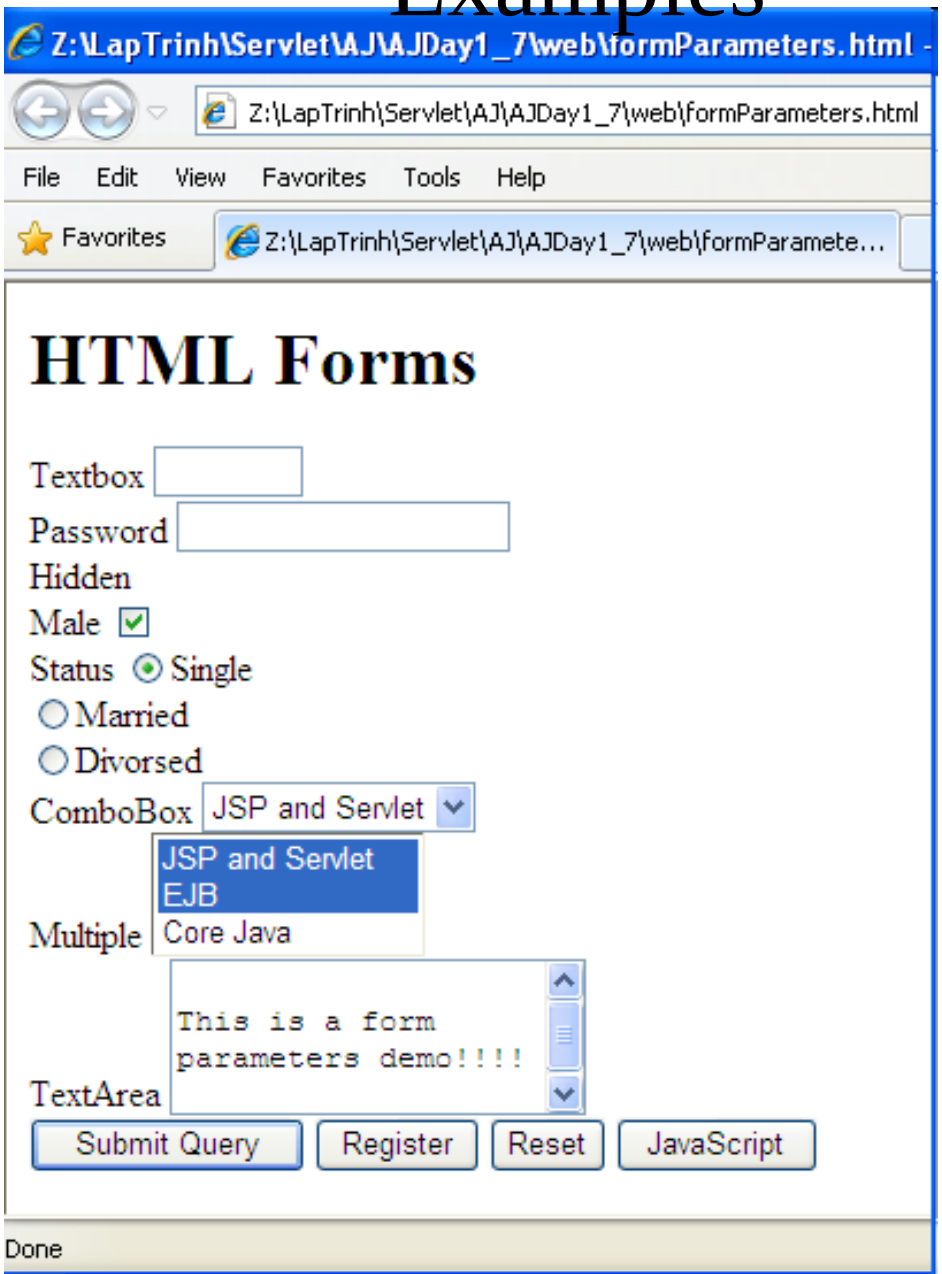
formParameters.html

Source | History

```
11      <body>
12          <h1>HTML Forms</h1>
13          <form action="index.html">
14              Textbox <input type="text" name="txtText" value="" size="5" /><br/>
15              Password <input type="password" name="txtPassword" value="" /><br/>
16              Hidden <input type="hidden" name="txtHidden" value="" /><br/>
17              Male <input type="checkbox" name="chkCheck" value="ON" checked="checked" /><br/>
18              Status
19              <input type="radio" name="rdoStatus" value="Single" checked="checked" />Single<br/>
20              <input type="radio" name="rdoStatus" value="Married" />Married<br/>
21              <input type="radio" name="rdoStatus" value="Divorsed" />Divorsed<br/>
22              ComboBox <select name="txtCombo">
23                  <option value="Servlet">JSP and Servlet</option>
24                  <option value="EJB">EJB</option>
25              </select><br/>
26              Multiple <select name="txtList" multiple="multiple" size="3">
27                  <option value="Servlet" selected>JSP and Servlet</option>
28                  <option value="EJB" selected>EJB</option>
29                  <option value="Java">Core Java</option>
30              </select><br/>
31              TextArea <textarea name="txtArea" rows="4" cols="20">
32                  This is a form parameters demo!!!!
33              </textarea><br/>
34              <input type="submit" name="txtB" />
35              <input type="submit" value="Register" name="action" />
36              <input type="reset" name="txtB" />
37              <input type="button" value="JavaScript" name="txtB" onclick="" />
38          </form>
39      </body>
40  </html>
```

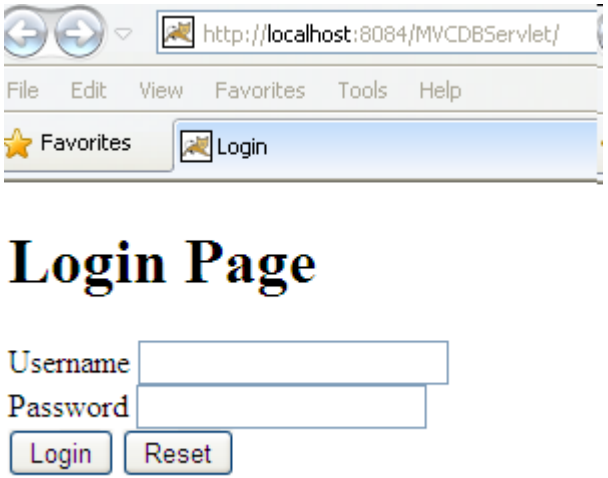
Form Parameters

Examples



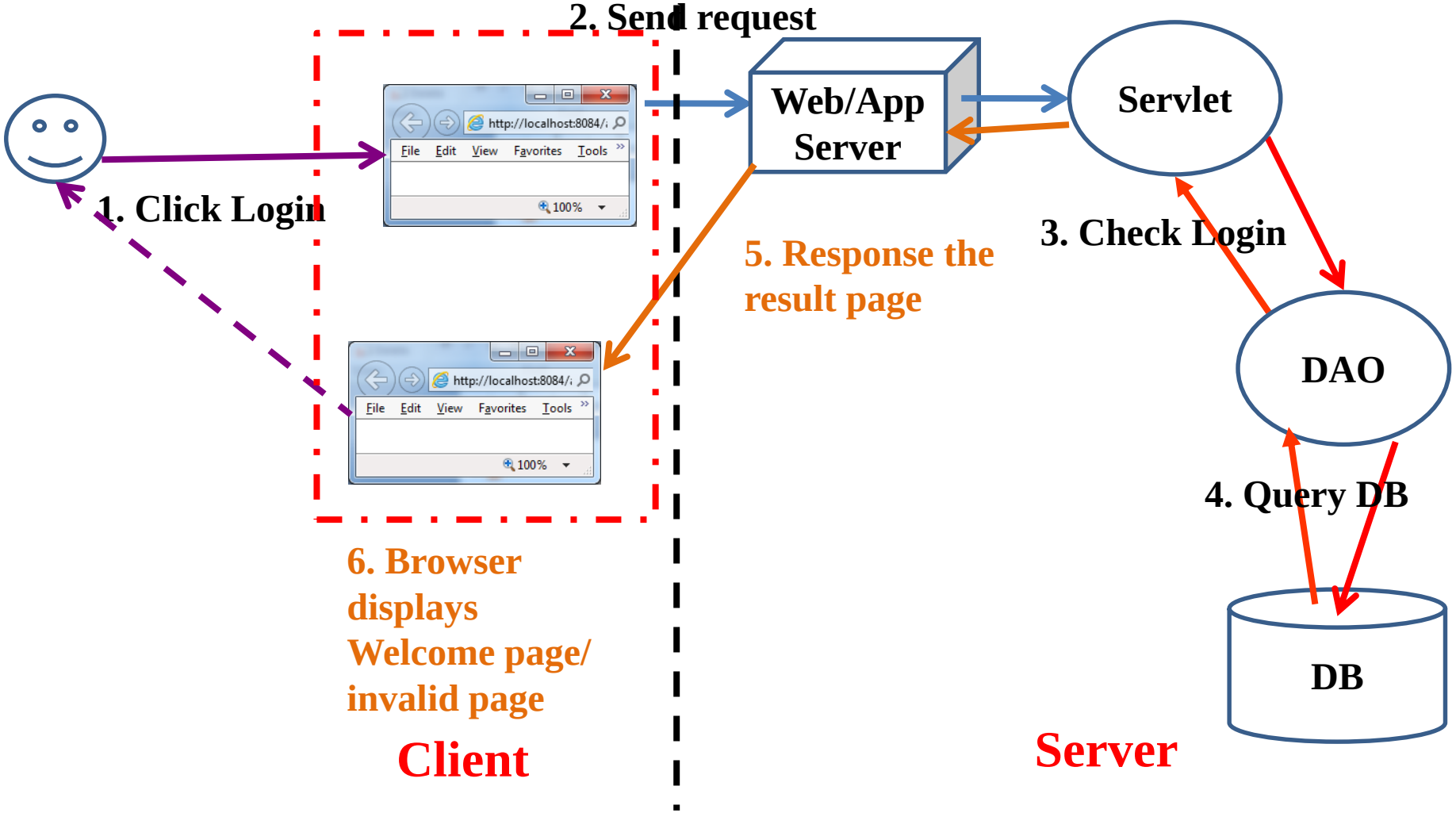
Build The Simple Web

Views



Build The Simple Web

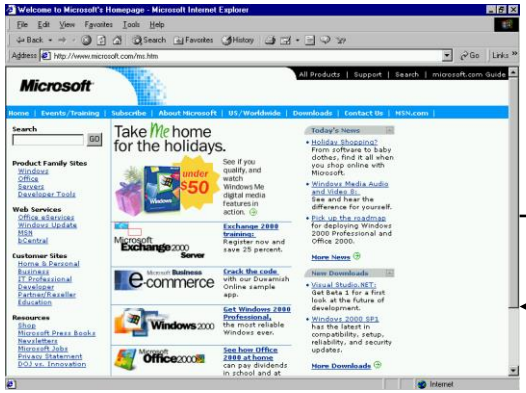
Interactive Server Model

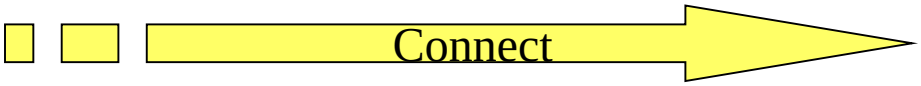


HTTP Protocols

Overview

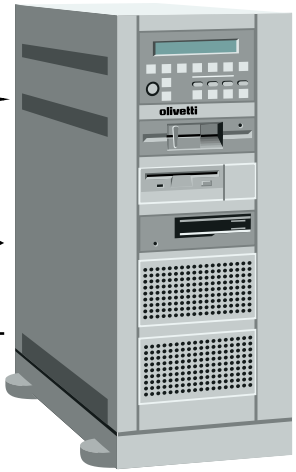
1. Convert http://microsoft.com/ to 192.168.54.3:80





2. Send a request to Web Server (index.html)

4. The result is responsed to Browser



http://microsoft.com/index.html

192.168.54.3:80

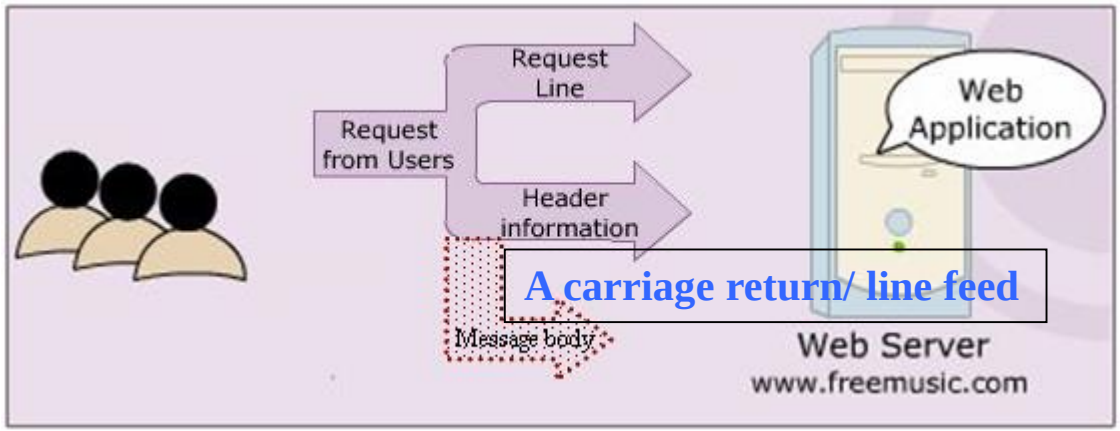
5. Web Browser views the result which contains a markup language

3. Web Server processes a request (connecting DB, calculating, call service …)

- **Request – Response** pairs
- **Stateless**
- Port **80** is default

HTTP Protocols

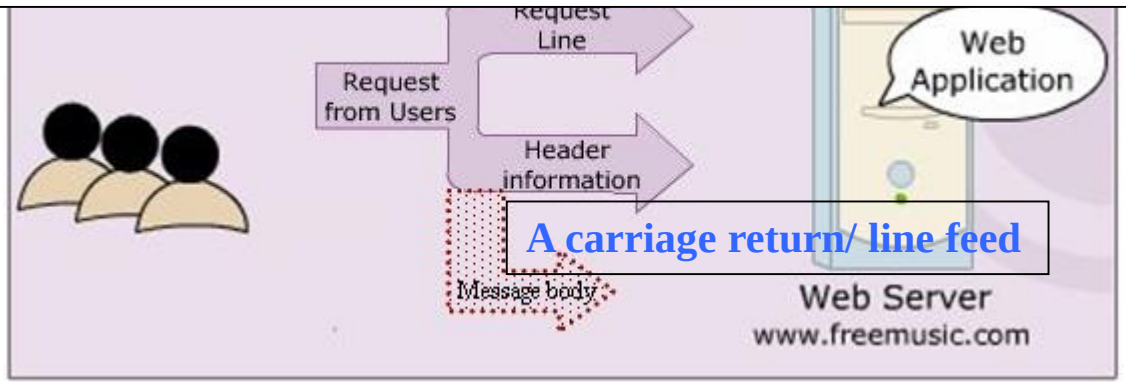
HTTP Requests



HTTP Protocols

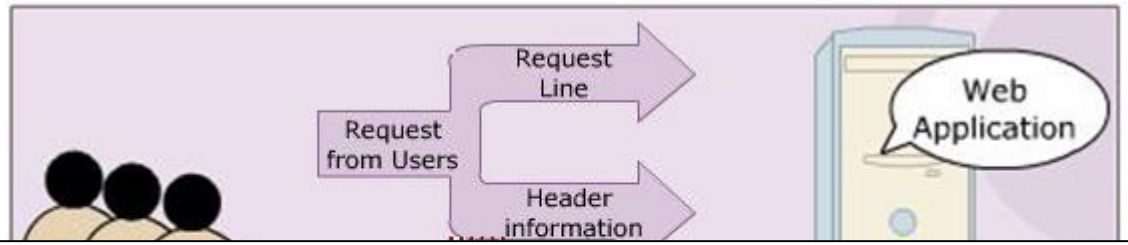
HTTP Requests

- **The HTTP method**
- **A pointer to the resource requested, in the form of a URI**
- **The version of HTTP protocol**
- Ex: **GET** /index.html HTTP/1.1



HTTP Protocols

HTTP Requests

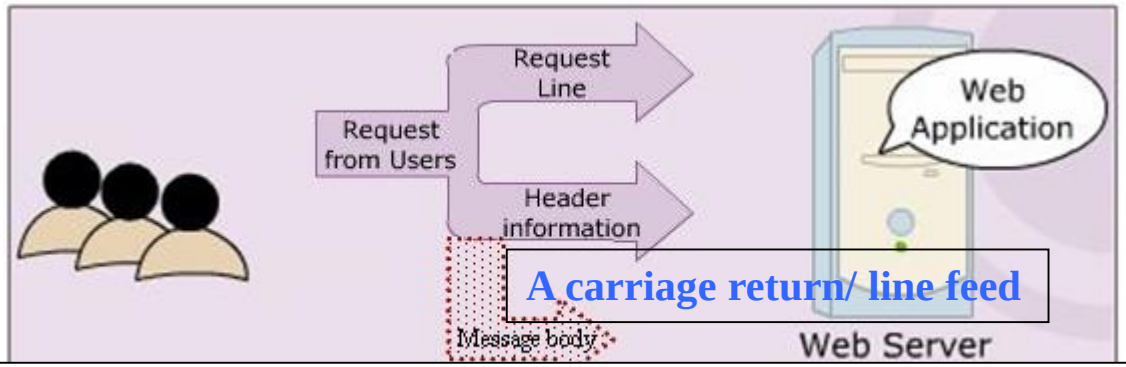


- Return the User-Agent (the **browser**) along **with** the **Accept header** in the form **name:value** (provides information on what media types the client can accept)

- **Ex**: User-Agent: Mozilla/4.0 (compatible: MSIE 4.0 : Windows 95)
Accept : image/gif, image/jpeg, text/*, */*

HTTP Protocols

HTTP Requests



•Contain pretty much any thing (a **set** of **parameters** and **values**, an **image** file intending to upload)

HTTP Protocols

HTTP Requests – Example

HTTP Request Header

```
GET /MVCDemo/ HTTP/1.1
Accept: text/html, application/xhtml+xml, */*
Accept-Language: vi-VN
User-Agent: Mozilla/5.0 (compatible; MSIE 9.0; Windows NT 6.1;
WOW64; Trident/5.0)
Accept-Encoding: gzip, deflate
Host: 192.168.19.128:8084
Connection: Keep-Alive
```

HTTP Request Header

```
GET /MVCDemo/Controller?txtUsername=khanh&txtPass=kieu123&btAction=Login HTTP/1.1
Accept: text/html, application/xhtml+xml, */*
Referer: http://192.168.19.128:8084/MVCDemo/
Accept-Language: vi-VN
User-Agent: Mozilla/5.0 (compatible; MSIE 9.0; Windows NT 6.1; WOW64; Trident/5.0)
Accept-Encoding: gzip, deflate
Host: 192.168.19.128:8084
Connection: Keep-Alive
Cookie: JSESSIONID=2A307CB619854E2F00DDF9630BE91DA7
```

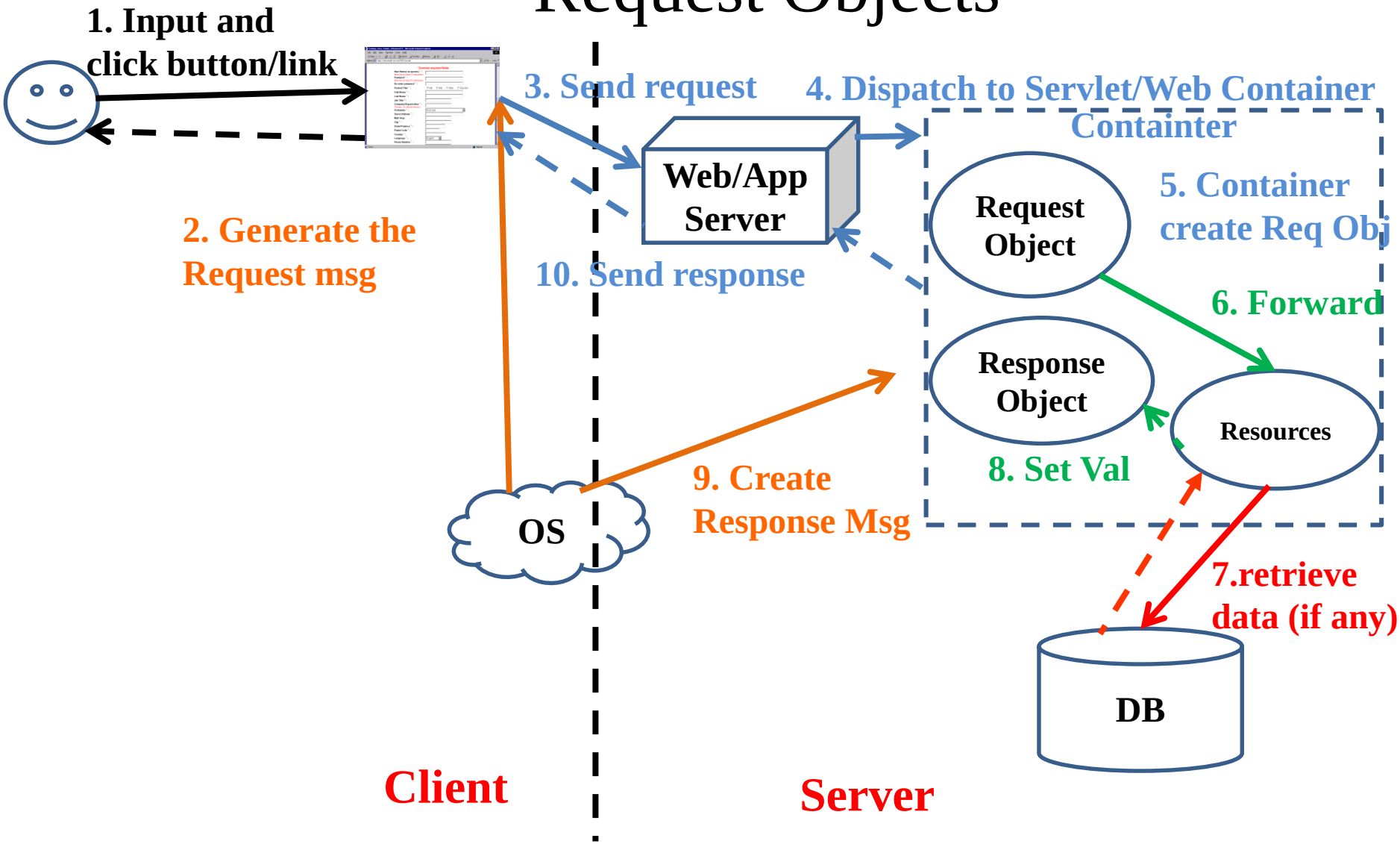
HTTP Protocols

HTTP Requests – Example

HTTP Request Header

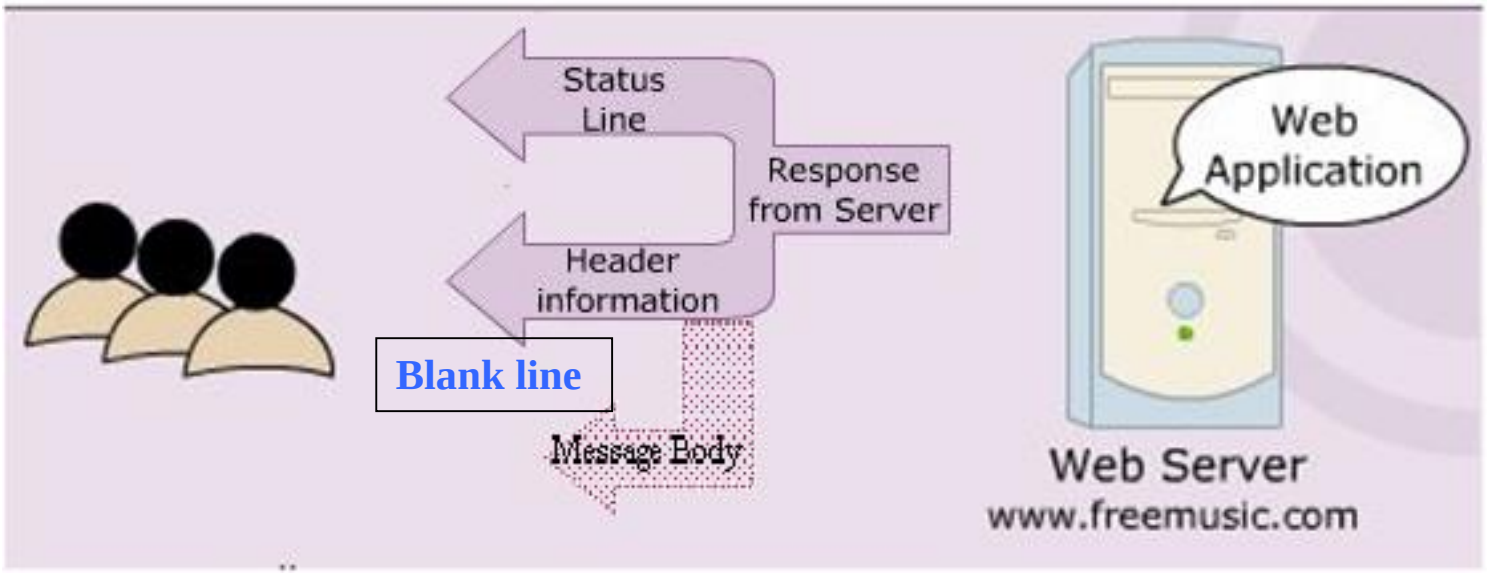
```
POST /MVCDemo/Controller HTTP/1.1
Accept: text/html, application/xhtml+xml, */*
Referer: http://192.168.19.128:8084/MVCDemo/
Accept-Language: vi-VN
User-Agent: Mozilla/5.0 (compatible; MSIE 9.0; Windows NT 6.1; WOW64; Trident/5.0)
Content-Type: application/x-www-form-urlencoded
Accept-Encoding: gzip, deflate
Host: 192.168.19.128:8084
Content-Length: 48
Connection: Keep-Alive
Cache-Control: no-cache
Cookie: JSESSIONID=D717A6BEECAD8631943F050A80D80AA3

txtUsername=khanh&txtPass=kieu123&btAction=Login
```

The Servlet Model
Request Objects



HTTP Protocols

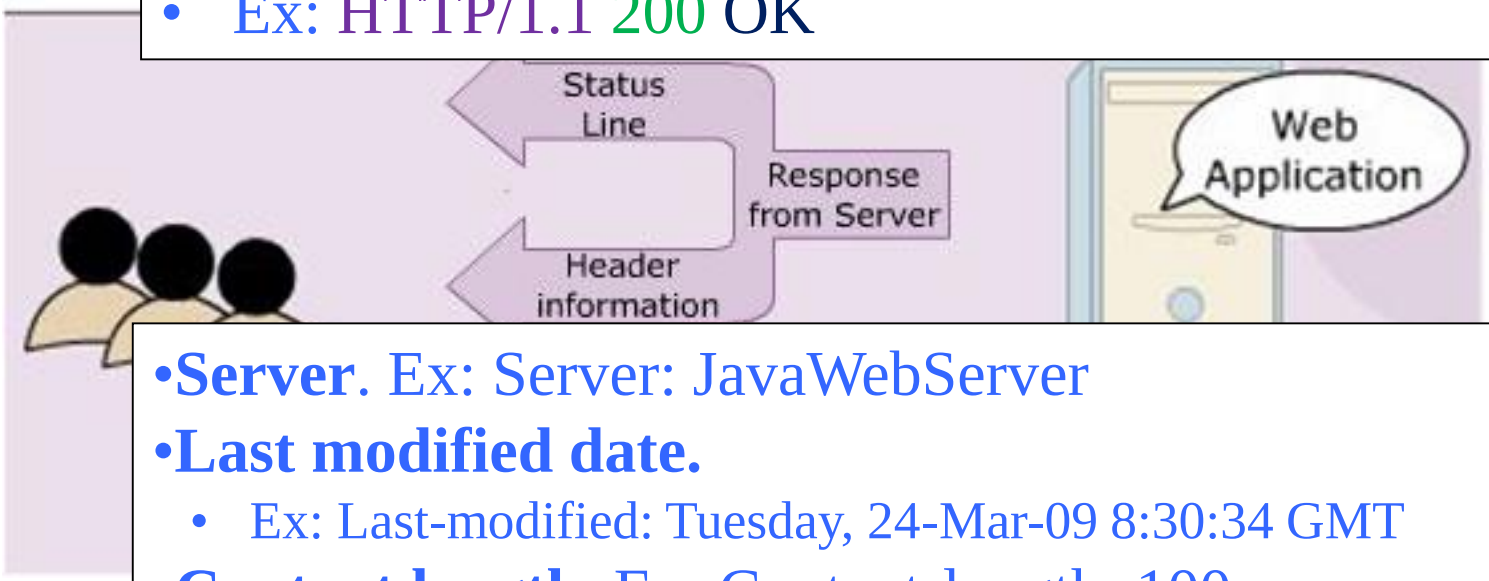
HTTP Responses



HTTP Protocols

HTTP Responses

- **Indicates status of request process (HTTP version, response code, status)**
- Ex: HTTP/1.1 200 OK



- **Server**. Ex: Server: JavaWebServer
- **Last modified date.**
  - Ex: Last-modified: Tuesday, 24-Mar-09 8:30:34 GMT
- **Content length**. Ex: Content-length: 100
- **Content type**. Ex: Content-type: text/plain

HTTP Protocols

HTTP Responses – Example

HTTP Response Header

```
HTTP/1.1 200 OK
Server: Apache-Coyote/1.1
Set-Cookie: JSESSIONID=2A307CB619854E2F00DDF9630BE91DA7; Path=/MVCDemo
Content-Type: text/html;charset=UTF-8
Content-Length: 635
Date: Tue, 21 Jun 2011 08:55:30 GMT
```

HTTP Response Header

```
HTTP/1.1 404 Not Found
Server: Apache-Coyote/1.1
Content-Type: text/html;charset=utf-8
Content-Length: 1003
Date: Tue, 21 Jun 2011 09:16:03 GMT
```

HTTP Protocols

HTTP Responses – Example

HTTP Response Header

```
HTTP/1.1 200 OK
Content-Length: 28620324
Content-Type: application/x-zip-compressed
Last-Modified: Sat, 18 Jun 2011 07:13:16 GMT
Accept-Ranges: bytes
ETag: "38b4f031872dcc1:258a"
Server: Microsoft-IIS/6.0
X-Powered-By: ASP.NET
Date: Tue, 21 Jun 2011 09:21:56 GMT
```

HTTP Protocols

Some commonly Status codes

Code	Associated Message	Meaning
101	Switching Protocols	- Server will **comply** with **Upgrade header** and **change** to **different protocol**. (New in HTTP 1.1)
200	OK	- **Everything** is **fine**; document follow - **Default** for servlets
201	Created	- Server **created** a **document** - The Location header indicates its URL
203	Non-Authoritative Information	- Document is being **returned normally**, **but** some of the **response headers** might be **incorrect** since a **document copy is being used**.
204	No Content	- Browser should **keep displaying previous** document
301	MovedPermanently	- **Document is moved to** a **separate location** as mentioned in the URL. - The page is **redirected to the mentioned URL**, to find the document
302	Found	- Temporary **replacement of file** from one location to the other as specified

HTTP Protocols

Some commonly Status codes

Status code	Associated Message	Meaning
400	Bad Request	- The **request placed** is **syntactically incorrect**
401	Unauthorized	- Authorization **not given to access** a password protected page
403	Permission denied	- **Authentication but authorization not given** to access protected resource
404	Not Found	- **Resource not found** in the specified address
408	Request Timeout	- **Time taken** by **client** is **very long to send** the **request** (only available in HTTP 1.1)
500	Internal Server Error	- Server is unable to locate the requested file. The servlet has been **deleted or crashed or** had been moved to a new location with out informing
503		- Indicates that the **HTTP server is temporarily overloaded,** and unable to handle the request
…	…	-…

HTTP Protocols

HTTP Methods – Basic

- **GET**
  - Is the method commonly used to **request a resource/ get information** *(access static resource such as HTML doc and images or retrieve dynamic information such as query parameters)* **from server**
  - The **restricted length of query string**, that is introduced by the question mark "?"
  - Is **trigger** by
    - **Typing** into the address line of the browser and pressing GO
    - **Clicking** on a **link** in a web page
    - **Pressing** the **submit button** in an HTML **form** with **GET method**
- **POST**
  - **Sends** data of **unlimited length** to the web server.
  - Is the method commonly used for passing user input/ sending information to the server (***access dynamic resources*** *and* ***enable secure data*** *in HTTP request because the request parameters are passed in the body of request*)
  - **No limit** and **cannot be booked mark** or emailed

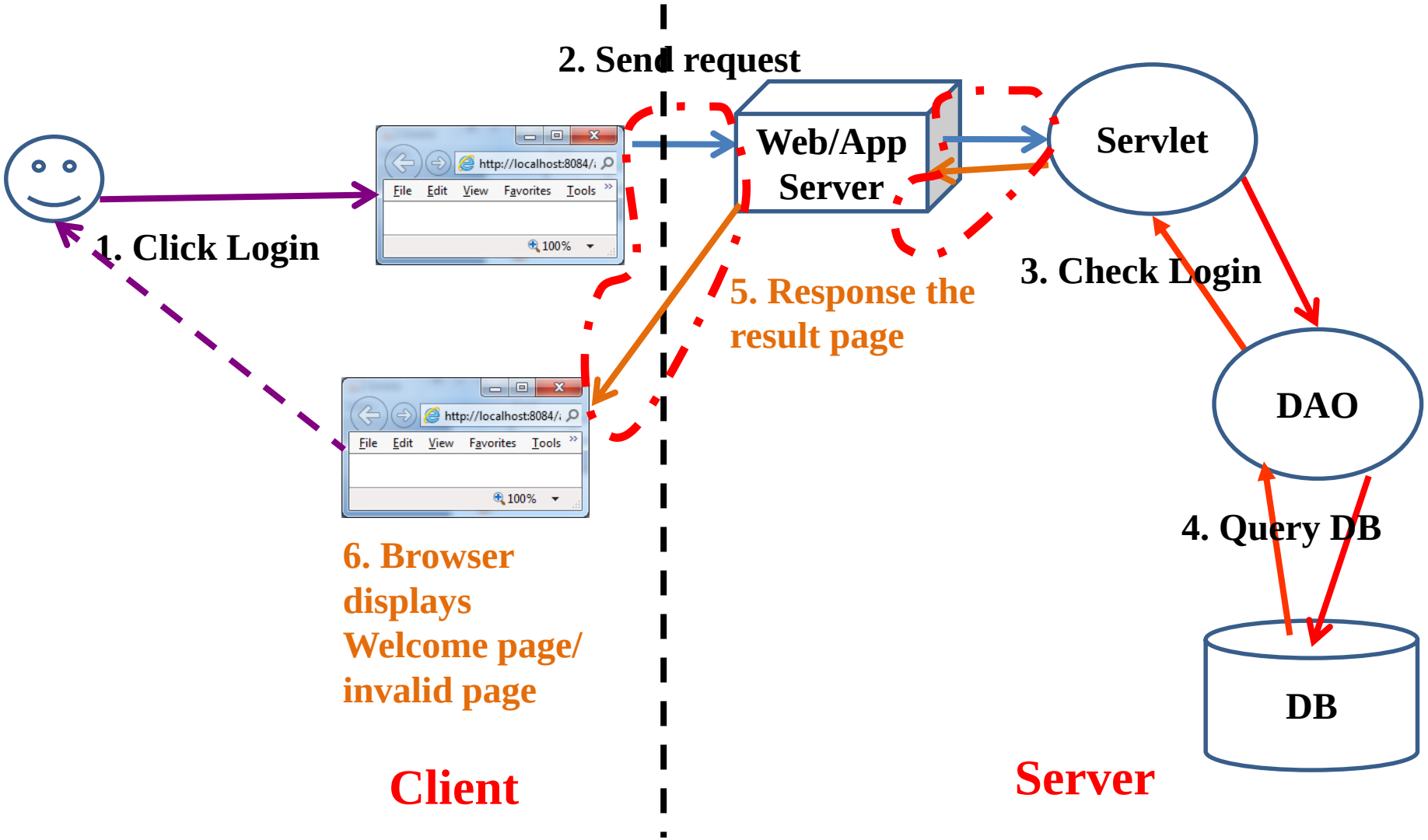
HTTP Protocols

HTTP Methods – Extends

- **HEAD**
  - **Returns** the **headers** identified by the **request** URL.
  - Is identical to the GET method but it doesn't return a message body
  - Is an economical way of checking that a resource is valid and accessible
- **OPTIONS**
  - **Returns** the **HTTP methods** the server supports.
- **PUT**
  - **Requests** the server to **store** the **data** enclosed in the HTTP message body **at a location provided in the request URL.**
- **DELETE**
  - **Requests** the server to **delete** the **resource identified** by the request URL.
- **TRACE**
  - Is **used** for **debugging** and **testing** the **request** sent to the server. It is **useful** when the **request** sent to the **server reaches** through the proxies.
- **Idempotency** and **Safety**
  - GET, TRACE, OPTIONS, and HEAD

Build The Simple Web

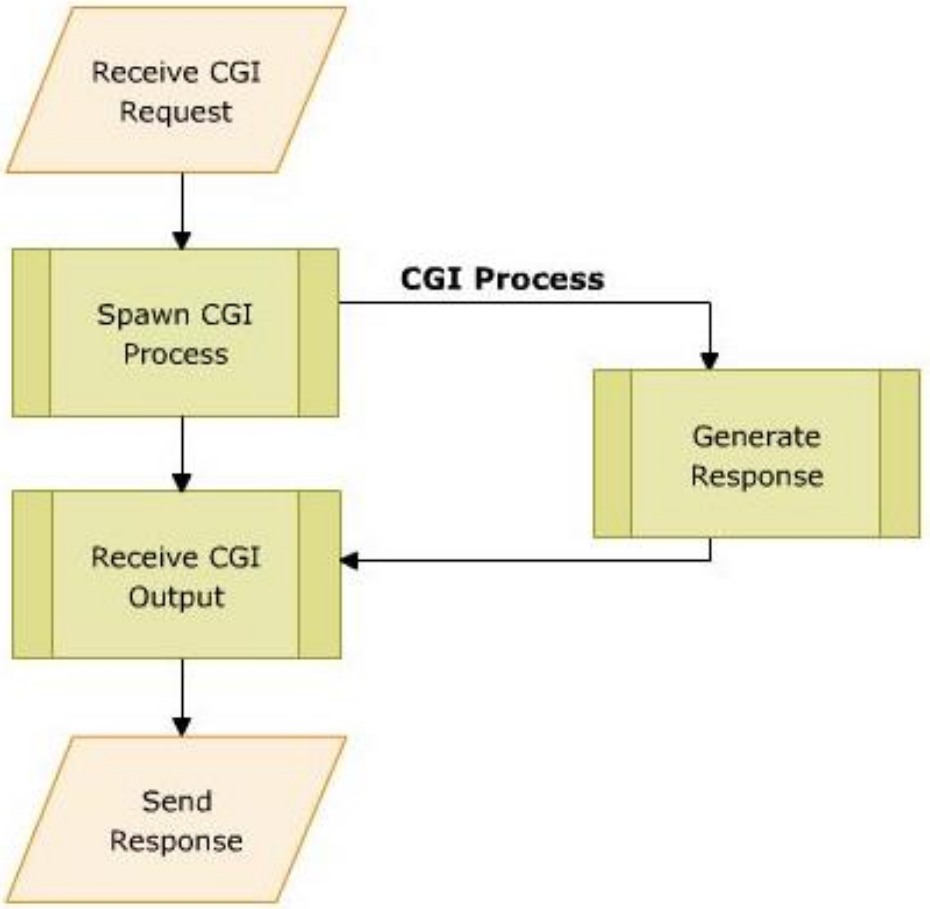
Interactive Server Model



The Servlet Model

Common Gateway Interface (CGI)

- A **small program (*.exe)** is **written** in **languages** such as **C/C++, Perl**, ... for the gateway programs.
- Used in complex applications, such as **Web pages**
- A set of standards followed to **interface applications form client side** to a Web Server
- Enables the Web server to send information to other files and Web browsers
- Helps to **process the inputs** to the form on the Web page
- Enables to **obtain information** and use it on the server machine (server side)
- When the **Browser sends request** to server, **CGI instantaties** to **receive and process**.

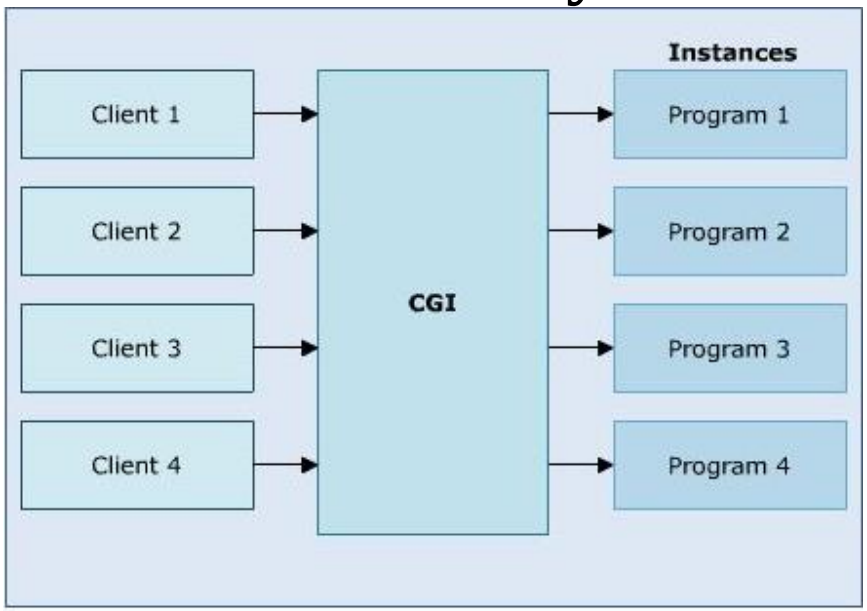


Server Process for running CGI

The Servlet Model

Common Gateway Interface (CGI)

- Disadvantages
  - **Reduced efficiency**



CGI process

The Servlet Model

Common Gateway Interface (CGI)

- Disadvantages
  - **Reduced efficiency**
  - **Reloading Perl interpreter**
    - The widely accepted platform for writing CGI script is Perl. Each time the server receives are quest, the Perl interpreter needs to be reloaded.
  - **Interactive**: not suitable for graphical or highly interactive programs
  - **Time consuming and more memory consumed**
  - **Debugging**: error detection is difficult
  - **Not support Session**

The Servlet Model

Servlets

- Are **Java classes** that **dynamically process** HTTP **requests** and **construct responses**
- Are **Java codes** that are used to **add dynamic** content to Web server.
- There is **only a single instance** of Servlet created on the Web server.
- To **service multiple clients' request**, the Web server **creates multiple threads** for the same Servlet instance (**Overcome CGI's consumed more memory**)
- Gets **auto refreshed** on receiving a request each time
- A Servlet's **initializing code** is used **only** for initializing **in the 1st time**
- **Merits**
  - Enhanced efficiency (initializing only once, auto refresh)
  - Ease to use (using Java combining HTML)
  - Powerful (using Java)
  - Portable
  - Safe and cheap
- **Demerits**
  - **Low-level HTML documentation** (Static well-formed-ness is not maintained)
  - **Unclear-session management** (flow of control within the codes is very unclear)

The Servlet Model

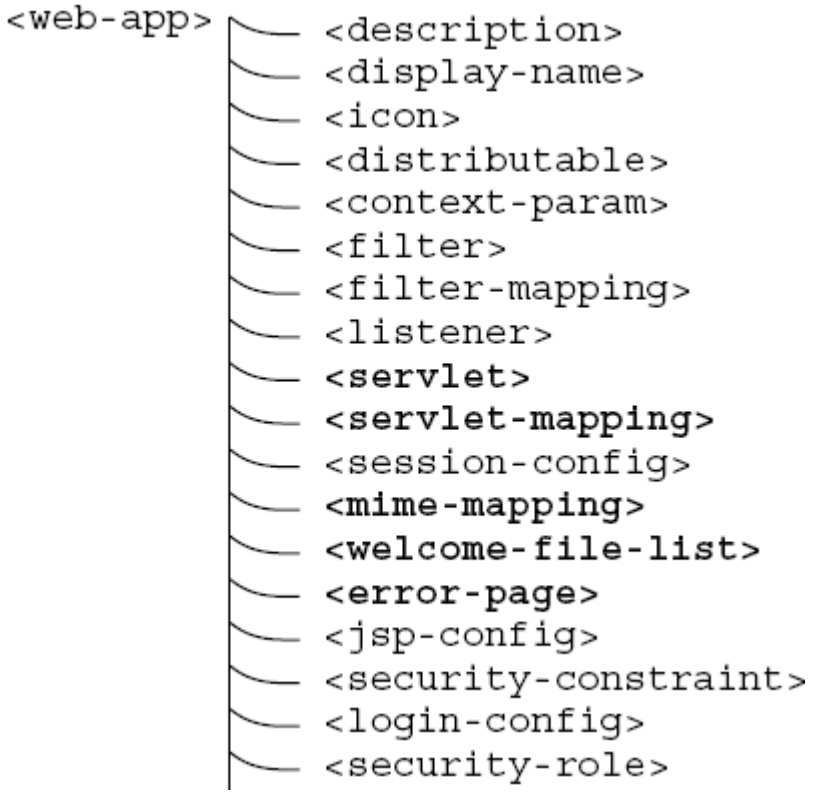
Servlets

- How to server **detecting** the **servlets** (difference from Java class), then, **initializing in the 1st time?**
  - **Web deployment descriptors (web.xml)**
  - **Annotations**

The Servlet Model

The Deployment Descriptor

- The Web Deployment Descriptor file **describes all** of **Web components**
- It is an **XML file**. Given that the name is **web.xml.**



The Servlet Model

The Deployment Descriptor – web.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<web-app version="2.5" xmlns="http://java.sun.com/xml/ns/javaee"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://java.sun.com/xml/ns/javaee
    http://java.sun.com/xml/ns/javaee/web-app_2_5.xsd">
    <servlet>
        <servlet-name>servlet name</servlet-name>
        <servlet-class>package.classname</servlet-class>
    </servlet>
    <servlet-mapping>
        <servlet-name>servlet name</servlet-name>
        <url-pattern>/context Path/root</url-pattern>
    </servlet-mapping>
    <session-config>
      <session-timeout>30</session-timeout>
     </session-config>
    <welcome-file-list>
        <welcome-file>default page to show</welcome-file>
    </welcome-file-list></web-app>
```

Servlets Declaration is same as **package.classname servlet_name;**

Define the access path to the servlet**;**

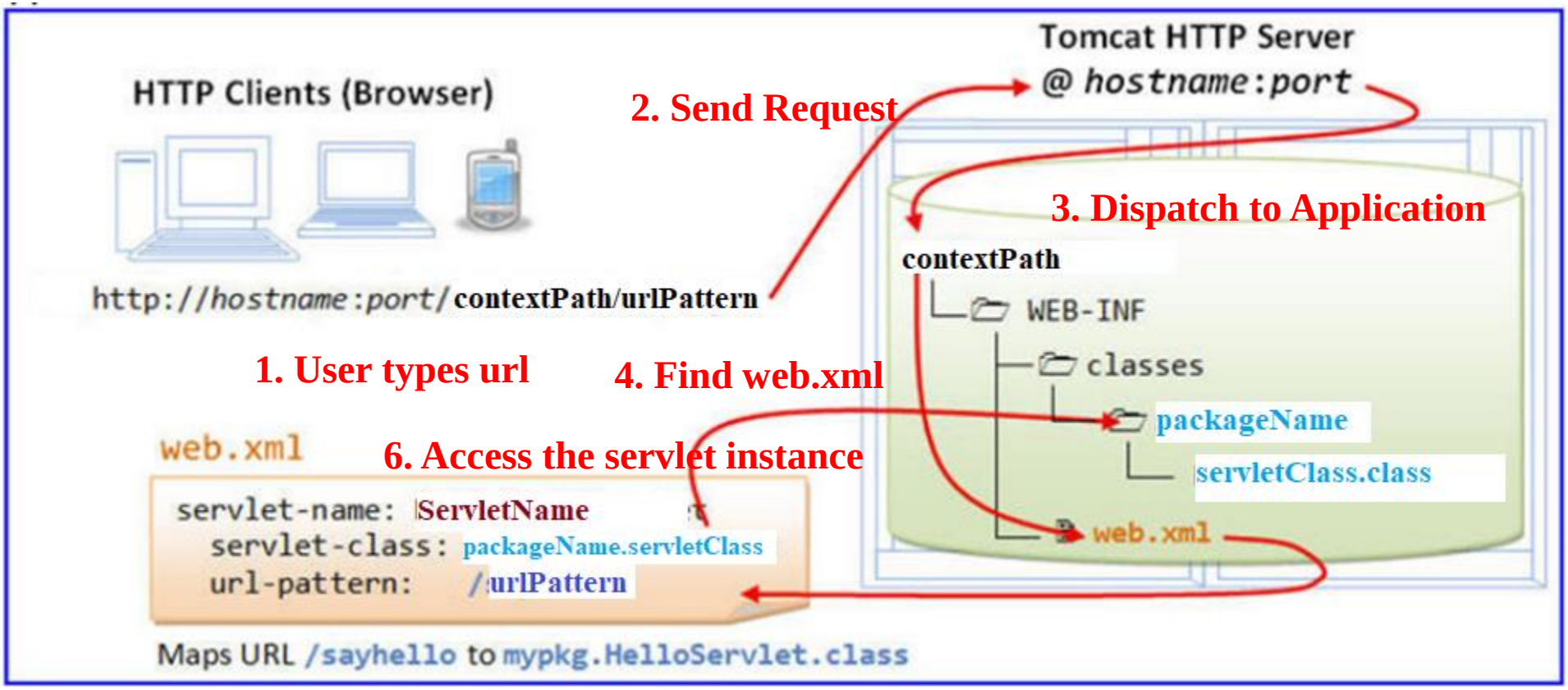
The Servlet Model

The Deployment Descriptor – Example

```
<?xml version="1.0" encoding="UTF-8"?>
<web-app version="2.5" xmlns="http://java.sun.com/xml/ns/javaee"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://java.sun.com/xml/ns/javaee
    http://java.sun.com/xml/ns/javaee/web-app_2_5.xsd">
    <servlet>
        <servlet-name>HelloServlet</servlet-name>
        <servlet-class>servlet.sample.HelloServlet</servlet-class>
    </servlet>
    <servlet-mapping>
        <servlet-name>HelloServlet</servlet-name>
        <url-pattern>/HelloServlet</url-pattern>
    </servlet-mapping>
    <session-config>
      <session-timeout>30</session-timeout>
     </session-config>
    <welcome-file-list>
        <welcome-file>HelloServlet</welcome-file>
    </welcome-file-list></web-app>
```

The Servlet Model

The Deployment Descriptor – Example



5. Look up the servlet class from mapping to find the servlet instance web.xml

The Servlet Model

Annotations

- Are one of the **major advancement** from Java EE 5.0 that makes the standard **web.xml deployment descriptors** files **optional**
  - To **avoid writing** such kind of **unnecessary codes**, annotations are used
- Can be defined as **metadata information** that can be **attached** to an element **within the code** to characterize it
  - Simplifies the **developer's work** to a great extent by significantly **reducing** the **amount of code** to be **written** by moving the metadata information into the source code itself
- Are **never executed and processed** when the code containing it are **compiled or interpreted by compilers, deployment tools**, and so on
- An annotation type takes **an 'at (@)' sign**, followed by the interface keyword and the annotation name

The Servlet Model

Annotations – Servlets

- The javax.servlet.**annotation** package provides annotations to declare Servlets by specifying metadata information in the Servlet class

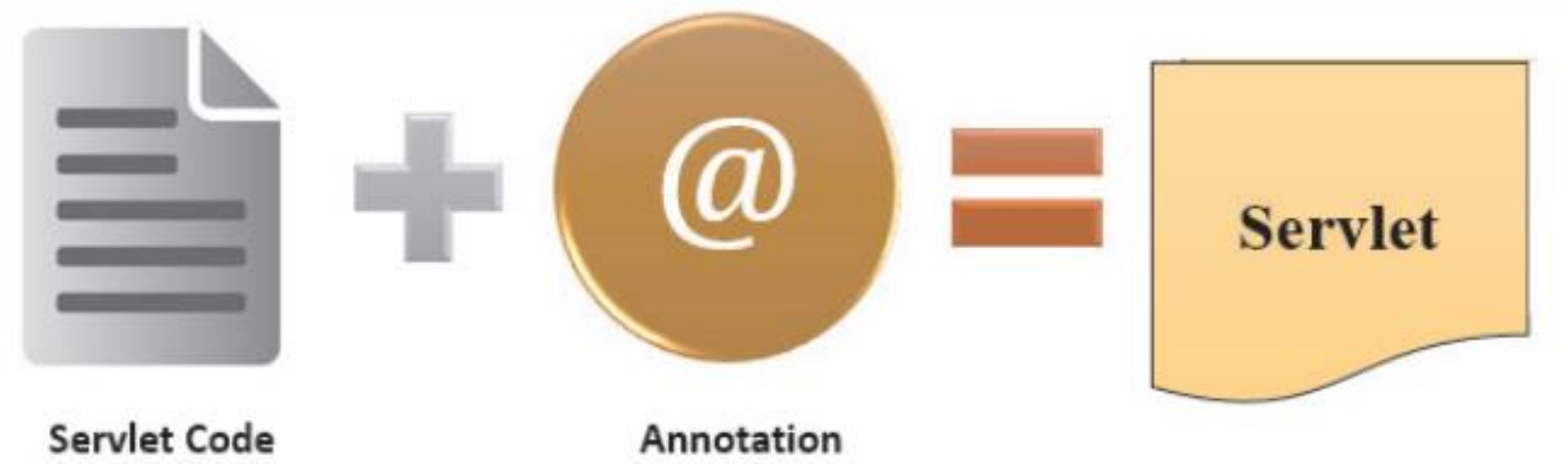


Figure 4.9: Servlet with Annotations, Web Component Development Using Java, Aptech World Wide

The Servlet Model

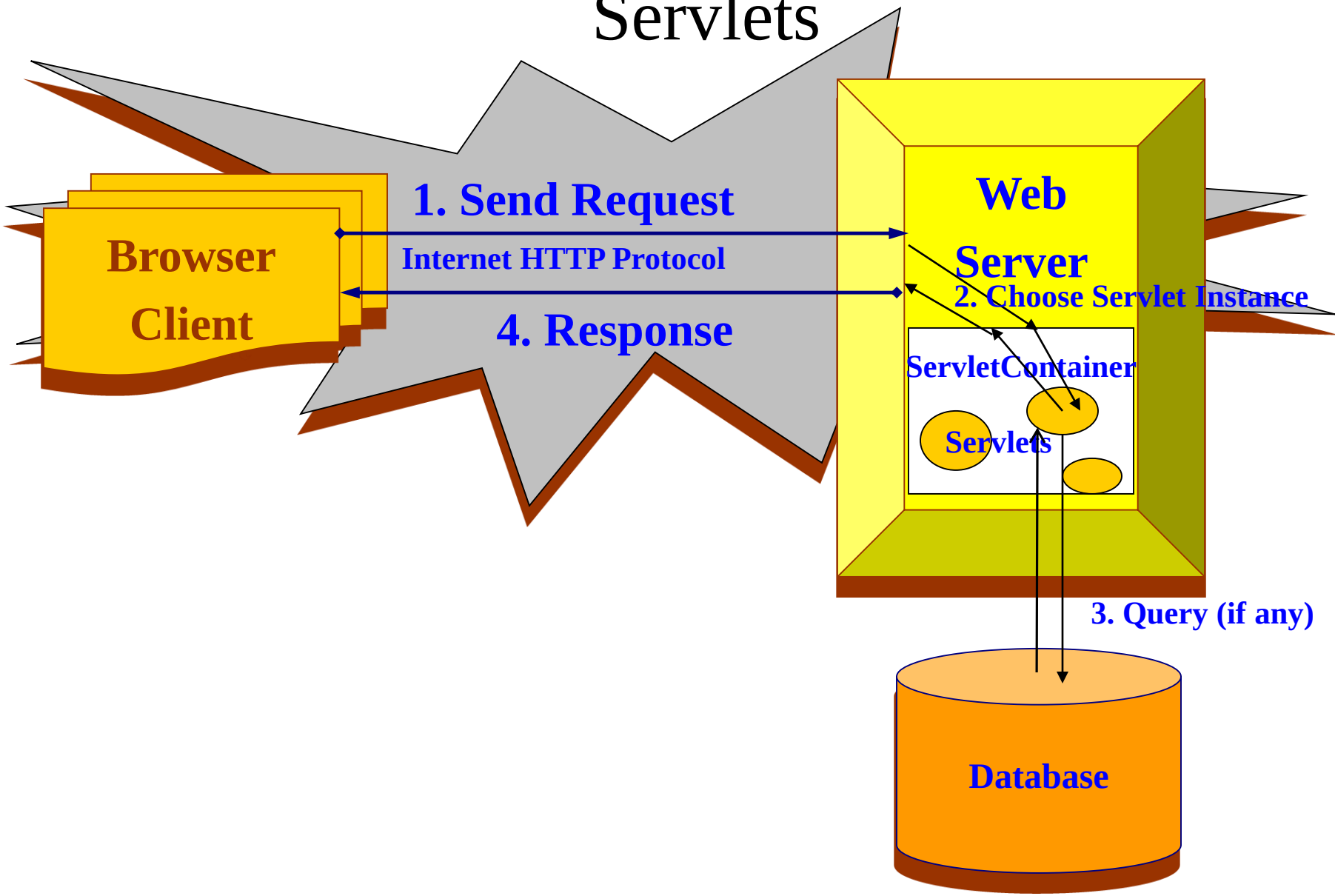
Annotations – Servlets

- **WebServlet**
  - Is used to provide the **mapping information of the Servlet**.
  - Is processed by the servlet container at the time of the **deployment**.

Attributes	Descriptions
name	Specifies the Servlet name. This attribute is optional.
urlPatterns	An array of url patterns use for accessing the Servlet, this attribute is required and should register one url pattern
initParams	An array of @WebInitParam, that can be used to pass servlet configuration parameters. This attribute is optional.
...	

The Servlet Model

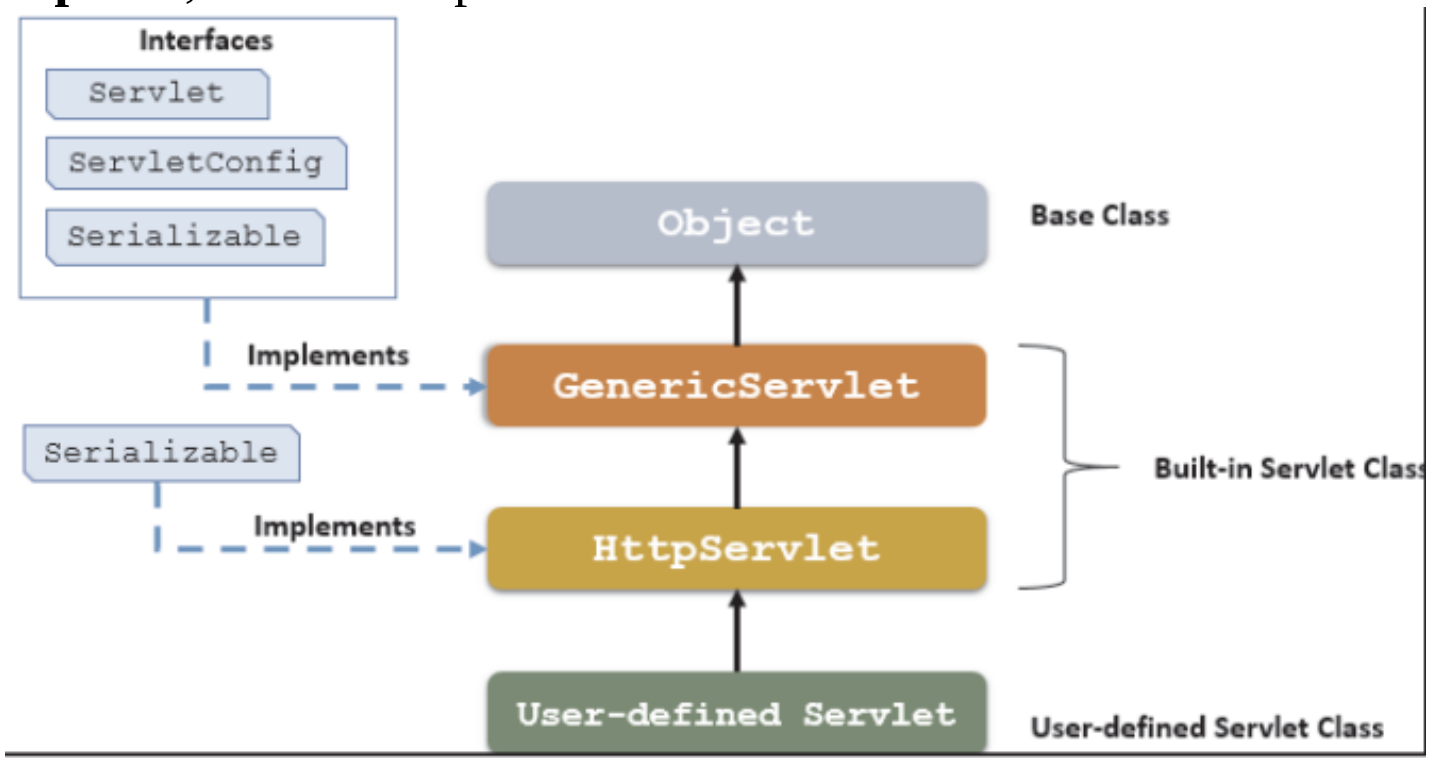
Servlets



The Servlet Model

Architecture of the Servlet packages

- The ***javax.servlet*** package provides interfaces and classes for writing servlets
  - The important interface is **javax.servlet.Servlet**
- When a servlet accepts a call from a client, it receives two objects:
  - **ServletRequest**, which encapsulates the communication from the client to the server.
  - **ServletResponse**, which encapsulates the communication from the servlet to the client.



The Servlet Model

GenericServlet class

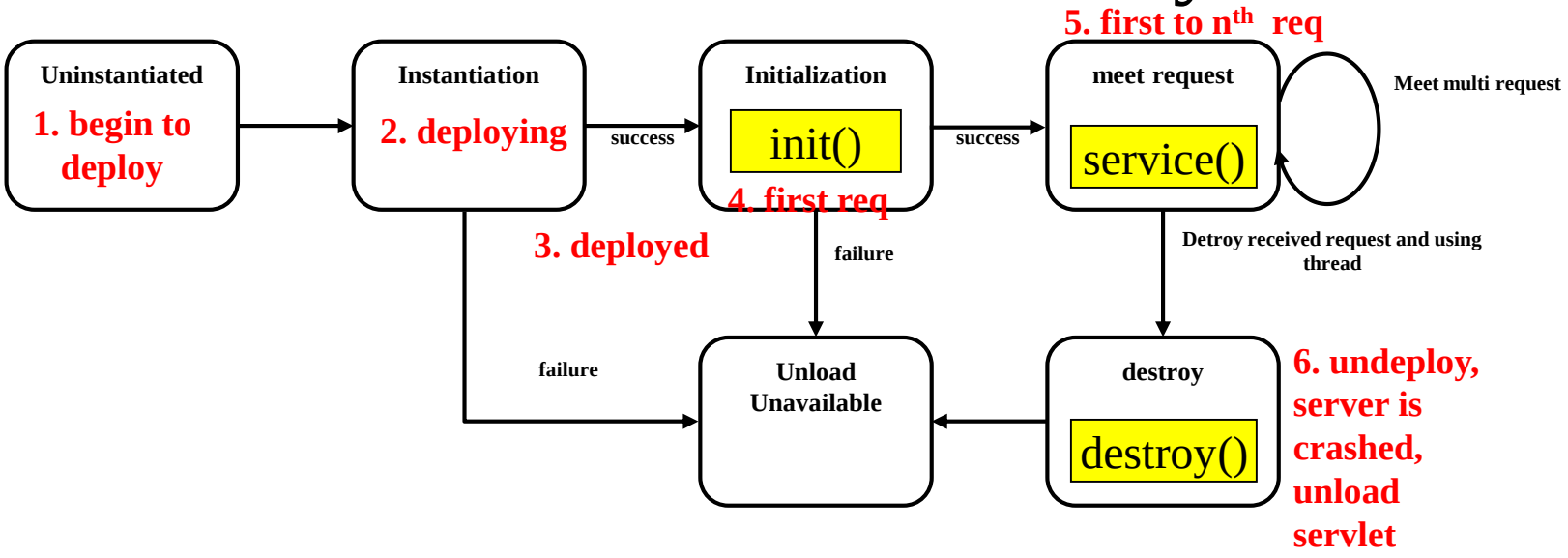
- Defines a **servlet** that **is not protocol dependent**
- **Implements** the **Servlet**, the **ServletConfig**, and the **java.io.Serializable** interfaces
- **Retrieves** the **configuration information** by implementing the ServletObject
- Some methods

Methods	Descriptions
init	- **public void init() throws ServletException** - Initializes the servlet
service	- **public abstract void service(ServletRequest req, ServletResponse res) throws ServletException, IOException** - Called by the container to respond to a servlet request
destroy	- **public void destroy():** cleaning the servlet

Servlet Life Cycle defined in Generic

The Servlet Model

The Servlet Life Cycle



The life cycle is defined by

- **init()** – called only one by the server in the first request
- **service()** – process the client's request, dispatch to doXXX() methods
- **destroy()** – called after all requests have been processed or a server-specific number of seconds have passed

The Servlet Model

The Servlet Life Cycle – Example

LifeCycleServlet.java

```
16      * @author Trong Khanh
17      */
18     public class LifeCycleServlet extends HttpServlet {
19         private int a = 0;
20         public void init() throws ServletException {
21             super.init();
22             System.out.println("init");
23             a += 5;
24             System.out.println("a = " + a);
25         }
26         /**...*/
33         protected void processRequest(HttpServletRequest request, HttpServletResponse response)
34                 throws ServletException, IOException {
35             response.setContentType("text/html;charset=UTF-8");
36             PrintWriter out = response.getWriter();
37             try {
38                 out.println("<html>");
39                 out.println("<head>");
40                 out.println("<title>Servlet</title>");
41                 out.println("</head>");
42                 out.println("<body>");
43                 out.println("<h1>Servlet Life Cycle</h1>");
44
45                 a += 10;
46                 out.println("a = " + a);
47             } finally {
48                 out.close();
49             }
50         }
```

The Servlet Model

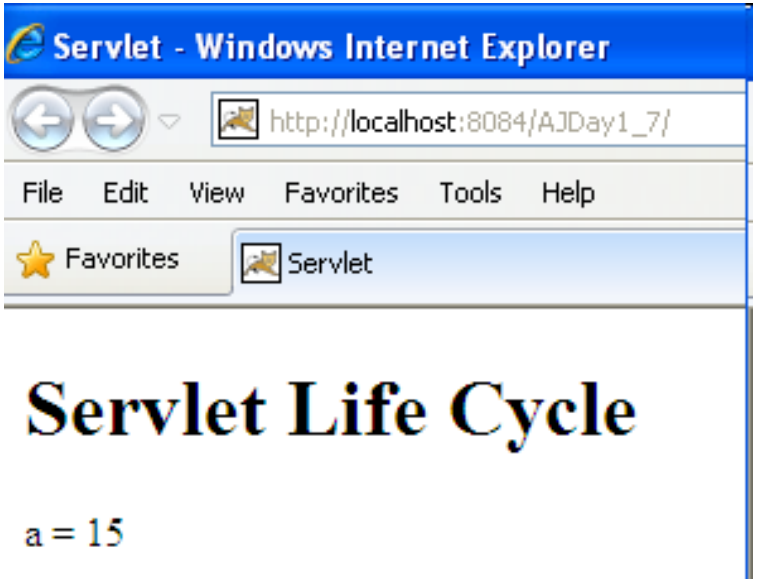
The Servlet Life Cycle – Example

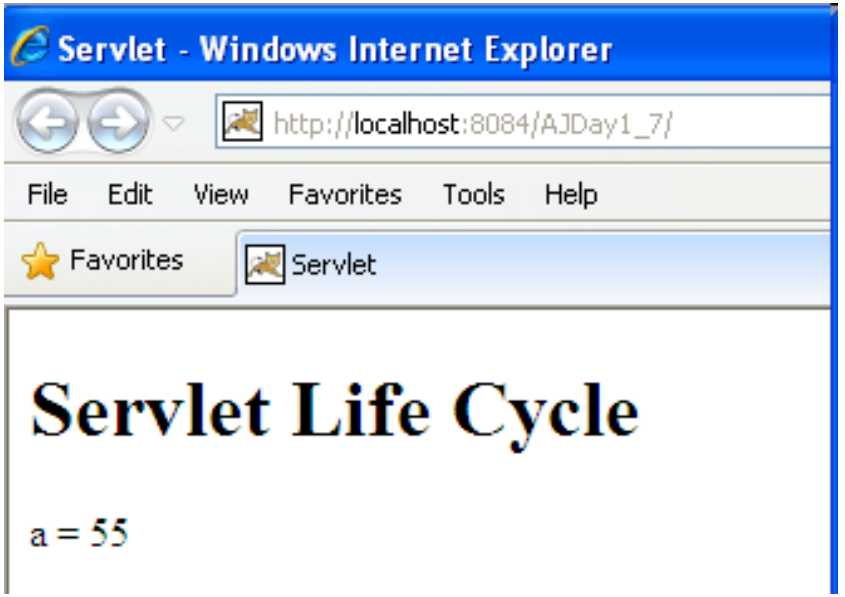
LifeCycleServlet.java

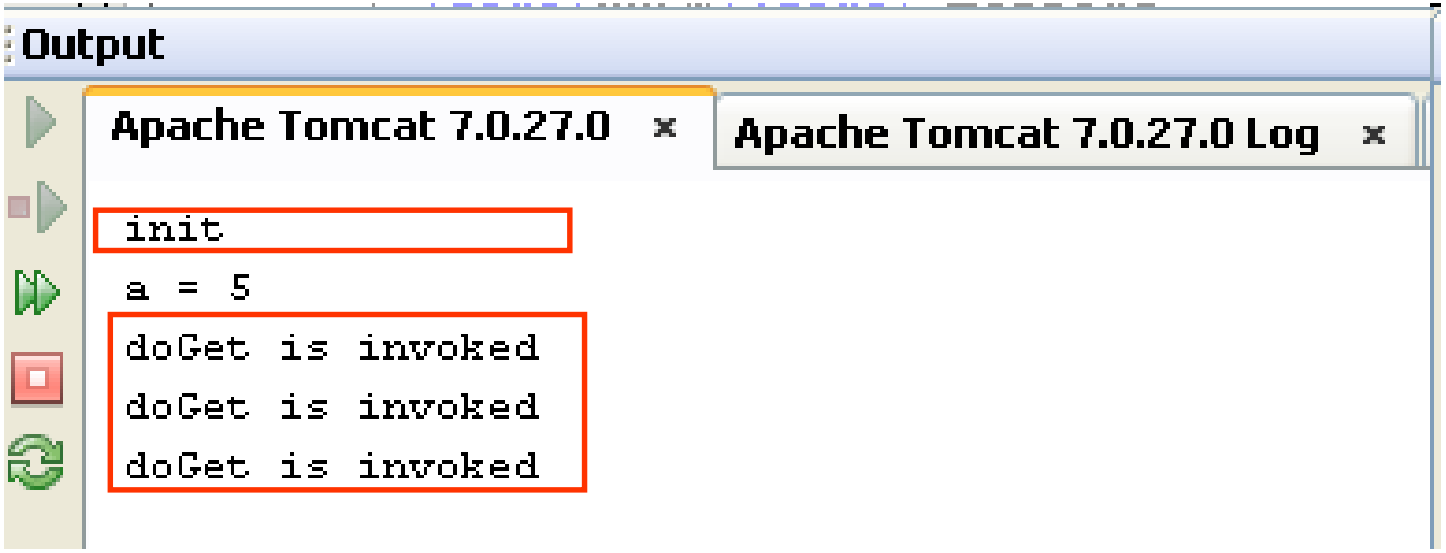
```
52      // <editor-fold defaultstate="collapsed" desc="HttpServlet methods. Click on the
53      /**...*/
        protected void doGet(HttpServletRequest request, HttpServletResponse response)
61              throws ServletException, IOException {
62          processRequest(request, response);
63          System.out.println("doGet is invoked");
64      }
65
66      /**...*/
        protected void doPost(HttpServletRequest request, HttpServletResponse response)
74              throws ServletException, IOException {
75          processRequest(request, response);
76          System.out.println("doPost is invoked");
77      }
```

The Servlet Model

The Servlet Life Cycle – Example







The Servlet Model

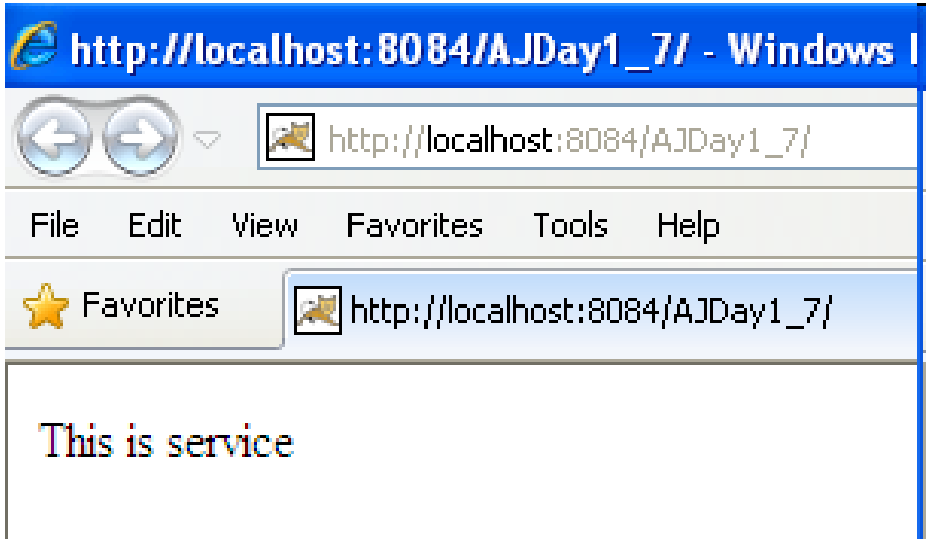
The Servlet Life Cycle – Example

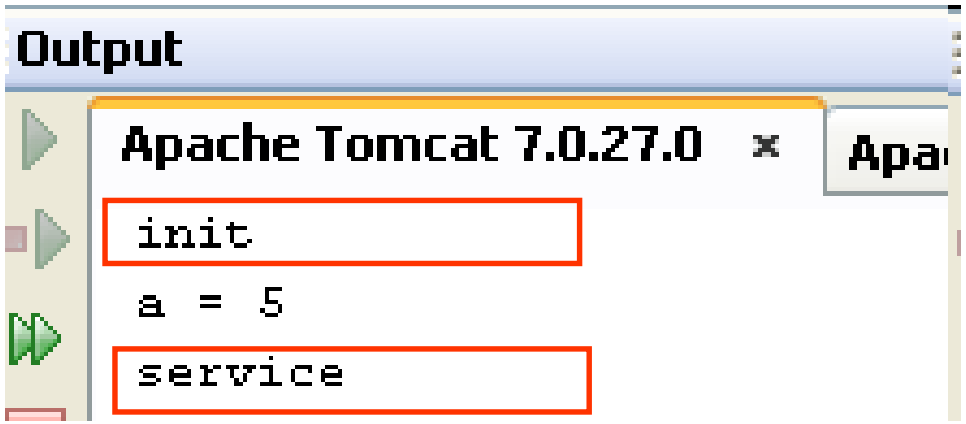
LifeCycleServlet.java

```
16      * @author Trong Khanh
17      */
18     public class LifeCycleServlet extends HttpServlet {
19         private int a = 0;
           public void init() throws ServletException {...}
26         /**...*/
33         protected void processRequest(HttpServletRequest request, HttpServletResponse response)
34                 throws ServletException, IOException {...}
51
           protected void service(HttpServletRequest request, HttpServletResponse response)
53                 throws ServletException, IOException {
54             System.out.println ("service");
55             response.setContentType("text/html");
56             PrintWriter out=response.getWriter();
57             out.println("This is service");
58         }
```

The Servlet Model

The Servlet Life Cycle – Example





The Servlet Model

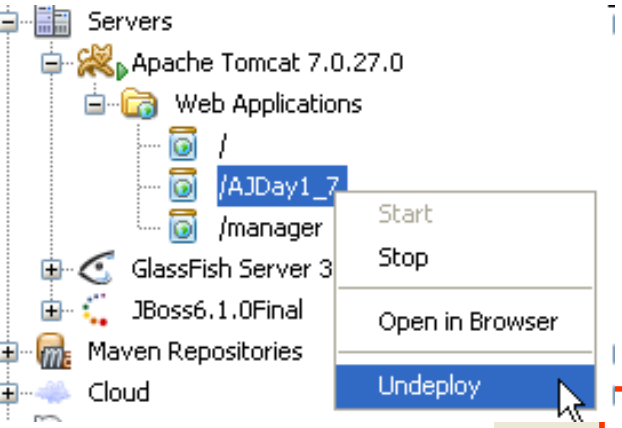
The Servlet Life Cycle – Example

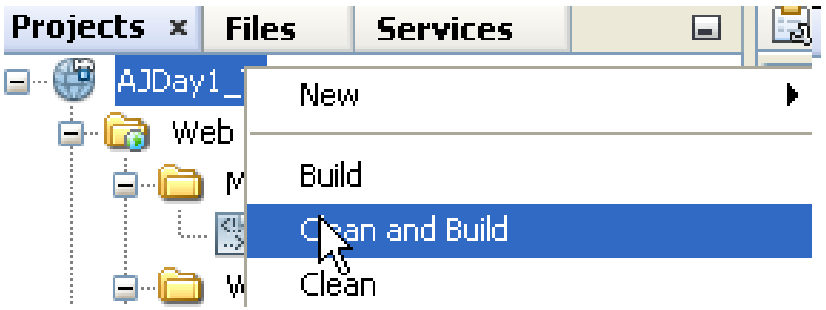
- **Addition the destroy method (**comment service method**)**

LifeCycleServlet.java

```
59
    public void destroy() {
61      super.destroy();
62      System.out.println ("Destroy");
63  }
```

- **Execute project again, then undeploy or clean and Build the current project on Tomcat Server**

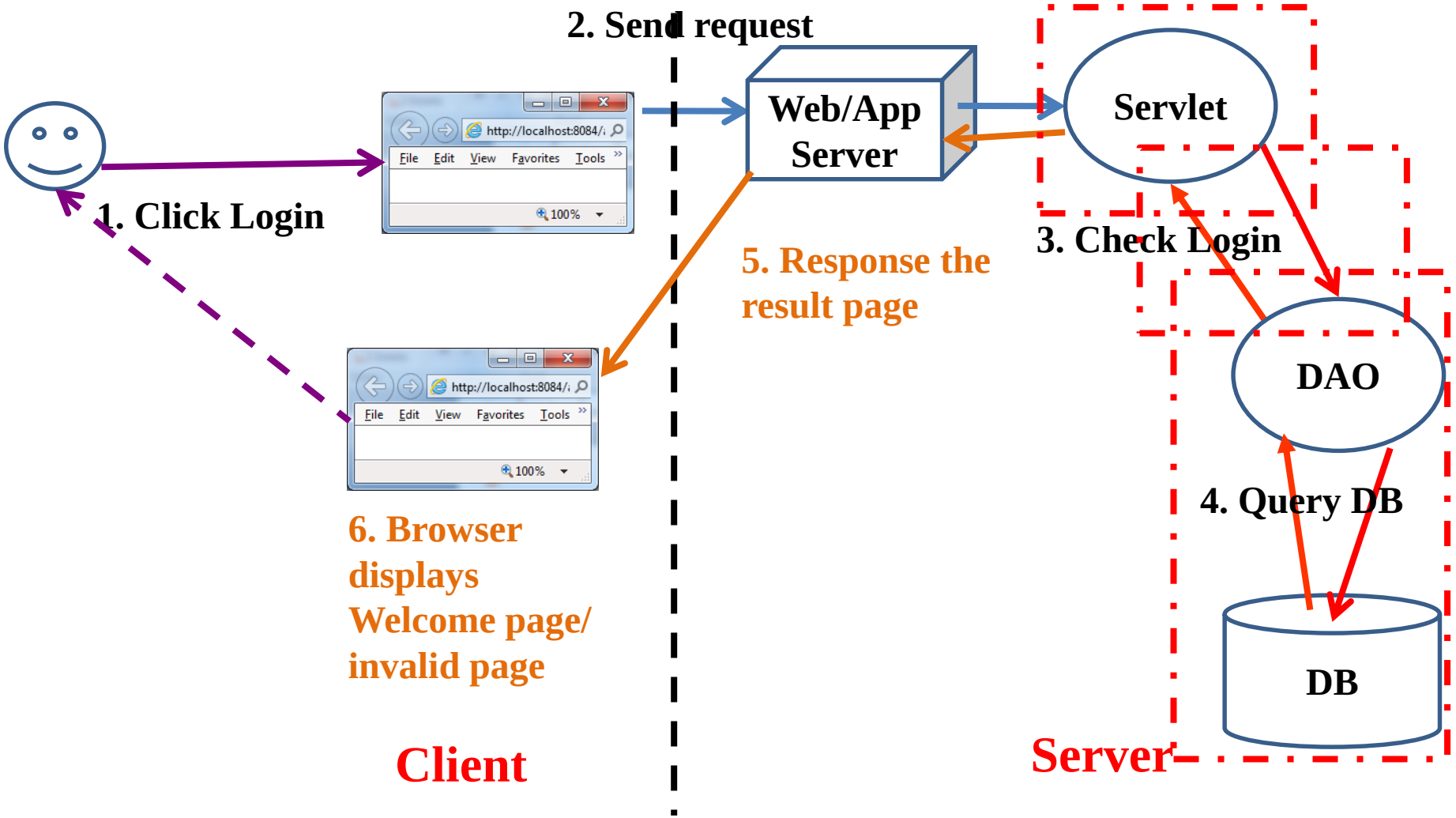





```
Destroy
thg 9 20, 2013 9:55:11 CH org.apache.c
INFO: Undeploying context [/AJDay1_7]
```

Build The Simple Web

Interactive Server Model



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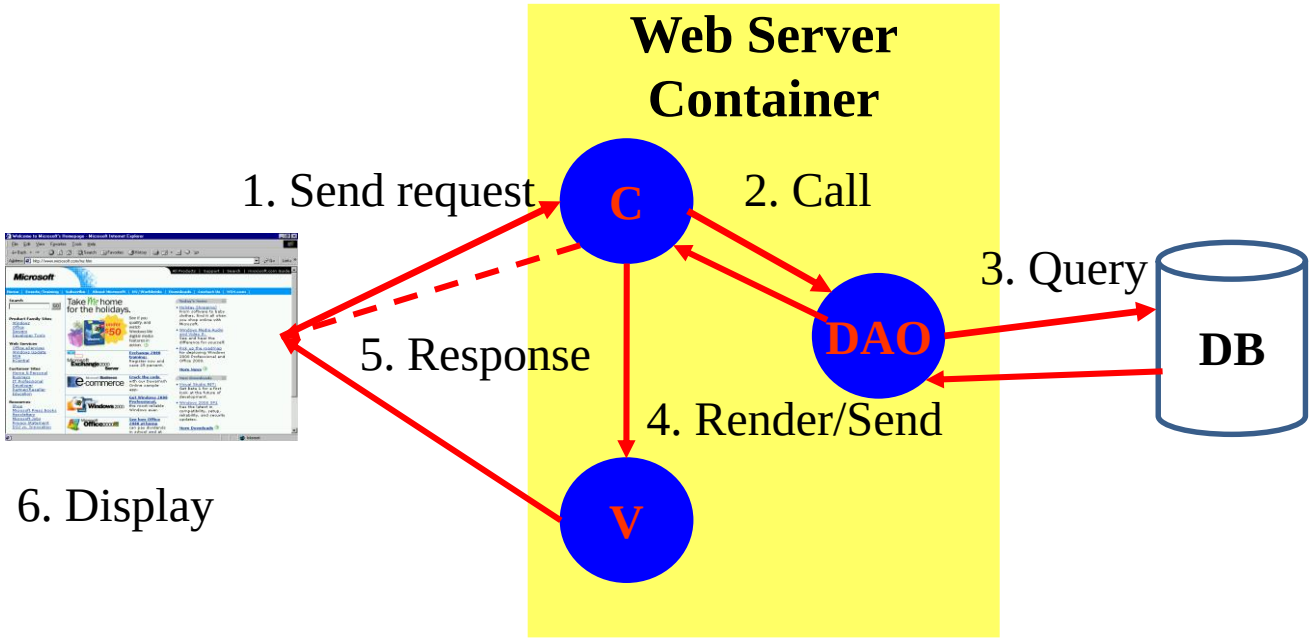
Summary

- **How to build the simple web site using html and servlet?**
  - Http Protocol and Methods
  - What is Servlet?
  - Parameters vs. Variables
  - Servlet Life Cycle
  - Break down structure component in building web application

Q&A

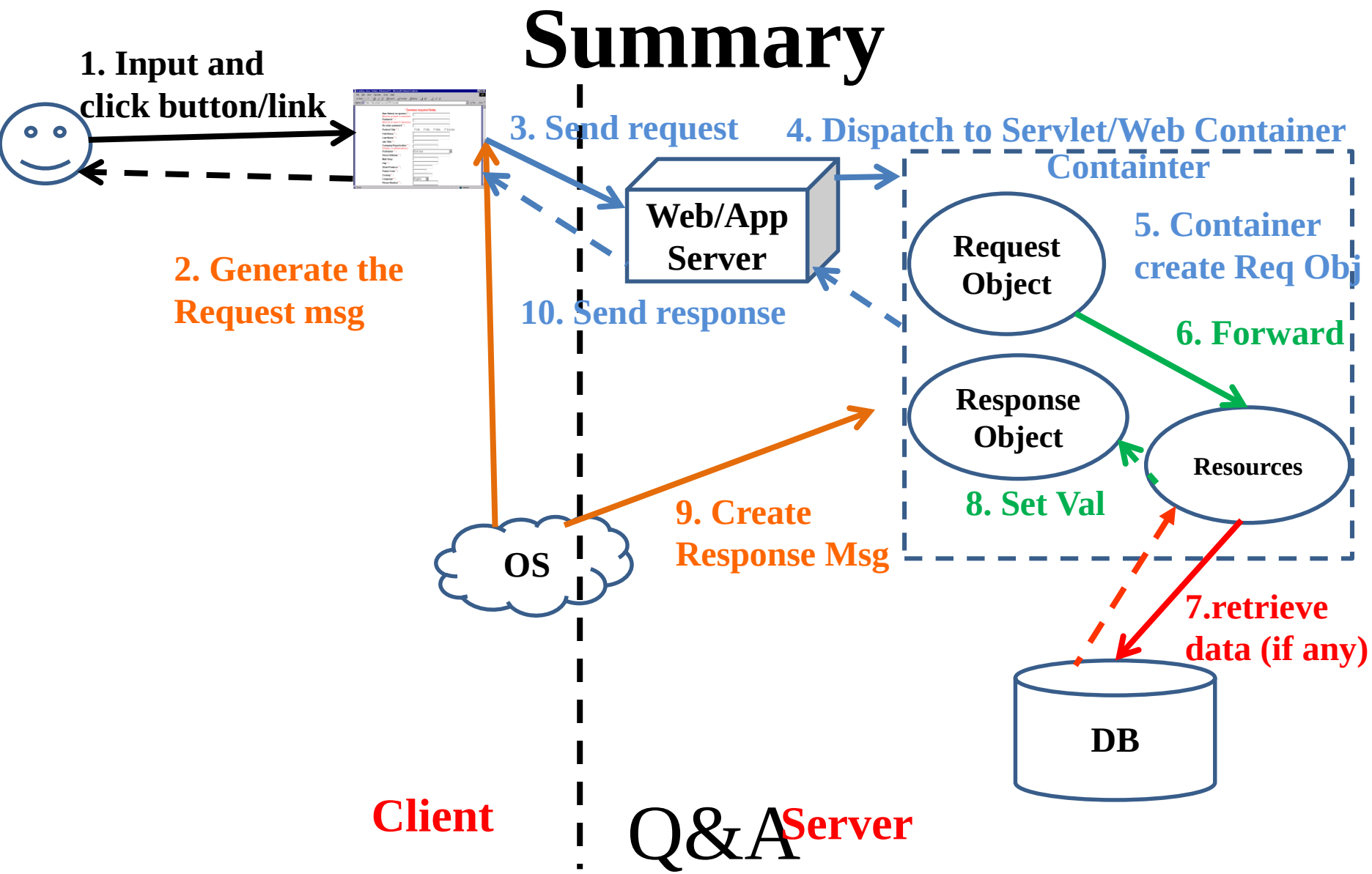
Summary


Web Server
Container
1. Send request
C
2. Call
3. Query
DAO
DB
5. Response
4. Render/Send
V
6. Display

Q&A

Fpt University

Summary



Q&A

Exercises

- Do it again all of demos
- Using servlet to write the programs as the following requirement
  - Present the Login form (naming LoginServlet) with title Login, header h1 – Login, 02 textbox with naming txtUser and txtPass, and the Login button
  - Writing the ColorServlet that presents “Welcome to Servlet course” with yellow in background and red in foreground

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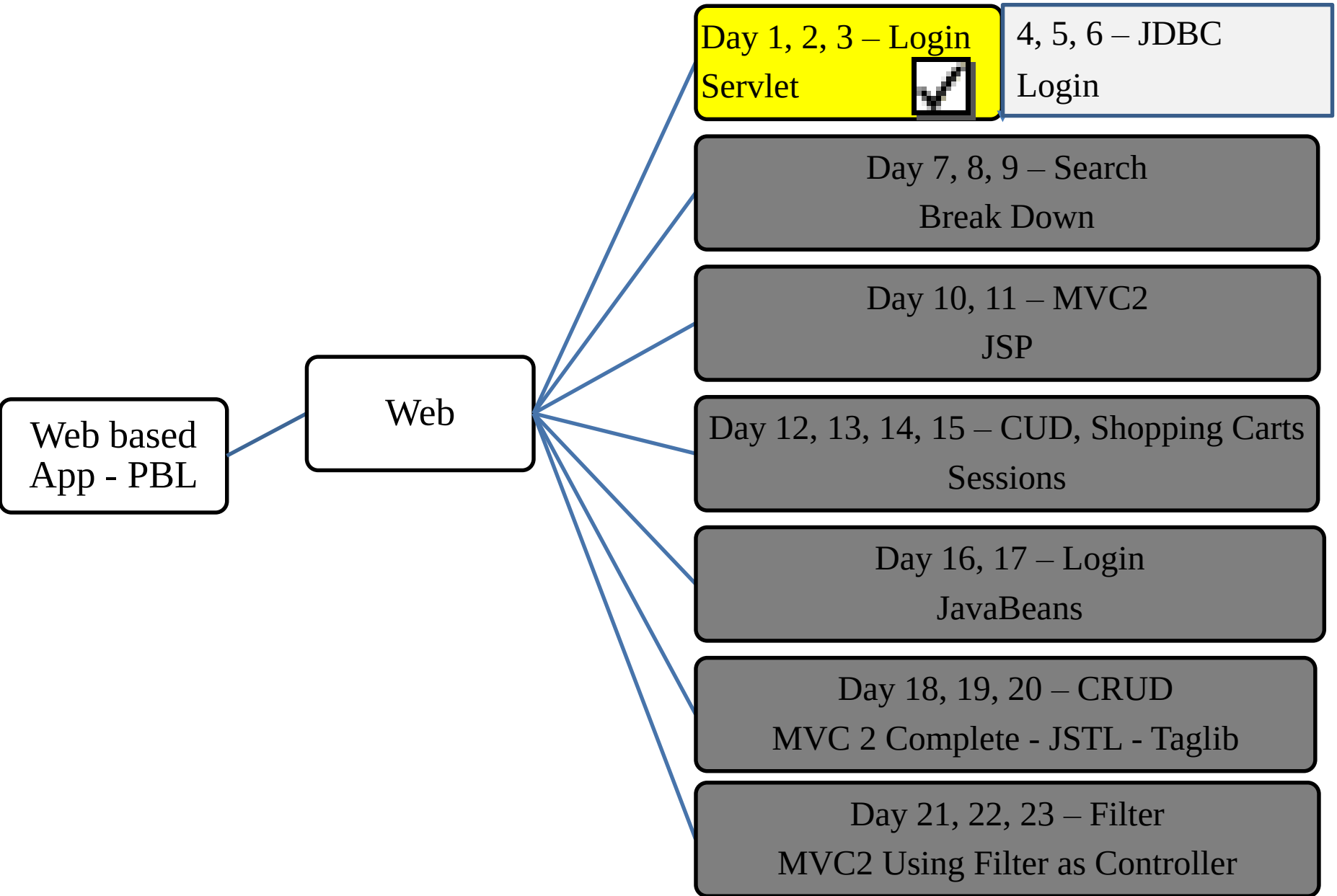
Next Lecture

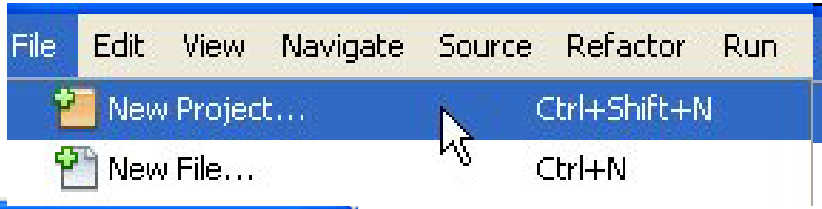
- **How to access database from web application?**
  - JDBC
  - Relational Database Overview
  - JDBC and JDBC Drivers
  - JDBC Basics: Processing SQL Statements
  - Implement CRUD application using MS SQL

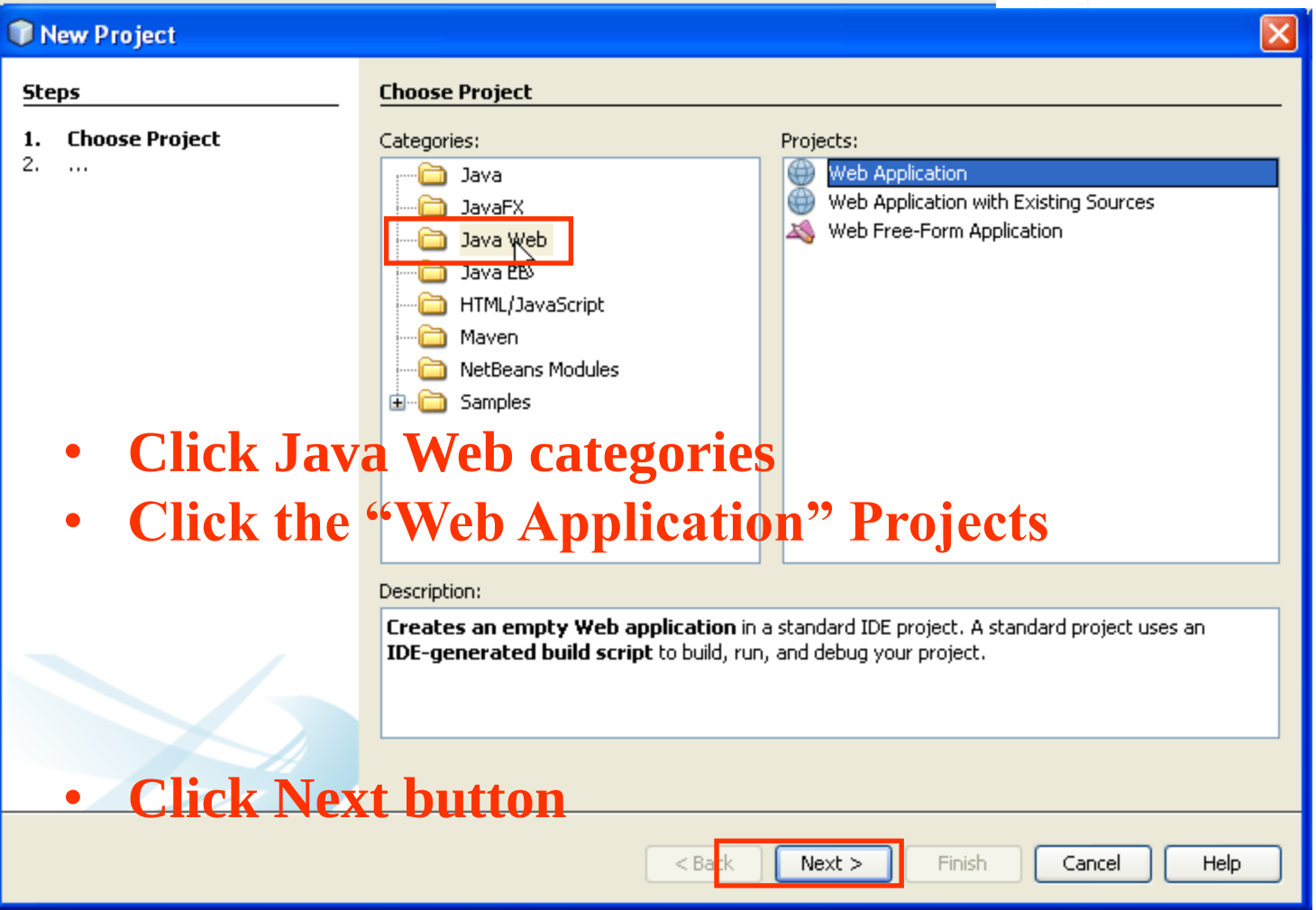
Next Lecture



Appendix – Build The Simple Web

How to Create Web Application Project

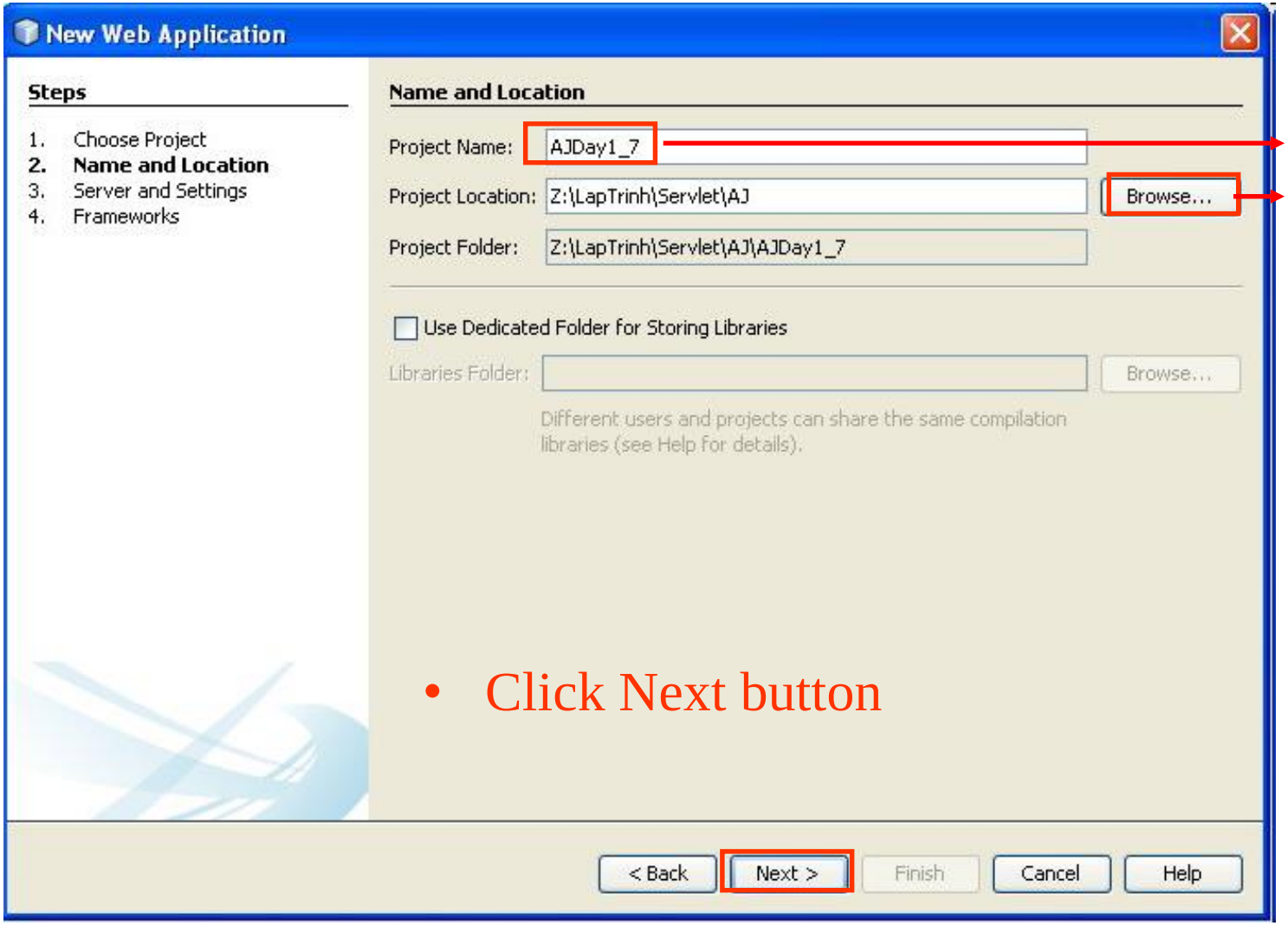




- **Click Java Web categories**
- **Click the "Web Application" Projects**
- **Click Next button**

Appendix – Build The Simple Web

How to Create Web Application Project



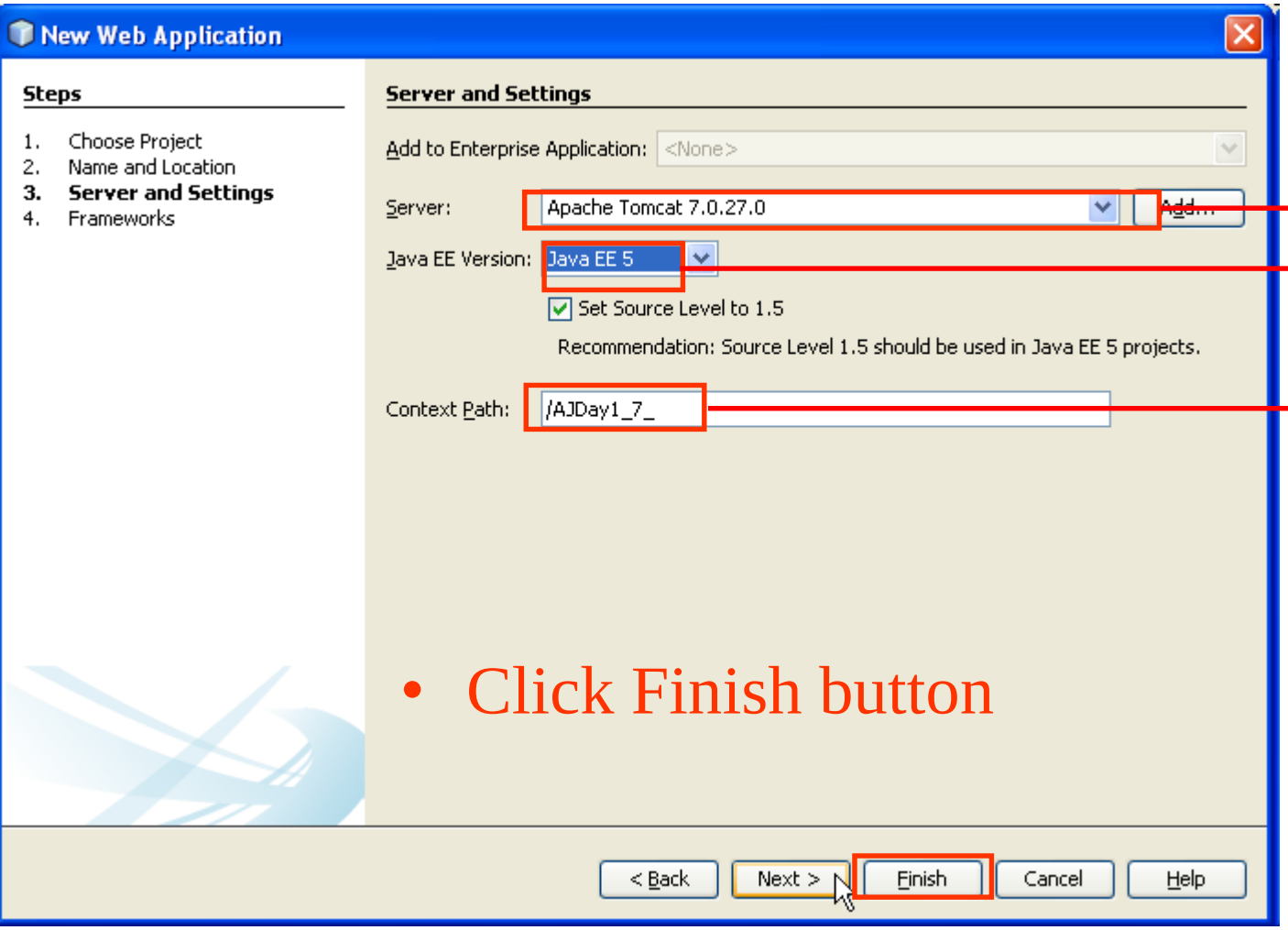
Fill your project name

Browser your location where store the project

- Click Next button

Appendix – Build The Simple Web

How to Create Web Application Project



- Click Finish button

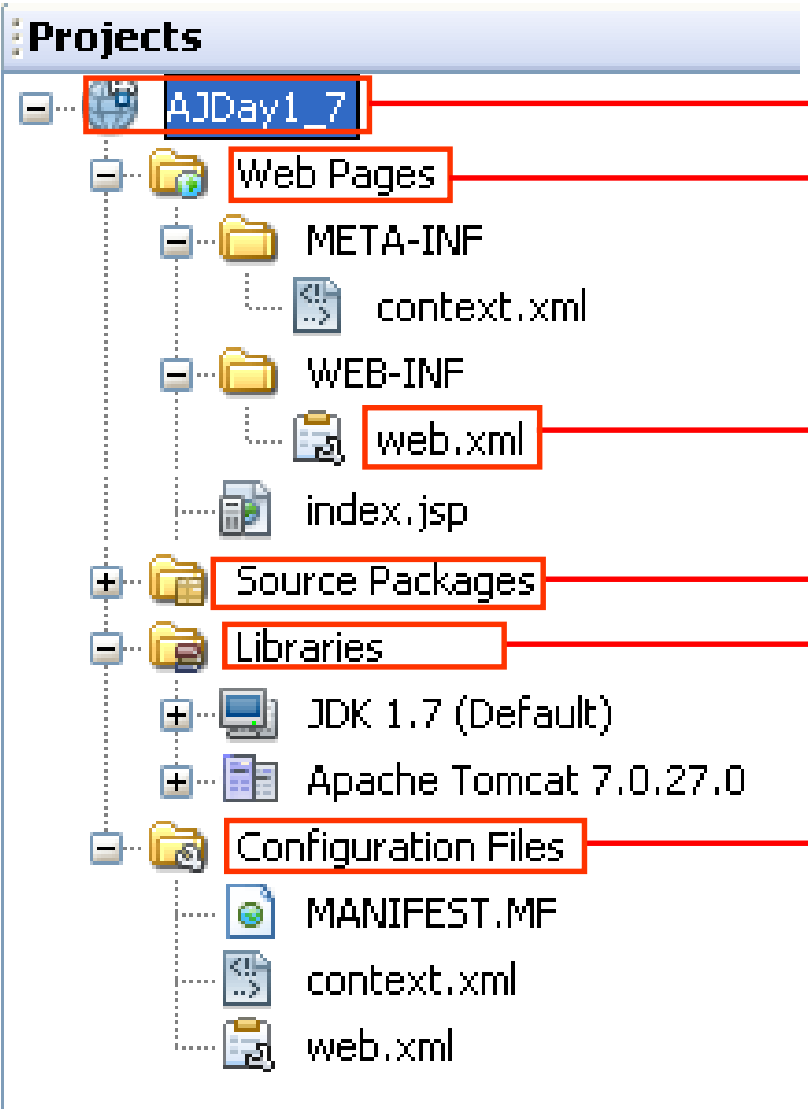
Choose deployed server

Choose Java EE 5/ J2EE 1.4

Modify the context path (if necessary). Defaults, it is named same as Project Name

Appendix – Build The Simple Web

How to Create Web Application Project



Project name

Web Directory

Web deployment descriptor

Source code directory, containing **java class**. When project is built, package in **classes directory**

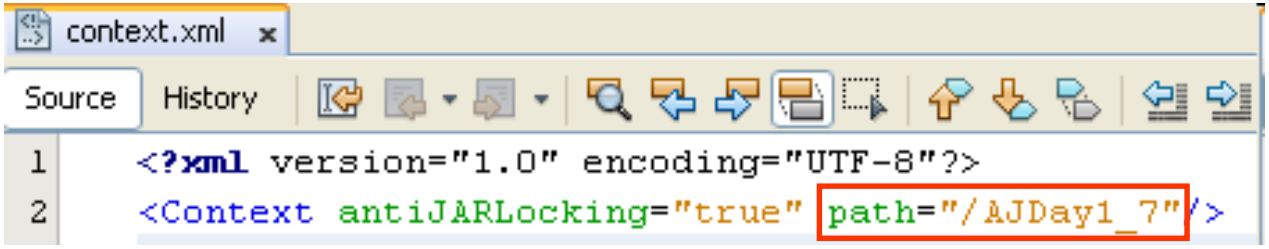
Support library directory, containing **jar file**. When project is built, package in **lib directory**

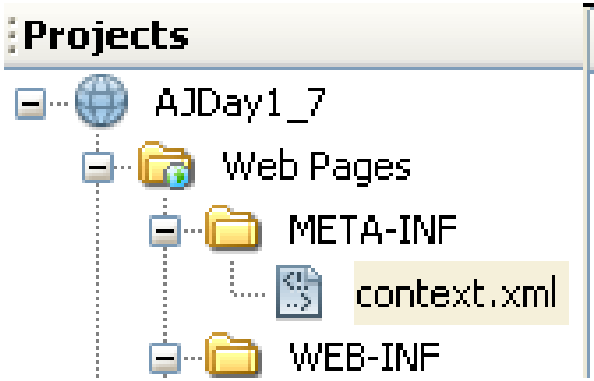
Configuration directory related define for Web App

Appendix – Web Applications

Add the META-INF/context.xml to project

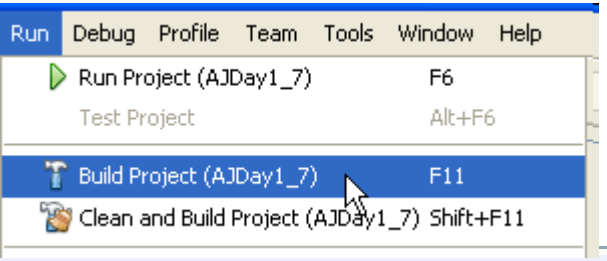
- ***optional – if it does not exist***
  - **Right click** the **Web Pages**, choose **New**, **then** choose **Other**
  - In New **File Dialog**, **choose Other**, then choose **Folder, click Next**
  - In New **Folder Dialog**, type the **META-INF** into Folder Name
  - Click **Finish**
  - **Right click the META-INF**, choose **New**, **then** choose **Other**
  - In New File Dialog, **choose XML**, then choose **XML Document**, click **Next**
  - In New XML Document Dialog, **type context** into **File Name, click Next, then click Finish**
  - Type the **content of content.xml file** as (**Notes: must type "/" in front of context**)

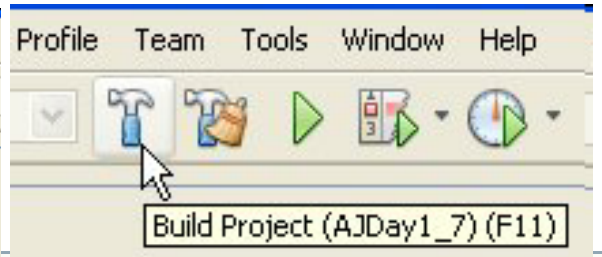


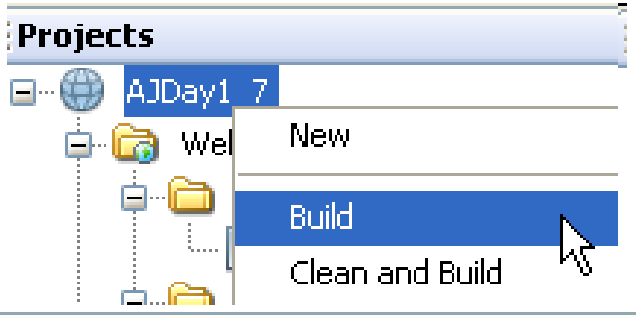


Appendix

Build Application





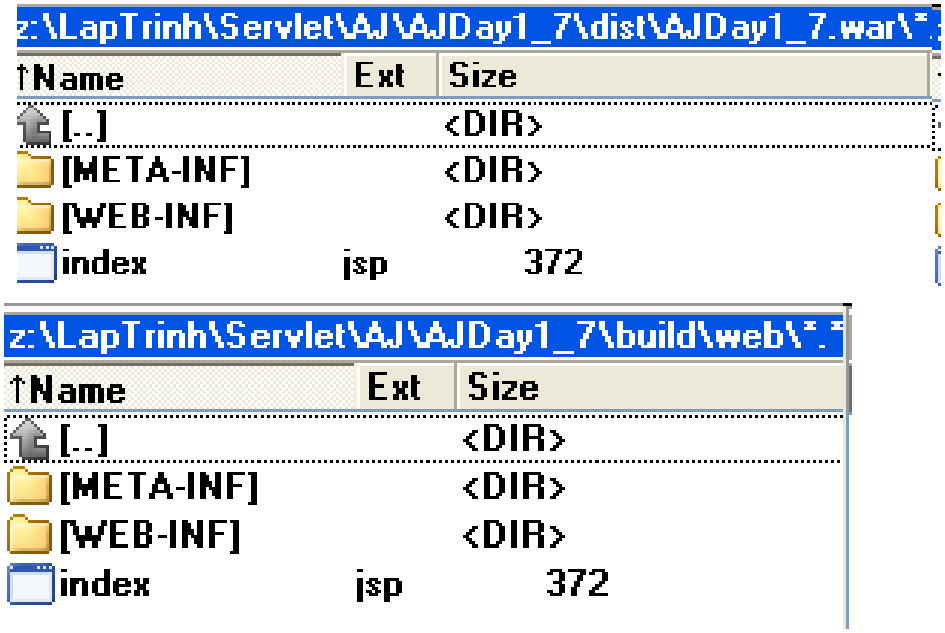


Output - AJDay1_7 (clean,dist)

```
deps-ear-jar:
deps-jar:
Created dir: Z:\LapTrinh\Servlet\AJ\AJDay1_7\build\web\WEB-INF\classes
Created dir: Z:\LapTrinh\Servlet\AJ\AJDay1_7\build\web\META-INF
Copying 1 file to Z:\LapTrinh\Servlet\AJ\AJDay1_7\build\web\META-INF
Copying 3 files to Z:\LapTrinh\Servlet\AJ\AJDay1_7\build\web
library-inclusion-in-archive:
library-inclusion-in-manifest:
Created dir: Z:\LapTrinh\Servlet\AJ\AJDay1_7\build\empty
Compiling 1 source file to Z:\LapTrinh\Servlet\AJ\AJDay1_7\build\web\WEB-INF\classes
warning: [options] bootstrap class path not set in conjunction with -source 1.5
1 warning
compile:
compile-jsps:
Created dir: Z:\LapTrinh\Servlet\AJ\AJDay1_7\dist
Building jar: Z:\LapTrinh\Servlet\AJ\AJDay1_7\dist\AJDay1_7.war
```

Appendix

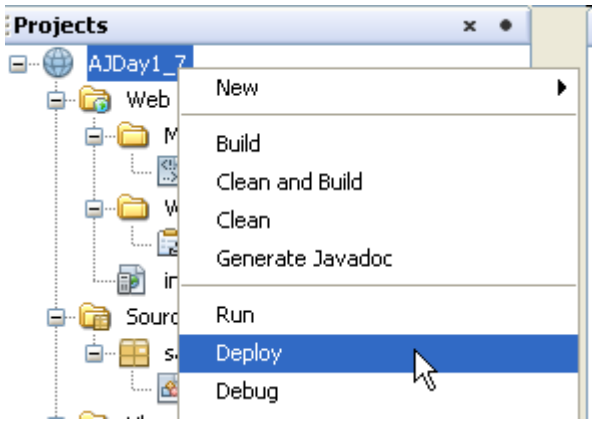
Build Application

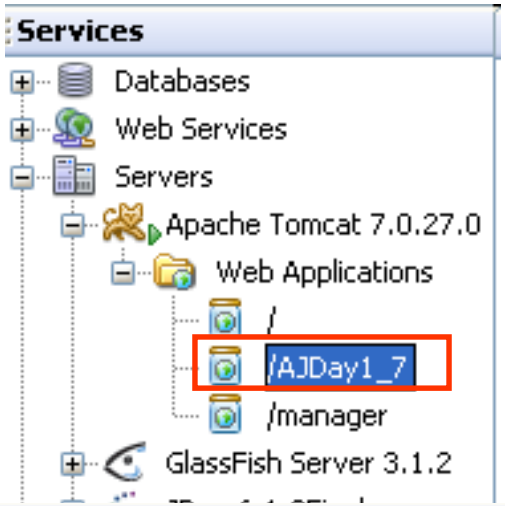


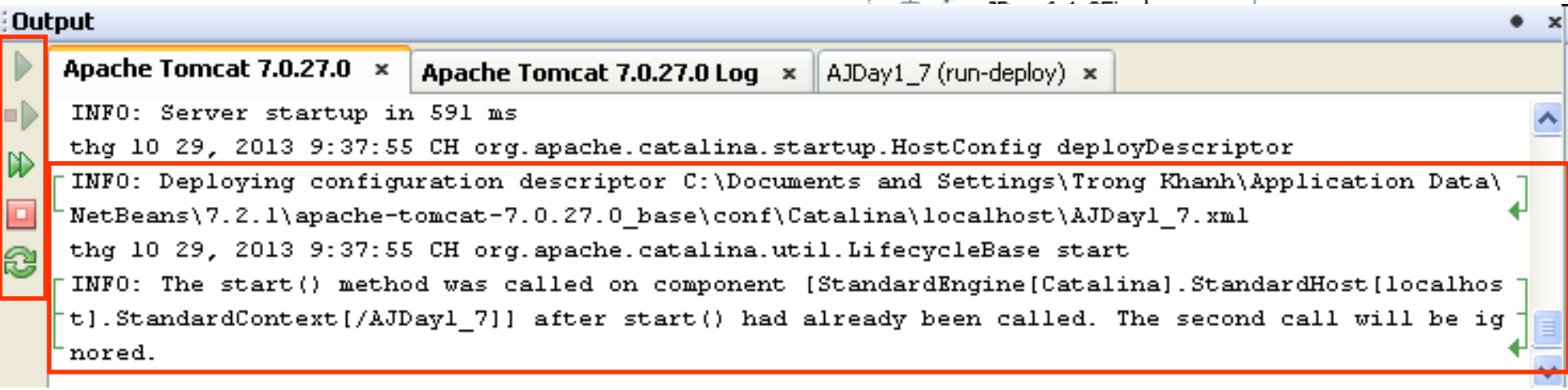
- **Package War file** with **command prompt**
  - **jar –cvf** fileName.war directoryOrFile
  - **Ex**: jar –cvf AJDay1_7.war *.jsp WEB-INF/*

Appendix

Deploy Application

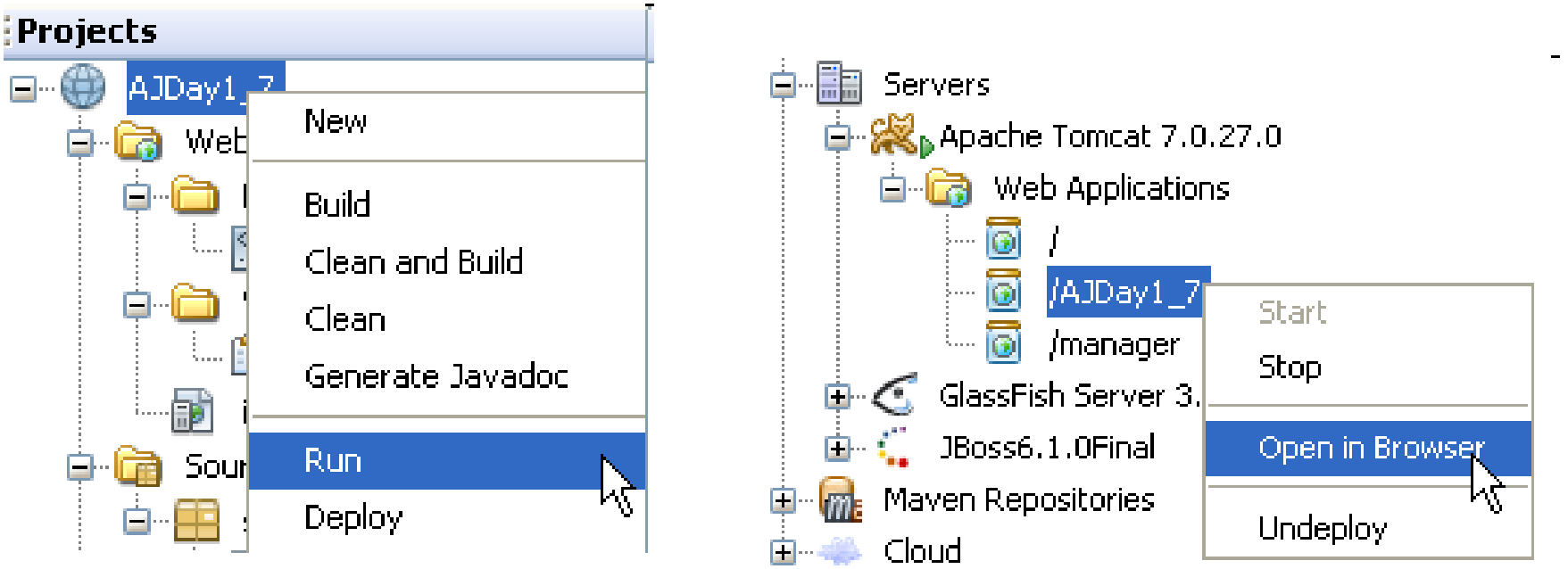






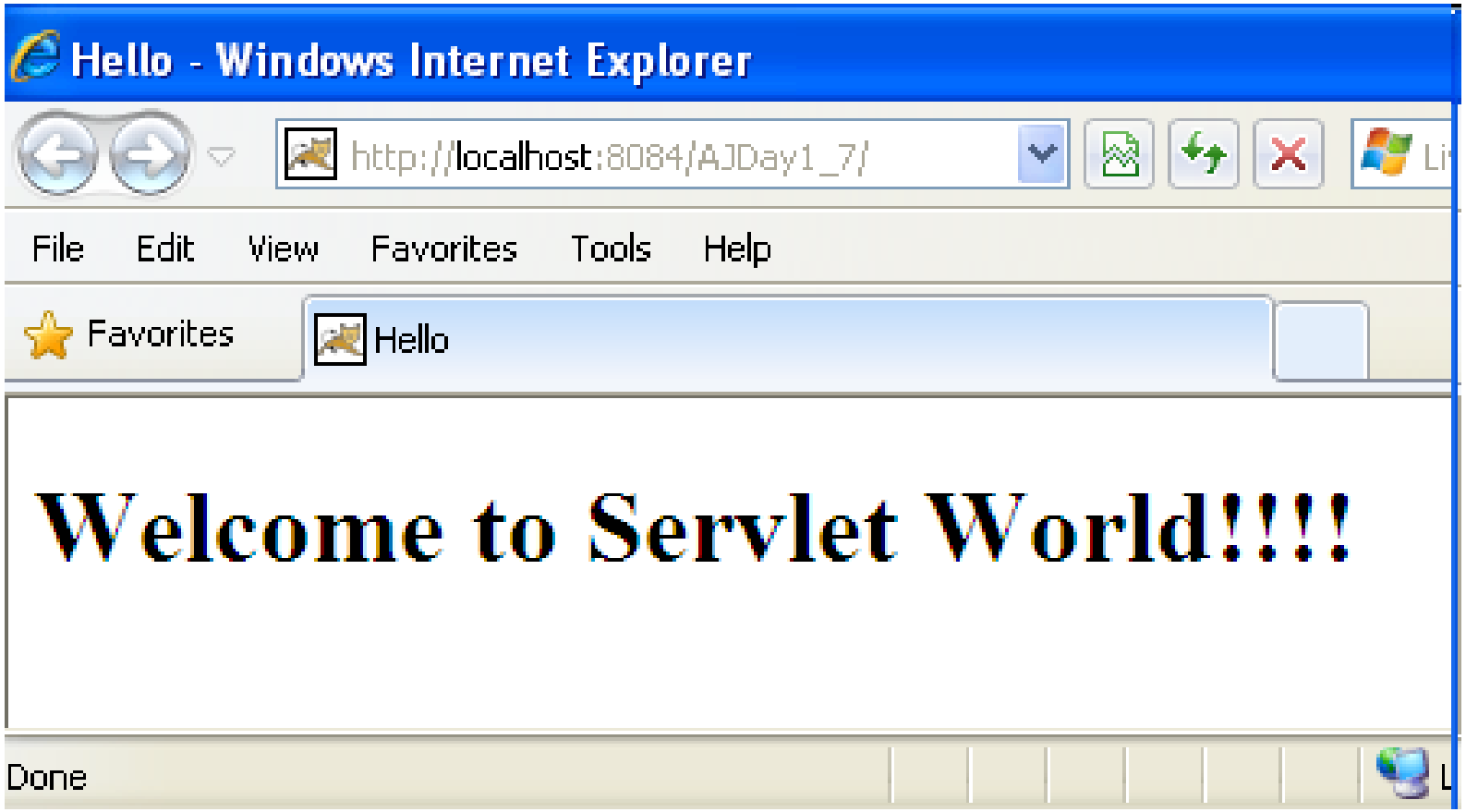
Appendix

Run Application

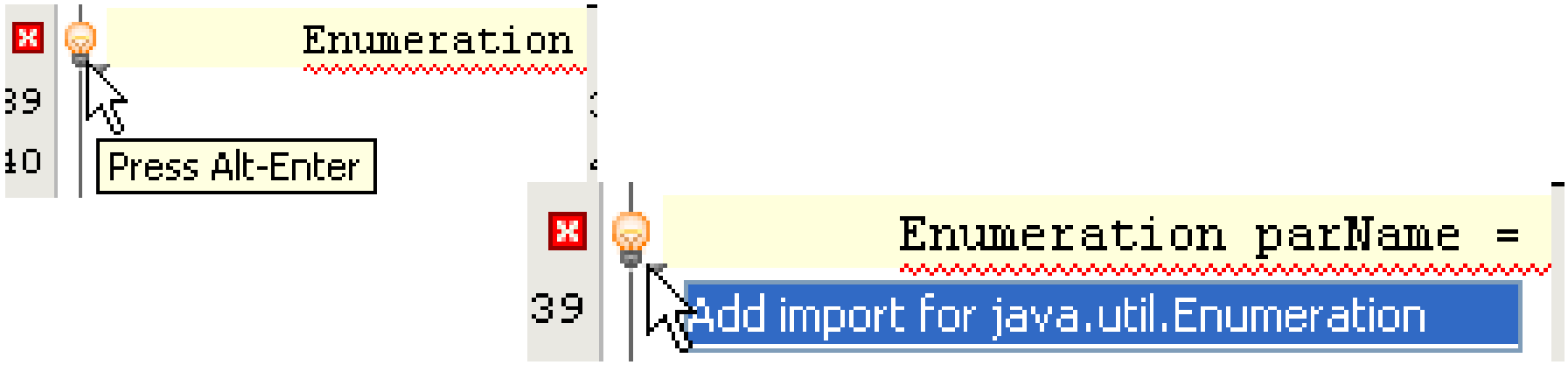


Appendix

Run Application

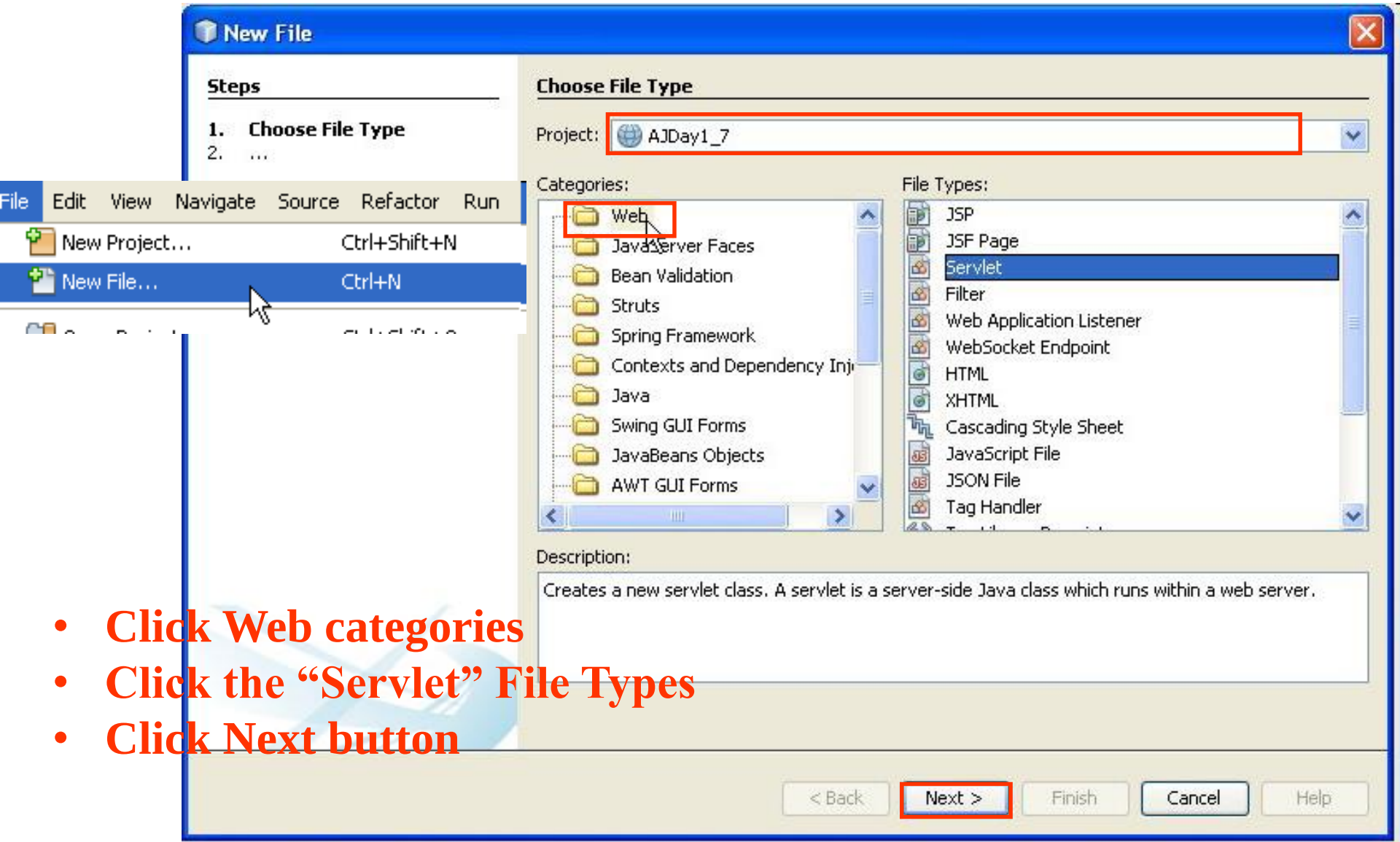


Appendix
Additional



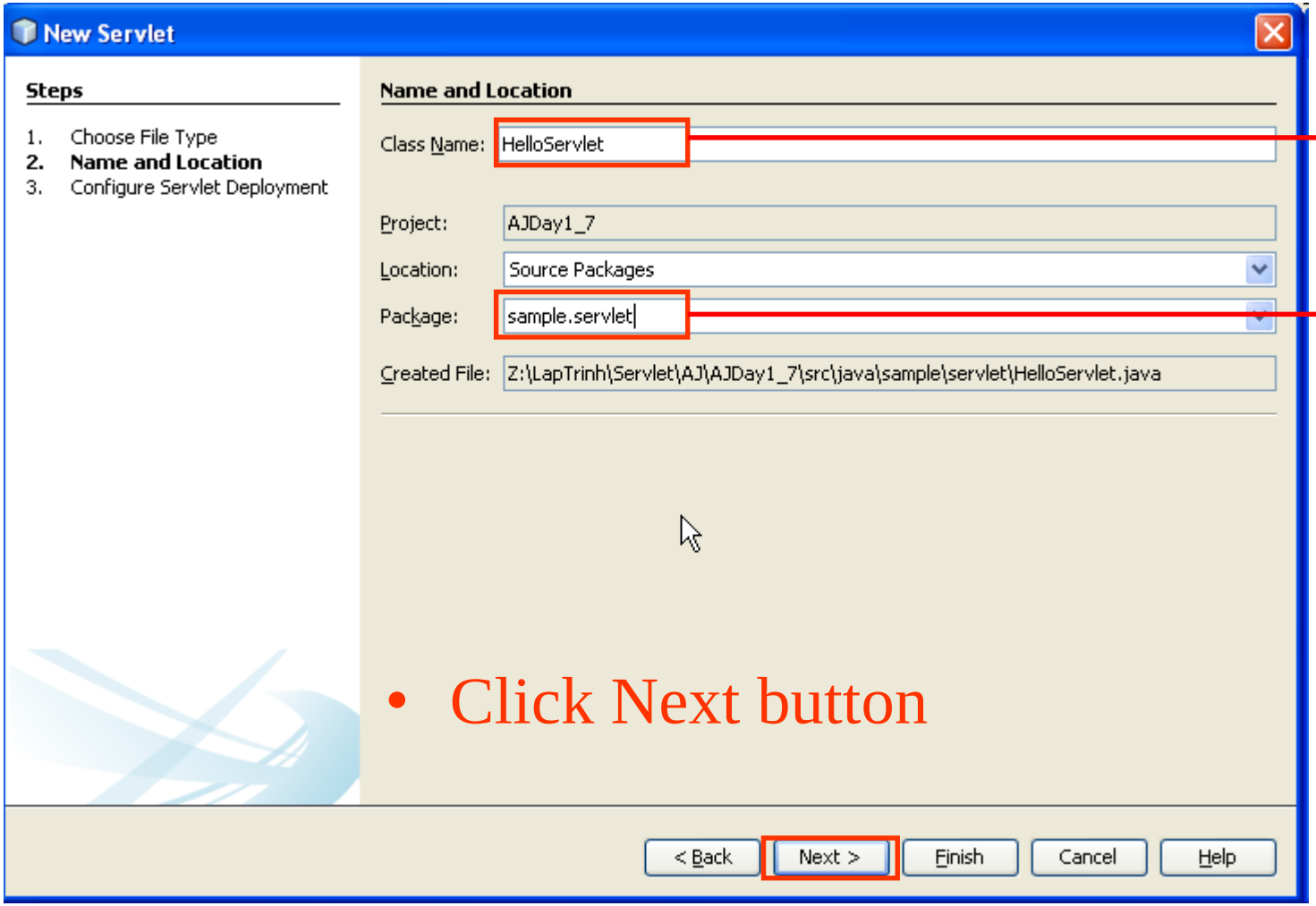
- **Caches of server**
  - **WinXP**: C:\Documents and Settings\LoggedUser\Application Data\NetBeans\version\apache-tomcat-tomcatVersion_base\work\Catalina \localhost\
  - **Vista or Win7, 8, 10**: C:\Users**LoggedUser**\AppData\Roaming\NetBeans\version\apache-tomcat-tomcatVersion_base\work\Catalina\localhost\
  - Above location should be **gone and cleared** when the application **cannot** be **undeployed** or the web servers **occur the errors**

Appendix
Create a Servlet



- **Click Web categories**
- **Click the "Servlet" File Types**
- **Click Next button**

Appendix
Create a Servlet



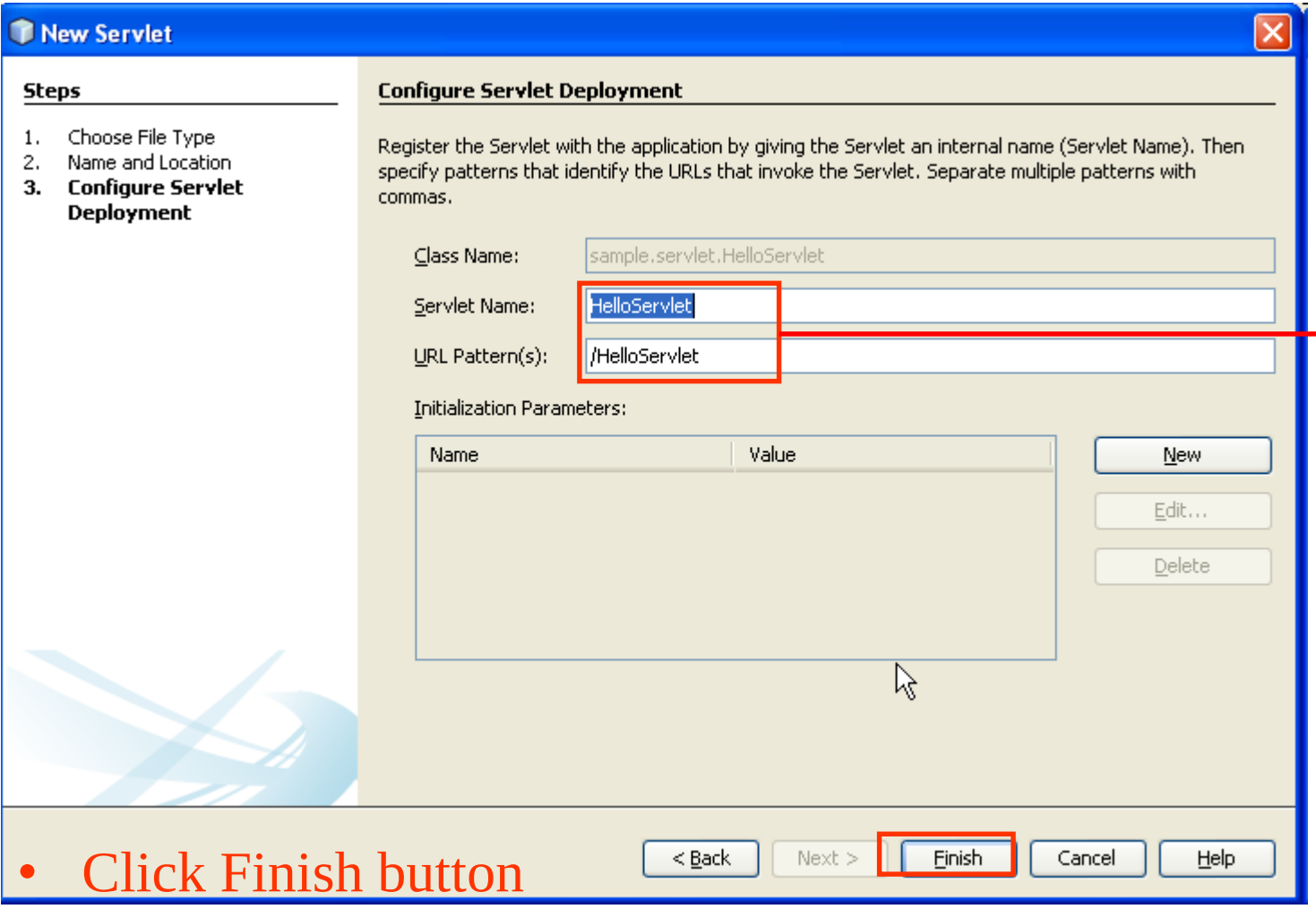
- Click Next button

Fill your servlet name

Fill or choose package name

Appendix

Create a Servlet



Modify the Servlet Name or URL Pattern if necessary) to configure the servlet information to web.xml

- Click Finish button
- The servlet class (ex: HelloServlet.java) is added to source packages (with package name if it's exist) and it's information is added to xml

Appendix

Create a Servlet

HelloServlet.java

Source | History

```
 * @author Trong Khanh
 */
public class HelloServlet extends HttpServlet {

    /**...*/
    protected void processRequest(HttpServletRequest request,
            HttpServletResponse response)
            throws ServletException, IOException {
        response.setContentType("text/html;charset=UTF-8");
        PrintWriter out = response.getWriter();
        try {
            /* TODO output your page here. You may use following s
            out.println("<!DOCTYPE html>");
            out.println("<html>");
            out.println("<head>");
            out.println("<title>Hello</title>");
            out.println("</head>");
            out.println("<body>");
            out.println("<h1>Welcome to Servlet World!!!!</h1>");
            out.println("</body>");
            out.println("</html>");
        } finally {
            out.close();
        }
    }

    HttpServlet methods. Click on the + sign on the left to edit t
}
```

Appendix

Create a Servlet

web.xml

Source | General | Servlets | Filters | Pages | References | Security | History

```
1  <?xml version="1.0" encoding="UTF-8"?>
2  <web-app version="2.5" xmlns="http://java.sun.com/xml/ns/javaee"
3           xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
4           xsi:schemaLocation="http://java.sun.com/xml/ns/javaee
5                 http://java.sun.com/xml/ns/javaee/web-app_2_5.xsd">
6      <servlet>
7          <servlet-name>HelloServlet</servlet-name>
8          <servlet-class>sample.servlet.HelloServlet</servlet-class>
9      </servlet>
10     <servlet-mapping>
11         <servlet-name>HelloServlet</servlet-name>
12         <url-pattern>/HelloServlet</url-pattern>
13     </servlet-mapping>
14     <session-config>
15         <session-timeout>
16             30
17         </session-timeout>
18     </session-config>
19     <welcome-file-list>
20         <welcome-file>index.jsp</welcome-file>
21     </welcome-file-list>
22 </web-app>
```

The Servlet Model

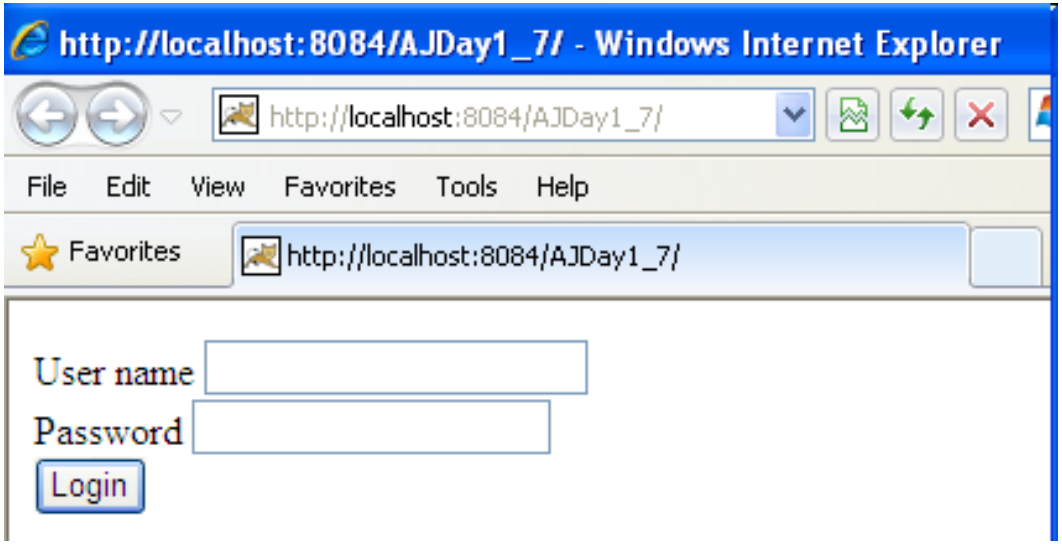
ServletRequest interface

- Provides **access** to **specific information about** the **request**
- Defines object (ServletRequest object)
  - **Containing actual request** (ex: protocol, URL, and type)
  - Containing **raw request** (ex: headers and input stream)
  - Containing client specific request **parameters**
  - Is **passed as an argument to** the **service**() method
- Some methods

Methods	Descriptions
getParameter	- **public String getParameter(String name)** - Returns the **value** of a specified parameter by the name (**or null or “”**) - String strUser = request.getParameter(“txtUser”);
getParameterNames	- **public Enumeration getParameterNames()** - Returns an **enumeration of string objects containing the name of parameters.** - Returns an **empty enumeration if** the request has **no parameters** - Enumeration strUser = request.getParameterName();
getParameterValues	- **public String[] getParameterValues(String names)** - Returns an **array of string objects** containing **all of the parameter values or null** if parameters do not exist. - String[] value = request.getParameterValues(”chkRemove”);

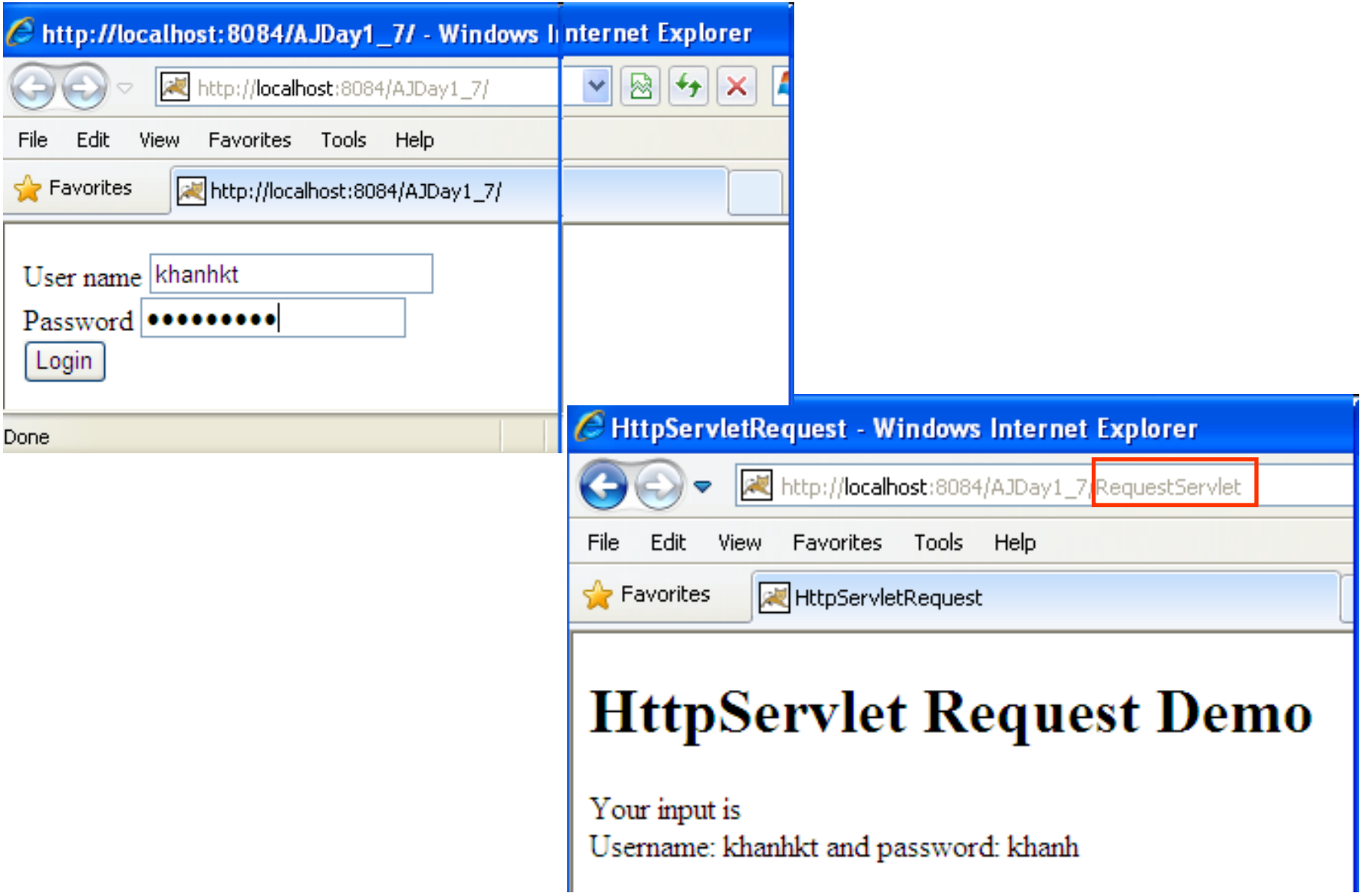
Appendix – The Servlet Model

HttpServletRequest interface – Examples



Appendix – Servlet Model

HttpServletRequest interface – Examples



Appendix – The Servlet Model

HttpServletRequest interface – Examples

httpRequestDemo.html

```
1  ...
5  <!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN">
6  <html>
7      <head>
8          <title></title>
9          <meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
10     </head>
11     <body>
12         <form action="RequestServlet" method="post">
13             User name <input type="text" name="txtUser"/><br/>
14             Password <input type="password" name="txtPass"/><br/>
15             <input type="submit" value="Login"/><br/>
16         </form>
17     </body>
18 </html>
```

Appendix – The Servlet Model

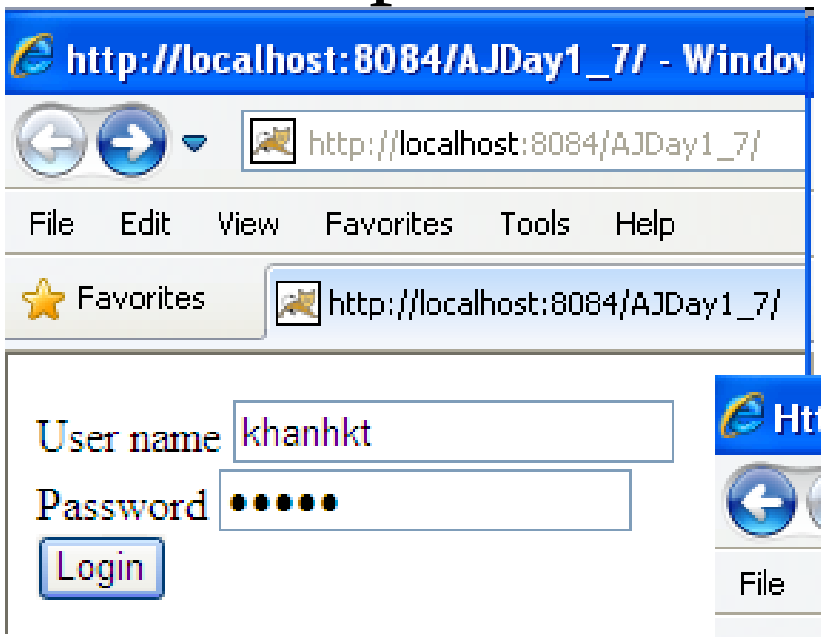
HttpServletRequest interface – Examples

RequestServlet.java

```
28      protected void processRequest(HttpServletRequest request, HttpServletResponse response)
29              throws ServletException, IOException {
30          response.setContentType("text/html;charset=UTF-8");
31          PrintWriter out = response.getWriter();
32          try {
33              out.println("<html>");
34              out.println("<head>");
35              out.println("<title>Servlet RequestServlet</title>");
36              out.println("</head>");
37              out.println("<body>");
38              out.println("<h1>HttpServlet Request Demo</h1>");
39              String username = request.getParameter("txtUser");
40              String password = request.getParameter("txtPass");
41
42              out.println("Your input is <br/>");
43              out.println("Username: " + username + " and password: " + password);
44
45              out.println("</body>");
46              out.println("</html>");
47          } finally {
48              out.close();
49          }
50      }
```

Appendix – The Servlet Model

HttpServletRequest interface – Examples



Appendix – The Servlet Model

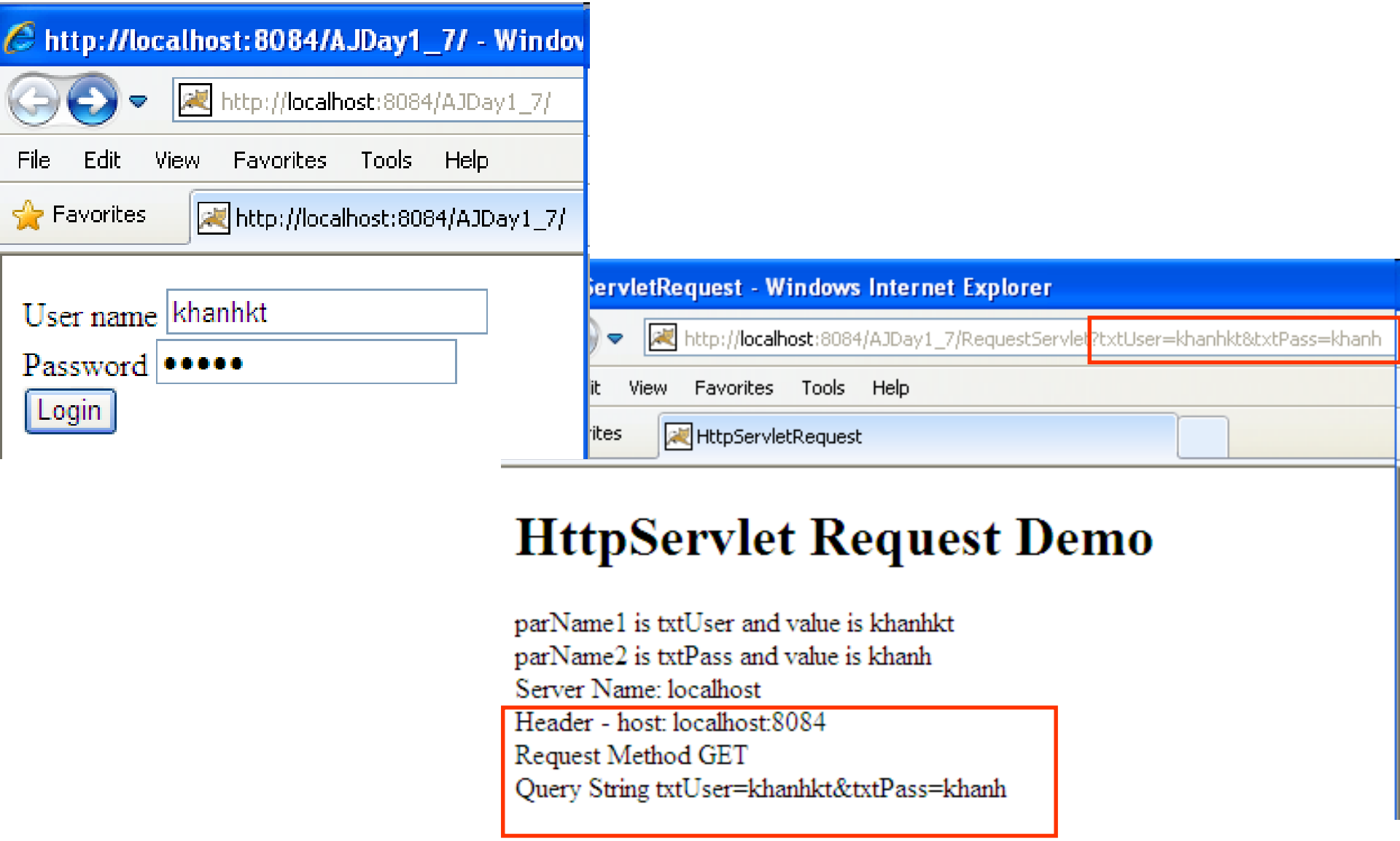
HttpServletRequest interface – Examples

RequestServlet.java

```
28      protected void processRequest(HttpServletRequest request, HttpServletResponse response)
29              throws ServletException, IOException {
30          response.setContentType("text/html;charset=UTF-8");
31          PrintWriter out = response.getWriter();
32          try {
33              out.println("<html>");
34              out.println("<head>");
35              out.println("<title>Servlet RequestServlet</title>");
36              out.println("</head>");
37              out.println("<body>");
38              out.println("<h1>HttpServlet Request Demo</h1>");
39              Enumeration parNames = request.getParameterNames();
40              int count = 0;
41              while (parNames.hasMoreElements()) {
42                  ++count;
43                  String parName = (String) parNames.nextElement();
44                  out.print("parName" + count + " is " + parName);
45
46                  String parVal = request.getParameter(parName);
47                  out.println(" and value is " + parVal + "<br/>");
48              }
49              String strServer = request.getServerName();
50              out.println("Server Name: " + strServer + "<br/>");
51              int length = request.getContentLength();
52              out.println("Length in bytes " + length + "<br/");
53              out.println("</body>");
54              out.println("</html>");
55          } finally {
56              out.close();
57          }
58      }
```

Appendix – The Servlet Model

HttpServletRequest interface – Examples



Appendix – The Servlet Model

HttpServletRequest interface – Examples

httpRequestDemo.html

```
1  ...
5  <!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN">
6  <html>
7      <head>
8          <title></title>
9          <meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
10     </head>
11     <body>
12         <form action="RequestServlet">
13             User name <input type="text" name="txtUser"/><br/>
14             Password <input type="password" name="txtPass"/><br/>
15             <input type="submit" value="Login"/><br/>
16         </form>
17     </body>
18 </html>
```

Appendix – The Servlet Model

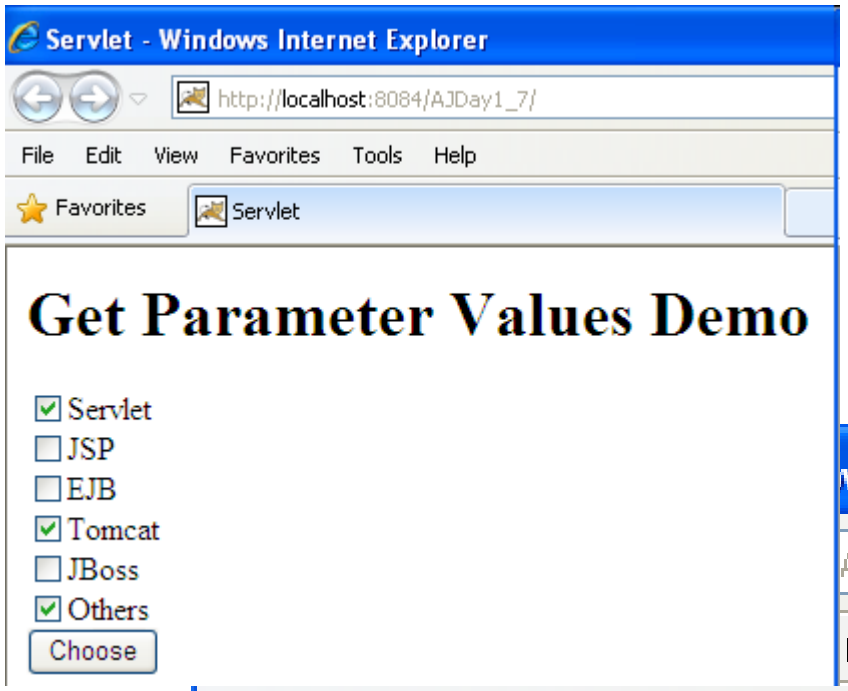
HttpServletRequest interface – Examples

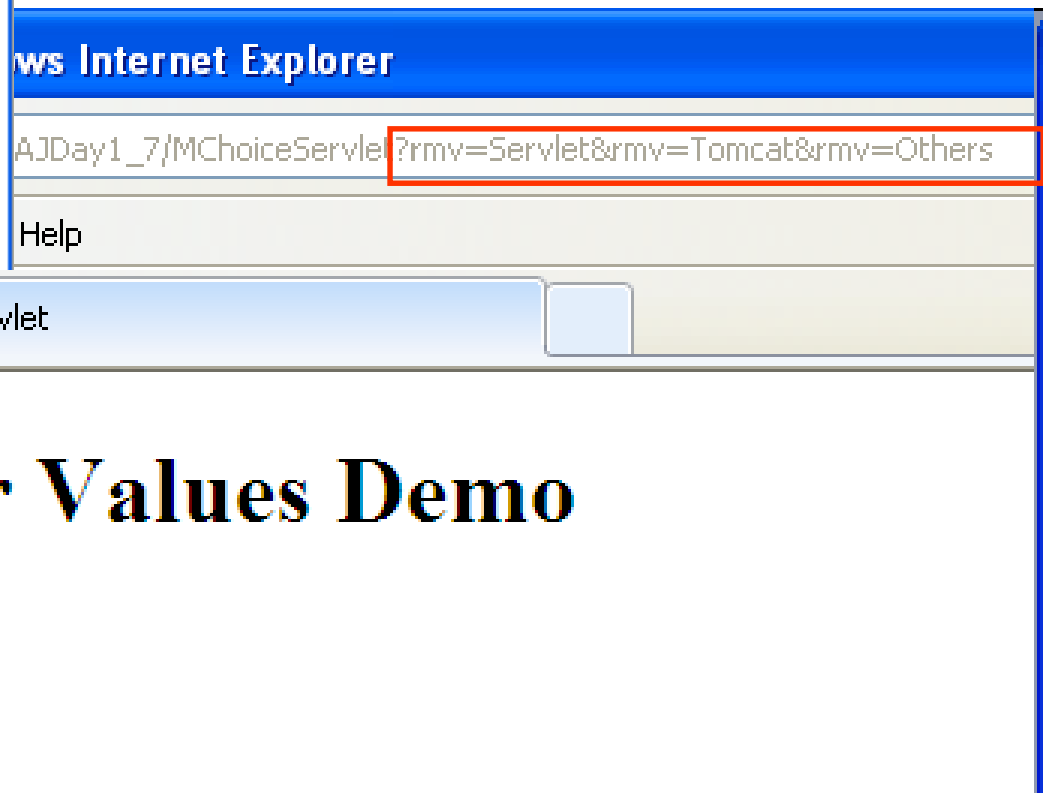
RequestServlet.java

```
37      protected void processRequest(HttpServletRequest request, HttpServletResponse response)
38              throws ServletException, IOException {
39          response.setContentType("text/html;charset=UTF-8");
40          PrintWriter out = response.getWriter();
41          try {
42              out.println("<html>");
43              out.println("<head>");
44              out.println("<title>Servlet RequestServlet</title>");
45              out.println("</head>");
46              out.println("<body>");
47              out.println("<h1>HttpServlet Request Demo</h1>");
48              Enumeration parNames = request.getParameterNames();
49              int count = 0;
50              while (parNames.hasMoreElements()) {
51                  ++count;
52                  String parName = (String) parNames.nextElement();
53                  out.print("parName" + count + " is " + parName);
54                  String parVal = request.getParameter(parName);
55                  out.println(" and value is " + parVal + "<br/>");
56              }
57              String strServer = request.getServerName();
58              out.println("Server Name: " + strServer + "<br/>");
59              String strHost = request.getHeader("host");
60              out.println("Header - host: " + strHost + "<br/>");
61              String strMethod = request.getMethod();
62              out.println("Request Method " + strMethod + "<br/>");
63              String qs = request.getQueryString();
64              out.println("Query String " + qs + "<br/><br/>");
65              out.println("</body>");
66              out.println("</html>");
```

Appendix – The Servlet Model

HttpServletRequest interface – Examples





Appendix – The Servlet Model

HttpServletRequest interface – Examples

parameterValues.html

```
1  ...
5  <!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN">
6  <html>
7    <head>
8      <title>Servlet</title>
9      <meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
10   </head>
11   <body>
12       <h1>Get Parameter Values Demo</h1>
13       <form action="MChoiceServlet">
14           <input type="checkbox" name="rmv" value="Servlet" />Servlet<br/>
15           <input type="checkbox" name="rmv" value="JSP" />JSP<br/>
16           <input type="checkbox" name="rmv" value="EJB" />EJB<br/>
17           <input type="checkbox" name="rmv" value="Tomcat" />Tomcat<br/>
18           <input type="checkbox" name="rmv" value="JBoss" />JBoss<br/>
19           <input type="checkbox" name="rmv" value="Others" />Others<br/>
20           <input type="submit" value="Choose" />
21       </form>
22   </body>
23 </html>
```

Appendix – The Servlet Model

HttpServletRequest interface – Examples

MChoiceServlet.java

```
        */
    protected void processRequest(HttpServletRequest request, HttpServletResponse response)
            throws ServletException, IOException {
        response.setContentType("text/html;charset=UTF-8");
        PrintWriter out = response.getWriter();
        try {
            out.println("<html>");
            out.println("<head>");
            out.println("<title>Servlet MChoiceServlet</title>");
            out.println("</head>");
            out.println("<body>");
            out.println("<h1>Get Parameter Values Demo</h1>");
            String[] strSelect = request.getParameterValues("rmv");
            if (strSelect != null) {
                for (int i = 0; i < strSelect.length; i++) {
                    out.println("Selected item name: " + strSelect[i] + "<br/>");
                }
            }
            out.println("</body>");
            out.println("</html>");
        } finally {
            out.close();
        }
    }
```

Appendix – The Servlet Model

HttpServletRequest interface – Examples

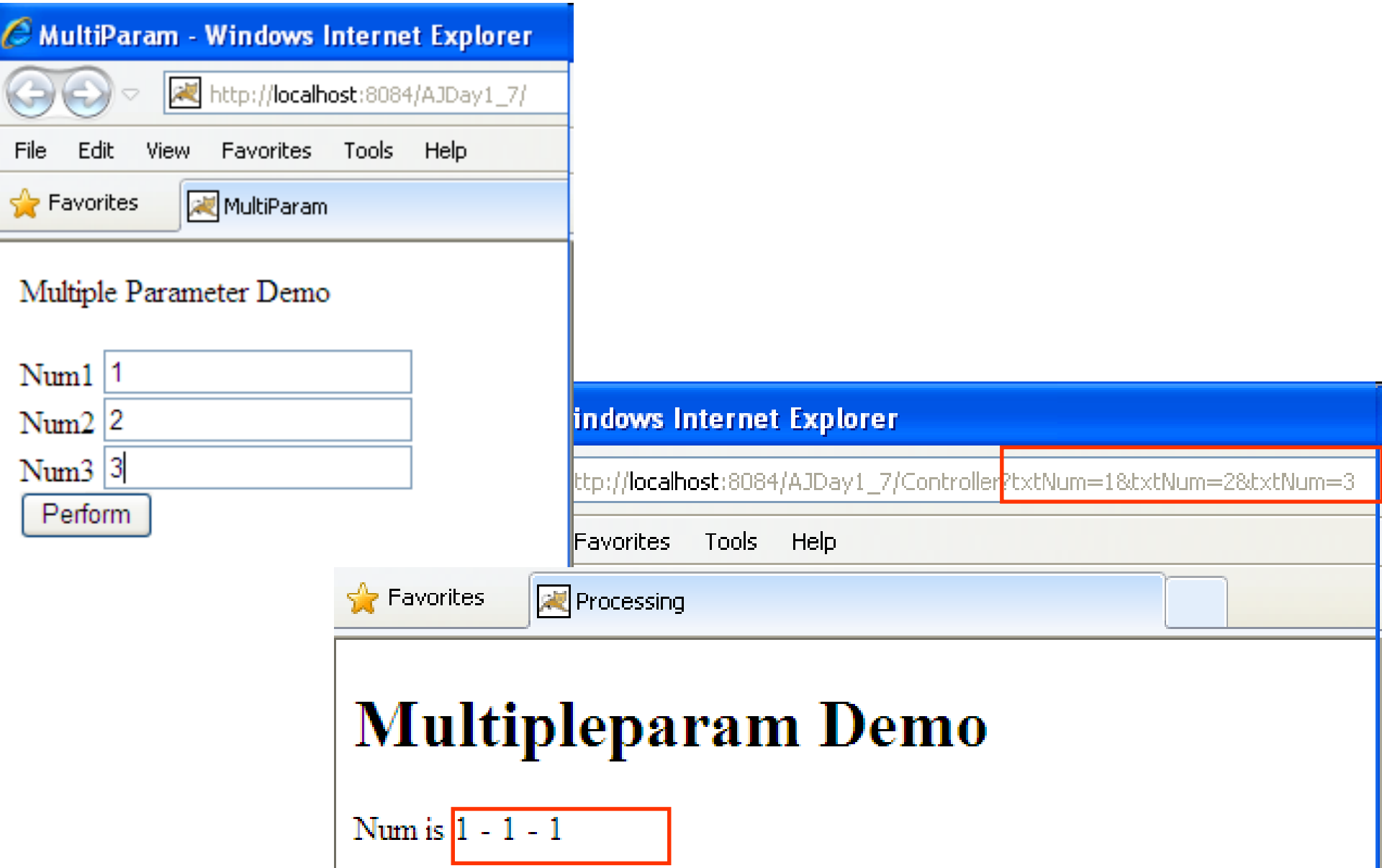
```
<body>
    <form action="Controller">
        Num1 <input type="text" name="txtNum"/> <br/>
        Num2 <input type="text" name="txtNum"/> <br/>
        Num3 <input type="text" name="txtNum"/> <br/>
        <input type="submit" value="Perform" />
    </form>

</body>
```

multiparam.html | Controller.java

```
28      protected void processRequest(HttpServletRequest request, HttpServle
29      throws ServletException, IOException {
30          response.setContentType("text/html;charset=UTF-8");
31          PrintWriter out = response.getWriter();
32          try {
33
34              out.println("<html>");
35              out.println("<head>");
36              out.println("<title>Processing</title>");
37              out.println("</head>");
38              out.println("<body>");
39              out.println("<h1>Multiparam Demo</h1>");
40
41              String num = request.getParameter("txtNum");
42              String num1 = request.getParameter("txtNum");
43              String num2 = request.getParameter("txtNum");
44              out.println("Num is " + num + " - " + num1 + " - " + num2);
45
46              out.println("</body>");
47              out.println("</html>");
48
49          } finally {
50              out.close();
51          }
52      }
```

Appendix – The Servlet Model

HttpServletRequest interface – Examples

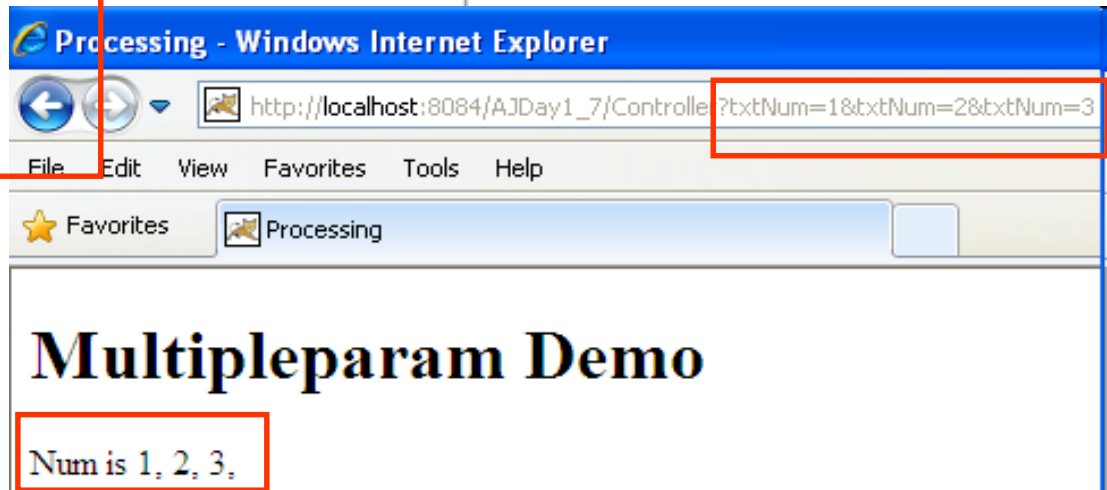


Appendix – The Servlet Model

HttpServletRequest interface – Examples

multiparam.html | Controller.java

```
28      protected void processRequest(HttpServletRequest request, Htt
29      throws ServletException, IOException {
30          response.setContentType("text/html;charset=UTF-8");
31          PrintWriter out = response.getWriter();
32          try {
33
34              out.println("<html>");
35              out.println("<head>");
36              out.println("<title>Processing</title>");
37              out.println("</head>");
38              out.println("<body>");
39              out.println("<h1>Multiparam Demo</h1>");
40
41              String[] num = request.getParameterValues("txtNum");
42              out.println("Num is: ");
43              for(int i=0; i<num.length; i++) {
44                  out.println(num[i] + ", ");
45              }
46
47              out.println("</body>");
48              out.println("</html>");
49
50          } finally {
51              out.close();
52          }
53      }
```



The Servlet Model

ServletResponse interface

- Is **response sent** by the servlet to the **client**
- Include **all the methods** needed **to create and manipulate** a **servlet's output**
- **Retrieve** an **output stream** to send data to the client, **decide** on the **content type** ...
- **Define objects** passed as an argument to service() method
- Some methods

Methods	Descriptions
getContentType	- **public String getContentType()** - Returns the **Multipurpose Internet Mail Extensions** (MIME) type of the request body or **null** if the type is not known - String contentType = response.getContentType();
getWriter	- **public PrintWriter getWriter() throws IOException** - Returns **an object of PrintWriter** class that **sends character text to the client, particular Browser.** - PrintWriter out = response.getWriter();

The Servlet Model

ServletResponse interface

Methods	Descriptions
getOutputStream	- **public ServletOutputStream getOutputStream() throws IOException** - Uses ServletOutputStream object to **write response as binary data to the client.** - ServletOutputStream out = response.getOutputStream(); - 02 supporting methods + **public void print(boolean b) throws IOException** . **writes a boolean value** to the client with no carriage return line feed (CRLF) character at the end . out.print(b); + **public void println(char c) throws IOException** . same as the print methods but it **writes a character value** to the client, followed by a carriage return line feed (CRLF)
setContentType	- **public void setContentType(String str)** - Used to **set format in which the data** is **sent to the client**, either normal text formate or html format - **Ex**: response.setContentType("text/html");

The Servlet Model

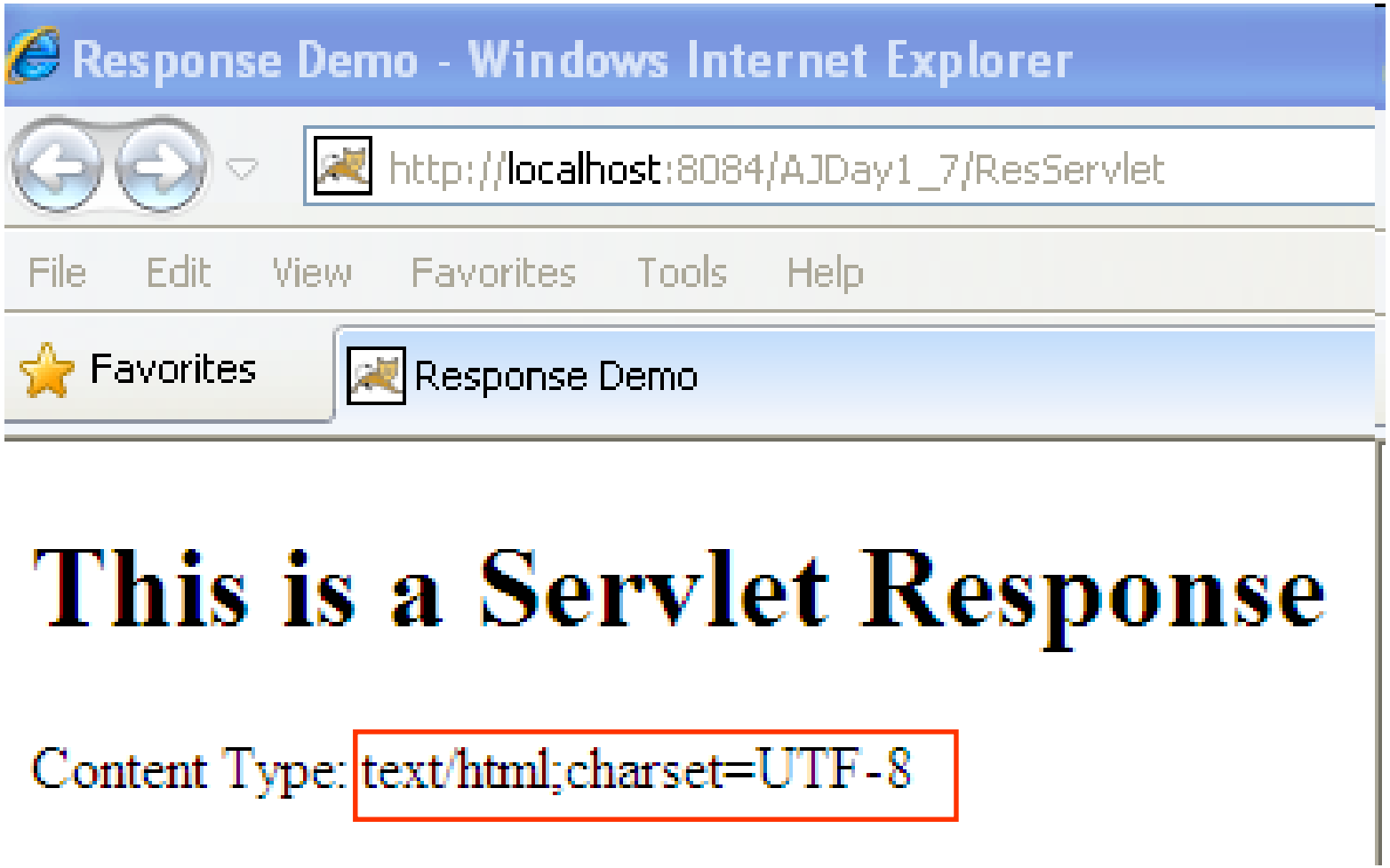
HttpServletResponse interface

- **Extends ServletResponse Interface**
- **Defines HttpServlet objects** to **pass** as an argument **to the service**() method to the client
- Set HTTP response, HTTP header, set content type of the response, acquire a text stream for the response, acquire a binary stream for the response, redirect an HTTP request to another URL or add cookies to the response

Methods	Descriptions
encodeRedirectURL	- **public String encodeRedirectURL (String url)** - **Encodes** the **specified URL for use** in the **sendRedirect** method, or **if encoding is not needed**, returns the URL unchanged
sendRedirect	- **public void sendRedirect(String URL) throws IOException** - Sends a redirect response to the client using the **specified redirect location URL** - the servlet using the sendRedirect method to decide the request handled by particular servlet or - Ex: response.sendRedirect("process.jsp");

Appendix – The Servlet Model

HttpServletResponse interface - Example



Appendix – The Servlet Model

HttpServletResponse interface - Example

- Using sendRedirect

RedirectServlet.java

```
14  /**
15   *
16   * @author Trong Khanh
17   */
18  public class RedirectServlet extends HttpServlet {
19
20      /**...*/
27      protected void processRequest(HttpServletRequest request, HttpServletResponse response)
28              throws ServletException, IOException {
29          response.setContentType("text/html;charset=UTF-8");
30          PrintWriter out = response.getWriter();
31          try {
32              response.sendRedirect(response.encodeRedirectURL("ResServlet"));
33          } finally {
34              out.close();
35          }
36      }
```

Appendix – The Servlet Model

HttpServletResponse interface - Example

- ResServlet

ResServlet.java

```
16      * @author Trong Khanh
17      */
18     public class ResServlet extends HttpServlet {
19
20         /**...*/
27         protected void processRequest(HttpServletRequest request, HttpServletResponse response)
28                 throws ServletException, IOException {
29             response.setContentType("text/html;charset=UTF-8");
30             PrintWriter out = response.getWriter();
31             try {
32                 out.println("<html>");
33                 out.println("<head>");
34                 out.println("<title>Response Demo</title>");
35                 out.println("</head>");
36                 out.println("<body>");
37                 out.println("<h1>This is a Servlet Response</h1>");
38
39                 out.println("Content Type: " + response.getContentType() + "<br/>");
40
41                 out.println("</body>");
42                 out.println("</html>");
43             } finally {
44                 out.close();
45             }
46         }
```

The Servlet Model

HttpServlet class

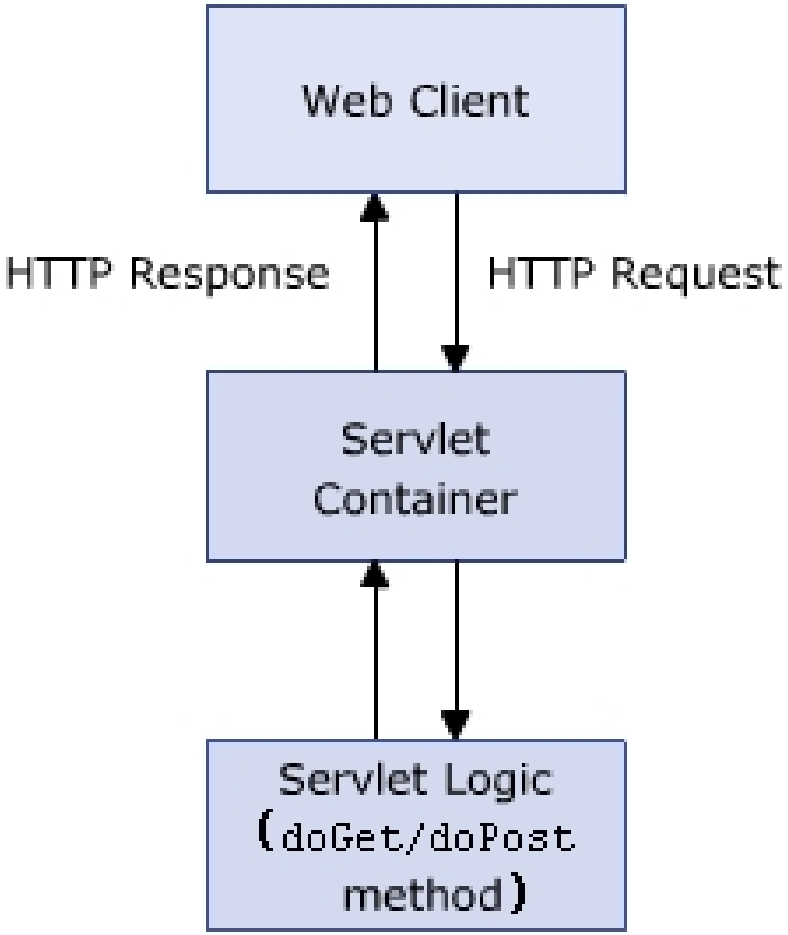
- The protocol **defines** a set of **text-based request messages** called HTTP 'methods' **implemented in *HttpServlet* class**
- Provides **an abstract class** to **create** an **HTTP Servlet**
- **Extends** the **GenericServlet class**
- A subclass of HttpServlet class **must override at least** one of the following methods: **doGet(), doPost,** doPut(), doDelete(), init(), destroy(), and getServletInfo
- Some methods to process the request

Methods	Descriptions
doGet	- **protected void doGet(HttpServletRequest req, HttpServletResponse res) throws ServletException, IOException** - **called by container** to **handle** the **GET** request. - This method is **called through service() method**
doPost	- **protected void doPost(HttpServletRequest req, HttpServletResponse res) throws ServletException, IOException** - **called** by **container** to **handle** the **POST request.** - This method is **called through service() method**

The Servlet Model

HttpServletRequest interface

- **Extends ServletRequest** Interface
- **Add a few more methods** for handling HTTP-specific request data
- **Defines an HttpServletRequest object passed as an argument to the service**() method



Appendix – Build The Simple Web

Login Page

login.html

Source | History

```
1   <!DOCTYPE html>
2   ...5 lines
7   <html>
8       <head>
9           <title>Login</title>
10          <meta charset="UTF-8">
11          <meta name="viewport" content="width=device-width, initial-scale=1.0">
12      </head>
13      <body>
14          <h1>Login Page</h1>
15
16          <form action="SE1162Servlet" method="POST">
17              Username <input type="text" name="txtUsername" value="" /><br/>
18              Password <input type="password" name="txtPassword" value="" /><br/>
19              <input type="submit" value="Login" name="btAction" />
20              <input type="reset" value="Reset" />
21          </form>
```

Appendix – Build The Simple Web

Invalid Page

invalid.html

Source | History

```
1   <!DOCTYPE html>
2   ...5 lines
7   <html>
8       <head>
9           <title>Invalid</title>
10          <meta charset="UTF-8">
11          <meta name="viewport" content="width=device-width, initial-scale=1.0">
12      </head>
13      <body>
14          <h1>
            <font color="red">
16              Invalid username or password!!!
17          </font>
18      </h1>
19
20      <a href="login.html">Click here to try again</a><br/>
```

Appendix – Build The Simple Web

Search Page

search.html

Source | History

```
1   <!DOCTYPE html>
2   ...5 lines
7   <html>
8       <head>
9           <title>Search</title>
10          <meta charset="UTF-8">
11          <meta name="viewport" content="width=device-width, initial-scale=1.0">
12      </head>
13      <body>
14          <h1>Search Page</h1>
15          <form action="SE1162Servlet">
16              Search Value <input type="text" name="txtSearchValue" value="" /><br/>
17              <input type="submit" value="Search" name="btAction" />
18          </form>
19      </body>
20  </html>
21
```