JSF: Controlling Page Navigation

Originals of Slides and Source Code for Examples:
http://www.coreservlets.com/JSF-Tutorial/

This somewhat old tutorial covers JSF 1, and is left online for those maintaining existing projects. All new projects should use JSF 2, which is both simpler and more powerful. See http://www.coreservlets.com/JSF-Tutorial/jsf2/.

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Topics in This Chapter

- JSF flow of control
- The basic steps in using JSF
- Static navigation
  - One result mapping
- Dynamic navigation
  - Multiple result mappings
- Accessing the request and response objects
- Common JSF problems

Static Navigation

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JSF Flow of Control (Highly Simplified)

A form is displayed
- Form uses f:view and h:form

The form is submitted to itself
- Original URL and ACTION URL are http://.../blah.faces

A bean is instantiated
- Listed in the managed-bean section of faces-config.xml

The action controller method is invoked
- Listed in the action attribute of h:commandButton

The action method returns a condition
- A string that matches from-outcome in the navigation rules in faces-config.xml
  - In this example, static condition is specified in form

A results page is displayed
- The page is specified by to-view-id in the navigation rules in faces-config.xml
Steps in Using JSF

1) Create a bean
   A) Properties for form data
   B) Action controller method
   C) Placeholders for results data

2) Create an input form
   A) Input fields refer to bean properties
   B) Button specifies return condition
      (or action controller method that will return condition)

3) Edit faces-config.xml
   A) Declare the bean
   B) Specify navigation rules

4) Create results pages
   Output form data and results data with h:outputText

5) Prevent direct access to JSP pages
   Use a filter that redirects blah.jsp to blah.faces

Example: Registration

- Started by copying jsf-blank-myfaces
  - Renamed it to jsf-navigation
  - Edited .settings/…component file as in previous lecture
- Original URL
  - http://hostname/jsf-navigation/register.faces
- When form submitted
  - A static page (WEB-INF/results/result.jsp) is displayed
- Static result
  - No business logic, beans, or Java code of any sort
- Main points
  - Format of original form
  - Use of navigation-rule in faces-config.xml
Main Points of This Example

• Input form has following format:
  ```
  <%@ taglib uri="http://java.sun.com/jsf/core" prefix="f" %>
  <%@ taglib uri="http://java.sun.com/jsf/html" prefix="h" %>
  <f:view>
    HTML markup
    <h:form>
      HTML markup and h:blah tags
    </h:form>
    HTML markup
  </f:view>
  ```

• faces-config.xml specifies navigation rules:
  ```
  <?xml version='1.0' encoding='UTF-8'?>
  <!DOCTYPE faces-config PUBLIC "...">
  <faces-config>
    <navigation-rule>
      <from-view-id>/blah.jsp</from-view-id>
      <navigation-case>
        <from-outcome>some string</from-outcome>
        <to-view-id>/WEB-INF/results/something.jsp</to-view-id>
      </navigation-case>
    </navigation-rule>
  </faces-config>
  ```

Step 1: Create a Bean

• Postponed until next lecture
  – This example ignores form data
  – Button in form directly specifies return condition
    • Rather than specifying an action controller method in the bean that will calculate the return condition
Step 2: Create Input Form

• Basic format
  ```html
  <%@ taglib uri="http://java.sun.com/jsf/core" prefix="f" %>
  <%@ taglib uri="http://java.sun.com/jsf/html" prefix="h" %>
  <f:view>
    ...
    <BODY>
    ...
    <h:form>
    ...
    </h:form>
    ...
  </BODY>
  </f:view>
  ```

• Invoking page
  – Actual file is `blah.jsp`
  – URL is `blah.faces`

Step 2: Create Input Form

• The `h:form` element
  – ACTION is automatically self (current URL)
  – METHOD is automatically POST

• Elements inside `h:form`
  – Use special tags to represent input elements
    • `h:inputText` corresponds to `<INPUT TYPE="TEXT">`
    • `h:inputSecret` corresponds to `<INPUT TYPE="PASSWORD">`
    • `h:commandButton` corresponds to `<INPUT TYPE="SUBMIT">`
  – In later sections, we will see that input elements will be associated with bean properties
  – For static navigation, specify simple string as action of `h:commandButton`
    • String must match navigation rule from faces-config.xml

• More info on `h:blah` elements
Step 2: Example Code (register.jsp)

```jsp
<%@ taglib uri="http://java.sun.com/jsf/core" prefix="f" %>
<%@ taglib uri="http://java.sun.com/jsf/html" prefix="h" %>
<f:view>
<<!DOCTYPE …>>
<HTML>
<HEAD>…</HEAD>
<BODY>
<CENTER>
<TABLE BORDER=5>
<TR><TH CLASS="TITLE">New Account Registration</TH></TR>
</TABLE>
<P>
<h:form>
Email address: <h:inputText/><BR>
Password: <h:inputSecret/><BR>
<h:commandButton value="Sign Me Up!" action="register"/>
</h:form>
</P>
</CENTER></BODY></HTML>
</f:view>
```

Step 2: Result

- File is …/WebContent/register.jsp
- URL is http://localhost/jsf-navigation/register.faces
Step 3: Edit faces-config.xml

• General format
  ```xml
  <?xml version='1.0' encoding='UTF-8'?>
  <!DOCTYPE faces-config PUBLIC ...>
  <faces-config>
    ...
  </faces-config>
  ```

• Specifying the navigation rules
  ```xml
  <faces-config>
    ...
  </faces-config>
  ```

Step 3: Example Code

  ```xml
  <?xml version='1.0' encoding='UTF-8'?>
  <!DOCTYPE faces-config PUBLIC ...>
  <faces-config>
    <navigation-rule>
      <from-view-id>/the-input-form.jsp</from-view-id>
      <navigation-case>
        <from-outcome>string-from-action</from-outcome>
        <to-view-id>/WEB-INF/.../something.jsp</to-view-id>
      </navigation-case>
    </navigation-rule>
  </faces-config>
  ```
Step 4: Create Results Pages

- **RequestDispatcher.forward used**
  - So page can/should be in WEB-INF

- **Example code:**
  - ../WEB-INF/results/result.jsp

```html
<!DOCTYPE ...>
<html>
  <head>...
  </head>
  <body>
    <center>
      <table border=5>
        <tr><th class="title">Success</th></tr>
        <tr><td>Success</td></tr>
      </table>
      <h2>You have registered successfully.</h2>
    </center>
  </body>
</html>
```

Step 4: Example Result

- **Note that URL is unchanged**
Step 5: Prevent Direct Access to JSP Pages

- **Filename/URL correspondence**
  - Actual files are of the form `blah.jsp`
  - URLs used are of the form `blah.faces`
  - You must prevent clients from directly accessing JSP pages
    - Since they would give erroneous results

- **Strategies**
  - You cannot put input-form JSP pages in WEB-INF
    - Because URL must correspond directly to file location
  - So, use filter in web.xml. But:
    - You have to know the extension (.faces)
    - Assumes no non-JSF .jsp pages
  - **This is a major drawback to JSF design**
Preventing Direct Access: FacesRedirectFilter

public class FacesRedirectFilter implements Filter {
    private final static String EXTENSION = "faces";

    public void doFilter(ServletRequest req,
            ServletResponse res,
            FilterChain chain)
            throws ServletException, IOException {
        HttpServletRequest request = (HttpServletRequest) req;
        HttpServletResponse response = (HttpServletResponse) res;
        String uri = request.getRequestURI();
        if (uri.endsWith(".jsp")) {
            int length = uri.length();
            String newAddress =
                uri.substring(0, length-3) + EXTENSION;
            response.sendRedirect(newAddress);
        } else { // Address ended in "/
            response.sendRedirect("index.faces");
        }
    }
}

...
Preventing Direct Access: Result

- Either URL
  - http://localhost/jsf-navigation/register.faces
  - http://localhost/jsf-navigation/register.jsp
JSF Flow of Control (Simplified)

- **A form is displayed**
  - Form uses f:view and h:form
- **The form is submitted to itself**
  - Original URL and ACTION URL are http://.../blah.faces
- **A bean is instantiated**
  - Listed in the managed-bean section of faces-config.xml
- **The action controller method is invoked**
  - Listed in the action attribute of h:commandButton
- **The action method returns a condition**
  - A string that matches from-outcome in the navigation rules in faces-config.xml
- **A results page is displayed**
  - The page is specified by to-view-id in the navigation rules in faces-config.xml
Steps in Using JSF

1) Create a bean
   A) Properties for form data
   B) Action controller method
   C) Placeholders for results data

2) Create an input form
   A) Input fields refer to bean properties
   B) Button specifies action controller method that will return condition

3) Edit faces-config.xml
   A) Declare the bean
   B) Specify navigation rules

4) Create results pages
   - Output form data and results data with h:outputText

5) Prevent direct access to JSP pages
   - Use a filter that redirects blah.jsp to blah.faces

Example: Health Plan Signup

• Original URL
  – http://hostname/jsf-navigation/signup.faces
    • Collects info to see if user qualifies for health plan

• When form submitted, one of two possible results will be displayed
  – User is accepted into health plan
  – User is rejected from health plan

• Main points
  – Specifying an action controller in the form
  – Creating an action controller method in the bean
  – Using faces-config.xml to
    • Declare bean
    • Map return conditions to output pages
Main Points of This Example

- Specify the controller with `#{beanName.methodName}`
  ```
  <h:commandButton
      value="Sign Me Up!"
      action="#{healthPlanController.signup}"/>
  ```
- Controller method returns strings corresponding to conditions
  - If null is returned, the form is redisplayed
  - Unlike with Struts, the controller need not extend a special class
- Use `faces-config.xml` to declare the controller as follows
  ```
  <faces-config>
    <managed-bean>
      <managed-bean-name>controller name</managed-bean-name>
      <managed-bean-class>controller class</managed-bean-class>
      <managed-bean-scope>request</managed-bean-scope>
    </managed-bean>
  </faces-config>
  ```
- Add multiple navigation-rule entries to `faces-config.xml`
  - One for each possible string returned by the controller
  - If no string matches, the form is redisplayed

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Scope could also be session or application

Step 1: Create a Bean

(A) Properties for form data
  - Postponed until next lecture

(B) Action controller method
  ```java
  public class HealthPlanController {
      public String signup() {
          if (Math.random() < 0.2) {
              return("accepted");
          } else {
              return("rejected");
          }
      }
  }
  ```

(C) Placeholders for results data
  - Postponed until next lecture
Step 2: Create Input Form

- Same general syntax as in previous example
  - Except for action of commandButton

```jsp
<%@ taglib uri="http://java.sun.com/jsf/core" prefix="f" %>
<%@ taglib uri="http://java.sun.com/jsf/html" prefix="h" %>
<f:view>
  ...
  <h:form>
    First name: <h:inputText/><BR>
    Last name: <h:inputText/><BR>
    ...
    <h:commandButton
      value="Sign Me Up!"
      action="#{healthPlanController.signup}"/>
  </h:form>
</f:view>
```

Step 2: Result

- File is .../WebContent/signup.jsp
- URL is http://localhost/jsf-navigation/signup.faces
Step 3: Edit faces-config.xml

(A) Declaring the bean

```xml
<faces-config>
  <managed-bean>
    <managed-bean-name>healthPlanController</managed-bean-name>
    <managed-bean-class>coreservlets.HealthPlanController</managed-bean-class>
    <managed-bean-scope>request</managed-bean-scope>
  </managed-bean>
</faces-config>
```

Use request scope unless you have a specific reason to use session scope or (rarely) application scope.

(B) Specifying navigation rules

Outcomes should match return values of controller.

```xml
<faces-config>
  <navigation-rule>
    <from-view-id>/signup.jsp</from-view-id>
    <navigation-case>
      <from-outcome>accepted</from-outcome>
      <to-view-id>/WEB-INF/results/accepted.jsp</to-view-id>
    </navigation-case>
  </navigation-rule>
  <navigation-rule>
    <from-view-id>/signup.jsp</from-view-id>
    <navigation-case>
      <from-outcome>rejected</from-outcome>
      <to-view-id>/WEB-INF/results/rejected.jsp</to-view-id>
    </navigation-case>
  </navigation-rule>
</faces-config>
```
Step 4: Create Results Pages

• \(/WEB-INF/results/accepted.jsp\)

```
<!DOCTYPE ...>
<html>
<head>...
</head>
<body>
<center>
<table border=5>
<tr><th class="title">Accepted!</th></tr>
</table>
<h2>You are accepted into our health plan.</h2>
Congratulations.
</center>
</body></html>
```

Step 4: Create Results Pages (Continued)

• \(/WEB-INF/results/rejected.jsp\)

```
<!DOCTYPE ...>
<html>
<head>...
</head>
<body>
<center>
<table border=5>
<tr><th class="title">Rejected!</th></tr>
</table>
<h2>You are rejected from our health plan.</h2>
Get lost.
</center>
</body></html>
```
Step 4: Results

You are accepted into our health plan.

Congratulations!

You are rejected from our health plan.

Get lost.

Step 5: Prevent Direct Access to JSP Pages

- Use filter that captures url-pattern *.jsp
  - No changes from previous example
Notes and Additional Capabilities

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Summary

- **Wildcards in navigation rule**
  - * for from-view-id matches any starting page
  - Omitting from-outcome results in all values matching

- **from-action in addition to from-outcome**
  - For when different buttons invoke different methods and methods have same values mapped differently. Overused.

- **Getting the request and response objects**
  
  ```java
  ExternalContext context = FacesContext.getCurrentInstance().getExternalContext();
  HttpServletRequest request = (HttpServletRequest) context.getRequest();
  HttpServletResponse response = (HttpServletResponse) context.getResponse();
  ```

- **Interleaving managed-bean & navigation-rule**
  - It is legal to alternate back and forth
Wildcards in Navigation Rules

• * for from-view-id matches any starting page
  – Used when multiple different pages map same return value to same result page

• Example
  <navigation-rule>
    <from-view-id>*</from-view-id>
    <navigation-case>
      <from-outcome>success</from-outcome>
      <to-view-id>/WEB-INF/results/success.jsp</to-view-id>
    </navigation-case>
  </navigation-rule>

Without Wildcards

<navigation-rule>
  <from-view-id>/page1.jsp</from-view-id>
  <navigation-case>
    <from-outcome>condition1</from-outcome>
    <to-view-id>/WEB-INF/results/result1.jsp</to-view-id>
  </navigation-case>
  <navigation-case>
    <from-outcome>unknown-user</from-outcome>
    <to-view-id>/WEB-INF/results/unknown.jsp</to-view-id>
  </navigation-case>
</navigation-rule>

<navigation-rule>
  <from-view-id>/page2.jsp</from-view-id>
  <navigation-case>
    <from-outcome>condition2</from-outcome>
    <to-view-id>/WEB-INF/results/result2.jsp</to-view-id>
  </navigation-case>
  <navigation-case>
    <from-outcome>unknown-user</from-outcome>
    <to-view-id>/WEB-INF/results/unknown.jsp</to-view-id>
  </navigation-case>
</navigation-rule>
**With Wildcards**

```xml
<navigation-rule>
  <from-view-id>*</from-view-id>
  <navigation-case>
    <from-outcome>unknown-user</from-outcome>
    <to-view-id>/WEB-INF/results/unknown.jsp</to-view-id>
  </navigation-case>
</navigation-rule>
```

```xml
<navigation-rule>
  <from-view-id>/page1.jsp</from-view-id>
  <navigation-case>
    <from-outcome>condition1</from-outcome>
    <to-view-id>/WEB-INF/results/result1.jsp</to-view-id>
  </navigation-case>
</navigation-rule>
```

```xml
<navigation-rule>
  <from-view-id>/page2.jsp</from-view-id>
  <navigation-case>
    <from-outcome>condition2</from-outcome>
    <to-view-id>/WEB-INF/results/result2.jsp</to-view-id>
  </navigation-case>
</navigation-rule>
```

**Wildcard Matching Return Conditions**

- Omitting from-outcome means all other return conditions match
  - Except for null, which always means redisplay form

**Example**

```xml
<navigation-rule>
  <from-view-id>/some-page.jsp</from-view-id>
  <navigation-case>
    <from-outcome>condition1</from-outcome>
    <to-view-id>/WEB-INF/results/result1.jsp</to-view-id>
  </navigation-case>
</navigation-rule>
```

```xml
<navigation-case>
  <to-view-id>/WEB-INF/results/default.jsp</to-view-id>
</navigation-case>
```

```xml
<navigation-case>
  <to-view-id>/WEB-INF/results/default.jsp</to-view-id>
</navigation-case>
```

</navigation-case>
</navigation-rule>
Explicit from-outcome

<navigation-rule>
  <from-view-id>/page1.jsp</from-view-id>
  <navigation-case>
    <from-outcome>condition1</from-outcome>
    <to-view-id>/WEB-INF/results/result1.jsp</to-view-id>
  </navigation-case>
  <navigation-case>
    <from-outcome>condition2</from-outcome>
    <to-view-id>/WEB-INF/results/result2.jsp</to-view-id>
  </navigation-case>
  <navigation-case>
    <from-outcome>condition3</from-outcome>
    <to-view-id>/WEB-INF/results/result2.jsp</to-view-id>
  </navigation-case>
  <navigation-case>
    <from-outcome>condition4</from-outcome>
    <to-view-id>/WEB-INF/results/result2.jsp</to-view-id>
  </navigation-case>
</navigation-rule>

Default (Omitted) from-outcome

<navigation-rule>
  <from-view-id>/page1.jsp</from-view-id>
  <navigation-case>
    <from-outcome>condition1</from-outcome>
    <to-view-id>/WEB-INF/results/result1.jsp</to-view-id>
  </navigation-case>
  <navigation-case>
    <to-view-id>/WEB-INF/results/result2.jsp</to-view-id>
  </navigation-case>
</navigation-rule>
• Designates the method that you came from
  – Suppose you had two buttons that invoked two different methods, and both returned "error". But you want the two "error" values to have different results pages.

```xml
<navigation-rule>
  <from-view-id>/somepage.jsp</from-view-id>
  <navigation-case>
    <from-action>${beanName.method1}</from-action>
    <from-outcome>error</from-outcome>
    <to-view-id>/WEB-INF/results/err1.jsp</to-view-id>
  </navigation-case>
  <navigation-case>
    <from-action>${beanName.method2}</from-action>
    <from-outcome>error</from-outcome>
    <to-view-id>/WEB-INF/results/err2.jsp</to-view-id>
  </navigation-case>
</navigation-rule>
```

– Easier to avoid using the same names for different things
– Rarely needed in real life, but some books (*JSF The Complete Reference*) use it needlessly.

---

• JSF controller methods do not have direct access to the request and response
  – Unlike in Struts, where controller method (execute) gets request and response automatically
  – If they are needed, use static method calls to get them

```java
ExternalContext context = FacesContext.getCurrentInstance().getExternalContext();
HttpServletRequest request = (HttpServletRequest)context.getRequest();
HttpServletResponse response = (HttpServletResponse)context.getResponse();
```

– In some environments, you cast results of getRequest and getResponse to values other than HttpServletRequest and HttpServletResponse
  • E.g., in a portlet environment, you might cast result to PortletRequest and PortletResponse
Getting the Request and Response Objects

• Purpose
  – Useful for many request properties
    • Explicit session manipulation (e.g., changing inactive interval or invalidating session)
    • Explicit cookie manipulation (e.g., long-lived cookies)
    • Reading request headers (e.g., User-Agent)
    • Looking up requesting host name
    • Not needed to get request parameters
      – Bean populated automatically as in next lecture
  – Useful for a few response properties
    • Setting status codes
    • Setting response headers
    • Setting long-lived cookies

Interleaving managed-bean and navigation-rule

• If you have several different addresses in your app, it is OK to alternate
  <managed-bean>
    Stuff for bean1
  </managed-bean>
  <navigation-rule>
    Rules for address that uses bean1
  </navigation-rule>
  <managed-bean>
    Stuff for bean2
  </managed-bean>
  <navigation-rule>
    Rules for address that uses bean2
  </navigation-rule>
  – Of course, it is also OK to put all bean defs at the top, followed by all navigation rules.
  • Whichever organization you find easier to manage
Common Problems

Pressing Button and Nothing Happens

- In JSF, many error conditions simply result in the system redisplaying the form
  - No error messages or warnings
  - Very confusing to beginning developers

- Debugging strategies for these situations
  - Many of the errors cause the process to abort at certain points. Knowing how far things got is very helpful.
  - Use print statements or IDE breakpoints
    - Put a print statement in the controller method
    - Put a print statement in the empty constructor
      - public MyBean() { System.out.println("MyBean built"); }
      - Bean should be instantiated twice for request scope
    - Put print statements in the bean setter methods
Pressing Button and Nothing Happens: Common Cases

1. Return value of controller method does not match from-outcome of navigation-case
   - Remember values are case sensitive

2. Using from-action instead of from-outcome
   <navigation-case>
   <from-action>accepted</from-action>
   <to-view-id>/WEB-INF/results/accepted.jsp</to-view-id>
   </navigation-case>
   - This is really a special case of (1), since there is now no from-outcome
   - This situation occurs frequently with Eclipse users that don't look carefully at the choices Eclipse offers in popup menu for the navigation-case entries.

3. Forgetting # in action of h:commandButton
   <h:commandButton
       value="Button Label"
       action="{beanName.methodName}"/>
   - This is really a special case of (1), since action="beanName.methodName" means the literal String "beanName.methodName" is the from-outcome
   - In this situation and several others, it is very helpful to put a print statement in controller method to see if/when it is invoked

4. Typo in from-view-id
   - This is a special case of (1), since the from-outcome applies to nonexistent page
Pressing Button and Nothing Happens: Common Cases

5. **Controller method returns null**
   - This is often done on purpose to redisplay the form, but can be done accidentally as well.

6. **Type conversion error**
   - You declare field to be of type int, but value is not an integer when you submit.
   - Behavior of redisplaying form is useful here. See validation section.

7. **Missing setter method**
   - You associate textfield with bean property foo, but there is no setFoo method in your bean.
   - Debugging hint: You will see printout for bean being instantiated, but not for controller method

8. **Missing h:form**
   - If you use h:inputText with no surrounding h:form, textfields will still appear but nothing will happen when you press submit button

Summary

- **Basic steps to using JSF**
  - Create a bean
    - For now, only contains controller method
  - Create an input form
    - The action of h:commandButton refers to controller method
  - Edit faces-config.xml
    - Declare bean
    - Define navigation rules
  - Create results pages
  - Prevent direct access to JSP pages

- **Static navigation**
  - Specify literal outcome as action of button
    - Outcome mapped by faces-config.xml to output page

- **Dynamic navigation**
  - Specify method as action of button
  - Method returns outcomes
    - Outcomes mapped by faces-config.xml to output pages
Questions?