nemo

ontology & conceptual modeling research group

Web Development in Java
Part II

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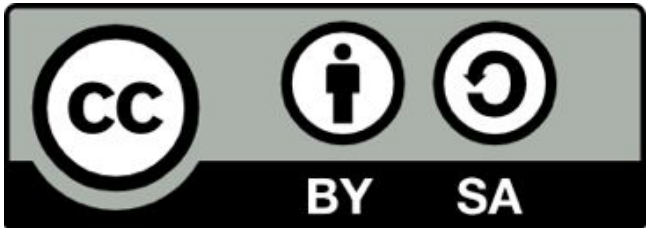


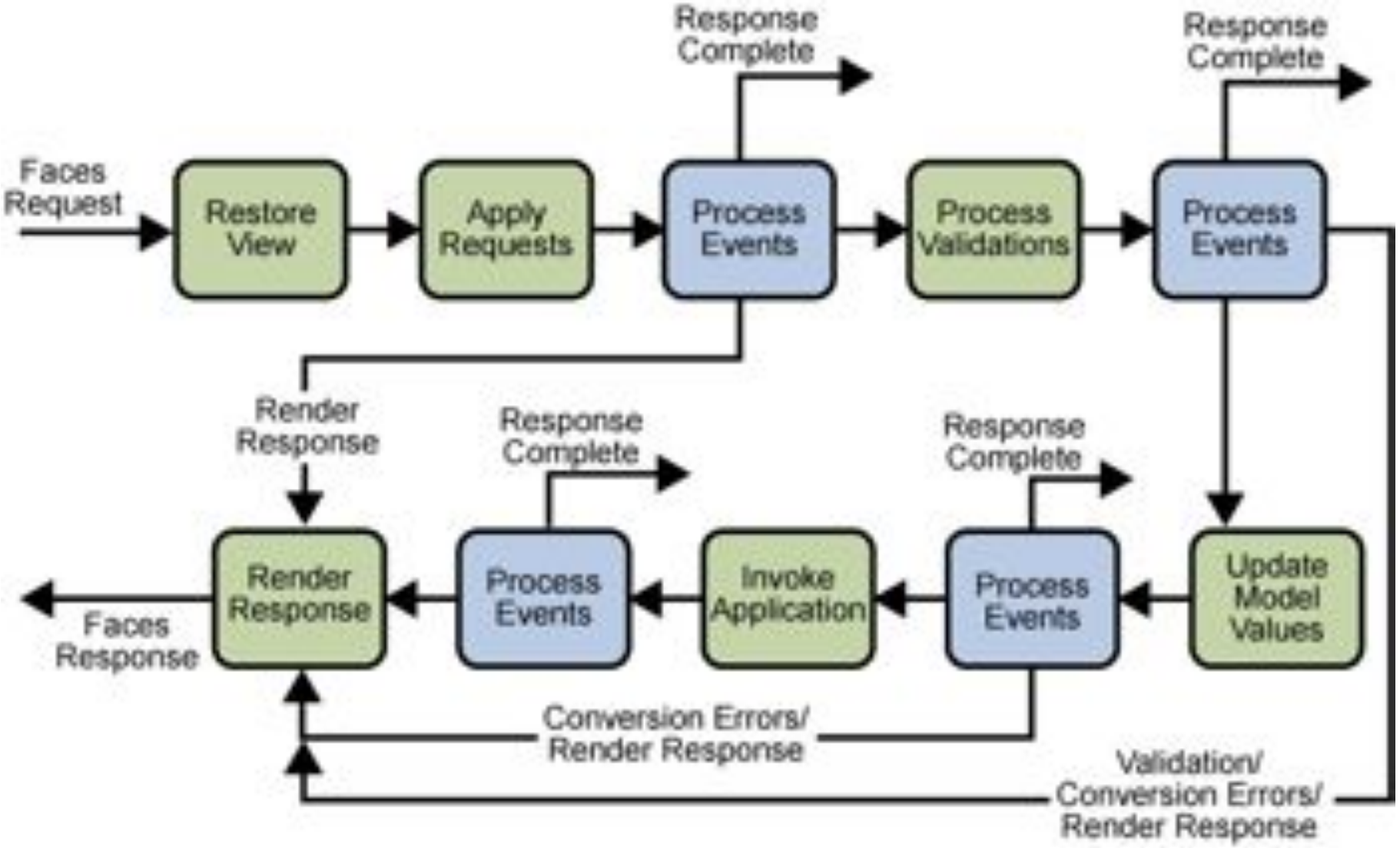
Outline of part II

- More on JSF: AJAX support, converters, formatters, i18n, Facelets components, etc.;
- More on CDI: scopes, producers, qualifiers, interceptors, decorators, events, etc.

Web Development in Java – Part II

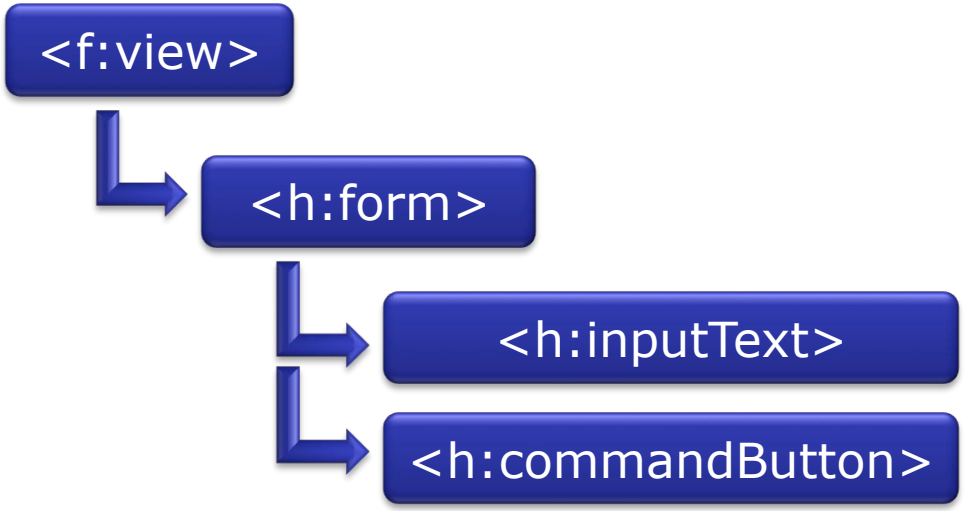
JAVASERVER FACES

The JSF lifecycle



The JSF lifecycle

- **Restore view** phase:
  - Build the view;
  - Wire event handlers and validators to components;
  - Save view in faces context;
  - For initial requests, view is empty, render response;



The JSF lifecycle

- **Apply request values** phase:
  - Extract values from components;
  - Convert them (generate error messages if needed);
  - Process validation, conversion and events of immediate components;
- **Process validations** phase:
  - Processes all components' validators;
  - Generate error messages and advance to render response if any values are invalid;
- **Update model values** phase:
  - Update bean attributes with components' values;
  - Generate error messages if conversion fails;

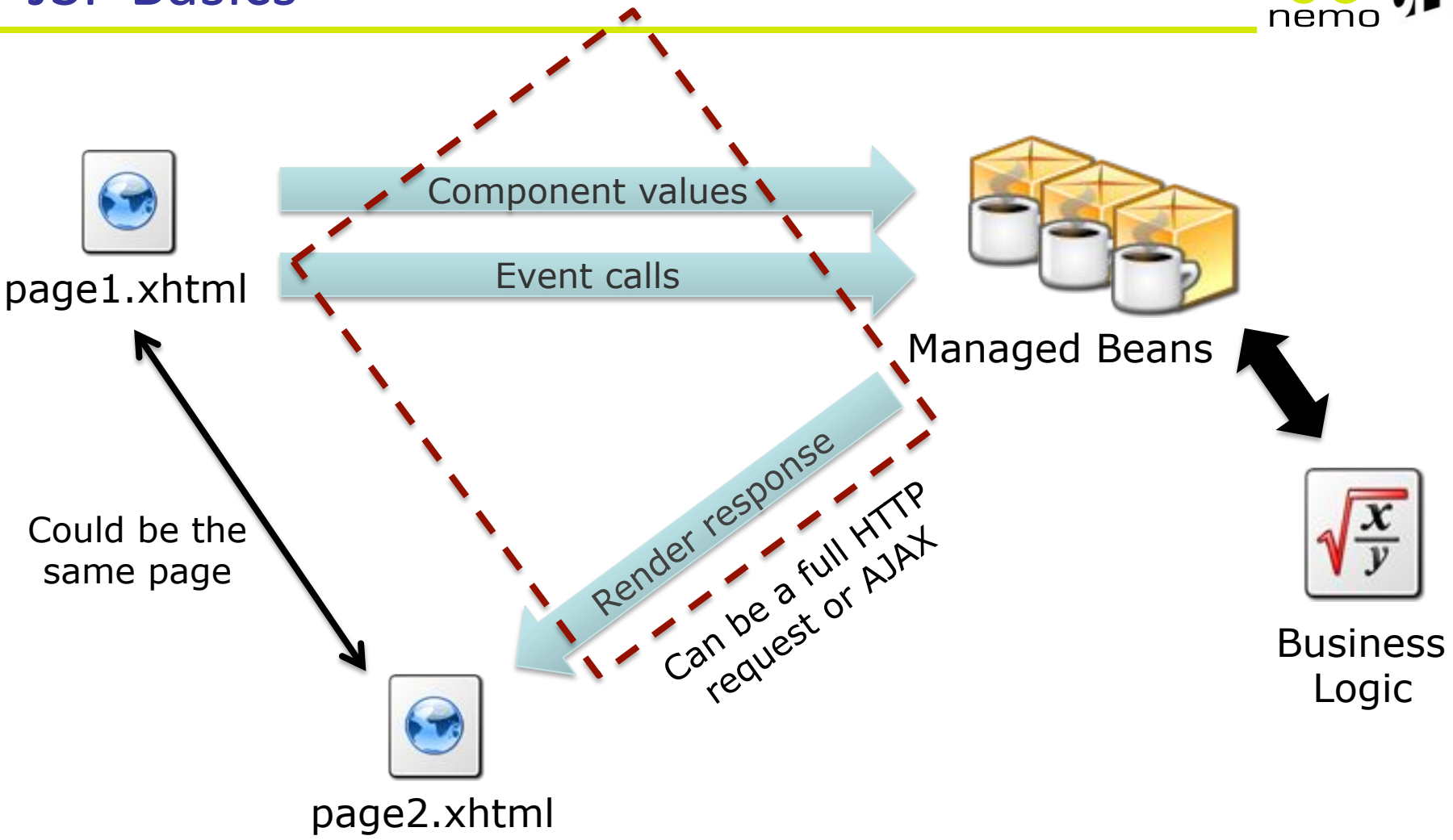
The JSF lifecycle

- **Invoke application** phase:
  - Handle application-level events (e.g. form submit);
  - Fire component events to listeners;
- **Render response** phase:
  - Render the response;
  - If postback request:
    - Response is rendered based on component tree;
    - If errors happened, render the original page with messages (<h:message /> or <h:messages /> required);
  - Save the state of response to be restored later.

The good news is…

- The lifecycle is handled transparently by JSF;
- Most JSF developers don’t need to concern themselves with it.

JSF Basics


page1.xhtml
Component values
Event calls
Managed Beans
Could be the same page
Render response
Can be a full HTTP request or AJAX
Business Logic
page2.xhtml

(Some) JSF standard components

<h:commandButton />

<h:commandLink />

<h:selectOneMenu />

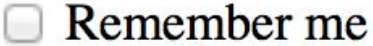
Your Shopping Cart	
Item Description	Price
Apple	1.0
Orange	0.5
Banana	1.25
Total: 2.75	

<h:dataTable />

<h:inputText /> and
<h:inputSecret />

<h:selectManyListbox />

<h:selectOneRadio />



<h:selectBooleanCheckbox />

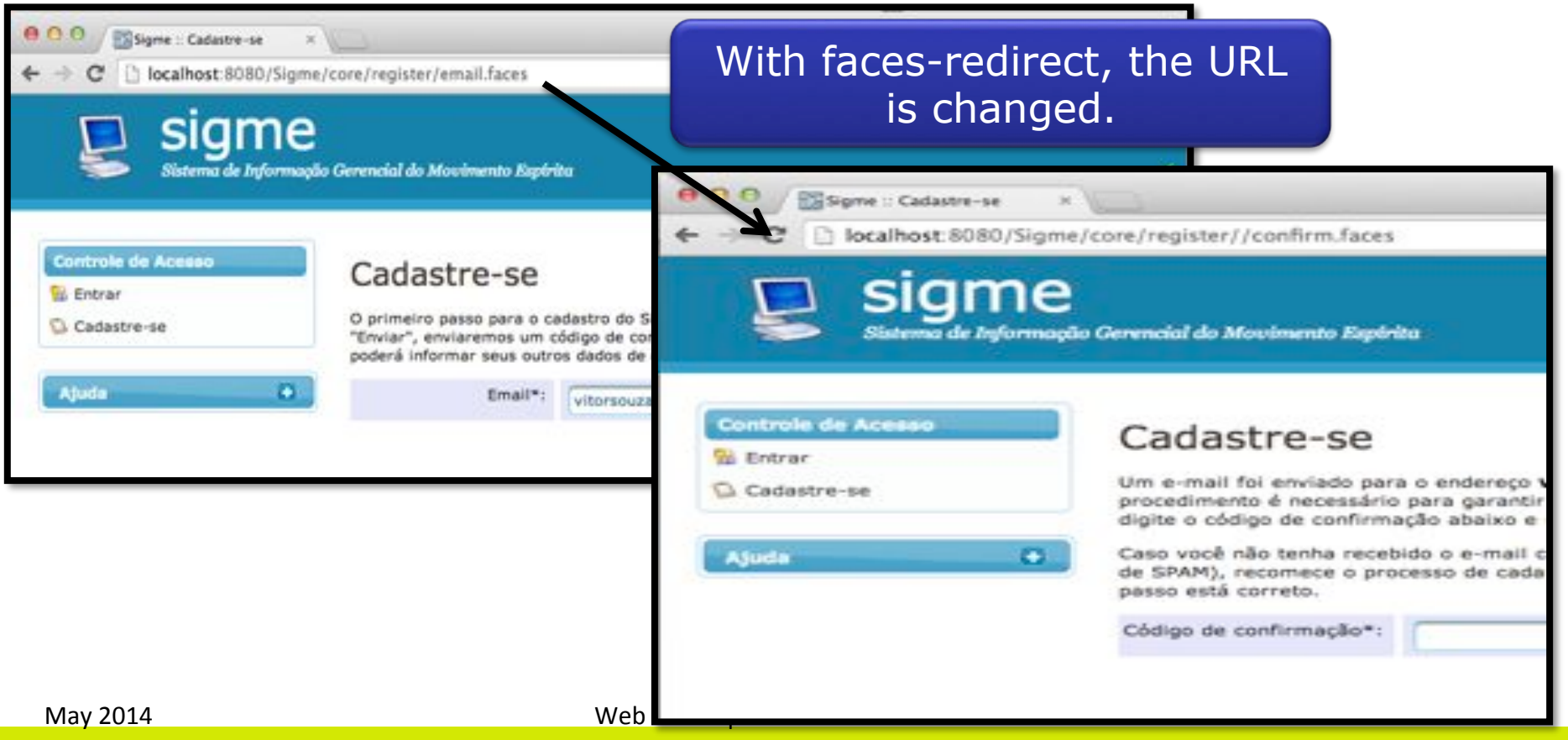
Source: http://www.jsftoolbox.com/documentation/help/12-TagReference/index.jsf

Page rendering vs. redirection

```
public String send() {
   // [...]
   catch (EmailAlreadyRegisteredException e) {
      return "/core/register/taken.xhtml";
   }
}
```

Page rendering vs. redirection

```
public String send() {
   // [...]

   return "/core/register/confirm.xhtml?faces-redirect=true";
}
```



AJAX support

- JSF 2 has AJAX support, no need for external tools;
- Tag **<f:ajax />**. Attributes:
  - **event**: which event should trigger the request: action, blur, change, click, dblclick, focus, keydown, keypress, keyup, mousedown, mousemove, mouseout, mouseover, mouseup, select;
  - **listener**: method to execute when the event occurs;
  - **execute**: data to submit in the request: @all, @none, @this, @form, component IDs;
  - **render**: what should be redrawn: @all, @none, @this, @form, component IDs.

AJAX examples

```
<h:form id="form">
  <h:commandButton action="#{myBean.doSomething()}"
    value="Do Something">
    <f:ajax render=":form:anotherComponent" />
  </h:commandButton>

  <h:panelGroup id="anotherComponent">
    <!-- ... -->
  </h:panelGroup>
</h:form>
```

Using the full name reference of a component.

```
<h:form id="form">
  <h:inputText id="value" value="#{myBean.value}" />

  <h:commandButton action="#{myBean.doSomething()}"
    value="Do Something">
    <f:ajax render=":form:anotherComponent" execute="value" />
  </h:commandButton>
</h:form>
```

Local name reference. Must be in the same form.

AJAX examples

```
<h:form id="form">
  <h:inputText id="name" value="#{myBean.obj.name}">
    <f:ajax event="blur" render="acronym"
      listener="#{myBean.suggestAcronym}" />
  </h:inputText>

  <h:inputText id="acronym" value="#{myBean.obj.acronym}" />

  <!-- ... -->
</h:form>
```

```
@Named
public class MyBean {
  private DomainObject obj = new DomainObject();
  public DomainObject getObj() { return obj; }

  public void suggestAcronym(AjaxBehaviorEvent event) {
    String acronym = /* Calculate an acronym based on obj.name. */
    obj.setAcronym(acronym);
  }
}
```

CDI vs. JSF scopes

- CDI has scopes:
  - javax.enterprise.context.ApplicationScoped;
  - javax.enterprise.context.ConversationScoped;
  - javax.enterprise.context.SessionScoped;
  - javax.enterprise.context.RequestScoped;
- JSF also has scopes:
  - javax.faces.beans.ApplicationScoped;
  - javax.faces.beans.SessionScoped;
  - javax.faces.beans.ViewScoped;
  - javax.faces.beans.RequestScoped;
  - javax.faces.beans.NoneScoped.

We will favor CDI scopes.

Converters

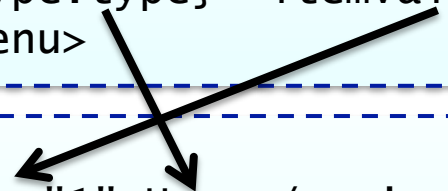
- HTML field values / HTTP parameters are Strings;
- JSF components are bound to objects of various classes;
- Standard converters handle simple types: characters, numbers and dates;
- Some of them can be configured:

```
<h:inputText value="#{myBean.myObject.updateDate}">
  <f:convertDateTime type="both" pattern="dd/MM/yyyy HH:mm:ss" />
</h:inputText>
```

Custom converters

- Sometimes you need to bind a field to an object:

```
<h:selectOneMenu id="telephoneType" value="#{myBean.contactType}"
converter="contactTypeConverter">
  <f:selectItems value="#{myBean.contactTypes}" var="type"
itemLabel="#{type.type}" itemValue="#{type}" />
</h:selectOneMenu>
```



```
<select>
  <option value="1">Home</option>
  <option value="2">Cell</option>
  <option value="3">Work</option>
</select>
```

- The above drop-down list renders an HTML select;
- Something must tell JSF how to convert the objects to their IDs (1, 2, 3) and vice-versa;
- Enter custom converters…

Custom converters

```
import javax.faces.component.UIComponent;
import javax.faces.context.FacesContext;
import javax.faces.convert.Converter;
import javax.faces.convert.FacesConverter;

@FacesConverter("contactTypeConverter")
public class ContactTypeConverter implements Converter {
   @Override
   public Object getAsObject(FacesContext context, UIComponent
component, String value) {
      // Gets the element as String value (the ID);
      // Converts it to the object and returns.
   }

   @Override
   public String getAsString(FacesContext context, UIComponent
component, Object value) {
      // Gets the element as Object value;
      // Generates its String representation (ID) and returns.
   }
}
```

Validators

- Validation can start at the UI;
  - But you should also validate at your business logic;
- JSF standard validators:
  - Number range;
  - String length;
  - Regular expression;
  - Required fields.

```
<h:inputText id="email" value="#{myBean.email}" size="30"
     required="true" validatorMessage="Not a valid email address.">
  <f:validateRegex
        pattern="([^.@]+)(\\.[^.@]+)*@([^.@]+\\.)+([^.@]+)" />
</h:inputText>
```

Custom validator

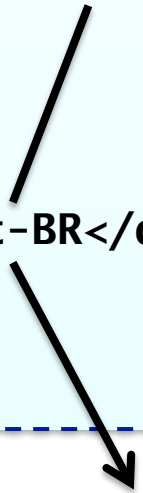
```
<h:inputText id="taxCode" value="#{myBean.client.taxCode}" size="20"
required="true">
  <f:validator validatorId="brazilianTaxCodeValidator" />
</h:inputMask>
```

```
import javax.faces.component.UIComponent;
import javax.faces.context.FacesContext;
import javax.faces.validator.*;

@FacesValidator("brazilianTaxCodeValidator")
public class BrazilianTaxCodeValidator implements Validator {
  @Override
  public void validate(FacesContext context, UIComponent component,
Object value) throws ValidatorException {

     // Verifies if value is a valid Brazilian CPF.
     // If not, use context.addMessage(FacesMessage), then
     // throw a new ValidatorException().

  }
}
```

Internationalization (i18n)

- As Java itself, JSF works with resource bundles:

```
<?xml version='1.0' encoding='UTF-8'?>
<faces-config ...>
<application>
   <resource-bundle>
      <base-name>br.org.feees.sigme.messages</base-name>
      <var>msgs</var>
   </resource-bundle>

   <locale-config>
      <default-locale>pt-BR</default-locale>
   </locale-config>
</application>
</faces-config>
```



- Given the above configuration, JSF will try to load:
  - /br/org/feees/sigme/messages_pt_BR.properties

Internationalization (i18n)

- You can have translations of your messages:

```
text.backToIndex = Voltar à página inicial
```

messages_pt_BR

```
text.backToIndex = Back to the home page
```

messages_en_US

```
text.backToIndex = Torna alla pagina iniziale
```

messages_it

- Then, at your web page (XHTML):

```
<p align="center"><a
href="#{facesContext.externalContext.requestContextPath}/">
<h:outputText value="#{msgs['text.backToIndex']}" /></a></p>
```

- Or at the bean/controller (Java):

```
ResourceBundle bundle = FacesContext.getCurrentInstance()
                .getApplication().getResourceBundle(context, "msgs");
String message = bundle.getString("text.backToIndex");
```

Facelets components

- Generic components reusable across projects should be developed as JSF components (e.g., PrimeFaces);
- Components reusable in a single project can be created using Facelets compositions (mini-templates):

```
<ui:composition ...>
  <div class="formField #{(fieldName == null or empty facesContext
     .getMessageList(fieldName)) ? '' : 'formFieldError'}">
    <div class="label">
     <ui:insert name="label" /><h:panelGroup styleClass="star"
rendered="#{(fieldName != null and facesContext.viewRoot
        .findComponent(fieldName).required)}">*</h:panelGroup>:
    </div>
    <div class="field">
     <p:message for="#{fieldName}" rendered="#{fieldName != null}" />
     <ui:insert /><p:tooltip for="#{fieldName}" value="#{tooltip}"
rendered="#{tooltip != null}" showEvent="focus" hideEvent="blur" />
    </div><div class="clear"></div>
  </div>
</ui:composition>
```

Facelets components

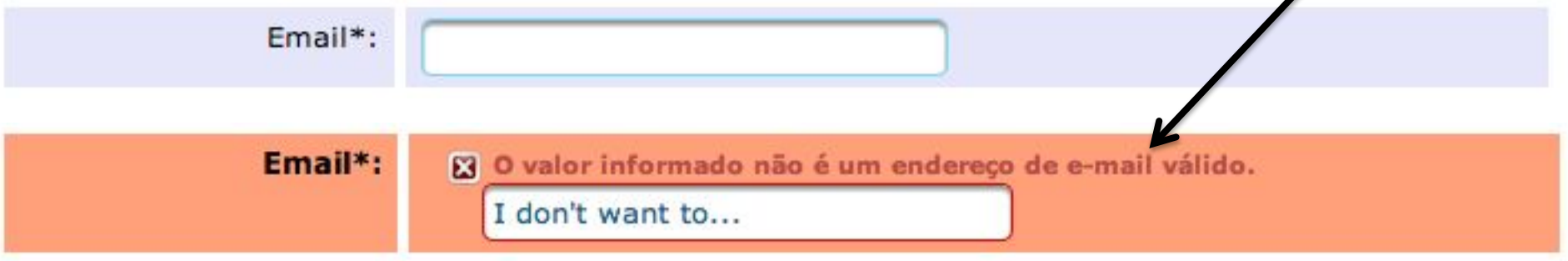
- Then, at the web page:

```
<h:panelGroup id="emailField">
  <ui:decorate template="/resources/templates/formfield.xhtml">
    <ui:param name="fieldName" value="form:email" />
    <ui:param name="tooltip" value="Type your e-mail." />
    <ui:define name="label"><h:outputText value="Email" /></ui:define>
    <p:inputText id="email" value="#{myBean.email}" size="30"
required="true" validatorMessage="...">
      <f:validateRegex pattern="..." />
      <p:ajax event="blur" update="emailField" />
    </p:inputText>
  </ui:decorate>
</h:panelGroup>
```

See slide 19

- The result (CSS not shown):

i18n set to pt_BR...

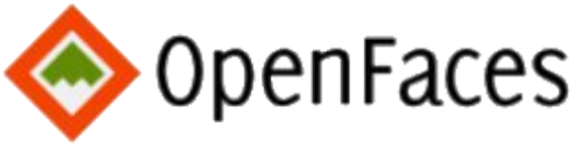


Error messages

- Validators / converters produce error messages;
  - Bound to a specific component ID;
  - Global (no component specified).
- We can display these in our pages with (respectively):
  - <h:message for="componentId" />
  - <h:messages globalOnly="true" />
- I suggest you place them at (respectively):
  - Your Facelets component for form fields;
  - Your Facelets decorator for the entire page.

Going forward…

- Study the standard JSF components;
- Choose an external JSF component library and familiarize yourself with their components;
- Start building your Web application and learn from practice!



Web Development in Java – Part II

CONTEXTS AND DEPENDENCY INJECTION FOR THE JAVA PLATFORM

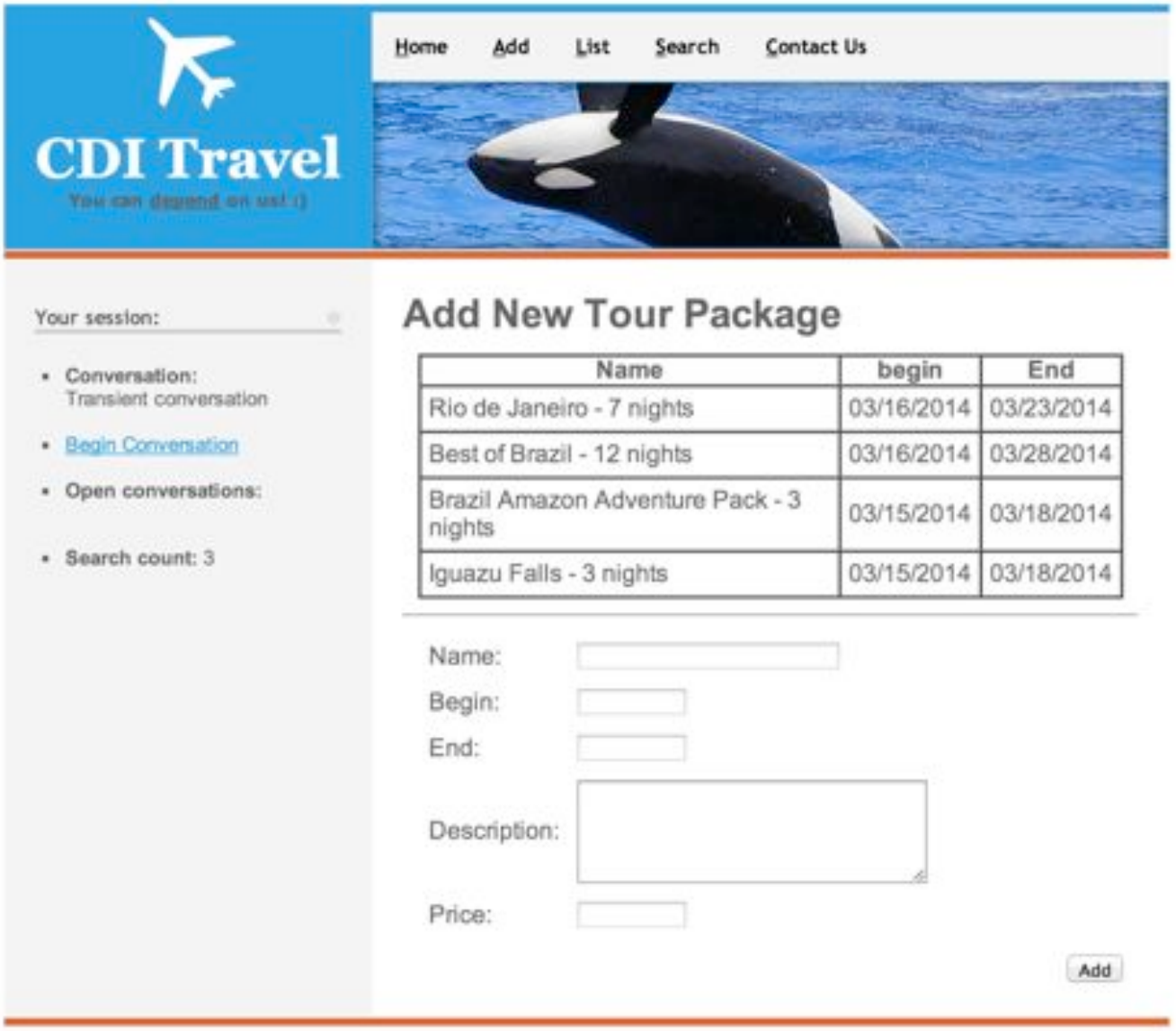
CDI goals (from its spec)

- A well-defined lifecycle for stateful objects bound to lifecycle contexts, where the set of contexts is extensible;
- A sophisticated, type-safe dependency injection mechanism, including the ability to select dependencies at either development or deployment time, without verbose configuration;
- Support for Java EE modularity and the Java EE component architecture—the modular structure of a Java EE application is taken into account when resolving dependencies between Java EE components;

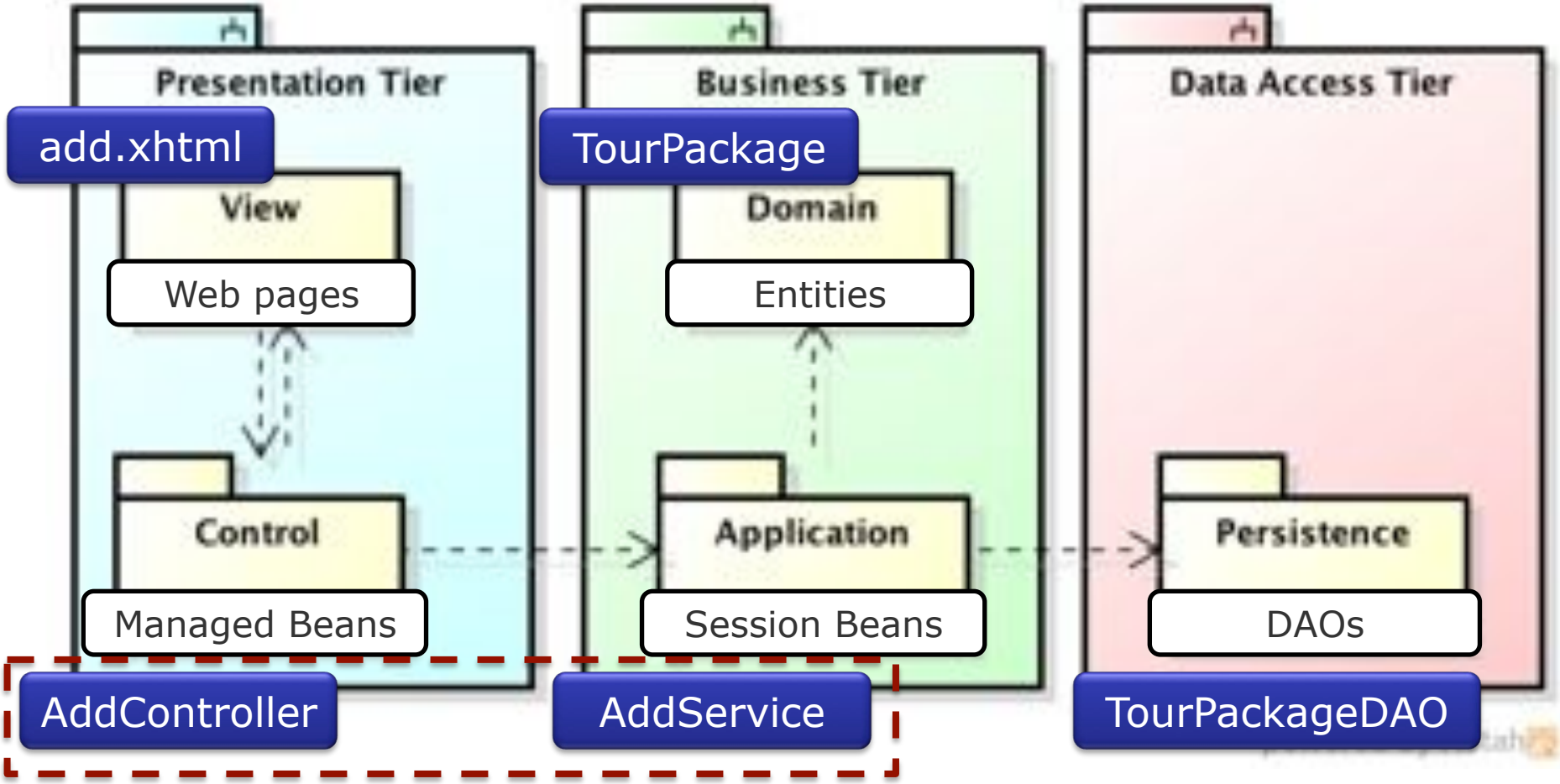
CDI goals (from its spec)

- Integration with the Unified Expression Language (EL), allowing any contextual object to be used directly within a JSF or JSP page;
- The ability to decorate injected objects;
- The ability to associate interceptors to objects via typesafe interceptor bindings;
- An event notification model;
- A web conversation context in addition to the three standard web contexts defined by the Java Servlets specification;
- An SPI allowing portable extensions to integrate cleanly with the container.

Imagine an information system…



Remember the proposed architecture…



For now, these two will be merged…

Start from the bottom: the DAO

```
@Local
public interface TourPackageDAO {
   long retrieveCount();
   List<TourPackage> retrieveAll();
   List<TourPackage> retrieveSome(int[] interval);
   TourPackage retrieveById(Long id);
   TourPackage save(TourPackage  object);
   void delete(TourPackage object);
   List<TourPackage> findByName(String name);
 }
```

Resource (EJB) declaration

```
@Stateless
public class TourPackageJPADAO implements TourPackageDAO {
   @PersistenceContext
   private EntityManager em;

   /* Implementation of the methods declared in the interface. */
}
```

Dependency Injection

DI annotations

- @PersistenceContext: the entity manager;
- @PersistenceUnit: the persistence unit;
- @WebServiceRef: reference to Web services;
- @Resources: miscellaneous Java EE resources;
- @EJB: Enterprise Java Beans;
- @Inject: your own objects.

The service + controller (buy 1, take 2)

```
@Stateful @LocalBean @Model
public class AddPackage {
   @EJB private TourPackageDAO tourPackageDAO;
   @Inject private LocaleBean loc;

   private List<TourPackage> packages;             // + getter
   private TourPackage pack = new TourPackage();  // + getter

   @Inject
   void loadPackages() {
      packages = tourPackageDAO.retrieveAll();
   }

   public String add() {
      tourPackageDAO.save(pack);
      packages.add(pack);
      pack = new TourPackage();
      return null;
   }
}
```

The @EJB annotation

- When an instance of AddPackage is needed:

```
public class AddPackage {
   @EJB private TourPackageDAO tourPackageDAO;
   // ...
```

- An instance of the only (default) implementation of the TourPackageDAO EJB is created/retrieved and injected:

```
@Local
public interface TourPackageDAO {
   // ...

@Stateless
public class TourPackageJPADAO implements TourPackageDAO {
   // ...
```

- No code needed. CDI does the job!

@Inject at an attribute

- Works like @EJB, but for POJOs (Plain Old Java Objects):

```
public class AddPackage {
   @Inject private LocaleBean loc;
   // ...
```

```
@ApplicationScoped
public class LocaleBean implements Serializable {
   // ...
```

- POJOs are associated with scopes…

CDI scopes

- javax.enterprise.context.ApplicationScoped:
  - One instance for the entire application;
- javax.enterprise.context.ConversationScoped:
  - An instance per conversation. Conversations are controller by the programmer (later we'll see how);
- javax.enterprise.context.SessionScoped:
  - One instance per user session (each connected browser gets a session, expires in time);
- javax.enterprise.context.RequestScoped:
  - One instance per HTTP request (AJAX or not).

@Inject at a method

- Defines an initializer method:

```
public class AddPackage {
  private List<TourPackage> packages;   // + getter

  @Inject
  void loadPackages() {
     packages = tourPackageDAO.retrieveAll();
  }

  // ...
```

  - This method is called every time an instance of AddPackage is created;
  - If it had parameters, they would have been injected. The DAO could have been a parameter, for instance.

@Inject at a constructor

- Like an initializer method, but using the constructor:

```
public class ListPackages {
   @Inject
   public ListPackages(NumberFormat nf) {
      this.nf = nf;
   }
   // ...
```

  - A NumberFormat (a class from the Java API!) must be **produced** and injected. Hold that thought…
  - Only one constructor can have @Inject;
  - If no constructors have it, CDI uses the default one to create the object.

Mind buffer:
- Conversations
- Producers

Being service and controller

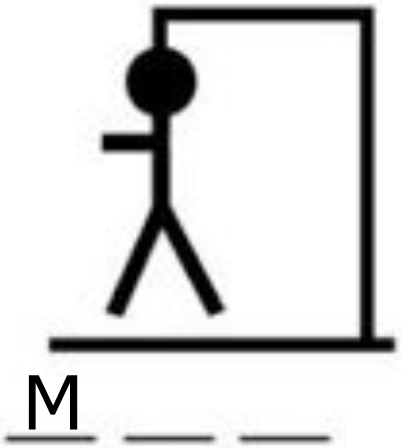
Service

Controller

```
@Stateful @LocalBean @Model
public class AddPackage {
   // ...
```

- @Stateful, @LocalBean, @Local, etc. are EJB stuff;
- @Model reminds you of anything?
- @Model is a stereotype:

```
@Named
@RequestScoped
@Documented
@Stereotype
@Target({ TYPE, METHOD, FIELD })
@Retention(RUNTIME)
public @interface Model {
}
```



The @Named annotation

- Allows a bean to be referred to via EL at a web page:

```
<h:outputText value="No package added yet."
rendered="#{addPackage.packages.size() == 0}" />
```

```
@Model
public class AddPackage {

   public List<TourPackage> getPackages() {
      return packages;
   }

// ...
```

If you don't like the default name, you can specify one in @Named

  - Looks for an instance at the specified scope;
  - If not found, creates a new one in the scope;
  - At the end of the scope, the instance is discarded.

Producers

- Beans can be injected (as seen);
- They can also produce the thing that will be injected:

Mind buffer:
- Conversations
- ~~Producers~~

```
@Stateless @Named("lp")
public class ListPackages {
   @Inject
   private List<TourPackage> packages;
   // ...
```

```
@ApplicationScoped
public class PackageProducer {
   @EJB private TourPackageDAO tourPackageDAO;

   @Produces
   public List<TourPackage> getAllPackages() {
      List<TourPackage> packages = tourPackageDAO.retrieveAll();
      return packages;
   }

   public void dispose(@Disposes List<TourPackage> packages) { }
}
```

Producers

- Attributes can also be producers:

```
@Stateless @Named("lp")
public class ListPackages {
  private NumberFormat nf;

  @Inject
  public ListPackages(NumberFormat nf) { this.nf = nf; }
  // ...
```

```
@ApplicationScoped
public class FormatterProducer {
  private static final Locale LOCALE = new Locale("en", "US");

  @Produces
  private final NumberFormat CF =
        NumberFormat.getCurrencyInstance(LOCALE);
```

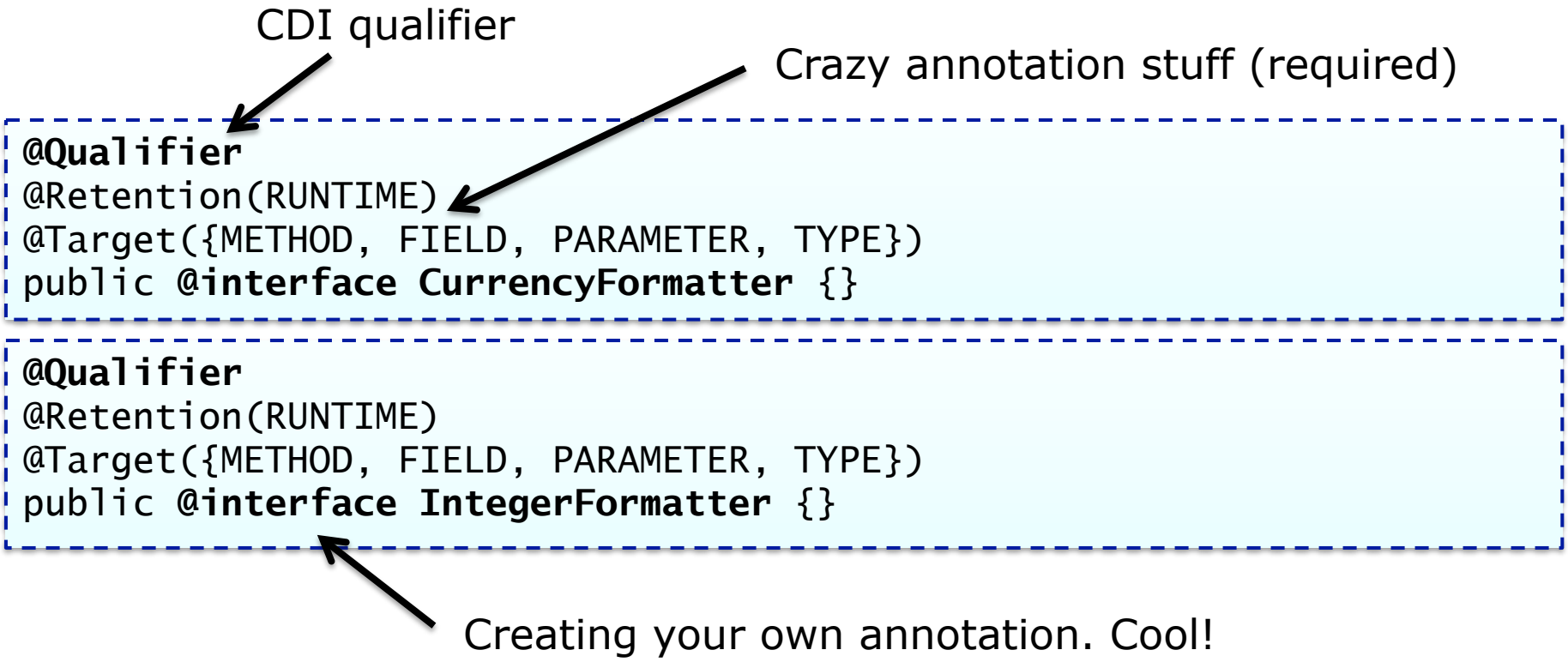
Recap: how does CDI finds things to inject?

- @Named things are found by their name in the EL;
- @EJBs are found by their interface and implementation;
- @Inject'ed objects are found:
  - If their class is directly associated with a scope, i.e., they are beans themselves;
  - If an attribute of their class is annotated with @Produces inside a bean;
  - If a method with their class as return type is annotated with @Produces inside a bean.

What if we need to produce different objects from the same class?

Qualifiers

- Producer methods can use polymorphism and determine which subclass to instantiate;
- However, if the class declaring the dependency knows the subclass it wants, we can use qualifiers:



Qualifiers

- Once you created the qualifiers, use them at both ends:

```
@Stateless @Named("lp")
public class ListPackages {
  private NumberFormat nf;
  private NumberFormat nfi;

  @Inject
  public ListPackages(@CurrencyFormatter NumberFormat nf,
        @IntegerFormatter NumberFormat nfi) { /* ... */ }
  // ...
```

```
@ApplicationScoped
public class FormatterProducer {
  private static final Locale LOCALE = new Locale("en", "US");

  @Produces @CurrencyFormatter private final NumberFormat CF =
     NumberFormat.getCurrencyInstance(LOCALE);

  @Produces @IntegerFormatter private final NumberFormat IF =
     NumberFormat.getIntegerInstance(LOCALE);

  // ...
```

Qualifiers

- Instead of new annotations, one could use:
  - @Named("currencyFormatter") on both ends;
  - @Named without the string, but in this case both variables must have the same name;
- New annotations are checked at compile time;
- @Named is checked at deploy time;
- XML configuration (old style) is checked at runtime;
- You can use as many qualifiers as you want;
  - @Inject @Q1 @Q2 … @Qn: CDI will look for the bean that has all the specified qualifiers.

Qualifiers

- Beans can also be qualified. Imagine, for instance:

```
@Stateless @JPADAO
public class TourPackageJPADAO implements TourPackageDAO {
   @PersistenceContext
   private EntityManager em;

   /* Implementation of the methods using JPA. */
}
```

```
@Stateless @JDBCDAO
public class TourPackageJDBCDAO implements TourPackageDAO {
   @Inject
   private Connection conn;

   /* Implementation of the methods using JDBC directly. */
}
```

Built-in qualifiers

- CDI comes with a few qualifiers ready to use:
  - @Default: optional, specifies the un-qualified dependency;
    - @Inject @Default == @Inject;
    - @Produces @Default == @Produces;
    - If the class produces two dependencies of the same class, only one of them can be the default (non-qualified).
  - @New: if you don't want to use the scope-related dependency. CDI creates a new one in the current scope;
  - @Any: the opposite of @New. Also optional;
    - @Inject @Any == @Inject.

Tired yet? Wait! There's more!

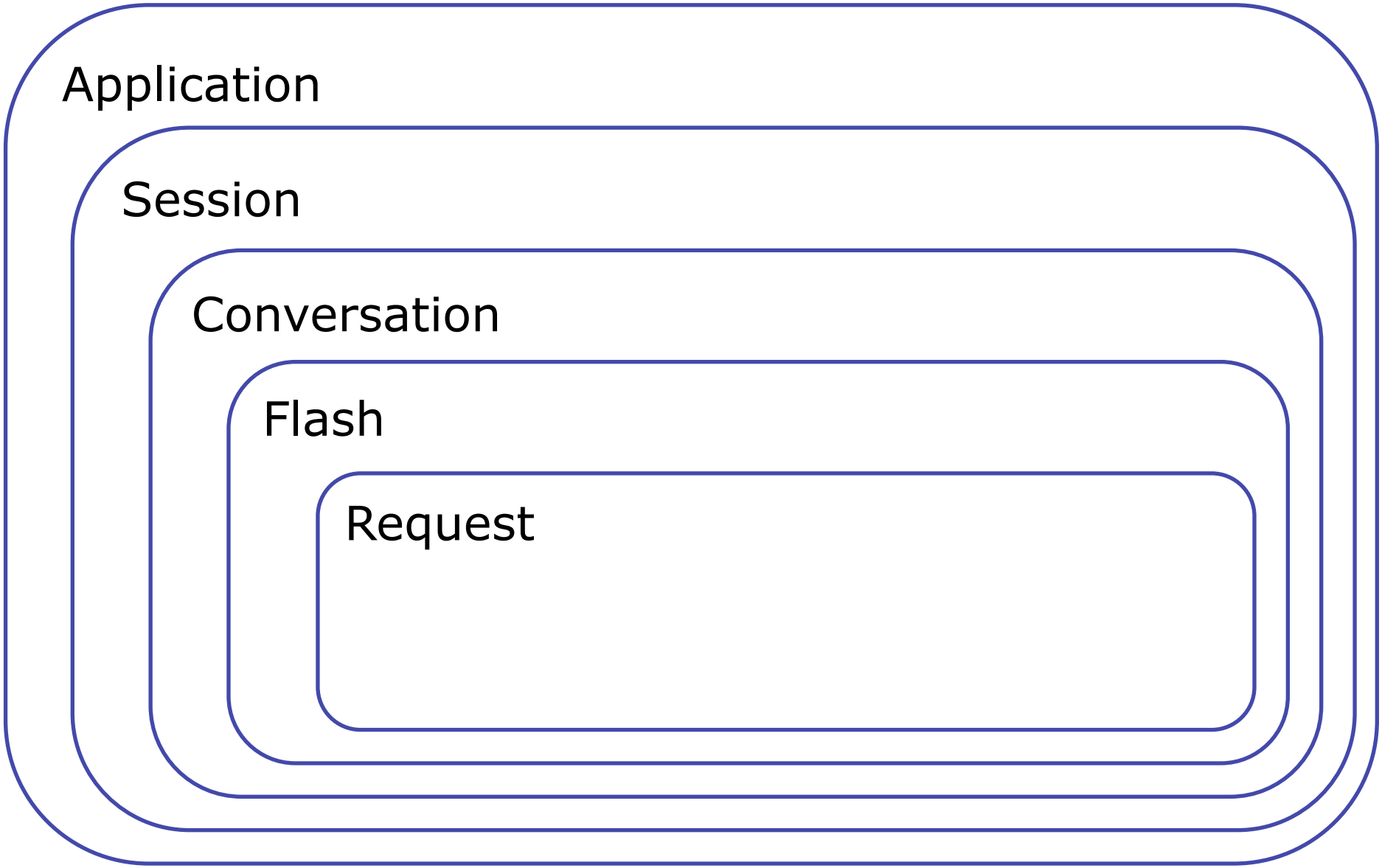
Back to contexts…

- Some components have no context: Singleton EJBs, stateless EJBs, Servlets, classes in general…;
- CDI beans have their lifecycle associated with a context:
  - Created automatically when needed;
  - Destroyed automatically when context ends;
  - Shared with other beans in the same context, if declared as dependencies.

Contexts are defined by the scope

- Some scopes are old friends of ours:
  - @RequestScoped: the HTTP request;
  - @SessionScoped: the HTTP session;
  - @ApplicationScoped: the entire application.
- Some are new, introduced by CDI:
  - @ConversationScoped: a conversation delimited by the programmer (specific calls to begin/end);
  - @Dependent pseudo-scope (and default): use the same scope as the bean declaring the dependency.
- JSF also created the Flash "scope";
- You can define new scopes (not included here).

Scopes inside other scopes



Passivation

- Some contexts hold user-related objects in memory for long periods of time (conversation, session);
- In case of need, the server will passivate these objects: serialize them to disk to free memory;
- For this reason, beans in this context must be serializable.

```
@SessionScoped
@Named
public class ConversationList implements Serializable {

   // ...

}
```

Conversation scope

- Every JSF request is bound to a conversation;
- Conversations are, by default, transient: begin and end with the request;
- Long-running conversations are more interesting:
  - Begin when begin() is called at the current transient conversation;
  - End (go back to transient) when end() is called at the current long-running conversation.
- Conversations belong to a single user session and are destroyed if the session is invalidated;
- A session can have multiple conversations.

Conversation handling

Your session:

- **Conversation:** Transient conversation
- Begin Conversation
- **Open conversations:**
- **Search count:** 3

Add New Tour Package

Name	begin	End
Rio de Janeiro - 7 nights	03/16/2014	03/23/2014
Best of Brazil - 12 nights	03/16/2014	03/28/2014
Brazil Amazon Adventure Pack - 3 nights	03/15/2014	03/18/2014
Iguazu Falls - 3 nights	03/15/2014	03/18/2014

Name:

Begin:

End:

Description:

Price:

Conversation handling

```
@RequestScoped
@Named("cvmg")
public class ConversationManager implements Serializable {
   @Inject private Conversation conversation;
   @Inject private ListConversations list;

   public Conversation getConversation() {
      return conversation;
   }

   public String beginConversation() {
      conversation.begin();
      list.add(conversation);
      return null;
}

   public String endConversation() {
      list.remove(conversation);
      conversation.end();
      return null;
   }
}
```

Conversation handling

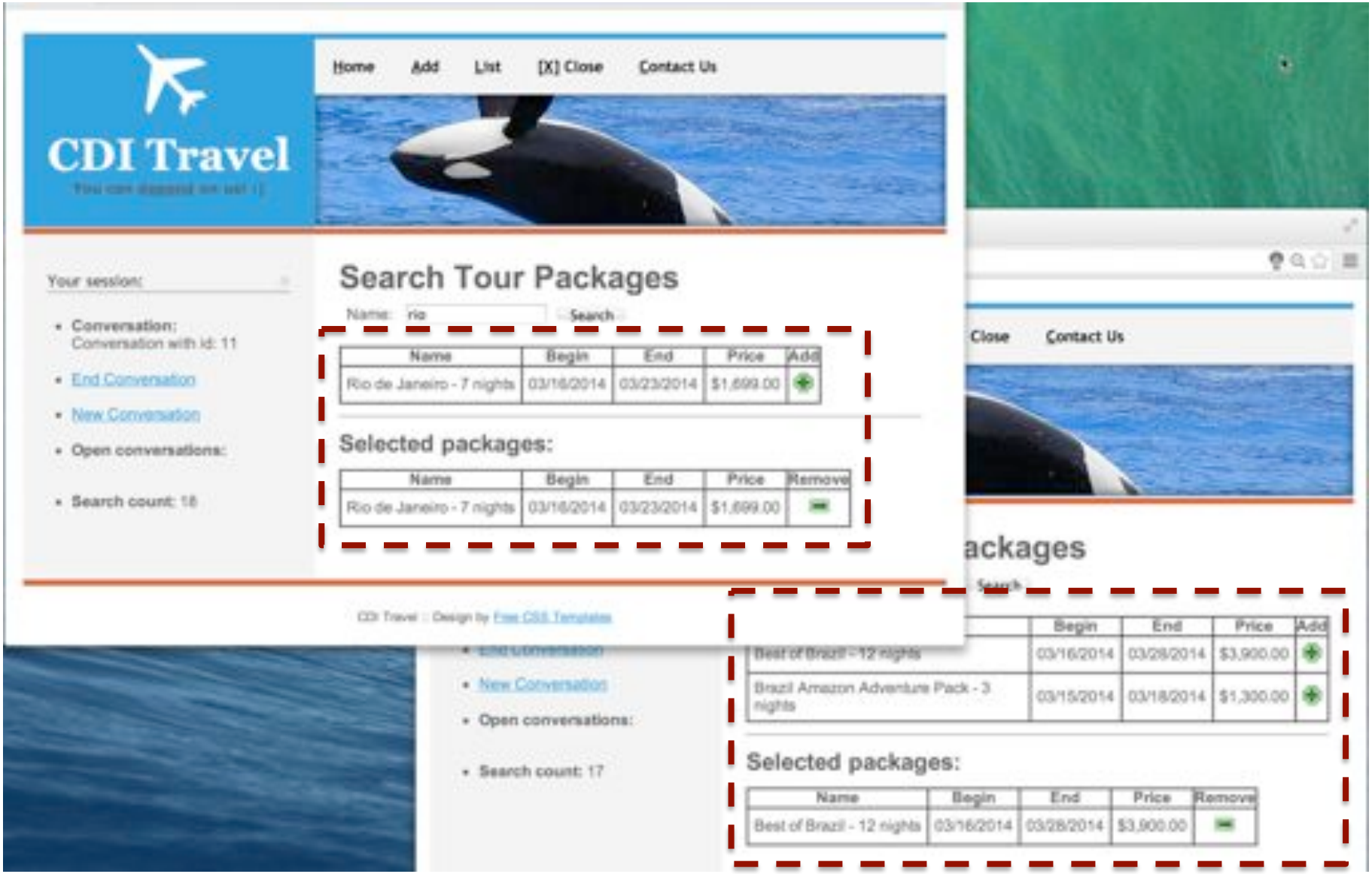
```
@SessionScoped
@Named
public class ListConversations implements Serializable {
   private List<String> conversationIds = new ArrayList<String>();

   public void add(Conversation conversation) {
      conversationIds.add(conversation.getId());
   }

   public void remove(Conversation conversation) {
      conversationIds.remove(conversation.getId());
   }

   public List<String> getList() {
      return conversationIds;
   }
}
```

Conversation handling

```
<ul>
  <li><strong>Conversation:</strong><br /><h:outputText
value="#{cvmg.conversation}" /></li>
  <h:panelGroup rendered="#{cvmg.conversation.transient}">
     <li><h:commandLink action="#{cvmg.beginConversation}"
value="Begin Conversation" /></li>
  </h:panelGroup>
  <h:panelGroup rendered="#{not cvmg.conversation.transient}">
     <li><h:commandLink action="#{cvmg.endConversation}" value="End
Conversation" /></li>
     <li><a href="index.faces">New Conversation</a></li>
  </h:panelGroup>
  <li><strong>Open conversations:</strong>
     <h:dataTable value="#{listConversations.list}" var="id">
        <h:column><a href="index.faces?cid=#{id}"><h:outputText
value="ID #{id}" /></a></h:column>
     </h:dataTable>
  </li>
  <!-- ... -->
</ul>
```

Note that when using links, ?cid= has to be used to keep in the same conversation. JSF components (e.g., buttons) keep the conversation.

Multiple conversations



Multiple conversations (decorator)

```
<h:form id="formMenu">
  <div id="menu">

     <!-- ... -->

     <li>
          <h:commandLink action="#{searchPackages.begin}"
accesskey="S" title="Search" target="_blank"
rendered="#{cvmg.conversation.transient}"><b>S</b>earch</
h:commandLink>
          <h:panelGroup rendered="#{not
cvmg.conversation.transient}"><a href="javascript:window.close();"
accesskey="X" title="[X] Close">[<b>X</b>] Close</a></h:panelGroup>
     </li>

     <!-- ... -->

  </div>
</h:form>
```

Opens a new window and begins a conversation.

Multiple conversations (bean)

```
@ConversationScoped @Named
public class SearchPackages implements Serializable {
   @Inject
   private Conversation conversation;

   // ...

   public String begin() {
      conversation.begin();
      return "/searchPackages.xhtml";
   }

   // ...
}
```

One could open multiple windows with different conversations.

Multiple conversations (web page)

```
<h1>Search Tour Packages</h1>

<h:form id="searchPackages">
  <h:panelGrid columns="3">
     <h:outputLabel for="name" value="Name:" />
     <h:inputText id="name" value="#{searchPackages.name}"
size="20" />
     <h:commandButton action="#{searchPackages.search}"
value="Search" />
  </h:panelGrid>

  <!-- ... -->
</h:form>
```

Multiple conversations (back to bean)

```
@ConversationScoped @Named
public class SearchPackages implements Serializable {
   @EJB private TourPackageDAO tourPackageDAO;
   private String name;                              // + getter/setter
   private List<TourPackage> searchResults;          // + getter

   // ...

   public String search() {
      searchEvent.fire(new SearchEvent(name));
      searchResults = tourPackageDAO.findByName(name);
      return null;
   }

   // ...
}
```

Search results are different in different conversations.

Multiple conversations (back to page)

```
<h:dataTable value="#{searchPackages.searchResults}" var="pack"
rendered="#{(searchPackages.searchResults != null) and (not
searchPackages.searchResults.isEmpty())}" border="1" cellspacing="0">
   <h:column>
      <f:facet name="header">Name</f:facet>
      <h:outputText value="#{pack.name}" />
   </h:column>
   <h:column>
      <f:facet name="header">Begin</f:facet>
      <h:outputText value="#{pack.begin}"><f:convertDateTime
pattern="MM/dd/yyyy" /></h:outputText>
   </h:column>

   <!-- ... -->

</h:dataTable>
```

And so on to select a package, deselect a package, etc.

Flash “scope”

- Not a CDI scope (there’s no @FlashScoped);
- Inspired on Ruby on Rails, included in JSF 2;
- Motivation:
  - Use of redirect after JSF processing;
  - Request data is lost due to redirect;
  - Promoting the bean to session scope is too much.

Flash “scope” (link and form)

```
<!-- In the decorator -->
<li><h:commandLink action="sendMessage.faces" accesskey="C"
title="Contact Us"><b>C</b>ontact Us</h:commandLink></li>
```

```
<h1>Contact Us</h1>                <!-- sendMessage.xhtml -->

<h:form id="sendMessage">
  <h:panelGrid columns="2">
     <h:outputLabel for="name" value="Name:" />
     <h:inputText id="name" value="#{sendMessage.name}" size="40" />

     <h:outputLabel for="email" value="E-mail:" />
     <h:inputText id="email" value="#{sendMessage.email}" size="30”/>

     <h:outputLabel for="message" value="Message:" />
     <h:inputTextarea id="message" value="#{sendMessage.message}"
cols="40" rows="4" />

     <h:commandButton action="#{sendMessage.send}" value="Send" />
  </h:panelGrid>
</h:form>
```

Flash “scope” (bean and result web page)

```
@Model
public class SendMessage {
   private String name;              // + getters/setters
   private String email;             // + getters/setters
   private String message;           // + getters/setters

   public String send() {
      /* Code that sends the message via e-mail (not implemented). */

      // Stores the bean in the FLASH context.
      Flash flash =
FacesContext.getCurrentInstance().getExternalContext().getFlash();
      flash.put("sendMessage", this);

      // Redirects to the thank you page.
      return "thanksForYourMessage.xhtml?faces-redirect=true";
   }
}
```

```
<h1>Contact</h1>

<p>Dear <h:outputText value="#{flash.sendMessage.name}" />, thank you
for your message!</p>
```

Alternatives

- Scenario: during testing I want to inject “mock” versions of beans, but when deploying use the real versions;
- Should we use producer methods?
  - Unnecessary processing for the deployed version;
- Should we use qualifiers?
  - Manual work of placing qualifiers, could lead to errors;
- Solution: alternatives.

Alternatives: how does it work?

- Program to interfaces, not classes (good practice):
  - The injected bean should have an interface;
  - The attribute that receives the injection should be defined as being of the interface type.
- All implementing classes but one receive the @Alternative annotation;
- The one without the annotation is the one used in real deployments;
- The alternatives can be “turned on” via a configuration in beans.xml.

Alternatives: example

```
public interface Message extends Serializable {
   String getMessage();
}
```

```
public class MessageBR implements Message {
   @Override
   public String getMessage() {
      return "A CDI Travel é uma agência com muita tradição...";
   }
}
```

```
@Alternative
public class MessageUS implements Message {
   @Override
   public String getMessage() {
      return "CDI Travel is a travel agency with years of...";
   }
}
```

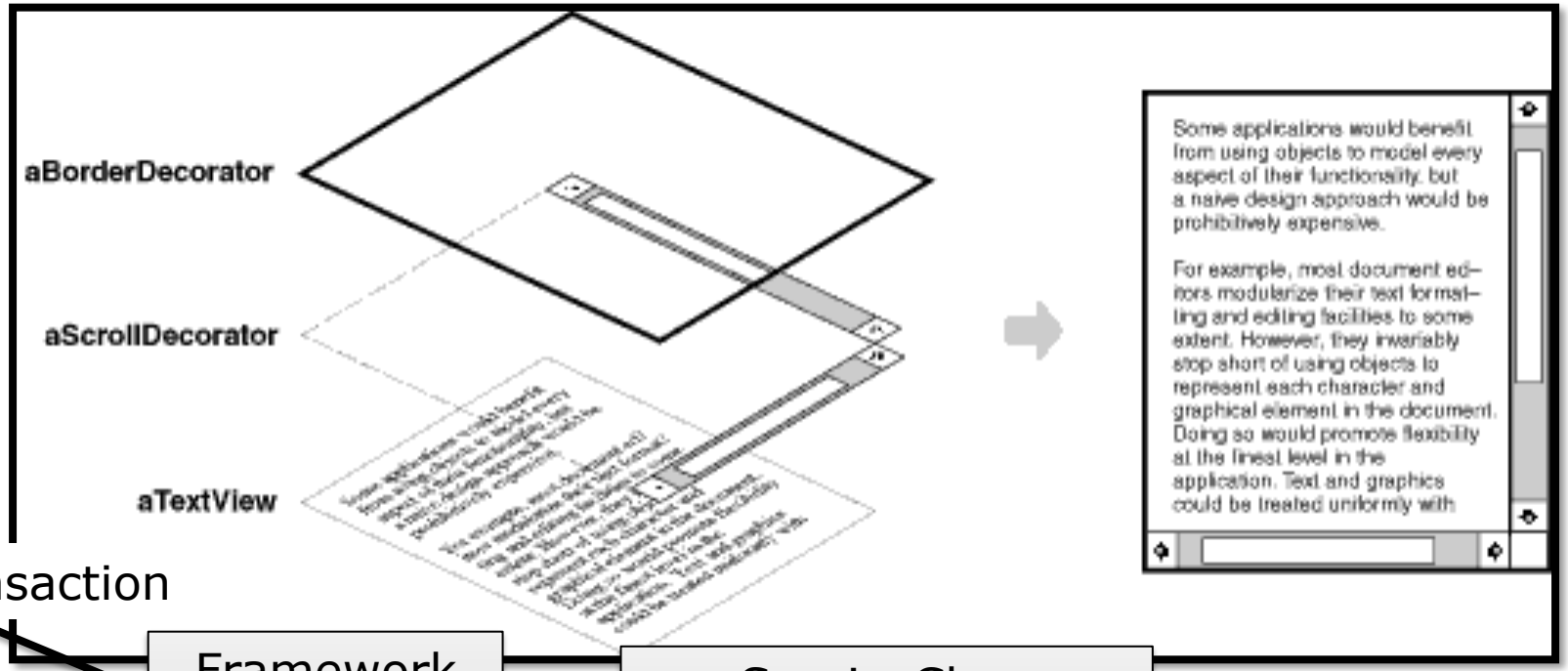
Alternatives: example

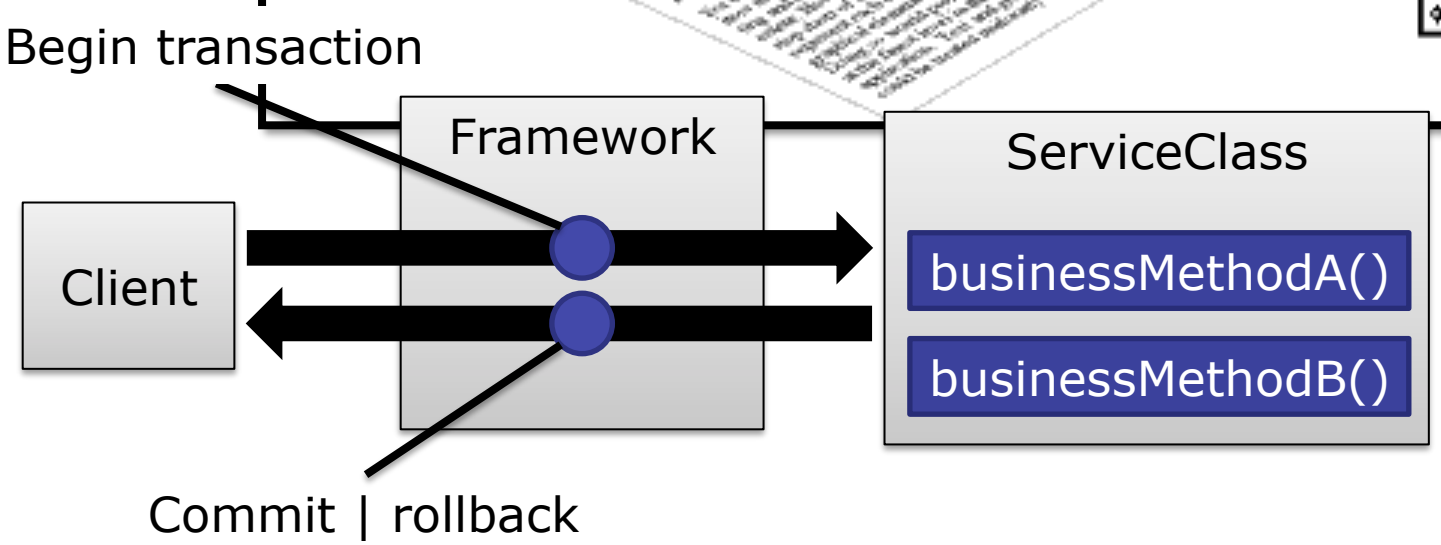
```
@ApplicationScoped @Named
public class ShowMessage implements Serializable {
   @Inject
   private Message message;

   public String getMessage() {
      return message.getMessage();
   }
}
```

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://java.sun.com/xml/ns/javaee"
       xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
       xsi:schemaLocation="http://java.sun.com/xml/ns/javaee http://
java.sun.com/xml/ns/javaee/beans_1_0.xsd">

   <alternatives>
      <class>br.ufes.inf.nemo.dev.cditravel.beans.MessageUS</class>
   </alternatives>

</beans>
```

Interceptors and decorators

- Design patterns, commonly used in AOP.





Interceptors: how does it work?

- Create an annotation that will represent your interceptor;
- Develop one (or more) implementations of your interceptor;
- Annotate one of your beans (the whole class or a specific method) or an entire stereotype with the interceptor annotation;
- Activate one of the interceptor's implementations in beans.xml.

Interceptors: example

```
@InterceptorBinding
@Target({TYPE, METHOD})
@Retention(RUNTIME)
public @interface Timed {}
```

```
@Timed @Interceptor
public class TimerInterceptor implements Serializable {
   private static final Logger logger =
Logger.getLogger(TimerInterceptor.class.getCanonicalName());

   @AroundInvoke
   public Object time(InvocationContext ctx) throws Exception {
      long start = System.currentTimeMillis();
      Object result = ctx.proceed();
      long time = System.currentTimeMillis() - start;
      logger.log(Level.INFO, "Time taken by method {0}: {1} ms", new
Object[] {ctx.getMethod().getName(), time});
      return result;
   }
}
```

Interceptors: example

```
@Stateless @Named("lp")
public class ListPackages {
   // ...

   @Timed
   public String getAveragePrice() {
      // ...
   }
}
```

```
<?xml version="1.0" encoding="UTF-8"?>
<beans ...>

   <interceptors>
      <class>br.ufes....TimerInterceptor</class>
   </interceptors>
</beans>
```

Interceptors vs. decorators

- Interceptors look a lot like decorators (“around” invoke);
- In CDI, there are two main differences:
  - Decorators implement the same interface as the bean they are decorating;
  - Can have the decorated bean injected (in an attribute, constructor or initializer method).
- Also the process is simpler:
  - Create the decorator class;
  - Activate it in beans.xml.

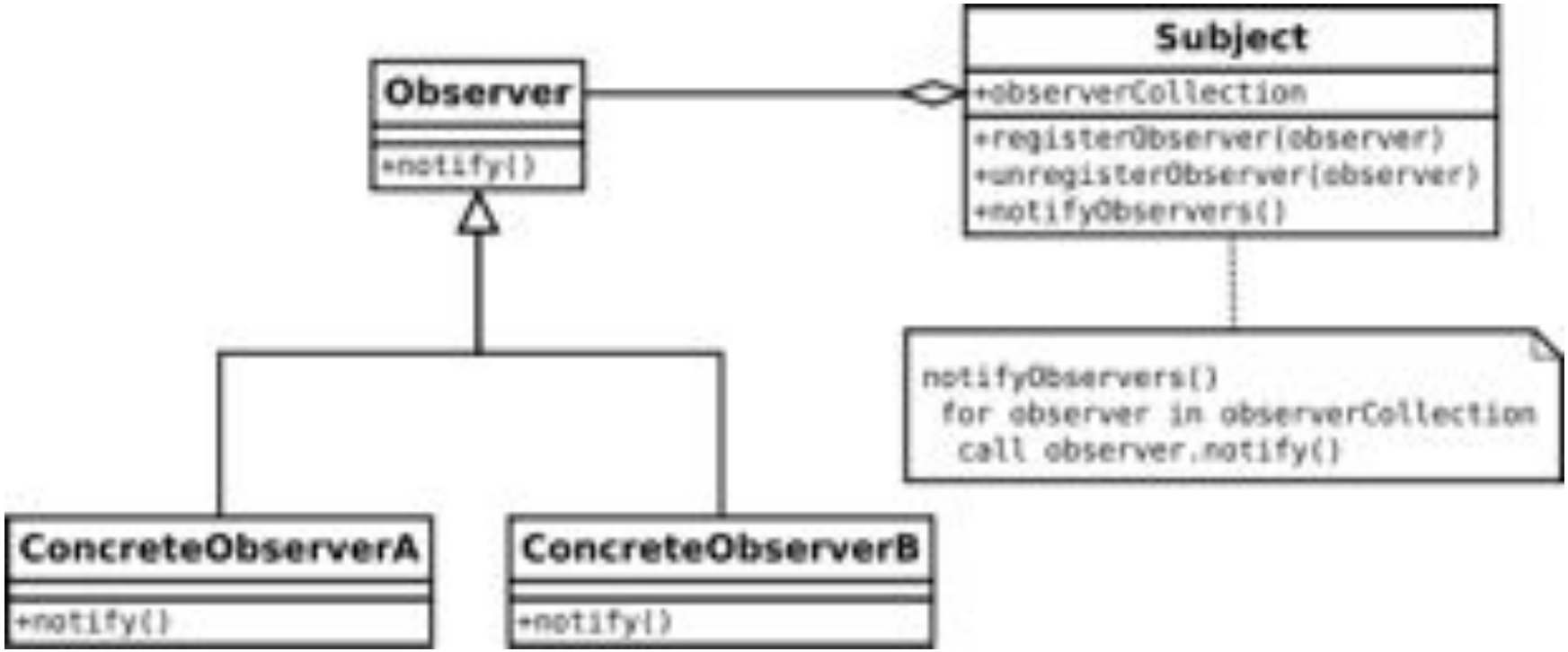
Decorators: example

```
@Decorator
public class QuotedMessage implements Message {
   @Inject @Delegate
   private Message message;

   @Override
   public String getMessage() {
      return "\"" + message.getMessage() + "\"";
   }
}
```

```
<?xml version="1.0" encoding="UTF-8"?>
<beans ...>

   <decorators>
      <class>br.ufes....QuotedMessage</class>
   </decorators>
</beans>
```

Events

- Event-based development (e.g., like in AWT/Swing);
- Beans can be producers and consumers of events;
- CDI implements the observer design pattern.



Events: example

```
public class SearchEvent {
   private String name;

   public SearchEvent(String name) { this.name = name; }
   public String getName() { return name; }
   public void setName(String name) { this.name = name; }
}
```

```
@ConversationScoped @Named
public class SearchPackages implements Serializable {
   // ...

   @Inject
   private Event<SearchEvent> searchEvent;

   public String search() {
      searchEvent.fire(new SearchEvent(name));
      searchResults = tourPackageDAO.findByName(name);
      return null;
   }
}
```

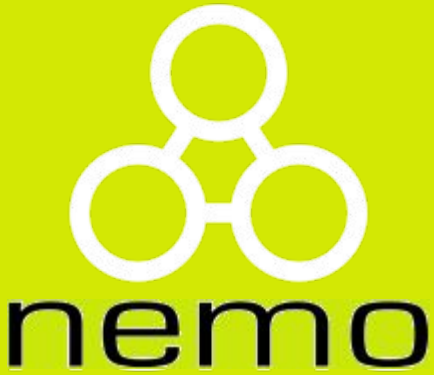
Events: example

```
@SessionScoped @Named
public class ShowNumberOfSearches implements Serializable {
  private static final Logger logger =
Logger.getLogger(ShowNumberOfSearches.class.getCanonicalName());

  private int qty = 0;

  public int getQty() {
     return qty;
  }

  public void countSearch(@Observes SearchEvent event) {
     logger.log(Level.INFO, "Counting one more search. Visitor
searched by name: {0}", event.getName());
     qty++;
  }
}
```

```
<!-- In the decorator -->
<strong>Search count:</strong>
<h:outputText value=" #{showNumberOfSearches.qty}" />
```

Next

- More on JPA: element collections, bean validation, JPQL, criteria API, etc.;
- More on EJBs: authorization, local/remote interfaces, singleton EJBs, asynchronous invocations, etc.



http://nemo.inf.ufes.br/