The J2EE™ Tutorial
Second Edition

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Foreword

When the first edition of *The J2EE™ Tutorial* was released, the Java™ 2 Platform, Enterprise Edition (J2EE) was the new kid on the block. Modeled after its forerunner, the Java 2 Platform, Standard Edition (J2SE™), the J2EE platform brought the benefits of “Write Once, Run Anywhere™” API compatibility to enterprise application servers. Now at version 1.4 and with widespread conformance in the application server marketplace, the J2EE platform has firmly established its position as the standard for enterprise application servers.

The J2EE™ Tutorial, Second Edition covers the J2EE 1.4 platform and more. If you have used the first edition of *The J2EE™ Tutorial*, you may notice that the second edition is triple the size. This reflects a major expansion in the J2EE platform and the availability of two upcoming J2EE technologies in the Sun Java System Application Server Platform Edition 8, the software on which the tutorial is based.

One of the most important additions to the J2EE 1.4 platform is substantial support for Web services with the JAX-RPC 1.1 API, which enables Web service endpoints based on servlets and enterprise beans. The platform also contains Web services support APIs for handling XML data streams directly (SAAJ) and for accessing Web services registries (JAXR). In addition, the J2EE 1.4 platform requires WS-I Basic Profile 1.0. This means that in addition to platform independence and complete Web services support, the J2EE 1.4 platform offers Web services interoperability.

The J2EE 1.4 platform contains major enhancements to the Java servlet and JavaServer Pages (JSP) technologies that are the foundation of the Web tier. The tutorial also showcases two exciting new technologies, not required by the J2EE 1.4 platform, that simplify the task of building J2EE application user interfaces: JavaServer Pages Standard Tag Library (JSTL) and JavaServer Faces. These new technologies are available in the Sun Java System Application Server. They will soon be featured in new developer tools and are strong candidates for inclusion in the next version of the J2EE platform.

Readers conversant with the core J2EE platform enterprise bean technology will notice major upgrades with the addition of the previously mentioned Web service endpoints, as well as a timer service, and enhancements to EJB QL and message-driven beans.

With all of these new features, I believe that you will find it well worth your time and energy to take on the J2EE 1.4 platform. You can increase the scope of the J2EE applications you develop, and your applications will run on the widest possible range of application server products.

To help you to learn all about the J2EE 1.4 platform, *The J2EE™ Tutorial, Second Edition* follows the familiar Java Series tutorial model of concise descriptions of the essential features of each technology with code examples that you can deploy and run on the Sun Java System Application Server. Read this tutorial and you will become part of the next wave of J2EE application developers.

Jeff Jackson
Vice President, J2EE Platform and Application Servers
Sun Microsystems
Santa Clara, CA
Thursday, June 3, 2004

About This Tutorial

THE *J2EE™ Tutorial, Second Edition* is a guide to developing enterprise applications for the Java 2 Platform, Enterprise Edition (J2EE) version 1.4. Here we cover all the things you need to know to make the best use of this tutorial.

Who Should Use This Tutorial

This tutorial is intended for programmers who are interested in developing and deploying J2EE 1.4 applications on the Sun Java System Application Server Platform Edition 8.

Prerequisites

Before proceeding with this tutorial you should have a good knowledge of the Java programming language. A good way to get to that point is to work through all the basic and some of the specialized trails in *The Java™ Tutorial*, Mary Campione et al. (Addison-Wesley, 2000). In particular, you should be familiar with relational database and security features described in the trails listed in Table 1.

Table 1 Prerequisite Trails in *The Java™ Tutorial*

Trail	**URL**
JDBC	`http://java.sun.com/docs/books/tutorial/jdbc`
Security	`http://java.sun.com/docs/books/tutorial/security1.2`

How to Read This Tutorial

The J2EE 1.4 platform is quite large, and this tutorial reflects this. However, you don't have to digest everything in it at once.

This tutorial opens with three introductory chapters, which you should read before proceeding to any specific technology area. Chapter 1 covers the J2EE 1.4 platform architecture and APIs along with the Sun Java System Application Server Platform Edition 8. Chapters 2 and 3 cover XML basics and getting started with Web applications.

When you have digested the basics, you can delve into one or more of the four main technology areas listed next. Because there are dependencies between some of the chapters, Figure 1 contains a roadmap for navigating through the tutorial.

- The Java XML chapters cover the technologies for developing applications that process XML documents and implement Web services components:
  - The Java API for XML Processing (JAXP)
  - The Java API for XML-based RPC (JAX-RPC)
  - SOAP with Attachments API for Java (SAAJ)
  - The Java API for XML Registries (JAXR)
- The Web-tier technology chapters cover the components used in developing the presentation layer of a J2EE or stand-alone Web application:
  - Java Servlet
  - JavaServer Pages (JSP)
  - JavaServer Pages Standard Tag Library (JSTL)
  - JavaServer Faces
  - Web application internationalization and localization
- The Enterprise JavaBeans (EJB) technology chapters cover the components used in developing the business logic of a J2EE application:
  - Session beans
  - Entity beans
  - Message-driven beans
  - Enterprise JavaBeans Query Language

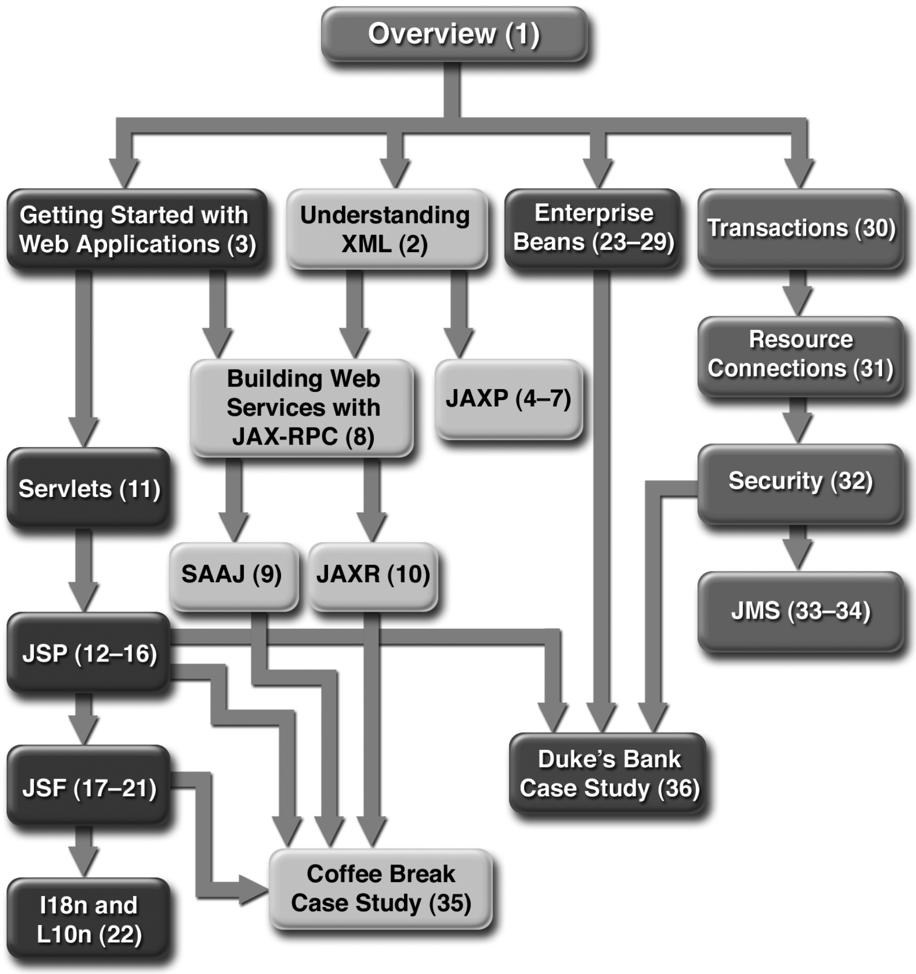

Figure 1 Roadmap to This Tutorial

- The platform services chapters cover the system services used by all the J2EE component technologies:
  - Transactions
  - Resource connections
  - Security
  - Java Message Service

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After you have become familiar with some of the technology areas, you are ready to tackle the case studies, which tie together several of the technologies discussed in the tutorial. The Coffee Break Application (Chapter 35) describes an application that uses the Web application and Web services APIs. The Duke's Bank Application (Chapter 36) describes an application that employs Web application technologies and enterprise beans.

Finally, the appendixes contain auxiliary information helpful to the J2EE application developer along with a brief summary of the J2EE Connector architecture:

- Java Encoding Schemes (Appendix A)
- XML standards (Appendix B)
- HTTP Overview (Appendix C)
- J2EE Connector Architecture (Appendix D)

About the Examples

This section tells you everything you need to know to install, build, and run the examples.

Required Software

Tutorial Bundle

The tutorial example source is contained in the tutorial bundle, which is distributed on the accompanying CD-ROM.

After you have installed the tutorial bundle, the example source code is in the `<INSTALL>/j2eetutorial14/examples/` directory, with subdirectories for each of the technologies discussed in the tutorial.

Application Server

The Sun Java System Application Server Platform Edition 8 is targeted as the build and runtime environment for the tutorial examples. To build, deploy, and run the examples, you need a copy of the Application Server and the Java 2 Software Development Kit, Standard Edition (J2SE SDK) 1.4.2_04 or higher.

The Application Server and J2SE SDK are contained in the J2EE 1.4 SDK, which is distributed on the CD-ROM accompanying the tutorial.

Application Server Installation Tips

In the Admin configuration pane of the Application Server installer,

- Select the Don't Prompt for Admin User Name radio button. This will save the user name and password so that you won't need to provide them when performing administrative operations with `asadmin` and `deploytool`. You will still have to provide the user name and password to log in to the Admin Console.
- Note the HTTP port at which the server is installed. This tutorial assumes that you are accepting the default port of 8080. If 8080 is in use during installation and the installer chooses another port, or if you decide to change it yourself, you will need to update the common build properties file (described in the next section) and the configuration files for some of the tutorial examples to reflect the correct port.

In the Installation Options pane, check the Add Bin Directory to PATH checkbox so that Application Server scripts (`asadmin`, `asant`, `deploytool`, and `wscompile`) override other installations.

Registry Server

You need a registry server to run the examples discussed in Chapters 10 and 35. Directions for obtaining and setting up a registry server are provided in those chapters.

Building the Examples

Most of the tutorial examples are distributed with a configuration file for `asant`, a portable build tool contained in the Application Server. This tool is an extension of the Ant tool developed by the Apache Software Foundation (`http://ant.apache.org`). The `asant` utility contains additional tasks that invoke the Application Server administration utility `asadmin`. Directions for building the examples are provided in each chapter.

Build properties and targets common to all the examples are specified in the files *`<INSTALL>`*`/j2eetutorial14/examples/common/build.properties` and

`<`*`INSTALL`*`>/j2eetutorial14/examples/common/targets.xml`. Build properties and targets common to a particular technology are specified in the files `<`*`INSTALL`*`>/j2eetutorial14/examples/`*`tech`*`/common/build.properties` and `<`*`INSTALL`*`>/j2eetutorial14/examples/`*`tech`*`/common/targets.xml`.

To run the `asant` scripts, you must set two common build properties as follows:

- Set the `j2ee.home` property in the file `<`*`INSTALL`*`>/j2eetutorial14/examples/common/build.properties` to the location of your Application Server installation. The build process uses the `j2ee.home` property to include the libraries in `<`*`J2EE_HOME`*`>/lib/` in the classpath. All examples that run on the Application Server include the J2EE library archive—`<`*`J2EE_HOME`*`>/lib/j2ee.jar`—in the build classpath. Some examples use additional libraries in `<`*`J2EE_HOME`*`>/lib/` and `<`*`J2EE_HOME`*`>/lib/endorsed/`; the required libraries are enumerated in the individual technology chapters. `<`*`J2EE_HOME`*`>` refers to the directory where you have installed the Application Server or the J2EE 1.4 SDK.

Note: On Windows, you must escape any backslashes in the `j2ee.home` property with another backslash or use forward slashes as a path separator. So, if your Application Server installation is `C:\Sun\AppServer`, you must set `j2ee.home` as follows:

```
j2ee.home = C:\\Sun\\AppServer
```

or

```
j2ee.home=C:/Sun/AppServer
```

- If you did not use port 8080 when you installed the Application Server, set the value of the `domain.resources.port` property in `<`*`INSTALL`*`>/j2eetutorial14/examples/common/build.properties` to the correct port.

Tutorial Example Directory Structure

To facilitate iterative development and keep application source separate from compiled files, the source code for the tutorial examples is stored in the following structure under each application directory:

- `build.xml`: `asant` build file
- `src`: Java source of servlets and JavaBeans components; tag libraries
- `web`: JSP pages and HTML pages, tag files, and images

The `asant` build files (`build.xml`) distributed with the examples contain targets to create a `build` subdirectory and to copy and compile files into that directory.

Further Information

This tutorial includes the basic information that you need to deploy applications on and administer the Application Server.

For reference information on the tools distributed with the Application Server, see the man pages at `http://docs.sun.com/db/doc/817-6092`.

See the *Sun Java™ System Application Server Platform Edition 8 Developer's Guide* at `http://docs.sun.com/db/doc/817-6087` for information about developer features of the Application Server.

See the *Sun Java™ System Application Server Platform Edition 8 Administration Guide* at `http://docs.sun.com/db/doc/817-6088` for information about administering the Application Server.

Typographical Conventions

Table 2 lists the typographical conventions used in this tutorial.

Table 2 Typographical Conventions

Font Style	**Uses**
italic	Emphasis, titles, first occurrence of terms
`monospace`	URLs; code examples; file names; path names; tool names; application names; programming language keywords; tag, interface, class, method, and field names; properties
`italic monospace`	Variables in code, file paths, and URLs
<*`italic monospace`*>	User-selected file path components

Menu selections indicated with the right-arrow character →, for example, First→Second, should be interpreted as: select the First menu, then choose Second from the First submenu.

Acknowledgments

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The chapters on custom tags and the Coffee Break and Duke's Bank applications use a template tag library that first appeared in *Designing Enterprise Applications with the J2EE™ Platform, Second Edition*, Inderjeet Singh et al., (Addison-Wesley, 2002).

The JavaServer Faces technology and JSP Documents chapters benefited greatly from the invaluable documentation reviews and example code contributions of these engineers: Ed Burns, Justyna Horwat, Roger Kitain, Jan Luehe, Craig McClanahan, Raj Premkumar, Mark Roth, and especially Jayashri Visvanathan.

The OrderApp example application described in the Container-Managed Persistence chapter was coded by Marina Vatkina with contributions from Markus Fuchs, Rochelle Raccah, and Deepa Singh. Ms. Vatkina's JDO/CMP team provided extensive feedback on the tutorial's discussion of CMP.

The security chapter writers are indebted to Raja Perumal, who was a key contributor both to the chapter and to the examples.

Monica Pawlan and Beth Stearns wrote the Overview and J2EE Connector chapters in the first edition of *The J2EE Tutorial* and much of that content has been carried forward to the current edition.

We are extremely grateful to the many internal and external reviewers who provided feedback on the tutorial. Their feedback helped improve the technical accuracy and presentation of the chapters and eliminate bugs from the examples.

We would like to thank our manager, Alan Sommerer, for his support and steadying influence.

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Finally, we would like to express our profound appreciation to Ann Sellers, Elizabeth Ryan, and the production team at Addison-Wesley for graciously seeing our large, complicated manuscript to publication.

Feedback

To send comments, broken link reports, errors, suggestions, and questions about this tutorial to the tutorial team, please use the feedback form at `http://java.sun.com/j2ee/1.4/docs/tutorial/information/sendusmail.html`.

18 Using JavaServer Faces Technology in JSP Pages

THE page author's responsibility is to design the pages of a JavaServer Faces application. This includes laying out the components on the page and wiring them to backing beans, validators, converters, and other back-end objects associated with the page. This chapter uses the Duke's Bookstore application and the Coffee Break application (see Chapter 35) to describe how page authors use the JavaServer Faces tags to

- Layout standard UI components on a page
- Reference localized messages
- Register converters, validators, and listeners on components
- Bind components and their values to back-end objects
- Reference backing bean methods that perform navigation processing, handle events, and perform validation

This chapter also describes how to include custom objects created by application developers and component writers on a JSP page.

The Example JavaServer Faces Application

The JavaServer Faces technology chapters of this tutorial primarily use a rewritten version of the Duke's Bookstore example to illustrate the basic concepts of JavaServer Faces technology. This version of the Duke's Bookstore example includes several JavaServer Faces technology features:

- The JavaServer Faces implementation provides `FacesServlet`, whose instances accept incoming requests and pass them to the implementation for processing. Therefore, the application does not need to include a servlet (such as the `Dispatcher` servlet) that processes request parameters and dispatches to application logic, as do the other versions of Duke's Bookstore.
- A custom image map component that allows you to select the locale for the application.
- Navigation configured in a centralized application configuration resource file. This eliminates the need to calculate URLs, as other versions of the Duke's Bookstore application must do.
- Backing beans associated with the pages. These beans hold the component data and perform other processing associated with the components. This processing includes handling the event generated when a user clicks a button or hyperlink.
- Tables that display the books from the database and the shopping cart are rendered with the `dataTable` tag, which is used to dynamically render data in a table. The `dataTable` tag on `bookshowcart.jsp` also includes input components.
- A custom validator and a custom converter are registered on the credit card field of the `bookcashier.jsp` page.
- A value-change listener is registered on the Name field of `bookcashier.jsp`. This listener saves the name in a parameter so that `bookreceipt.jsp` can access it.

This version of Duke's Bookstore includes the same pages listed in Table 12–1. It also includes the `chooselocale.jsp` page, which displays the custom image map that allows you to select the locale of the application. This page is displayed first and advances directly to the `bookstore.jsp` page after the locale is selected.

The packages of the Duke's Bookstore application are:

- `backing`: Includes the backing bean classes
- `components`: Includes the custom UI component classes
- `converters`: Includes the custom converter class
- `listeners`: Includes the event handler and event listener classes
- `model`: Includes a model bean class
- `renderers`: Includes the custom renderers
- `resources`: Includes custom error messages for the custom converter and validator
- `taglib`: Includes custom tag handler classes
- `util`: Includes a message factory class
- `validators`: Includes a custom validator class

Chapter 19 describes how to program backing beans, custom converters and validators, and event listeners. Chapter 20 describes how to program event handlers, custom components, renderers, and tag handlers.

The source code for the application is located in the `<INSTALL>/j2eetutorial14/examples/web/bookstore6/` directory. A sample `bookstore6.war` is provided in `<INSTALL>/j2eetutorial14/examples/web/provided-wars/`. To build, package, deploy, and run the example, follow these steps:

1. Build and package the `bookstore` common files as described in Duke's Bookstore Examples (page 100).
2. Go to `<INSTALL>/j2eetutorial14/examples/web/bookstore6/` and run `asant build`.
3. Start the Sun Java System Application Server Platform Edition 8.
4. Perform all the operations described in Accessing Databases from Web Applications, page 100.
5. Start `deploytool`.
6. Create a Web application called `bookstore6` by running the New Web Component Wizard. Select File→New→Web Component.
7. In the New Web Component wizard:
   a. Select the Create New Stand-Alone WAR Module radio button.
   b. In the WAR Location field, enter `<INSTALL>/j2eetutorial14/examples/web/bookstore6.war`.
   c. In the WAR Name field, enter `bookstore6`.

d. In the Context Root field, enter `/bookstore6`.
e. Click Edit Contents.
f. In the Edit Contents dialog box, navigate to `<INSTALL>/j2eetutorial14/examples/web/bookstore6/build/`. Select everything in the `build` directory and click Add.
g. In the Contents tree, drag the `resources` package to the `WEB-INF/classes` directory.
h. In the Contents tree, drag `faces-config.xml` to the `WEB-INF` directory.
i. In the Edit Contents dialog box, navigate to `<INSTALL>/j2eetutorial14/examples/web/bookstore/dist/`. Select `bookstore.jar` and click Add.
j. In the Edit Contents dialog box, navigate to `<J2EE_HOME>/lib/` and select the `jsf-api.jar`. Click Add, and then Click OK.
k. Click Next.
l. Select the Servlet radio button.
m. Click Next.
n. Select `javax.faces.webapp.FacesServlet` from the Servlet Class combo box.
o. In the Startup Load Sequence Position combo box, enter `1`.
p. Click Finish.

8. Provide a mapping for the `FacesServlet` Web component.
   a. Select the `FacesServlet` Web component that is contained in the `bookstore6` Web application from the tree.
   b. Select the Aliases tab.
   c. Click Add and enter `*.faces` in the Aliases field.
9. Specify where state is saved.
   a. Select the `bookstore6` WAR from the tree.
   b. Select the Context tabbed pane and click Add.
   c. Enter `javax.faces.STATE_SAVING_METHOD` in the Coded Parameter field.
   d. Enter `client` in the Value field.
10. Set preludes and codas for all JSP pages.
    a. Select the JSP Properties tab.
    b. Click Add.
    c. Enter `bookstore6` in the Name field.

   d. Click Add URL.
   e. Enter `*.jsp` in the URL Patterns field.
   f. Click Edit Preludes.
   g. Click Add.
   h. Enter `/template/prelude.jspf`.
   i. Click OK.
   j. Click Edit Codas.
   k. Click Add.
   l. Enter `/template/coda.jspf`.
   m. Click OK.

11. Add the listener class `listeners.ContextListener` (described in Handling Servlet Life-Cycle Events, page 441).
    a. Select the Event Listeners tab.
    b. Click Add.
    c. Select the `listeners.ContextListener` class from the drop-down menu in the Event Listener Classes pane.
12. Add a resource reference for the database.
    a. Select the Resource Ref's tab.
    b. Click Add.
    c. Enter `jdbc/BookDB` in the Coded Name field.
    d. Accept the default type `javax.sql.DataSource`.
    e. Accept the default authorization `Container`.
    f. Accept the default selected `Shareable`.
    g. Enter `jdbc/BookDB` in the JNDI Name field of the Sun-specific Settings frame.
13. Select File→Save.
14. Deploy the application.
15. Select Tools→Deploy.
16. In the Connection Settings frame, enter the user name and password you specified when you installed the Application Server.
17. Click OK.
18. A pop-up dialog box will display the results of the deployment. Click Close.
19. Open the URL `http://localhost:8080/bookstore6` in a browser.

Setting Up a Page

To use the JavaServer Faces UI components in your JSP page, you need to give the page access to the two tag libraries: the JavaServer Faces standard HTML render kit tag library and the JavaServer Faces core tag library. The JavaServer Faces standard HTML render kit tag library defines tags that represent common HTML user interface components. The JavaServer Faces core tag library defines tags that perform core actions and are independent of a particular render kit.

Using these tag libraries is similar to using any other custom tag library. This chapter assumes that you are familiar with the basics of using custom tags in JSP pages (see Using Custom Tags, page 502).

As is the case with any tag library, each JavaServer Faces tag library must have a TLD that describes it. The `html_basic` TLD describes the The JavaServer Faces standard HTML render kit tag library. The `jsf_core` TLD describes the JavaServer Faces core tag library.

Please refer to the TLD documentation at `http://java.sun.com/j2ee/javaserverfaces/1.0/docs/tlddocs/index.html` for a complete list of the JavaServer Faces tags and their attributes.

Your application needs access to these TLDs in order for your pages to use them. The Application Server includes these TLDs in `jsf-impl.jar`, located in *<J2EE_HOME>*`/lib`.

To use any of the JavaServer Faces tags, you need to include these `taglib` directives at the top of each page containing the tags defined by these tag libraries:

```
<%@ taglib uri="http://java.sun.com/jsf/html" prefix="h" %>
<%@ taglib uri="http://java.sun.com/jsf/core" prefix="f" %>
```

The `uri` attribute value uniquely identifies the TLD. The `prefix` attribute value is used to distinguish tags belonging to the tag library. You can use other prefixes rather than the `h` or `f` prefixes. However, you must use the prefix you have chosen when including the tag in the page. For example, the `form` tag must be referenced in the page via the `h` prefix because the preceding tag library directive uses the `h` prefix to distinguish the tags defined in `html_basic.tld`:

```
<h:form ...>
```

A page containing JavaServer Faces tags is represented by a tree of components. At the root of the tree is the `UIViewRoot` component. The `view` tag represents this component on the page. Thus, all component tags on the page must be enclosed in the `view` tag, which is defined in the `jsf_core` TLD:

```
<f:view>
  ... other faces tags, possibly mixed with other content ...
</f:view>
```

You can enclose other content, including HTML and other JSP tags, within the `view` tag, but all JavaServer Faces tags must be enclosed within the `view` tag.

The `view` tag has an optional `locale` attribute. If this attribute is present, its value overrides the `Locale` stored in the `UIViewRoot`. This value is specified as a `String` and must be of this form:

```
:language:[{-,_}:country:[{-,_}:variant]
```

The `:language:`, `:country:`, and `:variant:` parts of the expression are as specified in `java.util.Locale`.

A typical JSP page includes a form, which is submitted when a button or hyperlink on the page is clicked. For the data of other components on the page to be submitted with the form, the tags representing the components must be nested inside the `form` tag. See The UIForm Component (page 683) for more details on using the `form` tag.

If you want to include a page containing JavaServer Faces tags within another JSP page (which could also contain JavaServer Faces tags), you must enclose the entire nested page in a `subview` tag. You can add the `subview` tag on the parent page and nest a `jsp:include` inside it to include the page:

```
<f:subview id="myNestedPage">
  <jsp:include page="theNestedPage.jsp"/>
<f:subview>
```

You can also include the `subview` tag inside the nested page, but it must enclose all the JavaServer Faces tags on the nested page.

In summary, a typical JSP page that uses JavaServer Faces tags will look somewhat like this:

```
<%@ taglib uri="http://java.sun.com/jsf/html" prefix="h" %>
<%@ taglib uri="http://java.sun.com/jsf/core" prefix="f" %>

<f:view>
```

```
    <h:form>
      other JavaServer Faces tags and core tags,
      including one or more button or hyperlink components for
      submitting the form
    </h:form>
  </f:view>
```

The sections Using the Core Tags (page 678) and Using the HTML Component Tags (page 680) describe how to use the core tags from the JavaServer Faces core tag library and the component tags from the JavaServer Faces standard HTML render kit tag library.

Using the Core Tags

The tags included in the JavaServer Faces core tag library are used to perform core actions that are independent of a particular render kit. These tags are listed in Table 18–1.

Table 18–1 The `jsf_core` Tags

Tag Categories	Tags	Functions
Event-handling tags	`actionListener`	Registers an action listener on a parent component
	`valueChangeListener`	Registers a value-change listener on a parent component
Attribute configuration tag	`attribute`	Adds configurable attributes to a parent component
Data conversion tags	`converter`	Registers an arbitrary converter on the parent component
	`convertDateTime`	Registers a `DateTime` converter instance on the parent component
	`convertNumber`	Registers a `Number` converter instance on the parent component
Facet tag	`facet`	Signifies a nested component that has a special relationship to its enclosing tag

Table 18–1 The `jsf_core` Tags *(Continued)*

Tag Categories	**Tags**	**Functions**
Localization tag	`loadBundle`	Specifies a `ResourceBundle` that is exposed as a `Map`
Parameter substitution tag	`param`	Substitutes parameters into a `MessageFormat` instance and adds query string name-value pairs to a URL
Tags for representing items in a list	`selectItem`	Represents one item in a list of items in a `UISelectOne` or `UISelectMany` component
	`selectItems`	Represents a set of items in a `UISelectOne` or `UISelectMany` component
Container tag	`subview`	Contains all JavaServer Faces tags in a page that is included in another JSP page containing JavaServer Faces tags
Validator tags	`validateDoubleRange`	Registers a `DoubleRangeValidator` on a component
	`validateLength`	Registers a `LengthValidator` on a component
	`validateLongRange`	Registers a `LongRangeValidator` on a component
	`validator`	Registers a custom validator on a component
Output tag	`verbatim`	Generates a `UIOutput` component that gets its content from the body of this tag
Container for form tags	`view`	Encloses all JavaServer Faces tags on the page

These tags are used in conjunction with component tags and are therefore explained in other sections of this tutorial. Table 18–2 lists the sections that explain how to use specific `jsf_core` tags.

Table 18–2 Where the `jsf_core` Tags Are Explained

Tags	Where Explained
Event-handling tags	Registering Listeners on Components (page 710)
Data conversion tags	Using the Standard Converters (page 705)
`facet`	The UIData Component (page 686) and The UIPanel Component (page 694)
`loadBundle`	Using Localized Messages (page 703)
`param`	Using the outputFormat Tag (page 693) and
`selectItem` and `selectItems`	The UISelectItem, UISelectItems, and UISelectItem-Group Components (page 700)
`subview`	Setting Up a Page (page 676)
`verbatim`	Using the outputLink Tag (page 692)
`view`	Setting Up a Page (page 676)
Validator tags	Using the Standard Validators (page 712) and Creating a Custom Validator (page 750)

Using the HTML Component Tags

The tags defined by the JavaServer Faces standard HTML render kit tag library represent HTML form controls and other basic HTML elements. These controls display data or accept data from the user. This data is collected as part of a form and is submitted to the server, usually when the user clicks a button. This section explains how to use each of the component tags shown in Table 17–2, and is organized according to the `UIComponent` classes from which the tags are derived.

The next section explains the more important tag attributes that are common to most component tags. Please refer to the TLD documentation at `http://java.sun.com/j2ee/javaserverfaces/1.0/docs/tlddocs/index.html` for a complete list of tags and their attributes.

For each of the components discussed in the following sections, Writing Component Properties (page 730) explains how to write a bean property bound to a particular UI component or its value.

UI Component Tag Attributes

In general, most of the component tags support these attributes:

- `id`: Uniquely identifies the component
- `immediate`: If set to `true`, indicates that any events, validation, and conversion associated with the component should happen in the apply request values phase rather than a later phase.
- `rendered`: Specifies a condition in which the component should be rendered. If the condition is not satisfied, the component is not rendered.
- `style`: Specifies a Cascading Style Sheet (CSS) style for the tag.
- `styleClass`: Specifies a CSS stylesheet class that contains definitions of the styles.
- `value`: Identifies an external data source and binds the component's value to it.
- `binding`: Identifies a bean property and binds the component instance to it.

All of the UI component tag attributes (except id and var) are value-binding-enabled, which means that they accept JavaServer Faces EL expressions. These expressions allow you to use mixed literals and JSP 2.0 expression language syntax and operators. See Expression Language (page 489) for more information about the JSP 2.0 expression language.

The id Attribute

The `id` attribute is not required for a component tag except in these situations:

- Another component or a server-side class must refer to the component.
- The component tag is impacted by a JSTL conditional or iterator tag (for more information, see Flow Control Tags, page 545).

If you don't include an `id` attribute, the JavaServer Faces implementation automatically generates a component ID.

The immediate Attribute

`UIInput` components and command components (those that implement `ActionSource`, such as buttons and hyperlinks) can set the `immediate` attribute to `true` to force events, validations, and conversions to be processed during the apply request values phase of the life cycle. Page authors need to carefully consider how the combination of an input component's `immediate` value and a command component's `immediate` value determines what happens when the command component is activated.

Assume that you have a page with a button and a field for entering the quantity of a book in a shopping cart. If both the button's and the field's `immediate` attributes are set to `true`, the new value of the field will be available for any processing associated with the event that is generated when the button is clicked. The event associated with the button and the event, validation, and conversion associated with the field are all handled during the apply request values phase.

If the button's `immediate` attribute is set to `true` but the field's `immediate` attribute is set to `false`, the event associated with the button is processed without updating the field's local value to the model layer. This is because any events, conversion, or validation associated with the field occurs during its usual phases of the life cycle, which come after the apply request values phase.

The `bookshowcart.jsp` page of the Duke's Bookstore application has examples of components using the `immediate` attribute to control which component's data is updated when certain buttons are clicked. The `quantity` field for each book has its `immediate` attribute set to `false`. (The `quantity` fields are generated by the `UIData` component. See The UIData Component, page 686, for more information.) The `immediate` attribute of the Continue Shopping hyperlink is set to `true`. The `immediate` attribute of the Update Quantities hyperlink is set to `false`.

If you click the Continue Shopping hyperlink, none of the changes entered into the quantity input fields will be processed. If you click the Update Quantities hyperlink, the values in the quantity fields will be updated in the shopping cart.

The rendered Attribute

A component tag uses a Boolean JavaServer Faces (EL) expression, along with the `rendered` attribute, to determine whether or not the component will be rendered. For example, the `check commandLink` component on the `bookcatalog.jsp` page is not rendered if the cart contains no items:

```
<h:commandLink id="check"
  ...
  rendered="#{cart.numberOfItems > 0}">
  <h:outputText
    value="#{bundle.CartCheck}"/>
</h:commandLink>
```

The style and styleClass Attributes

The `style` and `styleClass` attributes allow you to specify Cascading Style Sheets (CSS) styles for the rendered output of your component tags. The UIMessage and UIMessages Components (page 698) describes an example of using the `style` attribute to specify styles directly in the attribute. A component tag can instead refer to a CSS stylesheet class. The `dataTable` tag on the `bookcatalog.jsp` page of the Duke's Bookstore application references the style class `list-background`:

```
<h:dataTable id="books"
  ...
  styleClass="list-background"
  value="#{bookDBAO.books}"
  var="book">
```

The stylesheet that defines this class is `stylesheet.css`, which is included in the application. For more information on defining styles, please see the Cascading Style Sheets Specification at `http://www.w3.org/Style/CSS/`.

The value and binding Attributes

A tag representing a component defined by `UIOutput` or a subclass of `UIOutput` uses `value` and `binding` attributes to bind its component's value or instance to an external data source. Binding Component Values and Instances to External Data Sources (page 714) explains how to use these attributes.

The UIForm Component

A `UIForm` component is an input form that has child components representing data that is either presented to the user or submitted with the form. The `form` tag encloses all the controls that display or collect data from the user. Here is an example:

```
<h:form>
... other faces tags and other content...
</h:form>
```

The `form` tag can also include HTML markup to lay out the controls on the page. The `form` tag itself does not perform any layout; its purpose is to collect data and to declare attributes that can be used by other components in the form. A page can include multiple form tags, but only the values from the form that the user submits will be included in the postback.

The UIColumn Component

The UIColumn component represents a column of data in a UIData component. While the UIData component is iterating over the rows of data, it processes the UIColumn for each row. UIColumn has no renderer associated with it and is represented on the page with a column tag. Here is an example column tag from the bookshowcart.jsp page of the Duke's Bookstore example:

```
<h:dataTable id="items"
  ...
  value="#{cart.items}"
  var="item">
  ...
  <h:column>
    <f:facet name="header">
      <h:outputText value="#{bundle.ItemQuantity}"/>
    </f:facet>
    <h:inputText
      ...
      value="#{item.quantity}">
      <f:validateLongRange minimum="1"/>
    </h:inputText>
  </h:column>
  ...
</h:dataTable>
```

The UIData component in this example iterates through the list of books (cart.items) in the shopping cart and displays their titles, authors, and prices. The column tag shown in the example renders the column that displays text fields that allow customers to change the quantity of each book in the shopping cart. Each time UIData iterates through the list of books, it renders one cell in each column.

The UICommand Component

The UICommand component performs an action when it is activated. The most common example of such a component is the button. This release supports Button and Link as UICommand component renderers.

In addition to the tag attributes listed in Using the HTML Component Tags (page 680), the `commandButton` and `commandLink` tags can use these attributes:

- `action`, which is either a logical outcome `String` or a method-binding expression that points to a bean method that returns a logical outcome `String`. In either case, the logical outcome `String` is used by the default `NavigationHandler` instance to determine what page to access when the `UICommand` component is activated.
- `actionListener`, which is a method-binding expression that points to a bean method that processes an `ActionEvent` fired by the `UICommand` component.

See Referencing a Method That Performs Navigation (page 720) for more information on using the `action` attribute.

See Referencing a Method That Handles an ActionEvent (page 721) for details on using the `actionListener` attribute.

Using the commandButton Tag

The `bookcashier.jsp` page of the Duke's Bookstore application includes a `commandButton` tag. When a user clicks the button, the data from the current page is processed, and the next page is opened. Here is the `commandButton` tag from `bookcashier.jsp`:

```
<h:commandButton value="#{bundle.Submit}"
  action="#{cashier.submit}"/>
```

Clicking the button will cause the `submit` method of `CashierBean` to be invoked because the `action` attribute references the `submit` method of the `CashierBean` backing bean. The `submit` method performs some processing and returns a logical outcome. This is passed to the default `NavigationHandler`, which matches the outcome against a set of navigation rules defined in the application configuration resource file.

The `value` attribute of the preceding example `commandButton` tag references the localized message for the button's label. The `bundle` part of the expression refers to the `ResourceBundle` that contains a set of localized messages. The `Submit` part of the expression is the key that corresponds to the message that is displayed on the button. For more information on referencing localized messages, see Using Localized Messages (page 703). See Referencing a Method That Performs Navigation (page 720) for information on how to use the `action` attribute.

Using the commandLink Tag

The `commandLink` tag represents an HTML hyperlink and is rendered as an HTML `<a>` element. The `commandLink` tag is used to submit an action event to the application. See Implementing Action Listeners (page 749) for more information on action events.

A `commandLink` tag must include a nested `outputText` tag, which represents the text the user clicks to generate the event. The following tag is from the `chooselocale.jsp` page from the Duke's Bookstore application.

```
<h:commandLink id="NAmerica" action="bookstore"
  actionListener="#{localeBean.chooseLocaleFromLink}">
  <h:outputText value="#{bundle.English}" />
</h:commandLink>
```

This tag will render the following HTML:

```
<a id="_id3:NAmerica" href="#"
  onclick="document.forms['_id3']['_id3:NAmerica'].
  value='_id3:NAmerica';
  document.forms['_id3'].submit();
  return false;">English</a>
```

Note: Notice that the `commandLink` tag will render JavaScript. If you use this tag, make sure your browser is JavaScript-enabled.

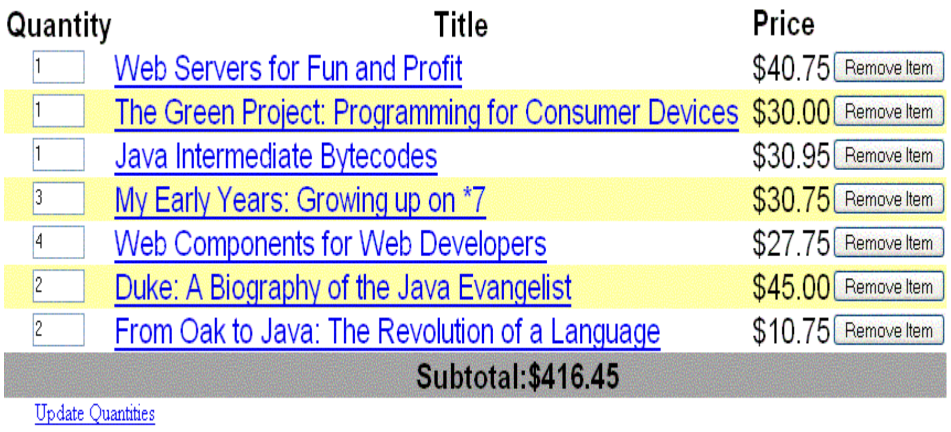
The UIData Component

The `UIData` component supports data binding to a collection of data objects. It does the work of iterating over each record in the data source. The standard `Table` renderer displays the data as an HTML table. The `UIColumn` component represents a column of data within the table. Here is a portion of the `dataTable` tag used by the `bookshowcart.jsp` page of the Duke's Bookstore example:

```
<h:dataTable id="items"
  columnClasses="list-column-center, list-column-left,
     list-column-right, list-column-center"
     footerClass="list-footer"
  headerClass="list-header"
  rowClasses="list-row-even, list-row-odd"
  styleClass="list-background"
  value="#{cart.items}"
  var="item">
```

```
   <h:column >
      <f:facet name="header">
         <h:outputText value="#{bundle.ItemQuantity}" />
      </f:facet>
      <h:inputText id="quantity" size="4"
         value="#{item.quantity}" />
      </h:inputText>
   </h:column>
   <h:column>
      <f:facet name="header">
         <h:outputText value="#{bundle.ItemTitle}"/>
      </f:facet>
      <h:commandLink action="#{showcart.details}">
         <h:outputText value="#{item.item.title}"/>
      </h:commandLink>
   </h:column>
   ...
   <f:facet name="footer"
      <h:panelGroup>
         <h:outputText value="#{bundle.Subtotal}"/>
         <h:outputText value="#{cart.total}" />
            <f:convertNumber type="currency" />
         </h:outputText>
      </h:panelGroup>
   </f:facet>
</h:dataTable>
```

Figure 18–1 shows a data grid that this `dataTable` tag can display.



Quantity	Title	Price	
1	Web Servers for Fun and Profit	$40.75	Remove Item
1	The Green Project: Programming for Consumer Devices	$30.00	Remove Item
1	Java Intermediate Bytecodes	$30.95	Remove Item
3	My Early Years: Growing up on *7	$30.75	Remove Item
4	Web Components for Web Developers	$27.75	Remove Item
2	Duke: A Biography of the Java Evangelist	$45.00	Remove Item
2	From Oak to Java: The Revolution of a Language	$10.75	Remove Item
	Subtotal:$416.45		

Update Quantities

Figure 18–1 Table on the `bookshowcart.jsp` Page

The example `dataTable` tag displays the books in the shopping cart as well as the number of each book in the shopping cart, the prices, and a set of buttons, which the user can click to remove books from the shopping cart.

The `facet` tag inside the first `column` tag renders a header for that column. The other column tags also contain `facet` tags. Facets can have only one child, and so a `panelGroup` tag is needed if you want to group more than one component within a `facet`. Because the facet tag representing the footer includes more than one tag, the `panelGroup` is needed to group those tags.

A `facet` tag is usually used to represent headers and footers. In general, a *facet* is used to represent a component that is independent of the parent-child relationship of the page's component tree. In the case of a data grid, header and footer data is not repeated like the other rows in the table, and therefore, the elements representing headers and footers are not updated as are the other components in the tree.

This example is a classic use case for a `UIData` component because the number of books might not be known to the application developer or the page author at the time the application is developed. The `UIData` component can dynamically adjust the number of rows of the table to accommodate the underlying data.

The `value` attribute of a `dataTable` tag references the data to be included in the table. This data can take the form of

- A list of beans
- An array of beans
- A single bean
- A `javax.faces.model.DataModel`
- A `java.sql.ResultSet`
- A `javax.servlet.jsp.jstl.sql.ResultSet`
- A `javax.sql.RowSet`

All data sources for `UIData` components have a `DataModel` wrapper. Unless you explicitly construct a `DataModel`, the JavaServer Faces implementation will create a `DataModel` wrapper around data of any of the other acceptable types. See Writing Component Properties (page 730) for more information on how to write properties for use with a `UIData` component.

The `var` attribute specifies a name that is used by the components within the `dataTable` tag as an alias to the data referenced in the `value` attribute of `dataTable`.

In the `dataTable` tag from the `bookshowcart.jsp` page, the `value` attribute points to a `List` of books. The `var` attribute points to a single book in that list. As the `UIData` component iterates through the list, each reference to `item` points to the current book in the list.

The `UIData` component also has the ability to display only a subset of the underlying data. This is not shown in the preceding example. To display a subset of the data, you use the optional `first` and `rows` attributes.

The `first` attribute specifies the first row to be displayed. The `rows` attribute specifies the number of rows—starting with the first row—to be displayed. By default, both `first` and `rows` are set to zero, and this causes all the rows of the underlying data to display. For example, if you wanted to display records 2 through 10 of the underlying data, you would set `first` to 2 and `rows` to 9. When you display a subset of the data in your pages, you might want to consider including a link or button that causes subsequent rows to display when clicked.

The `dataTable` tag also has a set of optional attributes for adding styles to the table:

- `columnClasses`: Defines styles for all the columns
- `footerClass`: Defines styles for the footer
- `headerClass`: Defines styles for the header
- `rowClasses`: Defines styles for the rows
- `styleClass`: Defines styles for the entire table

Each of these attributes can specify more than one style. If `columnClasses` or `rowClasses` specifies more than one style, the styles are applied to the columns or rows in the order that the styles are listed in the attribute. For example, if `columnClasses` specifies styles `list-column-center` and `list-column-right` and if there are two columns in the table, the first column will have style `list-column-center`, and the second column will have style `list-column-right`.

If the `style` attribute specifies more styles than there are columns or rows, the remaining styles will be assigned to columns or rows starting from the first column or row. Similarly, if the `style` attribute specifies fewer styles than there are columns or rows, the remaining columns or rows will be assigned styles starting from the first style.

The UIGraphic Component

The `UIGraphic` component displays an image. The Duke's Bookstore application uses a `graphicImage` tag to display the map image on the `chooselocale.jsp` page:

```
<h:graphicImage id="mapImage" url="/template/world.jpg"
  alt="#{bundle.chooseLocale}" usemap="#worldMap" />
```

The `url` attribute specifies the path to the image. It also corresponds to the local value of the `UIGraphic` component so that the URL can be retrieved, possibly from a backing bean. The URL of the example tag begins with a /, which adds the relative context path of the Web application to the beginning of the path to the image.

The `alt` attribute specifies the alternative text displayed when the user mouses over the image. In this example, the `alt` attribute refers to a localized message. See Performing Localization (page 741) for details on how to localize your JavaServer Faces application.

The `usemap` attribute refers to the image map defined by the custom component, `MapComponent`, which is on the same page. See Chapter 20 for more information on the image map.

The UIInput and UIOutput Components

The `UIInput` component displays a value to the user and allows the user to modify this data. The most common example is a text field. The `UIOutput` component displays data that cannot be modified. The most common example is a label.

The `UIInput` and `UIOutput` components can each be rendered in four ways. Table 18–3 lists the renderers of `UIInput` and `UIOutput`. Recall from Component Rendering Model (page 647) that the tags are composed of the component and the renderer. For example, the `inputText` tag refers to a `UIInput` component that is rendered with the `Text` renderer.

The `UIInput` component supports the following tag attributes in addition to the tag attributes described at the beginning of Using the HTML Component Tags (page 680). The `UIOutput` component supports the first of the following tag attributes in addition to those listed in Using the HTML Component Tags (page 680).

- `converter`: Identifies a converter that will be used to convert the component's local data. See Using the Standard Converters (page 705) for more information on how to use this attribute.

Table 18–3 `UIInput` and `UIOutput` Renderers

Component	Renderer	Tag	Function
`UIInput`	`Hidden`	`inputHidden`	Allows a page author to include a hidden variable in a page
	`Secret`	`inputSecret`	Accepts one line of text with no spaces and displays it as a set of asterisks as it is typed
	`Text`	`inputText`	Accepts a text string of one line
	`TextArea`	`inputTextarea`	Accepts multiple lines of text
`UIOutput`	`Label`	`outputLabel`	Displays a nested component as a label for a specified input field
	`Link`	`outputLink`	Displays an `<a href>` tag that links to another page without generating an `ActionEvent`
	`OutputMessage`	`outputFormat`	Displays a localized message
	`Text`	`outputText`	Displays a text string of one line

- `validator`: Identifies a method-binding expression pointing to a backing bean method that performs validation on the component's data. See Referencing a Method That Performs Validation (page 722) for an example of using the `validator` tag.
- `valueChangeListener`: Identifies a method-binding expression pointing to a backing bean method that handles the event of entering a value in this component. See Referencing a Method That Handles a ValueChangeEvent (page 722) for an example of using `valueChangeListener`.

The rest of this section explains how to use selected tags listed in Table 18–3. The other tags are written in a similar way.

Using the outputText and inputText Tags

The `Text` renderer can render both `UIInput` and `UIOutput` components. The `inputText` tag displays and accepts a single-line string. The `outputText` tag displays a single-line string. This section shows you how to use the `inputText` tag. The `outputText` tag is written in a similar way.

Here is an example of an inputText tag from the bookcashier.jsp page:

```
<h:inputText id="name" size="50"
  value="#{cashier.name}"
  required="true">
  <f:valueChangeListener type="listeners.NameChanged" />
</h:inputText>
```

The value attribute refers to the name property of CashierBean. This property holds the data for the name component. After the user submits the form, the value of the name property in CashierBean will be set to the text entered in the field corresponding to this tag.

The required attribute causes the page to reload with errors displayed if the user does not enter a value in the name text field. See Requiring a Value (page 713) for more information on requiring input for a component.

Using the outputLabel Tag

The outputLabel tag is used to attach a label to a specified input field for accessibility purposes. The bookcashier.jsp page uses an outputLabel tag to render the label of a checkbox:

```
<h:selectBooleanCheckbox
  id="fanClub"
  rendered="false"
  binding="#{cashier.specialOffer}" />
<h:outputLabel for="fanClubLabel"
  rendered="false"
  binding="#{cashier.specialOfferText}"  >
  <h:outputText id="fanClubLabel"
    value="#{bundle.DukeFanClub}" />
</h:outputLabel>
```

The for attribute of the outputLabel tag maps to the id of the input field to which the label is attached. The outputText tag nested inside the outputLabel tag represents the actual label component. The value attribute on the outputText tag indicates the text that is displayed next to the input field.

Using the outputLink Tag

The outputLink tag is used to render a hyperlink that, when clicked, loads another page but does not generate an action event. You should use this tag instead of the `commandLink` tag if you always want the URL—specified by the `outputLink` tag's `value` attribute—to open and do not have to perform any processing when the user clicks on the link. The Duke's Bookstore application does not utilize this tag, but here is an example of it:

```
<h:outputLink value="javadocs">
  <f:verbatim>Documentation for this demo</f:verbatim>
</h:outputLink>
```

As shown in this example, the `outputLink` tag requires a nested `verbatim` tag, which identifies the text the user clicks to get to the next page.

You can use the `verbatim` tag on its own when you want to simply output some text on the page.

Using the outputFormat Tag

The `outputFormat` tag allows a page author to display concatenated messages as a `MessageFormat` pattern, as described in the API documentation for `java.text.MessageFormat` (see `http://java.sun.com/j2se/1.4.2/docs/api/java/text/MessageFormat.html`). Here is an example of an `outputFormat` tag from the `bookshowcart.jsp` page of the Duke's Bookstore application:

```
<h:outputFormat value="#{bundle.CartItemCount}">
  <f:param value="#{cart.numberOfItems}"/>
</h:outputFormat>
```

The `value` attribute specifies the `MessageFormat` pattern. The `param` tag specifies the substitution parameters for the message.

In the example `outputFormat` tag, the `value` for the parameter maps to the number of items in the shopping cart. When the message is displayed in the page, the number of items in the cart replaces the `{0}` in the message corresponding to the `CartItemCount` key in the `bundle` resource bundle:

```
Your shopping cart contains " + "{0,choice,0#no items|1#one
item|1< {0} items
```

This message represents three possibilities:

- Your shopping cart contains no items.
- Your shopping cart contains one item.
- Your shopping cart contains `{0}` items.

The value of the parameter replaces the `{0}` from the message in the sentence in the third bullet. This is an example of a value-binding-enabled tag attribute accepting a complex JSP 2.0 EL expression.

An `outputFormat` tag can include more than one `param` tag for those messages that have more than one parameter that must be concatenated into the message. If you have more than one parameter for one message, make sure that you put the `param` tags in the proper order so that the data is inserted in the correct place in the message.

A page author can also hardcode the data to be substituted in the message by using a literal value with the `value` attribute on the `param` tag.

Using the inputSecret Tag

The `inputSecret` tag renders an `<input type="password">` HTML tag. When the user types a string into this field, a row of asterisks is displayed instead of the text the user types. The Duke's Bookstore application does not include this tag, but here is an example of one:

```
<h:inputSecret redisplay="false"
  value="#{LoginBean.password}" />
```

In this example, the `redisplay` attribute is set to `false`. This will prevent the password from being displayed in a query string or in the source file of the resulting HTML page.

The UIPanel Component

The `UIPanel` component is used as a layout container for its children. When you use the renderers from the HTML render kit, `UIPanel` is rendered as an HTML table. This component differs from `UIData` in that `UIData` can dynamically add or delete rows to accommodate the underlying data source, whereas `UIPanel` must have the number of rows predetermined. Table 18–4 lists all the renderers and tags corresponding to the `UIPanel` component.

The `panelGrid` tag is used to represent an entire table. The `panelGroup` tag is used to represent rows in a table. Other UI component tags are used to represent individual cells in the rows.

Table 18–4 `UIPanel` Renderers and Tags

Renderer	Tag	Renderer Attributes	Function
`Grid`	`panelGrid`	`columnClasses, columns, footerClass, headerClass, panel-Class, rowClasses`	Displays a table
`Group`	`panelGroup`		Groups a set of components under one parent

The `panelGrid` tag has a set of attributes that specify CSS stylesheet classes: `columnClasses`, `footerClass`, `headerClass`, `panelClass`, and `rowClasses`. These stylesheet attributes are not required. It also has a `columns` attribute. The `columns` attribute is required if you want your table to have more than one column because the `columns` attribute tells the renderer how to group the data in the table.

If a `headerClass` is specified, the `panelGrid` must have a header as its first child. Similarly, if a `footerClass` is specified, the `panelGrid` must have a footer as its last child.

The Duke's Bookstore application includes three `panelGrid` tags on the `bookcashier.jsp` page. Here is a portion of one of them:

```
<h:panelGrid columns="3" headerClass="list-header"
  rowClasses="list-row-even, list-row-odd"
  styleClass="list-background"
  title="#{bundle.Checkout}">
  <f:facet name="header">
    <h:outputText value="#{bundle.Checkout}"/>
  </f:facet>
  <h:outputText value="#{bundle.Name}" />
  <h:inputText id="name" size="50"
    value="#{cashier.name}"
    required="true">
    <f:valueChangeListener
      type="listeners.NameChanged" />
  </h:inputText>
  <h:message styleClass="validationMessage" for="name"/>
  <h:outputText value="#{bundle.CCNumber}"/>
  <h:inputText id="ccno" size="19"
    converter="CreditCardConverter" required="true">
    <bookstore:formatValidator
      formatPatterns="9999999999999999|
        9999 9999 9999 9999|9999-9999-9999-9999"/>
  </h:inputText>
  <h:message styleClass="validationMessage"  for="ccno"/>
  ...
</h:panelGrid>
```

This `panelGrid` tag is rendered to a table that contains controls for the customer of the bookstore to input personal information. This `panelGrid` uses stylesheet tags classes to format the table. The CSS classes are defined in the `stylesheet.css` file in the `<INSTALL>/j2eetutorial14/examples/web/bookstore6/web/` directory. The `list-header` definition is

```
.list-header {
  background-color: #ffffff;
  color: #000000;
  text-align: center;
}
```

Because the `panelGrid` tag specifies a `headerClass`, the `panelGrid` must contain a header. The example `panelGrid` tag uses a `facet` tag for the header. Facets can have only one child, and so a `panelGroup` tag is needed if you want to group more than one component within a `facet`. Because the example `panelGrid` tag has only one cell of data, a `panelGroup` tag is not needed.

A `panelGroup` tag can also be used to encapsulate a nested tree of components so that the tree of components appears as a single component to the parent component.

The data represented by the nested component tags is grouped into rows according to the value of the `columns` attribute of the `panelGrid` tag. The `columns` attribute in the example is set to `"3"`, and therefore the table will have three columns. In which column each component is displayed is determined by the order that the component is listed on the page modulo 3. So if a component is the fifth one in the list of components, that component will be in the 5 modulo 3 column, or column 2.

The UISelectBoolean Component

The `UISelectBoolean` class defines components that have a `boolean` value. The `selectBooleanCheckbox` tag is the only tag that JavaServer Faces technology provides for representing `boolean` state. The Duke's Bookstore application includes a `selectBooleanCheckbox` tag on the `bookcashier.jsp` page:

```
<h:selectBooleanCheckbox
  id="fanClub"
  rendered="false"
  binding="#{cashier.specialOffer}" />
<h:outputLabel
  for="fanClubLabel"
  rendered="false"
  binding="#{cashier.specialOfferText}">
  <h:outputText
    id="fanClubLabel"
    value="#{bundle.DukeFanClub}" />
</h:outputLabel>
```

This example tag displays a checkbox to allow users to indicate whether they want to join the Duke Fan Club. The label for the checkbox is rendered by the `outputLabel` tag. The actual text is represented by the nested `outputText` tag. Binding a Component Instance to a Bean Property (page 718) discusses this example in more detail.

The UISelectMany Component

The `UISelectMany` class defines a component that allows the user to select zero or more values from a set of values. This component can be rendered as a set of checkboxes, a list box, or a menu. This section explains the `selectManyCheckbox` tag. The `selectManyListbox` tag and `selectManyMenu` tag are written in a similar way.

A list box differs from a menu in that it displays a subset of items in a box, whereas a menu displays only one item at a time until you select the menu. The `size` attribute of the `selectManyListbox` tag determines the number of items displayed at one time. The list box includes a scrollbar for scrolling through any remaining items in the list.

Using the selectManyCheckbox Tag

The `selectManyCheckbox` tag renders a set of checkboxes, with each checkbox representing one value that can be selected. Duke's Bookstore uses a `selectManyCheckbox` tag on the `bookcashier.jsp` page to allow the user to subscribe to one or more newsletters:

```
<h:selectManyCheckbox
  id="newsletters"
  layout="pageDirection"
  value="#{cashier.newsletters}">
  <f:selectItems
    value="#{newsletters}"/>
</h:selectManyCheckbox>
```

The `value` attribute of the `selectManyCheckbox` tag identifies the `CashierBean` backing bean property, `newsletters`, for the current set of newsletters. This property holds the values of the currently selected items from the set of checkboxes.

The `layout` attribute indicates how the set of checkboxes are arranged on the page. Because layout is set to `pageDirection`, the checkboxes are arranged vertically. The default is `lineDirection`, which aligns the checkboxes horizontally.

The `selectManyCheckbox` tag must also contain a tag or set of tags representing the set of checkboxes. To represent a set of items, you use the `selectItems` tag. To represent each item individually, you use a `selectItem` tag for each item. The UISelectItem, UISelectItems, and UISelectItemGroup Components (page 700) explains these two tags in more detail.

The UIMessage and UIMessages Components

The `UIMessage` and `UIMessages` components are used to display error messages. Here is an example `message` tag from the `guessNumber` application, discussed in Steps in the Development Process (page 635):

```
<h:inputText id="userNo" value="#{UserNumberBean.userNumber}"
  <f:validateLongRange minimum="0" maximum="10" />
...
<h:message
```

```
    style="color: red;
    font-family: 'New Century Schoolbook', serif;
    font-style: oblique;
    text-decoration: overline" id="errors1" for="userNo"/>
```

The `for` attribute refers to the ID of the component that generated the error message. The `message` tag will display the error message wherever it appears on the page.

The `style` attribute allows you to specify the style of the text of the message. In the example in this section, the text will be red, New Century Schoolbook, serif font family, and oblique style, and a line will appear over the text.

If you use the `messages` tag instead of the `message` tag, all error messages will display.

The UISelectOne Component

A `UISelectOne` component allows the user to select one value from a set of values. This component can be rendered as a list box, a radio button, or a menu. This section explains the `selectOneMenu` tag. The `selectOneRadio` and `selectOneListbox` tags are written in a similar way. The `selectOneListbox` tag is similar to the `selectOneMenu` tag except that `selectOneListbox` defines a `size` attribute that determines how many of the items are displayed at once.

Using the selectOneMenu Tag

The `selectOneMenu` tag represents a component that contains a list of items, from which a user can choose one item. The menu is also commonly known as a drop-down list or a combo box. The following code example shows the `selectOneMenu` tag from the `bookcashier.jsp` page of the Duke's Bookstore application. This tag allows the user to select a shipping method:

```
<h:selectOneMenu   id="shippingOption"
  required="true"
  value="#{cashier.shippingOption}">
  <f:selectItem
    itemValue="2"
    itemLabel="#{bundle.QuickShip}"/>
  <f:selectItem
    itemValue="5"
    itemLabel="#{bundle.NormalShip}"/>
```

```
      <f:selectItem
         itemValue="7"
         itemLabel="#{bundle.SaverShip}"/>
   </h:selectOneMenu>
```

The `value` attribute of the `selectOneMenu` tag maps to the property that holds the currently selected item's value.

Like the `selectOneRadio` tag, the `selectOneMenu` tag must contain either a `selectItems` tag or a set of `selectItem` tags for representing the items in the list. The next section explains these two tags.

The UISelectItem, UISelectItems, and UISelectItemGroup Components

`UISelectItem` and `UISelectItems` represent components that can be nested inside a `UISelectOne` or a `UISelectMany` component. `UISelectItem` is associated with a `SelectItem` instance, which contains the value, label, and description of a single item in the `UISelectOne` or `UISelectMany` component.

The `UISelectItems` instance represents either of the following:

- A set of `SelectItem` instances, containing the values, labels, and descriptions of the entire list of items
- A set of `SelectItemGroup` instances, each of which represents a set of `SelectItem` instances

Figure 18–2 shows an example of a list box constructed with a `SelectItems` component representing two `SelectItemGroup` instances, each of which represents two categories of beans. Each category is an array of `SelectItem` instances.

The `selectItem` tag represents a `UISelectItem` component. The `selectItems` tag represents a `UISelectItems` component. You can use either a set of `select-Item` tags or a single `selectItems` tag within your `selectOne` or `selectMany` tag.

The advantages of using the `selectItems` tag are as follows:

- You can represent the items using different data structures, including `Array`, `Map`, and `Collection`. The data structure is composed of `Selec-tItem` instances or `SelectItemGroup` instances.

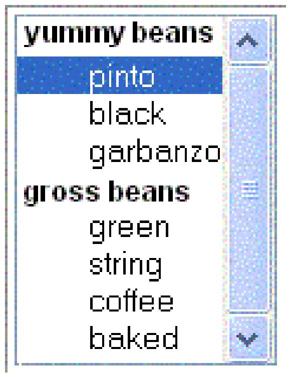


Figure 18–2 An Example List Box Created Using `SelectItemGroup` Instances

- You can concatenate different lists together into a single `UISelectMany` or `UISelectOne` component and group the lists within the component, as shown in Figure 18–2.
- You can dynamically generate values at runtime.

The advantages of using `selectItem` are as follows:

- The page author can define the items in the list from the page.
- You have less code to write in the bean for the `selectItem` properties.

For more information on writing component properties for the `UISelectItems` components, see Writing Component Properties (page 730). The rest of this section shows you how to use the `selectItems` and `selectItem` tags.

Using the selectItems Tag

Here is the `selectManyCheckbox` tag from the section The UISelectMany Component (page 697):

```
<h:selectManyCheckbox
  id="newsletters"
  layout="pageDirection"
  value="#{cashier.newsletters}">
  <f:selectItems
    value="#{newsletters}"/>
</h:selectManyCheckbox>
```

The `value` attribute of the `selectItems` tag is bound to the `newsletters` managed bean, which is configured in the application configuration resource file. The `newsletters` managed bean is configured as a list:

```
<managed-bean>
  <managed-bean-name>newsletters</managed-bean-name>
  <managed-bean-class>
    java.util.ArrayList</managed-bean-class>
  <managed-bean-scope>application</managed-bean-scope>
  <list-entries>
    <value-class>javax.faces.model.SelectItem</value-class>
    <value>#{newsletter0}</value>
    <value>#{newsletter1}</value>
    <value>#{newsletter2}</value>
    <value>#{newsletter3}</value>
  </list-entries>
</managed-bean>
<managed-bean>
<managed-bean-name>newsletter0</managed-bean-name>
<managed-bean-class>
  javax.faces.model.SelectItem</managed-bean-class>
<managed-bean-scope>none</managed-bean-scope>
<managed-property>
  <property-name>label</property-name>
  <value>Duke's Quarterly</value>
</managed-property>
<managed-property>
  <property-name>value</property-name>
  <value>200</value>
</managed-property>
</managed-bean>
...
```

As shown in the `managed-bean` element, the `UISelectItems` component is a collection of `SelectItem` instances. See Initializing Array and List Properties (page 799) for more information on configuring collections as beans.

You can also create the list corresponding to a `UISelectMany` or `UISelectOne` component programmatically in the backing bean. See Writing Component Properties (page 730) for information on how to write a backing bean property corresponding to a `UISelectMany` or `UISelectOne` component.

The arguments to the `SelectItem` constructor are:

- An `Object` representing the value of the item
- A `String` representing the label that displays in the `UISelectMany` component on the page
- A `String` representing the description of the item

UISelectItems Properties (page 737) describes in more detail how to write a backing bean property for a `UISelectItems` component.

Using the selectItem Tag

The `selectItem` tag represents a single item in a list of items. Here is the example from Using the selectOneMenu Tag (page 699):

```
<h:selectOneMenu
  id="shippingOption" required="true"
  value="#{cashier.shippingOption">
  <f:selectItem
    itemValue="2"
    itemLabel="#{bundle.QuickShip}"/>
  <f:selectItem
    itemValue="5"
    itemLabel="#{bundle.NormalShip}"/>
  <f:selectItem
    itemValue="7"
    itemLabel="#{bundle.SaverShip}"/>
</h:selectOneMenu>
```

The `itemValue` attribute represents the default value of the `SelectItem` instance. The `itemLabel` attribute represents the `String` that appears in the drop-down menu component on the page.

The `itemValue` and `itemLabel` attributes are value-binding-enabled, meaning that they can use value-binding expressions to refer to values in external objects. They can also define literal values, as shown in the example `selectOneMenu` tag.

Using Localized Messages

All data and messages in the Duke's Bookstore application have been completely localized for Spanish, French, German, and American English. Performing

Localization (page 741) explains how to produce the localized messages as well as how to localize dynamic data and messages.

The image map on the first page allows you to select your preferred locale. See Chapter 20 for information on how the image map custom component was created.

This section explains how to use localized static data and messages for JavaServer Faces applications. If you are not familiar with the basics of localizing Web applications, see Chapter 22. Localized static data can be included in a page by using the `loadBundle` tag, defined in `jsf_core.tld`. Follow these steps:

1. Reference a `ResourceBundle` from the page.
2. Reference the localized message located within the bundle.

A `ResourceBundle` contains a set of localized messages. For more information about resource bundles, see

```
http://java.sun.com/docs/books/tutorial/i18n/index.html
```

After the application developer has produced a `ResourceBundle`, the application architect puts it in the same directory as the application classes. Much of the data for the Duke's Bookstore application is stored in a `ResourceBundle` called `BookstoreMessages`.

Referencing a ResourceBundle from a Page

For a page with JavaServer Faces tags to use the localized messages contained in a `ResourceBundle`, the page must reference the `ResourceBundle` using a `loadBundle` tag.

The `loadBundle` tag from `bookstore.jsp` is

```
<f:loadBundle var="bundle"
  basename="messages.BookstoreMessages" />
```

The `basename` attribute value refers to the `ResourceBundle`, located in the `messages` package of the `bookstore` application. Make sure that the `basename` attribute specifies the fully qualified class name of the file.

The `var` attribute is an alias to the `ResourceBundle`. This alias can be used by other tags in the page in order to access the localized messages.

Referencing a Localized Message

To reference a localized message from a `ResourceBundle`, you use a value-binding expression from an attribute of the component tag that will display the localized data. You can reference the message from any component tag attribute that is value-binding-enabled.

The value-binding expression has the notation `"var.message"`, in which `var` matches the `var` attribute of the `loadBundle` tag, and `message` matches the key of the message contained in the `ResourceBundle` referred to by the `var` attribute. Here is an example from `bookstore.jsp`:

```
<h:outputText value="#{bundle.Talk}"/>
```

Notice that `bundle` matches the `var` attribute from the `loadBundle` tag and that `Talk` matches the key in the `ResourceBundle`.

Another example is the `graphicImage` tag from `chooseLocale.jsp`:

```
<h:graphicImage id="mapImage" url="/template/world.jpg"
  alt="#{bundle.ChooseLocale}"
  usemap="#worldMap" />
```

The `alt` attribute is value-binding-enabled, and this means that it can use value-binding expressions. In this case, the `alt` attribute refers to localized text, which will be included in the alternative text of the image rendered by this tag.

See Creating the Component Tag Handler (page 772) and Enabling Value-Binding of Component Properties (page 783) for information on how to enable value binding on your custom component's attributes.

Using the Standard Converters

The JavaServer Faces implementation provides a set of `Converter` implementations that you can use to convert component data. For more information on the conceptual details of the conversion model, see Conversion Model (page 651).

The standard `Converter` implementations, located in the `javax.faces.convert` package, are as follows:

- `BigDecimalConverter`
- `BigIntegerConverter`
- `BooleanConverter`
- `ByteConverter`
- `CharacterConverter`
- `DateTimeConverter`
- `DoubleConverter`
- `FloatConverter`
- `IntegerConverter`
- `LongConverter`
- `NumberConverter`
- `ShortConverter`

Two of these standard converters (`DateTimeConverter` and `NumberConverter`) have their own tags, which allow you to configure the format of the component data by configuring the tag attributes. Using DateTimeConverter (page 707) discusses using `DateTimeConverter`. Using NumberConverter (page 709) discusses using `NumberConverter`.

You can use the other standard converters in one of three ways:

- You can make sure that the component that uses the converter has its value bound to a backing bean property of the same type as the converter.
- You can refer to the converter by class or by its ID using the component tag's `converter` attribute. The ID is defined in the application configuration resource file (see Application Configuration Resource File, page 792).
- You can refer to the converter by its ID using the `converterId` attribute of the `converter` tag.

The latter two will convert the component's local value. The first method will convert the model value of the component. For example, if you want a component's data to be converted to an `Integer`, you can bind the component to a property similar to this:

```
Integer age = 0;
public Integer getAge(){ return age;}
public void setAge(Integer age) {this.age = age;}
```

Alternatively, if the component is not bound to a bean property, you can use the converter attribute on the component tag:

```
<h:inputText value="#{LoginBean.Age}"
  converter="javax.faces.convert.IntegerConverter" />
```

The data corresponding to this tag will be converted to a java.lang.Integer. Notice that the Integer type is already a supported type of the NumberConverter. If you don't need to specify any formatting instructions using the convertNumber tag attributes, and if one of the other converters will suffice, you can simply reference that converter using the component tag's converter attribute.

Finally, you can nest a converter tag within the component tag and refer to the converter's ID via the converter tag's converterId attribute. If the tag is referring to a custom converter, the value of converterID must match the ID in the application configuration resource file. Here is an example:

```
<h:inputText value="#{LoginBean.Age}" />
  <f:converter converterId="Integer" />
</h:inputText>
```

Using DateTimeConverter

You can convert a component's data to a java.util.Date by nesting the convertDateTime tag inside the component tag. The convertDateTime tag has several attributes that allow you to specify the format and type of the data. Table 18–5 lists the attributes.

Here is a simple example of a convertDateTime tag from the bookreceipt.jsp page:

```
<h:outputText value="#{cashier.shipDate}">
  <f:convertDateTime dateStyle="full" />
</h:outputText>
```

Here is an example of a date and time that this tag can display:

```
Saturday, Feb 22, 2003
```

You can also display the same date and time using this tag:

```
<h:outputText value="#{cashier.shipDate}">
  <f:convertDateTime
     pattern="EEEEEEEE, MMM dd, yyyy" />
</h:outputText>
```

Table 18–5 `convertDateTime` Tag Attributes

Attribute	Type	Description
`dateStyle`	`String`	Defines the format, as specified by `java.text.DateFormat`, of a date or the date part of a `date` string. Applied only if `type` is `date` (or both) and `pattern` is not defined. Valid values: `default`, `short`, `medium`, `long`, and `full`. If no value is specified, `default` is used.
`locale`	`String` or `Locale`	`Locale` whose predefined styles for dates and times are used during formatting or parsing. If not specified, the `Locale` returned by `FacesContext.getLocale` will be used.
`pattern`	`String`	Custom formatting pattern that determines how the date/time string should be formatted and parsed. If this attribute is specified, `dateStyle`, `timeStyle`, and `type` attributes are ignored.
`timeStyle`	`String`	Defines the format, as specified by `java.text.DateFormat`, of a `time` or the time part of a `date` string. Applied only if `type` is time and `pattern` is not defined. Valid values: `default`, `short`, `medium`, `long`, and `full`. If no value is specified, `default` is used.
`timeZone`	`String` or `TimeZone`	Time zone in which to interpret any time information in the `date` string.
`type`	`String`	Specifies whether the string value will contain a `date`, a `time`, or both. Valid values are `date`, `time`, or both. If no value is specified, `date` is used.

If you want to display the example date in Spanish, you can use the `parseLocale` attribute:

```
<h:inputText value="#{cashier.shipDate}">
  <f:convertDateTime dateStyle="full"
     locale="Locale.SPAIN"
     timeStyle="long" type="both" />
</h:inputText>
```

This tag would display

```
Sabado, Feb 22, 2003
```

Please refer to the Customizing Formats lesson of the Java Tutorial at `http://java.sun.com/docs/books/tutorial/i18n/format/simpleDateFormat.html` for more information on how to format the output using the `pattern` attribute of the `convertDateTime` tag.

Using NumberConverter

You can convert a component's data to a `java.lang.Number` by nesting the `convertNumber` tag inside the component tag. The `convertNumber` tag has several attributes that allow you to specify the format and type of the data. Table 18–6 lists the attributes.

Table 18–6 `convertNumber` Attributes

Attribute	Type	Description
`currencyCode`	`String`	ISO4217 currency code, used only when formatting currencies.
`currencySymbol`	`String`	Currency symbol, applied only when formatting currencies.
`groupingUsed`	`boolean`	Specifies whether formatted output contains grouping separators.
`integerOnly`	`boolean`	Specifies whether only the integer part of the value will be parsed.
`maxFractionDigits`	`int`	Maximum number of digits formatted in the fractional part of the output.
`maxIntegerDigits`	`int`	Maximum number of digits formatted in the integer part of the output.
`minFractionDigits`	`int`	Minimum number of digits formatted in the fractional part of the output.
`minIntegerDigits`	`int`	Minimum number of digits formatted in the integer part of the output.

Continues

Table 18–6 `convertNumber` Attributes *(Continued)*

Attribute	Type	Description
`locale`	`String` or `Locale`	`Locale` whose number styles are used to format or parse data.
`pattern`	`String`	Custom formatting pattern that determines how the number string is formatted and parsed.
`type`	`String`	Specifies whether the string value is parsed and formatted as a `number`, `currency`, or `percentage`. If not specified, `number` is used.

The `bookcashier.jsp` page of Duke's Bookstore uses a `convertNumber` tag to display the total prices of the books in the shopping cart:

```
<h:outputText value="#{cart.total}" >
  <f:convertNumber type="currency"
</h:outputText>
```

Here is an example of a number this tag can display

```
$934
```

This number can also be displayed using this tag:

```
<h:outputText id="cartTotal"
  value="#{cart.Total}" >
  <f:convertNumber pattern="$####" />
</h:outputText>
```

Please refer to the Customizing Formats lesson of the Java Tutorial at `http://java.sun.com/docs/books/tutorial/i18n/format/decimalFormat.html` for more information on how to format the output using the `pattern` attribute of the `convertNumber` tag.

Registering Listeners on Components

A page author can register a listener implementation class on a component by nesting either a `valuechangeListener` tag or an `actionListener` tag within the component's tag on the page.

An application developer can instead implement these listeners as backing bean methods. To reference these methods, a page author uses the component tag's `valueChangeListener` and `actionListener` attributes, as described in Referencing a Method That Handles an ActionEvent (page 721) and Referencing a Method That Handles a ValueChangeEvent (page 722).

The Duke's Bookstore application includes a value-change listener implementation class but does not use an action listener implementation class. This section explains how to register the `NameChanged` `ValueChangeListener` and a hypothetical `LocaleChange` `ActionListener` implementation on components. Implementing Value-Change Listeners (page 748) explains how to implement `NameChanged`. Implementing Action Listeners (page 749) explains how to implement the hypothetical `LocaleChange`.

Registering a ValueChangeListener on a Component

A page author can register a `ValueChangeListener` implementation on a `UIInput` component or a component represented by one of the subclasses of `UIInput` by nesting a `valueChangeListener` tag within the component's tag on the page. Here is the tag corresponding to the `name` component from the `bookcashier.jsp` page:

```
<h:inputText  id="name" size="50" value="#{cashier.name}"
  required="true">
  <f:valueChangeListener type="listeners.NameChanged" />
</h:inputText>
```

The `type` attribute of the `valueChangeListener` tag specifies the fully qualified class name of the `ValueChangeListener` implementation.

After this component tag is processed and local values have been validated, its corresponding component instance will queue the `ValueChangeEvent` associated with the specified `ValueChangeListener` to the component.

Registering an ActionListener on a Component

A page author can register an `ActionListener` implementation on a `UICommand` component by nesting an `actionListener` tag within the component's tag on the page. Duke's Bookstore does not use any `ActionListener` implementations. Here is one of the `commandLink` tags on the `chooselocale.jsp` page, changed to reference an `ActionListener` implementation rather than a backing bean method:

```
<h:commandLink id="NAmerica" action="bookstore">
   <f:actionListener type="listeners.LocaleChange" />
</h:commandLink>
```

The `type` attribute of the `actionListener` tag specifies the fully qualified class name of the `ActionListener` implementation.

When this tag's component is activated, the component's `decode` method (or its associated `Renderer`) automatically queues the `ActionEvent` implementation associated with the specified `ActionListener` implementation to the component.

Using the Standard Validators

JavaServer Faces technology provides a set of standard classes and associated tags that page authors and application developers can use to validate a component's data. Table 18–7 lists all the standard validator classes and the tags that allow you to use the validators from the page.

Table 18–7 The Validator Classes

Validator Class	Tag	Function
`DoubleRangeValidator`	`validateDoubleRange`	Checks whether the local value of a component is within a certain range. The value must be floating-point or convertible to floating-point.
`LengthValidator`	`validateLength`	Checks whether the length of a component's local value is within a certain range. The value must be a `java.lang.String`.
`LongRangeValidator`	`validateLongRange`	Checks whether the local value of a component is within a certain range. The value must be any numeric type or `String` that can be converted to a `long`.

All these validator classes implement the `Validator` interface. Component writers and application developers can also implement this interface to define their own set of constraints for a component's value.

When using the standard `Validator` implementations, you don't need to write any code to perform validation. You simply nest the standard validator tag of your choice inside a tag that represents a component of type `UIInput` (or a subclass of `UIInput`) and provide the necessary constraints, if the tag requires it. Validation can be performed only on `UIInput` components or components whose classes extend `UIInput` because these components accept values that can be validated.

This section shows you how to use the standard `Validator` implementations.

See The UIMessage and UIMessages Components (page 698) for information on how to display validation error messages on the page.

Requiring a Value

The `name inputText` tag on the `bookcashier.jsp` page has a `required` attribute, which is set to `true`. Because of this, the JavaServer Faces implementation checks whether the value of the component is `null` or is an empty `String`.

If your component must have a non-`null` value or a `String` value at least one character in length, you should add a `required` attribute to your component tag and set it to `true`. If your tag does have a `required` attribute that is set to `true` and the value is `null` or a zero-length string, no other validators registered on the tag are called. If your tag does not have a `required` attribute set to `true`, other validators registered on the tag are called, but those validators must handle the possibility of a `null` or zero-length string.

Here is the `name inputText` tag:

```
<h:inputText id="name" size="50"
  value="#{cashier.name}" required="true">
  ...
</h:inputText>
```

Using the LongRangeValidator

The Duke's Bookstore application uses a `validateLongRange` tag on the `quantity` input field of the `bookshowcart.jsp` page:

```
<h:inputText id="quantity" size="4"
  value="#{item.quantity}" >
  <f:validateLongRange minimum="1"/>
</h:inputText>
<h:message for="quantity"/>
```

This tag requires that the user enter a number that is at least 1. The `size` attribute specifies that the number can have no more than four digits. The `validateLongRange` tag also has a `maximum` attribute, with which you can set a maximum value of the input.

Binding Component Values and Instances to External Data Sources

As explained in Backing Bean Management (page 656), a component tag can wire its component's data to a back-end data object by doing one of the following:

- Binding its component's value to a bean property or other external data source
- Binding its component's instance to a bean property

A component tag's `value` attribute uses a value-binding expression to bind a component's value to an external data source, such as a bean property. A component tag's `binding` attribute uses a value-binding expression to bind a component instance to a bean property.

When referencing the property using the component tag's `value` attribute, you need to use the proper syntax. For example, suppose a backing bean called `MyBean` has this `int` property:

```
int currentOption = null;
int getCurrentOption(){...}
void setCurrentOption(int option){...}
```

The `value` attribute that references this property must have this value-binding expression:

```
"#{MyBean.currentOption}"
```

Table 18–8 Example Value-Binding Expressions

Value	Expression
A Boolean	`cart.numberOfItems > 0`
A property initialized from a context `init` parameter	`initParam.quantity`
A bean property	`CashierBean.name`
Value in an array	`books[3]`
Value in a collection	`books["fiction"]`
Property of an object in an array of objects	`books[3].price`

In addition to binding a component's value to a bean property, the `value` attribute can specify a literal value or can map the component's data to any primitive (such as `int`), structure (such as an array), or collection (such as a list), independent of a JavaBeans component. Table 18–8 lists some example value-binding expressions that you can use with the `value` attribute.

The next two sections explain in more detail how to use the `value` attribute to bind a component's value to a bean property or other external data sources and how to use the `binding` attribute to bind a component instance to a bean property

Binding a Component Value to a Property

To bind a component's value to a bean property, you specify the name of the bean and the property using the `value` attribute. As explained in Backing Bean Management (page 656), the value-binding expression of the component tag's `value` attribute must match the corresponding managed bean declaration in the application configuration resource file.

This means that the name of the bean in the value-binding expression must match the `managed-bean-name` element of the managed bean declaration up to the first . in the expression. Similarly, the part of the value-binding expression after the . must match the name specified in the corresponding `property-name` element in the application configuration resource file.

For example, consider this managed bean configuration, which configures the ImageArea bean corresponding to the North America part of the image map on the chooselocale.jsp page of the Duke's Bookstore application:

```
<managed-bean>
  <managed-bean-name> NA </managed-bean-name>
  <managed-bean-class> model.ImageArea </managed-bean-class>
  <managed-bean-scope> application </managed-bean-scope>
  <managed-property>
    <property-name>shape</property-name>
    <value>poly</value>
  </managed-property>
  <managed-property>
    <property-name>alt</property-name>
    <value>NAmerica</value>
  </managed-property>
  ...
</managed-bean>
```

This example configures a bean called NA, which has several properties, one of which is called shape.

Although the area tags on the chooselocale.jsp page do not bind to an ImageArea property (they bind to the bean itself), to do this, you refer to the property using a value-binding expression from the value attribute of the component's tag:

```
<h:outputText value="#{NA.shape}" />
```

Much of the time you will not include definitions for a managed bean's properties when configuring it. You need to define a property and its value only when you want the property to be initialized with a value when the bean is initialized.

If a component tag's value attribute must refer to a property that is not initialized in the managed-bean configuration, the part of the value-binding expression after the . must match the property name as it is defined in the backing bean.

See Application Configuration Resource File (page 792) for information on how to configure beans in the application configuration resource file.

Writing Component Properties (page 730) explains in more detail how to write the backing bean properties for each of the component types.

Binding a Component Value to an Implicit Object

One external data source that a `value` attribute can refer to is an implicit object.

The `bookreceipt.jsp` page of the Duke's Bookstore application includes a reference to an implicit object from a parameter substitution tag:

```
<h:outputFormat  title="thanks" value="#{bundle.ThankYouParm}">
  <f:param value="#{sessionScope.name}"/>
</h:outputFormat>
```

This tag gets the name of the customer from the session scope and inserts it into the parameterized message at the key `ThankYouParm` from the resource bundle. For example, if the name of the customer is Gwen Canigetit, this tag will render:

```
Thank you, Gwen Canigetit, for purchasing your books from us.
```

The `name` tag on the `bookcashier.jsp` page has the `NameChanged` listener implementation registered on it. This listener saves the customer's name in the session scope when the `bookcashier.jsp` page is submitted. See Implementing Value-Change Listeners (page 748) for more information on how this listener works. See Registering a ValueChangeListener on a Component (page 711) to learn how the listener is registered on the tag.

Retrieving values from other implicit objects is done in a similar way to the example shown in this section. Table 18–9 lists the implicit objects that a value attribute can refer to. All of the implicit objects except for the scope objects are read-only and therefore should not be used as a value for a `UIInput` component.

Table 18–9 Implicit Objects

Implicit Object	**What It Is**
`applicationScope`	A `Map` of the application scope attribute values, keyed by attribute name
`cookie`	A `Map` of the cookie values for the current request, keyed by cookie name
`facesContext`	The `FacesContext` instance for the current request

Continues

Table 18–9 Implicit Objects *(Continued)*

Implicit Object	What It Is
`header`	A `Map` of HTTP header values for the current request, keyed by header name
`headerValues`	A `Map` of `String` arrays containing all the header values for HTTP headers in the current request, keyed by header name
`initParam`	A `Map` of the context initialization parameters for this Web application
`param`	A `Map` of the request parameters for this request, keyed by parameter name
`paramValues`	A `Map` of `String` arrays containing all the parameter values for request parameters in the current request, keyed by parameter name
`requestScope`	A `Map` of the request attributes for this request, keyed by attribute name
`sessionScope`	A `Map` of the session attributes for this request, keyed by attribute name
`view`	The root `UIComponent` in the current component tree stored in the `FacesRequest` for this request

Binding a Component Instance to a Bean Property

A component instance can be bound to a bean property using a value-binding expression with the `binding` attribute of the component's tag. You usually bind a component instance rather than its value to a bean property if the bean must dynamically change the component's attributes.

Here are two tags from the `bookcashier.jsp` page that bind components to bean properties:

```
<h:selectBooleanCheckbox
  id="fanClub"
  rendered="false"
  binding="#{cashier.specialOffer}" />
<h:outputLabel for="fanClubLabel"
  rendered="false"
  binding="#{cashier.specialOfferText}"  >
```

```
    <h:outputText id="fanClubLabel"
      value="#{bundle.DukeFanClub}"
    />
  </h:outputLabel>
```

The `selectBooleanCheckbox` tag renders a checkbox and binds the `fanClub` `UISelectBoolean` component to the `specialOffer` property of `CashierBean`. The `outputLabel` tag binds the component representing the checkbox's label to the `specialOfferText` property of `CashierBean`. If the application's locale is English, the `outputLabel` tag renders:

```
I'd like to join the Duke Fan Club, free with my purchase of over
$100
```

The `rendered` attributes of both tags are set to `false`, which prevents the checkbox and its label from being rendered. If the customer orders more than $100 (or 100 euros) worth of books and clicks the `Submit` button, the `submit` method of `CashierBean` sets both components' `rendered` properties to `true`, causing the checkbox and its label to be rendered.

These tags use component bindings rather than value bindings because the backing bean must dynamically set the values of the components' `rendered` properties.

If the tags were to use value bindings instead of component bindings, the backing bean would not have direct access to the components, and would therefore require additional code to access the components from the `FacesContext` to change the components' `rendered` properties.

Writing Properties Bound to Component Instances (page 739) explains how to write the bean properties bound to the example components and also discusses how the `submit` method sets the `rendered` properties of the components.

Referencing a Backing Bean Method

A component tag has a set of attributes for referencing backing bean methods that can perform certain functions for the component associated with the tag. These attributes are summarized in Table 18–10.

Only components that implement `ActionSource` can use the `action` and `actionListener` attributes. Only `UIInput` components or components that extend `UIInput` can use the `validator` or `valueChangeListener` attributes.

Table 18–10 Component Tag Attributes that Reference Backing Bean Methods

Attribute	Function
`action`	Refers to a backing bean method that performs navigation processing for the component and returns a logical outcome `String`
`actionListener`	Refers to a backing bean method that handles `ActionEvents`
`validator`	Refers to a backing bean method that performs validation on the component's value
`valueChangeListener`	Refers to a backing bean method that handles `ValueChan-geEvents`

The component tag refers to a backing bean method using method-binding expression as a value of one of the attributes. The following four sections give examples of how to use the four different attributes.

Referencing a Method That Performs Navigation

If your page includes a component (such as a button or hyperlink) that causes the application to navigate to another page when the component is activated, the tag corresponding to this component must include an `action` attribute. This attribute does one of the following:

- Specifies a logical outcome `String` that tells the application which page to access next
- References a backing bean method that performs some processing and returns a logical outcome `String`

The `bookcashier.jsp` page of the Duke's Bookstore application has a `command-Button` tag that refers to a backing bean method that calculates the shipping date. If the customer has ordered more than $100 (or 100 euros) worth of books, this method also sets the `rendered` properties of some of the components to `true` and returns `null`; otherwise it returns `receipt`, which causes the `bookreceipt.jsp` page to display. Here is the `commandButton` tag from the `bookcashier.jsp` page:

```
<h:commandButton
  value="#{bundle.Submit}"
  action="#{cashier.submit}" />
```

The `action` attribute uses a method-binding expression to refer to the `submit` method of `CashierBean`. This method will process the event fired by the component corresponding to this tag.

Writing a Method to Handle Navigation (page 755) describes how to implement the `submit` method of `CashierBean`.

The application architect must configure a navigation rule that determines which page to access given the current page and the logical outcome, which is either returned from the backing bean method or specified in the tag. See Configuring Navigation Rules (page 805) for information on how to define navigation rules in the application configuration resource file.

Referencing a Method That Handles an ActionEvent

If a component on your page generates an `ActionEvent`, and if that event is handled by a backing bean method, you refer to the method by using the component's `actionListener` attribute.

The `chooselocale.jsp` page of the Duke's Bookstore application includes some components that generate action events. One of them is the `NAmerica` component:

```
<h:commandLink id="NAmerica" action="bookstore"
  actionListener="#{localeBean.chooseLocaleFromLink}">
```

The `actionListener` attribute of this component tag references the `chooseLocaleFromLink` method using a method-binding expression. The `chooseLocaleFromLink` method handles the event of a user clicking on the hyperlink rendered by this component.

The `actionListener` attribute can be used only with the tags of components that implement `ActionSource`. These include `UICommand` components.

Writing a Method to Handle an ActionEvent (page 757) describes how to implement a method that handles an action event.

Referencing a Method That Performs Validation

If the input of one of the components on your page is validated by a backing bean method, you refer to the method from the component's tag using the `validator` attribute.

The Coffee Break application includes a method that performs validation of the `email` input component on the `checkoutForm.jsp` page. Here is the tag corresponding to this component:

```
<h:inputText id="email" value="#{checkoutFormBean.email}"
  size="25" maxlength="125"
  validator="#{checkoutFormBean.validateEmail}"/>
```

This tag references the `validateEmail` method described in Writing a Method to Perform Validation (page 757) using a method-binding expression.

The `validator` attribute can be used only with `UIInput` components or those components whose classes extend `UIInput`.

Writing a Method to Perform Validation (page 757) describes how to implement a method that performs validation.

Referencing a Method That Handles a ValueChangeEvent

If you want a component on your page to generate a `ValueChangeEvent` and you want that event to be handled by a backing bean method, you refer to the method using the component's `valueChangeListener` attribute.

The `name` component on the `bookcashier.jsp` page of the Duke's Bookstore application references a `ValueChangeListener` implementation that handles the event of a user entering a name in the `name` input field:

```
<h:inputText
  id="name"
  size="50"
  value="#{cashier.name}"
  required="true">
  <f:valueChangeListener type="listeners.NameChanged" />
</h:inputText>
```

For illustration, Writing a Method to Handle a Value-Change Event (page 758) describes how to implement this listener with a backing bean method instead of a listener implementation class. To refer to this backing bean method, the tag uses the `valueChangeListener` attribute:

```
<h:inputText
  id="name"
  size="50"
  value="#{cashier.name}"
  required="true"
  valueChangeListener="#{cashier.processValueChangeEvent}" />
</h:inputText>
```

The `valueChangeListener` attribute of this component tag references the `processValueChange` method of `CashierBean` using a method-binding expression. The `processValueChange` method handles the event of a user entering his name in the input field rendered by this component.

The `valueChangeListener` attribute can be used only with the tags of `UIInput` components and components whose classes extend `UIInput`.

Writing a Method to Handle a Value-Change Event (page 758) describes how to implement a method that handles a `ValueChangeEvent`.

Using Custom Objects

As a page author, you might need to use custom converters, validators, or components packaged with the application on your JSP pages.

A custom converter is applied to a component either by using the component tag's `converter` attribute or by nesting a `converter` tag inside the component's tag.

A custom validator is applied to a component by nesting either a `validator` tag or the validator's custom tag inside the component's tag.

To use a custom component, you use the custom tag associated with the component.

As explained in Setting Up a Page (page 676), you must ensure that the TLD that defines the custom tags is packaged in the application. TLD files are stored in the `WEB-INF` directory or subdirectory of the WAR file or in the `META-INF/` directory or subdirectory of a tag library packaged in a JAR.

Next, you include a `taglib` declaration so that the page has access to the tags. All custom objects for the Duke's Bookstore application are defined in `bookstore.tld`. Here is the `taglib` declaration that you would include on your page so that you can use the tags from this TLD:

```
<%@ taglib uri="/WEB-INF/bookstore.tld" prefix="bookstore" %>
```

When including the custom tag in the page, you can consult the TLD to determine which attributes the tag supports and how they are used.

The next three sections describe how to use the custom converter, validator, and UI components included in the Duke's Bookstore application.

Using a Custom Converter

To apply the data conversion performed by a custom converter to a particular component's value, you must either set the `converter` attribute of the component's tag to the `Converter` implementation's identifier or set the nested `converter` tag's `converterId` attribute to the `Converter` implementation's identifier. The application architect provides this identifier when registering the `Converter` with the application, as explained in Registering a Custom Converter (page 804). Creating a Custom Converter (page 744) explains how a custom converter is implemented.

The identifier for the `CreditCardConverter` is `creditCardConverter`. The `CreditCardConverter` is registered on the `ccno` component, as shown in this tag from the `bookcashier.jsp` page:

```
<h:inputText id="ccno"
  size="19"
  converter="CreditCardConverter"
  required="true">
  ...
</h:inputText>
```

By setting the `converter` attribute of a component's tag to the converter's identifier, you cause that component's local value to be automatically converted according to the rules specified in the `Converter` implementation.

A page author can use the same custom converter with any similar component by simply supplying the `Converter` implementation's identifier to the `converter` attribute of the component's tag or to the `convertId` attribute of the nested `converter` tag.

Using a Custom Validator

To use a custom validator in a JSP page, you must nest the validator's custom tag inside the tag of the component whose value you want to be validated by the custom validator.

Here is the `formatValidator` tag from the `ccno` field on the `bookcashier.jsp` page of the Duke's Bookstore application:

```
<h:inputText id="ccno" size="19"
  ...
  required="true">
  <bookstore:formatValidator
     formatPatterns="9999999999999999|9999 9999 9999 9999|
     9999-9999-9999-9999" />
</h:inputText>
<h:message styleClass="validationMessage"  for="ccno"/>
```

This tag validates the input of the `ccno` field against the patterns defined by the page author in the `formatPatterns` attribute.

You can use the same custom validator for any similar component by simply nesting the custom validator tag within the component tag.

Creating a Custom Validator (page 750) describes how to create the custom validator and its custom tag.

If the application developer who created the custom validator prefers to configure the attributes in the `Validator` implementation rather than allow the page author to configure the attributes from the page, the developer will not create a custom tag for use with the validator.

Instead, the page author must follow these steps:

1. Nest the `validator` tag inside the tag of the component whose data needs to be validated.
2. Set the `validator` tag's `validatorId` attribute to the ID of the validator that is defined in the application configuration resource file. Registering a Custom Validator (page 803) explains how to define the validator in the application configuration resource file.

The following tag registers a hypothetical validator on a component using a `validator` tag and referencing the ID of the validator:

```
<h:inputText id="name" value="#{CustomerBean.name}"
       size="10" ... >
  <f:validator validatorId="customValidator" />
  ...
</h:inputText>
```

Using a Custom Component

Using a custom component on a page is similar to using a custom validator, except that custom validator tags must be nested inside component tags. In order to use the custom component in the page, you need to declare the tag library that defines the custom tag that render the custom component. This is explained in Using Custom Objects (page 723).

The Duke's Bookstore application includes a custom image map component on the `chooselocale.jsp` page. This component allows you to select the locale for the application by clicking on a region of the image map:

```
...
<h:graphicImage id="mapImage" url="/template/world.jpg"
  alt="#{bundle.chooseLocale}"
  usemap="#worldMap" />
  <bookstore:map id="worldMap" current="NAmericas"
    immediate="true"
    action="bookstore"
    actionListener="#{localeBean.chooseLocaleFromMap}">
    <bookstore:area id="NAmerica" value="#{NA}"
      onmouseover="/template/world_namer.jpg"
      onmouseout="/template/world.jpg"
      targetImage="mapImage" />
    ...
    <bookstore:area id="France" value="#{fraA}"
      onmouseover="/template/world_france.jpg"
      onmouseout="/template/world.jpg"
      targetImage="mapImage" />
</bookstore:map>
```

The `graphicImage` tag associates an image (`world.jpg`) with an image map that is referenced in the `usemap` attribute value.

The custom `map` tag represents the custom component, `MapComponent`, specifies the image map, and contains a set of custom `area` tags. Each `area` tag represents a custom `AreaComponent` and specifies a region of the image map.

On the page, the `onmouseover` and `onmouseout` attributes define the image that is displayed when the user performs the actions described by the attributes. The page author defines what these images are. The custom renderer also renders an `onclick` attribute.

In the rendered HTML page, the `onmouseover`, `onmouseout`, and `onclick` attributes define which JavaScript code is executed when these events occur. When the user moves the mouse over a region, the `onmouseover` function associated with the region displays the map with that region highlighted. When the user moves the mouse out of a region, the `onmouseout` function redisplays the original image. When the user clicks a region, the `onclick` function sets the value of a hidden `input` tag to the ID of the selected area and submits the page.

When the custom renderer renders these attributes in HTML, it also renders the JavaScript code. The custom renderer also renders the entire `onclick` attribute rather than let the page author set it.

The custom renderer that renders the `map` tag also renders a hidden `input` component that holds the current area. The server-side objects retrieve the value of the hidden `input` field and set the locale in the `FacesContext` according to which region was selected.

Chapter 20 describes the custom tags in more detail and also explains how to create the custom image map components, renderers, and tags.