

CS320 Web and Internet Programming

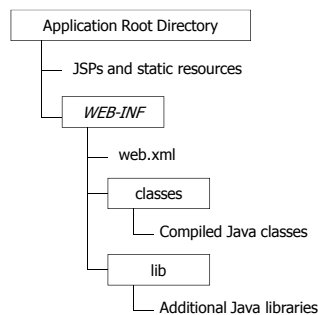
Introduction to Java Servlets

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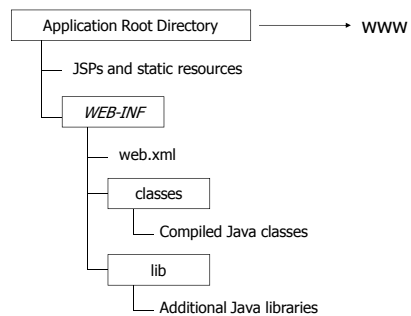
Java Web Application Components

- ◆ Compiled Java classes (.class files)
 - Servlets, beans, filters, ...
- ◆ Additional Java libraries (.jar files)
- ◆ JavaServer Pages (JSPs)
- ◆ Static resources
 - HTML, CSS, images, ...
- ◆ Metadata files
 - web.xml, ...

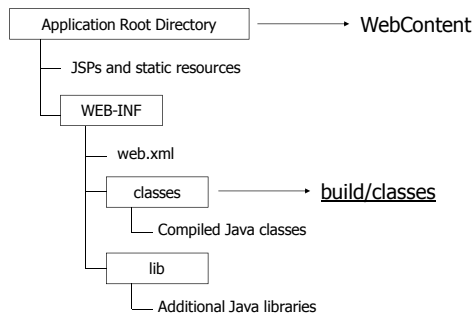
Directory Structure of a Java Web Application



Directory Structure on CS3



Directory Structure of an Eclipse Dynamic Web Project



Servlet HelloWorld

```
import java.io.*;
import javax.servlet.*;
import javax.servlet.http.*;
```

```
@WebServlet( "/HelloWorld" )
public class HelloWorld extends HttpServlet {
    public void doGet( HttpServletRequest request,
        HttpServletResponse response )
        throws ServletException, IOException
    {
        PrintWriter out = response.getWriter();
        out.println( "Hello World" );
    }
}
```

Some Simple Observations

- ◆ Inherits from `HttpServlet`
 - <http://download.oracle.com/javase/6/api/javax/servlet/http/HttpServlet.html>
 - There's no `main()` method
- ◆ `doGet()`
 - Input: `HttpServletRequest`
 - Output: `HttpServletResponse` → sent back to the client browser

Example: HelloWorld in HTML

- ◆ Modify the `HelloWorld` servlet to output in HTML

Generating HTML

- ◆ `HttpServletResponse`
- ◆ Set content type to "text/html"
 - `setContentType()`
- ◆ Generate an HTML page
 - `getWriter().println()`
 - ♦ `<html>`, `<head>`, `<body>` ...

Servlet Mapping

- ◆ `@WebServlet(<URL Pattern(s)>)`

Servlet mapping



`http://<host>/<app>/<path>`
Request URL

Java Annotations

- ◆ Available since JDK 1.5 (Java 5)
- ◆ Data about a program that is not part of the program itself
- ◆ Can be used by compiler, VM, and other software tools for *various purposes*

Annotation Examples ...

- ◆ Error detection

```
@Override  
protected void doGet()
```

- ◆ Suppress warning

```
@SuppressWarnings("unchecked")  
public List<User> getAllUsers()  
{  
    return (List<User>) new ArrayList();  
}
```

... Annotation Examples

- ◆ Servlet mapping in Sevelet 3.x Specification

```
@WebServlet("/HelloServlet")
public class HelloServlet extends HttpServlet
```

- ◆ Web service

```
@WebService
public class HashService {

    @WebMethod
    public String md5( String text )
}
```

About Annotations

- ◆ An annotation may have elements
 - E.g. `@WebServlet(value={"/HelloServlet"})`
- ◆ The default element is `value`
 - E.g. `@WebServlet({"/HelloServlet"})`
- ◆ An element has a type (like a variable in Java)
- ◆ `{}` can be omitted for array values if there's only one value in the array
 - E.g. `@WebServlet("/HelloServlet")`

@WebServlet

- ◆ <http://download.oracle.com/javaee/6/api/javax/servlet/annotation/WebServlet.html>

@WebServlet Elements for URL Patterns

- ◆ `value`
 - URL pattern(s) of the servlet
 - The default element
- ◆ `urlPatterns`
 - Same purpose as `value`
 - Usually used when more than one element is specified
 - Only one of `value` and `urlPatterns` can be specified

@WebServlet Examples

```
@WebServlet( "/HelloServlet" )
@WebServlet( {"/HelloServlet", "/member/*"} )
@WebServlet( name="Hello", urlPatterns={"/HelloServlet", "/*.html"} )

@WebServlet(
    urlPatterns="/MyPattern",
    initParams={@WebInitParam(name="ccc", value="333")}
)
```

Be Careful with URL Patterns

- ◆ Invalid patterns
 - E.g. `member/index.html`, or `/member/*.html`
- ◆ Conflicting patterns
 - E.g. two `/HelloServlet`
- ◆ Overlapping patterns
 - E.g. `*.html` and `/member/*`

Wildcard in Servlet Mapping

- ◆ A string beginning with a `/` and ending with a `/*`
 - E.g. `/*`, `/content/*`
- ◆ A string beginning with a `*`.
 - E.g. `*.html`, `*.do`

See Servlet Specification 3.0, Section 12

Example: RequestCounter

- ◆ Display the number of times a servlet is requested

You are visitor #1001.

Servlet Life Cycle

- ◆ When the servlet is loaded – `init()`
 - Executed only once
 - Don't forget `super.init(config)`
- ◆ Per request – `service()`
 - dispatch to `doXxx()`
- ◆ When the servlet is unloaded – `destroy()`

Why Use `init()` Instead of Constructor

- ◆ Historical reasons – see http://csns.calstatela.edu/wiki/content/cysun/notes/servlet_data_init
- ◆ `ServletContext` cannot be accessed in a constructor

Example: SharedRequestCounter

- ◆ Use one servlet to count the number of requests, and another servlet to display the count

Application Scope

- ◆ A "storage area" where data can be stored and accessed
- ◆ Data in application scope will remain there as long as the application is running
- ◆ Data in application scope is shared by all servlets

Access Application Scope

- ◆ **HttpServlet**
 - `getServletContext()`
- ◆ **ServletContext**
 - `setAttribute(String name, Object value)`
 - ♦ Give any object a name and save it to application scope
 - `getAttribute(String name)`
 - ♦ Retrieve the object from application scope

loadOnStartup

- ◆ By default, a servlet is not created until it is accessed for the first time
 - Could cause problem if one servlet must run before another servlet
- ◆ Use the `loadOnStartup` element of `@WebServlet` to have a servlet created during application startup

loadOnStartup Example

```
@WebServlet(  
    name="Hello",  
    urlPatterns={"/HelloServlet", "/*.html"},  
    loadOnStartup=1  
)
```

The value for `loadOnStartup` is the order in which the application server will start the servlets.

About web.xml

- ◆ Web application deployment descriptor
 - `<web-app>`
 - ♦ `version`
 - `<welcome-file-list>`
- ◆ More about `web.xml` in Java Servlet Specification

Versions

Servlet/JSP Spec	Tomcat	Java
3.0/2.2	7.0.x	1.6
2.5/2.1	6.0.x	1.5
2.4/2.0	5.5.x	1.4



The `version` attribute of `<web-app>` in `web.xml`

Debugging Servlets

- ◆ Read error message carefully
- ◆ View the source of the generated HTML
 - View `Source` in browser
 - Validation
 - ♦ <http://validator.w3.org/>
 - ♦ Use the Web Developer addon of Firefox
- ◆ Using the Eclipse debugger
 - Set *break points*
 - Debug As → Debug on Server

Summary

- ◆ Standard directory structure
- ◆ Servlet basics
 - Generate HTML response
 - URL mapping with @WebServlet
 - Lifecycle
- ◆ Data sharing using application scope
 - `loadOnStartup`
- ◆ `web.xml`
- ◆ Debugging tips