References & collections

lesson9

In previous lessons you learned how to add your own actions. However this is not enough to fully customize the behavior of your application, because the generated user interface, in concrete the user interface for references and collections, has a standard behavior that sometimes is not the most convenient.

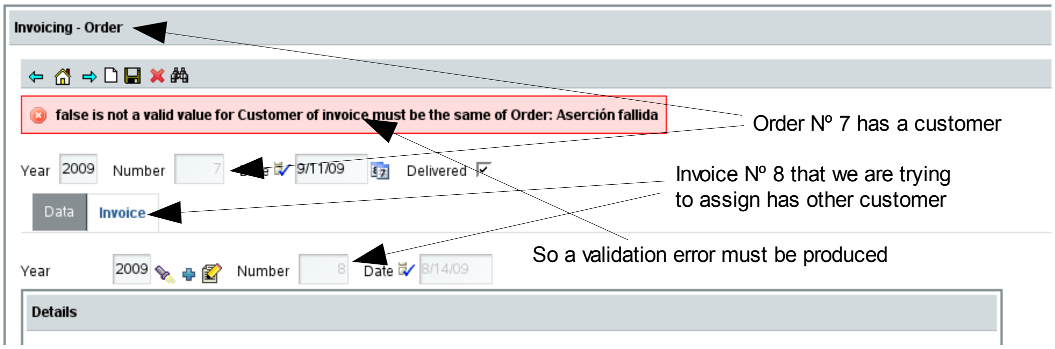
Fortunately, OpenXava provides many ways to customize the behavior for references and collections. In this lesson you will learn how to do some of these customization, and how this adds value to your application.

9.1 Refining reference behavior

You might have noticed that the `Order` module has a little slip: the user can add any invoice he wants to the current order, even if the invoice customer was different. This is not acceptable. Let's fix it.

9.1.1 Validation is good, but not enough

The user can only associate an invoice to an order if both, invoice and order, belong to the same customer. This is specific business logic of your application, so the standard OpenXava behavior does not solve it.


false is not a valid value for Customer of invoice must be the same of Order: Aserción fallida

Invoicing - Order
Year 2009 Number 7 Date 9/11/09 Delivered
Data Invoice
Year 2009 Number 8 Date 8/14/09
Details
Order Nº 7 has a customer
Invoice Nº 8 that we are trying to assign has other customer
So a validation error must be produced

Figure 9.1 Validation error when customer of invoice is incorrect

Since this is business logic we are going to put it in the model layer, that is, in the entities. We'll do it adding a validation. Thus you'll get the effect of figure 9.1.

You already know how to add this validation to your `Order` entity. It's just adding a method annotated with `@AssertTrue`. You can see it in listing 9.1.

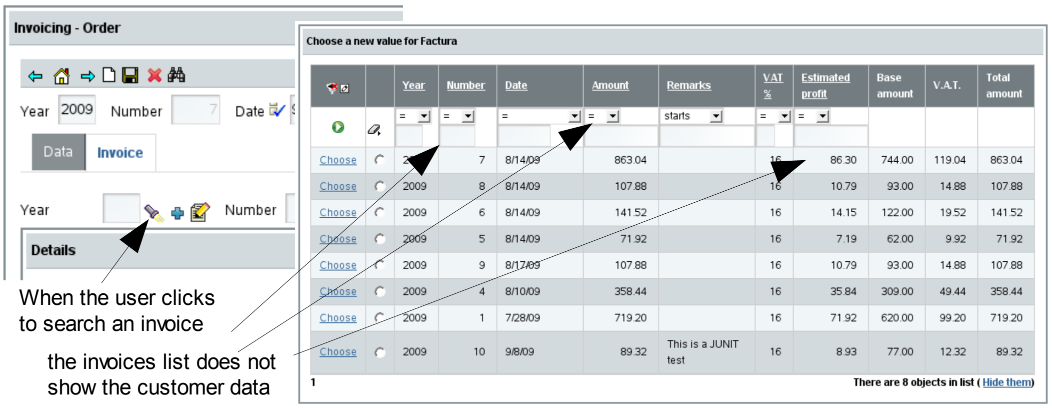
Listing 9.1 New validation method in Order entity

```
@AssertTrue   // This method must return true for this order to be valid
private boolean isCustomerOfInvoiceMustBeTheSame() {
    return invoice == null ||   // invoice is optional
        invoice.getCustomer().getNumber()==getCustomer().getNumber();
}
```

Here we verify that the customer of the invoice is the same as the customer of this order. This is enough to preserve the data integrity, but this validation alone is a poor option from the user viewpoint.

9.1.2 *Modifying default tabular data helps*

Although validation prevents the user from assigning an incorrect invoice to an order, he has a hard time trying to find a correct invoice. Because when the user clicks to search an invoice, all existing invoices are shown and even worse the customer data is not in the list. Look at figure 9.2.



Invoicing - Order

Year 2009 Number 7 Date

Year Number

Choose a new value for Factura

		Year	Number	Date	Amount	Remarks	VAT %	Estimated profit	Base amount	V.A.T.	Total amount
		=	=	=	=	starts	=	=			
Choose		2009	7	8/14/09	863.04		16	86.30	744.00	119.04	863.04
Choose		2009	8	8/14/09	107.88		16	10.79	93.00	14.88	107.88
Choose		2009	6	8/14/09	141.52		16	14.15	122.00	19.52	141.52
Choose		2009	5	8/14/09	71.92		16	7.19	62.00	9.92	71.92
Choose		2009	9	8/17/09	107.88		16	10.79	93.00	14.88	107.88
Choose		2009	4	8/10/09	358.44		16	35.84	309.00	49.44	358.44
Choose		2009	1	7/28/09	719.20		16	71.92	620.00	99.20	719.20
Choose		2009	10	9/8/09	89.32	This is a JUNIT test	16	8.93	77.00	12.32	89.32

1 There are 8 objects in list (Hide them)

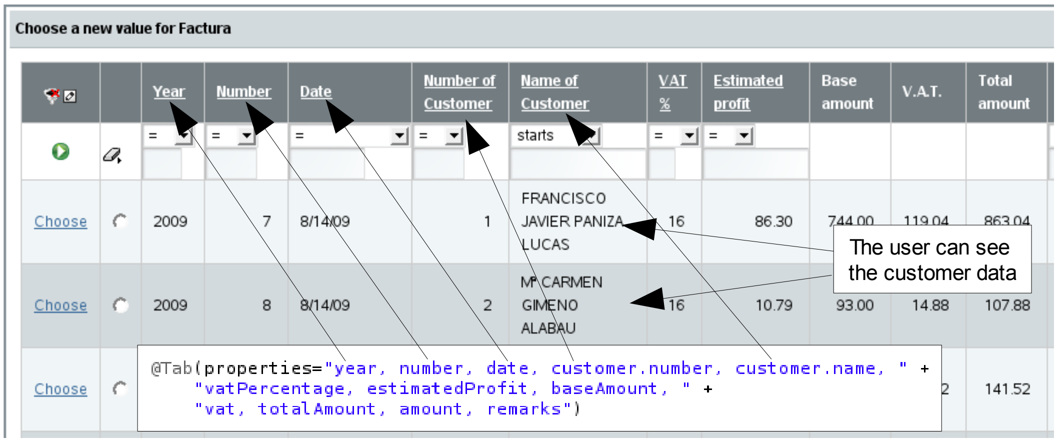
Figure 9.2 The list to search invoices does not show customer data

Obviously, it's difficult to look for an invoice if you do not see the customer. So, let's add the customer to the list using the `properties` attribute of `@Tab` in `Invoice` entity, just as shown in listing 9.2.

Listing 9.2 Tabular data definition for Invoice

```
@Tabs({
    @Tab(
       baseCondition = "deleted = false",
       properties="year, number, date, customer.number, customer.name," +
          "vatPercentage, estimatedProfit, baseAmount, " +
          "vat, totalAmount, amount, remarks"),
    @Tab(name="Deleted", baseCondition = "deleted = true")
})
public class Invoice extends CommercialDocument {
```

The tabular data by default (that is, the list mode) for an entity are all its plain properties, but it does not include references. To change the way the tabular data is shown you can use `properties` in `@Tab` annotations. These properties can be qualified, that is you can, using dot notation, put a property from a reference, as `customer.number` and `customer.name` in this case.



Choose a new value for Factura

		Year	Number	Date	Number of Customer	Name of Customer	VAT %	Estimated profit	Base amount	V.A.T.	Total amount
		=	=	=	=	starts	=	=			
Choose		2009	7	8/14/09	1	FRANCISCO JAVIER PANIZA LUCAS	16	86.30	744.00	119.04	863.04
Choose		2009	8	8/14/09	2	Mª CARMEN GIMENO ALABAU	16	10.79	93.00	14.88	107.88
Choose										2	141.52

The user can see the customer data

```
@Tab(properties="year, number, date, customer.number, customer.name, " +
    "vatPercentage, estimatedProfit, baseAmount, " +
    "vat, totalAmount, amount, remarks")
```

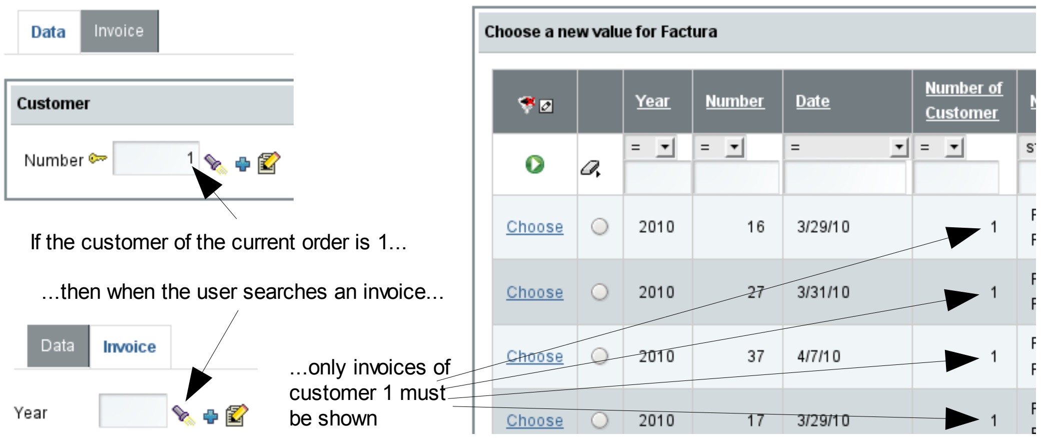
Figure 9.3 Thanks to @Tab the customer data is shown in invoices list

Now the list for choosing an invoice from an order is like the one in figure 9.3.

With this invoice list it is easier to choose the correct one, because now the user can see the customer of each invoice. Moreover, the user can filter by customer to show only the invoices from the customer he is looking for. However, it would be even better if only invoices whose customer is the same as the current order would be shown. Thus the user has no way to make a mistake. Let's do it in the next section.

9.1.3 *Refining action for searching reference with list*

Currently when the user searches an invoice all the invoices are available to choose from. We are going to improve this for showing only the invoices from the customer of the current displayed order, just as shown in figure 9.4.



Data
Invoice
Customer
Number 1
If the customer of the current order is 1...
...then when the user searches an invoice...
Data
Invoice
Year
...only invoices of customer 1 must be shown

Choose a new value for Factura

		Year	Number	Date	Number of Customer
		=	=	=	=
Choose		2010	16	3/29/10	1
Choose		2010	27	3/31/10	1
Choose		2010	37	4/7/10	1
Choose		2010	17	3/29/10	1

Figure 9.4 Searching invoice from order must filter by customer

For defining our own search action for the invoice reference we will use the `@SearchAction` annotation. Listing 9.3 shows the needed modification in `Order` class.

Listing 9.3 @SearchAction to define a custom action to search invoices

```
public class Order extends CommercialDocument {

    @ManyToOne
    @ReferenceView("NoCustomerNoOrders")
    @OnChange(ShowHideCreateInvoiceAction.class)
    @SearchAction("Order.searchInvoice")  // To define our own action to search invoices
    private Invoice invoice;

    ...

}
```

In this simple way we define the action to execute when the user clicks on the flashlight button to search an invoice. The argument used for `@SearchAction`, `Order.searchInvoice`, is the qualified name of the action, that is the action `searchInvoice` of the controller `Order` as defined in *controllers.xml* file.

Now we have to edit *controllers.xml* to add the definition of our new action, just as shown in listing 9.4.

Listing 9.4 Order.searchInvoice action declaration in controllers.xml

```
<controller name="Order">

    ...

    <action name="searchInvoice"
       class="org.openxava.invoicing.actions.SearchInvoiceFromOrderAction"
       hidden="true" image="images/search.gif"/>
       <!--
       hidden="true" :  Because we don't want the action to be shown in module button bar
       image="images/search.gif" :  The same image as for the standard search action
       -->

</controller>
```

Our action extends from `ReferenceSearchAction` which needs them. Listing 9.5 shows the code of the action.

Listing 9.5 Code for custom action to search an invoice from an order

```
package org.openxava.invoicing.actions;   // In 'actions' package

import org.openxava.actions.*;  // To use ReferenceSearchAction

public class SearchInvoiceFromOrderAction
    extends ReferenceSearchAction {   // Standard logic for searching a reference

    public void execute() throws Exception {
       super.execute();  // It executes the standard logic that shows a dialog
```

```
            int customerNumber =
               getPreviousView()   // getPreviousView() is the main view (getView() is the dialog)
                  .getValueInt("customer.number");   // Reads from the view the
                                                     // customer number of the current order
            if (customerNumber > 0) {   // If there is customer we use it to filter
               getTab().setBaseCondition("${customer.number} = " + customerNumber);
            }
        }
 }
```

Note how we use `getTab().setBaseCondition()` to establish a condition for the list to choose the reference. That is, from a `ReferenceSearchAction` you can use `getTab()` to manipulate the way the search list behaves.

If there is no customer we don't add any condition so all the invoices will be shown, this is the case when the user chooses the invoice before choosing the customer.

9.1.4 Searching the reference typing in fields

The list for choosing a reference already works fine. However, we want to give the user the possibility to choose the invoice without the list, by just typing the year and number. Very useful if the user already know which invoice he wants.

OpenXava provides this functionality by default. If the `@Id` fields are displayed in the reference they are used for searching, otherwise OpenXava uses the first displayed field to search. This is not convenient in our case, because the first displayed field is the year, and searching an invoice only by year is not very precise. Figure 9.5 shows the default behavior and a more convenient alternative.

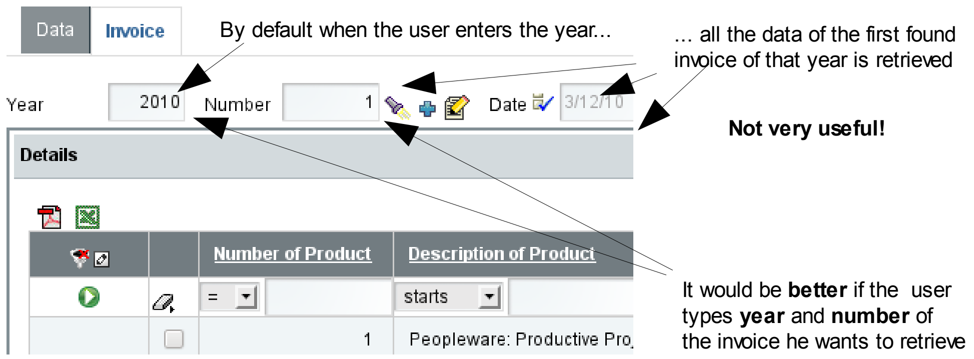

Data
Invoice
By default when the user enters the year...
... all the data of the first found invoice of that year is retrieved
Year
2010
Number
1
Date
3/12/10
Not very useful!
Details
Number of Product
Description of Product
starts
Peopleware: Productive Pro
It would be **better** if the user types **year** and **number** of the invoice he wants to retrieve

Figure 9.5 By default invoice is searched only by year

Fortunately it's easy to indicate which fields we want to use to search from a user perspective. This is done by means of `@SearchKey` annotation. Just edit the `CommercialDocument` class (remember, the parent of `Order` and `Invoice`) and add this annotation to the `year` and `number` properties (listing 9.6).

Listing 9.6 Defining year and number as search key in CommercialDocument

```
abstract public class CommercialDocument extends Deletable {

    ...

    @SearchKey  // Add this annotation here
    @Column(length=4)
    @DefaultValueCalculator(CurrentYearCalculator.class)
    private int year;

    @SearchKey  // Add this annotation here
    @Column(length=6)
    @ReadOnly
    private int number;


    ...

}
```

In this way when the user searches an order or invoice from a reference he must type the year and the number, and the corresponding entity will be retrieved from database and will populate the user interface.

Now it's easy for the user to choose an invoice for the order without using the searching list, just by typing year and number.

9.1.5 Refining action for searching reference typing key

Now that retrieving an invoice by the year and number is usable, we want to refine it in order to help our user to do his work more efficiently. For example, it would be useful that if the user has not chosen a customer for the order yet and he chooses an invoice, the customer of that invoice will be assigned to the current order automatically. Figure 9.6 visualizes the wanted behavior.

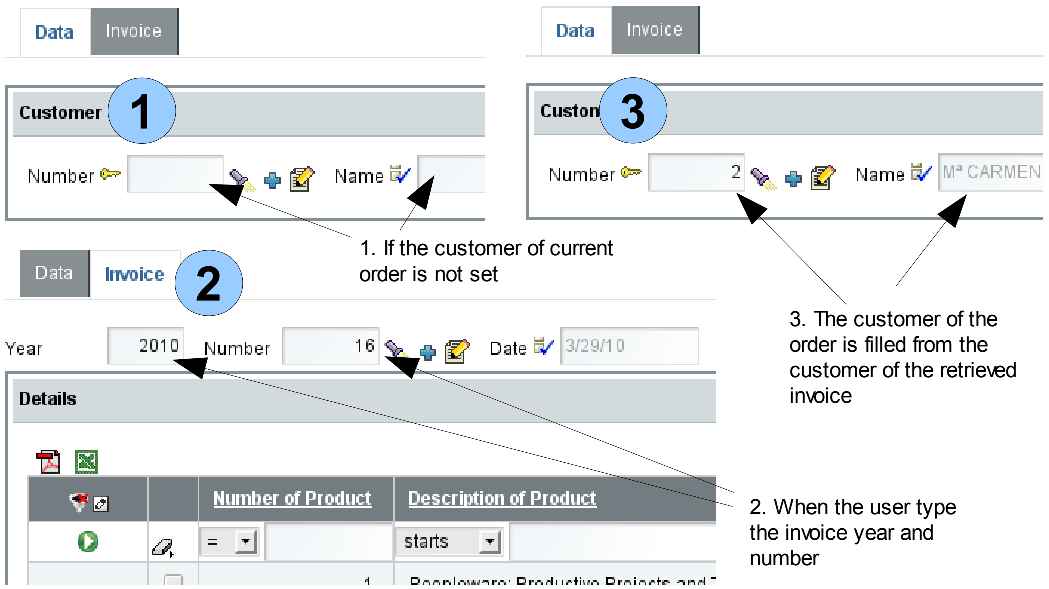
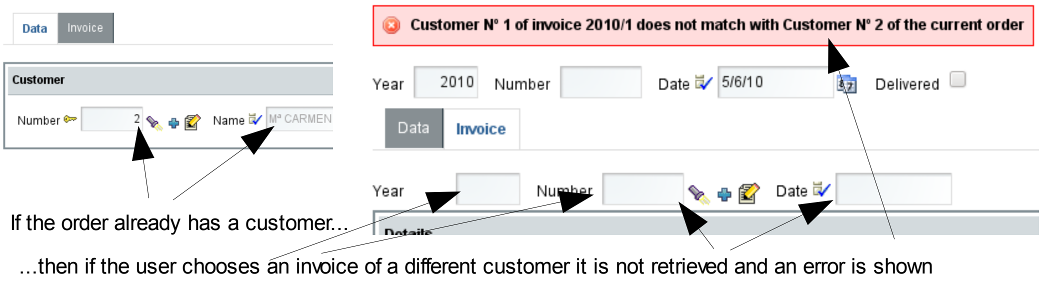

Data
Invoice
Customer
1
Number
Name
1. If the customer of current order is not set
2
Year 2010
Number 16
Date 3/29/10
Details
Number of Product
Description of Product
starts
3
Number 2
Name Mª CARMEN
3. The customer of the order is filled from the customer of the retrieved invoice
2. When the user type the invoice year and number

Figure 9.6 Choosing an invoice when there is no customer selected yet

On the other hand, if the user already has selected the customer for the order, if he is not the same in the invoice, it will be rejected and a message error displayed, just as shown in figure 9.7.


Customer Nº 1 of invoice 2010/1 does not match with Customer Nº 2 of the current order

Data
Invoice
Customer
Number 2
Name Mª CARMEN
Year 2010
Number
Date 5/6/10
Delivered
Year
Number
Date
Details
If the order already has a customer...
...then if the user chooses an invoice of a different customer it is not retrieved and an error is shown

Figure 9.7 Choosing an invoice when the customer is already selected

For defining this special behavior we have to add an `@OnChangeSearch` annotation in the the `invoice` reference of `Order`. `@OnChangeSearch` allows you to define your own action to do the search of the reference when its key changes in the user interface. You can see the modified reference in listing 9.7.

Listing 9.7 Refining action to get Invoice from Order when its key changes

```
public class Order extends CommercialDocument {

    @ManyToOne
    @ReferenceView("NoCustomerNoOrders")
    @OnChange(ShowHideCreateInvoiceAction.class)
    @OnChangeSearch(OnChangeSearchInvoiceAction.class)  // Add this annotation
    @SearchAction("Order.searchInvoice")
    private Invoice invoice;

    ...

}
```

From now on when the user types a new year and number for the invoice, the logic of `OnChangeSearchInvoiceAction` will be executed. In this action you have to read the invoice data from database and update the user interface. Listing 9.8 shows the action code.

Listing 9.8 Action for searching the invoice when typing a year and number

```
package org.openxava.invoicing.actions;   // In 'actions' package

import java.util.*;
import org.openxava.actions.*;   // To use OnChangeSearchAction
import org.openxava.invoicing.model.*;
import org.openxava.model.*;
import org.openxava.view.*;

public class OnChangeSearchInvoiceAction
    extends OnChangeSearchAction {   // Standard logic for searching a reference when the
                                     // the key values change in the user interface (1)
    public void execute() throws Exception {
        super.execute();   // It executes the standard logic (2)
        Map keyValues = getView()// getView() here is the reference view, not the main one (3)
            .getKeyValuesWithValue();
        if (keyValues.isEmpty()) return; // If key is empty no additional logic is executed
        Invoice invoice = (Invoice)   // We search the Invoice entity from the typed key (4)
            MapFacade.findEntity(getView().getModelName(), keyValues);
        View customerView = getView().getRoot().getSubview("customer"); // (5)
        int customerNumber = customerView.getValueInt("number");
        if (customerNumber == 0) {   // If there is no customer we fill it (6)
            customerView.setValue("number", invoice.getCustomer().getNumber());
            customerView.refresh();
        }
        else {   // If there is already customer we verify that he matches the invoice customer (7)
            if (customerNumber != invoice.getCustomer().getNumber()) {
                addError("invoice_customer_not_match",
                    invoice.getCustomer().getNumber(), invoice, customerNumber);
                getView().clear();
            }
        }
    }

}
```

Given the action extends from `OnChangeSearchAction` (1) and we use `super.execute()` (2) it behaves just in the standard way, that is, when the user types a year and number the invoice data is retrieved and fills the user interface. Afterwards, we use `getView()` (3) to obtain the key of the displayed invoice to find the corresponding entity using `MapFacade` (4). From inside an `OnChangeSearchAction` `getView()` returns the subview of the reference, and not the global view. Therefore, in this case `getView()` is the view of the invoice reference. This allows you to create more reusable `@OnChangeSearch` actions. Thus you have to write `getView().getRoot().getSubview(“customer”)` (5) to access to the customer view.

To implement the behavior visualized in the previous figure 9.6, the action asks if there is no customer (`customberNumber == 0`) (6). If this is the case it fills the customer from the customer of the invoice. Otherwise it implements the logic from figure 9.7 verifying that the customer of the current order matches the customer of the retrieved invoice.

The last remaining detail is the message text. Add the entry in listing 9.9 to the *Invoicing-messages_en.properties* file of *i18n* folder.

Listing 9.9 Invoice search error in Invoicing-messages_en.properties

```
invoice_customer_not_match=Customer Nº {0} of invoice {1} does not match with
Customer Nº {2} of the current order
```

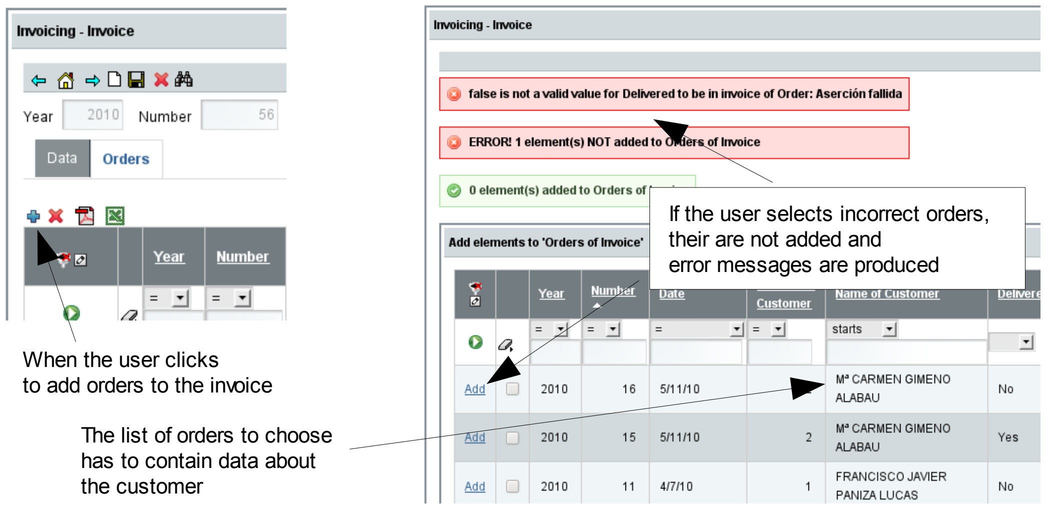
One interesting thing about `@OnChangeSearch` is that it is also executed when the invoice is chosen from a list, because in this case the year and number of the invoice also changes. Hence, this is a centralized place to refine the logic for retrieving the reference and populating the view.

9.2 Refining collection behavior

We can refine collections in the same way we have refined references. This is very useful, because it allows us to improve the current behavior of the `Invoice` module. The user can only add an order to an invoice if the invoice and the orders belongs to the same customer. Moreover, the order must be delivered and must not have an invoice yet.

9.2.1 Modifying default tabular data helps

With the default behavior the user may have a hard time trying to find the correct orders to add to his invoice. Because when the user clicks to add orders, all existing orders are shown, and even worse, the customer data is not shown in the list. We wanted that the customer data would be shown in the orders list, just as shown figure 9.8.



false is not a valid value for Delivered to be in invoice of Order: Aserción fallida

ERROR! 1 element(s) NOT added to Orders of Invoice

0 element(s) added to Orders of I

If the user selects incorrect orders, their are not added and error messages are produced

When the user clicks to add orders to the invoice

The list of orders to choose has to contain data about the customer

		Year	Number	Date	Customer	Name of Customer	Delivere
Add	☐	2010	16	5/11/10		Mª CARMEN GIMENO ALABAU	No
Add	☐	2010	15	5/11/10	2	Mª CARMEN GIMENO ALABAU	Yes
Add	☐	2010	11	4/7/10	1	FRANCISCO JAVIER PANIZA LUCAS	No

Figure 9.8 Adding orders to invoice showing customer data in orders list

Listing 9.10 shows how to add the customer to the list using the `properties` attribute of `@Tab` in `Order` entity.

Listing 9.10 Tabular data definition for Order

```
@Tabs({
    @Tab(baseCondition = "deleted = false",
       properties="year, number, date, customer.number, customer.name," +
          "delivered, vatPercentage, estimatedProfit, baseAmount, " +
          "vat, totalAmount, amount, remarks"
    ),
    @Tab(name="Deleted", baseCondition = "deleted = true")
})
public class Order extends CommercialDocument {
```

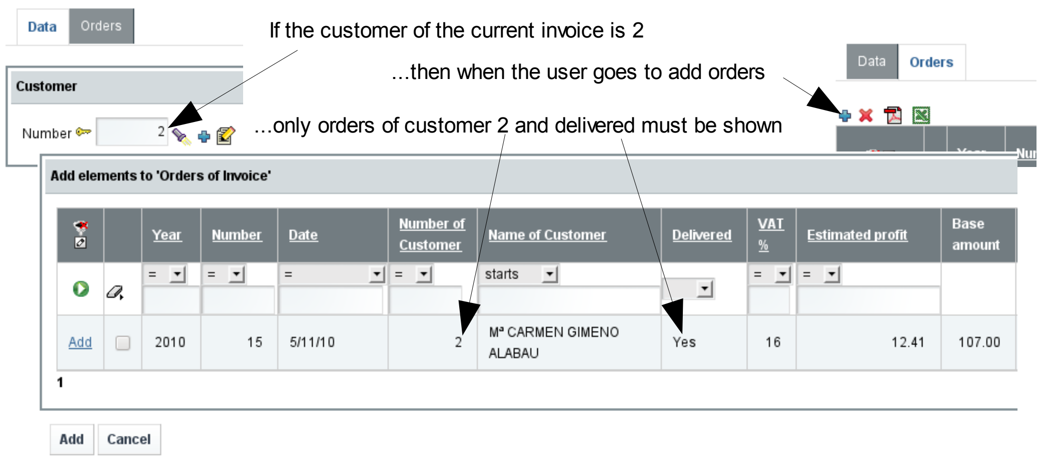
Note how we have added `customer.number` and `customer.name`.

Figure 9.8 also shows how the validation in the entities prevent the user from adding incorrect orders.

However, it would be better if only orders available to be added to the current invoice would be present in the list. Thus, the user has no way to make a mistake. Let's do it in next section.

9.2.2 *Refining the list for adding elements to a collection*

Currently when the user tries to add orders to an invoice all the orders are available. We are going to improve this for showing only the orders from the customer of the invoice, delivered and with not invoice yet, just as shown in figure 9.9.


Data
Orders
Customer
Number 2
If the customer of the current invoice is 2
...then when the user goes to add orders
...only orders of customer 2 and delivered must be shown
Add
Cancel

Add elements to 'Orders of Invoice'

		Year	Number	Date	Number of Customer	Name of Customer	Delivered	VAT %	Estimated profit	Base amount
		=	=	=	=	starts		=	=	
Add	☐	2010	15	5/11/10	2	Mª CARMEN GIMENO ALABAU	Yes	16	12.41	107.00

1

Figure 9.9 Adding orders shows only delivered orders of the current customer

We will use the `@NewAction` annotation for defining our own action to show the list for adding orders. Listing 9.11 shows the needed modification in `Order` class.

Listing 9.11 @NewAction to define a custom action to go to add orders list

```
public class Invoice extends CommercialDocument {

    @OneToMany(mappedBy="invoice")
    @CollectionView("NoCustomerNoInvoice")
    @NewAction("Invoice.addOrders")   // To define our own action to add orders
    private Collection<Order> orders;

    ...

}
```

In this simple way we define the action to execute when the user clicks on the plus sign (+) button to add orders. The argument used for `@NewAction`, `Invoice.addOrders`, is the qualified name of the action, that is the action `addOrders` of the controller `Invoice` as defined in *controllers.xml* file.

Now we have to edit *controllers.xml* to add the `Invoice` controller (it does not exist yet) definition with our new action. Listing 9.12 shows the controller definition.

Listing 9.12 Invoice.addOrders action declaration in controllers.xml

```
<controller name="Invoice">
    <extends controller="Invoicing"/>

    <action name="addOrders"
       class="org.openxava.invoicing.actions.GoAddOrdersToInvoiceAction"
       hidden="true" image="images/create_new.gif"/>
       <!--
       hidden="true" :  Because we don't want the action to be shown in module button bar
```

```
        image="images/create_new.gif":  The same image as for the standard action
        -->

</controller>
```

Listing 9.13 shows the action code.

Listing 9.13 Code for custom action to go to "add orders" from an invoice

```
package org.openxava.invoicing.actions;  // In 'actions' package

import org.openxava.actions.*;  // To use GoAddElementsToCollectionAction

public class GoAddOrdersToInvoiceAction
    extends GoAddElementsToCollectionAction {    // Standard logic to go to
                                                 // adding collection elements list
    public void execute() throws Exception {
       super.execute();  // It executes the standard logic, that shows a dialog
       int customerNumber =
          getPreviousView() // getPreviousView() is the main view (we are in a dialog)
             .getValueInt("customer.number");  // Reads the customer number
                                                 // of the current invoice from the view
       getTab().setBaseCondition(  // The condition of the orders list to add
          "${customer.number} = " + customerNumber +
          " and ${delivered} = true and ${invoice.oid} is null"
       );
    }

}
```

Note how we use `getTab().setBaseCondition()` to establish a condition for the list to choose the entities to add. That is, from a `GoAddElementsToCollectionAction` you can use `getTab()` to manipulate the way the list behaves.

9.2.3 Refining the action to add elements to a collection

A useful improvement for the orders collection would be that when the user adds orders to the current invoice, the detail lines of those orders will be copied automatically to the invoice.

We cannot use the `@NewAction` for this, because it is the action to show the list to add elements to the collection. But this is not the action that adds the elements. Let's learn how to define the action that actually adds the elements (figure 9.10).

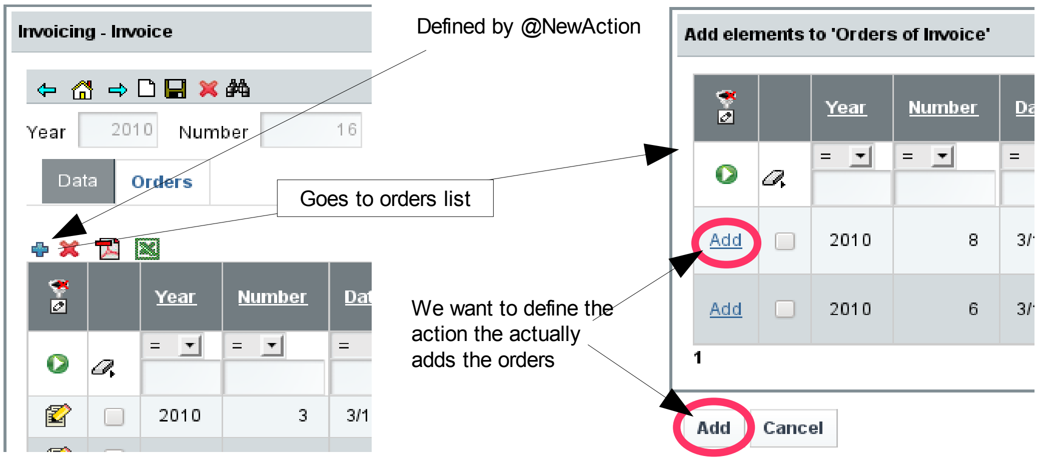


Figure 9.10 We want to refine the 'Add' action in orders list

Unfortunately, there is not an annotation to directly define this 'Add' action. However, that is not a very difficult task, we only have to refine the `@NewAction` instructing it to show our own controller, and in this controller we can put the actions we want. Given we already have defined our `@NewAction` in the previous section we only have to add a new method to the already existing `GoAddOrdersToInvoiceAction` class. Listing 9.14 shows this method.

Listing 9.14 Method getNextController() added to GoAddOrdersToInvoiceAction

```
public class GoAddOrdersToInvoiceAction ... {

    ...

    public String getNextController() {   // We add this method
        return "AddOrdersToInvoice";  // The controller with the available actions in
    }                                 // the list of orders to add

}
```

By default the actions in the list of entities to add (the 'Add' and 'Cancel' buttons) are from the standard OpenXava controller `AddToCollection`. Overwriting `getNextController()` in our action allows us to define our own controller instead. Listing 9.15 shows the definition of our custom controller for adding elements in *controllers.xml*.

Listing 9.15 Custom controller to add orders to the invoice

```
<controller name="AddOrdersToInvoice">
    <extends controller="AddToCollection"/> <!-- Extends from the standard controller -->

    <!-- Overwrites the action to add -->
    <action
       name="add"
       class="org.openxava.invoicing.actions.AddOrdersToInvoiceAction"/>
```

```
</controller>
```

In this way the action to add orders to the invoice is `AddOrdersToInvoiceAction`. Remember that the goal of our action is to add the orders to the invoice in the usual way, but also to copy the detail lines from those orders to the invoice. Listing 9.16 shows the action code.

Listing 9.16 Code for custom action to to add orders to an invoice

```
package org.openxava.invoicing.actions;   // In 'actions' package

import java.rmi.*;
import java.util.*;
import javax.ejb.*;
import org.openxava.actions.*;   // To use AddElementsToCollectionAction
import org.openxava.invoicing.model.*;
import org.openxava.model.*;
import org.openxava.util.*;
import org.openxava.validators.*;

public class AddOrdersToInvoiceAction
    extends AddElementsToCollectionAction {   // Standard logic for adding
                                               // collection elements
    public void execute() throws Exception {
        super.execute();   // We use the standard logic "as is"
        getView().refresh();      // To display fresh data, including recalculated
    }                             // amounts, which depend on detail lines

    protected void associateEntity(Map keyValues)   // The method called to associate
        throws ValidationException,         // each entity to the main one, in this case to
            XavaException, ObjectNotFoundException,// associate each order to the invoice
            FinderException, RemoteException
    {
        super.associateEntity(keyValues);   // It executes the standard logic (1)
        Order order = (Order) MapFacade.findEntity("Order", keyValues); // (2)
        order.copyDetailsToInvoice();   // Delegates the main work to the entity (3)
    }

}
```

We overwrite the `execute()` method only to refresh the view after the process. Really, we want to refine the logic for associating an order to the invoice. The way to do this is overwriting the `associateEntity()` method. The logic here is simple, after executing the standard logic (1) we search the corresponding `Order` entity and then call the `copyDetailsToInvoice()` in that `Order`.

Obviously, we need to have a `copyDetailsToInvoice()` method in `Order` entity. Listing 9.17 shows this method.

Listing 9.17 Method copyDetailsInvoice() in Order class

```
public class Order extends CommercialDocument {
    ...

    public void copyDetailsToInvoice() {
       copyDetailsToInvoice(getInvoice());   // We rely in an already existing method
    }

}
```

Luckily we already have a method to copy details from an `Order` to the specified `Invoice`, we just call this method sending the `Invoice` of the `Order`.

These little modifications to the behavior of `orders` collection of `Invoice` are enough to convert the `Invoice` module in an effective tool for invoicing individual customers. You only have to create a new invoice, choose a customer and add orders. It is even easier than using the list mode of `Order` module (we developed an action to do it in section 8.2) because from `Invoice` module only the suitable orders for the customer are shown.

9.3 JUnit tests

We still are in the healthy habit of doing some application code, then some testing code. And now it's time to write the test code for the new feature we added in this lesson.

9.3.1 Adapting OrderTest

If you run `OrderTest` right now it does not pass. This is because our test code relies in some details that have changed. Therefore, we have to modify the current test code. Edit the `testSetInvoice()` method of `OrderTest` and apply the changes in listing 9.18.

Listing 9.18 Modifications in testSetInvoice() method of OrderTest

```
public void testSetInvoice() throws Exception {

    ...

    assertValue("invoice.number", "");
    assertValue("invoice.year", "");
    ~~execute("Reference.search",~~   // The standard action for invoice searching
       ~~"keyProperty=invoice.year");~~     // is no longer used
    execute("Order.searchInvoice",   // Instead we use our custom action (1)
       "keyProperty=invoice.number");
    execute("List.orderBy", "property=number");

    ...

    // Restore values
    setValue("delivered", "false");
    setValue("invoice.year", "");  // Now we need to type a year
    setValue("invoice.number", "");  // and a number to search the invoice (2)
    execute("CRUD.save");
    assertNoErrors();
}
```

Remember that we annotated the invoice reference in `Order` with `@SearchAction("Order.searchInvoice")` (section 9.1.3), so we have to modify the test to call `Order.searchInvoice` (1) instead of `Reference.search`. In section 9.1.4 we added `@SearchKey` to `year` and `number` of `CommercialDocument`, therefore our test has to indicate both `year` and `number` to get (or clear in this case) an invoice (2). Because of this last point we also have to modify `testCreateInvoiceFromOrder()` of `OrderTest` as shown in listing 9.19.

Listing 9.19 Modifications in testCreateInvoiceFromOrder() method of OrderTest

```
public void testCreateInvoiceFromOrder() throws Exception {

    ...

    // Restoring the order for running the test the next time
    setValue("invoice.year", "");  // Now we need to type a year
    setValue("invoice.number", "");  // and a number to search the invoice (2)
    assertValue("invoice.number", "");
    assertCollectionRowCount("invoice.details", 0);
    execute("CRUD.save");
    assertNoErrors();
}
```

After these changes the `OrderTest` must pass. However, we still have to add the testing of the new functionality of `Order` module.

9.3.2 Testing the @SearchAction

In section 9.1.3 we used `@SearchAction` in the `invoice` reference of `Order` for showing in the search list only the invoices from the customer of the current order. Listing 9.20 shows the test of this functionality.

Listing 9.20 Testing searching invoice from order in OrderTest

```
public void testSearchInvoiceFromOrder() throws Exception {
    execute("CRUD.new");
    setValue("customer.number", "1");  // If the customer is 1...
    execute("Sections.change", "activeSection=1");
    execute("Order.searchInvoice",  // ...when the user clicks to choose an invoice...
       "keyProperty=invoice.number");
    assertCustomerInList("1");  // ...only the invoices of customer 1 are shown
    execute("ReferenceSearch.cancel");
    execute("Sections.change", "activeSection=0");
    setValue("customer.number", "2");  // And if the customer is 2...
    execute("Sections.change", "activeSection=1");
    execute("Order.searchInvoice",  // ...when the user clicks to choose an invoice...
        "keyProperty=invoice.number");
    assertCustomerInList("2");  // ...only the invoices of customer 2 are shown
}
```

The trickier part is to assert the invoices list, this is the work for `assertCustomerInList()` whose code you can see in listing 9.21.

Listing 9.21 Asserting all the values of the customer column are the expected

```
private void assertCustomerInList(String customerNumber) throws Exception {
    assertListNotEmpty();
    int c = getListRowCount();
    for (int i=0; i<c; i++) {  // A loop over all rows
       if (!customerNumber.equals(getValueInList(i, "customer.number"))) {
          fail("Customer in row " + i +  // If the customer is not the expected one it fails
             " is not of customer " + customerNumber);
       }
    }
}
```

It consists in a loop over all rows verifying the customer number.

9.3.3 Testing the @OnChangeSearch

In section 9.1.5 we used `@SearchAction` in the `invoice` reference of `Order` for assigning automatically the customer of the chosen invoice to the current order when the order has no customer yet, or for verifying that the invoice and order customer matches, if the order already has a customer. Listing 9.22 shows the test method in `OrderTest`.

Listing 9.22 Testing events on changing the invoice of an order

```
public void testOnChangeInvoice() throws Exception {
    execute("CRUD.new");  // We are creating a new order
    assertValue("customer.number", "");  // so it has no customer yet
    execute("Sections.change", "activeSection=1");
    execute("Order.searchInvoice",  // Looks for the invoice using a list
       "keyProperty=invoice.number");

    execute("List.orderBy", "property=customer.number");  // It orders by customer
    String customer1Number = getValueInList(0, "customer.number"); // Memorizes..
    String invoiceYear1 = getValueInList(0, "year");  // ..the data of the...
    String invoiceNumber1 = getValueInList(0, "number");  // ...first invoice
    execute("List.orderBy", "property=customer.number");  // It  orders by customer
    String customer2Number = getValueInList(0, "customer.number"); // Memorizes..
    String customer2Name = getValueInList(0, "customer.name");  // ..the data of
                                                           // ...the last invoice
    assertNotEquals("Must be invoices of different customer",
       customer1Number, customer2Number);  // The 2 memorized invoices aren't the same

    execute("ReferenceSearch.choose","row=0");// The invoice is chosen using the list (1)
    execute("Sections.change", "activeSection=0");
    assertValue("customer.number", customer2Number);      // The customer data is
    assertValue("customer.name", customer2Name);          // filled automatically (2)
    execute("Sections.change", "activeSection=1");
    setValue("invoice.year", invoiceYear1);   // We try to put an invoice of another...
    setValue("invoice.number", invoiceNumber1); // ...customer (3)

    assertError("Customer Nº " + customer1Number + " of invoice " + // It shows
       invoiceYear1 + "/" + invoiceNumber1 +                  // an error message... (4)
       " does not match with Customer Nº " +
       customer2Number + " of the current order");

    assertValue("invoice.year", "");  // ...and resets the invoice data (5)
    assertValue("invoice.number", "");
    assertValue("invoice.date", "");
}
```

Here we test that our on-change action fills the customer data (3) on choosing an invoice (2), and that if the customer is already set, an error message is shown (4) and the invoice is cleared in the view (5). Note how the first time we use the list (1) to choose the invoice and the second time we do it typing the year and number (3).

9.3.4 Adapting InvoiceTest

As in the case of `OrderTest`, `InvoiceTest` also fails to pass. You have to do a little adjustments so it works fine. Edit `testAddOrders()` of `InvoiceTest` and apply the changes shown in listing 9.23.

Listing 9.23 Modifications in testAddOrders() method of InvoiceTest

```
public void testAddOrders() throws Exception {
    assertListNotEmpty();
    execute("List.orderBy", "property=number");
    execute("Mode.detailAndFirst");
    execute("Sections.change", "activeSection=1");
    assertCollectionRowCount("orders", 0);
    ~~execute("Collection.add",~~  // The standard action for adding orders is no longer used
    execute("Invoice.addOrders",  // Instead we use our custom action
       "viewObject=xava_view_section1_orders");
    ~~checkFirstOrderWithDeliveredEquals("Yes");~~  // Now all orders in the list are
    ~~checkFirstOrderWithDeliveredEquals("No");~~   // delivered so it makes no sense

    ~~execute("AddToCollection.add");~~  // Instead of the standard action...
    execute("AddOrdersToInvoice.add", "row=0");  // ...now we have our custom one
    ~~assertError("ERROR! 1 element(s) NOT added to Orders of Invoice");~~  // It is
                                   // impossible because the use cannot chose incorrect orders
    assertMessage("1 element(s) added to Orders of Invoice");
    assertCollectionRowCount("orders", 1);
    checkRowCollection("orders", 0);
    execute("Collection.removeSelected",
       "viewObject=xava_view_section1_orders");
    assertCollectionRowCount("orders", 0);
}
```

The `checkFirstOrderWithDeliveredEquals()` method is no longer necessary, therefore we can remove it from `InvoiceTest` (listing 9.24).

Listing 9.24 Removing checkFirstOrderWithDeliveredEquals() from InvoiceTest

```
~~private void checkFirstOrderWithDeliveredEquals(String value)~~
    ~~throws Exception { ... }~~
```

After these changes the `InvoiceTest` must pass. However, we still have to add the testing of the new functionality of `Invoice` module.

9.3.5 Testing the @NewAction

In section 9.2.2 we annotated the `orders` collection of `Invoice` with `@NewAction` to refine the list of orders to be added to the collection. In this way only delivered orders of the customer of the current invoice and with no invoice yet are shown. We are going to test this, and at the same time, we'll learn how to refactor the existing code in order to reuse it.

First, we want to verify that the list to add orders only contains orders of the current customer. Listing 9.25 shows the changes in `testAddOrders()` to accomplish this.

Listing 9.25 Verifying all orders in list are from the current customer

```
public void testAddOrders() throws Exception {
    assertListNotEmpty();
    execute("List.orderBy", "property=number");
    execute("Mode.detailAndFirst");
    String customerNumber = getValue("customer.number");   // We take note of the
    execute("Sections.change", "activeSection=1"); // customer of the invoice
    assertCollectionRowCount("orders", 0);
    execute("Invoice.addOrders",
       "viewObject=xava_view_section1_orders");
    assertCustomerInList(customerNumber);      // We assert all customers in list
                                                  // matches the invoice customer
    ...

}
```

Now we have to write the `assertCustomerInList()` method. But, wait a minute, we already have written this method in `OrderTest`. We saw it in listing 9.34 (section 9.3.2). We are in `InvoiceTest` so we cannot call this method, fortunately both `InvoiceTest` and `OrderTest` extend the `CommercialDocumentTest`, therefore we only need to pull up the method. To do it copy the `assertCustomerInList()` method from `OrderTest` and paste it in `CommercialDocumentTest`, changing `private` to `protected`, just as shown in listing 9.26.

Listing 9.26 assertCustomerInList() moved to CommercialDocumentTest

```
abstract public class CommercialDocumentTest extends ModuleTestBase {

    ~~private~~ protected void   // We change private to protected
```

```
        assertCustomerInList(String customerNumber) throws Exception {

        ...

    }

    ...

}
```

Now you can remove the `assertCustomerInList()` method from `OrderTest` (listing 9.27).

Listing 9.27 assertCustomerInList() removed from OrderTest

```
public class OrderTest extends CommercialDocumentTest {

    ~~private void  assertCustomerInList(String customerNumber)~~
       ~~throws Exception { ... }~~

    ...

}
```

After these changes the `testAddOrders()` method compiles and works.

We not only want to test if the orders in list are from the correct customer, but also that they are delivered. The first primary impulse is to copy and paste `assertCustomerInList()` for creating an `assertDeliveredInList()` method. However, we resist the temptation, instead we are going to create a reusable method. First, we copy and paste `assertCustomerInList()` as `assertValueForAllRows()`. Listing 9.28 shows these two methods in `CommercialDocumentTest`.

Listing 9.28 Creating assertValueForAllRows() from assertCustomerInList()

```
protected void assertCustomerInList(String customerNumber) throws Exception {
    assertListNotEmpty();
    int c = getListRowCount();
    for (int i=0; i<c; i++) {
       if (!customerNumber.equals(
          getValueInList(i, "customer.number")))   // We ask "ad hoc" for customer
       {
          fail("Customer in row " + i + " is not of customer "
             + customerNumber);
       }
    }
}

protected void assertValueForAllRows(int column, String value)
    throws Exception
{
    assertListNotEmpty();
    int c = getListRowCount();
    for (int i=0; i<c; i++) {
       if (!value.equals(
            getValueInList(i, column)))   // We ask for the column sent as parameter
        {
            fail("Column " + column + " in row " + i + " is not " + value);
        }
    }
}
```

You can see how with a very slight modification we have turned `assertCustomerInList()` in a generic method to ask for the value of any column, not just customer number. Now we have to remove the redundant code, you can either remove `assertCustomerInList()` or reimplementing it using the new one. Listing 9.29 shows the later option.

Listing 9.29 Reimplementing assertCustomerInList() calling to the new method

```
protected void assertCustomerInList(String customerNumber) throws Exception {
    assertValueForAllRows(3, customerNumber);   // Customer number is in column 3
}
```

Let's use `assertValueForAllRows()` to assert the orders list contains only delivered orders. Listing 9.30 shows the needed modification in `testAddOrders()` of `InvoiceTest`.

Listing 9.30 Asserting that all orders in list are delivered

```
public void testAddOrders() throws Exception {
    assertListNotEmpty();
    execute("List.orderBy", "property=number");
    execute("Mode.detailAndFirst");
    String customerNumber = getValue("customer.number");
    execute("Sections.change", "activeSection=1");
    assertCollectionRowCount("orders", 0);
    execute("Invoice.addOrders",
       "viewObject=xava_view_section1_orders");
    assertCustomerInList(customerNumber);
    assertValueForAllRows(5, "Yes");   // All the cells of column 5 (delivered) contain 'Yes'

    ...

}
```

Moreover, we want to test that only orders with no invoice are shown in the list. A simple way to do it is verifying that after adding an order to the current invoice, the list of orders has an entry fewer. Listing 9.31 shows the needed changes to `testAddOrders()` to do this testing.

Listing 9.31 Testing that the added orders cannot be added again

```
public void testAddOrders() throws Exception {

    ...

    assertCustomerInList(customerNumber);
    assertValueForAllRows(5, "Yes");
    int ordersRowCount = getListRowCount();   // We take note of orders count
    execute("AddOrdersToInvoice.add", "row=0");  // when the list is shown
    assertMessage("1 element(s) added to Orders of Invoice");
    assertCollectionRowCount("orders", 1);  // An order was added
    execute("Invoice.addOrders",   // We show the orders list again
       "viewObject=xava_view_section1_orders");
    assertListRowCount(ordersRowCount - 1);  // Now we have an order fewer in the list
    execute("AddToCollection.cancel");

    ...

}
```

With the code of this section we have tested the `@NewAction` of `orders` collection, and at the same time we have seen how it's not needed to develop generic code from start, because it's not difficult to convert the concrete code into generic on demand.

9.3.6 *Testing the action to add elements to the collection*

In section 9.2.3 we learned how the refine the action that adds orders to the invoice, now it's the moment of testing it. Remember that this action copies the lines from selected orders to the current invoice. Listing 9.32 shows the changes for testing of our custom action to add orders.

Listing 9.32 When an order is added its lines are added to the invoice

```
public void testAddOrders() throws Exception {

    ...

    String customerNumber = getValue("customer.number");
    deleteDetails();  // Deletes the detail lines if any (1)
    assertCollectionRowCount("details", 0);  // Now the invoice has no details
    assertValue("baseAmount", "0.00");  // With no details base amount is 0
    execute("Sections.change", "activeSection=1");
    assertCollectionRowCount("orders", 0);
    execute("Invoice.addOrders",  // When we show the order list (2) ...
       "viewObject=xava_view_section1_orders");
    assertCustomerInList(customerNumber);
    assertValueForAllRows(5, "Yes");
    String firstOrderBaseAmount = getValueInList(0, 8);  // ...we take note of base
    int ordersRowCount = getListRowCount();        // amount of first order in the list (3)
    ...
    assertCollectionRowCount("orders", 1);
    execute("Sections.change", "activeSection=0");
    assertCollectionNotEmpty("details");  // There are details, they have been copied (4)
    assertValue("baseAmount", firstOrderBaseAmount);  // The base amount of the
    execute("Sections.change", "activeSection=1"); // invoice matches with the one
                                                   // of the recently added order (5)
    ...

}
```

We remove the detail lines from the invoice (1), afterwards we add an order

(2), taking note of its base amount (3), then we verify that current invoice has details (4) and its base amount is the same of the added order (5).

All that remains is the `deleteDetails()` method, shown in listing 9.33.

Listing 9.33 Deletes all the details of the displayed invoice

```
private void deleteDetails() throws Exception {
    int c = getCollectionRowCount("details");
    for (int i=0; i<c; i++) {  // A loop over all rows
       checkRowCollection("details", i);  // Checks each row
    }
    execute("Collection.removeSelected",  // Removes the checked rows
       "viewObject=xava_view_section0_details");
}
```

It selects all the rows of the `details` collection and clicks on the 'Remove selected' button.

The `testAddOrders()` method is finished. You can see its definitive code in listing 9.34.

Listing 9.34 Definitive code for testAddOrders() of InvoiceTest

```
public void testAddOrders() throws Exception {
    assertListNotEmpty();
    execute("List.orderBy", "property=number");
    execute("Mode.detailAndFirst");
    String customerNumber = getValue("customer.number");
    deleteDetails();
    assertCollectionRowCount("details", 0);
    assertValue("baseAmount", "0.00");
    execute("Sections.change", "activeSection=1");
    assertCollectionRowCount("orders", 0);
    execute("Invoice.addOrders",
       "viewObject=xava_view_section1_orders");
    assertCustomerInList(customerNumber);
    assertValueForAllRows(5, "Yes");
    String firstOrderBaseAmount = getValueInList(0, 8);
    int ordersRowCount = getListRowCount();
    execute("AddOrdersToInvoice.add", "row=0");
    assertMessage("1 element(s) added to Orders of Invoice");
    assertCollectionRowCount("orders", 1);
    execute("Sections.change", "activeSection=0");
    assertCollectionNotEmpty("details");
    assertValue("baseAmount", firstOrderBaseAmount);
    execute("Sections.change", "activeSection=1");
    execute("Invoice.addOrders",
       "viewObject=xava_view_section1_orders");
    assertListRowCount(ordersRowCount - 1);
    execute("AddToCollection.cancel");
    checkRowCollection("orders", 0);
    execute("Collection.removeSelected",
       "viewObject=xava_view_section1_orders");
    assertCollectionRowCount("orders", 0);
}
```

We have finished the test code. Now it's time to execute all the tests for your project. They must be green.

9.4 Summary

This lesson has shown you how to refine the standard behavior of references and collections in order for your application to fit the users needs. Here you only have seen some illustrative examples, but OpenXava provides many more possibilities for refining collections and references, such as the next annotations: `@ReferenceView`, `@ReadOnly`, `@NoFrame`, `@NoCreate`, `@NoModify`, `@NoSearch`, `@AsEmbedded`, `@SearchAction`, `@DescriptionsList`, `@LabelFormat`, `@Action`, `@OnChange`, `@OnChangeSearch`, `@Editor`, `@CollectionView`, `@EditOnly`, `@ListProperties`, `@RowStyle`, `@EditAction`, `@ViewAction`, `@NewAction`, `@SaveAction`, `@HideDetailAction`, `@RemoveAction`, `@RemoveSelectedAction`, `@ListAction`, `@DetailAction` and `@OnSelectElementAction`.

And if that wasn't enough you always have the option of defining your own editor for references or collections. Editors allows you to create a custom user interface component for displaying and editing the reference or collection.

This flexibility allows you to use automatic user interfaces for practically any possible case in real life business applications.