Inside WebObjects

Developing Applications Using JavaServer Pages and Servlets

January 2002

Apple Computer, Inc.
1 Infinite Loop
Cupertino, CA 95014
408-996-1010

Simultaneously published in the United States and Canada

Contents

Figures, Listings, and Tables

CHAPTER 1

About This Book

JavaServer Pages (JSP) and servlets are important parts of Sun's J2EE (Java 2 Platform, Enterprise Edition) architecture. JSP is a specification that defines interfaces that servlet-container vendors can implement to provide developers the ability to create dynamic Web pages, which are files with the extension `.jsp`. Servlet containers interpret these files and create servlets (also know as workhorse servlets) to process HTTP requests and produce responses. Servlets are server plug-ins that extend the capabilities of your HTTP server. They provide a straightforward deployment mechanism for your applications. Servlets are deployed inside servlet containers, which are plug-ins to your HTTP server.

You should read this book if you want to deploy your WebObjects applications inside a servlet container or want to take advantage of WebObjects components (both standard and custom) in your JSP pages.

Deploying WebObjects applications as servlets allows you to take advantage of the features that your servlet container provides. Keep in mind that deployment tools such as Monitor and wotaskd do work with servlets. WebObjects uses version 2.2 of the Servlet API, and version 1.1 of the JSP specification.

The book addresses two major points, each contained in its own chapter:

- Chapter 2, "Deploying WebObjects Applications as Servlets" (page 11), explains how you develop WebObjects applications to be deployed as servlets and how to add servlet capability to existing applications.
- Chapter 3, "Developing JSP-Based WebObjects Applications" (page 27), tells you how to write JSP-based applications, which can be thought of as JSP applications that use WebObjects technology or hybrids—applications that use JSP pages to accomplish some tasks and WebObjects components or direct actions to perform others.

- Appendix A, "Special Issues" (page 51), addresses special issues to consider when you deploy WebObjects applications as servlets or when you develop JSP-based applications.

To get the most out of this book, you must be familiar with WebObjects application development. In particular, you need to know how to create applications using Project Builder and how to layout WebObjects components using WebObjects Builder.

If you need to learn the basics about developing WebObjects applications, you can find that information in the following books:

- *Inside WebObjects: WebObjects Overview* provides you with a survey of WebObjects technologies and capabilities.
- *Inside WebObjects: Discovering WebObjects for HTML* shows you how to develop HTML-based applications.
- *Inside WebObjects: Deploying WebObjects Applications* describes how to use WebObjects tools to deploy your applications as standalone entities.

For additional WebObjects documentation and links to other resources, visit http://developer.apple.com/webobjects.

In addition to WebObjects development experience, you also need to be acquainted with the syntax used in JSP pages and with the layout of WAR (Web Application Archive) files. You can find information about JSP and J2EE in the following books:

- *Java Servlet Programming*, 2nd edition (O'Reilly) provides an in-depth treatise on servlets. You can find more information at http://java.oreilly.com.
- *J2EE Technology in Practice* (Sun) provides an overview of J2EE technology.
- *JavaServer Pages Technology Syntax* (Sun) is a short document that describes the syntax used in JSP pages. You can download it from http://java.sun.com/products/jsp/technical.html. For more information on JSP and servlets, see http://java.sun.com/products/jsp.
- *Java Servlet Technology* contains the latest information on Sun's Java Servlet technology. You can view it at http://java.sun.com/products/servlet/.

WebObjects Developer also includes a commented, application project that shows you how JSP pages can take advantage of WebObjects components and direct actions. The example—using the client/server approach—includes two WebObjects application projects named SchoolToolsClient and SchoolToolsServer.You can find the projects in the `/Developer/Examples/JavaWebObjects` directory.

CHAPTER 1

About This Book

CHAPTER 2

Deploying WebObjects Applications as Servlets

Servlet technology was developed as an improvement over CGI. It's an open standard that can be freely adopted by any vendor. It provides an infrastructure that allows applications from different manufactures to cooperate, and share resources.

The following sections explain how you can take advantage of servlet technology in WebObjects:

- "Servlets in WebObjects" (page 12) provides an overview of servlet technology as it is implemented in WebObjects.
- "Developing and Deploying a Servlet" (page 13) guides you through creating a servlet from scratch.
- "Deploying an Existing Application as a Servlet" (page 21) explains how to deploy an existing WebObjects application as a servlet.
- "Cross-Platform Deployment" (page 23) shows you how to simplify cross-platform deployment (or deployment in a platform other than the development platform) by allowing you to easily define the paths your servlet container uses to locate WebObjects frameworks, local frameworks, and WebObjects application bundles—WebObjects Application (WOA) directories.

Servlets in WebObjects

Servlets are generic server extensions that expand the functionality of a server. By deploying WebObjects applications as servlets running inside servlet containers, you can take advantage of the features that your servlet container offers. Alternatively, you can deploy your applications using an HTTP adaptor that runs as a plug-in in your HTTP server. The adaptor forwards requests to your servlet container.

WebObjects applications can be deployed as servlets inside a servlet container such as Tomcat (version 3.2.3) or WebLogic. When an application runs as a servlet, instead of as a separate Java virtual machine (JVM) process, it runs inside the servlet container's JVM, along with other applications. Note, however, that you can run only one instance of an application inside a servlet container. To run multiple instances of an application, you have to use multiple servlet containers. In addition, WebObjects deployment tools such as Monitor and wotaskd cannot be used with servlets.

To deploy an application as a servlet, you need to add the JavaWOJSPServlet framework to your project. When you build the project, Project Builder generates a WAR (Web application archive) file in addition to the WOA (WebObjects application) bundle. The WAR file has the appropriate classes and the `web.xml` file in the `WEB-INF` directory that your servlet container needs to launch the servlet. All you need to do in order to deploy the servlet is copy the WAR file to the application deployment directory of your servlet container.

You may have to modify `web.xml.template`, specifically the `%WOClassPath%` marker, to ensure that the classpath to the application's WOA is correct. For WebLogic, the default Session class must be placed in a package because it conflicts with an internal WebLogic class. In general, all your classes should be inside packages.

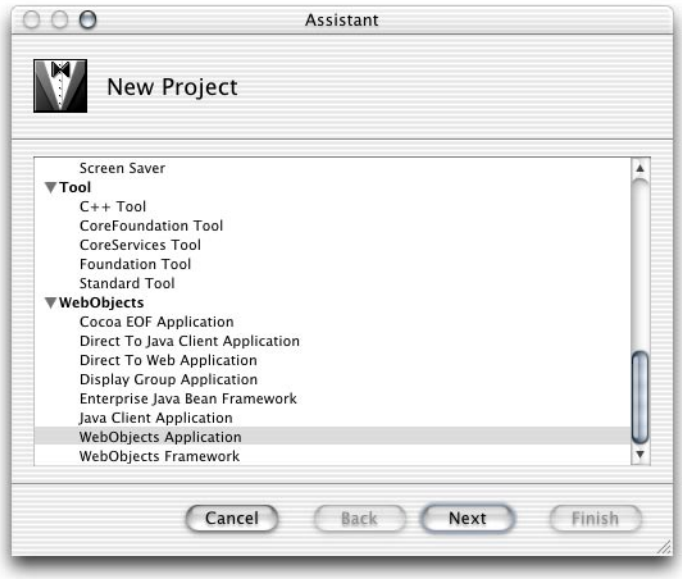
Note: The WAR file is not a complete application. WebObjects Deployment must be installed on the application host, as well as the application's WOA bundle.

Developing and Deploying a Servlet

Follow these steps to create a new project with servlet support.

1. Create a new project using Project Builder.

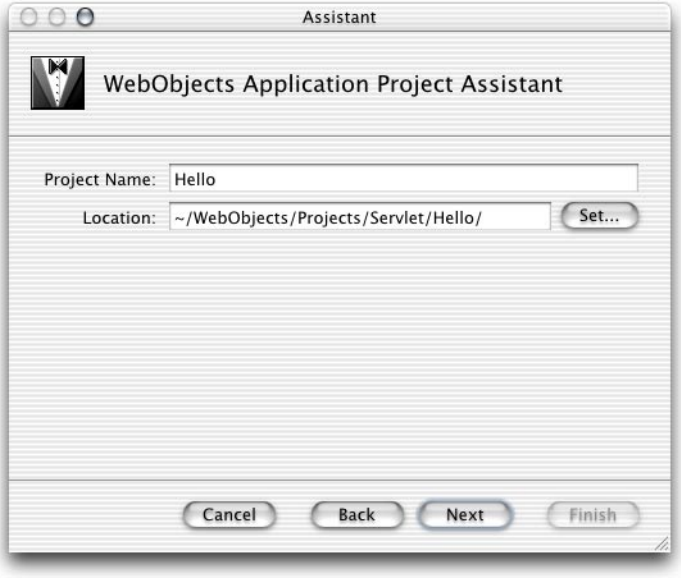
   Select WebObjects Application from the list of project types, and click Next.



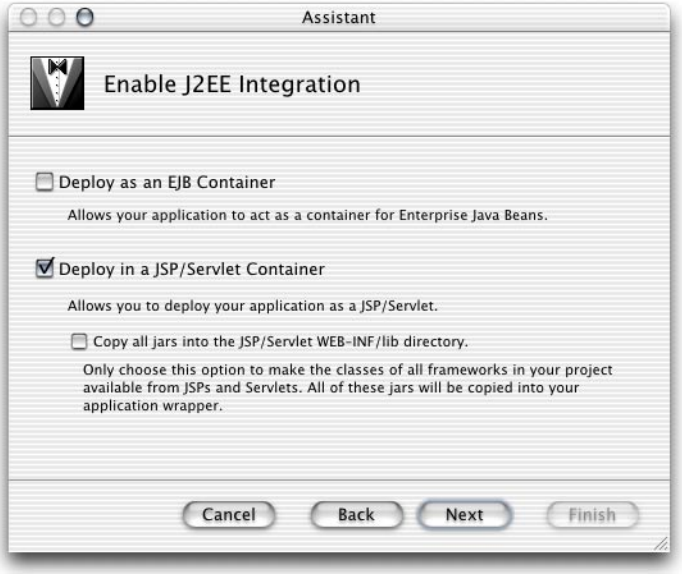
   You can deploy as a servlet other types of WebObjects applications, such as Direct to Java Client, Direct to Web, Display Group, and Java Client.

2. Identify the project.

   Name the project Hello, select a location for it, and click Next.

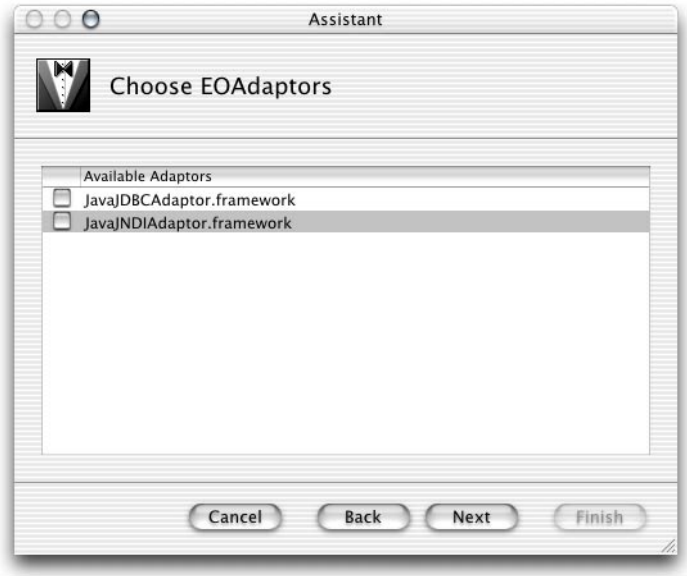


3. Select Deploy in a JSP/Servlet Container, and click Next.

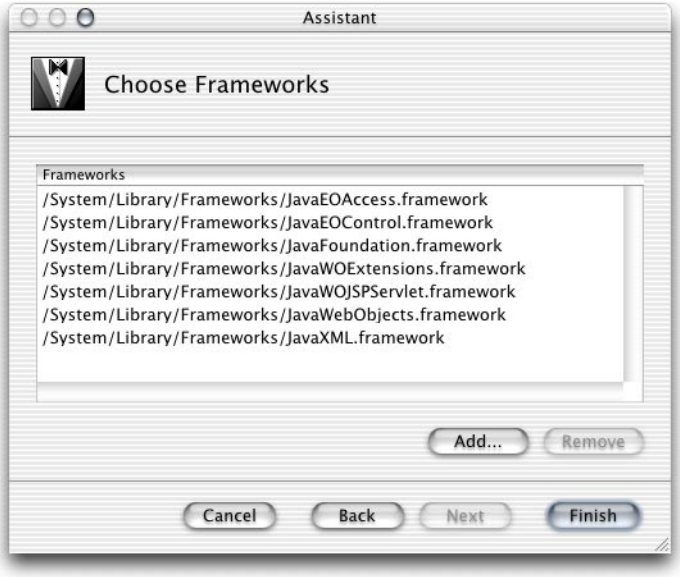


Selecting "Copy all JARs inside the JSP/Servlet WEB-INF directory" tells Project Builder to copy framework and application JAR files to the `WEB-INF/lib` directory (necessary only when the servlet uses other servlets, or for JSPs that make use of actual objects).

4. Make sure no data-source adaptors are selected in the Choose EOAdaptors pane, because this application doesn't make use of a data source, and click Next.

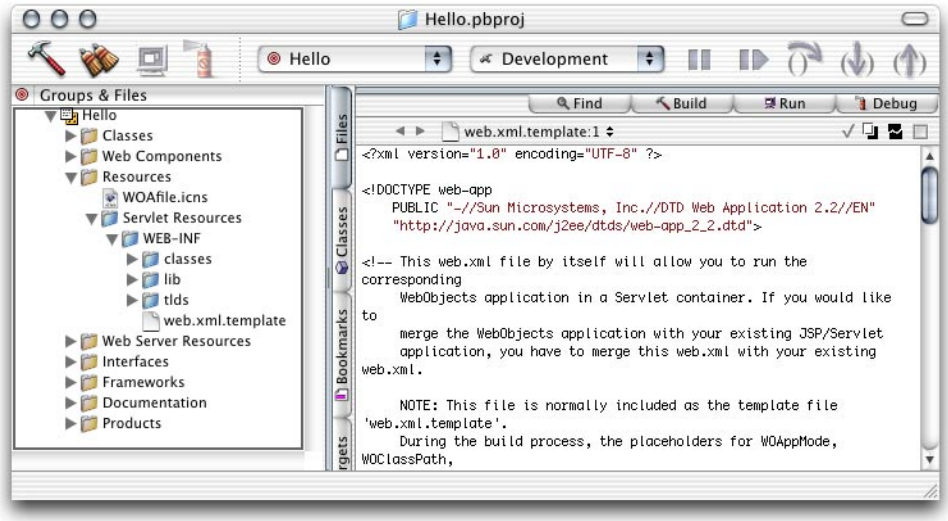


5. No additional frameworks are needed. Click Finish.



When Project Builder is finished creating the project, you'll see a window similar to the one in Figure 2-1 (page 17).

Figure 2-1 New WebObjects Application project with servlet-support

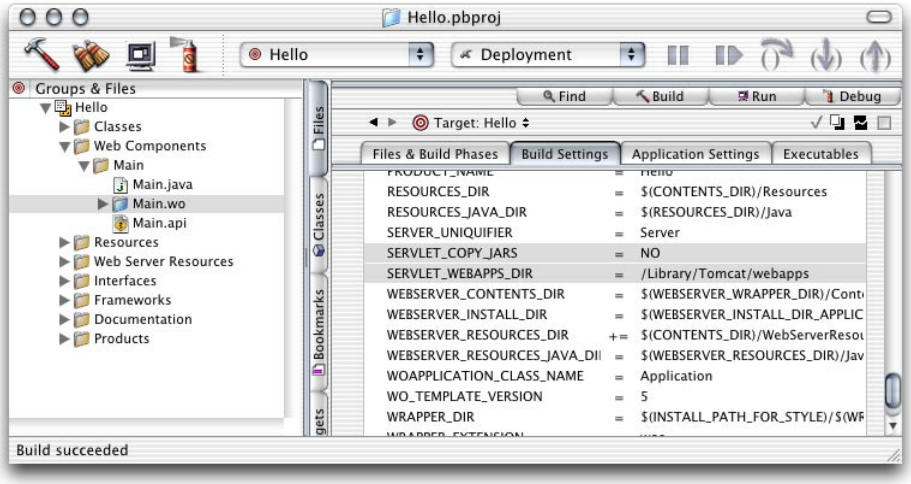


The newly created project is, in all respects, a standard WebObjects Application project. However, Project Builder adds the Servlet Resources folder to the Resources group. Anything you add to this folder is included in the WAR file that Project Builder creates when you build the project, following the same directory structure (the Servlet Resources folder is a real directory in the project's root directory).

The WEB-INF folder, under Server Resources, contains the `web.xml.template` file, which Project Builder uses to generate the servlet's deployment descriptor. You can edit this template to customize the deployment descriptor for your deployment environment. There are several elements whose values are surrounded by percent (%) characters (these are placeholders that Project Builder evaluates when you build the project). These elements include cross-platform settings (see "Cross-Platform Deployment" (page 23) for details). You can replace the placeholders with other values if your environment requires it.

Project Builder also adds a couple of build settings to JSP/Servlet projects, as shown in Figure 2-2.

Figure 2-2 Build settings for a servlet project



The `SERVLET_COPY_JARS` build setting tells Project Builder whether to copy framework and application JAR files to the `WEB-INF/lib` directory (necessary only when the servlet uses other servlets, or for JSPs that make use of actual objects).

You can tell Project Builder where to put the WAR file by setting the value of the `SERVLET_WEBAPPS_DIR` build setting (this is especially convenient during development). By default, WAR files are places in the `build` directory of your project.

Project Builder WO (on Windows) adds two buckets to your project: JSP Servlet WEB-INF and JSP Servlet Resources. The JSP Servlet WEB-INF bucket is a holding place for JARs, classes, and TLDs (which are auto-routed to the correct subdirectories in the `WEB-INF` directory of the generated WAR file, `lib`, `class`, and `tld` respectively; the `web.xml.template` file is also located here). The JSP Servlet Resources bucket contains any other items you want to add to the WAR file (you can drag files and folders into this bucket; Project Builder WO preserves the directory structure when it generates the WAR file). These items are not auto-routed.

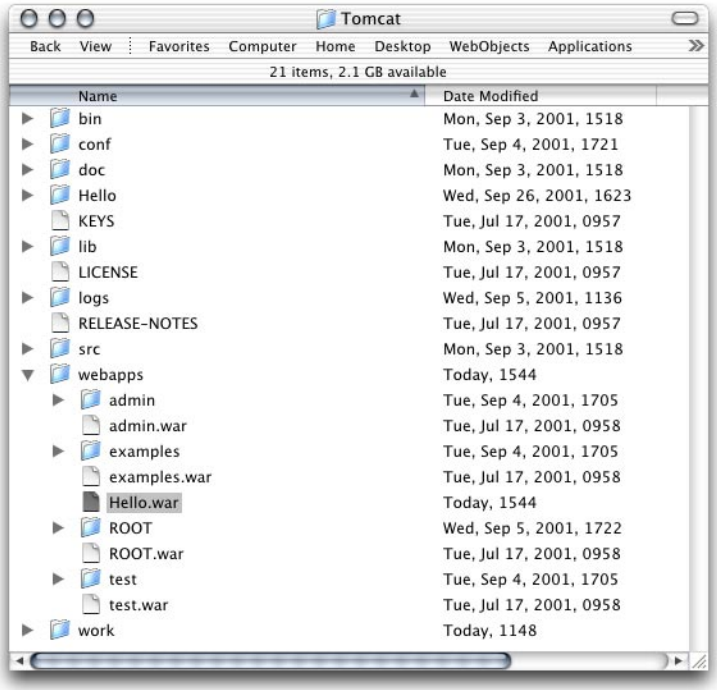
There are also several new variables defined in `Makefile.preamble` . The `SERVLET_APP_MODE` variable indicates whether Web-server resources are loaded from the WOA bundle (the default) or the servlet container (by setting it to `"Deployment"`. The `SERVLET_WEBAPPS_DIR` and `SERVLET_COPY_JARS` variables perform the same function described for Project Builder's servlet-related build settings above.

This is how you set up the `SERVLET_WEBAPPS_DIR` variable in Project Builder WO:

```
export SERVLET_WEBAPPS_DIR = C:\Tomcat\webapps
```

You can test the servlet by setting the `SERVLET_WEBAPPS_DIR` build setting to the path of your servlet container's application deployment directory and building the project. Before you build, you can edit `Main.wo` using WebObjects Builder to add a message to the page, such as "`Hello. I'm a servlet.`" When Project Builder finishes building the application, it places the `Hello.war` file in your servlet container's application deployment directory. Figure 2-3 (page 20) shows the deployment directory of a servlet deployed within Tomcat.

Figure 2-3 Tomcat's application-deployment directory



After restarting Tomcat you'll be able to view your application's output by connecting to it through your servlet container. By default, the connection URL is

```
http://host:port/AppName/WebObjects/AppName.woa
```

where `host` and `port` are defined by the servlet container. Table 2-1 (page 21) lists the default host and port for Tomcat and WebLogic.

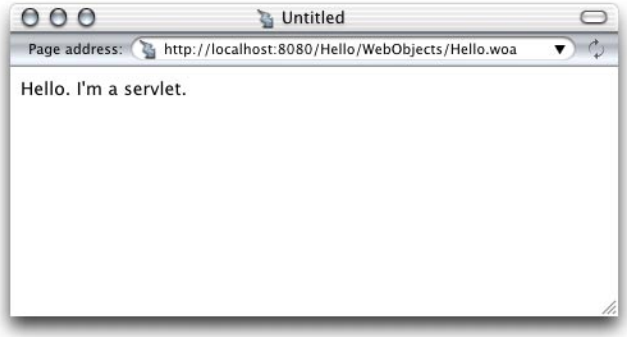


Table 2-1 Default host and port in Tomcat and WebLogic

	Host	Port
Tomcat	`localhost`	`8080`
WebLogic	`localhost`	`7001`

Deploying an Existing Application as a Servlet

To deploy an existing application as a servlet all you need to do is add the JavaWOJSPServlet framework to your project and re-build it. On Mac OS X, follow these steps:

1. Open the project you want to add servlet support to in Project Builder.
2. Add the JavaWOJSPServlet framework.
   a. Select the Frameworks group from the Groups & Files list.
   b. Choose Project > Add Frameworks.

      A sheet appears with the Frameworks folder selected.

c. Select JavaWOJSPServlet.framework from the file list, and click Open.

d. Select Application Server from the target list, and click Add.

Notice that the Servlet Resources folder is added to the Resources group.

3. Build the project using the Deployment build style.
4. Copy the WAR file in the `build` directory of your project to the application deployment directory of your servlet container.

   You can avoid this step by setting `SERVLET_WEBAPPS_DIR` to the path of your servlet container's application-deployment directory.
5. If necessary, restart your servlet container (Tomcat 3.2.3 must be restarted. Tomcat 4.x and WebLogic 6.1 do not need to be restarted.)

The servlet should now be available through your servlet container.

On Windows, follow these steps:

1. Open the project you want to add servlet support to in Project Builder WO.
2. Add the JavaWOJSPServlet framework.
   a. Select the Frameworks bucket.
   b. Choose Project > Add Files.
   c. If necessary, navigate to the `\Apple\Library\Frameworks` directory (the directory should be selected by default).
   d. Select `JavaWOJSPServlet.framework` from the file list and click Open.
3. Re-build the project.
4. If necessary, copy the WAR file in the project's `build` directory to the application deployment directory of your servlet container. On Windows, the WAR file is located at the top level of the project's directory.
5. If necessary, restart your servlet container.

Cross-Platform Deployment

To support cross-platform deployment, WebObjects uses three variables that tell the servlet container at runtime where to find WebObjects frameworks (directories with the `.framework` extension) and the WOA bundles (bundles with the extension `.woa`):

- `WOROOT` indicates the path where WebObjects frameworks are installed. On Mac OS X, for example, WebObjects frameworks are located in the `/System/Library/Frameworks` directory and `WOROOT` is set to `/System`. On Windows, `WOROOT` could be set to `C:\Apple`, and on Solaris it may be `/opt/Apple`.
- `LOCALROOT` indicates the path where local frameworks are installed. On Mac OS X, these frameworks are located in the `/Library/Frameworks` directory, and `LOCALROOT` is set to `/`. On Windows, `LOCALROOT` may be set to `C:\Apple\Local`, while on Solaris it could be `/opt/Apple/Local`.
- `WOAINSTALLROOT` specifies the location of WOA bundles. On Mac OS X, the default is `/Library/WebObjects/Applications`.

When you deploy the WAR file of your servlet on a computer where the framework and WOA files are in different locations from the default ones, you can specify the correct paths using the variables described above. You can accomplish this in two ways:

- configuring the application's deployment descriptor
- configuring the servlet container

Configuring the Deployment Descriptor

The deployment descriptor of a servlet is the `web.xml` file, located in the `WEB-INF` directory of the WAR file. This file is generated from the `web.xml.template` file in your project.

To configure your application's deployment descriptor during development, you edit the `web.xml.template` file. Alternatively, you can edit the `web.xml` file of the WAR file (after expanding the WAR file). Locate the `<param-name>` tags for the appropriate variables, and set the value for their corresponding `<param-value>` tag.

This is an example of a `web.xml.template` file on Windows:

```
<web-app>
    <context-param>
        <param-name>WOROOT</param-name>
        <param-value>C:\WebObjectsFrameworks</param-value>
    </context-param>
    <context-param>
        <param-name>LOCALROOT</param-name>
        <param-value>C:\Apple\Local</param-value>
    </context-param>
    <context-param>
        <param-name>WOAINSTALLROOT</param-name>
        <param-value>C:\WebObjectsApplications</param-value>
    </context-param>
    ...
</web-app>
```

You expand the WAR file by executing the following commands in your shell editor:

```
mkdir filename
jar -xvf filename.war
```

When you're done editing the `web.xml` file, you re-create the WAR file by executing

```
jar -cvf fileName.war .
```

Configuring the Servlet Container

This method allows your settings to be propagated to all applications and it overrides the values set in the deployment descriptor. Using this approach, you can deploy WebObjects applications without worrying about each application's configuration. You can configure the servlet container in two ways:

- editing the launch script of the servlet container
- defining environment variables

This is an example the launch script in Tomcat 3.2.3 (`startup.sh`):

```
#! /bin/sh
...
$JAVACMD $TOMCAT_OPTS -DWOROOT=/Library/WebObjectsFrameworks
-DWOAINSTALLROOT=/WebObjectsApplications -Dtomcat.home=${TOMCAT_HOME}
org.apache.tomcat.startup.Tomcat "$@" &

BASEDIR='dirname $0'
$BASEDIR/tomcat.sh start "$@"
```

This is an example of the launch script in WebLogic:

```
"%JAVA_HOME%\bin\java" -hotspot -ms64m -mx64m -classpath "%CLASSPATH%"
-Dweblogic.Domain=mydomain -Dweblogic.Name=myserver "-Dbea.home=C:\bea"
"-DWOROOT=C:\Apple" "-DLOCALROOT=C:\Apple\Local"
"-DWOAINSTALLROOT=C:\TestApps\woa" -Dweblogic.management.password=%WLS_PW%
-Dweblogic.ProductionModeEnabled=%STARTMODE%
"-Djava.security.policy==C:\bea\wlserver6.1\lib\weblogic.policy"
weblogic.Server
```

This is how you would define environment variables using the bash or zsh shell editors:

```
% export TOMCAT_OPTS="-DWOROOT=/opt/Apple -DLOCALROOT=/opt/Apple/Local -
DWOAINSTALLROOT=/opt/Apple/Local/WebObjects/Applications"
```

And this is how you would do it using the csh shell editor:

```
% setenv TOMCAT_OPTS "-DWOROOT=/opt/Apple -DLOCALROOT=/opt/Apple/Local -
DWOAINSTALLROOT=/opt/Apple/Local/WebObjects/Applications"
```

CHAPTER 2

Deploying WebObjects Applications as Servlets

CHAPTER 3

Developing JSP-Based WebObjects Applications

JavaServer Pages (JSP) is a specification that describes what a servlet-based content creation system should do. One of its main purposes is to facilitate the creation of dynamic Web pages.

You can directly access WebObjects components in your JSP pages. These components can be WOComponents or WODirectActions. This allows you to create JSP-based applications that take advantage of WebObjects technologies, such as Enterprise Objects.

When your servlet container receives a request addressed to a JSP page, the container reads the `.jsp` file and compiles it into a workhorse servlet that processes the HTTP requests and produces responses to them.

This chapter addresses the following topics:

- "JSP-Page Writing Guidelines" (page 28) introduces the custom tag library that your JSP pages must include to be able to access WebObjects components.
- "Creating a JSP-Based Application" (page 30) walks you through the steps needed to create a simple JSP-based WebObjects application.
- "Passing Data From a JSP Page to a Component" (page 34) explains what you need to do in order to pass data from a JSP page to a WebObjects component or direct action.
- "Using WebObjects Classes in a JSP Page" (page 38) shows you how to write JSP pages that use WebObjects classes.
- "Using Direct Actions in JSP Pages" (page 42) explains how to use a direct action in a JSP page.
- "Custom-Tag Reference" (page 47) provides a detailed explanation for each of the tags defined in the custom tag library.

JSP-Page Writing Guidelines

To be able to use WebObjects components in your JSP pages, you have to include the `WOTaglib_1_0.tld` custom tag library. It's located in `/System/Library/Frameworks/JavaWOJSPServlet.framework/Resources`.
This custom tag library uses the tag library descriptor format defined in a DTD (Document Type Definition) from Sun. This DTD is available at http://java.sun.com/j2ee/dtds/web-jsptaglibrary_1_1.dtd.

The tags you use in your JSP pages have the form `<wo:`*tagName*`>`. *tagName* indicates the type of element you want to use. For example, to use a `component` element within a JSP page, you add code like the following to the `.jsp` file:

```
<wo:component ...>
    ...
</wo:component>
```

Version 1.0 of the custom tag library defines five tags as described in Table 3-1.

Table 3-1 Custom tags defined in WOTaglib_1_0.tld

Tag	Children	Description
`<wo:component>`	`binding` `extraHeader`	Top-level element. Specifies the component that is used in the JSP page.
`<wo:directAction>`	`formValue` `extraHeader`	Top-level element. Specifies the direct action that is used in the JSP page.
`<wo:extraHeader>`	None	Specifies the extra HTTP headers to be passed to the component or direct action.
`<wo:binding>`	None	Specifies the key-value pair to be passed to the containing `<wo:component>` for binding.
`<wo:formValue>`	None	Specifies the form value to be passed to the containing `<wo:directAction>`.

For detailed information on the WebObjects custom tag library, see "Custom-Tag Reference" (page 47).

To use the `<wo:component>` or `<wo:directAction>` tags on a JSP page, you must add the following directive to the page:

```
<%@ taglib uri="/WOtaglib_1_0.tld" prefix="wo" %>
```

When you need to access WebObjects classes or objects from your JSP page, you need to copy all the framework and application JAR files necessary into the WAR file. You accomplish this by calling the `initStatics` method of the WOServletAdaptor class:

```
<% WOServletAdaptor.initStatics(application); %>
```

Note that you need to invoke the `initStatics` method only once during the lifetime of an application. Furthermore, anytime a `<wo:component>` or `<wo:directAction>` tag is used in a JSP page, the method is invoked automatically.

You also need to import the appropriate packages before using the classes with the `import` attribute of the page directive in your JSP page:

```
<%@ page import = "com.webobjects.jspservlet.*" %>
```

These directives need to be performed only once per page. However, additional invocations have no ill effect. Referencing classes directly is useful when using components that require binding values—for example, a WORepetition whose `list` attribute is bound to an array of enterprise-object instances.

This is an example of a `directAction` definition:

```
<wo:directAction actionName="random" className="DirectAction">
    <wo:formValue key = "formKey" value = '<%= "formValue" %>'/>
    <wo:extraHeader key = "headerKey" value = '<%= "headerValue" %>'/>
</wo:directAction>
```

This is an example of a `component` definition:

```
<wo:component className="MyImageComponent">
    <wo:binding key="filename" value='<%= "start.gif" %>' />
</wo:component>
```

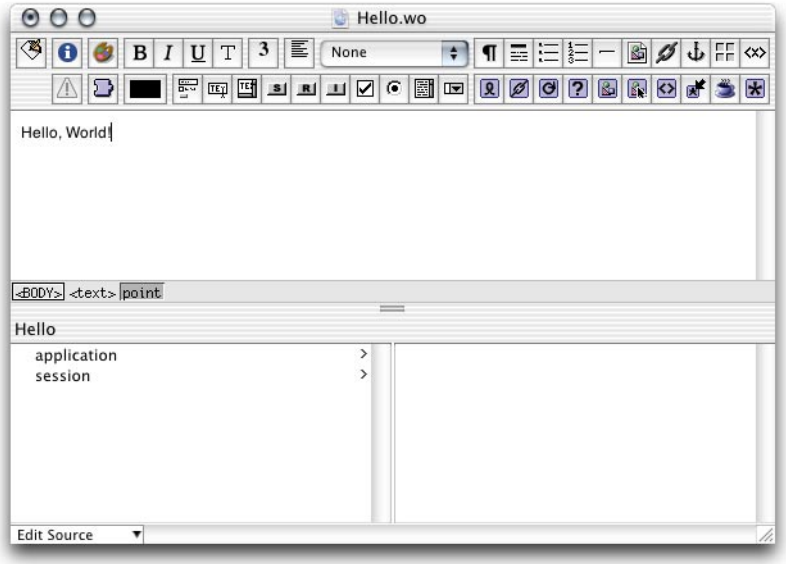
To embed dynamic elements in a JSP page, such WOConditional and WORepetition, you have to wrap them in a WebObjects component, which you then use in your JSP page.

Creating a JSP-Based Application

This section shows you how to create a simple JSP-based WebObjects application. In it you learn how to use the `<wo:component>` tag in a JSP page.

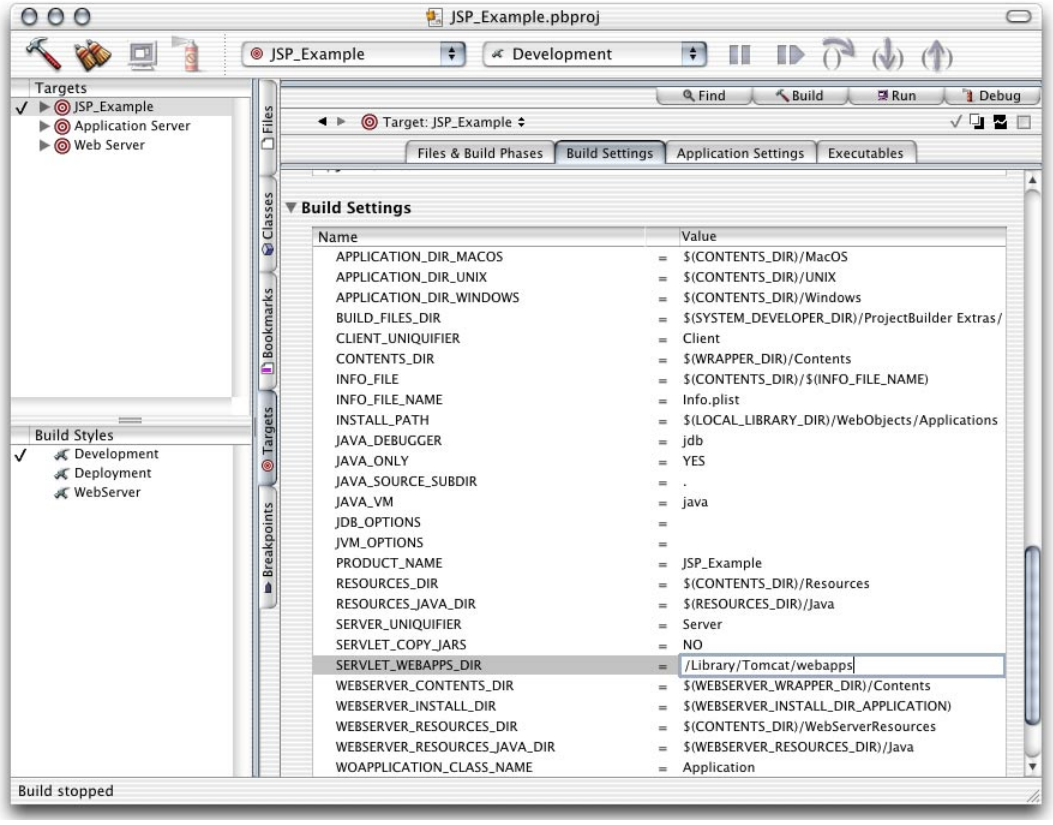
1. Launch Project Builder and create a WebObjects Application project called JSP_Example.
2. In the Enable J2EE Integration pane of the Project Builder Assistant, select Deploy in a JSP/Servlet Container.
3. In Project Builder, create a component called Hello (make sure you assign it to the Application Server target). Edit the component using WebObjects Builder so that it looks like Figure 3-1 (page 31).

Figure 3-1 The Hello component in WebObjects Builder



4. Set the servlet application directory.
    a. In Project Builder click Targets, then click the JSP_Example target the Targets list.
    b. Click Build Settings, then scroll down until you see the Build Settings list.
    c. Locate the `SERVLET_WEBAPPS_DIR` build setting and enter the path of your servlet container's application directory, as shown in Figure 3-2 (page 32).

Figure 3-2 Telling Project Builder where to put the WAR file



5. Using Finder, navigate to the Servlet Resources folder, located in the JSP_Example folder, and create a folder called jsp.
6. Using a text editor, create a file with the following contents:

```
<%-- Welcome.jsp --%>

<%@ taglib uri="/WOtaglib" prefix="wo" %>
```

```
<HTML>

<HEAD>
    <TITLE>Welcome to JSP in WebObjects</TITLE>
</HEAD>

<BODY>
    <wo:component className="Hello">
    </wo:component>
</BODY>

</HTML>
```

7. Save the file as `Welcome.jsp` in the `jsp` directory.
8. Build the JSP_Example project (if necessary, restart your servlet container).

You should now be able to connect to your application. In Tomcat, you use the following URL:

```
http://localhost:8080/JSP_Example/jsp/Welcome.jsp
```

A page similar to the one in Figure 3-3 should appear in your browser. (Otherwise, consult your servlet container's documentation to make sure that it's configured properly.)

Figure 3-3 The output of Welcome.jsp

Passing Data From a JSP Page to a Component

In this section, you'll expand the JSP_Example project to include

- a new component called FavoriteFood
- a JSP page, called DiningWell, that uses the Hello and FavoriteFood components to generate its output

The FavoriteFood component contains two attributes: `visitorName` and `favoriteFood`. When the DiningWell workhorse servlet receives a request, it passes two strings to the FavoriteFood component. The FavoriteFood component then uses those string to render its HTML code.

1. Using a text editor, create a file with the following contents:

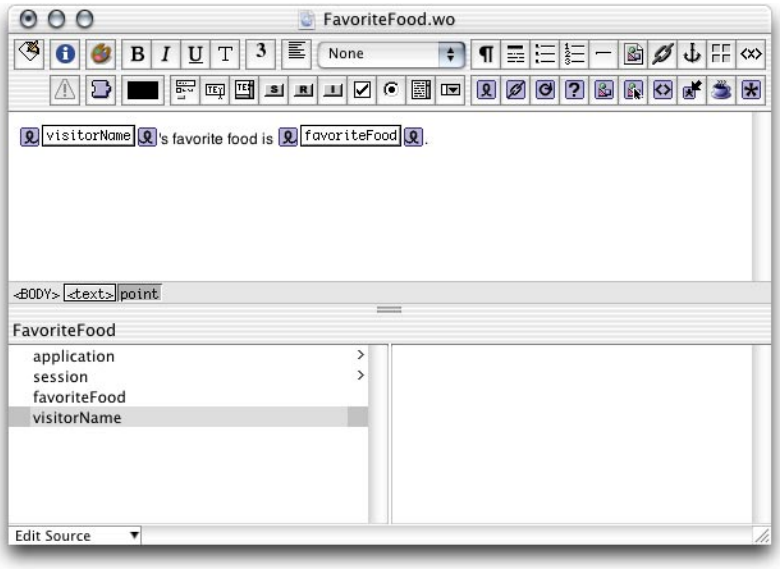
```
<%-- DiningWell.jsp --%>

<%@ taglib uri="/WOtaglib" prefix="wo" %>

<HTML>

<HEAD>
    <TITLE>Using Two Components</TITLE>
</HEAD>

<BODY>
    <wo:component className="Hello">
    </wo:component>
    <P><P>
    <wo:component className="FavoriteFood" bodyContentOnly="true">
        <wo:binding key="visitorName" value='<%= "Worf" %>' />
        <wo:binding key="favoriteFood" value='<%= "gagh" %>' />
    </wo:component>
</BODY>

</HTML>
```

Note that in this case the `bodyContentOnly` attribute of the `<wo:component>` tag is set to `true` (this is the default, so you don't need to specify a value for it). This allows you to define the FavoriteFood component as "Full document" (the default setting in WebObjects Builder) instead of "Partial document." This way, the component can be viewed as a Web page on its own and as a component within a JSP page.

For faster processing, you can set the `bodyContentOnly` attribute to `false` if you are certain that the component only includes the `<BODY>` tag and not the `<HTML>` tag.

2. Save the file as `DiningWell.jsp` in the `JSP_Example/Servlet Resources/jsp` directory.
3. In Project Builder, create a component called FavoriteFood (make sure you assign it to the Application Server target).
4. Edit the component using WebObjects Builder so that it looks like Figure 3-4. Make sure to add accessor methods to the `visitorName` and `favoriteFood` String keys.

Figure 3-4 The DiningWell component in WebObjects Builder



When you're done `FavoriteFood.java` should look like Listing 3-1.

Listing 3-1 FavoriteFood.java

```
import com.webobjects.foundation.*;
import com.webobjects.appserver.*;
import com.webobjects.eocontrol.*;
import com.webobjects.eoaccess.*;

public class FavoriteFood extends WOComponent {
    protected String visitorName;
    protected String favoriteFood;

    public FavoriteFood(WOContext context) {
        super(context);
    }

    public String visitorName() {
        return visitorName;
    }
    public void setVisitorName(String newVisitorName) {
        visitorName = newVisitorName;
    }

    public String favoriteFood() {
        return favoriteFood;
    }
    public void setFavoriteFood(String newFavoriteFood) {
        favoriteFood = newFavoriteFood;
    }
}
```

5. Make sure the FavoriteFood component is set to "Full document" (see "Creating a JSP-Based Application" (page 30) for details).
6. Build the project and, if you're using Tomcat 3.2.3, restart your servlet container.

If you're using Tomcat, you can view the new page in your browser with this URL

```
http://localhost:8080/JSP_Example/jsp/DiningWell.jsp
```

The Web page should look like Figure 3-5.

Figure 3-5 The output of DiningWell.jsp

This is the HTML code your Web browser receives:

```
<HTML>

<HEAD>
    <TITLE>What to eat?</TITLE>
</HEAD>

<BODY>
    Hello, World!
    <P><P>
    Worf's favorite food is gagh.
</BODY>

</HTML>
```

Using WebObjects Classes in a JSP Page

This section explains how to write a JSP page that makes use of two WebObjects classes, NSArray and NSMutableArray, to pass information to a component called MusicGenres. You'll continue to work with the JSP_Example project.

1. Using a text editor, create a file with the contents of Listing 3-2.

Listing 3-2 InternetRadio.jsp file

```
<%-- InternetRadio.jsp --%>

<%@ taglib uri="/WOtaglib" prefix="wo" %>

<%-- Import statements --%>
<%@ page import="com.webobjects.foundation.*" %>
<%@ page import="com.webobjects.jspservlet.*" %>

<%-- Initialize JSP/servlet-WebObjects integration system --%>
<%
    WOServletAdaptor.initStatics(application);
%>

<%-- Create musical-genre list --%>
<%
    NSMutableArray genres = new NSMutableArray();
    genres.addObject(new String("Classical"));
    genres.addObject(new String("Country"));
    genres.addObject(new String("Eclectic"));
    genres.addObject(new String("Electronica"));
    genres.addObject(new String("Hard Rock/Metal"));
    genres.addObject(new String("Hip-Hop/Rap"));
    genres.addObject(new String("Jazz"));
%>
```

```
<HTML>

<HEAD>
    <TITLE>Music Available on Internet Radio Stations</TITLE>
</HEAD>

<BODY>
    <wo:component className="MusicGenres" bodyContentOnly="true">
        <wo:binding key="genres" value='<%= genres %>' />
    </wo:component>
</BODY>

</HTML>
```

Note the invocation of the `initStatics` method of the WOServletAdaptor class. It performs the initialization of objects needed to integrate WebObjects with your servlet container (for example, adding a WOSession object to the JSPSession object).

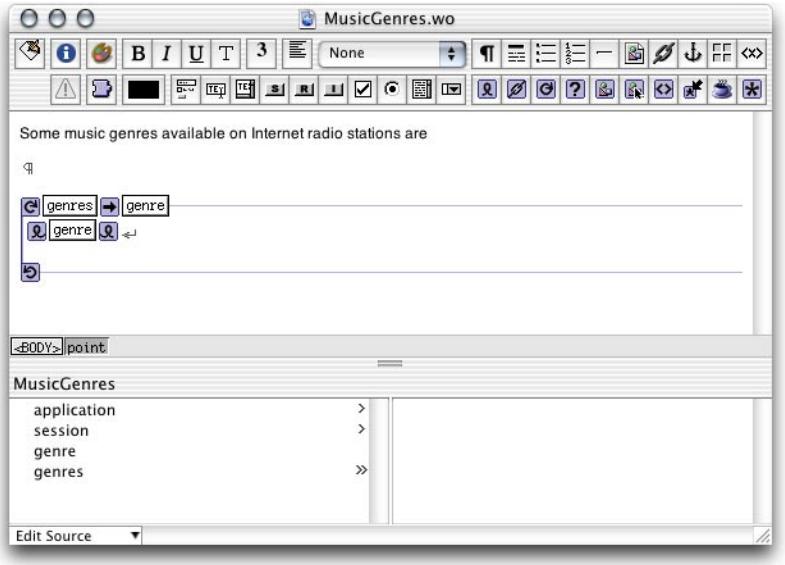
2. Save the file as `InternetRadio.jsp` in the `JSP_Example/Servlet Resources/jsp` directory.
3. In Project Builder, create a component called MusicGenres (make sure you assign it to the Application Server target).
4. Add the `genres` and `genre` keys to MusicGenres using WebObjects Builder. `genres` is an array of Strings and `genre` is a String. Add a setter method for `genres`.

   Alternatively, you can add the following code to `MusicGenres.java`:

   ```
   protected String genre;

   /** @TypeInfo java.lang.String */
   protected NSArray genres;

   public void setGenres(NSArray newGenres) {
       genres = newGenres;
   }
   ```

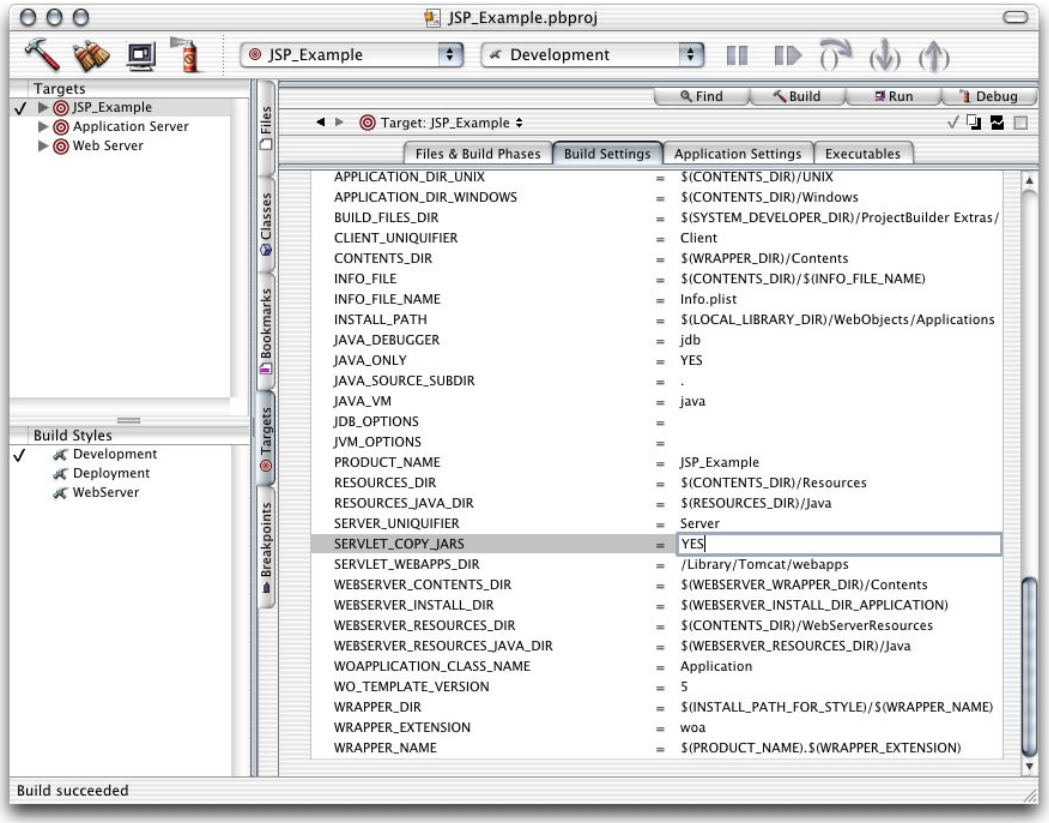
5. Edit the component using WebObjects Builder so that it looks like Figure 3-6 (page 40).

Figure 3-6 The MusicGenres component in WebObjects Builder



6. Tell Project Builder to copy the necessary WebObjects classes to the WAR file.
   a. In Project Builder click Targets, then click on the JSP_Example target in the Targets list.
   b. Click Build Settings, then scroll down until you see the Build Settings list.
   c. Locate the `SERVLET_COPY_JARS` build setting and set its value to `YES` , as shown in Figure 3-7.

Figure 3-7 Telling Project Builder to copy WebObjects classes to the WAR file



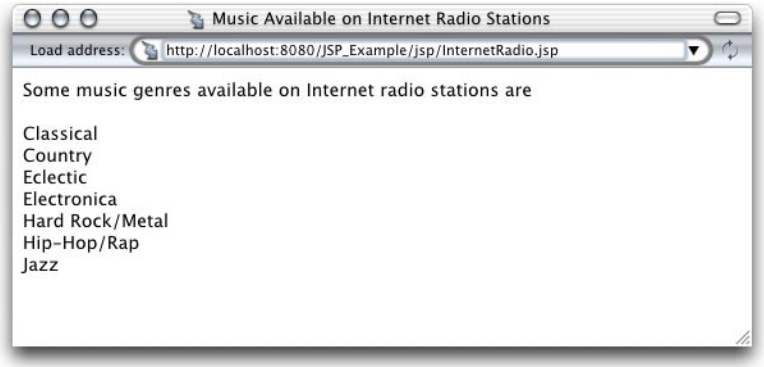
7. Build the project and restart your servlet container.

To view the output of the InternetRadio JSP page in Tomcat use the following URL:

```
http://localhost:8080/JSP_Example/jsp/InternetRadio.jsp
```

You should see a page like the one in Figure 3-8 (page 42).

Figure 3-8 The output of InternetRadio.jsp



Using Direct Actions in JSP Pages

In this section you'll create a WebObjects component called FoodInquiry that contains a WOForm element with two WOTextFields and a WOSubmitButton. The FoodInquiry page is displayed by a direct action, which itself is invoked by a JSP page that provides the FoodInquiry component with initial values for its form elements using `<wo:formValue>` tags.

1. Using a text editor, create a file with the following contents:

```
<%-- LogIn.jsp --%>

<%@ taglib uri="/WOtaglib" prefix="wo" %>

<wo:directAction actionName="login" className="LoginAction"
bodyContentOnly="false">
    <wo:formValue key="VisitorName" value='<%= "enter name" %>' />
    <wo:formValue key="FavoriteFood" value='<%= "enter food" %>' />
</wo:directAction>
```

2. Save the file as `LogIn.jsp` in the `JSP_Example/Servlet Resources/jsp` directory.
3. In Project Builder, create a component called FoodInquiry (make sure you assign it to the Application Server target).
4. Add the `visitorName` and `favoriteFood` String keys to the component (create accessor methods). Also add the `showFavoriteFood` action returning the FavoriteFood component.

   When you're done, `FoodInquiry.java` should look like Listing 3-3. (Note that if you use WebObjects Builder to add the keys and the action, you need to add a couple of lines of code to the `showFavoriteFood` method.

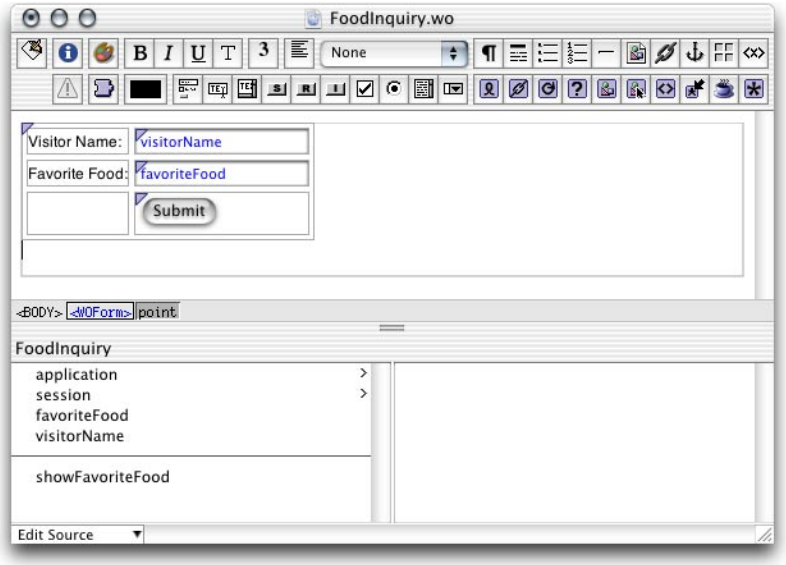
Listing 3-3 FoodInquiry.java

```
import com.webobjects.foundation.*;
import com.webobjects.appserver.*;
import com.webobjects.eocontrol.*;
import com.webobjects.eoaccess.*;

public class FoodInquiry extends WOComponent {
    protected String visitorName;
    protected String favoriteFood;

    public FoodInquiry(WOContext context) {
        super(context);
    }

    public FavoriteFood showFavoriteFood() {
        FavoriteFood nextPage =
(FavoriteFood)pageWithName("FavoriteFood");

        // set the properties of the FavoriteFood component
        nextPage.setVisitorName(visitorName);
        nextPage.setFavoriteFood(favoriteFood);

        return nextPage;
    }

    public String visitorName() {
        return visitorName;
```

```
        }
        public void setVisitorName(String newVisitorName) {
            visitorName = newVisitorName;
        }

        public String favoriteFood() {
            return favoriteFood;
        }
        public void setFavoriteFood(String newFavoriteFood) {
            favoriteFood = newFavoriteFood;
        }
    }
```

5. Edit the component using WebObjects Builder so that it looks like Figure 3-9.

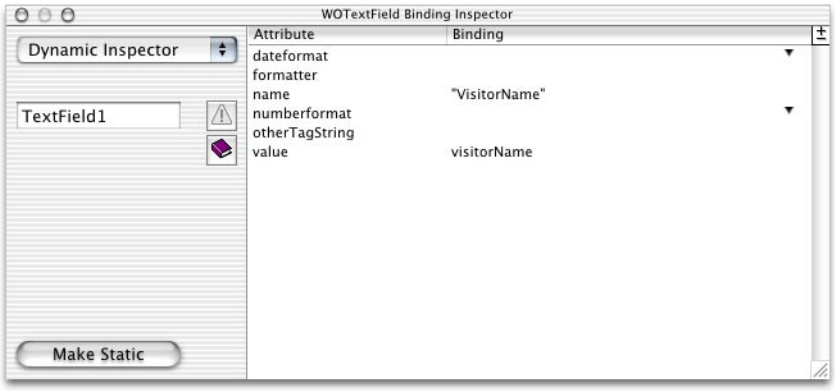
Figure 3-9 The FoodInquiry component in WebObjects Builder



a. Bind the Submit button to the `showFavoriteFood` action.

b. Enter `Food Inquiry` as the component's title.

c. Enter "`VisitorName`" as the value for the `name` attribute of the WOTextField that corresponds to the Visitor Name label.



d. Enter "`FavoriteFood`" as the value for the `name` attribute of the WOTextField that corresponds to the Favorite Food label.

e. Build the project and restart the servlet container.

6. Add the `loginAction` method (listed below) to the DirectAction class.

```
public WOActionResults loginAction() {
    FoodInquiry result = (FoodInquiry)pageWithName("FoodInquiry");

    // get form values
    String visitorName = request().stringFormValueForKey("VisitorName");
    String favoriteFood= request().stringFormValueForKey("FavoriteFood");

    // set the component's instance variables
    result.setVisitorName(visitorName);
    result.setFavoriteFood(favoriteFood);

    return result;
}
```

7. Finally, you need to add the JSP page that invokes the direct action. Using a text editor, create a file the following contents and save it in the `jsp` directory of the project as `LogIn.jsp`.

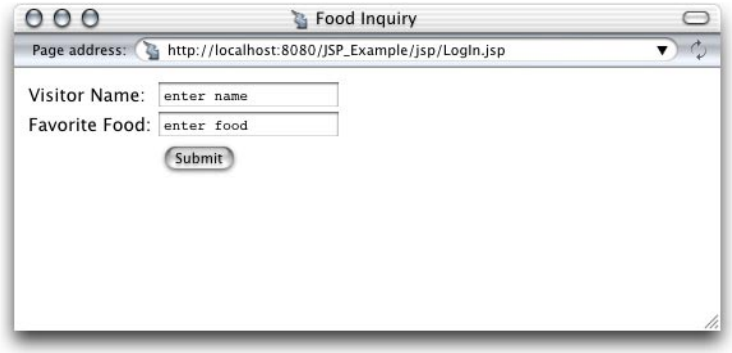
```
<%-- LogIn.jsp --%>

<%@ taglib uri="/WOtaglib" prefix="wo" %>

<wo:directAction actionName="login" className="LoginAction"
bodyContentOnly="false">
    <wo:formValue key="FavoriteFood" value='<%= "enter food" %>' />
    <wo:formValue key="VisitorName"  value='<%= "enter name" %>' />
</wo:directAction>
```

To view the output of the LogIn JSP page in Tomcat use the following URL:

```
http://localhost:8080/JSP_Example/jsp/LogIn.jsp
```

You should see a page like the one in Figure 3-10.

Figure 3-10 The output of LogIn.jsp



Custom-Tag Reference

The following sections provide details about the custom WebObjects JSP tags that WOtaglib_1_0.tld defines.

<wo:component>

To use a WebObjects component within a JSP page, you use the `<wo:component>` tag. Table 3-2 describes its attributes.

Table 3-2 Attributes of the <wo:component> tag

Attribute	Required	Description
`className`	Yes	Class name of the WebObjects component.
`bodyContentOnly`	No	Indicates whether the JSP page requires only the body content of the response (without `<HTML>` and `</HTML>` tags). Values: `true` or `false`. Default: `true`.
`mergeResponseHeaders`	No	Indicates whether the WOResponse headers are to be merged with the ServletResponse headers. Values: `true` or `false`. Default: `false`.

<wo:directAction>

To use a direct action within a JSP page, use the <wo:directAction> tag. Table 3-3 describes its attributes.

Table 3-3 Attributes of the <wo:directAction> tag

Attribute	Required	Description
actionName	Yes	Specifies the direct-action name.
className	No	Specifies the direct-action class name. Default: DirectAction.
contentStream	No	Specifies the source of the request's content; it must be an InputStream (or a subclass).
bodyContentOnly	No	Indicates whether the JSP page requires only the body content of the response (without <HTML> and </HTML> tags). Values: true or false. Default: true.
mergeResponseHeaders	No	Indicates whether the WOResponse headers are to be merged with the ServletResponse headers. Values: true or false. Default: false.

<wo:extraHeader>

The <wo:extraHeader> tag specifies a key-value pair to be passed to the component or direct action as an HTTP header. A <wo:extraHeader> tag has to be used for each header value; you can pass multiple values for one header by using the same value for the key attribute in multiple <wo:extraHeader> tags. If the value is not null, it

must be a String. Otherwise, the corresponding header is removed from the request before it's passed to the component or direct action. Table 3-4 describes the attributes of the <wo:extraHeader> tag.

Table 3-4 Attributes of the <wo:extraHeader> tag

Attribute	Required	Description
key	Yes	Specifies the HTTP header.
value	Yes	Specifies the value for the HTTP header.

<wo:binding>

The <wo:binding> tag specifies a key-value pair to be passed to the component to satisfy one of its bindings. You need a <wo:binding> tag for each of the component's bindings. Table 3-5 describes its attributes.

Table 3-5 Attributes of the binding element

Attribute	Required	Description
key	Yes	Specifies the component's binding.
value	Yes	Specifies the value for the binding.

<wo:formValue>

The <wo:formValue> tag specifies a key-value pair to be passed to the direct action in a query string; it must be a String. You need a <wo:formValue> for each item in the form. Table 3-6 describes the attributes of the <wo:formValue> tag.

Table 3-6 Attributes of the formValue element

Attribute	Required	Description
key	Yes	Specifies the form element.
value	Yes	Specifies the value for the form element.

APPENDIX A

Special Issues

There are two special issues regarding JSP and Servlet support in WebObjects that you should keep in mind: deploying more than one WebObjects application within a single container and updating existing servlet-based WebObjects applications to future versions of WebObjects. The sections below explain how to address both of these.

Deploying Multiple WebObjects WAR Files in a Single Servlet Container

Having more than one WebObjects WAR file in a servlet container is relatively safe. However, as each application launches, it pushes the values of its launch properties to the system properties (the properties maintained by the `java.lang.System` class. Therefore, the WebObjects application launched last within a servlet container overrides the properties set by previously launched WebObjects applications in that container.

The solution is to ensure WebObjects applications deployed within one servlet container use the same values for the following properties:

- `NSProjectSearchPath`
- `WOAdaptorURL`
- `WOAdditionalAdaptors`
- `WOAllowsCacheControlHeader`
- `WOAllowsConcurrentRequestHandling`

- WOApplicationBaseURL
- WOAutoOpenClientApplication
- WOAutoOpenInBrowser
- WOCachingEnabled
- WOContextClassName
- WODebuggingEnabled
- WOFrameworksBaseURL
- WOIncludeCommentsInResponse
- WOMaxHeaders
- WOMaxIOBufferSize
- WOSMTPHost
- WOSessionStoreClassName

Updating Servlet-Based WebObjects Applications to Future Versions of WebObjects

If future versions of WebObjects include changes to the JSP and Servlet system, it is likely that you need to update the `web.xml.template` file (on Mac OS X) or the `Makefile.preamble` file (on Windows) for existing applications.

To update the `web.xml.template` in a project developed on Mac OS X follow these steps:

1. Open the project you want to update in Project Builder.
2. Create a new WebObjects Application project that includes JSP and Servlet support by choosing "Deploy in a JSP/Servlet Container" in the Enable J2EE Integration pane of the Assistant.

3. Copy the contents of the new project's `web.xml.template` file to the `web.xml.template` file of the project you want to update.

   On Mac OS X, if you have made changes to the `web.xml.template` file, you can use FileMerge to keep your modifications in the updated version.

To update a WebObjects application developed on Windows perform the following steps:

1. Open the project you want to update in Project Builder WO.
2. Create a new Java WebObjects Application project that includes JSP and Servlet support by choosing "Deploy in a JSP/Servlet Container" in the Enable J2EE Integration pane of the WebObjects Application Wizard.
3. Copy the contents of the new project's `Makefile.preamble` file to the `Makefile.preamble` file of the project you want to update.

In addition, you should also rebuild your projects (re-generate the WAR files) to update the applications with the latest version of the WebObjects frameworks.

APPENDIX A

Special Issues

Glossary

bundle On Mac OS X systems, a bundle is a directory in the file system that stores executable code and the software resources related to that code. The bundle directory, in essence, groups a set of resources in a discrete package.

CGI A standard for communication between external applications and information servers, such as HTTP or Web servers.

component An object (of the WOComponent class) that represents a Web page or a reusable portion of one.

data-source adaptor A mechanism that connects your application to a particular database server. For each type of server you use, you need a separate adaptor. WebObjects provides an adaptor for databases conforming to JDBC. See also **JDBC adaptor**.

deployment descriptor XML file that describes the configuration of a Web application. It's located in the `WEB-INF` directory of the application's WAR file and named `web.xml`. See also **WAR**.

HTTP adaptor A process (or a part of one) that connects WebObjects applications to a Web server. See also **HTTP server**.

HTTP server, Web server An application that serves Web pages to Web browsers using the HTTP protocol. In WebObjects, the Web server lies between the browser and a WebObjects application. When the Web server receives a request from a browser, it passes the request to the WebObjects adaptor, which generates a response and returns it to the Web server. The Web server then sends the response to the browser. See also **HTTP adaptor**.

J2EE (Java 2 Platform, Enterprise Edition) Specification that define a platform for the development and deployment of Web applications. It defines an environment under which enterprise beans, servlets, and JSP pages can share resources and work together.

JAR (Java archive) A file created using the `jar` utility (and saved with the `.jar` extension) that contains all the files that make up a Java application.

JSP (JavaServer Pages) Technology that facilitates the development of dynamic Web pages and Web applications that use existing components, such as JavaBeans and WebObjects components.

Monitor WebObjects application used to configure and maintain deployed WebObjects applications capable of handling multiple applications, application instances, and applications hosts at the same time.

Project Builder Application used to manage the development of a WebObjects application or framework.

request A message conforming to the Hypertext Transfer Protocol (HTTP) sent from the user's Web browser to a Web server that asks for a resource like a Web page. See also **response**.

response A message conforming to the Hypertext Transfer Protocol (HTTP) sent from the Web server to the user's Web browser that contains the resource specified by the corresponding request. The response is typically a Web page. See also **request**.

servlet A Java program that runs as part of a network service, typically an HTTP server and responds to requests from clients. Servlets extend an HTTP server by generating content dynamically.

servlet container Java application that provides a working environment for servlets. It manages the servlet's interaction with its client and provides the servlet access to various Java-based services. Containers can be implemented as standalone HTTP servers, server plug-ins, and components that can be embedded in an application.

TLD (tag library descriptor) XML document that describes a tag library. A JSP container uses the information contained in the TLD file to validate a JSP page's tags.

WAR (Web application archive) A file created using the `jar` utility (and saved with the `.war` extension) that contains all the files that make up a Web application. See also **Web application; JAR (Java Archive)**.

WOA (WebObjects application bundle) A bundle that stores all the files needed by a WebObjects application. See also **bundle**.

wotaskd (WebObjects task daemon) WebObjects Deployment tool that manages the instances on an application host. It's used by Monitor to propagate site configuration changes throughout the site's application hosts. See also **Monitor**.

Web application, Web app File structure that contains servlets, JSP pages, HTML documents and other resources. This structure can be deployed on any servlet-enabled HTTP server. See also **servlet container**.

Index

E

F, G

H

I

J

K

L

M

N

O

P, Q

R

S

T, U

V

W, X, Y

Z