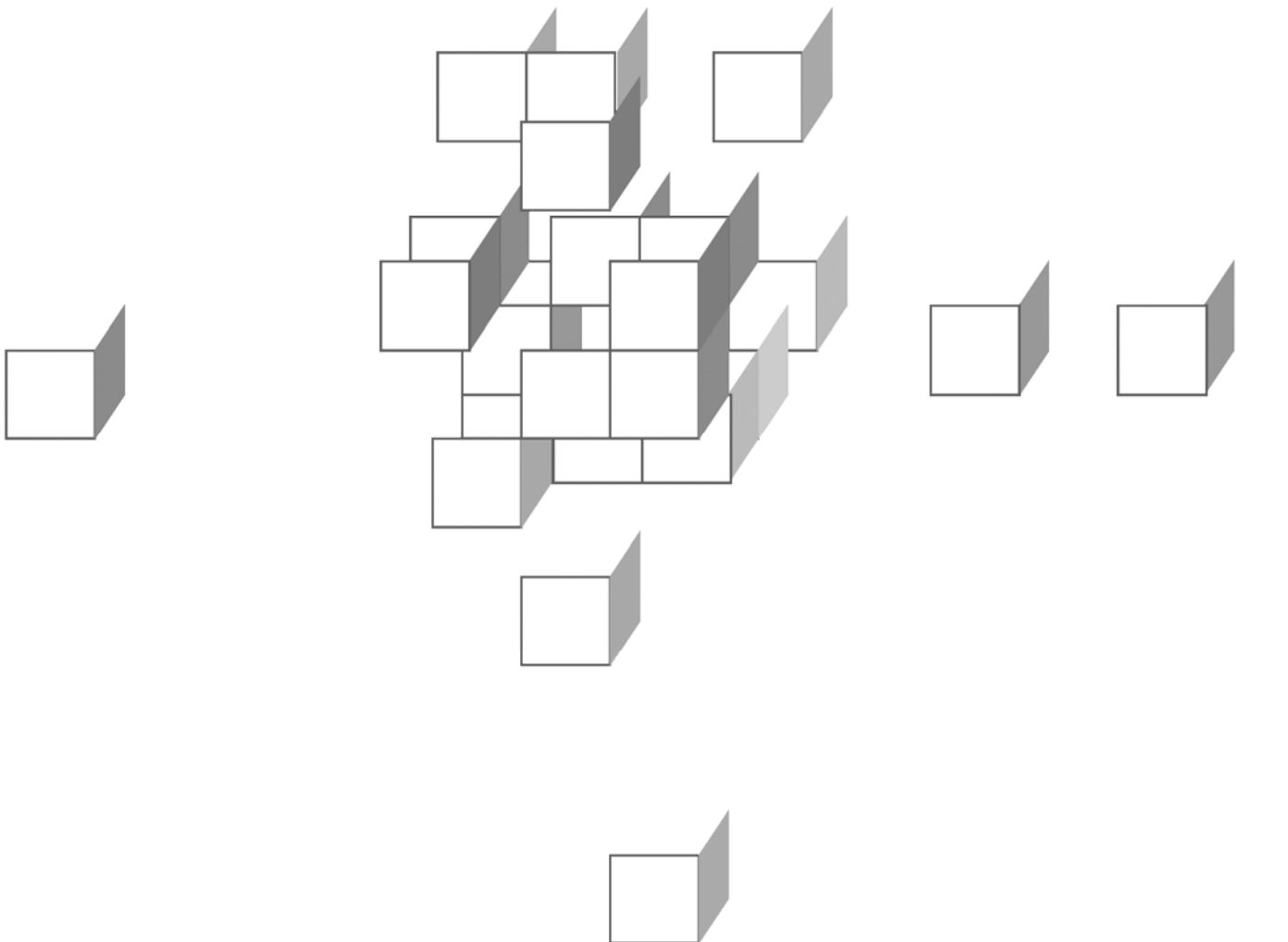


CHAPTER 12

VALIDATORS



OBJECTIVES

After completing “Validators,” you will be able to:

- Describe the JSF validator architecture.
- Use standard validators and the **required** attribute to enforce basic input-validation rules.
- Define custom error messages, support error-message localization, and apply CSS styling specifically to error output.
- Implement custom validator classes and validation methods.
- Use UI tree navigation to enforce constraints involving multiple inputs.
- Take advantage of JSR-303 Bean Validation constraints when encountered on backing beans.

Validating Input

- Well here we are, most of the way through our JSF course, and we've yet to acknowledge the sad fact that (shh):

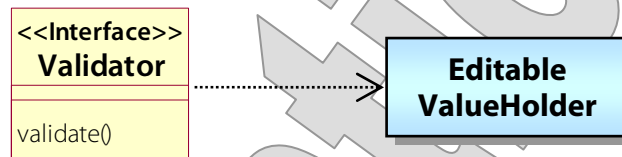
Users don't always do what they're supposed to do.

- Most web applications devote a significant portion of their logic to validating user input:
 - Did the user provide all the **required** information?
 - Are data of the correct **type** (number, boolean, date, etc.)?
 - Are given values in legal **ranges**?
 - Are values provided in correct numerical, alphabetical or chronological **order**?
 - Do values **match** where they're expected to match?
- Validation is a form of error handling, and it is **proactive**, or **eager**: we seek out possible problems and report them **immediately**.
 - This saves processing time and bandwidth.
 - It also tends to result in clearer reporting: would you rather get a message that one of the values you typed isn't legal, for a specific reason – or a **NullPointerException** from some faraway province of Java code that you probably didn't write?
- Validation is also an important application-security tool, because here's another sad truth:

Users aren't always trying do what they're supposed to do; sometimes, they're trying to break into your system.

The Validator Interface

- JSF defines the role of a **validator**: a component that is responsible for testing the validity of a component value.
- It encapsulates this basic responsibility in the **Validator** interface:

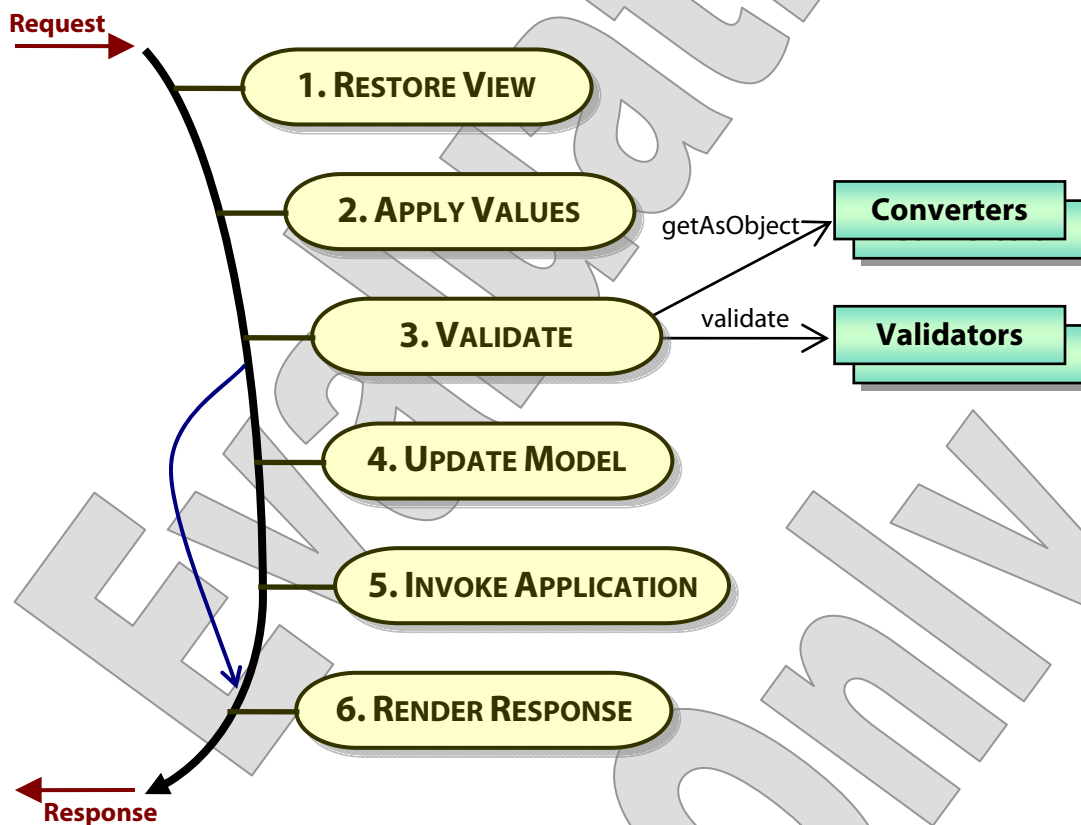


```
public interface Validator
{
    public void validate
        (FacesContext, UIComponent, Object value)
        throws ValidatorException;
}
```

- As with **Converter**, the context and component parameters often go unused, but they can come in handy for some purposes.
- Most validators just perform tests on the given **value**.
- If the value is not valid, the validator must throw a **ValidatorException**, which wraps an error message.

Handling Validity Errors

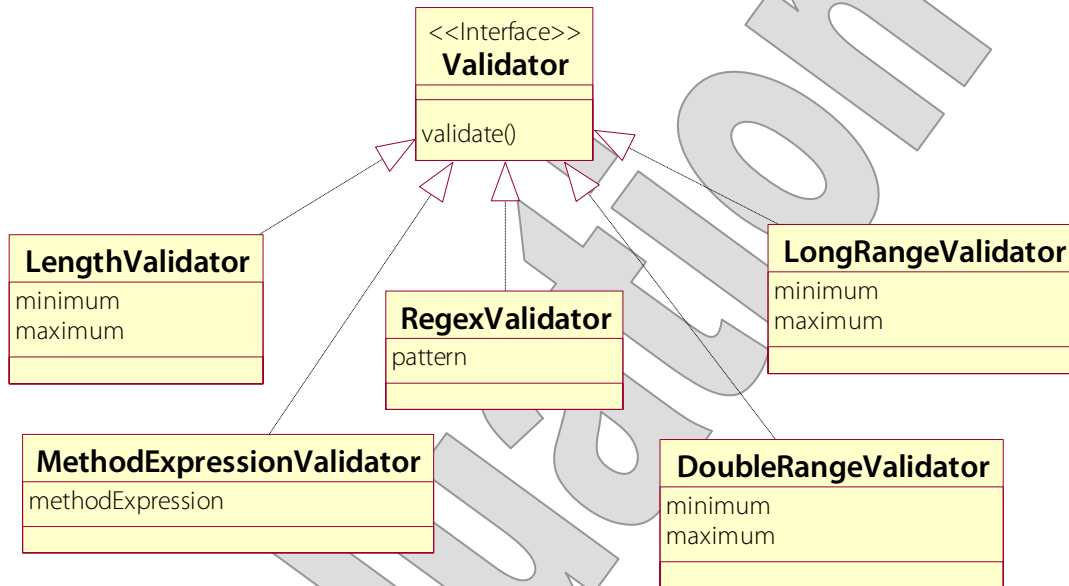
- Validators are registered on components and invoked during – you guessed it! – the Process Validations phase.
- If any **ValidatorExceptions** are caught during this phase, the associated component's **valid** property is set to false.
- At the end of the phase, if there are any invalid components, JSF bails out of the cycle, moving directly to Render Response.



- In fact the same sort of handling occurs on any conversion failures – different exceptions, different messages, same flow.

Standard Validators and Required Values

- JSF provides a handful of validators for the most common logic:



- LengthValidator** constrains the length of the lexical representation – regardless of the data type.
 - The **range validators** allow you to set a minimum value, maximum value, or both, for integral or floating-point numbers.
 - MethodExpressionValidator** is a way to trigger a method on a JavaBean and let it perform validation – this is one of three main ways in JSF to plug in custom validation logic.
 - The **RegexValidator** applies a given **pattern** as a regular expression; non-matching values are considered invalid.
- You may wonder at the absence of a **RequiredValidator**.
 - This is such a common need that JSF makes it even simpler:
 - Setting **required** to **true** on any **EditableValueHolder** causes JSF to treat a null or blank value as invalid for the component.



Declaring Validation Rules in the View

- Set **required** to **true** to force a check for a non-empty value:

```
<h:inputText value="#{bean.prop}"  
    required="true"  
/>
```

- Include the appropriate core tag as a child of the component to assign a standard validator – you can assign multiple validators:

```
<h:inputText value="#{bean.fullName}" >  
    <f:validateLength maximum="32" />  
</h:inputText>
```

```
<h:inputText value="#{bean.age}" >  
    <f:validateLongRange minimum="18" />  
</h:inputText>
```

```
<h:inputText value="#{bean.probability}" >  
    <f:validateDoubleRange minimum="0" maximum="1" />  
    <f:validateLength maximum="6" />  
</h:inputText>
```

- Note one frustrating limitation of the **DoubleRangeValidator**: it cannot be told to exclude a boundary value.
 - It will always work **inclusively** – that is, they will always allow your stated minimum or maximum value as a valid value.
 - This is fine for integer ranges, but we often find reason to find a floating-point number to be valid if it is, say, greater than a minimum (not greater than or equal to).
 - What if we want a positive number? Zero is the minimum but should be excluded. **DoubleRangeValidator** can't do that.

Required Fields

EXAMPLE

- **Examples/LandUse** provides a simple example of the use of the **required** attribute – see **docroot/detail.xhtml**:

```
<td>Parcel:</td>
<td>
  <h:inputText
    id="affectedParcel"
    label="affected parcel"
    value="#{DB.selectedProposal.affectedParcel}"
    required="true"
  />
</td>
```

- Any failure to provide required values results in an error message:

<http://localhost:8080/LandUse>

Proposal

Parcel:

Applicant:

Application date:

Proposed use:

The proposed use is required.

Proposed start date:

Proposed end date:

Strong Passwords

DEMO

- We'll begin a small case study for this chapter with a demonstration of constraining password length and format.
 - Do your work in **Demos/Validation**.
 - The completed demo is in **Examples/Passwords/Step2**.
- The starter code lays out a three-field form by which the user can register as a member of a website.
- It sets the **required** flag on each component, and uses `<h:messages>` as the simplest means of feeding error messages back to the user.
 - See **docroot/register.xhtml**:

```
<f:view>
  <h:form>
    <h:messages />
    <table>
      <tr>
        <td>User name:</td>
        <td><h:inputText
          id="name"
          value="#{member.name}"
          required="true"
        /></td>
```

- The command button will trigger navigation to a **success.jsp**, but whenever validation errors occur, JSF skips to rendering the response, and always with a **null** outcome, so the originating page is served again.

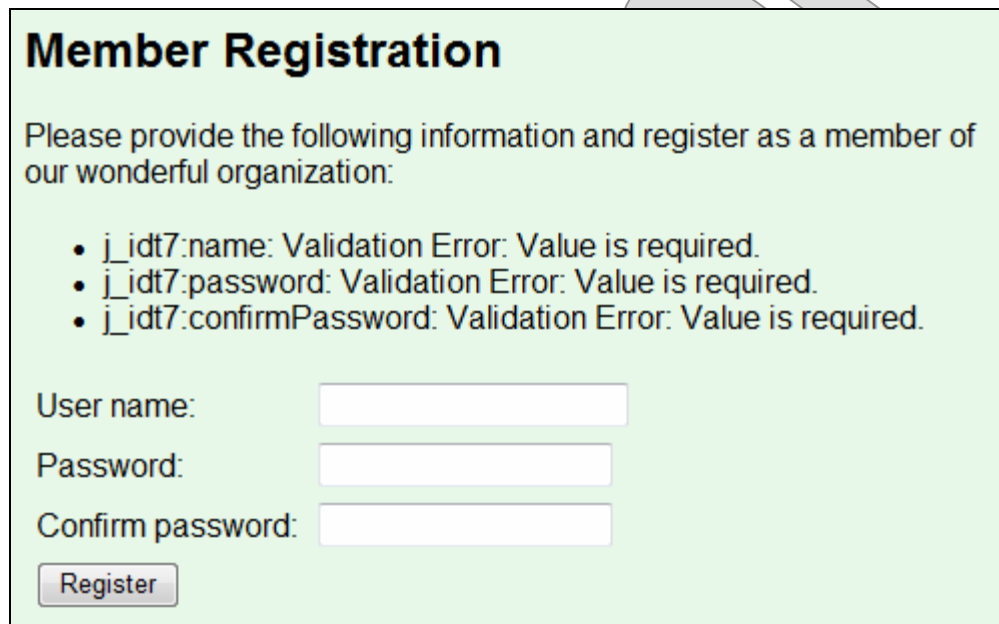
```
<h:commandButton value="Register"
  action="success" />
```

Strong Passwords

DEMO

1. Build and test the starter application. If you fail to enter values, you see three not-very-friendly error messages:

`http://localhost:8080/Passwords`



Member Registration

Please provide the following information and register as a member of our wonderful organization:

- j_idt7:name: Validation Error: Value is required.
- j_idt7:password: Validation Error: Value is required.
- j_idt7:confirmPassword: Validation Error: Value is required.

User name:

Password:

Confirm password:

2. Before we even get into validation, let's make those messages at least a little nicer. We already have **id** attributes on the individual text fields. But since we don't define an **id** for the `<h:form>`, JSF generates one for us. Define one now:

```
<h:form id="form" >
```

3. If you test again, with just that one change, you'll see the error messages all start with "form:" instead of "j_idt7".

Strong Passwords

DEMO

4. We can do even better by setting **label** attributes into the text fields themselves – as in:

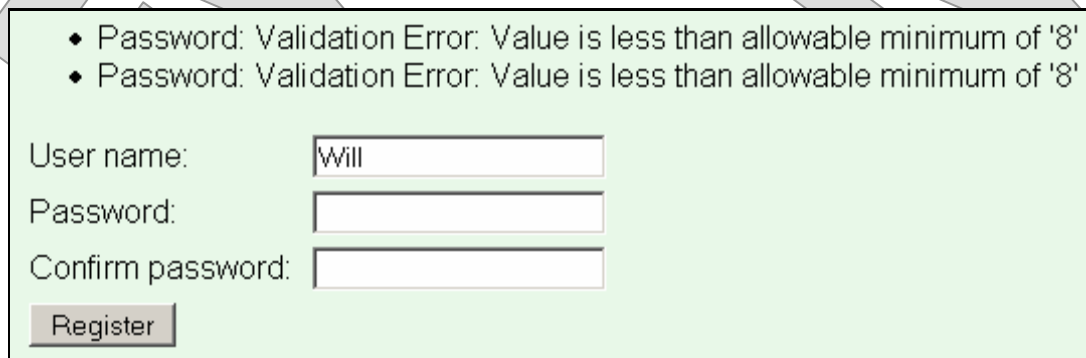
```
<h:inputSecret
  id="password"
  label="Password"
  value="#{member.confirmPassword}"
  required="true"
/>
```

5. Now the whole ID, for example “form:password”, becomes simply “Password” – test this now if you like, or see it in later steps.

6. Now set length constraints on each of the two password fields:

```
<h:inputSecret id="password" label="Password"
  value="#{member.confirmPassword}"
  required="true"
>
  <f:validateLength minimum="8" />
</h:inputSecret>
```

7. Build and test, and try providing shorter passwords:



The screenshot shows a web form with a light green background. At the top, there are two red error messages: "Password: Validation Error: Value is less than allowable minimum of '8'" and "Confirm password: Validation Error: Value is less than allowable minimum of '8'". Below the errors, there are three input fields: "User name:" with the value "Will", "Password:", and "Confirm password:". A "Register" button is at the bottom left.

- The previously-entered password value is cleared when the page is re-served, because this is an `<h:inputSecret>` component.

Strong Passwords

DEMO

8. So we have our validation logic in place; let's clean up the presentation of error messages a bit. Get rid of the `<h:messages>` tag at the top of the form.
9. To each of the three rows of the table with input components, add a third cell that holds an `<h:message>` component. Call out the client ID for which you want to show messages, and set an **errorStyle**:

```
<td>User name:</td>
<td><h:inputText id="name" label="User name"
    value="#{member.name}"
    required="true"
/></td>
<td><h:message for="name"
    errorClass="errorMessage" /></td>
</tr>
```

- This style is already defined in **docroot/register.css**.

10. Build and test one last time, and see that messages are now visually connected to their subjects:

User name:	<input type="text"/>	User name: Validation Error: Value is required.
Password:	<input type="password"/>	Password: Validation Error: Value is less than allowable minimum of '8'
Confirm password:	<input type="password"/>	Password: Validation Error: Value is less than allowable minimum of '8'
<input type="button" value="Register"/>		

Strong Passwords

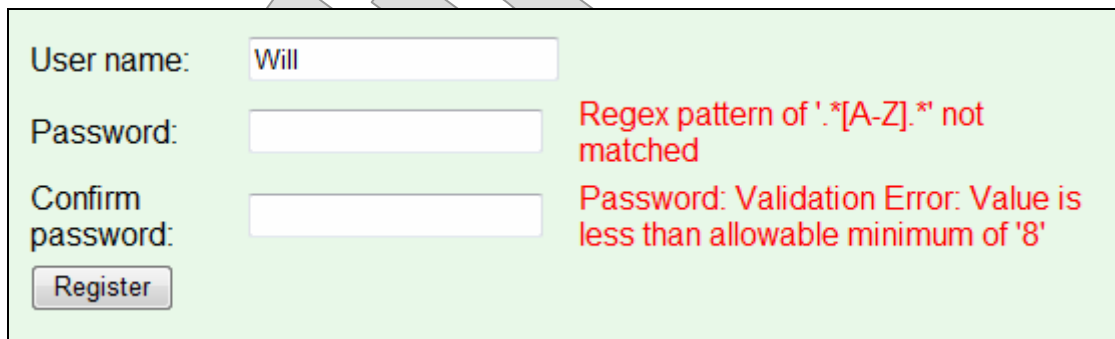
DEMO

11. Finally, let's insist on stronger passwords by requiring at least one of each of a few character classes. Apply the following validators to each of the two password fields:

```
<f:validateRegex pattern=".*[A-Z].*" />
<f:validateRegex pattern=".*[a-z].*" />
<f:validateRegex pattern=".*[0-9].*" />
```

12. Build and test, and see that none of the following passwords will be found valid ...

Provost	(no digit)
mypassword3	(no capital letter)
Aa1	(too short!)



A registration form with a light green background. It contains three input fields: 'User name:' with the value 'Will', 'Password:', and 'Confirm password:'. Below the 'Confirm password:' field is a 'Register' button. To the right of the 'Password:' field, there is a red error message: 'Regex pattern of '.*[A-Z].*' not matched'. To the right of the 'Confirm password:' field, there is a red error message: 'Password: Validation Error: Value is less than allowable minimum of '8''.

— ...while these will:

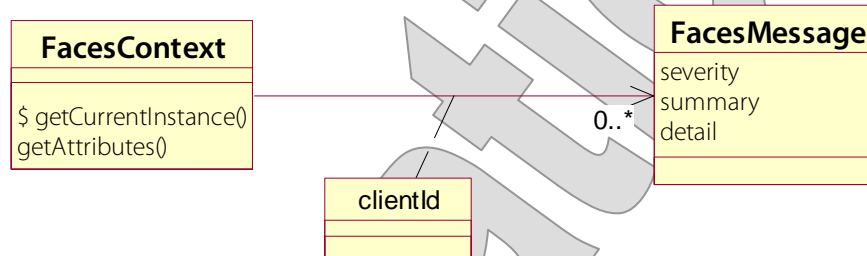
Provost9
BIG000deal

Registration Complete

Thank you! You can now feel free to roam amid the wonderful resources we've prepared for you.

Producing Error Messages

- Each **ValidatorException** wraps an instance of **FacesMessage**.
- These are collected during the Apply Request Values and Process Validations phases by the **FacesContext** object:



- It is not a simple list or bag of messages, but a map.
- The key is the **client ID** of the component with the problem.
- And, it's not a simple map but a **map of lists of messages**.
- This makes sense for what we need to do with error messages, because each field can encounter multiple problems:

firstName	REQUIRED
lastName	(no errors)
bankBalance	BELOW MINIMUM
	INVALID FRACTION
	INVALID CURRENCY

The FacesMessage Class

- **FacesMessage**, in turn, encapsulates three values: **severity**, **summary** message, and **detail** message.
- Message severity is a simple enumeration of possible levels – these are defined as instances of the inner class

FacesMessage.Severity:

```
FacesMessage.SEVERITY_FATAL  
FacesMessage.SEVERITY_ERROR  
FacesMessage.SEVERITY_WARN  
FacesMessage.SEVERITY_INFO
```

- Each message includes a pair of strings for summary and detail.
 - There is no formal distinction between these, and often they're identical.
 - The framework is just giving you some room to define shorter and longer versions of messages if you choose to do so.
 - The UI components that present messages can be tweaked to show one or the other: by default `<h:messages>` shows summaries and `<h:message>` shows details.

Message Keys

- Server-side code must produce error messages – whether that code is in the JSF framework, your application, or both.
- But error messages become visible to the user on the client side.
- This means that they must be localized – or at least that JSF must support localization of your messages.
- By default, the standard validators will use pre-defined message keys to generate their **FacesMessage** instances.
- Here are some of the most common validator keys:

```
javax.faces.component.UIInput.REQUIRED  
javax.faces.validator.LengthValidator.MINIMUM  
javax.faces.validator.LengthValidator.MAXIMUM  
javax.faces.validator.LongRangeValidator.MINIMUM  
javax.faces.validator.LongRangeValidator.MAXIMUM  
javax.faces.validator.DoubleRangeValidator.MINIMUM  
javax.faces.validator.DoubleRangeValidator.MAXIMUM
```

- See the JSF specification (section 2.5.2.4) for a complete list.
 - The great majority of standard keys are actually for type-conversion errors, and not specifically for validators.

Message Parameters

- The message values all carry replaceable parameters – here's the message for required fields:
`{0}: Validation Error: Value is required`
- The rules for replacement are a little vague in the specification, but one thing is stated clearly:
 - The **last** of the numbered parameters will be replaced with the component's **label**.
 - Other parameters, if present, will mean different things for different messages and validators.
 - It's usually obvious from the message what each parameter should mean; here's the message for minimum integer value:

```
javax.faces.validator.LongRangeValidator.MINIMUM =  
{1}: Validation Error: Value is greater than  
allowable maximum of "{0}"
```

Presenting Error Messages

- The custom tags `<h:messages>` and `<h:message>` each take different approaches to rendering error messages onto a page.
 - `<h:messages>` will render the summary value of every message in the context, in a simple bullet-list style.
 - `<h:message>` will render the detail value for the first message for a specific component – keyed by a client ID supplied by the **for** attribute – as raw text or as an HTML `` to implement specific formatting.
- It's possible to use both:
 - `<h:messages>` at the top of the page
 - An `<h:message>` for each component, as a third column on the table

```

<f:view>
  <h:messages />
  <h:form>
    ...
    <h:inputText id="a" label="Semi-axis A"
      value="#{ellipsoid.a}"
      required="true" >
      <f:validateDoubleRange minimum="0.0000001"/>
    </h:inputText>
  </td>
  <td><h:message for="a" /></td>
  ...

```

- It's also possible to use either **absolute or relative client IDs**; if relative they will be based on the nearest **NamingContainer** enclosing the `<h:message>` tag.

The `errorStyle` and `errorClass` Attributes

- Both of these tags support the **`errorStyle`** attribute – along with **`fatalStyle`**, **`warnStyle`**, and **`infoStyle`**.
 - Each attribute defines styling for a specific **message severity**.
- A second set of attributes are **`fatalClass`**, **`errorClass`**, **`warnClass`**, and **`infoClass`**.
 - Here the value is a CSS class, which will be defined on a (usually) separate stylesheet.
- Conversion and validation errors will exhibit error-level severity – this is **`FacesMessage.SEVERITY_ERROR`**.
- So, use **`errorClass`** to indicate presentation styling for your validation and conversion error messages:

```
<h:message  
  for=":form:firstName"  
  errorClass="errorMessage"  
>
```

- The error-message class in the associated stylesheet might be:

```
.errorMessage  
{  
  color: red;  
  font-weight: bold;  
}
```

Custom Messages

DEMO

- Picking up where we left off with our user-registration page, let's further fine-tune the message output with custom messages for required fields and string length.
 - Do your work in **Demos/Messages**, or continue your work in **Demos/Validation**.
 - The completed demo is in **Examples/Passwords/Step3**.
- 1. Open the configuration file and declare an `<application>` config with one resource bundle:

```
<application>  
  <message-bundle>Resources</message-bundle>  
</application>
```
- 2. Create a file **docroot/WEB-INF/classes/Resources.properties**, with the following message keys and values:

```
javax.faces.component.UIInput.REQUIRED=  
  {0} is required.  
javax.faces.validator.LengthValidator.MINIMUM=  
  {1} must be at least {0} characters.
```

 - Note that there should be no line breaks between the key, the equals sign, and the value; the line breaks above are used to format the information for the coursebook.
- 3. Build and test again, and see your messages in play:

User name:	<input type="text"/>	User name is required.
Password:	<input type="password"/>	
Confirm password:	<input type="password"/>	Password must be at least 8 characters.

Producing Messages from Anywhere

EXAMPLE

- It is also possible to add messages to the JSF context programmatically, from any code that is invoked in that context.
- Consider **Examples/Shopping/Step6**, which posts an informational message if, after valid inputs are provided, the control logic winds up merging quantities for an item that had already been ordered.
- See **src/cc/biz/web/ShoppingCart.java**, which watches for any purchased item whose key matches any of those already in the cart.
 - If any such items are found, it delegates to an **ErrorHandler**:

```
if (someItemsMerged)
    ErrorHandler.info
        ("One or more items were already ...");
```

Producing Messages from Anywhere

EXAMPLE

- The handler method “manually” adds a message to the current context – see **src/cc/jsf/ErrorHandler.java**.
 - One overload of the **info** method delegates to the other, passing **null** as the associated client ID; this is legal, and just means the message is “global:”

```
public static void info (String message)
{
    info (message, null);
}
```

- The other overload adds a message to the context, taking the given string to be both summary and detail messages:

```
public static void info (String message, String ID)
{
    FacesContext.getCurrentInstance ()
        .addMessage (ID, new FacesMessage
            (FacesMessage.SEVERITY_INFO,
             message, message));
}
```

Producing Messages from Anywhere

EXAMPLE

- Adding messages to the context does not interrupt the JSF lifecycle in any way.
- But the next view presentation will be able to present those messages, using `<h:message(s)>` as usual.
- Build and test this version, and see that if you purchase some additional quantity of an item after adding it to the cart once, you'll get this message – which after all is just informational:

`http://localhost:8080/Shopping`

Your Order So Far

- One or more items were already in your cart; please confirm that the quantities below are correct.

Product	Price	Quantity	Amount	
Sierra Designs Lhasa	\$229.99	<input type="text" value="2"/>	459.98	<input type="button" value="Remove"/>
Total price			459.98	

Validating Invoice Data

LAB 12A**Suggested time: 30 minutes**

In this lab you will add validation constraints to the invoice forms in the Billing application:

- Customer, invoice number, invoice date, and amount are all required fields.
- Amounts must not be negative numbers, nor zero.

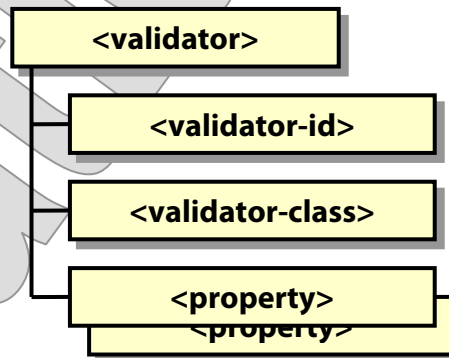
You will also set labels for all inputs, and enhance the page design to place field-specific error messages next to the input fields themselves, instead of relying on a summary at the top of the page as the starter code does.

Detailed instructions are found at the end of the chapter.

Custom Validators

- You can define your own validation logic in several ways – this is largely parallel to what we’ve seen for converters, except that there is no `validator-for-class` option:
 - Create a class that implements **Validator** and register it as a validator in the configuration file:

```
<validator>
  <validator-id>
    myValidator
  </validator-id>
  <validator-class>
    com.me.MyValidator
  </validator-class>
</validator>
```



- Annotate your implementation as a **@FacesValidator**.

```
@FacesValidator
public class MyValidator
    implements Validator
```



- Configure a **Validator** implementation as a managed bean.
 - Implement a method on any bean with the same signature as the **validate** method from **Validator**, but your own choice of method name. This can be a nice way to include validation logic on the backing bean itself, or on a related controller.

<f:validator> and the validator Attribute

- Plug your validation logic into your view definitions using different techniques, depending on how the logic was defined:

- Attach an **<f:validator>** tag to any editable component, using the **validatorId** attribute to identify the validator you want.

```
<h:inputText value="#{bean.prop}" >  
  <f:validator validatorId="myValidator" />  
</h:inputText>
```

- Use this same tag, but with a **binding** attribute, to identify a managed bean that implements **Validator**:

```
<h:inputText value="#{bean.prop}" >  
  <f:validator binding="#{myValidatorBean}" />  
</h:inputText>
```

- Invoke a validation method using the **validator** attribute on the editable component to identify it:

```
<h:inputText  
  value="#{bean.prop}"  
  validator="#{bean.validateProp}"  
>
```

- Using the reference implementation, you can also set **validator** to a validator ID – this is undocumented and non-standard:

```
validator="myValidator"
```

- Either way, one small issue with this last technique is that you can only do it **once per component**; you can't mix and match validation methods the way you can with validator classes.

Conversion/Validation Lifecycle

EXAMPLE

- Partly as a simple example of a custom validator, and partly to explore the lifecycle implications of validation errors, we will observe a new version of the Lifecycle application.
- See **Examples/Lifecycle/Step8**, which has two new features:
 - A custom validator that traces calls to **validate**, and also can trigger a validation error, thus altering the request handling
 - Code in the existing **value-change listener** that invalidates user input later in the validations phase
- First, see **docroot/lifecycle.xhtml**, which now assigns a custom validator to the menu component:

```
<h:selectOneMenu
  value="#{bean.selection}"
  valueChangeListener=
    "#{bean.valueChangeListener}"
>
  <f:selectItems value="#{bean.selections}" />
  <f:valueChangeListener
    type="cc.jsf.ValueChangeListener" />
  <f:converter converterId="converterHook" />
  <f:validator validatorId="validatorHook" />
</h:selectOneMenu>
```

- The validator is declared in **docroot/faces-config.xml**:

```
<validator>
  <validator-id>validatorHook</validator-id>
  <validator-class>cc.jsf.ValidatorHook
    </validator-class>
</validator>
```

Conversion/Validation Lifecycle

EXAMPLE

- The implementation in `src/cc/jsf/ValidatorHook.java` is simple: it traces the call to **validate** and then succeeds for most values, but flunks one.

```
public void validate (FacesContext context,
    UIComponent component, Object value)
    throws ValidatorException
{
    System.out.print ("  Validator.validate() ... ");
    if (value.equals (Menu.Choice.UNSUBSCRIBE))
    {
        System.out.println ("FAILS.");
        throw new ValidatorException (new FacesMessage
            (FacesMessage.SEVERITY_ERROR,
                "No!", "Not allowed!"));
    }
    else
        System.out.println ("succeeds.");
}
```

- Build and test as usual. When you submit any value except **UNSUBSCRIBE**, we see the full lifecycle, with the validator called after the converter during the validations phase:

`http://localhost:8080/Lifecycle`

```
ViewPhaseListener.before(PROCESS_VALIDATIONS 3)
  Converter.getAsObject()
  Validator.validate() ... succeeds.
  Menu.getSelections()
  Menu.getSelections()
  Menu.getSelection()
  Menu.valueChangeListener()
  ValueChangeListener.processValueChange()
ViewPhaseListener.after(PROCESS_VALIDATIONS 3)
```

Conversion/Validation Lifecycle

EXAMPLE

- If you go back and submit **UNSUBSCRIBE**, you'll see that the lifecycle is shortened based on the validator's actions:

```
GlobalPhaseListener.before(PROCESS_VALIDATIONS 3)
ViewPhaseListener.before(PROCESS_VALIDATIONS 3)
Converter.getAsObject()
Validator.validate() ... FAILS.
ViewPhaseListener.after(PROCESS_VALIDATIONS 3)
GlobalPhaseListener.after(PROCESS_VALIDATIONS 3)
```

```
GlobalPhaseListener.before(RENDER_RESPONSE 6)
ViewPhaseListener.before(RENDER_RESPONSE 6)
Menu.getSelection()
Menu.getSelections()
Converter.getAsString()
Converter.getAsString()
Converter.getAsString()
Converter.getAsString()
```

Jul 17, 2010 7:24:24 PM

```
com.sun.faces.renderkit.RenderKitUtils
renderUnhandledMessages
```

INFO: WARNING: FacesMessage(s) have been enqueued, but may not have been displayed.

sourceId=form:j_idt3[severity=(ERROR 2), summary=(No!), detail=(Not allowed!)]

```
ViewPhaseListener.after(RENDER_RESPONSE 6)
GlobalPhaseListener.after(RENDER_RESPONSE 6)
```

- Of course the expected page navigation is set aside as well.
- Notice too a behavior of JSF that we've seen here and there during the course but not yet highlighted: it knows which error messages have been reported and which haven't, and it does the developer a kindness by dumping the unreported ones to the console.

Conversion/Validation Lifecycle

EXAMPLE

- Now, try **VOLUNTEER**: this also fails:

```
GlobalPhaseListener.before(PROCESS_VALIDATIONS 3)
  ViewPhaseListener.before(PROCESS_VALIDATIONS 3)
    Converter.getAsObject()
    Validator.validate() ... succeeds.
    Menu.getSelections()
    Menu.getSelections()
    Menu.getSelection()
    Menu.valueChangeListener()
    ValueChangeListener.processValueChange()
      Resetting valid flag on UIComponent ...
    ViewPhaseListener.after(PROCESS_VALIDATIONS 3)
GlobalPhaseListener.after(PROCESS_VALIDATIONS 3)

GlobalPhaseListener.before(UPDATE_MODEL_VALUES 4)
  ViewPhaseListener.before(UPDATE_MODEL_VALUES 4)
  ViewPhaseListener.after(UPDATE_MODEL_VALUES 4)
GlobalPhaseListener.after(UPDATE_MODEL_VALUES 4)

GlobalPhaseListener.before(RENDER_RESPONSE 6)
  ViewPhaseListener.before(RENDER_RESPONSE 6)
    Menu.getSelections()
    Converter.getAsString()
    Converter.getAsString()
    Converter.getAsString()
    Converter.getAsString()
Jul 17, 2010 7:26:36 PM
com.sun.faces.renderkit.RenderKitUtils
renderUnhandledMessages
INFO: WARNING: FacesMessage(s) have been enqueued,
but may not have been displayed.
sourceId=form:j_idt3[severity=(WARN 1),
summary=(Hello), detail=(Just kidding ...)]
  ViewPhaseListener.after(RENDER_RESPONSE 6)
GlobalPhaseListener.after(RENDER_RESPONSE 6)
```

Conversion/Validation Lifecycle

EXAMPLE

- This is the work of additional code in the pre-existing listener class. See **src/cc/jsf/ValueChangeListener.java**:

```
public void processValueChange (ValueChangeEvent ev)
{
    System.out.println
        ("  ValueChangeListener.processValueChange()");

    if (ev.getNewValue ().equals
        (Menu.Choice.VOLUNTEER))
    {
        System.out.println
            ("  Resetting valid flag on UIComponent...");
        ((EditableValueHolder) ev.getComponent ())
            .setValid (false);
        FacesContext.getCurrentInstance ().addMessage
            (ev.getComponent ().getClientId (),
             new FacesMessage
                (FacesMessage.SEVERITY_WARN,
                 "Hello", "Just kidding .."));
    }
}
```

- The processing of validators had already concluded by the time this code was called, so the shortening of the lifecycle didn't occur until the next phase.
- Still, no application of the model value occurred, so the difference isn't substantial.

Validating Multiple Inputs

- JSF makes validating single inputs pretty easy – even for more complex validation logic.
- It is weaker in its support for validation logic that requires multiple inputs:
 - Making sure **passwords match**
 - Checking that start and end dates are in **chronological order**
 - **Requiring** one field only **if** another value is provided or is equal to some expected value
- MVC frameworks tend to apply validation starting at the request scope and drilling down from there.
 - This makes them better at multi-input validation, but less facile for single inputs.
- You can “look outside” the scope of the single input you’re given in any validator or validation method.
 - Use the provided **UIComponent** and call navigation methods including **getParent**, **getChildren**, and **findComponent**.
 - Then derive other values from the form as needed and apply your multi-value constraints.
- Though workable, this isn’t a totally clean system.
 - The eventual error message will be associated with the field to which the validator is attached, even though others are involved.
 - It’s not obvious where to encode the ID(s) of the other input component(s) to minimize maintenance concerns.

Matching Passwords

EXAMPLE

- **Examples/Passwords/Step4** has been enhanced with a validator that assures that the two passwords match.
- See **src/cc/jsf/PasswordValidator.java**:

```
public void validate (FacesContext context,
    UIComponent component, Object value)
    throws ValidatorException
{
    Object mainPassword = ((EditableValueHolder)
        component.findComponent (":form:password"))
        .getValue ();

    if (mainPassword != null &&
        !mainPassword.equals (value))
        throw new ValidatorException (new FacesMessage
            (FacesMessage.SEVERITY_ERROR,
                "Passwords must match.",
                "Passwords must match."));
}
```

– Note that we hard-code the absolute ID of the first password field.

- **Build and test**, and see that, if all other validations succeed, but the passwords don't match, we see the associated error message:

http://localhost:8080/Passwords

User name:

Password:

Confirm password: Passwords must match.

Chronological Order

EXAMPLE

- **Examples/LandUse** also uses a custom validator for multi-field validation:
 - It assures that two date fields are in **chronological order**.
 - It assures that two others are in order and also separated by a mandatory **delay**.
- See **docroot/detail.xhtml**.
 - The proposed start date associates a specific method on a managed bean as a validator:

```
<td>Proposed start date:</td>
<td>
  <h:inputText
    id="useStart"
    label="start date"
    value="#{DB.selectedProposal.useStart.time}"
    required="true"
    validator=
      "#{dateValidator.startVsApplicationDate}"
  >
    <f:convertDateTime pattern="M/d/yy" />
  </h:inputText>
</td>
```

- The end date does something similar:
validator="#{dateValidator.endVsStartDate}"

Chronological Order

EXAMPLE

- See `src/gov/usda/usfs/landuse/web/DateValidator.java` for the bean class.
 - `startVsApplicationDate` compares one date to another and insists on an “approval time” to boot:

```
public void startVsApplicationDate
    (FacesContext context,
     UIComponent component, Object value)
    throws ValidatorException
{
    long startTime = ((Date) value).getTime ();
    long applicationTime =
        ((Date) ((ValueHolder) component
            .findComponent (":details:applicationDate"))
            .getValue ()).getTime ();

    if (applicationTime + APPROVAL_TIME > startTime)
        throw new ValidatorException (new FacesMessage
            (FacesMessage.SEVERITY_ERROR,
             "Starts too soon",
             "You must allow 6 months from the " +
              "proposal date for project approval."));
}
```

- `endVsStartDate` does almost the same thing, with no lag time.

Chronological Order

EXAMPLE

- Test these constraints on any of the existing proposals:

`http://localhost:8080/LandUse`

A screenshot of a web form with a light green background. It contains several input fields with labels in blue text: 'Parcel:' with the value 'White Mountains NF', 'Applicant:' with 'Cranmore Paper', 'Application date:' with '10/16/07', 'Proposed use:' with 'Selective logging', 'Proposed start date:' with '7/16/07', and 'Proposed end date:' with '12/1/07'. A message in blue text states: 'You must allow 6 months from the proposal date for project approval.' A 'Done' button is at the bottom.

Parcel:	White Mountains NF
Applicant:	Cranmore Paper
Application date:	10/16/07
Proposed use:	Selective logging
Proposed start date:	7/16/07
You must allow 6 months from the proposal date for project approval.	
Proposed end date:	12/1/07
Done	

A screenshot of a web form similar to the one above, but with the 'Proposed start date' changed to '7/16/08'. The 'Proposed end date' remains '12/1/07'. A message in blue text states: 'End date must follow start date.' A 'Done' button is at the bottom.

Parcel:	White Mountains NF
Applicant:	Cranmore Paper
Application date:	10/16/07
Proposed use:	Selective logging
Proposed start date:	7/16/08
Proposed end date:	12/1/07
End date must follow start date.	
Done	

Invoice and Payment Date

LAB 12B**Suggested time: 45-60 minutes**

In this lab you will add two custom validators to the Billing application. One is a generalization of the date-ordering validator we just saw for LandUse: it can be configured as to the client ID of the “other” date component, and it does a better job of presenting localizable error messages. This validator is complete, and you will just need to attach it to the payment-date component.

You will then build the second validator, which assures that a date is a business day – which, in a not-so-globally-robust fashion, we’ll define as being anything but Saturday or Sunday. You will then attach this validator to both date components, enforcing a rule that we don’t date either invoices or payments on weekends.

Detailed instructions are found at the end of the chapter.

JSF and “Bean Validation”



- A new validation standard enters the Java EE platform as of edition 6: this is known as **Bean Validation** or sometimes by its JSR number, 303.
- By this standard, any JavaBean can carry source-code annotations that declare validation constraints on its properties.
- These annotations can then be observed and enforced by a validation tool – at any time, in any tier of the application.
- So the advantage is that we can define validation constraints once, instead of having to write them out in different languages for different parts of a large application.
- JSF 2.0 supports Bean Validation automatically – if an implementation of JSR-303 is found on the class path.
 - In this case, whenever a backing property has any JSR-303 annotations, JSF will trigger the bean validator.
 - Error messages reported by the validator will be wrapped in **FacesMessages** and added to the context, and the target component will be set to invalid.

Validation Annotations

EXAMPLE

- **Examples/JSR303** holds a simple Java SE application that validates values on two different JavaBeans.
- One of these is familiar – see **src/cc/math/Ellipsoid.java**:

```
@DecimalMin
(
    value=".0000001",
    message="Semi-axis A must be a positive number"
)
private double a = 1;
```

- The other, in **src/cc/web/PersonalInfo.java**, sets various constraints on its properties: rejecting **null** values and enforcing a regular expression, setting a value range, etc:

```
@NotNull
@Pattern
(
    regexp="([A-Za-z\\'\\-]+)( [A-Za-z\\'\\-]+)+",
    message="Must include at least ..."
)
private String name;

@Min
(
    value=18,
    message="Age must be at least 18"
)
@Max
(
    value=120,
    message="Age must be no greater than 120"
)
private int age;
```

Validation Annotations

EXAMPLE

- An application class creates a few instances of each type and applies the Bean Validator to them; we won't dig into this code as it's not directly relevant to JSF practice, since the JSF implementation will carry out this process for us.
- Build and test as follows:

```
ant
```

```
ant run
```

```
Ellipsoid "sphere":  
  Validation succeeded.
```

```
Ellipsoid "twoD":  
  Semi-axis B must be a positive number.
```

```
Ellipsoid "senseless":  
  Semi-axis C must be a positive number.
```

```
Good PersonalInfo:  
  Validation succeeded.
```

```
Bad PersonalInfo:  
  Must include at least first and last name.  
  Please keep reference to 40 characters or less.  
  Invalid e-mail address.  
  Invalid SSN.  
  Age must be at least 18.
```


Using Existing Constraints

EXAMPLE

- **Examples/Passwords/Step5** uses constraint annotations instead of defining validators in the view.
- Here's the new backing bean – see **src/cc/jsf/Member.java**:

```
@Size(min=8, message=PASSWORD_LENGTH_MESSAGE)
@Pattern.List
({
    @Pattern(regex=".*[A-Z].*",
        message=PASSWORD_FORM_MESSAGE),
    @Pattern(regex=".*[a-z].*",
        message=PASSWORD_FORM_MESSAGE),
    @Pattern(regex=".*[0-9].*",
        message=PASSWORD_FORM_MESSAGE)
})
private String password;
```

- In the view, the length and regular-expression validators have been removed.
 - We've kept the **required** attributes.
 - We've also kept the custom validator for password matching – this is more than we could manage with JSR-303.
- Build and test, and see the same basic logic, but with the new messages stemming from the source-code annotations:

<http://localhost:8080/Passwords>

Password:	<input type="text"/>	Passwords must be at least 8 characters.
Confirm password:	<input type="text"/>	Passwords must include at least one digit, one uppercase, and one lowercase letter.

Using <f:validateBean>

- The <f:validateBean> tag gives you some options regarding JSR-303 validation.
 - You can place this component as either an **ancestor or child** of one or more input components.

```
<h:inputText value="#{myBean.trickyProperty}" >  
  <f:validateBean disabled="true" />  
</h:inputText>
```

```
<f:validateBean validationGroups="#{groups}" >  
  <h:inputText value="#{bean.prop1}" />  
  <h:inputText value="#{bean.prop2}" />  
  <h:inputText value="#{bean.prop3}" />  
</f:validateBean>
```

- You can set **validation groups** relevant to this form or to certain fields, thus filtering the possible validation constraints; this is going to be beyond our scope.
- You can **disable** JSR-303 validation outright – again, for a field or for an entire form.

Disabling Bean Validation

DEMO

- In **Demos/Disable**, we have the latest version of the HR application, and we'll experiment a bit with entering invalid salaries from the payroll-management page.
1. Build and test at the following URL:
`http://localhost:8080/HR`
 2. Click the **Payroll** link.
 3. Enter a salary of \$1,000.00 for the first employee in the first department, and you'll see an error message:

Human Resources: Departments		
• The employee's salary must be greater than or equal to 10,000		
Department	Location	Payroll
Administration	Boston, MA	\$615,000.00
Facilities	Boston, MA	\$178,000.00

- This is JSF observing the validation constraint on the backing bean
- see **Examples/HR/JPA/src/cc/hr/entity/Employee.java**:

```
@Min(value = 10000,  
      message = "The employee's salary must ...")  
@Max(value = 9999999,  
      message = "The employee's salary must ...")  
private Long salary;
```

Disabling Bean Validation

DEMO

4. Open **docroot/payroll.xhtml**, and (near the bottom of the file) disable JSR-303 validation for this field:

```
<h:inputText
  id="salary"
  value="#{employee.salary}"
  valueChangeListener="..."
>
  <f:convertNumber type="currency" />
  <f:validateBean disabled="true" />
</h:inputText>
```

5. Build and test again – what happens?

Human Resources: Departments

- Failed to save salary change; the persistence layer threw an exception.

- You did indeed disable JSR-303 validation for the salary field – but only as it was being performed by the JSF runtime.
- There's another layer to this application, which is a system of JPA-2.0 façades and entities.
- JPA 2.0 also observes JSR-303 constraints!
 - And of course this is the intended value of JSR-303: that we get validation and “re-validation” of values throughout an application, based on a central definition of validation constraints.
 - See the server console for plenty of detail on what JPA didn't like.

SUMMARY

- Like the converter framework, JSF validation is simple to use and surprisingly powerful.
- Simple rules including required fields, string lengths, and value ranges can easily be declared as part of the view definition.
 - Bear in mind that these simple rules account for the overwhelming majority of all input validation in web applications.
- More complex logic can be plugged in by a handful of straightforward techniques.
- If there is a weak spot, it's multi-input validation.
 - But a little extra logic to navigate the UI tree will bridge the gap between subject components.
- Where JSR-303 validation constraints are available, JSF makes it easy to take full leverage from them.

Validating Invoice Data

LAB 12A

In this lab you will add validation constraints to the invoice forms in the Billing application:

- Customer, invoice number, invoice date, and amount are all required fields.
- Amounts must not be negative numbers, nor zero.

You will also set labels for all inputs, and enhance the page design to place field-specific error messages next to the input fields themselves, instead of relying on a summary at the top of the page as the starter code does.

Lab workspace: Labs/Lab12A

Backup of starter code: Examples/Billing/Step11

Answer folder(s): Examples/Billing/Step12

Files: docroot/WEB-INF/tags/biz/invoiceForm.facelet
docroot/WEB-INF/classes/cc/jsf/Resources.properties (to be created)
docroot/WEB-INF/faces-config.xml

Instructions:

1. Open **invoiceForm.facelet**. Start by adding a **required** attribute to each of the first four input fields: customer and invoice number, date, and amount. Note that this attribute goes on the actual user-input component – e.g. `<h:inputText>` – and not on the hidden-input used when a given value is not editable.

You can test this immediately, if you like, or wait until you've added the next couple of validators.

2. Add a range validator to the amount input field:

```
<f:validateDoubleRange minimum=".01" />
```

Earlier we were complaining that it's not possible with this validator to exclude a boundary number – for example to exclude zero but allow even the smallest positive number. This is indeed a problem in the general case; but for this application it's hard to get too upset, as we probably don't want to allow values such as .0001 anyway.

3. Give each input a meaningful **label** attribute.

Validating Invoice Data

LAB 12A

4. Build at this point. The easiest way to test is to create a new invoice. First try removing all values – customer is impossible to “delete” at this point, but the other three can be deleted. You should see your **required** attributes at work:

<http://localhost:8080/Billing>

- invoice number: Validation Error: Value is required.
- invoice date: Validation Error: Value is required.
- amount: Validation Error: Value is required.

5. Now try invalid amounts such as -800 or zero:

- amount: Validation Error: Value is less than allowable minimum of '0.01'

6. Now let's place those error messages more effectively on the screen. Add a column to each of the table rows, to show a detail error message if present. Each component must refer to the corresponding input component, and we have a CSS error style already in place, so let's refer to that using the **errorClass** attribute. Here's how this looks for the invoice number:

```
<td>
  <h:message for="number" errorClass="error" />
</td>
```

7. To the table cell holding the options for payment type, add **colspan="2"**, since we won't have a messages component for this one and it will otherwise occupy unnecessary space in the table layout.
8. Test again, and see your messages aligned with their targets:

Customer:	<input type="text" value="Albert Rawlins"/>	
Invoice number:	<input type="text"/>	invoice number: Validation Error: Value is required.
Invoice date:	<input type="text" value="7/17/10"/>	
Amount:	<input type="text" value="-800"/>	amount: Validation Error: Value is less than allowable minimum of '0.01'

Validating Invoice Data**LAB 12A**

9. Now let's get the error messages under control. Create a new file **docroot/WEB-INF/classes/cc/jsf/Resources.properties**.
10. Provide overrides for the two messages your users can encounter at this point:
`javax.faces.component.UIInput.REQUIRED=The {0} is required.`
`javax.faces.validator.DoubleRangeValidator.MINIMUM= (keep on one line)
The {1} must be a positive number.`
11. Open **faces-config.xml** and identify this new resource bundle:

```
<application>  
  <message-bundle>cc.jsf.Resources</message-bundle>  
</application>
```
12. Build again, and test your constraints to see the new error messages:

Customer:

Invoice number: The invoice number is required.

Invoice date:

Amount: The amount must be a positive number.

Date paid:

Payment type: ☐ Cash ☐ Check ☐ Credit card

Invoice and Payment Date

LAB 12B

In this lab you will add two custom validators to the Billing application. One is a generalization of the date-ordering validator we just saw for LandUse: it can be configured as to the client ID of the “other” date component, and it does a better job of presenting localizable error messages. This validator is complete, and you will just need to attach it to the payment-date component.

You will then build the second validator, which assures that a date is a business day – which, in a not-so-globally-robust fashion, we’ll define as being anything but Saturday or Sunday. You will then attach this validator to both date components, enforcing a rule that we don’t date either invoices or payments on weekends.

Lab workspace: Labs/Lab12B

Backup of starter code: Examples/Billing/Step12

Answer folder(s): Examples/Billing/Step13

Files:

- src/cc/jsf/ChronologicalOrder.java
- docroot/WEB-INF/faces-config.xml
- docroot/WEB-INF/tags/biz/invoiceForm.facelet
- src/cc/jsf/BusinessDay.java (to be created)
- src/cc/jsf/StringLookup.java
- docroot/WEB-INF/classes/cc/jsf/Resources.properties

Instructions:

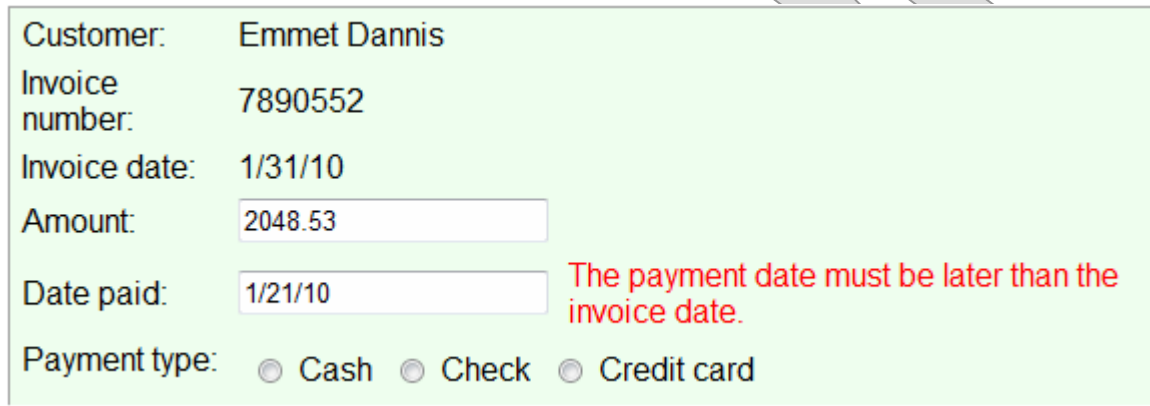
1. Open **ChronologicalOrder.java** and review the code there. The basic validation logic is not much different from the **DateValidator** class in the LandUse application. But the class is more general and reusable: it takes the **priorID** as an injectable property, which in turn means it configures as a managed bean with a name and scope, instead of as a validator with an ID.
2. Open **faces-config.xml** and define a managed bean of this class, at application scope, called **chronological**.
3. Give the bean a managed property of **prior**, and provide the value “:form:date”.
4. Open **invoiceForm.facelet** and assign the validator method to the payment-date component – like this:

```
<f:validator binding="#{chronological}" />
```

Invoice and Payment Date**LAB 12B**

5. Build and test; you should now see that it's impossible to set a payment date that precedes the invoice date:

<http://localhost:8080/Billing>



Customer:	Emmet Dannis		
Invoice number:	7890552		
Invoice date:	1/31/10		
Amount:	<input type="text" value="2048.53"/>		
Date paid:	<input type="text" value="1/21/10"/>	The payment date must be later than the invoice date.	
Payment type:	<input type="radio"/> Cash <input type="radio"/> Check <input type="radio"/> Credit card		

6. Now you'll build the second validator: create the new class **cc.jsf.BusinessDay**, and make it implement **Validator**.
7. Import **Validator**, **ValidatorException**, and **FacesValidator** from **javax.faces.validator**. You'll also need **javax.faces.context.FacesContext** and **javax.faces.component.UIComponent**.
8. Annotate the class as a **@FacesValidator**. Give it an ID of "businessDay".
9. Create the skeleton for an implementation of **validate** – remember the three arguments and to announce that the method **throws ValidatorException**.
10. If your third parameter, which we'll call **value**, is **null**, just **return**.
11. Create an instance of **java.util.Calendar** (using **Calendar.getInstance**).
12. Set the time of the calendar to your **value** (you'll have to cast it to a **java.util.Date**).
13. Create an **int** variable called **dayOfWeek**, and initialize it by calling **calendar.get** and passing **Calendar.DAY_OF_WEEK**.
14. Now, if **dayOfWeek** is **Calendar.SATURDAY** or **Calendar.SUNDAY**, we have a problem: open a block of code for this purpose.
15. In that block, **throw** a new **ValidatorException**, with a **FacesMessage** of **SEVERITY_ERROR** and two hard-coded messages. The messages can be anything you like, as they're just placeholders for some quick testing. We're going to replace them with localized strings later in the lab.
- You'll need to import **FacesMessage** from **javax.faces.application**.
16. In **invoiceForm.facelet**, assign your validator to both date components.

Invoice and Payment Date**LAB 12B**

17. Build and test, and see that your validator mostly works. That is, one or the other weekend day will trigger a validation failure:

Customer:	Emmet Dannis	
Invoice number:	7890552	
Invoice date:	1/31/10	
Amount:	<input type="text" value="2048.53"/>	
Date paid:	<input type="text" value="7/18/10"/>	Not on a business day!
Payment type:	<input type="radio"/> Cash <input type="radio"/> Check <input type="radio"/> Credit card	

But all is not well – and in about half of the world (including all of North America) you will see this clearly when you try a Saturday or a Monday date – both of which will give the wrong results. What’s going on?

Quite a surprise here, in fact: it turns out that, by default, the JSF date/time converters will use Greenwich Mean Time (GMT) when converting inputs. So unless your machine is in that time zone, your users will be setting dates and times that are not absolutely correct!

18. To fix this you must set a context parameter in **web.xml**:

```
<context-param>
  <param-name>
    javax.faces.DATETIMECONVERTER_DEFAULT_TIMEZONE_IS_SYSTEM_TIMEZONE
  </param-name>
  <param-value>true</param-value>
</context-param>
```

You will need this parameter whenever your application produces date and time values that have to align with absolute dates and times used by other systems – such as when storing them in a database from which other code might read them. And if your users may be connecting from other time zones (a pretty common thing), you will need further customization of time conversion logic, since the “system timezone” refers to the server locale, not the client locale.

19. With this parameter in place, you should see completely reliable behavior from your validator, catching only Saturdays and Sundays as incorrect values.

Optional Steps

20. Finally, let's get a better error message in place. We'll follow the algorithm required of built-in validators by the JSF specification: we'll look for summary and detail message keys, in either the application resource bundle or the standard JSF one, and then we'll replace any parameter {0} with the label of the validated component.

The code from the **ChronologicalOrder** validator will be a useful reference for this section of the lab.

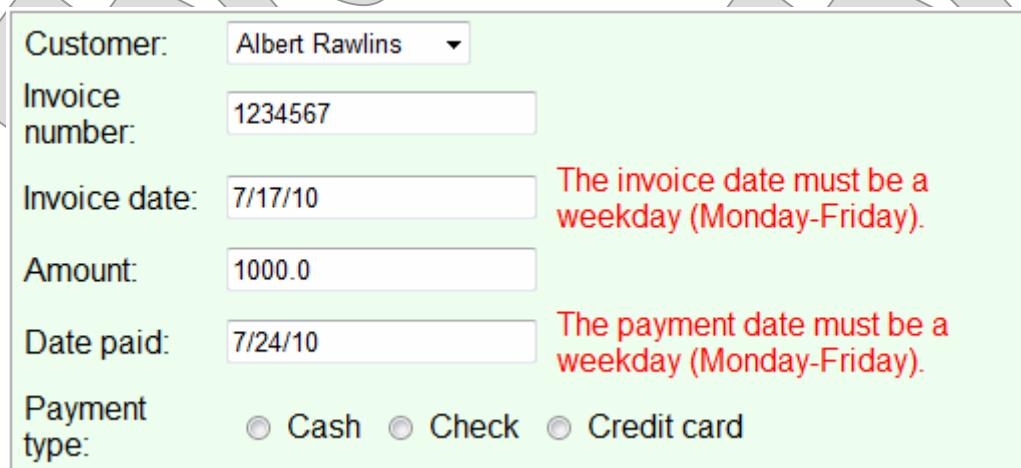
First off, working just above the point at which you throw your exception, get the label of the target component, like this:

```
String label = (String) component.getAttributes().get("label");
```

21. To get a string from the resource bundle, a utility is already available in the application – you can review this in **src/cc/jsf/StringLookup.java**.
22. Call **StringLookup.localize**, passing the validator's class name as the key. This will be your **summary** string. Then let **summary** equal the results of a call to **summary.replace**, passing "{0}" and your **label** as arguments.
23. Do the same things to derive a **detail** message – the only difference is that the message key will be the class name plus the suffix "_detail".
24. Now use **summary** and **detail** in place of your literal-string messages.
25. Now, open **Resources.properties** and add strings for your validator:

```
cc.jsf.BusinessDay=The {0} must be a weekday.  
cc.jsf.BusinessDay_detail=The {0} must be a weekday (Monday-Friday).
```

26. Test, and you should see your error messages, with appropriate labels:



The screenshot shows a web form with a light green background. It contains several input fields and a radio button group. The 'Customer' field is a dropdown menu showing 'Albert Rawlins'. The 'Invoice number' field contains '1234567'. The 'Invoice date' field contains '7/17/10' and has a red error message to its right: 'The invoice date must be a weekday (Monday-Friday)'. The 'Amount' field contains '1000.0'. The 'Date paid' field contains '7/24/10' and has a red error message to its right: 'The payment date must be a weekday (Monday-Friday)'. The 'Payment type' field has three radio buttons: 'Cash', 'Check', and 'Credit card', all of which are unselected.

Note that the answer version of the validator has some additional defensive code. For each of summary and detail strings, it has a fallback error message in case the string lookup fails. Also, if the component does not have a **label** attribute, the validator will use the client ID instead.