

# **GETTING STARTED WITH WEBOBJECTS**

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# Preface



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## About WebObjects

WebObjects is an object-oriented environment for developing and deploying World Wide Web applications. A WebObjects application runs on a server machine and receives requests from a user's web browser on a client machine. It dynamically generates HTML pages in response to the user's requests. WebObjects provides a suite of tools for rapid application development, as well as prebuilt application components and a web application server.

WebObjects is flexible enough to suit the needs of any web programmer. You can write code using one of three programming languages: Java, Objective-C, or WebScript. You can write simple WebObjects applications in a matter of minutes. For more complex projects, WebObjects makes it easy by performing common web application tasks automatically and by allowing you to reuse objects you've written for other applications.

## About This Book

This book contains three tutorials that help you learn what WebObjects is and how to use it:

- Chapter 1, "Creating a Simple WebObjects Application" (page 11), teaches you the basic concepts and steps involved in creating a WebObjects project, using the applications Project Builder and WebObjects Builder. You'll create a simple application that takes input from a user and displays it.
- Chapter 2, "Enhancing Your Application" (page 37), extends the capabilities of your application and shows you additional techniques you use when working with WebObjects.
- Chapter 3, "Creating a WebObjects Database Application" (page 59), teaches you how to create a more complex application, one that accesses a database.

WebObjects can run on several platforms. Screen shots in this book are for Windows NT systems; if you are running on a different platform, the look of your windows may vary slightly.

## Where to Go From Here

After you have worked through the tutorials in this book, you should have a good working knowledge of WebObjects. For more in-depth information about how WebObjects works, read the *WebObjects Developer's Guide*.

Other valuable information about WebObject is available online. You can access all online information through the WebObjects Home Page. It is located in your server's document root, and you can access it at this URL:

```
http://localhost/WebObjects/Documentation/WOHomePage.html
```

In particular, the WebObjects HomePage gives you access to some books that are available only online:

- *WebObjects Tools and Techniques* is a more comprehensive guide to using Project Builder and WebObjects Builder to develop WebObjects applications.
- *Serving WebObjects* describes how to administer and deploy WebObjects applications after you've written them.
- The *Dynamic Elements Reference* documents the dynamic elements provided with WebObjects and provides examples of how to use them.
- The *Client-Side Components Reference* describes what client-side components are available for use in your program and the Java classes used to create them.
- The *WebObjects Class Reference* provides a complete reference to the classes in the WebObjects framework. Reference material is provided for both the Java and Objective-C languages.

Additionally, for more information on Enterprise Objects Framework, read the *Enterprise Objects Framework Developer's Guide*. This book provides in-depth information about how Enterprise Objects Framework works and about techniques for developing database applications with it.

*Chapter 1*

# **Creating a Simple WebObjects Application**



This chapter introduces you to the basic concepts and procedures of developing WebObjects applications. You'll develop, in stages, a simple application for the World Wide Web. The application you'll write is called GuestBook.

When you've finished the steps in this chapter, your application will have a single web page containing a form that allows users to enter their names, e-mail addresses, and comments. When the form is submitted, the application redraws the page with the user's information at the bottom.



In Chapter 2, “Enhancing Your Application” (page 37), you will add features to the application, including a second page, a table that displays information from multiple users, and hyperlinks.

This application illustrates the basic techniques you use to create a WebObjects application. You'll use two primary tools, Project Builder and WebObjects Builder.

Project Builder is an integrated software-development application. It contains a project browser, a code editor, build and debugging support, and many other features needed to develop an application. In this tutorial, you'll learn to use Project Builder to:

- Create a new WebObjects application project.
- Write scripts or compiled code to provide behavior in your application.
- Build and launch your application.

WebObjects Builder is an application that provides graphical tools for creating dynamic web pages. You'll learn to use WebObjects Builder to:

- Create static content for your pages.
- Add dynamic elements to your pages.
- Bind the dynamic elements to variables and methods in your code.

## Creating a WebObjects Application Project

A WebObjects application project contains all the files needed to build and maintain your application. You use Project Builder to create a new project.

1. Launch Project Builder.

On Windows NT, you can launch Project Builder from the WebObjects program group in the Start menu. On other platforms, you can launch the application by navigating to the directory *NeXT\_ROOT/NextDeveloper/Apps/* and launching **ProjectBuilder.app**. *NeXT\_ROOT* is an environment variable defined when you installed WebObjects. On Windows NT systems, it is **C:\NeXT** by default. On Mach systems, it is the root directory */*.

2. Choose Project ► New.



3. In the New Project panel, select WebObjectsApplication from the Project Type pop-up list.

- Click Browse.



- In the Save panel, navigate to the *DocumentRoot*/**WebObjects** directory.

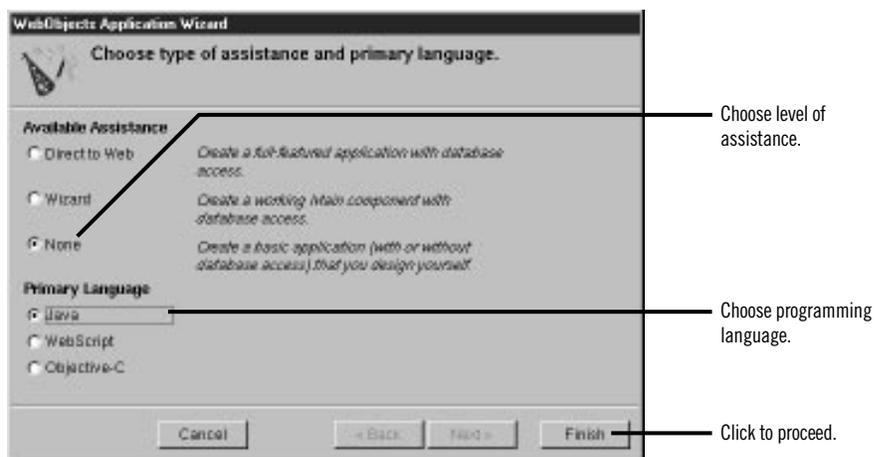
*DocumentRoot* is your HTTP server's document root, which you specified when you installed WebObjects.

- Type the name of the project you want to create (GuestBook).
- Click Save.

The New Project panel shows the path you specified.

- Click OK.

The WebObjects Application Wizard starts.



9. For Available Assistance, choose None.

If you are developing an application that accesses a database, you may wish to use one of the levels of assistance that WebObjects provides. For more information on these options, see Chapter 3, “Creating a WebObjects Database Application” (page 59).

## Choosing the Programming Language

WebObjects supports three languages:

- Java
- Objective-C
- WebScript

Java and Objective-C are *compiled* languages. They require you to build your application before running it. WebScript, which is based on Objective-C, is a *scripted* language. It allows you to make changes to your application while it is running.

When you create a new project, Project Builder provides you with a *component* called Main. In WebObjects terminology, a component represents a page in your application (or possibly part of a page).

In the Wizard, you specify the language you’ll use to program your Main component, as well as the *application* and *session* code files (which will be described later).

1. For the primary language, select Java.

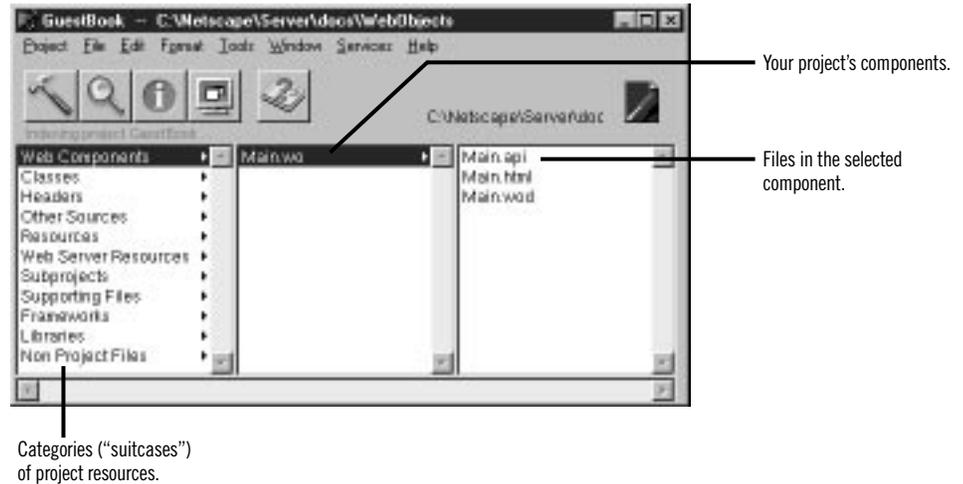
Later, you’ll create an additional component for your application and write its code in WebScript.

2. Click Finish.

Project Builder creates a new application directory called **GuestBook**. This directory contains the files you work with in both Project Builder and WebObjects Builder.

## Examining Your Project

Project Builder displays a browser showing the contents of your project. The first column lists several categories of files that your project may contain. This section describes some of the most important files you'll use.



### 1. Select Web Components.

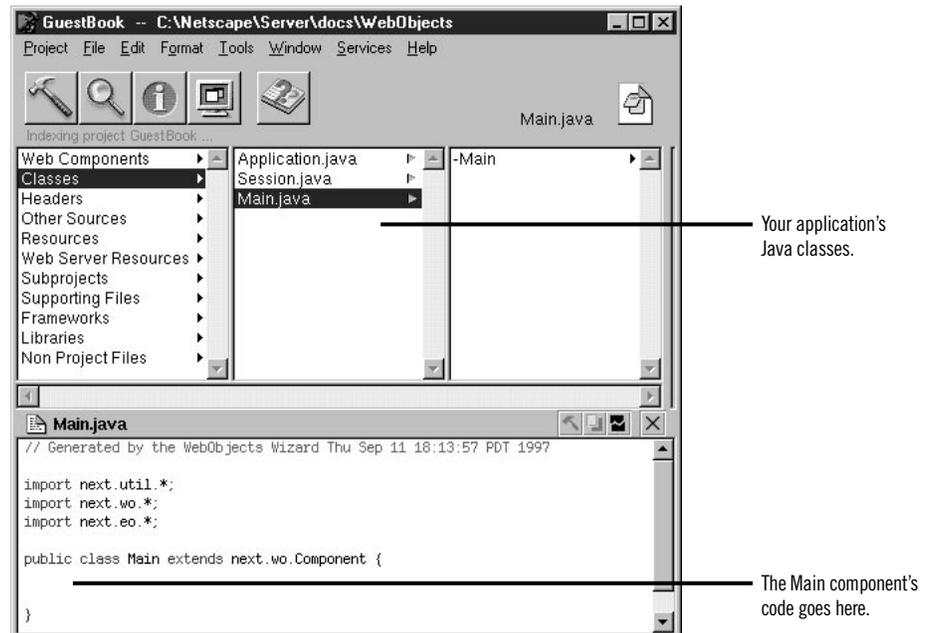
The next column displays a list with one element, **Main.wo**, which is a directory containing the first *component* in your application. Every application starts with a component called Main.

### 2. Select **Main.wo**.

The files you see displayed in the next column are some of the files you work with when developing your component:

- **Main.api** is used for components that are going to be reused by other components; you won't use it in this tutorial. See *WebObjects Tools and Techniques* for more information on creating reusable components.
- **Main.html** is the HTML template for your page. It can include tags for dynamic WebObjects elements as well as regular HTML. Typically, you do not edit this file directly; you create your page's elements graphically using WebObjects Builder.
- **Main.wod** is the declarations file that specifies bindings between the dynamic elements and variables or methods in your scripts. Normally, you don't edit this file directly; you use WebObjects Builder to generate the bindings for you.

3. Select Classes in the first column of the browser.



You'll see three files listed in the second column:

- **Main.java** is a file that allows you to specify behavior associated with the component. You do this by writing code in Java (since you specified Java as the language when you created the project). You use Project Builder to edit this file.
- **Application.java** and **Session.java** are other Java files that you may want to work with. In Chapter 2, you'll add code to **Application.java** and learn about application and session variables.

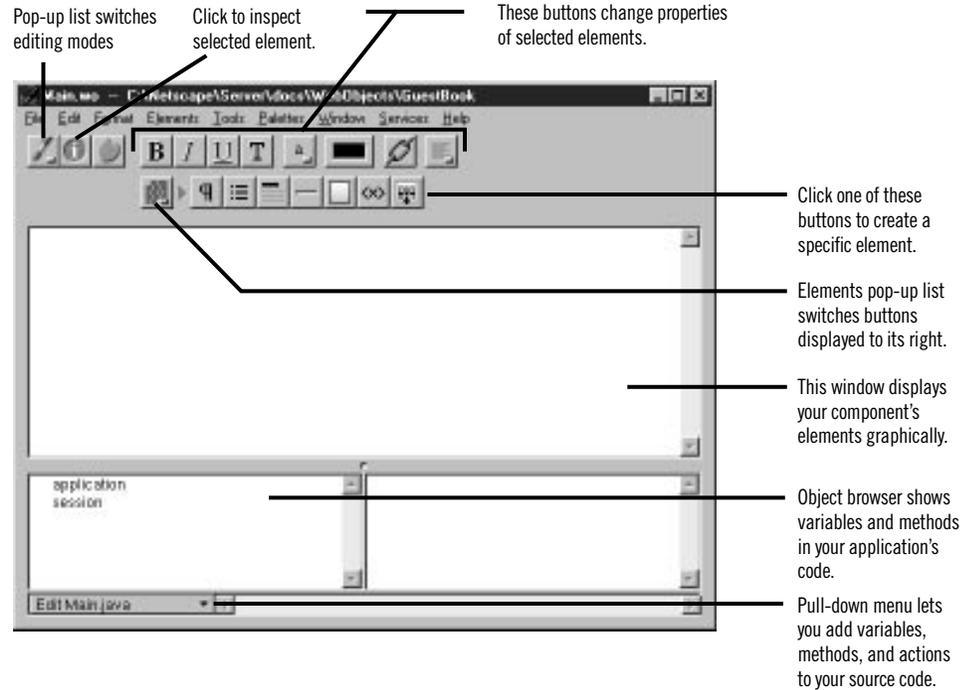
## Launching WebObjects Builder

Now that you've created your project, you'll edit the Main component with WebObjects Builder.

1. Select Web Components in the first column of the browser.

2. Double-click **Main.wo** in the second column.

The application WebObjects Builder launches and displays a window entitled **Main.wo**. This represents your application's Main component.



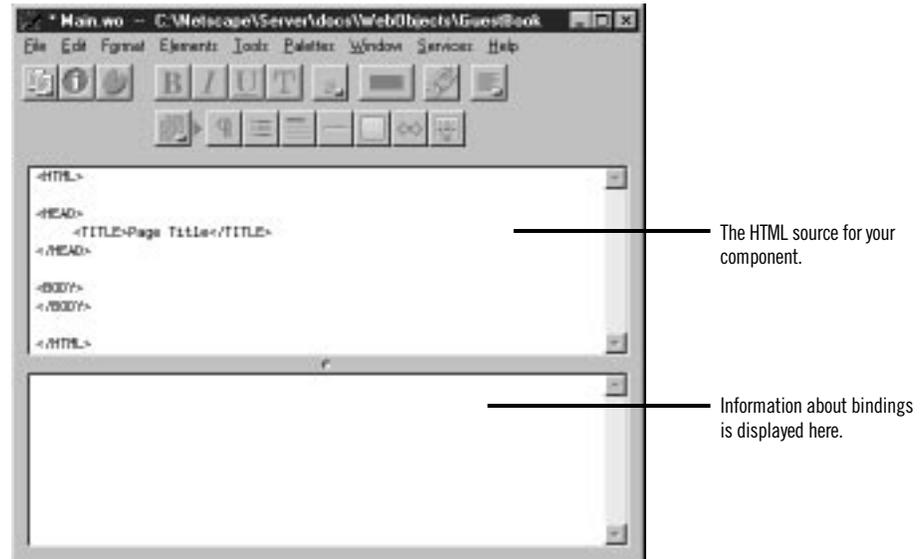
You create your component graphically in the upper pane of the component window. The browser at the bottom of the window (known as the *object browser*) is used to display variables and methods your component uses. Note that there are two variables already defined, **application** and **session**. You'll create others later.

The toolbar at the top of the window contains several buttons that allow you to create the content of your component. WebObjects Builder also has menu commands corresponding to these buttons.

**Note:** Depending on the width of the window, the toolbar may appear in two rows or one.

3. From the  pop-up list at the left of the toolbar, choose .

This pop-up list allows you to switch between graphical editing mode and source editing mode. When you choose source editing mode, the text of your HTML template (**Main.html**) appears. It is a skeleton at this point, since the page is empty. As you add elements graphically, their corresponding HTML tags appear in this file.



The bottom pane shows your declarations (**Main.wod**) file. Later, when you bind variables to your dynamic elements, this file stores the information. Normally, you never edit this file directly.

4. Switch back to graphical editing mode. For the rest of the tutorial, you'll work in this mode.

## Creating the Page's Content

A web page consists of *elements*. In addition to the standard static HTML elements found in all web pages, WebObjects allows you to create *dynamic elements*, whose look and behavior are determined at run time.

To create elements, you use the buttons on the bottom row of the toolbar (or at the right of the toolbar if your window is large). The  button is a pop-up list that lets you switch the group of buttons that are displayed to its right. There are four groups of buttons:

- **Structures** . Use these buttons to create paragraphs, lists, images, and other static HTML elements. This setting is the default.
- **Tables** . Use these buttons to create and manipulate HTML table elements.
- **Dynamic form elements** . Use these buttons to create form elements in which users enter information. WebObjects gives your application access to the data entered by users by allowing you to associate, or *bind*, these elements to variables in your application.
- **Other WebObjects** . Use these buttons to create other dynamic elements, which you can bind to variables and methods in your program to control how they are displayed. Some of these (such as hyperlinks) have direct HTML equivalents. Others are *abstract dynamic elements*, such as repetitions and conditionals, which determine how many times an element is displayed or whether it is displayed at all.

## Entering Static Text

The simplest way to add text to a page is to type it directly into the component's window. To demonstrate this, add a title for the GuestBook's page.

1. Type `My Guest Book` and press Enter.

The text is displayed at the insertion point, in this case at the beginning of the page.

2. Select the text you just typed.
3. Click the  button in the toolbar. This converts the text to a heading element and displays it in bold.
4. From the  pop-up list in the toolbar, choose center justification.

The toolbar also has buttons that allow you to apply text styles such as bold, underline, and italics.

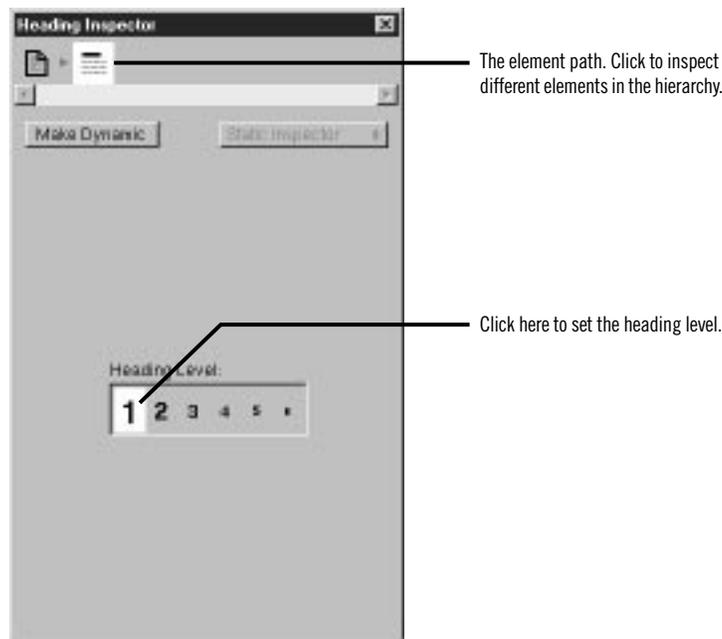
HTML provides several levels of headings. Typically, a document's main title should be displayed as an `<H1>` heading. To change the level, you use the Inspector window. You'll use this window frequently throughout these tutorials.

## Using the Inspector

You use the Inspector window to set properties of the elements in your component. The Inspector's title and contents reflect the element you've selected in the component window.

1. Click .

A window titled Heading Inspector appears. It allows you to set the level of the heading.



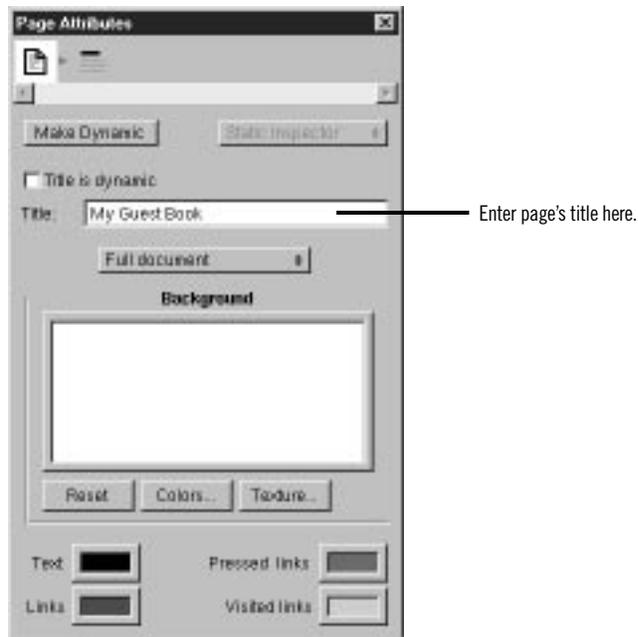
2. Click “1”.

The text is now part of an `<H1>` tag, and it is displayed in a larger font.

3. Click the  icon at the top of the window.

The top of the window shows the *element path* to the selected element. Any element can be contained in a hierarchy of several levels of elements and can in turn contain other elements. Here, the element path shows that the heading element is contained in the page element, which is the top level of the hierarchy. By clicking the icons in the element path, you can easily choose different elements in the hierarchy.

Each element has its own Inspector that allows you to set properties appropriate for the element. The Page Attributes Inspector allows you to set properties such as the page's title and its text color.



4. Enter a title (such as My Guest Book, or something else of your choosing) in the Title text field. This is the title of the window that appears in your web browser when you run the application.
5. Close the Inspector window.
6. Choose File ► Save to save the Main component.

**Note:** Version 3.5 of WebObjects Builder doesn't allow you to undo actions you take when editing your component. Therefore, it is a good idea to save frequently. That way, if you make a mistake, you can revert to your previously saved version.

## Creating Form-Based Dynamic HTML Elements

In this section, you'll create a form with several elements to capture input from a guest. These elements look and act like HTML form elements but are actually dynamic WebObjects elements, which enable your code to receive and manipulate the data entered by the user.

1. To display the dynamic form elements buttons in the toolbar, choose  from the Elements pop-up list.
2. Place the cursor on the line after the “My Guest Book” text and press Enter.
3. Click .

WebObjects Builder adds a form element to your component. The triangle at the upper-left corner indicates that it is a dynamic form, as opposed to a static form. The gray border indicates the extent of the form. You can increase its size by adding additional elements inside it.

4. Type the text “Name: ” and press Enter.

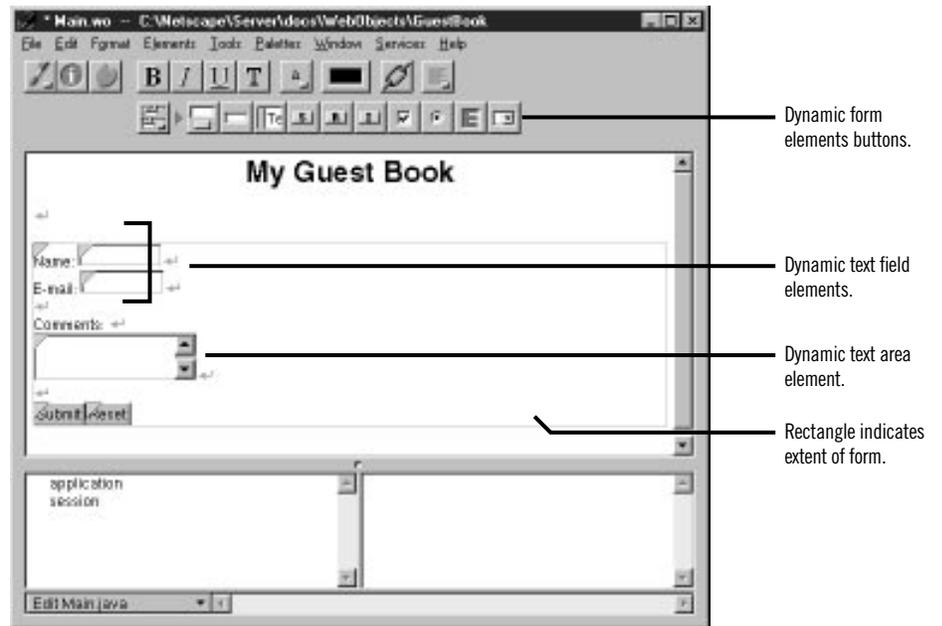
This text replaces the word “Form” that was displayed by default.

5. Type “E-mail: ” and press Enter twice
6. Type “Comments: ” followed by Enter.

You have just entered three lines (and a blank line) of static text inside the form. Now you’ll enter some dynamic elements to receive input from the user: two text fields and a multi-line text area.

7. Place the cursor to the right of the text “Name: ”.
8. Click  to create a dynamic text field element (WOTextField).
9. Repeat steps 7 and 8 for “E-mail: ”.
10. Use the  button to create a multi-line text area below the “Comments: ” line.
11. Press Enter twice to create two blank lines.
12. Click  to create a Submit button, which is used to send the data in the form to the server.
13. Click  to create a Reset button, which is used to clear the data in the form.

The window should now look like this:



## Resizing the Form Elements

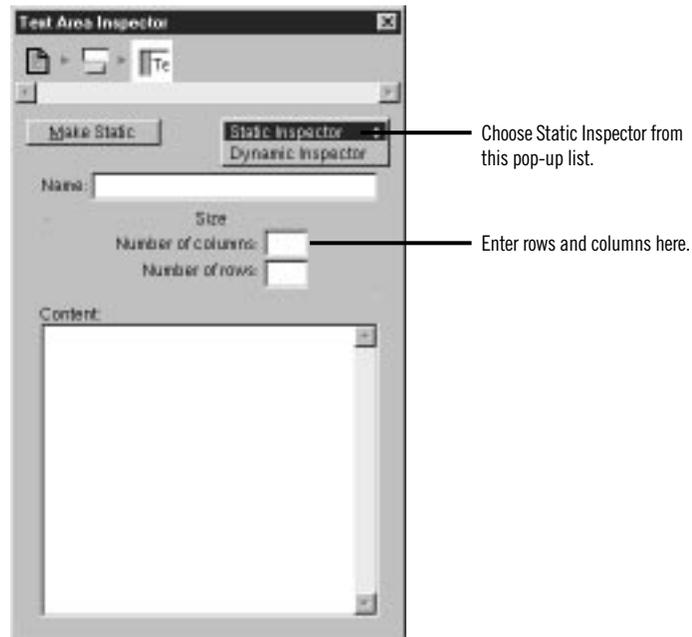
The text fields and text area are a bit small, so you'll resize them using the Inspector window.

To inspect an element, you must first select it. Some elements (such as text fields and text areas) can be selected simply by clicking them; they appear with a gray line underneath.



You select text elements as you would in most text-editing applications (by dragging, or by double-clicking words, or by triple-clicking lines); they appear with gray shading.

1. Inspect the Name text field (that is, select the text field and open the Inspector window).



2. Change the setting of the pop-up list at the upper right of the window from Dynamic Inspector to Static Inspector.

All WebObjects elements have a *dynamic inspector*, that is, one that allows you to set bindings (you'll work with bindings in the next section). In addition, many WebObjects elements (those with direct counterparts in static HTML) also have a *static inspector*. This inspector allows you to set the standard HTML attributes for that type of element.

In this window, you can set various attributes of the static counterpart of a WOTextField, which is an HTML `<INPUT TYPE=TEXT>` element.

3. In the Size field, type 20 and press Enter to set the width of the text field to 20 characters.

**Note:** Be sure to press Enter after typing the values; otherwise, they won't "stick."

4. Repeat steps 1 through 3 for the E-mail field.

5. Inspect the multi-line text area.

In Text Area Inspector, you can set various attributes corresponding to those of a `<TEXTAREA>` element.

6. Increase the size of the element by specifying the number of columns and number of rows to, say, 30 and 6.
7. Save the Main component.

## Binding Elements

When a user enters information in GuestBook's form elements, your application needs a way of accessing that information. This is done by *binding* the form elements to variables in your application. When the user submits the form, WebObjects puts the data into the variables you've specified.

Then, your application typically processes the data and returns a new page (or the same page) displaying information that makes sense based on the user's input. The information displayed is usually represented by other dynamic elements that are bound to variables and methods in your code.

This process of receiving a request (triggered by actions such as submitting a form or clicking a hyperlink) and responding by returning a page is known as the *request-response loop*. This loop is at the heart of WebObjects programming.

In this tutorial, you'll have WebObjects return the same page, with the information you received from the user displayed, in a slightly different format, at the bottom. In the second chapter, you'll add an additional page to your application.

### Creating Variables

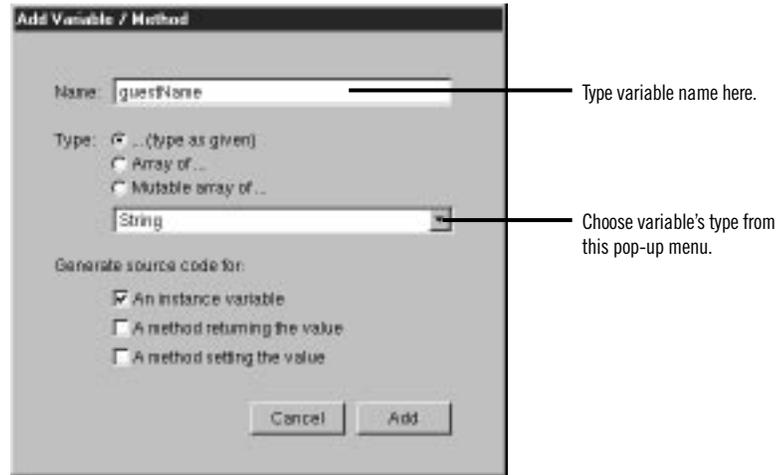
In this section, you'll declare individual variables in your code file (`Main.java`) to hold the name, e-mail address, and comments entered by a single guest. Later on, you'll structure this information differently in order to work with data from multiple users.

WebObjects Builder allows you to declare variables without having to edit your source file directly. At the bottom of the window there is a pull-down menu called `Edit Main.java`. It has three items:

- **Add Variable/Method** allows you to add a *key* to your source file. A key can be either an instance variable or a method that returns a value.
- **Add Action** allows you to add the template for an *action method*, which is a method that takes no parameters and returns a component (the next page to be displayed).
- **View Source File** opens the source file in a Project Builder window.

1. Choose Add Variable/Method from the pull-down menu.

The Add Variable/Method panel opens.



2. Type `guestName` in the Name field.
3. To specify the variable's type, select `String` from the pop-up menu (or you can type `String` directly in the box).
4. Click Add.

You have just created a variable called `guestName` of type `String`. It appears in the first column of the object browser. A declaration for `guestName` also appears in `Main.java`, which you'll edit later.

5. Create the variables `email` and `comments` in the same way (they are also of type `String`.)

## Binding the Input Elements

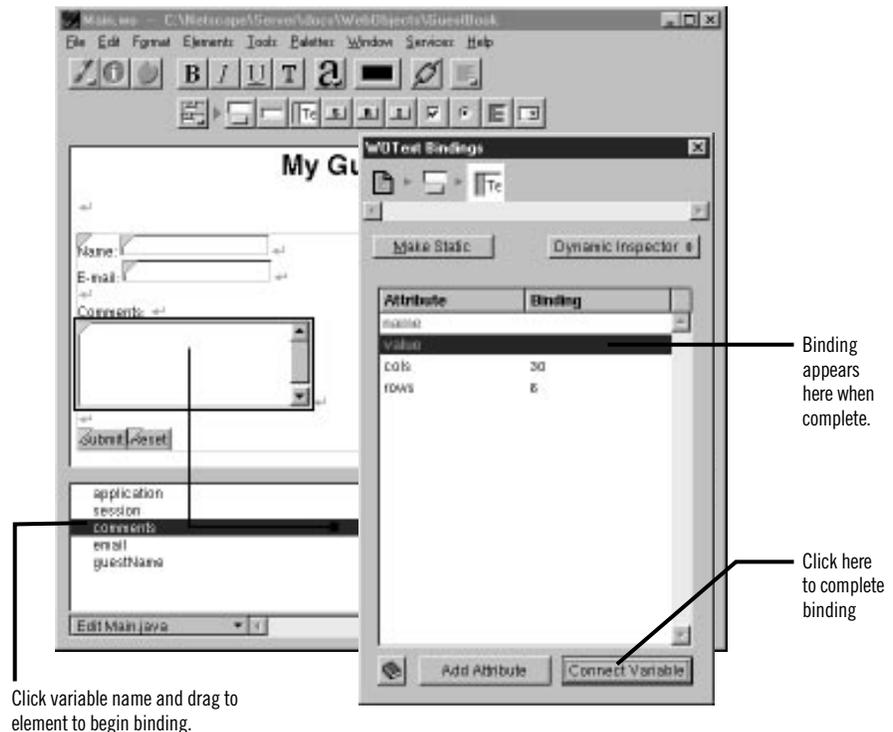
Each dynamic element contains several *attributes*. These attributes determine what happens when the element is displayed or when a form element is submitted. When you bind an element, you actually bind one or more of its attributes.

For example, a WOText element (which represents a multi-line text area) is defined as having two attributes:

- **value** specifies the string the user enters in the text area.
- **name** specifies a unique identifier for the text area.

In this tutorial, the only attribute you are concerned with is **value**, which represents the string entered by the user in the comments field. You'll bind this to the **comments** variable. You don't need to bind the **name** attribute in this application. In a later example, you'll bind more than one attribute of an element.

1. In the object browser, click the **comments** variable and drag the cursor into the Comments text area. Then release the mouse button.



The Inspector window comes to the front, displaying the bindings for the text area. The **value** attribute is automatically selected (since that is the one that is most commonly used in bindings). If you wanted to choose a different attribute to bind (you don't at this time), you would simply select the binding of your choice.

2. Click Connect Variable.

**comments** appears in the Binding column next to the **value** attribute of the text area, indicating that the binding has been made. Also, the text **comments** appears in the text field to show that it has been bound.

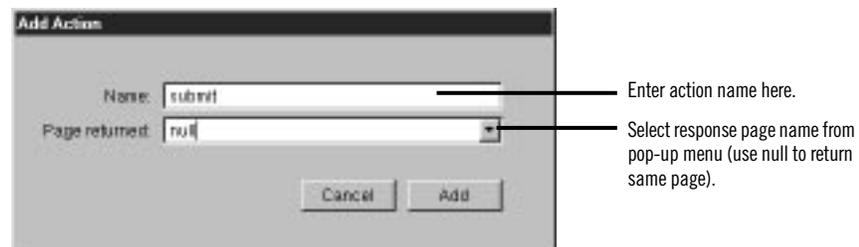
**Note:** you can also bind a variable by typing its name directly in the Binding column for the desired attribute.

3. In the same way, bind the **guestName** and **email** variables to the two text fields.
4. Save the Main component.

## Implementing an Action Method

When the user clicks the Submit button, your application will respond by redisplaying the page with the submitted information shown at the bottom. To make this happen, you implement an *action method* and bind that method to the **action** attribute of the WOSubmitButton.

1. From the Edit Main.java menu at the bottom of the object browser, choose Add Action.



2. Enter `submit` as the name of your action method.

3. From the “Page returned” pop-up menu, select **null**.

The value returned by an action method represents the next page (component) to be displayed. When you return **null** (or **nil** if using WebScript), the current page is redrawn. In a later task, you’ll see how to return a new component.

4. Click Add.

The **submit** action appears below a horizontal line in the first column of the object browser.

5. Click **submit** in the object browser and drag the cursor to the submit button.

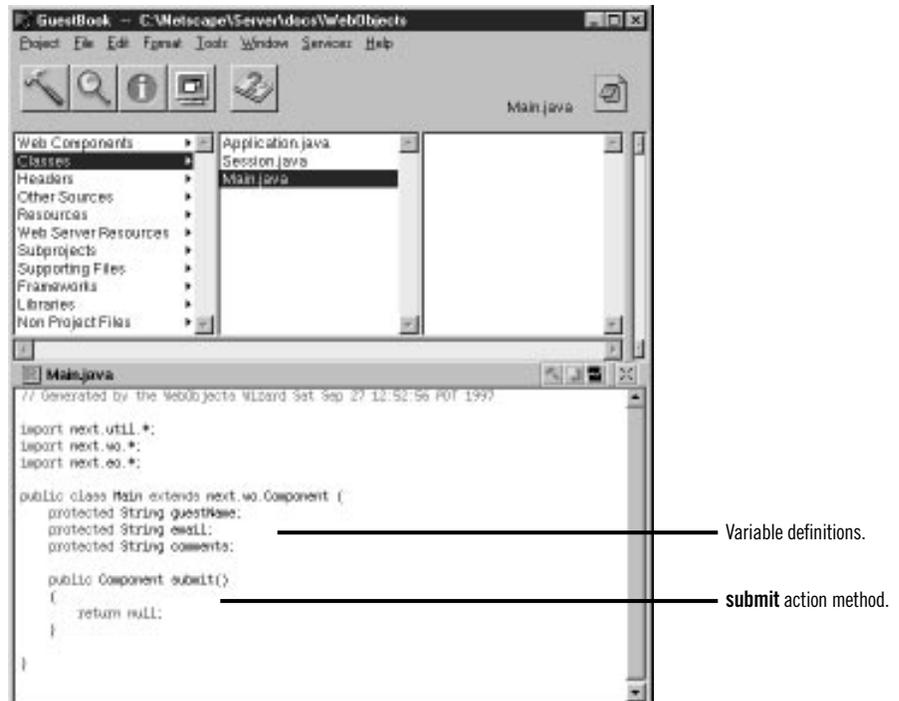
The Inspector opens with the button’s **action** attribute selected.

6. Click Connect Variable.

You just bound the **submit** method you created to the **action** attribute of the WOSubmitButton. You don’t need to write any additional code, so your application is now ready to run. However, you may want to look at your source file.

7. From the pull-down menu at the bottom of the window, choose View Source File.

Project Builder becomes active and displays the code for your component (in **Main.java**). You’ll notice that this file contains declarations for the variables you created earlier, as well as a declaration for the **submit** action method.



## Creating the Application's Output

So far, you have a way for the guest to enter information and a way for the application to store that information. Now, the application needs to do something with the information.

For now, you'll have the application simply display the same information the user entered, in a slightly different format. This allows you to verify that you have correctly received the data. To do this, you'll add dynamic string elements (WOStrings) to the main page and bind them. In the next chapter, you'll use more complex forms of output.

1. In WebObjects Builder, place the cursor at the end of the document, making sure that it is *outside* the gray rectangle that represents the form, and press Enter.

2. Choose  from the Elements pop-up list to display the Structures buttons.
3. Click  to create a horizontal line (an <HR> element).
4. Press Enter to add a blank line.
5. Select  from the Elements pop-up list to display the Other WebObjects buttons.
6. Add a WOString element by clicking .

A WOString is a dynamic element whose value is determined at run time. It is shown as a small rectangle surrounded by two icons.



7. In the object browser, click the **guestName** variable and drag the cursor to the center rectangle of the WOString.

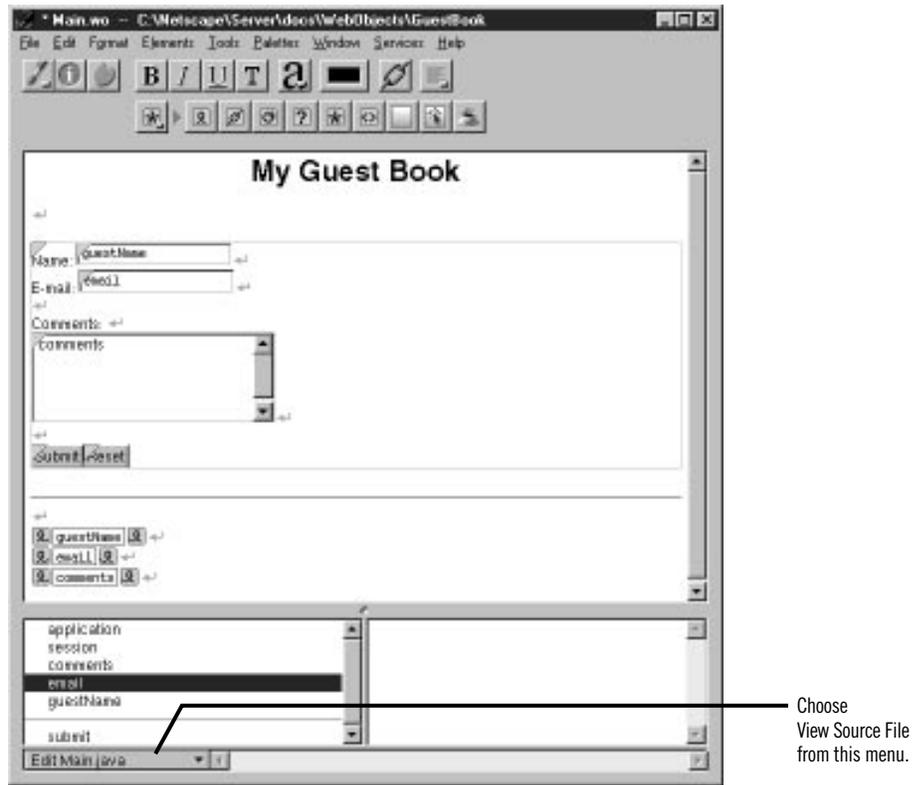
Notice that the name **guestName** appears inside the WOString, and the Inspector window doesn't come to the front. The message "Connected guestName to value" appears in the upper-right corner of the window.

WebObjects provides this shortcut for binding to the **value** attribute of WOStrings, because it is the attribute you most often want to bind. The **value** attribute signifies the string that will be displayed when the page is drawn. If you want to bind a different attribute, you drag-connect to the left or right icon, and the Inspector appears as usual.

8. Click to the right of the WOString and press Enter.
9. Create two more WOStrings and bind them to **email** and **comments**, respectively.

Note that it isn't necessary to resize the WOStrings as you did with the text fields. They expand at run time to display the value of the variables to which they are bound.

10. Save your component. It should now look like this:



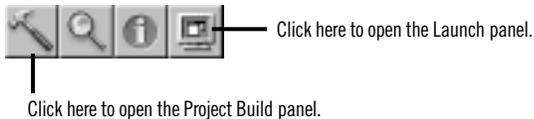
In summary, when the user clicks the Submit button, a new request-response cycle begins. WebObjects stores the data entered in the dynamic form elements in the variables they are bound to (**guestName** contains the value in the Name field, **email** contains the value in the E-mail field, and **comments** contains the value in the Comments field). It then triggers the action method bound to the **action** attribute of the **WOSubmitButton**. The action method returns a page (which, in this example, is the same page). When the page is redrawn, the dynamic strings at the bottom show the values entered by the user.

Now you are ready to test your application.

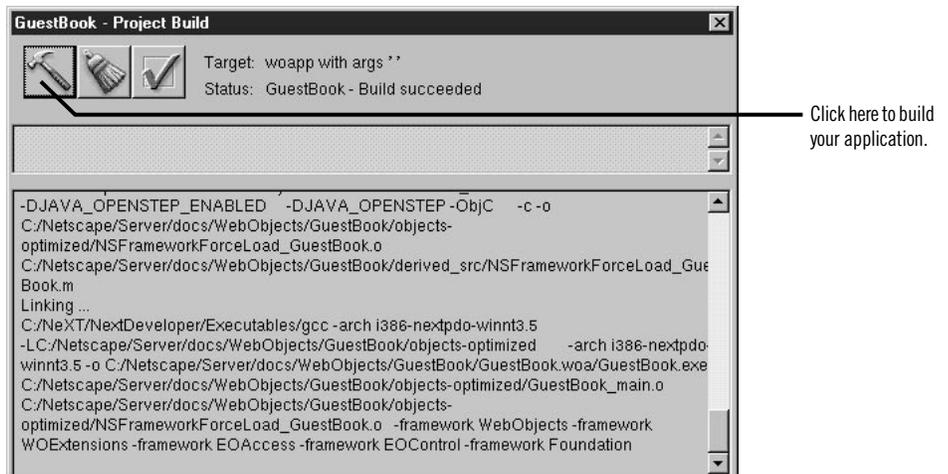
## Building and Running Your Application

1. Make Project Builder active. A quick way to do this from WebObjects Builder is to choose View Source File from the pull-down menu at the bottom of the window.

To build and launch your application, you use buttons in Project Builder's toolbar.



2. Click  in the toolbar to open the Project Build panel.
3. Click  in the Project Build panel.



The Project Build panel displays the commands that are being executed to build your project. If all goes well, it displays the status message “Build succeeded.”

4. Close the panel.
5. Click  in the toolbar to open the Launch panel.

- Click  in the Launch panel to launch your application.

The Launch Panel displays a series of messages. If all goes well, you should see messages such as the following, which mean that your application is running successfully.



Your web browser (such as Netscape Navigator or Internet Explorer) should launch automatically and load the correct URL for your application. If it doesn't, do the next step; otherwise, proceed to step 8.

- Launch your web browser and load a URL with the following form:

`http://web_server_host/cgi-bin_directory/adaptor/application_directory`

Your application directory is **GuestBook**, which was created by Project Builder under the **WebObjects** subdirectory of your server's document root when you first created the project. The default adaptor name is **WebObjects** (see *Serving WebObjects* for more information about WebObjects adaptors). So if, for example, your web server is named **gandhi** and its cgi-bin directory is named **cgi-bin**, you would use this URL:

`http://gandhi/cgi-bin/WebObjects/GuestBook`

- Test your application by entering information and submitting the form.

If all goes well, your page should look like the one shown at the beginning of this chapter (page 11).

*Chapter 2*

## **Enhancing Your Application**



In the previous tutorial, you learned how to create a web component that has input and output elements and how to bind these elements to variables and methods in your code.

Now you'll add some additional features to your project that move it a bit more in the direction of being a real-world web application. The application will:

- Use a custom Java class to represent the data for a guest, rather than using three separate variables.
- Maintain a guest list, which keeps track of all guest data (whether entered by you or multiple users of your application), rather than just the current guest.
- Have a second component, so that the guest list is displayed in a new page rather than the same page. You'll use WebScript rather than Java to implement this component's behavior.
- Make use of additional interface elements (such as HTML tables).

## Duplicating Your Project

Before proceeding, you'll create a new project by copying the old one and renaming it. This way, you can make changes and still retain your previous version.

1. In WebObjects Builder, close the component window.
2. In Project Builder, close GuestBook's project window.

If there are any unsaved files, you are prompted to save them.

3. In your machine's file system, navigate to the directory where your project is located (the WebObjects directory under your server's document root).



4. Duplicate the GuestBook folder.

On Windows NT, you can do this by selecting the folder, choosing Edit ► Copy, then Edit ► Paste.

5. Open the new folder (Copy of GuestBook) and double-click the project file **PB.project**.

Project Builder opens a new browser window for this project. (Alternatively, you could have opened the project from within Project Builder by choosing Project ► Open, then navigating to the project folder and selecting **PB.project**.)

6. Click  from the toolbar to bring up the Project Build panel.
7. Click  in the Project Build panel.

This command deletes all the files that were generated when you built the project previously.

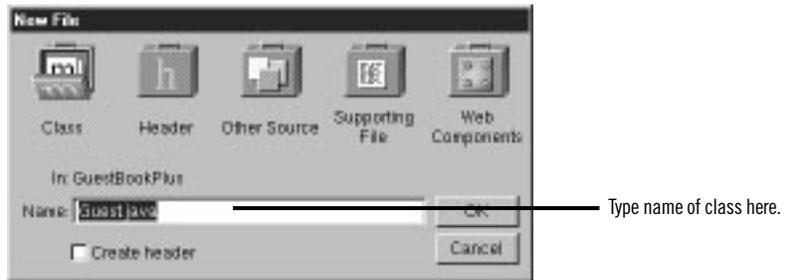
8. Click  to open the Project Inspector.
9. Choose Project Attributes from the pop-up list at the top of the window.
10. In the Name field, enter `GuestBookPlus` and press Enter.
11. Respond Yes to the prompt that asks if you want to rename the folder.

You now have a new project called GuestBookPlus.

## Creating a Custom Guest Class

In the first chapter, you created individual variables to store a guest's name, e-mail address, and comments. When keeping track of multiple guests, it's more useful to encapsulate all the data for a guest as a single entity. You'll do this by creating a Java class that contains the data for a single guest.

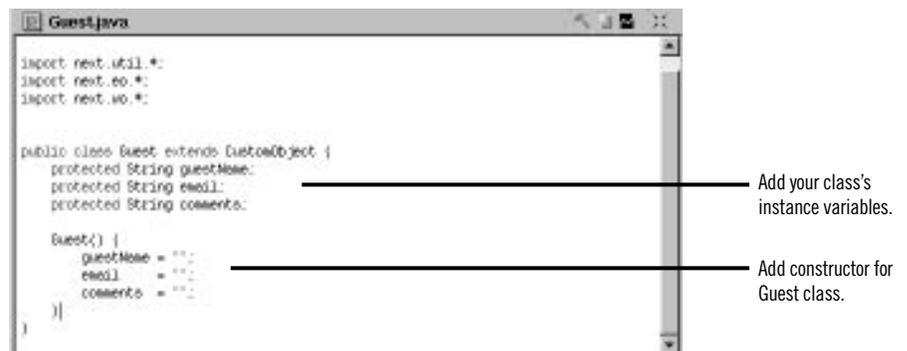
1. In Project Builder's browser, select Classes in the first column.
2. Choose File ► New in Project.



3. Type `Guest.java` as the name of the file.
4. Click OK.

The newly created file contains a skeleton for a class called `Guest`.

5. Enter the following code to complete the definition of the `Guest` class.



A class stores information in its *instance variables* (also referred to as *data members*). Here you're declaring three instance variables for `Guest`: **name**, **email**, and **comments**. Note that these declarations are the same as those that appeared in the code for `Main.java` when you added the three variables using WebObjects Builder. In WebObjects, a component is

also a class, specifically a subclass of the class `next.wc.Component` (called `WOComponent` in WebScript or Objective-C).

Java classes require a *constructor* to initialize an instance (or *object*) of a particular class whenever one is created. A constructor has the same name as the class and returns no value.

Whenever your application creates a new `Guest` class, its instance variables are initialized with empty strings, which is the default value if the user enters no data. (If you prefer, you can use different strings for these initial values.)

6. Save `Guest.java`.

Saving the file lets WebObjects Builder know about your newly created `Guest` class.

## Binding the Class's Instance Variables to the Form Elements

In the first chapter, you bound the input elements to variables in `Main`'s code. Now you'll modify the bindings to use the class you just created.

1. Select Web Components in the first column of the browser.
2. Double-click `Main` in the second column of the browser to open the component in WebObjects Builder.
3. Using the Add Variable/Method panel, add a variable called `currentGuest` to your component and specify its type as `Guest`. (Note that you can now choose `Guest` from the Type pop-up menu.)

An entry for `currentGuest` appears in the object browser. Notice the “>” symbol to the right of its name. This means that there is additional data to be displayed in the second column.

4. Select `currentGuest` in the object browser.

The second column displays the three fields of `currentGuest`, as determined by the definition of its class, `Guest`.

5. Click `guestName` in the second column of the object browser next to `currentGuest` and drag the cursor to the Name text field.

This time, when the Inspector opens, there is already a binding for the `value` attribute (`guestName`), because you bound it in the first tutorial.

- Double-click the row containing the **value** binding.

This removes the binding for **guestName** you made previously and binds **currentGuest.guestName** to the **value** attribute.

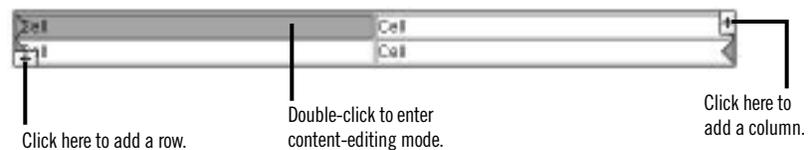
- Bind the other two input elements to **currentGuest.email** and **currentGuest.comments**.

## Creating a Table to Display the Output

In the first chapter, you created three WOString elements to display the information the guest entered. In this task, you'll create a different type of element, an HTML table, to display the information. In later tasks, you'll display data for multiple users in the table.

- Delete the WOStrings below the horizontal line in the Main component, because you'll be replacing them with a table.
- Choose  from the Elements pop-up list to display table elements.
- Click the  button.

A table with two rows and two columns appears.



- Click the  icon at the upper right of the table.

A third column appears, and the columns are equally spaced.

- Select the upper-left cell of the table by clicking it.

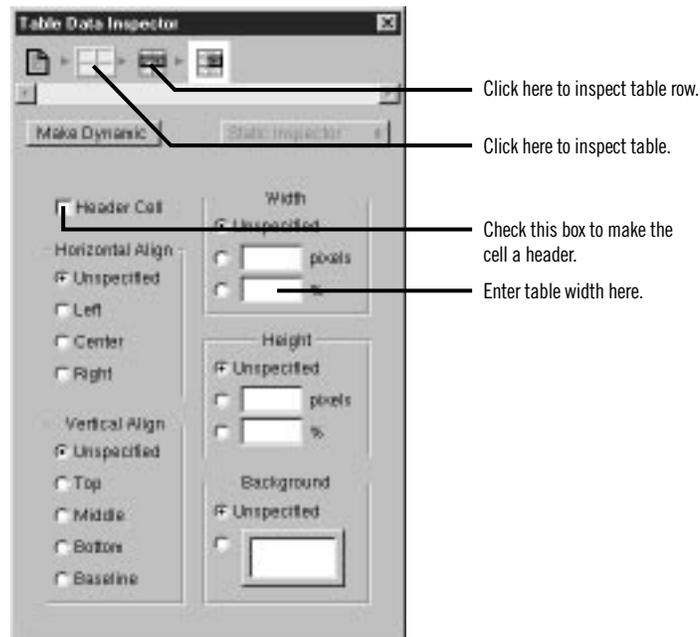
There are two modes for table editing: *content-editing* mode, which lets you change the text in a cell and add other elements to it; and *structure-editing* mode, which lets you perform operations on a cell such as splitting it in two. The cell you just selected is now in structure-editing mode.

6. Double-click the upper-left cell.

You can now edit the contents of the cell. If you want to resume structure editing, click  in the toolbar, which allows you to toggle between modes. (Alternatively, you can hold down the Control key and click in a different cell to enter structure-editing mode.)

7. Change the text in the cell to Name.
8. Open the Inspector.

The Inspector presents a number of modifiable settings that apply to the table cell you've selected. Note also that the top row of the Inspector window shows the element path, which includes the cell, the row it is contained in, and the table itself. Selecting any of those allows you to set specific properties of the elements.



9. Click the Header Cell checkbox.

The text in the cell becomes bold and centered. (However, you don't see the changes until you begin editing another cell.)

10. In the Width box, enter 150 in the field marked "pixels" and press Enter.

The width of the column is set to 150 pixels.

11. Click in the component window, then press Tab.

Pressing Tab when editing a table causes the contents of the next cell to the right to be selected (or the first cell of the next row if in the rightmost column). Pressing Shift-Tab moves in the opposite direction through the table.

12. Repeat steps 7 through 11 for the second and third cells of the top row. Label the middle column `E-mail` and set its width to 150 pixels. Label the third column `Comments` and leave its width unset. (The comments field takes up the remainder of the width of the table.)

**Note:** It isn't necessary to adjust the height of the columns, since they expand at run time to accommodate the size of the text being displayed.

### **Adding Dynamic Elements to Table Cells**

Tables and cells are static HTML elements, so you can't bind them to variables or methods. To display dynamic information in cells, you add dynamic elements, such as WOSTrings, to the cells.

1. Select the contents of the first cell in the second row of the table by clicking in the cell, then double-clicking the text.
2. Choose  from the Elements pop-up list.
3. Click  to add a WOSTring to the cell.
4. Press the Tab key.

The contents of the next cell to the right are selected.

5. Repeat steps 3 and 4 for the other two cells in the second row.

### **Binding the Dynamic Elements in the Table**

1. Select `currentGuest.guestName` in the object browser and drag the cursor to the center of the WOSTring in the first column to bind its `value` attribute.
2. Similarly, bind `currentGuest.email` and `currentGuest.comments` to the second and third WOSTrings.

The table should now look like this:

Name	E-mail	Comments
<input type="text" value="currentGuest.guestName"/>	<input type="text" value="currentGuest.email"/>	<input type="text" value="currentGuest.comments"/>

3. Save the Main component.

## Creating the Guest Object

Earlier in this chapter, you created a Java class of type `Guest` and wrote a constructor for it. You also added a variable of that class, `currentGuest`, to the Main component. However, adding a variable in this way doesn't actually create a new `Guest` object; you need to create one explicitly at some point in your code.

You'll create the `Guest` object in the constructor method for your component. This method is called when the component is first created; that is, the first time the user accesses the component.

**Note:** In `WebScript` or `Objective-C`, you use a method called `init` for this purpose.

1. Choose `View Source File` from the pull-down menu at the bottom of the window.

Project Builder becomes active and displays the code for `Main.java`. Notice the following declaration that was added to your code when you added the `currentGuest` variable:

```
protected Guest currentGuest;
```

2. Delete the declarations of `guestName`, `email` and `comments`, since you aren't using them anymore.
3. Add the constructor method inside the `Main` class definition:

```
Main() {
    super();
    currentGuest = new Guest();
}
```

The first statement calls the constructor of `Main`'s superclass (which is `next.wo.Component`). The second statement allocates a new empty `Guest` object and calls `Guest`'s constructor to initialize its instance variables.

4. Save `Main.java`.
5. Build and run your application.

The application should work similarly to the first chapter, except that the guest's data is displayed in a table at the bottom of the page instead of as plain text.



Name	E-mail	Comments
Abraham Lincoln	abe@gettysburg.com	Four score and seven years ago our fathers brought forth on this continent a new nation conceived in liberty and dedicated to the proposition

At this point, your application still handles information from a single guest only; in the next section, you'll keep track of multiple guests.

## Keeping Track of Multiple Guests

You've been using the variable `currentGuest` in the `Main` component to hold the information entered by the user. You'll need another variable (an array) to store the list of all the guests who have registered.

Before doing this, it is important to understand the scope and life span of variables in WebObjects:

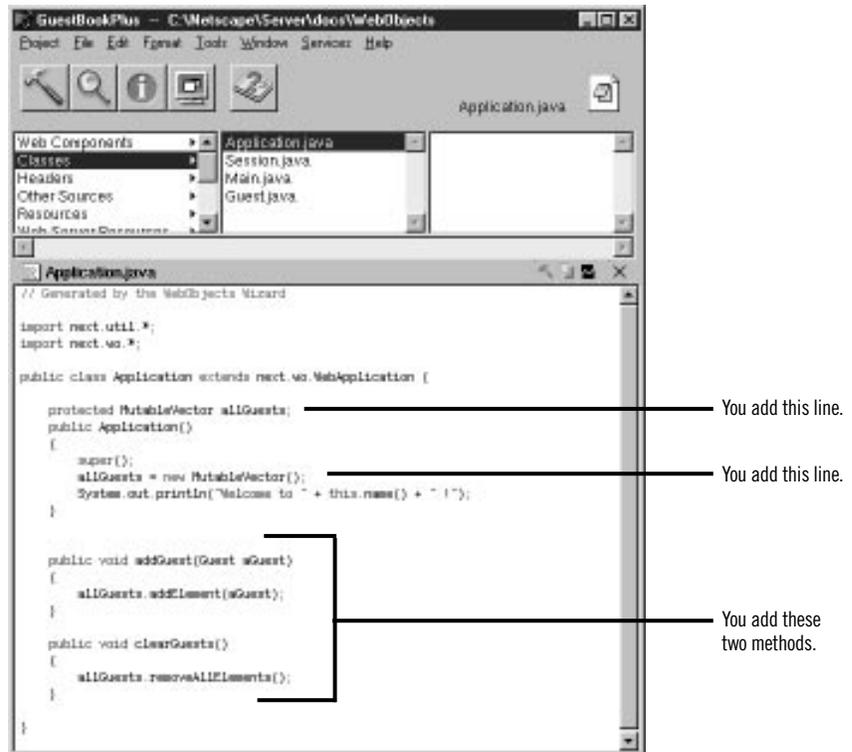
- *Component variables*, such as **currentGuest**, exist for the lifetime of the component. These variables are defined in the component (in this case, **Main.java**) and are accessible only by its methods. Each user that uses a component gets a separate instance of the variable.
- *Session variables* exist for the lifetime of one user's session and are accessible by all code in the session. They are defined in **Session.java**. An instance of each session variable is created for each user.
- *Application variables* live as long as the application does and are accessible by all code in the application. They are defined in **Application.java**. A single instance of an application variable is shared by all users of the application.

## Creating a Guest List

To store the information from all guests that have accessed the application, you'll create an application variable called **allGuests**, which exists for the life of the application.

1. In Project Builder, select Classes in the first column of the Browser. Then select **Application.java** from the second column.

The application's code appears in the window. The following figure shows the code generated by the Wizard, along with code you will add.



Note that there is one method already defined: **Application**, which is the constructor for the application object. The first line calls the constructor for Application's superclass (which is the class `WebApplication`). The second line prints a message, which you see in the Launch panel when you launch your application.

2. After the call to **super**, enter this code:

```
allGuests = new MutableVector();
```

This statement initializes **allGuests** to be a new object of class `MutableVector`. This class is the Java equivalent of the Objective-C class `NSMutableArray`, which provides an interface that allows you to add, change and delete objects from an array.

3. At the top of the Application class definition, enter this declaration:

```
protected MutableVector allGuests;
```

This declares **allGuests** to be of type `MutableVector`. Declaring it `protected` means that it is accessible only from this class or one of its subclasses. It is standard object-oriented practice for a class to prevent other classes from directly manipulating its instance variables. Instead, you provide *accessor methods* that other objects use to read or modify the instance variables.

4. Add the accessor methods **addGuest** and **clearGuests**, as shown in the figure.

The **addGuest** method adds an object of class `Guest` to the end of the **allGuests** array, using the `MutableVector` method **addElement** (its Objective-C equivalent is **addObject**).

The **clearGuests** method removes all the objects from the array using the `MutableVector` method **removeAllElements** (its Objective-C equivalent is **removeAllObjects**).

5. Save **Application.java**.

## Adding Guests to the Guest List

Now, when the user submits the form, you'll add the information to the **allGuests** array rather than displaying it directly.

1. Switch to the code for **Main.java**.
2. In the **submit** method, add the following code before the `return` statement:

```
((Application)application()).addGuest(currentGuest);  
currentGuest = new Guest();
```

This code calls the application's **addGuest** method, which adds an object (in this case, **currentGuest**) to the end of the array. Then it creates a new `Guest` object to hold the next guest's data.

**Note:** The **addGuest** method is defined in the class `Application`, which is a subclass of `WebApplication`. The component's **application** method (called in the above statement) returns an object of type `WebApplication`, so you must cast it to `Application` in order to access its **addGuest** method.

Your next step is to create a new component to display the list of guests that **allGuests** stores.

## Adding a Second Component

In this section, you'll create a new component. Instead of Java, you'll implement its code using WebScript.

1. In Project Builder's browser, click Web Components in the first column.
2. Choose File ► New in Project.

Note that the Web Components suitcase is selected.

3. Type `GuestList` as the name of the new component. Then click OK.

The WebObjects Component Wizard appears.

4. Choose None for Available Assistance and WebScript for Component Language.
5. Click Finish.
6. In the second column of the browser, click **GuestList.wo**.

Note that there is an additional file you didn't have with your Java component. **GuestList.wo** is your script file, the WebScript equivalent of **Main.java** in the Main component. For WebScript components, the script files are stored under the component, rather than in the Classes bucket. You'll add code to your script file in a later step.

7. Double-click **GuestList.wo** to bring up the component window in WebObjects Builder.
8. Create a heading for this page, as you did for the Main component. Call it "Guest List" (or something else of your choosing). Then press Enter twice.
9. Add a WOString below the heading. Then type the text " guests have signed this guestbook."

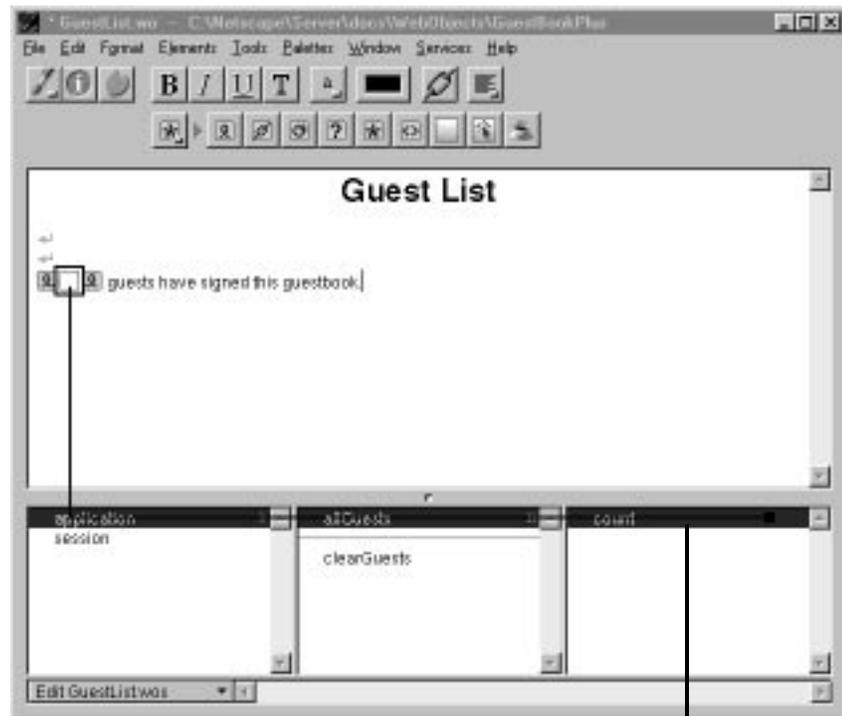
You're going to bind this WOString so that it reflects the number of guests who have submitted this form.

- In the object browser, click **application**.

There is an entry in the second column for the **allGuests** application variable you created. This entry appears in the Main component as well, since application variables are accessible from anywhere in the code.

If you click **allGuests**, you'll see in the third column an entry for **count**. This is a standard method that returns the number of objects in the array.

- Click **count** and drag to the center rectangle to bind it to the WOSTring's **value** attribute.



**allGuests.count** represents the number of objects in the array. Drag to bind it to the WOSTring.

- Save the GuestList component.

You need to do one more thing so that the GuestList page now displays when the user submits the form.

- Go back to Project Builder and view the source code for **Main.java**. Replace the return statement in the **submit** method with the following code:

```
return application().pageWithName("GuestList");
```

`pageWithName` is a standard WebObjects method (defined in the `WebApplication` class) that allows you to specify a new page to display.

At this point, the code for `Main.java` looks like this:



```

import next.util.*;
import next.wo.*;
import next.eo.*;

public class Main extends next.wo.Component {
    protected Guest currentGuest;

    public Component submit()
    {
        ((Application)application()).addGuest(currentGuest);
        currentGuest = new Guest();
        return application().pageWithName("GuestList");
    }

    Main()
    {
        super();
        currentGuest = new Guest();
    }
}

```

14. Save `Main.java`.

15. Build and run your application.

Each time you submit the form, the number of guests displayed in the `WOString` should increase.

To return to the Main page, you'll have to use your browser's backtrack button. Later in the tutorial, you'll add a hyperlink to return to the Main page.

## Using a Repetition

You have demonstrated the use of a second component. Now you'll create a table to display the entire list of guests in the `GuestList` component. To do so, you'll use a dynamic element called a *repetition* (`WORepetition`). Repetitions are one of the most important elements in WebObjects, since it is quite common for applications to display repeated data (often from databases) when the amount of data to be displayed isn't known until run time. Typically, a repetition is used to generate items in a list or a browser, multiple rows in a table, or multiple tables.

A repetition can contain any other elements, either static HTML or dynamic WebObjects elements. In the `GuestList` component, you'll create a repetition that contains a table row.

You'll bind the `allGuests` array to the `WORepetition`'s `list` attribute. This tells WebObjects to generate the elements in the repetition once for each item in the array. Each time WebObjects iterates through the array, it sets the repetition's `item` attribute to the current array object. You bind `item` to the variable `currentGuest` and use `currentGuest`'s fields to bind the elements inside the repetition (such as `WOStrings`). At run time, the table will consist of one row (displaying name, e-mail address, and comments) for each guest.

1. In WebObjects Builder, make the Main component window active.
2. Select the table at the bottom of the page by clicking outside it and dragging across it.
3. Choose Edit ► Copy.
4. Make the GuestList component active.
5. Place the cursor at the bottom of the page and choose Edit ► Paste.

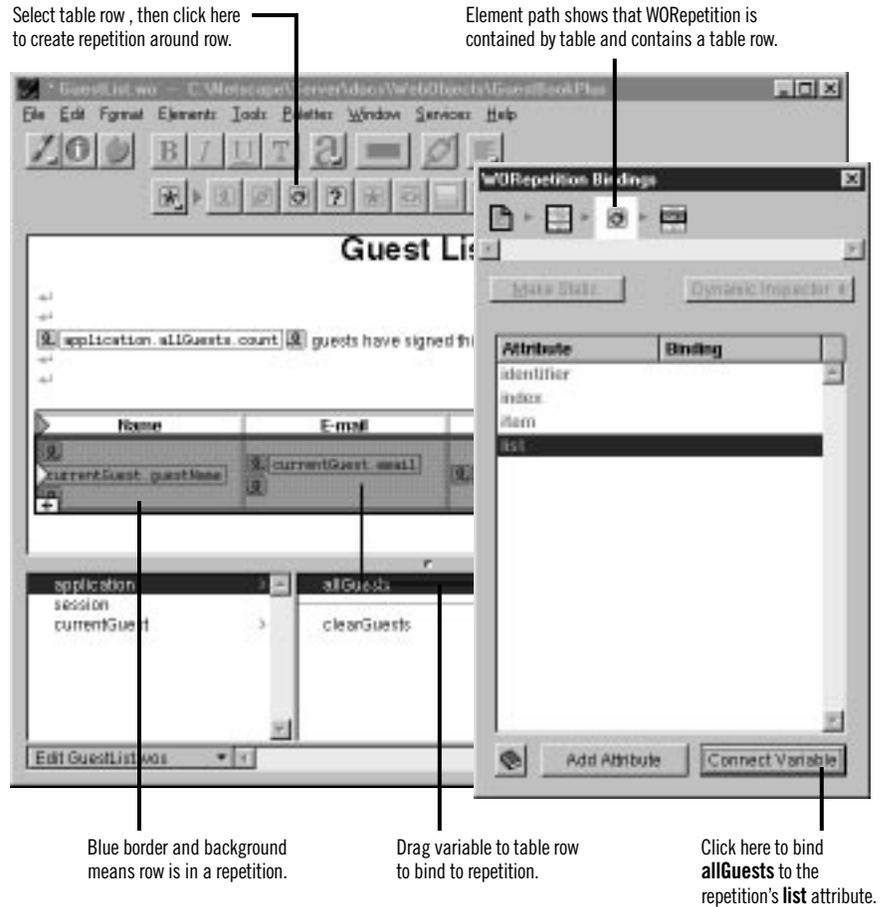
You have just copied the table from Main into GuestList. It has all the same properties, including the bindings. The `WOStrings` in the table are still bound to instance variables of `currentGuest`. Since `currentGuest` is a component variable defined in Main, it isn't accessible from GuestList. Therefore, you need to declare it here.

6. From the pull-down menu at the bottom of the window, choose Add Variable/Method. Enter `currentGuest` as the name of the variable and `Guest` as its type.
7. Choose  from the Elements pop-up list to display the Tables buttons.
8. Click somewhere in the table, then click  in the toolbar to enter structure-editing mode. (Alternatively, Control-click on the table.)
9. Click one of the triangles in the second row to select the entire row.
10. Choose  to display Other WebObjects in the toolbar and click .

When you wrap a repetition around a table row in this way, the `WORepetition` symbol  doesn't appear in the table. Instead, a blue border appears around the row. For additional examples of using repetitions, see Chapter 3, "Creating a WebObjects Database Application" (page 59).

11. In the object browser, select **application** in the first column.
12. In the second column, click **allGuests** and drag the cursor to anywhere inside the row (but *not* inside one of the WOStrings).

The Inspector window opens showing the repetition's bindings. The **list** attribute is selected by default.



13. Click **Connect Variable** to bind **application.allGuests** to the **list** attribute.
14. Bind **currentGuest** to the repetition's **item** attribute.

To do this, you can select the row for **item**, then double-click in the Binding column and type `currentGuest`.

By using the name `currentGuest` for the `item` attribute, you are taking advantage of the fact that the strings in your table are already bound to the fields of `currentGuest`.

You now have finished implementing the repetition. When the table is generated, it will have one row for each item in the `allGuests` array.

15. Save the `GuestList` component.
16. Delete the table from `Main`, since you no longer need it.
17. Build and launch your application.
18. Test your application by entering data for multiple guests and verifying that each guest appears in the table.

## Adding the Finishing Touches

There are a few additional things you'll do to make your application a bit more user friendly:

- Add a button that, when clicked, clears the guest list.
- Add a hyperlink to the `GuestList` page that allows users to return to the `Main` page.

### Clearing the Guest List

While developing your application, you may find it useful to be able to remove all guests from the list. (Typically, you wouldn't allow users to remove all guests from the list.)

1. In `WebObjects Builder`, make the `GuestList` component window active.
2. Choose `Add Action` from the pull-down menu at the bottom of the window. In the panel, enter `clearGuestList` as the name of the action and set the page returned to `nil`.
3. Choose `View Source File` from the pull-down menu.

`Project Builder` displays the code for `GuestList.wos`. You'll notice that there is a skeleton of the `clearGuestList` action method, using `WebScript` syntax, as well as the declaration for `currentGuest` that you created previously.

4. Enter the following code before the return statement in `clearGuestList`:

```
[[self application] clearGuests];
```

This code calls the application's `clearGuests` method, which removes all the Guest objects from the array.

5. Save `GuestList.wos`.
6. Go back to WebObjects Builder.
7. Place the cursor below the table and press Enter.
8. Choose  from the Elements pop-up list and click .

This creates a submit button that the user will click to clear the guest list.

9. Using the Inspector, bind the submit button's `value` attribute to (including the quotes) `"Clear Guest List"`.

This changes the title of the button. Note that the quotes are necessary to indicate that you're binding a string, not a variable.

10. Bind the `action` attribute to `clearGuestList`.

When the user clicks the button, the `clearGuestList` action method is called, which causes the guest list to be cleared and the page to be redrawn.

## Adding a Dynamic Hyperlink

Now you'll create a hyperlink that returns the user to the Main page.

1. Place the cursor below the submit button (outside the rectangle of its containing form).
2. Choose  from the Elements pop-up list and click .
3. Double-click the text "Hyperlink" and type `Return to Sign-in Page`.
4. Inspect the hyperlink.

5. Select the **pageName** attribute, then double-click in the Binding column and type (including the quotes) "Main".

**Note:** You must specifically type the quotation marks in "Main", because you are specifying a string representing the name of the page to be returned. If you left off the quotes, you would be specifying a variable or method called **Main**.

6. Save the GuestList component.
7. Test your application.

**Note:** In this case, you don't have to rebuild and relaunch your application in order to test it. Building is only required when you have made changes to Java or Objective-C code. If you modify a component or WebScript code only, the changes take effect even if the application is already running.

The GuestList page should now look like this:



*Chapter 3*

## **Creating a WebObjects Database Application**



---

One of the most powerful features of WebObjects is its ability to provide access to databases. To do so, it uses a framework called the Enterprise Objects Framework. This chapter introduces you to the Enterprise Objects Framework by showing you how to create a simple database application. The steps you take in creating this application demonstrate the principles you'll use in every other application you develop with the WebObjects and Enterprise Objects Framework.

The application you'll create in this tutorial is called Movies. It makes use of a sample database, the Movies database, that contains information about movies. Before you do this tutorial, you need to set up the Movies database as described in the *Post-Installation Instructions*. In addition, if you aren't familiar with Project Builder and WebObjects Builder, read the first tutorials in this book, "Creating a Simple WebObjects Application" (page 11) and "Enhancing Your Application" (page 37), which introduce basic concepts and procedures you should know before you go on.

In this tutorial, you will:

- Use the WebObjects Application Wizard to create a fully functional Main component that reads and writes from the Movies database.
- Create and configure *display groups* for interacting with a database in terms of objects.
- Create bindings between display groups and a user interface.
- Write code to manipulate display groups' selected objects.
- Set up display groups in a master-detail configuration.
- Use EOModeler to maintain a model file.
- Create custom enterprise object classes.

Along the way, you'll learn basic Enterprise Objects Framework concepts you can use to design your own database applications.

## The Movies Application

The Movies application has two pages, each of which allows you to access information from the database in different ways:

- *MovieSearch* (the main page) lets you search for movies that match user-specified criteria. For example, you can search for all comedies starting with the letter “T” that have an R rating. Once you find the movie you’re looking for, you can make changes to its data or delete it. You can also use this page to insert new movies into the database.
- *MovieDetails* displays the actors who star in a selected movie and the roles those actors play. You can add new roles, change the name of a role, and assign a different actor to a role.

### Search for Movies

Title:

Category:

Rating:

[After Hours](#)  
[Alien](#)  
[Amarcord](#)  
[Apocalypse Now](#)

---

Title:

Category:

Rating:

Date Released:

Revenue:

[Movie Details](#)

### Movie Details

**After Hours**

Category: Comedy  
 Rating: R  
 Date Released: 23 Sep 1985  
 Revenue: \$ 2,300,000.00

Starring:  
 Teri Garr as [Julie](#)  
 Linda Fiorentino as [Kiki](#)  
 Rosanna Arquette as [Marcy](#)

---

Anémone  
 Mia-Miou  
 Vampira  
 Kareem Abdul-Jabbar  
 Isabelle Adjani

Role Name:

---

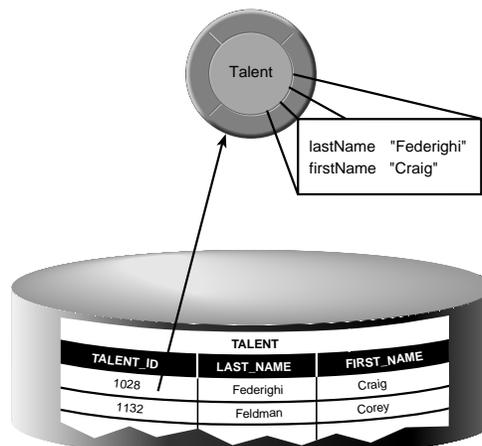
[Movie Search](#)

## Enterprise Objects and the Movies Database

Enterprise Objects Framework manages the interaction between the database and objects in the Movies application. Its primary responsibility is to fetch data from relational databases into *enterprise objects*. An enterprise object, like any other object, couples data with methods for operating on that data. In addition, an enterprise object has properties that map to stored data. Enterprise object classes typically correspond to database tables. An enterprise object instance corresponds to a single row or record in a database table.

The Movies application centers around three kinds of enterprise objects: Movies, MovieRoles, and Talents. A movie has many roles, and talents (or actors) play those roles.

The Movie, MovieRole, and Talent enterprise objects in the Movies application correspond to tables in a relational database. For example, the Talent enterprise object corresponds to the TALENT table in the database, which has LAST\_NAME and FIRST\_NAME columns. The Talent enterprise object class in turn has **lastName** and **firstName** instance variables. In an application, Talent objects are instantiated using the data from a corresponding database row, as shown in the following figure:



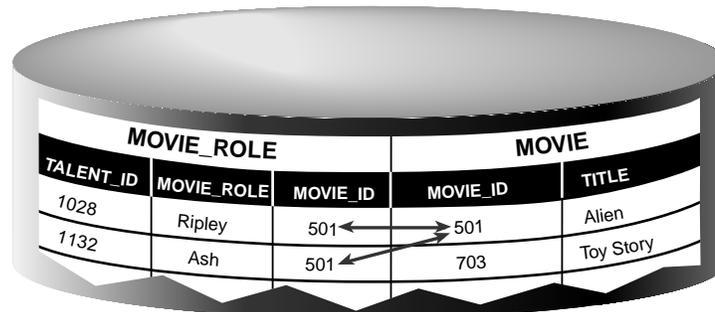
## Enterprise Objects and Relationships

Relational databases model not just individual entities, but entities' relationships to one another. For example, a movie has zero, one, or more roles. This is modeled in the database by both the MOVIE table and

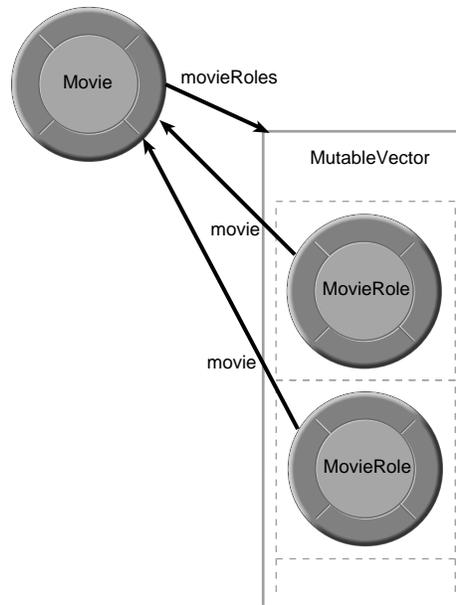
MOVIE\_ROLE table having a MOVIE\_ID column. In the MOVIE table, MOVIE\_ID is a *primary key*, while in MOVIE\_ROLE it's a *foreign key*.

A primary key is a column or combination of columns whose values are guaranteed to uniquely identify each row in that table. For example, each row in the MOVIE table has a different value in the MOVIE\_ID column, which uniquely identifies that row. Two movies could have the same name but still be distinguished from each other by their MOVIE\_IDs.

A foreign key matches the value of a primary key in another table. The purpose of a foreign key is to identify a relationship from a source table to a destination table. In the following diagram, notice that the value in the MOVIE\_ID column for both MOVIE\_ROLE rows is 501. This matches the value in the MOVIE\_ID column of the “Alien” MOVIE row. In other words, “Ripley” and “Ash” are both roles in the movie “Alien.”



Suppose you fetch a Movie object. Enterprise Objects Framework takes the value for the movie's MOVIE\_ID attribute and looks up movie roles with the corresponding MOVIE\_ID foreign key. The framework then assembles a network of enterprise objects that connects a Movie object with its MovieRole objects. As shown below, a Movie object has a vector of its MovieRoles, and the MovieRoles each have a Movie.



## Designing the Main Page

Every WebObjects application has at least one component—usually named Main—that represents the first page the application displays. In Movies, the Main component represents the MovieSearch page.

To design the Main component, you'll use the WebObjects Application Wizard. The wizard performs all the setup that's necessary to fetch database records and display them in a web page. Specifying different wizard options yields different pages: The MovieSearch page is an example of one of the many different layouts you can generate with the wizard.

### Starting the WebObjects Application Wizard

1. In Project Builder, choose Project ► New.
2. In the New Project panel, select WebObjects Application from the Project Type pop-up list.
3. Click Browse.
4. In the Open panel, navigate to a directory under *DocumentRoot/WebObjects*, where you want to create your new project.

5. Type `Movies` in the “File name” field.
6. Click `Save`.
7. In the `New Project` panel, click `OK`.

This starts the `WebObjects Application Wizard`.

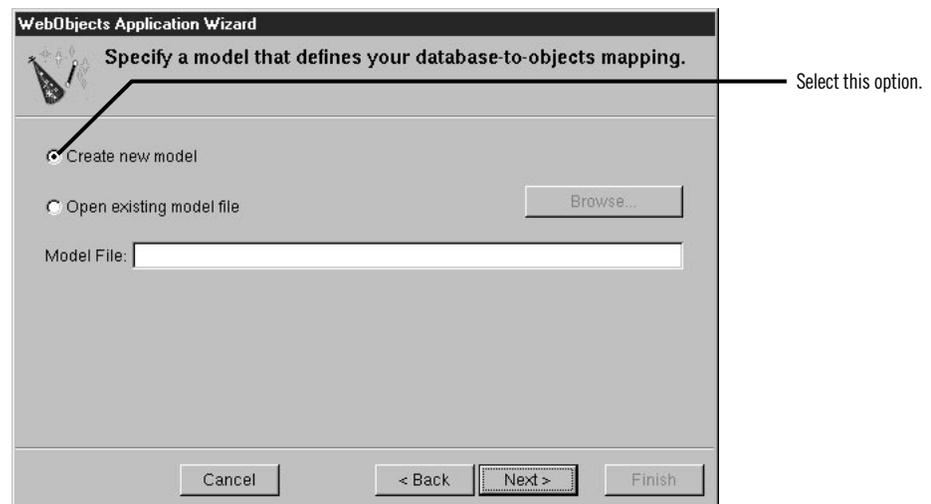
8. Choose `Wizard` under `Available Assistance`.

With this option, the wizard guides you through the creation of a `Main` component for your application. When you finish, you can immediately build and run your application without performing any additional steps and without adding any code.

9. Choose `Java` as the primary language.
10. Click `Next`.

## Specifying a Model File

A *model* associates database columns with instance variables of objects. It also specifies relationships between objects in terms of database join criteria. You typically create model files using the `EOModeler` application, but the wizard can create a first cut at a model as a starting point. Later on, you’ll use `EOModeler` to modify the model created by the wizard.



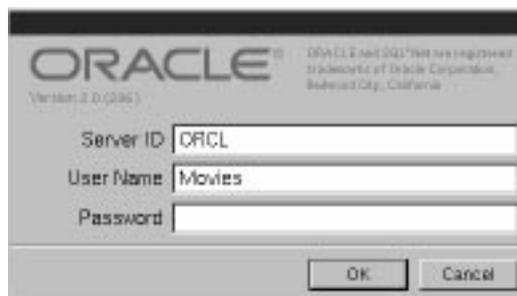
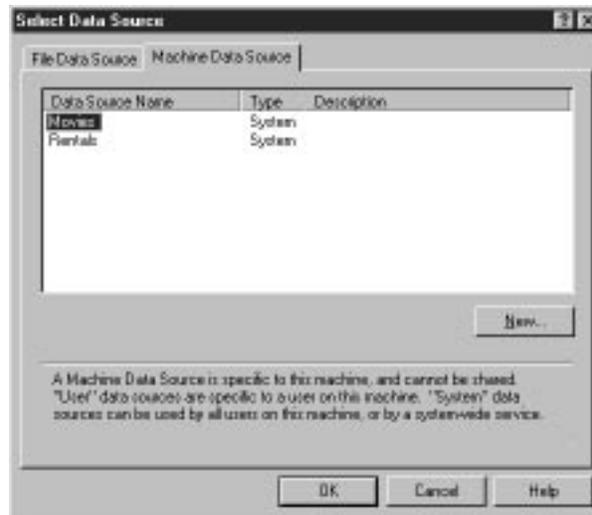
1. Choose “`Create new model`.”
2. Click `Next`.

## Choosing an Adaptor

An *adaptor* is 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 adaptors for Informix, Oracle, and Sybase servers. If you're working on a Windows platform, WebObjects also provides an ODBC adaptor for use with ODBC-compliant database sources.

1. In the wizard panel, choose the adaptor for your database.
2. Click Next.

A login panel for the selected adaptor opens. Different databases require different login information, so each database's login panel looks different. Shown below are the login panels for the ODBC and Oracle adaptors, for use with ODBC-compliant database servers (such as Microsoft Access) and Oracle database servers, respectively.



### 3. Complete the login panel.

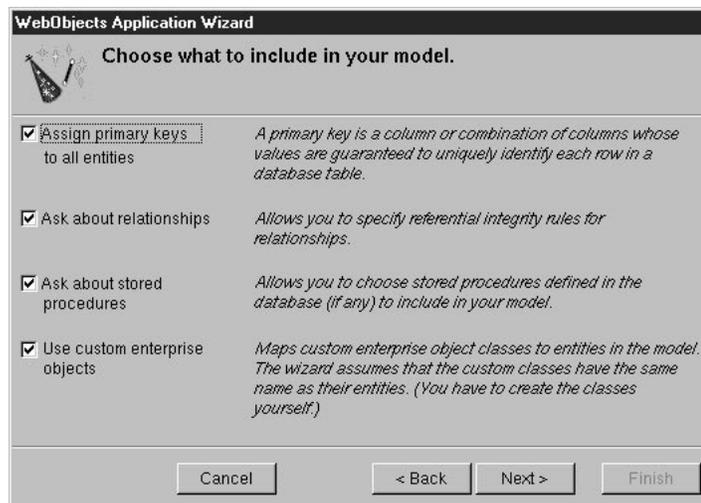
Specify the connection information you provided when you created and populated the Movies database. *Post-Installation Instructions* provides more information.

### 4. Click OK.

When you use the wizard to create a model file, the wizard uses the adaptor you specify to connect to your database. With the information you specified in the adaptor's login panel, the adaptor logs in, reads the database's schema information, and creates a model. The wizard uses your answers to the questions in the next several pages to configure that model.

## Choosing What to Include in Your Model

In this next wizard page, you can specify the degree to which the wizard configures your model.



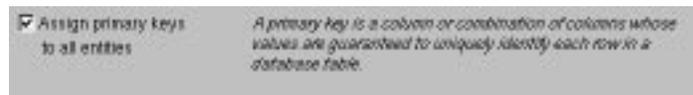
The basic model the wizard creates contains *entities*, *attributes*, and *relationships*. An *entity* is the part of the database-to-object mapping that associates a database table with an enterprise object class. For example, the *Movie* entity maps rows from the *MOVIE* table to *Movie* objects. Similarly, an *attribute* associates a database column with an instance variable. For example, the *title* attribute in the *Movie* entity maps the *TITLE* column of the *MOVIE* table to the *title* instance variable of *Movie* objects.

A *relationship* is a link between two entities that's based on attributes of the entities. For example, the Movie entity has a relationship to the MovieRole entity based on the entities' **movieId** attributes (although the attributes in this example have the same name in both entities, they don't have to). This relationship makes it possible to find all of a Movie's MovieRoles.

How complete the basic model is depends on how completely the schema information is inside your database server. For example, the wizard includes relationships in your model only if the server's schema information specifies foreign key definitions.

Using the options in this page, you can supplement the basic model with additional information. (Note that the wizard doesn't modify the underlying database.)

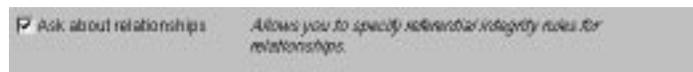
1. Check the "Assign primary keys to all entities" box.



Enterprise Objects Framework uses primary keys to uniquely identify enterprise objects and to map them to the appropriate database row. Therefore, you must assign a primary key to each entity you use in your application. The wizard automatically assigns primary keys to the model if it finds primary key information in the database's schema information.

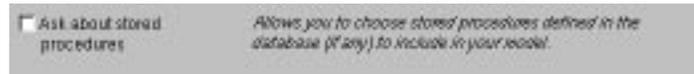
Checking this box causes the wizard to prompt you to choose primary keys that aren't defined in the database's schema information. If your database doesn't define them, the wizard later prompts you to choose primary keys.

2. Check the "Ask about relationships" box.



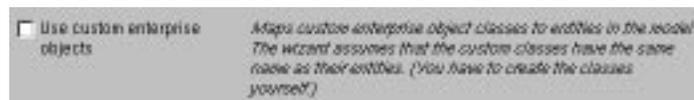
If there are foreign key definitions in the database's schema information, the wizard includes the corresponding relationships in the basic model. However, a definition in the schema information doesn't provide enough information for the wizard to set all of a relationship's options. Checking this box causes the wizard to prompt you to provide the additional information it needs to complete the relationship configurations.

3. Uncheck the “Ask about stored procedures” box.



Checking this box causes the wizard to read stored procedures from the database’s schema information, display them, and allow you to choose which to include in your model. Because the Movies application doesn’t require the use of any stored procedures, don’t check this box.

4. Uncheck the “Use custom enterprise objects” box.



An entity maps a table to enterprise objects by storing the name of a database table (MOVIE, for example) and the name of the corresponding enterprise object class (a Java class, Movie, for example). When deciding what class to map a table to, you have two choices: GenericRecord or a custom class. GenericRecord is a class whose instances store key-value pairs that correspond to an entity’s properties and the data associated with each property.

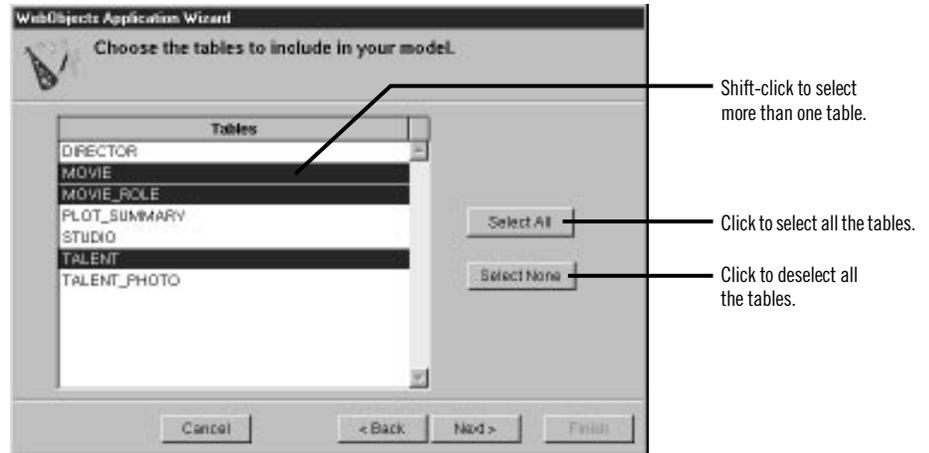
If you don’t check the “Use custom enterprise objects” box, the wizard maps all your database tables to GenericRecord. If you do check this box, the wizard maps all your database tables to custom classes. The wizard assumes that each entity is to be represented by a custom class with the same name. For example, a table named MOVIE has an entity named Movie, whose corresponding custom class is also named Movie.

Use a custom enterprise object class only when you need to add business logic; otherwise use GenericRecord. The Movies application uses GenericRecord for the Movie entity and custom classes for the Talent and MovieRole entities. Later on, you’ll use EOModeler to specify the custom classes.

5. Click Next.

## Choosing the Tables to Include

1. In the wizard panel, select MOVIE, MOVIE\_ROLE, and TALENT in the Tables browser.



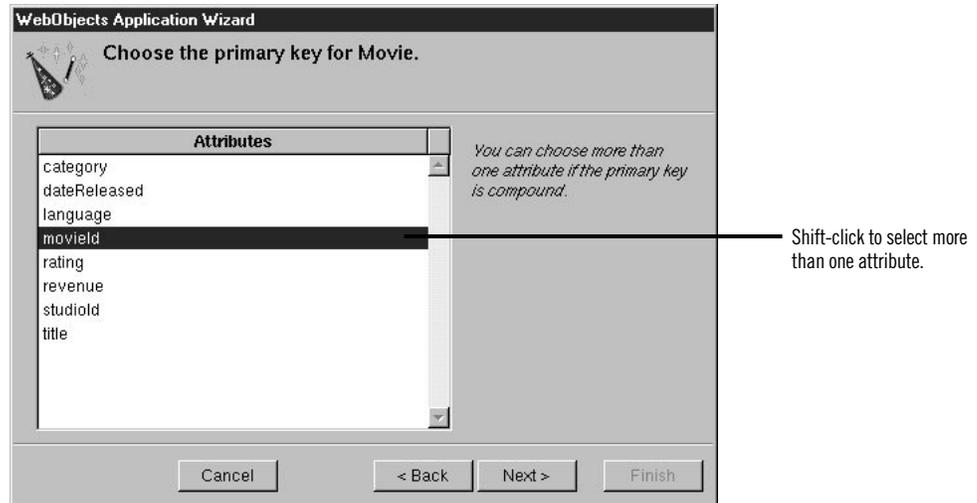
The wizard creates entities only for the tables you select. Since the Movies application doesn't interact with any of the other tables (DIRECTOR, PLOT\_SUMMARY, STUDIO, and TALENT\_PHOTO), you don't need to include them in the model.

2. Click Next.

## Specifying Primary Keys

If you are using a database that stores primary key information in its database server's schema information, the wizard skips this step. The wizard has already successfully read primary key information from the schema information and assigned primary keys to your model.

However, if primary key information isn't specified in your database server's schema information (as with Microsoft Access), the wizard now asks you to specify a primary key for each entity.



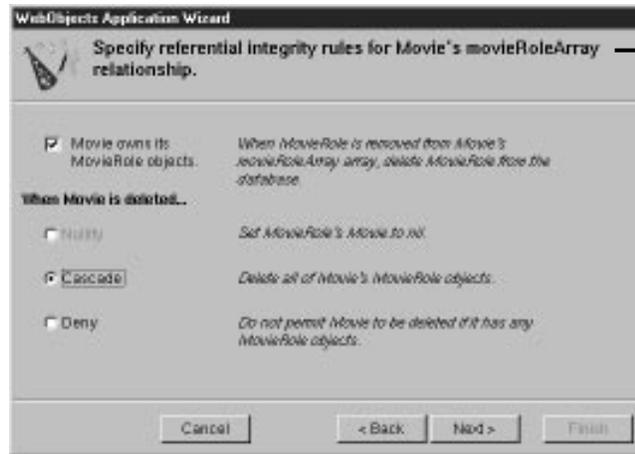
1. Select **movieId** as the primary key for the Movie entity.
2. Click Next.
3. Select both **movieId** and **talentId** as the primary key for the MovieRole entity.

MovieRole's primary key is *compound*; that is, it's composed of more than one attribute. Use a compound primary key when any single attribute isn't sufficient to uniquely identify a row. For MovieRole, the combination of the **movieId** and **talentId** attributes is guaranteed to uniquely identify a row.

4. Click Next.
5. Select **talentId** as the primary key for the Talent entity.
6. Click Next.

### Specifying Referential Integrity Rules

If you're using a database that stores foreign key definitions in its database server's schema information, the wizard reads them and creates corresponding relationships in your model. For example, Movie has a to-many relationship to MovieRole (that is, a Movie has a vector of MovieRoles), and Talent has a to-many relationship to MovieRole. The wizard now asks you to provide additional information about the relationships so it can further configure them.

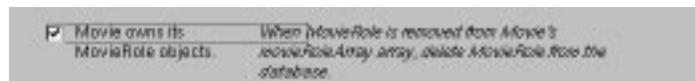


In this example, the relationship name is **movieRoleArray**, but the name is dependent on the adaptor you're using.

If foreign key definitions aren't specified in your database server's schema information (as with Microsoft Access), the wizard hasn't created any relationships at all, and it skips this step. You'll add relationships to your model using EOModeler later in this tutorial.

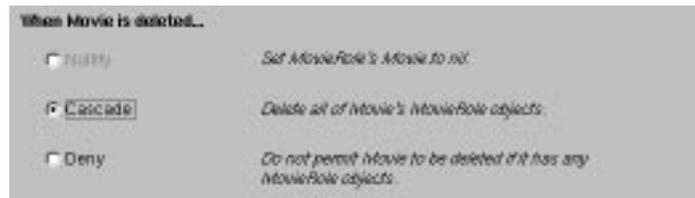
In the first relationship configuration page, the wizard asks you about Movie's relationship to MovieRole. The name of the relationship is dependent on the adaptor you're using.

1. Check the "Movie owns its MovieRole objects" box.



This option specifies that a MovieRole can't exist without its Movie. Consequently, when a MovieRole is removed from its Movie's vector of MovieRoles, the MovieRole is deleted—deleted in memory and deleted in the database.

2. Choose Cascade.



This option specifies what to do when the source object (the Movie) is deleted. The cascade delete rule specifies that when a source object is deleted, the source's destination objects should also be deleted—again, deleted in memory and correspondingly in the database.

3. Click Next.

Now the wizard asks you about Talent's relationship to MovieRole.

4. Check the “Talent owns its MovieRole objects” box.
5. Choose Deny.

The deny delete rule specifies that if the relationship source (a Talent) has any destination objects (MovieRoles), then the source object can't be deleted.

6. Click Next.

You're done with the model configuration part of the wizard. The rest of the wizard pages are to help you configure your application's user interface.

## Choosing an Entity

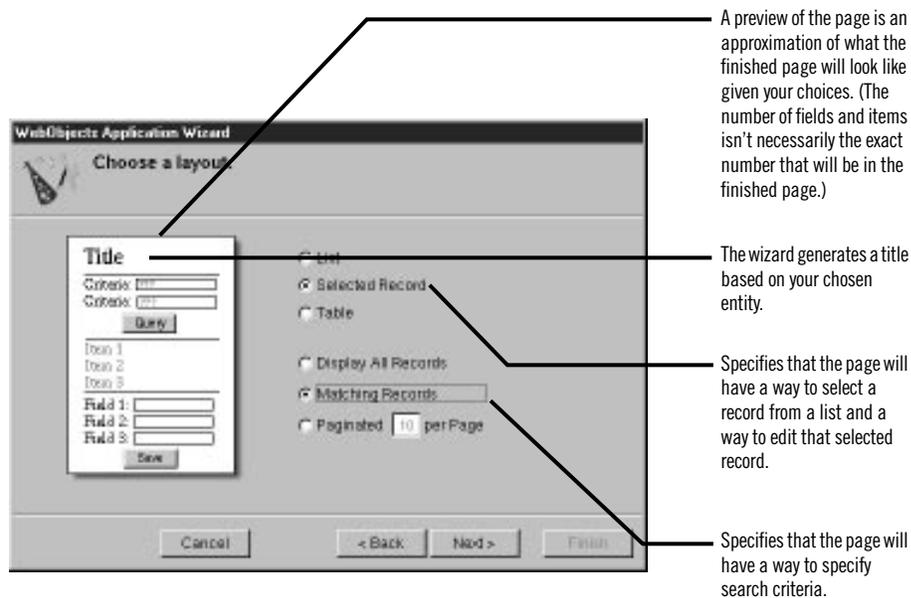
In this page, the wizard asks you to choose the entity around which the Main component will be centered. Your Main component centers around the Movie entity.

1. Select the Movie entity.
2. Click Next.

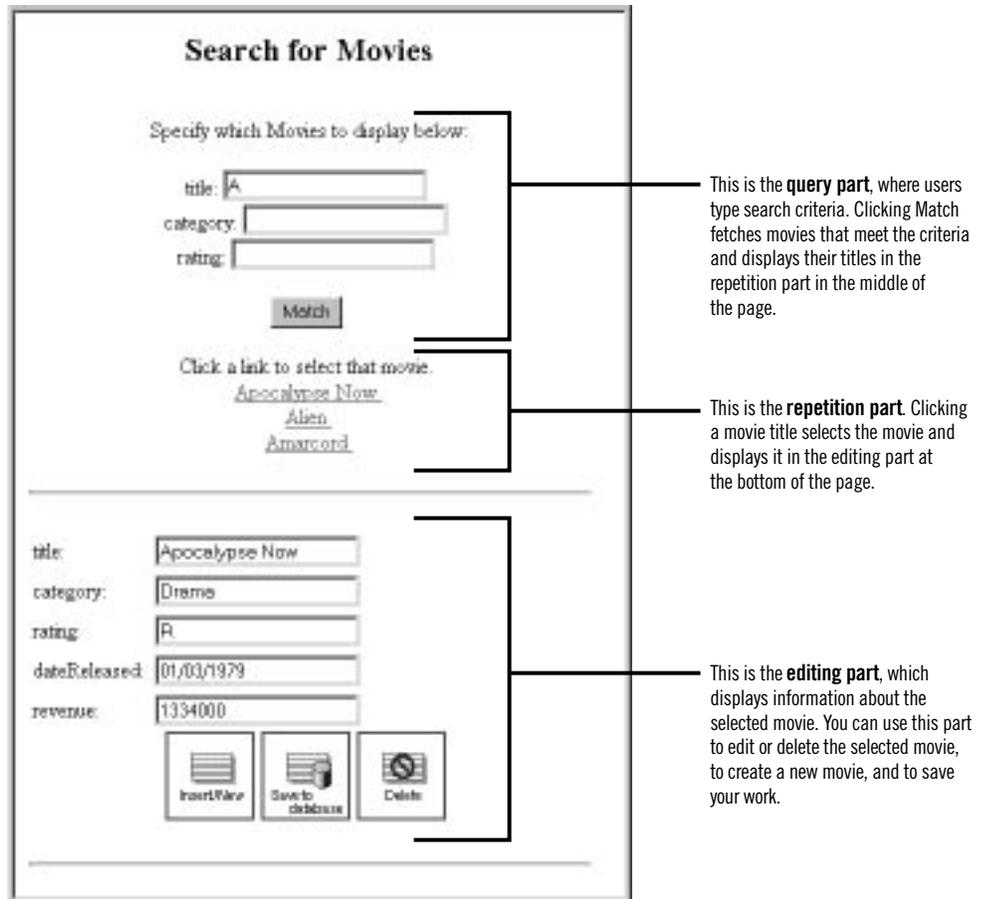
## Choosing a Layout

The wizard provides several page layout options for formatting objects fetched from the database.

1. Choose Selected Record.
2. Choose Matching Records.



Based on your specifications, the wizard shows you a preview of the page it will generate. To see how the wizard's preview corresponds with the actual page the wizard will create, the finished page is shown below.



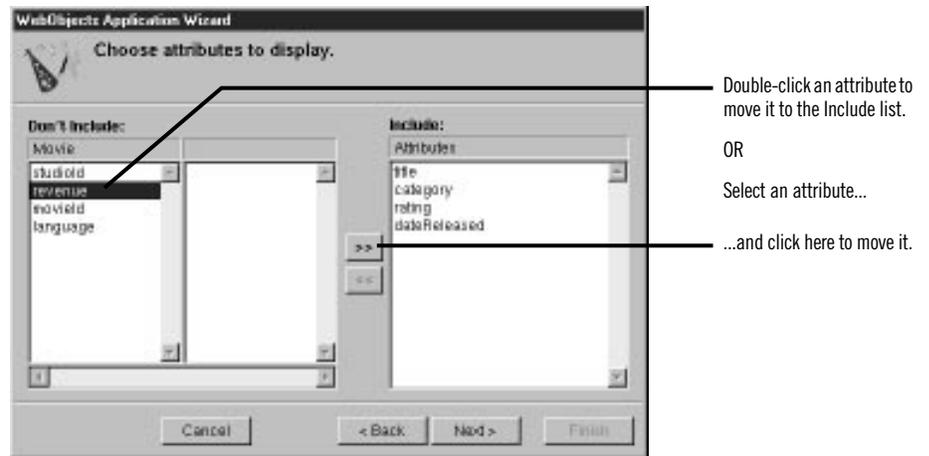
There are three parts to this page: the query part (at the top of the page), which contains fields into which users provide search criteria; the repetition part (in the middle of the page), which contains a list of matching records fetched from the database; and the editing part (at the bottom of the page), which allows you to make changes to the selected record.

3. In the wizard panel, click Next.

## Choosing Attributes to Display

The next step is to choose which of the Movie entity's attributes to display in the editing part at the bottom of the page.

1. Move attributes from the Don't Include list to the Include list.



The order in which you add the attributes determines the order in which they appear on the page, so add them in the following order: **title**, **category**, **rating**, **dateReleased**, and **revenue**.

Don't add any of the remaining attributes (**language**, **movied**, and **studid**). They don't have meaning to users, and should not be displayed in the page.

2. Click Next.

### Choosing an Attribute to Display as a Hyperlink

You now need to specify the attribute used in the repetition part of the page to identify each record. This attribute will be displayed as a hyperlink. Clicking the hyperlink displays the corresponding record in the detail part of the page.

1. Add the **title** attribute to the Include browser.
2. Click Next.

### Choosing Attributes to Query On

Specify the attributes to display in the query part of the page. The wizard creates search criteria fields for each of the attributes you choose.

1. Add the **title**, **category**, and **rating** attributes to the Include browser.
2. Click Finish.

When the wizard finishes, your new project is displayed in Project Builder. The wizard has produced all the files and resources for a fully functional, one-page application. All you need to do before running your Movies application is build it.

## Running Movies

Build and run the application.

The screenshot shows a web application titled "Search for Movies". It has two main sections. The top section is for searching, with a heading "Specify which Movies to display below:" and three input fields for "title:", "category:", and "rating:". The "title:" field contains the letter "A". Below these fields is a "Match" button. Underneath the button, there is a link "Click a link to select that movie." followed by three underlined links: "Apocalypse Now", "Alien", and "Amarcord". The bottom section is for editing a movie, with a heading "Click a link to select that movie." and five input fields: "title:" (containing "Apocalypse Now"), "category:" (containing "Drama"), "rating:" (containing "R"), "dateReleased:" (containing "01/03/1979"), and "revenue:" (containing "1334000"). Below these fields are three buttons: "Insert/Update", "Save to database", and "Delete".

Annotations for the screenshot:

- Type matching criteria. A database string matches if it begins with the string in the text field. For example, strings match "The" if they start with the string "The".
- Click here to fetch and return matching movies.
- Click a movie to select it and display its information below.
- Use these text fields to edit the information about a movie.
- Click here to create a new, empty movie.
- Click here to delete the selected movie.
- Click here to save your work in the database (add the new movies you inserted, remove the movies you deleted, and save changes you made to existing movies).

Experiment with the application by entering different search criteria. Insert, update, and delete movies. Try entering dates with different formats, such as:

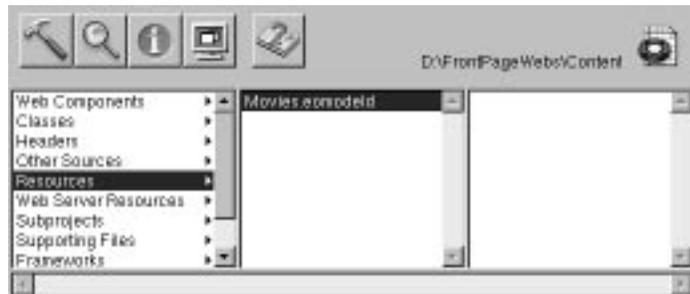
- 6/7/97
- June 7, 1997
- today

## Examining Your Project

Whenever you create a new project, Project Builder populates the project with ready-made files and directories. What it includes depends on the choices you make in the wizard, so this project has a set of files different from those of the GuestBook project.

Like GuestBook, the Movies project contains a Main component (**Main.wo**) and classes (**Application.java**, **Session.java**, and **Main.java**). It also includes some files that the GuestBook doesn't have: a model file and images used by the Main component.

In Project Builder, navigate to the Movie project's Resources category. This is where the model, named **Movies.eomodel**, is located. Later in this tutorial you'll use EOModeler to open the model and enhance it.



Navigate to the Web Server Resources category. This is where your project's images are located: **DBWizardInsert.gif**, **DBWizardUpdate.gif**, and **DBWizardDelete.gif**, for the "Insert/New," "Save to database," and "Delete" buttons, respectively.

The biggest difference between the GuestBook and Movies projects are their Main components. Whereas the Main component you created for the GuestBook project was empty, the Main component for the Movies project contains a fully functional user interface. Also, the **Main.java** class already contains code that supplies the component with behavior. In the next sections, you'll examine Movies' **Main.wo** component and its **Main.java** class.

## Examining the Variables

1. Double-click **Main.wo** in Project Builder's WebObjects Components category to open the Main component in WebObjects Builder.

There are four variables in the object browser: the **application** and **session** variables that are available in all components and two others, **movie** and **movieDisplayGroup**.

The **movie** variable is an enterprise object that represents a row fetched from the MOVIE table. **movieDisplayGroup** is a *display group*—an object that interacts with a database, indirectly through classes in the Enterprise Objects Framework. Display groups are used to fetch, insert, update, and delete enterprise objects that are associated with a single entity. **movieDisplayGroup**'s entity is Movie, which you specified in the wizard's "Choose an entity" page.

2. In Project Builder, look at the class file **Main.java** to see how **movie** is declared.

The **movie** declaration (shown below) declares **movie** to be an EnterpriseObject—a Java interface that describes the general behavior that all enterprise objects must have.

```
/** @TypeInfo Movie */ protected EnterpriseObject movie;
```

At run time, **movie** is a GenericRecord object. Recall that GenericRecord is used to represent enterprise objects unless you specify a custom class. Since you didn't check the "Use custom enterprise objects" box in the wizard's "Choose what to include in your model" page, your application defaults to using GenericRecord for all its entities.

The comment (`/** @TypeInfo Movie */`) is used by WebObjects Builder to identify **movie**'s entity (Movie). Knowing the entity allows WebObjects Builder to display **movie**'s attributes (**category**, **dateReleased**, and so on). You can see **movie**'s attributes if you select the **movie** variable in the WebObjects Builder's object browser.

3. In Project Builder, examine **movieDisplayGroup**'s declaration in **Main.java**.

The declaration (shown below) declares **movieDisplayGroup** to be a DisplayGroup.

```
protected DisplayGroup movieDisplayGroup;
```

Also note the comment explaining how `movieDisplayGroup` is initialized. The `Main.java` class doesn't have any code to create and initialize the display group. Instead, it's instantiated from an archive file, `Main.wo`, that's stored in the `Main.wo` component. You shouldn't edit `wo` files by hand; they're maintained by WebObjects Builder. The `wo` file archiving mechanism is described in more detail later in "Specifying a Sort Order" (page 86).

## Examining the Bindings

Now examine the bindings of your `Main` component in WebObjects Builder.

Everything within this gray box is in a form.

The gray "shadow" on this text field indicates that it's selected.

This is a repetition.

Everything within this gray box is in the repetition.

This gray box identifies another form.

This is a table with five rows and two columns.

This text field is in a table cell.

This is a WOImageButton.

Remember that you can use WebObjects Builder's Inspector to see the bindings for an element's attributes. Simply select the element to inspect, and click the  button to open the Inspector.

## Bindings in the Query Part

In the query part of the component, `movieDisplayGroup.queryMatch.title` is bound to the Title text field. There are similar bindings to the Category and Rating text fields. The `queryMatch` bindings allow users to specify search criteria to use when `movieDisplayGroup` next fetches movies. The Match button is bound to `movieDisplayGroup.qualifyDataSource`, which actually performs the fetch.

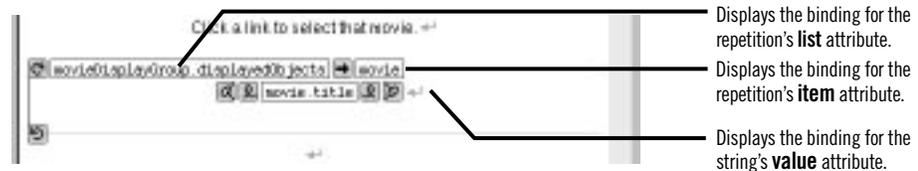
For example, to display only R-rated comedies, a user types “Comedy” in the Category text field, types “R” in the Rating text field, and clicks the Match button. `movieDisplayGroup` then refetches, selecting only movies whose `category` values are set to Comedy and whose `rating` values are set to R.



## Bindings in the Repetition Part

In the repetition part of the component where matching movies are listed, `movieDisplayGroup.displayedObjects` is bound to a repetition. More specifically, `displayedObjects` is bound to the repetition’s `list` attribute, providing a vector of movies for the repetition to iterate over.

The `movie` variable is bound to the repetition’s `item` attribute to hold each movie in turn, and `movie.title` is bound to the string element inside the repetition. These bindings produce a list of movie titles.



The repetition’s string element is enclosed in a hyperlink. By clicking a movie title, the user *selects* the corresponding movie.

1. Inspect the hyperlink.

Its **action** attribute is bound to the action method **selectObject**.



2. Look in the **Main.java** class to see how **selectObject** is implemented.

The method (shown below) simply sets **movieDisplayGroup**'s selected object to the movie the user clicked.

```
public void selectObject() {
    movieDisplayGroup.selectObject(movie);
}
```

### Bindings in the Editing Part

The text fields in the editing part are all bound to attributes of the **movieDisplayGroup**'s **selectedObject**—the movie on which the user clicked.

Typing new values into these fields updates the Movie enterprise object.

To actually save the updated values to the database, the user must click the “Save to database” button.



1. Inspect the middle image button.

Its **action** attribute is bound to the action method **saveChanges**.

2. Look in the **Main.java** class to see how **saveChanges** is implemented.

The method (shown below with comments omitted) simply saves any changes that have been made to **movieDisplayGroup**'s objects to the database.

```
public void saveChanges() throws Exception {
    try {
        this.session().defaultEditingContext().saveChanges();
    }
    catch (Exception exception) {
        System.err.println("Cannot save changes ");
        throw exception;
    }
}
```

**this.session()** returns a **Session** object that represents a connection to the application by a single user. A **Session** object provides access to an **EditingContext** object. The expression

```
this.session().defaultEditingContext().saveChanges();
```

sends a **saveChanges** message to the **Session**'s **defaultEditingContext**. This default **EditingContext** object manages graphs of objects fetched from the database, and all changes to the database are saved through it. For more information, see the **EditingContext** class specification in the *Enterprise Objects Framework Reference*.

An **EditingContext**'s **saveChanges** method uses other **Enterprise Objects Framework** objects to analyze its network of enterprise objects (**Movie** objects referenced by the application) for changes and then to perform a set of corresponding operations in the database. If an error occurs during this process, **saveChanges** throws an exception. **Main.java**'s **saveChanges** method simply raises the exception, having the effect of returning a diagnostic page. You could return an error page that explains the reason for the save failure instead, but the application in this tutorial uses the default behavior.

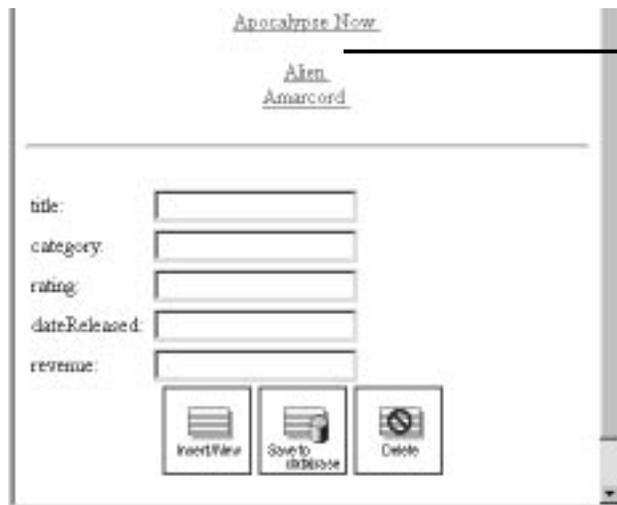
3. Inspect the first and third image buttons to see what their **action** attributes are bound to.

They are bound to **movieDisplayGroup.insert** and **movieDisplayGroup.delete**, respectively. The **DisplayGroup insert** method creates a new enterprise object, then inserts it into the display group's list of objects just past the current selection. The **DisplayGroup delete** method deletes the display

group’s selected object. These changes happen only in memory—not in the database. To actually insert a new row in the database (or delete a row), the user must click the “Save to database” button, invoking **saveChanges** on the session’s `EditingContext`. The editing context analyzes the enterprise objects in memory; determines if any objects have been added, updated, or deleted; and then executes database operations to sync the database with the application.

## Refining Main.wo

You may have noticed that your application doesn’t list fetched movies in any particular order. Also, when you insert a new movie, it appears in the list of movies as a blank line.



A newly inserted movie doesn’t have a title set, so it appears in the list of movies as a blank line.

In this section you’ll tidy up the user interface to fix these things and a few others. Specifically, you’ll:

- Configure **movieDisplayGroup** to sort the movies it displays.
- Assign default values to new `Movie` objects.
- Change the way that dates and numbers are displayed.

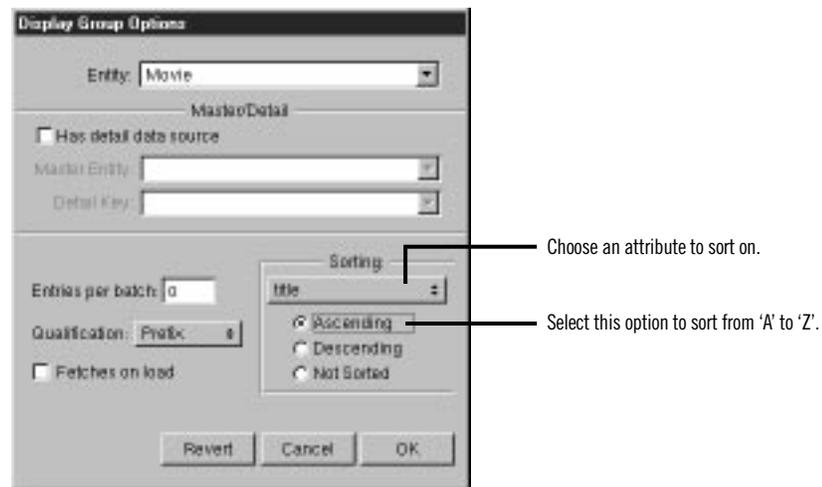
You can also put the query part of the page in a table and capitalize **Main.wo**’s text field labels—for example, use “Title” instead of “title” and “Date Released” instead of “dateReleased.”

## Specifying a Sort Order

You can change your application to sort movies alphabetically without writing any code. Display groups manage sorting behavior, and WebObjects Builder provides a Display Group Options panel for configuring this and other characteristics of display groups.

1. Double-click the `movieDisplayGroup` variable in the object browser.

The Display Group Options panel opens for configuring `movieDisplayGroup`.



2. Select the **title** attribute in the Sorting pop-up list.
3. Select Ascending.
4. Click OK.

WebObjects Builder stores your settings in an archive that specifies how to create and configure `movieDisplayGroup` at run time. The archive is stored inside your Main component in a file named `Main.woo`. You can't see the file from Project Builder because you're not meant to edit it directly, but WebObjects Builder's object browser shows you which of your component's variables are initialized from the archive (or `woo` file) so you don't have to view its contents directly.



An image in this column means that the variable can be initialized from the component's archive.

A  means that initialization parameters are already set. The variable is created and initialized from the archive as a part of the component's initialization.

A  means that no initialization parameters have been set, and so the variable isn't automatically created. Double-click the variable to configure it and add it to the archive.

## Specifying Default Values for New Enterprise Objects

When new enterprise objects are created in your application, it's common to assign default values to some of their properties. For example, in your Movies application it makes sense to assign a default value for the **title** attribute so a new movie won't be displayed in the list of movies as a blank line.

You could write an action method for the Insert/New button instead of binding it directly to the display group **insert** action method. In the custom action, you would create a new **Movie** object, assign default values to it, and then insert the new object into the display group. However, there are two additional ways to specify default values for new enterprise objects, without making explicit assignments:

- Assign default values in the enterprise object class.
- Specify default values using a display group.

For a particular situation, one of the approaches is usually better than the other. If the default values are intrinsic to the enterprise object, assign them in the enterprise object class. For example, consider a **Member** class with a **memberSince** property. It's likely that you would automatically assign the current date to **memberSince** instead of forcing a user to supply a value. You'll see how to use this technique in “Adding Behavior to Your Enterprise Objects” (page 117).

On the other hand, if the default values are specific to an application or to a particular user interface, explicitly initialize the object in code or specify the default values using a display group. In the Movies application, the need for default values is motivated by Main's user interface: you need to provide a default value so users can tell when a newly inserted record is selected. In another situation, you might not want a new movie to have a default title; you might instead want a new movie's title to be blank.

The Movies application specifies default values for newly created Movie objects using the display group, `movieDisplayGroup`.

1. Open `Main.java` in Project Builder.
2. Add the following constructor:

```
public Main() {  
    super();  
    MutableHashtable defaultValues = new MutableHashtable();  
    defaultValues.put("title", "New Movie Title");  
    movieDisplayGroup.setInsertedObjectDefaultValues(defaultValues);  
}
```

This method assigns the value “New Movie Title” as the default value for a new movie’s `title` attribute. When `movieDisplayGroup` inserts a new movie (as it does when a user clicks the Insert button), it creates a new movie and assigns this default value to that movie.

## Setting a Date Format

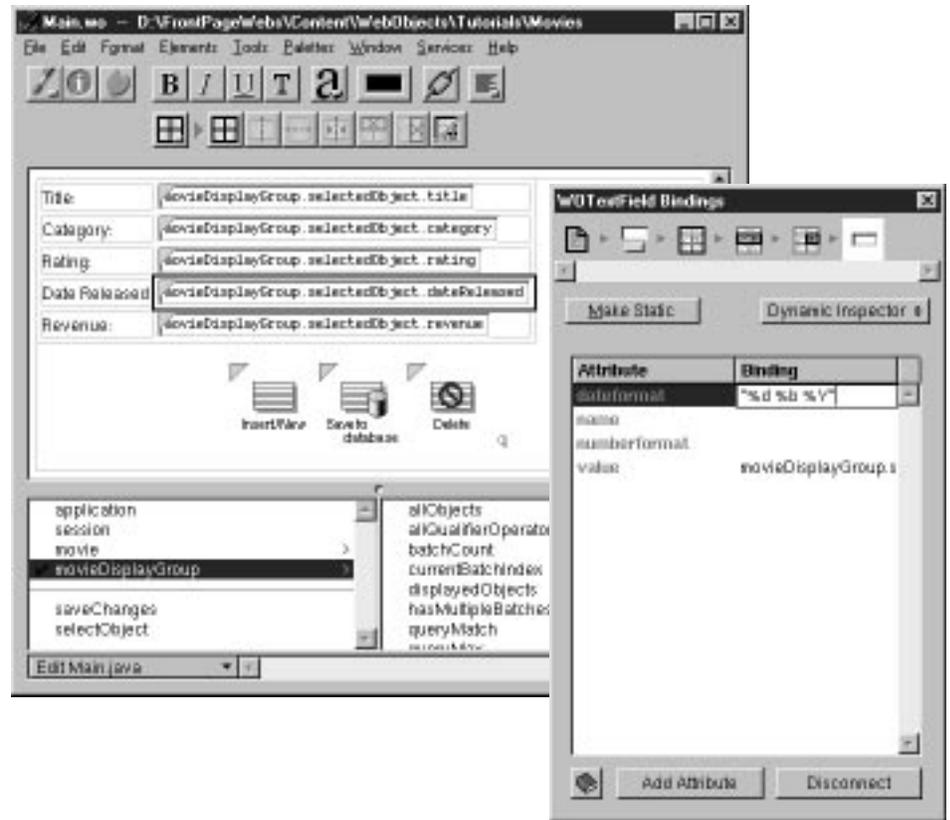
To change the way that dates are displayed, you assign a date format to the element that displays the dates.

1. Inspect the `dateReleased` text field, which is near the bottom of the Main component window.

Notice that the text field has a `dateformat` attribute that is bound to the string “%m/%d/%y”. This binding tells the text field that it’s displaying dates and describes how to format them. The `%m` conversion specifier stands for month as a decimal number, `%d` stands for day of the month, and `%y` stands for year without century.

2. Change the `dateformat` value to the string (including the quotes) “%d %b %Y”.

This date format displays dates such as 3 Sep 1997. The `%b` conversion specifier stands for abbreviated month name, and `%Y` stands for year with century. You can create your own date formats with any of the conversion specifiers defined for dates. For more information, see the `CalendarDate` class specification in the *Foundation Framework Reference*.



## Setting a Number Format

In addition to a `dateformat` attribute, text field elements also have a `numberformat` attribute.

1. Inspect the `revenue` text field.

The `revenue` text field's `numberformat` attribute is bound to the string `"###.##"`. This binding tells the text field that it's displaying a number and describes how to format it.

2. Change the text field's `numberformat` binding value to the string (including the quotes): `"$ #,##0.00"`.

Using this number format, the Movies application formats the number 1750000 as \$ 1,750,000. For more information on creating number formats, see the `NumberFormatter` class specification in the *Foundation Framework Reference*.

## Optional Exercise

You can tidy up the user interface even further by putting the query part of the page in a table to match the editing part of the page. Also, you should consider capitalizing **Main.wo**'s text field labels.

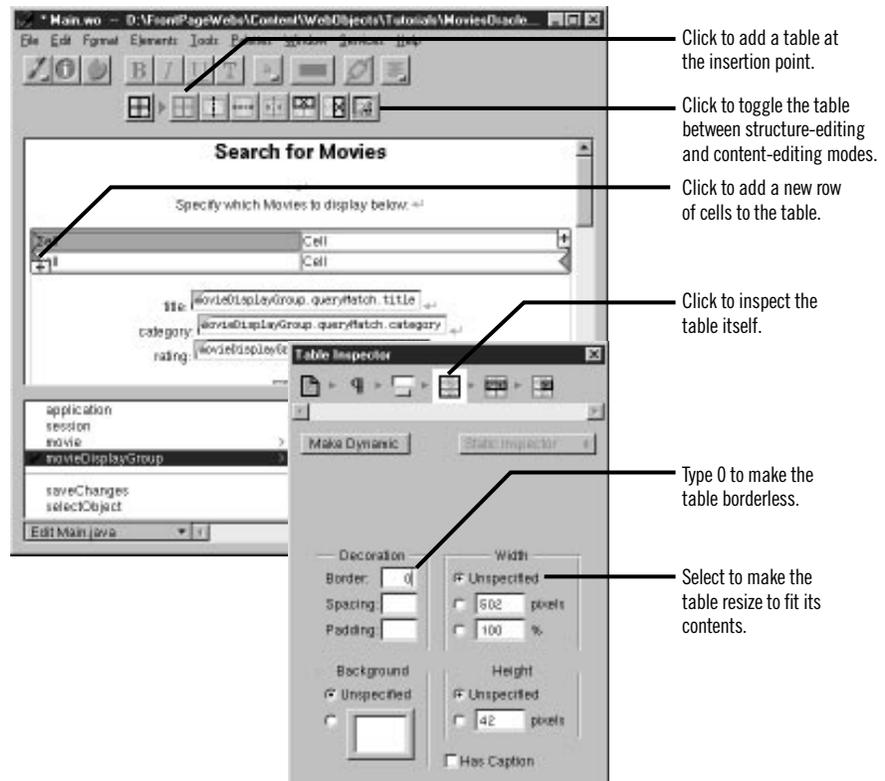
To put the query part of the page in a table, follow these steps:

1. Put the cursor inside the form element before the “title” text field.
2. In the Tables toolbar, click the  button to add a table.

A table with two rows and two columns appears. Initially the table spans the entire width of the page. You'll resize it later.

When the table is first added, it's in structure-editing mode. You can tell it's in structure-editing mode because it has  buttons for adding rows and columns and because it has  and  icons around each of the table's rows.

3. Inspect the new table.



- In the Table Inspector, choose Unspecified for the table width.

The table resizes to just fit its contents. When you change the cell contents later, the table will resize again to accommodate the new values.

- Also in the Table Inspector, set the border to 0 to remove the appearance of a border.
- Click the  button in the lower left of the table to add a new row to the table.
- Type the labels `Title:`, `Category:`, and `Rating:` in the cells in the first column.

Recall that to put the table into content-editing mode, click the  button or double-click in one of the table's cells.

The table doesn't resize to accommodate new cell content until you're done typing; that is, until you move the cursor out of the edited cell.

- Cut and paste the query text fields into their corresponding table cells.

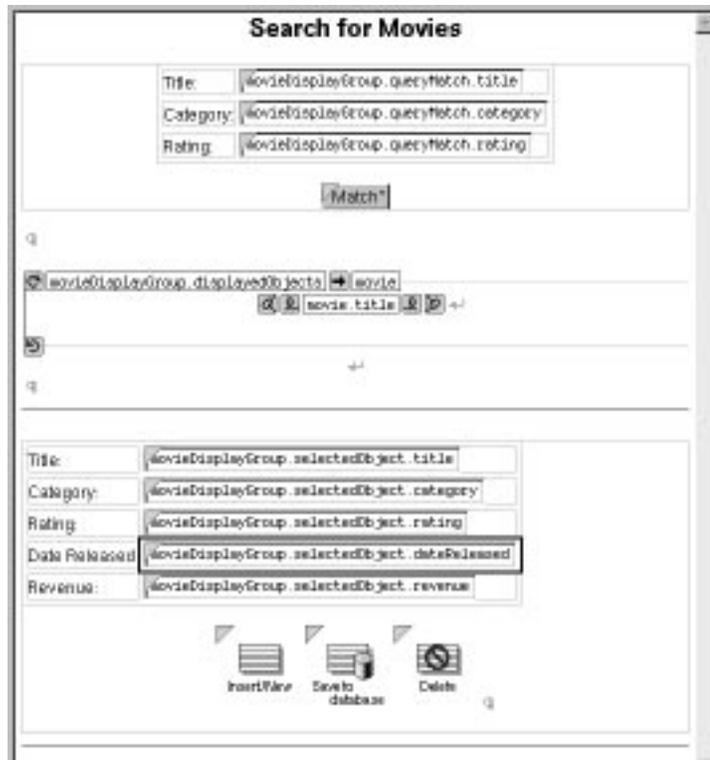
Just click on a text field to select it. When a text field is selected, it displays with a gray "shadow."

- Delete the old query field labels.

When you're done, the query part should look like this:



Now edit the text labels in the editing part of the page and put any other finishing touches on the page that you want. The finished component might look something like this:



## Adding the MovieDetails Page

The MovieDetails page shows you the detailed information about a movie you select in the Main page. For this to work, the Main page has to tell the MovieDetails page which movie the user selected. The MovieDetails page keeps track of the selected movie in its own instance variable. In this section, you'll:

- Create a new component whose interface you'll create yourself.
- Assign Main's selected movie to a variable in the MovieDetails page.
- Create a way to navigate from Main to MovieDetails and back.

In the sections following this one, you'll extend the MovieDetails page to display movie roles and the starring actors.

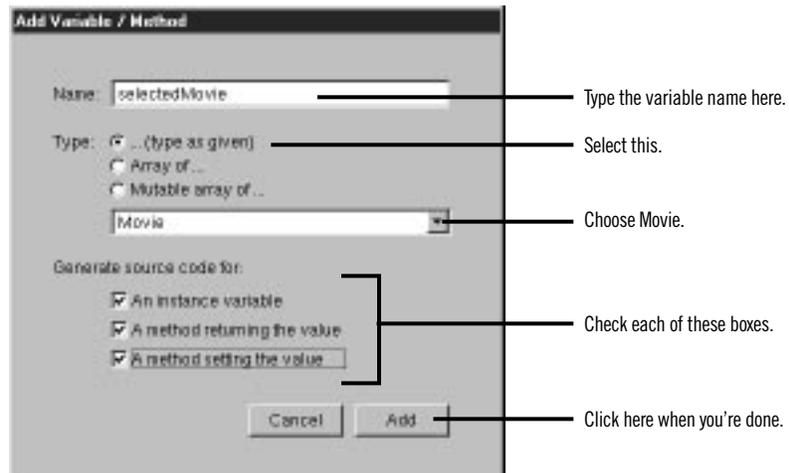
## Creating the MovieDetails Component

1. In Project Builder, choose File ► New in Project.
2. In the New File panel, click the Web Components suitcase.
3. Type `MovieDetails` in the Name field.
4. Click OK.
5. In the wizard panel, choose None from the available assistance.
6. Choose Java as the component language.
7. Click Finish.
8. Open the new component in WebObjects Builder.

## Storing the Selected Movie

Now, in the `MovieDetails` component, create a variable that holds the application's selected movie. Later on, you'll add code to the `Main.java` class that assigns `Main`'s selected movie to this variable.

1. Choose Add Variable/Method from the pull-down menu.



2. Name the variable `selectedMovie`.
3. Set the variable's type to `Movie`.

Movie isn't actually a class; it's an entity. It's listed in the combo box as a type along with entries for all the entities in your model. When you choose an entity as the type for your variable, WebObjects Builder recognizes that the variable is an enterprise object. Using information in the model, WebObjects Builder can determine the entity's corresponding enterprise object class and the properties of that class.

4. Check the "An instance variable" box.
5. Check the "A method returning the value" box.
6. Check the "A method setting the value" box.
7. Click Add.

### Navigating from Main to MovieDetails

To get to the MovieDetails page from the Main page, users use a hyperlink. Clicking the hyperlink should set MovieDetail's `selectedMovie` variable and then open the MovieDetails page.

1. Add a hyperlink at the bottom of the Main component.
2. Replace the text "Hyperlink" with "Movie Details."



3. Choose Add Action from the pull-down menu.
4. In the Add Action panel, type `showDetails` in the Name field.
5. Type `MovieDetails` in the "Page returned" field.
6. Click Add.
7. Bind the `showDetails` action to the hyperlink's `action` attribute.

- In Project Builder, modify the `showDetails` action to look like the following:

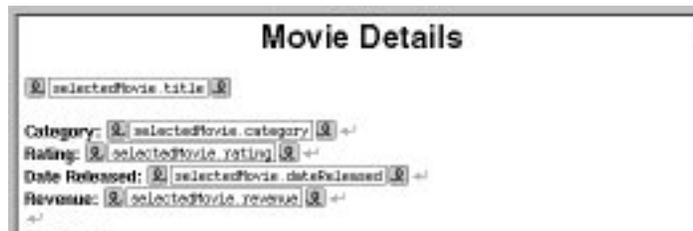
```
public Component showDetails()
{
    MovieDetails nextPage =
        (MovieDetails)application().pageWithName("MovieDetails");
    EnterpriseObject selection =
        (EnterpriseObject)movieDisplayGroup.selectedObject();

    nextPage.setSelectedMovie(selection);
    return nextPage;
}
```

This method creates the `MovieDetails` page and then invokes its `setSelectedMovie` method with the movie that's selected in the Main page. The display group method `selectedObject` returns its selected object, which, in the Main component, is set when a user clicks a movie title hyperlink.

## Designing MovieDetails' User Interface

Now lay out the user interface for `MovieDetails`. When you're done, your component should look like the following:



- Create a top-level heading with the text `Movie Details`.

Recall that to create a top-level heading, you type the text of the heading, select the text, click the  button to add a heading element around the text, and then use the Inspector to set the heading's level, as you did in "Using the Inspector" (page 22).

- Below the heading, add a string element.
- With the string element selected, add a heading.

This adds a new level 3 heading element around the string. The MovieDetails page will show the title of the selected movie in this heading.

4. Add labels and string elements to display the selected movie's category, rating, date released, and revenue.
5. Bold the labels.
6. Bind `selectedMovie.title` to the `value` attribute of the first string element (the one in the heading).
7. Similarly, create bindings for the Category, Rating, Date Released, and Revenue strings.
8. At the bottom of the page, add a horizontal rule.

### Adding Date and Number Formats

String elements have `dateformat` and `numberformat` attributes just like text field elements. Create bindings for the Date Released and Revenue strings so that `dateReleased` and `revenue` values are displayed the way they are in the Main page.

1. Add the date format "%d %b %Y" to the Date Released string.
2. Add the number format "\$ #,##0.00" to the Revenue string.

### Navigating from MovieDetails to Main

Now add a hyperlink to the MovieDetails page so users can navigate back to the Main page from MovieDetails.

1. Add a hyperlink to the bottom of the page.
2. Label it `MovieSearch`.



3. Bind the hyperlink's `pageName` attribute to the text (including the quotes) "Main".

Recall that the `pageName` attribute is a mechanism for navigating to another page without writing code. By setting the attribute to "Main", you're

telling the application to open the MovieSearch page when the hyperlink is clicked.

## Running Movies

Be sure that all your project's files are saved (including the components in WebObjects Builder), and build and run your application. In the Main page, select a movie and click the Movie Details link. The MovieDetails page should display all the movie's information.

## Refining Your Model

The model created for you by the wizard is just a starting point. For most applications, you need to do some additional work to your model to make it useful in your application. To refine your model so that it can be used in the Movies application, you'll ultimately need to do all of the following:

- Remove primary and foreign keys as class properties.
- Add relationships to your model if the wizard didn't have enough information to add them for you.
- Configure your model's relationships in the Advanced Relationship Inspector.
- Generate source files for the Talent class.

These steps are described in more detail throughout the rest of this tutorial.

## Opening Your Model

1. In Project Builder, click the Resources category.
2. Select **Movies.eomodeld**.
3. Double-click the model icon.



Project Builder opens your model file in EOModeler, launching EOModeler first if it isn't already running. EOModeler displays your model in the Model Editor. It lists the entities for the tables you specified in the wizard—Movie, MovieRole, and Talent.



## Removing Primary and Foreign Keys as Class Properties

By default, EOModeler makes all of an entity's attributes *class properties*. When an attribute is a class property, it means that the property is a part of your enterprise object, usually as an instance variable.

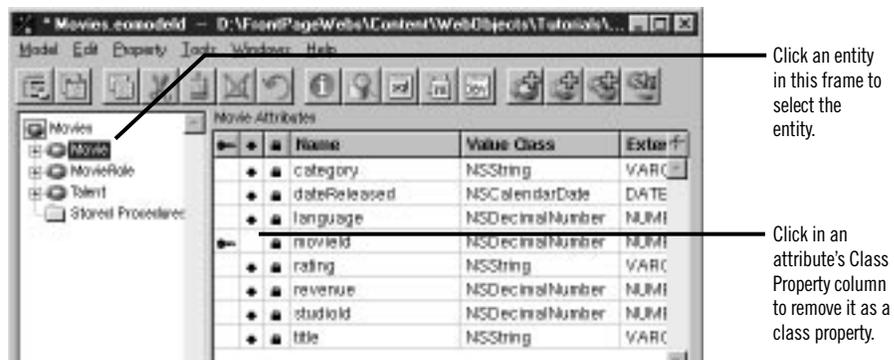
You should mark as class properties only those attributes whose values are meaningful in the objects that are created when you fetch from the database. Attributes that are essentially database artifacts, such as primary and foreign keys, shouldn't be marked as class properties unless the key has meaning to the user and must be displayed in the user interface.

Eliminating primary and foreign keys as class properties has no adverse effect on how Enterprise Objects Framework manages enterprise objects in your application.

1. In the left frame (or *tree view*), click the Movie entity.

The right frame switches from a view of the entities in the model to a view of Movie's attributes.

2. Click in the Class Property column to remove the  symbol for the **movieid** attribute.
3. Now repeat the previous step to remove **studioid** as a class property.



- In the MovieRole entity, remove `movieId` and `talentId` as class properties.
- In the Talent entity, remove `talentId` as a class property.

## Adding Relationships to Your Model

The Movies application uses two pairs of inverse relationships. The first pair defines the relationship between the Movie and MovieRole entities, while the second pair defines the relationship between the MovieRole and Talent entities. An Enterprise Objects Framework relationship is *directed*; that is, a relationship has a source and a destination. Generally models define a relationship for each direction.

- Select the Movie entity.

The right frame of the Model Editor shows the Movie's relationships as well as its attributes.



Your model's Movie entity might have a different name than the `movieRoles` relationship shown above. That's because the wizard created

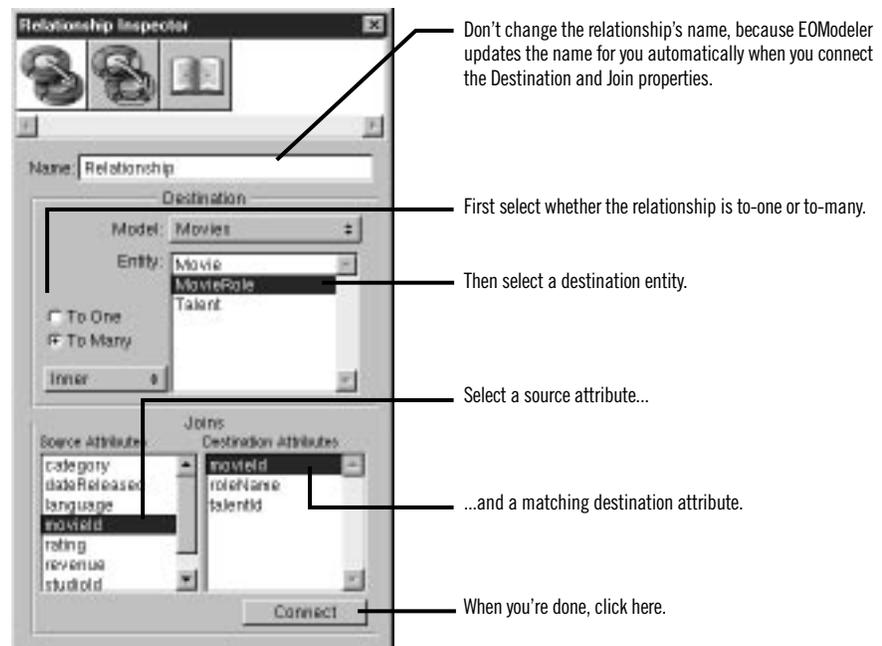
your relationship, and the relationship's name is dependent on the adaptor the wizard used. Adaptors don't all have the same naming convention for to-many relationships. For example, the Oracle adaptor names Movie's relationship **movieRoleArray** instead of **movieRoles**.

If your Movie entity doesn't have a **movieRoles** relationship, it means that the database server's schema information for your database didn't have enough information for the wizard to create them. You need to create them by hand now. The next several steps explain how.

2. Choose Property ► Add Relationship.

A new relationship named "Relationship" is added in the table view at the bottom of the Model Editor. The new relationship is already selected.

3. With the relationship selected in the right frame of the Model Editor, click the  button (in the toolbar) to inspect the relationship.



4. In the Inspector, select the To Many option.
5. Select MovieRole as the destination entity.
6. Select **movieId** in the Source Attributes list.
7. Select **movieId** in the Destination Attributes list.

## 8. Click Connect.

EOModeler automatically renames the relationship based on the name of the destination entity. For example, after connecting a to-many relationship from Movie to MovieRole, EOModeler names the relationship “movieRoles.” To-one relationships are named with the singular form of the destination entity’s name. For example, EOModeler names the inverse to-one relationship (from MovieRole to Movie) “movie.”

If the wizard created your relationship and used a name other than “movieRoles,” consider renaming the relationship. The rest of this tutorial assumes that your relationships are named using EOModeler’s naming convention.

## 9. Repeat the steps above to create the following relationships:

A to-one relationship named “movie” in the MovieRole entity where:

- The destination entity is Movie.
- The source attribute is **movieId**.
- The destination attribute is **movieId**.

A to-one relationship named “talent” in the MovieRole entity where:

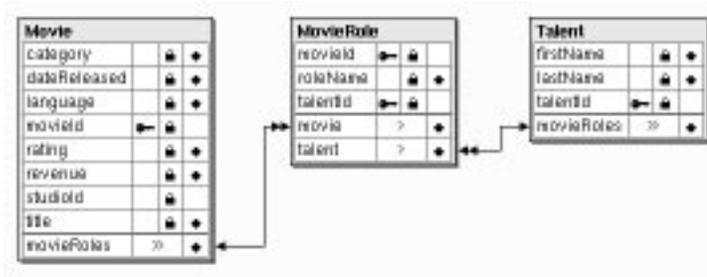
- The destination entity is Talent.
- The source attribute is **talentId**.
- The destination attribute is **talentId**.

A to-many relationship named “movieRoles” in the Talent entity where:

- The destination entity is MovieRole.
- The source attribute is **talentId**.
- The destination attribute is **talentId**.

10. Choose  in the toolbar pop-up list to switch the Model Editor to Diagram View.

At this point your model has all the relationships it needs. The Diagram View gives you an overview of the entities in the model and their relationships to other entities.

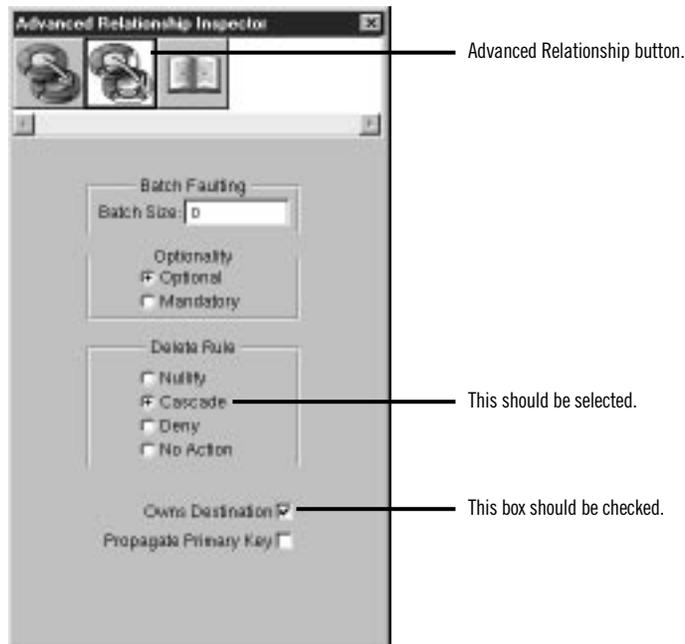


You can also use the Diagram View to edit your model. Double-click an attribute or relationship to change its name. To create a relationship and its inverse, Control-drag from the relationship's source attribute to its destination attribute.

## Using the Advanced Relationship Inspector

There are several additional settings you use to configure a relationship's referential integrity rules. For these, use the Advanced Relationship Inspector.

1. Inspect Movie's **movieRoles** relationship.
2. In the Inspector, click the Advanced Relationship button.



3. Ensure that the delete rule is set to Cascade.

If the wizard created relationships for you, the relationship's delete rule should already be set to Cascade. You specified this in the wizard. If you created your relationships by hand, you'll have to set the delete rule yourself.

4. Ensure that the Owns Destination box is checked.

As with the delete rule, if the wizard created relationships for you, the relationship's Owns Destination box should already be checked. If you created your relationships by hand, you'll have to check this box yourself.

5. Check the Propagate Primary Key box.

A relationship that propagates its primary key *propagates* its key value to newly inserted objects in the destination of the relationship. In this case, checking the Propagate Primary Key box means that if you create a new `MovieRole` and add it to a `Movie`'s list of `MovieRoles`, the `Movie` object automatically assigns its `movieId` value as the value for the new `MovieRole`'s `movieId` property.

This option is usually used with relationships that own their destination. For more information on propagates primary keys, see "Where Do Primary Keys Come From?" (page 103).

6. Ensure that Talent's `movieRoles` relationship has its delete rule set to Deny.
7. Ensure that Talent's `movieRoles` relationship owns its destination.
8. Set Talent's `movieRoles` relationship to propagate its primary key.

## Where Do Primary Keys Come From?

Enterprise Objects Framework uses primary keys to identify enterprise objects in memory, and it works best if you never change an enterprise object's primary key from its initial value. Consequently, applications usually generate and assign primary key values automatically instead of having users provide them. For example, the `Movies` application assigns a `movieId` value to a new movie when it's created, and the value never changes afterward. The `Movies` interface doesn't even display `movieId` values because they aren't meaningful to users of the application.

Enterprise Objects Framework provides several mechanisms for generating and assigning unique values to primary key attributes. By default, Enterprise Objects Framework uses a native database mechanism to assign primary key values. See the chapter “Answers to Common Design Questions” in the *Enterprise Objects Framework Developer’s Guide* for more information.

The Movies application generates primary key values for Movie and Talent objects using the default mechanism, but MovieRole is a special case because:

- MovieRole’s primary key is compound. The default behavior of generating a primary key value using a native database mechanism works only on simple (not compound) primary keys.
- A MovieRole’s primary key attributes, **movieId** and **talentId**, must match the corresponding attributes in the MovieRole’s Movie and Talent objects. The default mechanism generates new, unique values.

Instead of the default mechanism, Enterprise Objects Framework uses primary key propagation to assign primary keys to MovieRole objects. By configuring the Movie’s **movieRoles** relationship to propagate primary key, the Framework knows to assign a new MovieRole’s **movieId** to the same value as the **movieId** of the MovieRole’s Movie. Similarly, a new MovieRole’s **talentId** is set to the same value as the **talentId** of the MovieRole’s Talent.

## Setting Up a Master-Detail Configuration

So far your Movies application fetches, inserts, updates, and deletes only Movie objects. Considered alone, a Movie object isn’t as interesting as it is when it’s related to actors and roles. In this section, you’ll add MovieRole and Talent objects to the Movies application.

The relationships defined in your model now come into play. Using Movie’s **movieRoles** relationship, you can display the MovieRoles for the selected Movie. In this type of configuration, called *master-detail*, a master display group holds enterprise objects for the source of a relationship, while a detail display group holds records for the destination. As individual records are selected in the master display group, the detail display group gets a new set of enterprise objects to correspond to the selection in the master.

In the Movies application, the master-detail configuration is built around Movie's **movieRoles** relationship. The configuration is split across two pages in the application. The master, **movieDisplayGroup**, is in the Main component, while the detail is in MovieDetails.

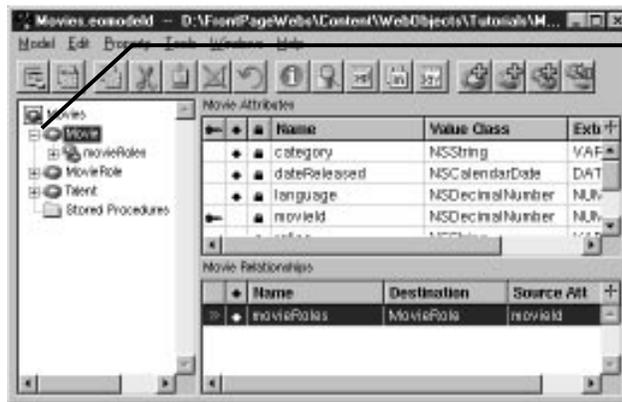
In this section, you'll:

- Create and configure the detail display group.
- Extend the MovieDetails user interface to hold MovieRole and Talent information.

## Creating a Detail Display Group

You can create a detail display group several different ways. You can write a declaration for it in Project Builder, or you can use WebObjects Builder's Add Variable/Method command. But the easiest way to create a detail display group is by dragging a relationship from EOModeler into your component, as described below.

1. In EOModeler's tree view, expand the Movie entity.



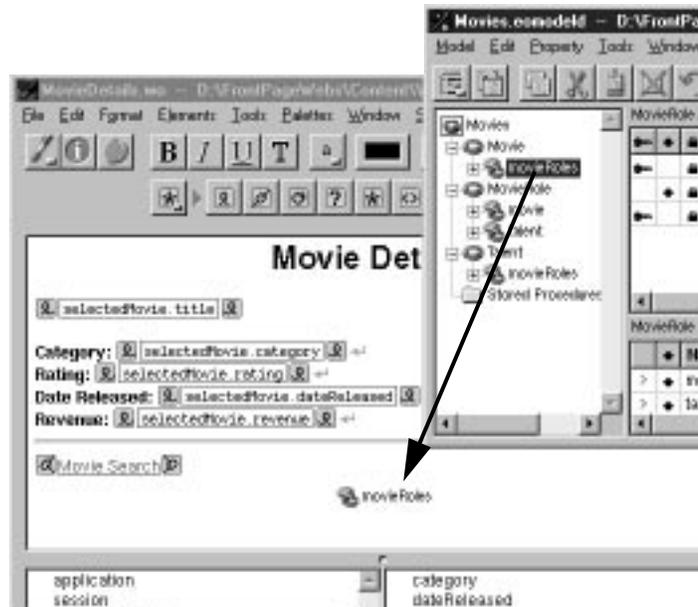
Click here to expand or contract an entity.

 means that the entity is already expanded. Click the dash to contract the entity.

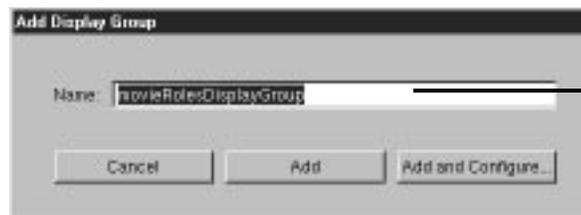
 means that the entity can be expanded to display its relationships. Click the plus to expand the entity.

If an entity has neither a dash nor a plus, the entity has no relationships, and therefore can't be expanded.

2. Drag the Movie's **movieRoles** relationship from the tree view into the MovieDetails component's object browser.



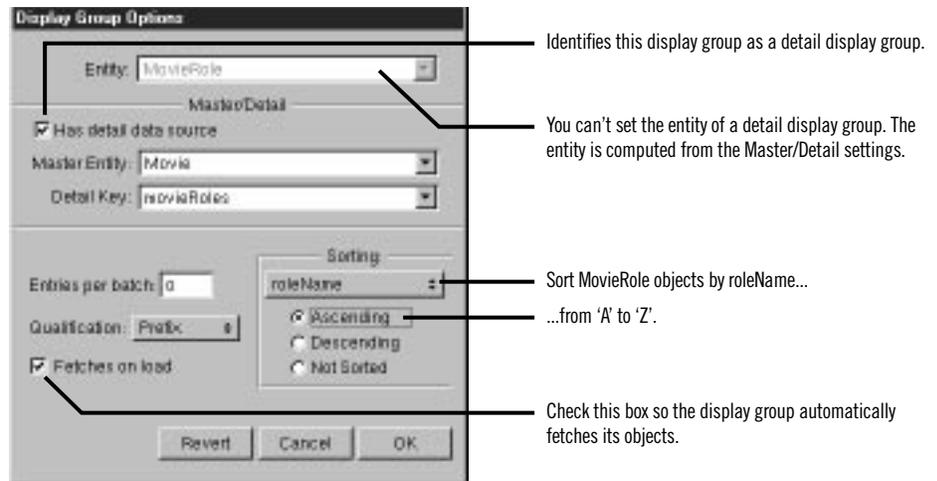
An Add Display Group panel opens.



WebObjects Builder assigns a default name based on the relationship name.

3. In the Add Display Group panel, change the name to `movieRoleDisplayGroup` (remove the “s” from “Roles”).
4. Click Add and Configure.

The Display Group Options panel opens so you can immediately configure the newly created display group.



Notice that the “Has detail data source” box is checked. This means that `movieRoleDisplayGroup` gets its objects from a `DetailDataSource` object.

All display groups use some kind of *data source* to fetch their objects. A data source is an object that exists primarily as a simple means for a `DisplayGroup` to access a store of objects. It’s through a data source that a display group fetches, inserts, updates, and deletes database records.

A `DetailDataSource` is a subclass of `DataSource` that’s intended for use in master-detail configurations. A detail data source keeps track of a *master object* and a *detail key*. The master object is typically the selected object in a master display group, but a master display group isn’t strictly required. The detail key is the name of the relationship on which the master-detail configuration is based. When a detail display group asks its data source to fetch, the `DetailDataSource` simply gets the destination objects from the master object as follows:

```
detailObjects = masterObject.valueForKey(detailKey);
```

In your master-detail configuration, the master object is the selected `Movie`, and the detail key is `movieRoles`. When `movieRoleDisplayGroup` asks its data source for its `MovieRole` objects, the detail `DisplayGroup` returns the objects in the selected `Movie`’s `movieRoles` vector of `MovieRoles`. Similarly, when `MovieRole` objects are inserted or deleted in `movieRoleDisplayGroup`, they are added and removed from the master object’s `movieRoles` vector.

5. Set the display group to sort alphabetically by `roleName`.

6. Check the “Fetches on load” box.

When “Fetches on load” is selected, the display group fetches its objects as soon as the component is loaded into the application. You want this feature in the MovieDetails page so that users are immediately presented with the selected movie’s roles. In contrast, the Main page does not fetch on load; it shouldn’t present a list of movies until the user has entered search criteria and clicked Match.

7. Click OK.
8. In Project Builder, modify MovieDetail’s `setSelectedMovie` method to look like the following:

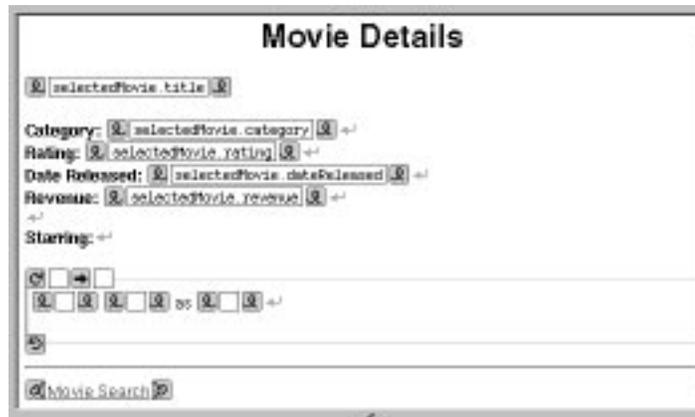
```
public void setSelectedMovie(EnterpriseObject newSelectedMovie) {
    selectedMovie = newSelectedMovie;

    // Add this line.
    movieRoleDisplayGroup.setMasterObject(newSelectedMovie);
}
```

With this addition, whenever a user navigates to the MovieDetails page, `setSelectedMovie` updates the `movieRoleDisplayGroup`’s master object so it displays the corresponding MovieRole objects.

## Adding a Repetition

Now you’ll extend the user interface of the MovieDetails component to display the actors in the selected movie. Because different movies have different numbers of roles, you need the dynamism of a repetition element. When you’re done adding the repetition, your component should look like this:



1. In the MovieDetails component window, add the bolded text **Starring:** beneath the Revenue line.
2. Below the Starring label, add a repetition.
3. Replace the “Repetition” text with three string elements.

The strings should all be on the same line, so don't type carriage returns between them.

4. Type a space between the first two strings and the word “ as ” (with a space before and after) between the last two.
5. Add a carriage return after the last string.

### **Configuring a Repetition**

Now configure MovieDetails' repetition in a way similar to the way Main's repetition is configured. First you need to create a new variable to bind to the repetition's **item** attribute.

1. Use the Add Variable/Method command to add a new variable, **movieRole**, whose type is set to the MovieRole entity.

Don't create set and get methods for **movieRole**. You won't need accessor methods because the variable is used only within the MovieDetails component and shouldn't be visible to any other classes.

2. Bind **movieRoleDisplayGroup.displayedObjects** to the repetition's **list** attribute.
3. Bind **movieRole** to the repetition's **item** attribute.
4. Bind **movieRole.talent.firstName** to the **value** attribute of the first string in the repetition.
5. Bind **movieRole.talent.lastName** to the **value** attribute of the second string.
6. Bind **movieRole.roleName** to the **value** attribute of the last string.

When you're done, the repetition bindings should look like the following:



## Running Movies

Be sure that all your project's files are saved (including the components in WebObjects Builder and the model in EOModeler), and build and run your application. In the Main page, select a movie and click the Movie Details link. Now, in addition to displaying all the movie's information, the Movie Details page should also display the movie's roles and actors.

## Updating Objects in the Detail Display Group

In this section, you'll add the ability to insert, update, and delete movie roles. The MovieDetails page will then look something like this:

**Movie Details**

**After Hours**

Category: Comedy  
 Rating: R  
 Date Released: 23 Sep 1985  
 Revenue: \$ 2,300,000.00

**Starring:**  
 Teri Garr as Julie  
 Linda Fiorentino as Kiki  
 Rosanna Arquette as Marcy

Anémone  
 Miu-Miu  
 Vampire  
 Kareem Abdul-Jabbar  
 Isabelle Adjani

Role Name: Julie

Insert New   Save to Database   Delete

Movie Search

Click a role to select it and display its information in the editing part below.

Use the browser to choose an actor for the selected role.

Edit the name of the selected role.

Click here to create a new, empty role.

Click here to delete the selected role.

Click here to save your work in the database (add the new roles you inserted, remove the roles you deleted, and save changes you made to existing roles).

Many of the features in this page are similar to features in the Main page, but in this section you perform by hand the tasks the wizard performed for you to create Main. Already you've learned how to create a DisplayGroup variable and how to bind it to dynamic elements. In this section you'll:

- Write code to update a display group's selected object.
- Create and configure a browser.
- Create a custom enterprise object class.
- Configure image buttons to insert, update, and delete using display group actions.

## Managing a DisplayGroup's Selection

Remember how clicking a movie title in the Main page selects the corresponding `Movie` object in `movieDisplayGroup`. `MovieDetails` has a similar behavior for selecting a `MovieRole` object in `movieRoleDisplayGroup`.

First you need to add a hyperlink element around the repetition's role name string so that users can select a particular `MovieRole`. When a user clicks one of the movie role hyperlinks, the application should select the corresponding `MovieRole` object in the `movieRoleDisplayGroup`.

1. Select the repetition's role name string element.
2. Click the Add WOHyperlink button in the Other WebObjects toolbar to add a hyperlink element around the string.

Now you need to create an action method to invoke when the hyperlink is clicked.

3. Use the Add Action command in the pull-down menu to add an action named `selectObject`, returning `null`.

Before you write the body of the `selectObject` method, bind it to the hyperlink while you're still in WebObjects Builder.

4. Bind the `selectObject` method to the hyperlink's `action` attribute.

Now write the code for `selectObject` in `MovieDetail.java`.

5. Modify the `selectObject` action to look like the following:

```
public Component selectObject()
{
    movieRoleDisplayGroup.selectObject(movieRole);
    return null;
}
```

## Adding a Form

Now lay out the user interface used to view and edit the selected `MovieRole`. When you're done, it should look like the following:



1. Add another horizontal rule after the repetition.
2. Use the  button (in the “Dynamic form elements” toolbar) to add a browser element between the two horizontal rules.  
A form element is automatically created around the browser.
3. Beneath the browser, type the bolded text **Role Name** :
4. Add a text field.
5. Bind the text field to `movieRoleDisplayGroup.selectedObject.roleName`.

## Adding a Talent Display Group

The browser you just created is going to display a list of Talent objects. Like a repetition element, a browser has `list` and `item` attributes. As the browser moves through its `list`, the browser sets `item` to the object at the current index. The Movies application uses a display group to provide the browser with a list of Talent objects, so now you need to create the new display group and a variable to bind to the browser's `item` attribute.

1. Use the Add Variable/Method command to create two new instance variables:
  - `talentDisplayGroup`, whose type is `DisplayGroup`
  - `talent`, whose type is `Talent`

You don't need to add set and get methods for the variables.

- Using the Display Group Options panel, assign `talentDisplayGroup`'s entity to Talent.

Remember that to open the Display Group Options panel, simply double-click the `talentDisplayGroup` variable in the object browser. The  icon initially displayed next to the variable indicates that initialization parameters have not yet been set.

- Configure `talentDisplayGroup` to sort its objects alphabetically (ascending) by `lastName`.
- Configure it to fetch on load.

After you configure `talentDisplayGroup`, the object browser shows a  icon next to the variable.

The Movies application uses a display group to provide Talent objects, but you could fetch the Talent objects from the database without one. Display groups provide a simple way to fetch, insert, update, and delete enterprise objects without writing much, if any, code. To get finer-grained control over these operations, you can work directly with an `EditingContext` object. An editing context can do everything a display group does and much more, but you have to write more code to use one. For more information, see the `EditingContext` class specification in the *Enterprise Objects Framework Reference*.

## Configuring the Browser

In a way similar to the way you create bindings for a repetition, create your browser's bindings.

- Bind `talentDisplayGroup.displayedObjects` to the browser's `list` attribute.
- Bind `talent` to the browser's `item` attribute.
- Bind `talent.lastName` to the browser's `value` attribute.

The `value` attribute tells the browser what string to display. For each `item` in its `list`, the browser evaluates the `item`'s `value`.

The browser in the `MovieDetails` page should display the actors' full names, but there isn't an attribute for full name. In the next section, you'll create a custom Talent class that implements a `fullName` method, but for now just use `talent.lastName` as the `value` attribute.

A browser also has a `selections` attribute that should be bound to a vector of objects. A browser's selection can be zero, one, or many objects; but in the

Talent browser, the selection should refer to a single object. Consequently, you need to add two methods to manage the browser's selection: one to return a vector containing the selected Talent and one to set the selected Talent from a vector object.

4. Add the method **talentSelection** to the **MovieDetails.java** class as follows:

```
public ImmutableVector talentSelection () {
    EnterpriseObject aTalent;
    EnterpriseObject aMovieRole =
        (EnterpriseObject)movieRoleDisplayGroup.selectedObject();

    if (aMovieRole == null) {
        return null;
    }

    aTalent = (EnterpriseObject)aMovieRole.valueForKey("talent");
    if (aTalent == null) {
        return null;
    } else {
        EnterpriseObject talentArray[] = {aTalent};
        return new ImmutableVector(talentArray);
    }
}
```

Because the browser expects a vector for its **selections** attribute, this method packages the selected MovieRole's **talent** object in a vector. If the selected MovieRole object is **null**, **talentSelection** simply returns **null** to indicate that the browser shouldn't set a selection.

5. Add the method **setTalentSelection** as follows:

```
public void setTalentSelection(ImmutableVector talentVector) {
    if (talentVector.size() > 0) {
        EnterpriseObject aMovieRole =
            (EnterpriseObject)movieRoleDisplayGroup.selectedObject();
        EnterpriseObject selectedTalent =
            (EnterpriseObject)talentVector.firstElement();

        aMovieRole.addObjectToBothSidesOfRelationshipWithKey(
            selectedTalent,
            "talent"
        );
    }
}
```

Again because the browser uses a vector for its **selections** attribute, the **setTalentSelection** method must take a vector as its argument. If **talentVector**'s size is nonzero, then this method sets the selected **MovieRole**'s **talent** to the first object in the vector. Note that by default, a user can't select more than one actor in a browser.

With the addition of these methods, WebObjects Builder now displays **talentSelection** in **MovieDetail**'s object browser.

6. Bind **talentSelection** to the browser's **selections** attribute.

## Adding Insert, Save, and Delete Buttons

Now add the buttons that let users insert, save, and delete **MovieRoles**. When you're done, it should look like the following:



1. Inside the form, add three image buttons below the **Role Name** text field.
2. Inspect the first active image element.
3. Bind the **filename** attribute to the text (including the quotes) `"DBWizardInsert.gif"`.
4. Follow the same procedure to set the second image's **filename** attribute to the text (including the quotes) `"DBWizardUpdate.gif"`.
5. Set the last image's **filename** attribute to the text (including the quotes) `"DBWizardDelete.gif"`.

The **DisplayGroup** class defines the actions **insert** and **delete** that you'll bind to the **Insert/New** and **Delete** buttons. It doesn't, however, provide a **save** method. You'll have to provide that yourself.

- Copy the `saveChanges` method from the `Main.java` class and paste it into the `MovieDetails.java` class:

```
public void saveChanges() throws Exception {
    try {
        this.session().defaultEditingContext().saveChanges();
    }
    catch (Exception exception) {
        System.err.println("Cannot save changes ");
        throw exception;
    }
}
```

- Bind `movieRoleDisplayGroup.insert` to the Insert/New image's `action` attribute.
- Bind the `saveChanges` method to the "Save to database" image's `action` attribute.
- Bind `movieRoleDisplayGroup.delete` to the Delete image's `action` attribute.

## Adding Behavior to Your Enterprise Objects

Right now, the Movies application maps all its entities to the `GenericRecord` class. As the preceding sections illustrate, you can go quite far in an application using just this default enterprise object class, but now you need to add some custom classes to the Movies application.

In this section, you'll learn how to:

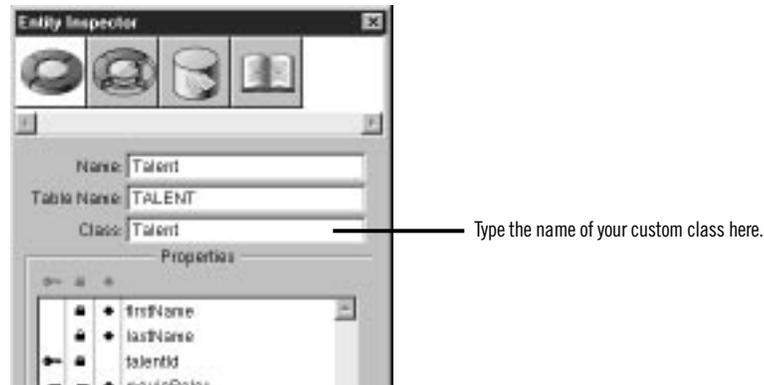
- Generate source code for a custom enterprise object class.
- Provide default values in a custom enterprise object class.

You'll create custom classes for the `Talent` and `MovieRole` entities. In the `Talent` class, you'll write a `fullName` method that concatenates a `Talent`'s first and last names. You'll use the method to populate `MovieDetail`'s browser element. In the `MovieRole` class, you'll provide default values for newly inserted `MovieRoles` so they don't show up in the list of movie roles as a blank line.

### Specifying Custom Enterprise Object Classes

Unless you specify otherwise, `EOModeler` maps entities to the `GenericRecord` class. When you want to use a custom class instead, you need to specify that custom class in the model.

1. In EOModeler, inspect the Talent entity.
2. In the Entity Inspector for Talent, type `Talent` in the Class field.



3. Set the MovieRole entity's class to MovieRole.

Now you can generate the source files for your Talent and MovieRole classes.

## Generating Custom Enterprise Object Classes

You can easily create a custom class to hold your business logic: EOModeler provides a command to generate enterprise object classes.

1. In EOModeler, select the Talent entity.
2. Choose Property ► Generate Java Files.

A Choose Class Name panel opens. If you opened the model file from Project Builder, the Choose Class Name panel displays the project as the destination directory and **Talent.java** as the default file name.

3. Ensure that the Movies project directory is selected.
4. Click Save.

A panel opens, asking if you want to insert the file in your project.

5. Click Yes.

EOModeler creates the source file **Talent.java** and adds it to your project.

6. Follow the same procedure for MovieRole.

## Adding Custom Behavior to Talent

Now add the `fullName` method to `Talent` and bind it to the browser.

1. Open `Talent.java` in Project Builder.

The class file declares instance variables for all of `Talent`'s class properties (`firstName` and `lastName`) and implements set and get methods for those instance variables.

2. Add the method, `fullName`, as follows.

```
public String fullName() { return firstName() + " " + lastName(); }
```

After you save, `fullName` appears in the object browser of `WebObjects Builder` as a property of `Talent`.

3. Bind `talent.fullName` to the browser's `value` attribute.

## Providing Default Values in MovieRole

As discussed in “Specifying Default Values for New Enterprise Objects” (page 87), there are two main ways to specify default values for new enterprise objects without making explicit assignments:

- Assign default values in the enterprise object class.
- Specify default values using a display group.

For the `Movie` class, you specified default values using a display group. This approach is also the more appropriate choice for the `MovieRole` class, but you'll use the other approach for `MovieRole` just to see how its done.

1. Open `MovieRole.java` in Project Builder.
2. Add the method, `awakeFromInsertionInEditingContext`, as follows.

```
public void awakeFromInsertionInEditingContext(EditingContext
context) {
    super.awakeFromInsertionInEditingContext(context);
    roleName = "New Role";
}
```

This method is automatically invoked right after your enterprise object class creates a new `MovieRole` and inserts it into an editing context, which happens when you use a display group to insert.

## **Running Movies**

Be sure that all your project's files are saved (including your model file), and build and run your application. Now when a user clicks the Insert/New button on the MovieDetails page, a new MovieRole is inserted, with "New Role" already displayed as the role name.