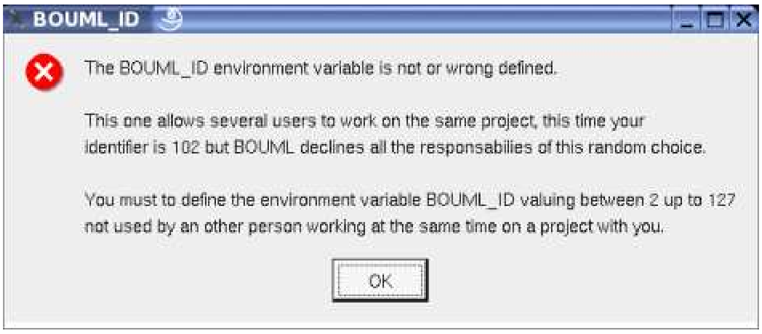
Bouml – Tutorial

This tutorial is written to help you to use BOUML for the first time, only few features of BOUML are exposed here, but a f description of BOUML is given in the reference manual.

The tutorial must be read in order because I will not repeat each time the general commands to call a menu etc ...

Starting

When you execute BOUML the following message appears, hit *ok* this time, but you will have to define you own identifier for an effective usage of BOUML :

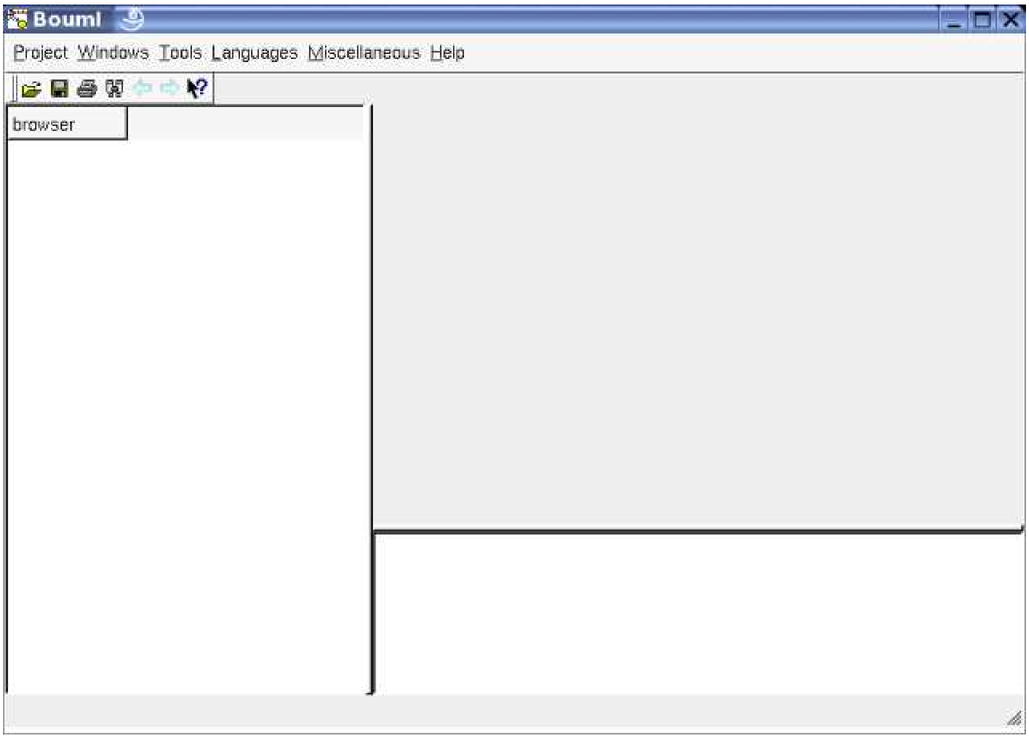


The BOUML_ID environment variable is not or wrong defined.

This one allows several users to work on the same project, this time your identifier is 102 but BOUML declines all the responsabilies of this random choice.

You must to define the environment variable BOUML_ID valuing between 2 up to 127 not used by an other person working at the same time on a project with you.

The BOUML window appears (the drawing is dependent on the used release of Qt, here the 2.4 under Linux to be compatible with the Windows release) :



The *bouml* window is composed of three parts :

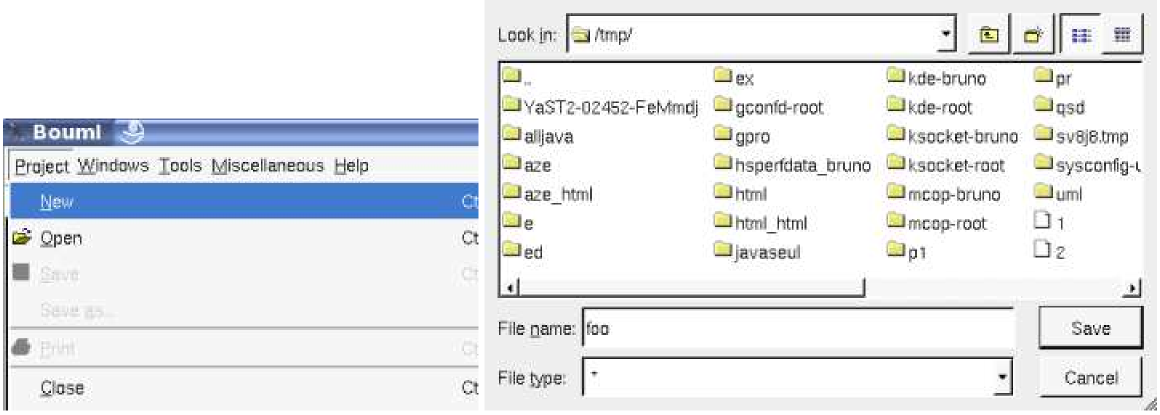
- The left sub-window display a browser presenting your project, the navigation may be done by the mouse or the keyboar arrows. The bold font is used when an item is modifiable, an item is *read-only* when you do not have the write permission for the file(s) supporting it.
- The bottom-right sub-window is used to display/modify the comment associated to the current selected item.
- The top-right part is used to display/modify the diagrams, these ones may be maximized or minimized.

Obviously the respective sizes of the sub-windows may be changed, placing the mouse on the separation between them. Note : if you have at least a dual monitor configuration the better is to set the environment variable BOUML_LIMIT_DESKTOP, see here.

At this level you have to create a new project, or to load an already existing project.

Create a new project

Here we create a new project : in the menu *Project* choose *new,* a file dialog appears (its aspect depend on the used system and window manager) and you have to select the directory where the project will be placed and its name, I choose the project *foo* placed under */tmp* :

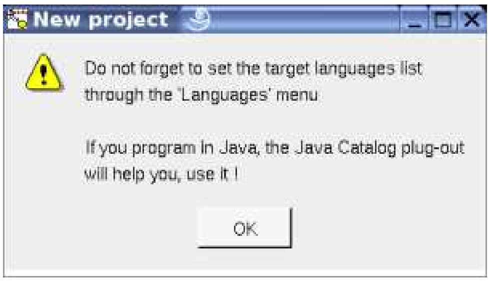


File name: foo

File type: *

In this case BOUML creates the directory *foo* under */tmp,* and places some files in */tmp/foo* including *foo.prj* which is the file to load when you will re-load this project. Note : do **not** rename or delete the files produced by BOUML nor the directory itself !

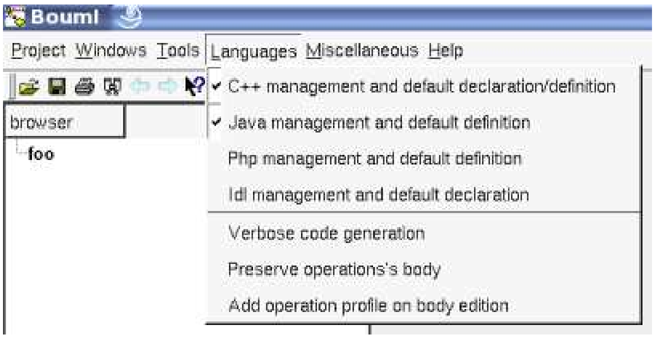
A new dialog appears :



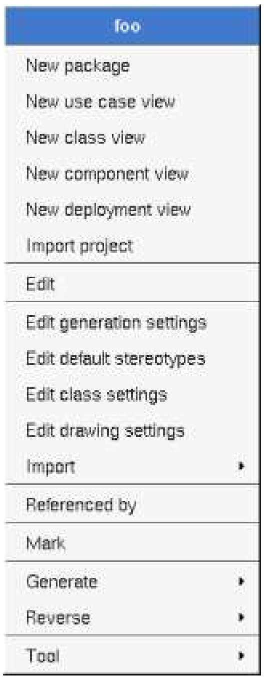
Do not forget to set the target languages list through the 'Languages' menu

If you program in Java, the Java Catalog plug-out will help you, use it !

Following the recommendation, I set for instance the toggle for C++ and Java in the *Language* menu (we will see why later) :


Bouml
Project Windows Tools Languages Miscellaneous Help
browser
foo
✔ C++ management and default declaration/definition
✔ Java management and default definition
Php management and default definition
Idl management and default declaration
Verbose code generation
Preserve operations's body
Add operation profile on body edition

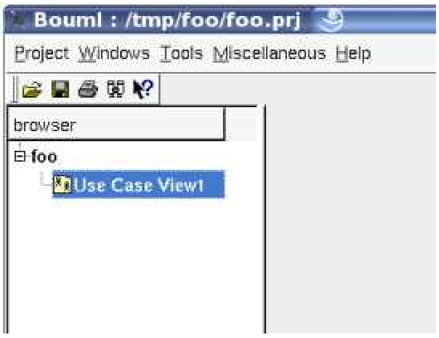
The name of the project appears in the browser, the project is the top level *package*, a right mouse click on it produces the menu :



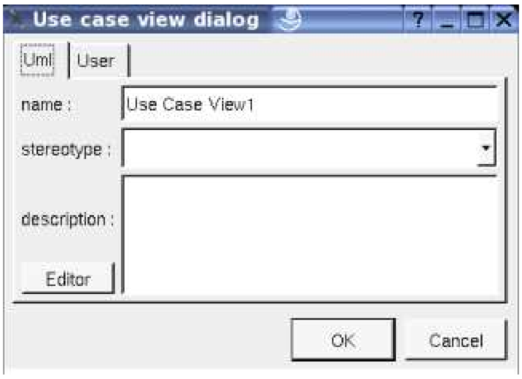
As you can see, a *package* may contain other *packages* and some views : *use case view, class view, component view* and *deployment view*.

View, Use case

To define *use cases* we need to have a *use case view*, so we choose *new use case view* :



Bouml ask for the name of the view, to change it later the *use case view* must be edited through a double mouse click, or choosing *edit* in the menu appearing on a right mouse click, showing the *use case* editor :



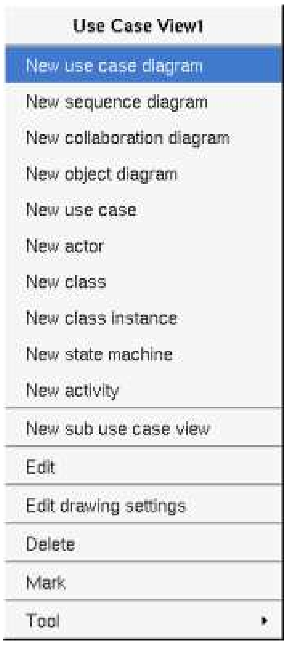
name : Use Case View1

stereotype :

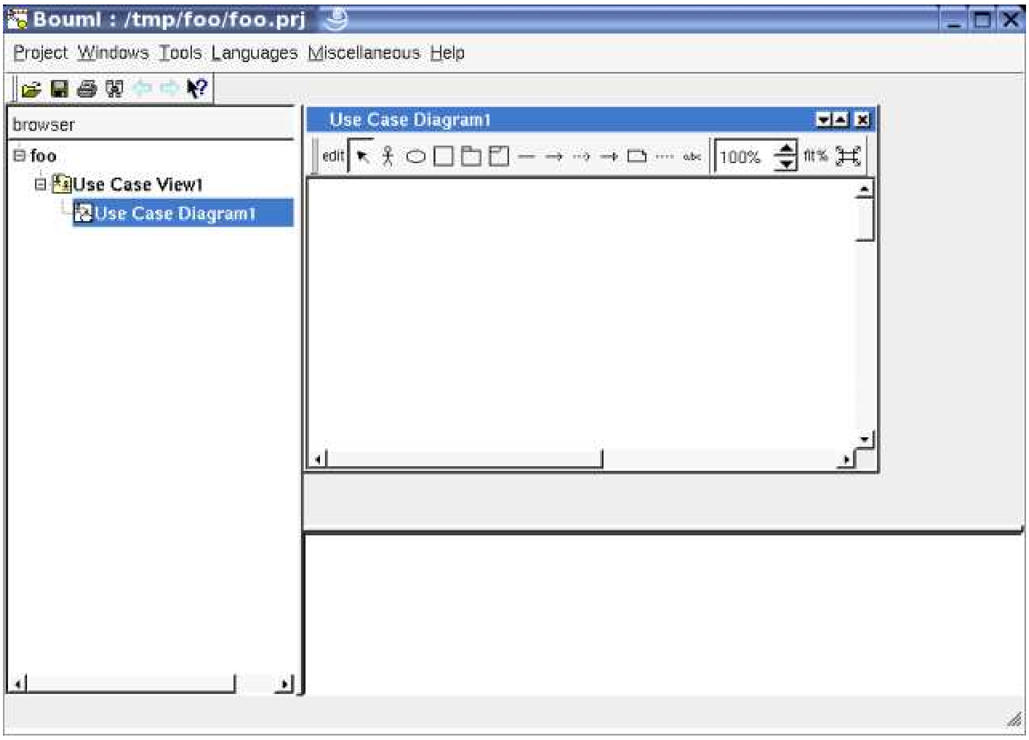
description :

Diagram

To create a *use case diagram* in this view, do a right click on the *use case view* and choose *new use case diagram* :



The name is also asked, to change it the *use case diagram* must be edited choosing *edit* in the menu appearing on a right mouse click. Contrary to the non diagram items, a double click on a diagram show it :



Add elements in a diagram

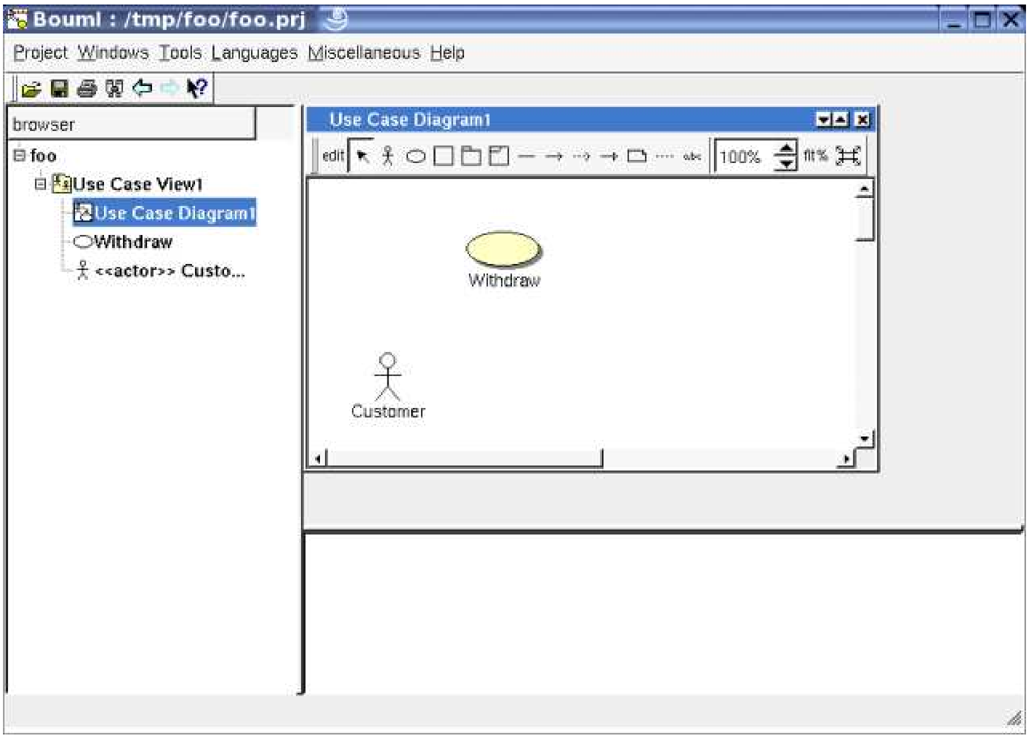
To create and place a *use case* in the *use case diagram* you have two ways :

- to do a right click on the *use case view* and to choose *new use case*, then to drag it from the browser to the diagram,
- or to hit the ellipsis button in the top of the diagram sub-windows, then to hit somewhere in the diagram sub-window. Note that the *use case* is created in the view containing the diagram, this will be the same thing in the others case whatever the diagram except for the *states machine*.

Let's *Withdraw* the name of the *use case.*

To move the *use case* in the diagram, do a left click on it and move the mouse click down, the name follow the *use case* but the name may be moved independently, for instance to place it in the middle of the ellipsis. You may also select the *use case* and to use the arrows of the keyboard.

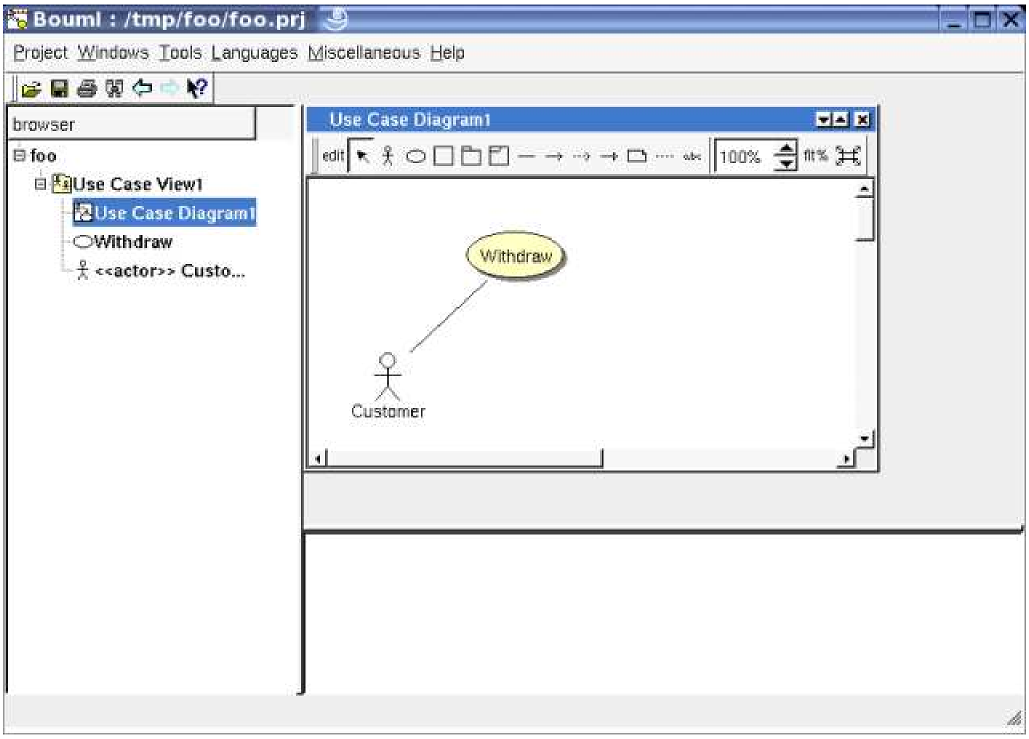
Create an *actor* named *Customer* like you create the use case, to have :



Note that an *actor* is in fact a *class*, when the stereotype is *actor* the icon shown in the browser is an *actor*, else a *class*. To change the stereotype edit the class (double mouse click on the class, or choosing *edit* in the menu appearing on a right mouse click on the class), choose among the predefined list of stereotypes or enter a new one, read the reference manual to change the predefin stereotypes.

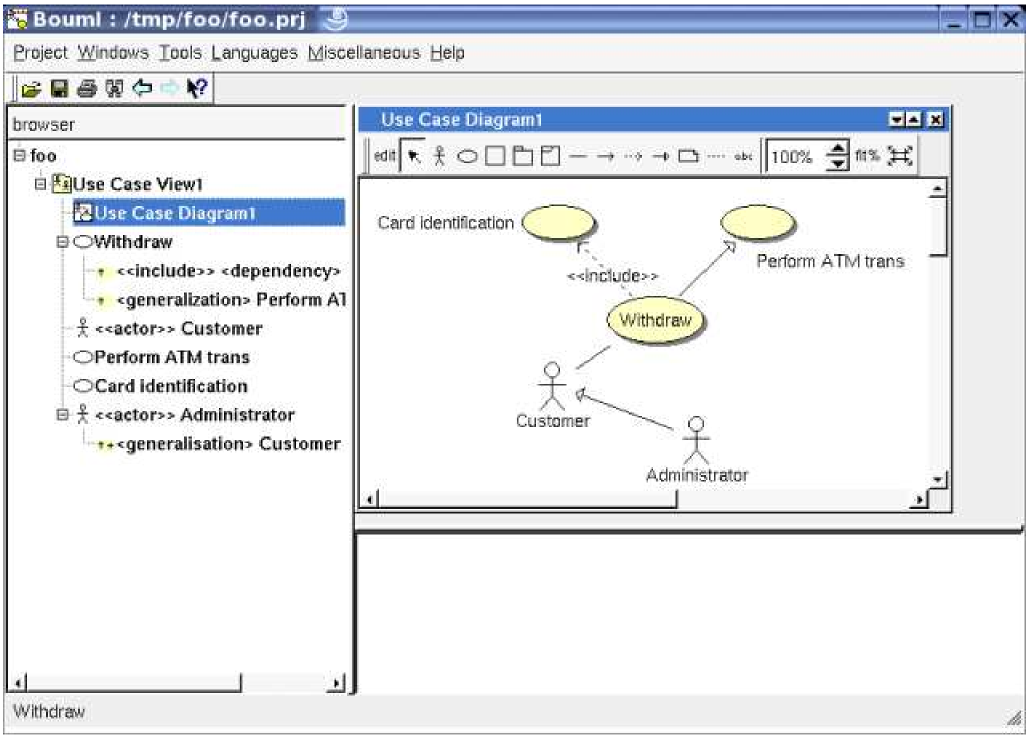
The *use case* picture may be resized moving the points appearing when you click on the *use case*. The *actor* can't be resized.

You have to ways to draw the association : a simple line as UML recommendation, or an arrow. Hit on the desired icon, left click o the *actor*, move the mouse click down up to the *use case* and release the click :



The lines may be broken during the initial construction if you release the click out of any item, or after the construction with a le mouse click on the line and moving the mouse click down. To remove a point in a line, double left click on it, or right click to show the menu and choose *remove from view*. To abort a line during its construction : double click.

Add new elements in the diagram like this (edit the *dependency* to set the stereotype *include*) :



As you can see, the *generalizations* and *dependencies* are visible on the browser, their menu (on a right click) in the browser allows to navigate to the target.

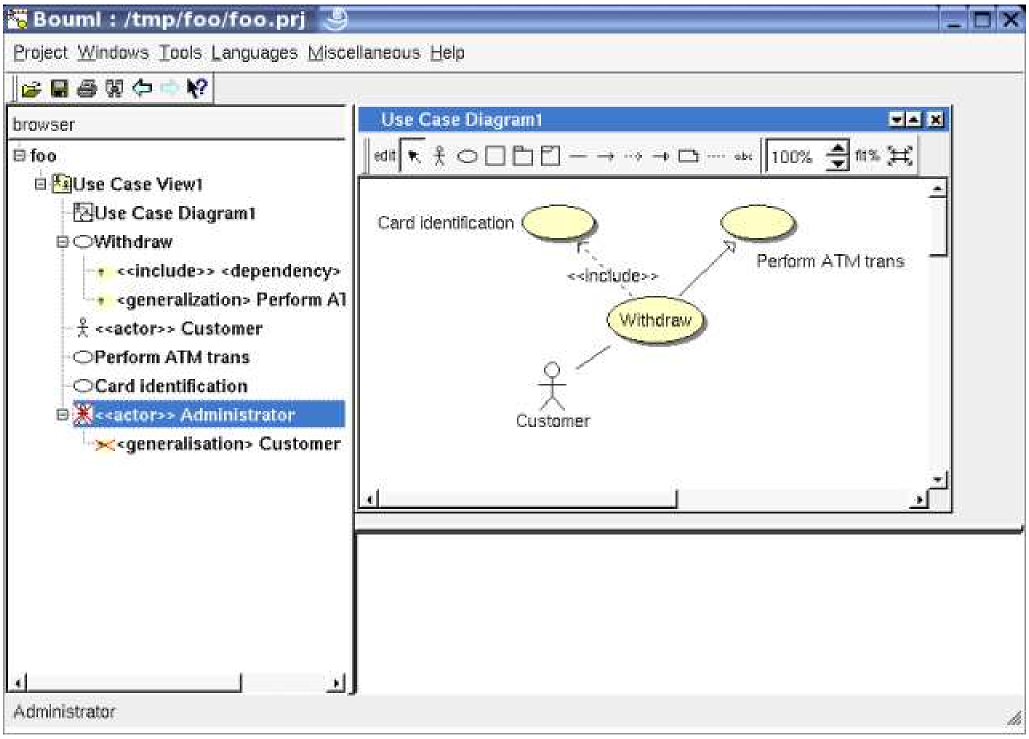
If you edit the *generalization* from *Withdraw* you will have a simple dialog, this is not the case for the *generalization* between the actors because this inheritance may produce source code : an *actor* is a *class*.

Remove an element in a diagram

To remove something in the diagram, select the desired elements (left click on it) and press *Suppr* or call the menu and choose *remove from view*. Note that this is not possible to remove a label.

Delete / undelete browser element

To delete something from the model, use *control-d* or choose *delete from model*, you may also do that on the item in the browser. For instance if I delete the *Administrator* :



Obviously the *Administrator* and the *generalization* disappear from the diagram, but this is not the case in the browser : they are just marked deleted. Their menu is modified : you undelete just the *Administrator* or this one and all his children (*undelete recursively*), you have no menu for the *generalization* because it can't be undeleted while *Administrator* is deleted !

Note that the deleted elements are not saved, if you reload the project the deleted elements will be definitively lost.

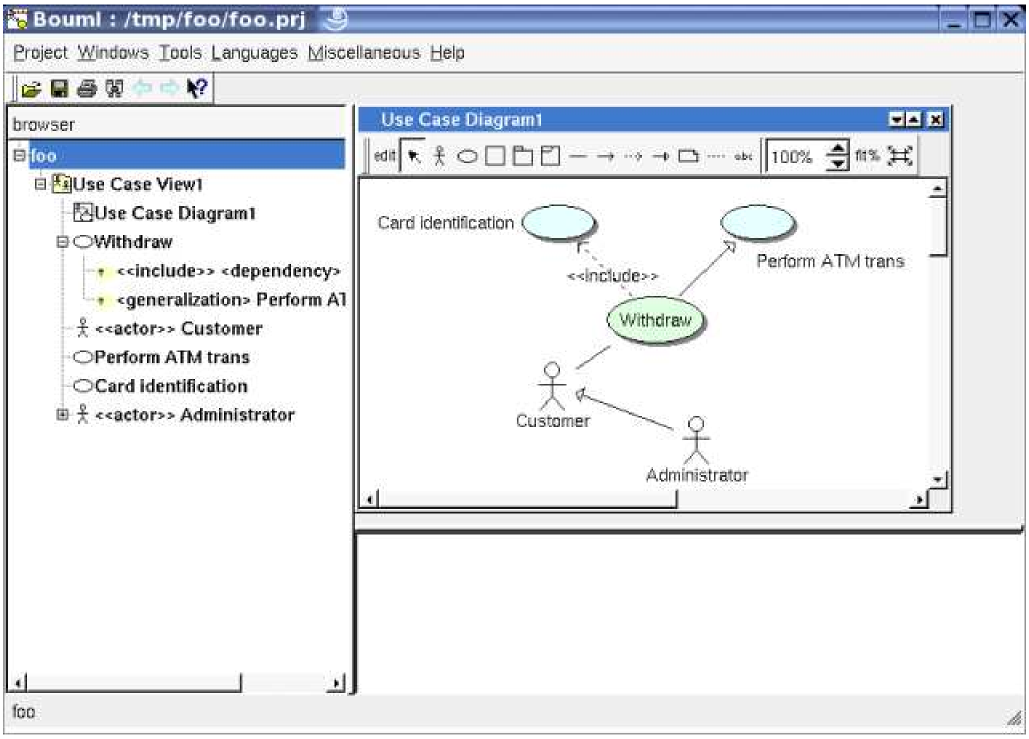
Undelete the *actor* and the *generalization*, they do not reappears in the diagram.

Reinsert the *actor* in the diagram, using a drag&drop from the browser to the diagram sub-window, or hit the *actor* icon in the diagram then click somewhere in the diagram and select *Administrator* in the proposed list. The generalization is not automatically drawn, but this may be the case for a *class diagram* (depending on the *drawing settings*). To draw the *generalization* do a drag&drop from it the browser to the diagram.

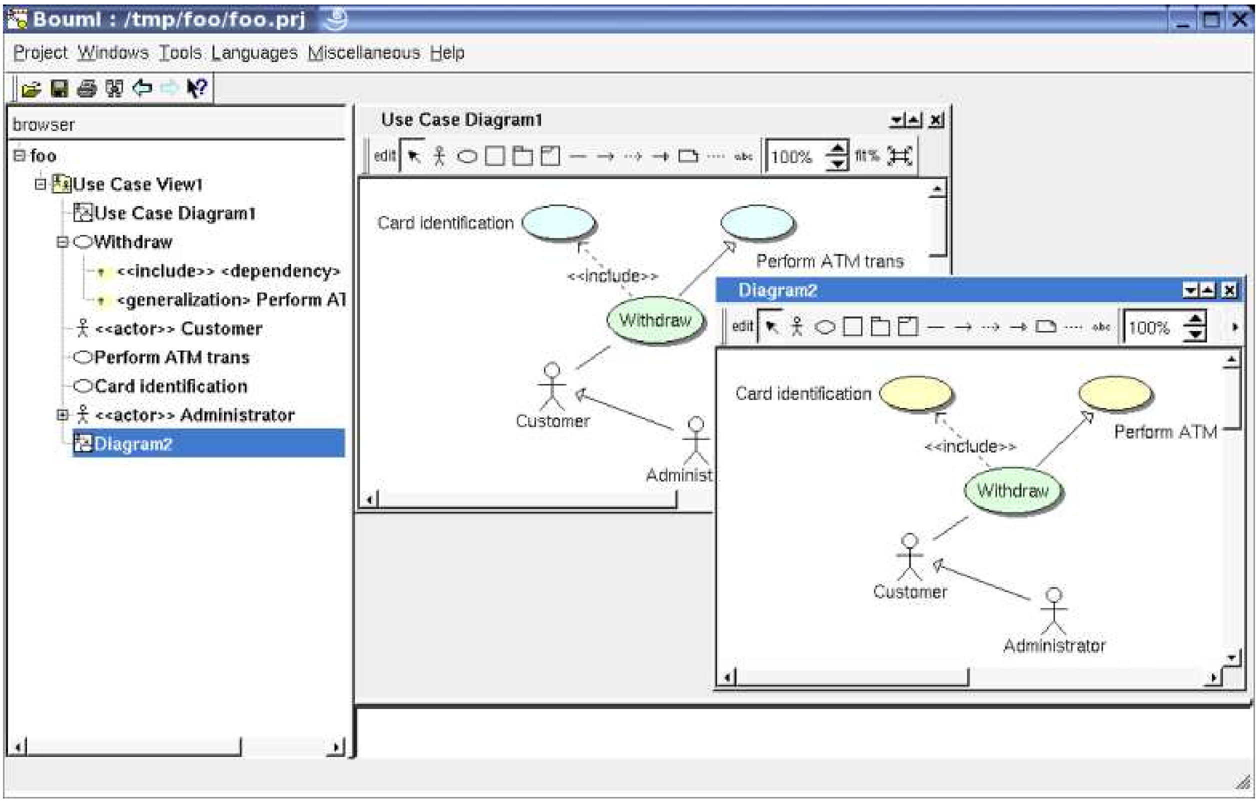
Drawing settings

The colors and other drawing characteristics may be changed setting the *drawing settings*. If you prefer to always have blue *use case* the better is to call the menu on the project (i.e. on *foo* in the browser) and choose *edit drawing settings*, go in the last *tab* and change the *default use case color*. If you do that on a sub level, for instance on the diagram, the scope of the new value will be limited c chosen level and recursively on all its children. The value specified on a upper level is followed while the setting values *default*, this is the case by default except at the project level (there is nothing upper).

So, we change the color of the *use cases* to blue at the project level, now all are blue. We call the menu on *Withdraw* (in the browser or the diagram, doing a right click) and choose *edit drawing settings*, change the color which is *default* (to follow the rule defined upper) to green :



Now, in the browser call the menu on the diagram and choose *duplicate*, this duplicate the diagram and call the dialog on the clone to change the name for instance. Hit *ok* and open the diagram, yes this is a clone, edit its *drawing setting* to have yellow *use case* and of course :



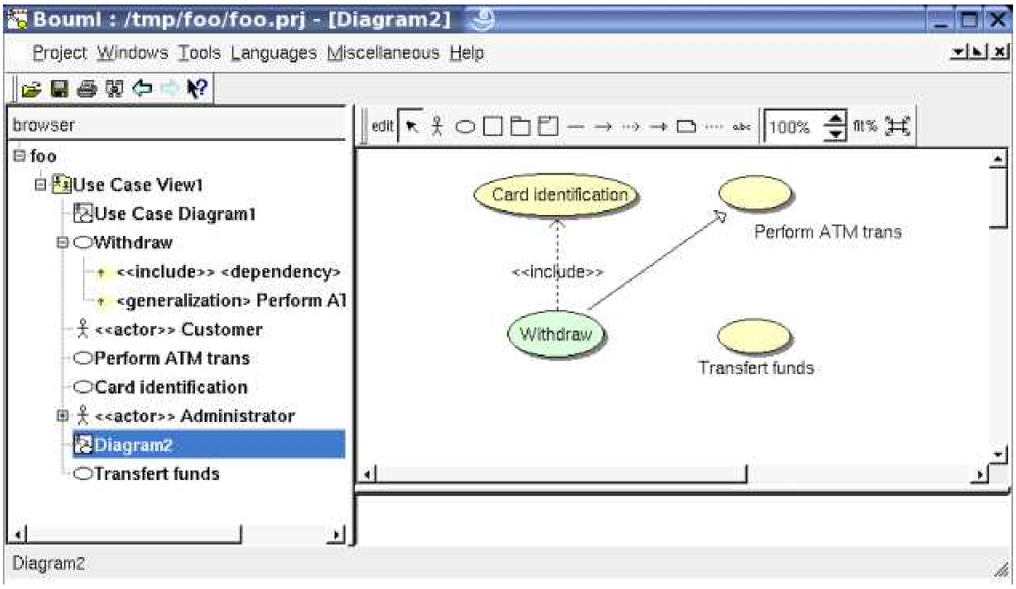
Select elements in a diagram

To select several elements in the diagram, for instance to move them :

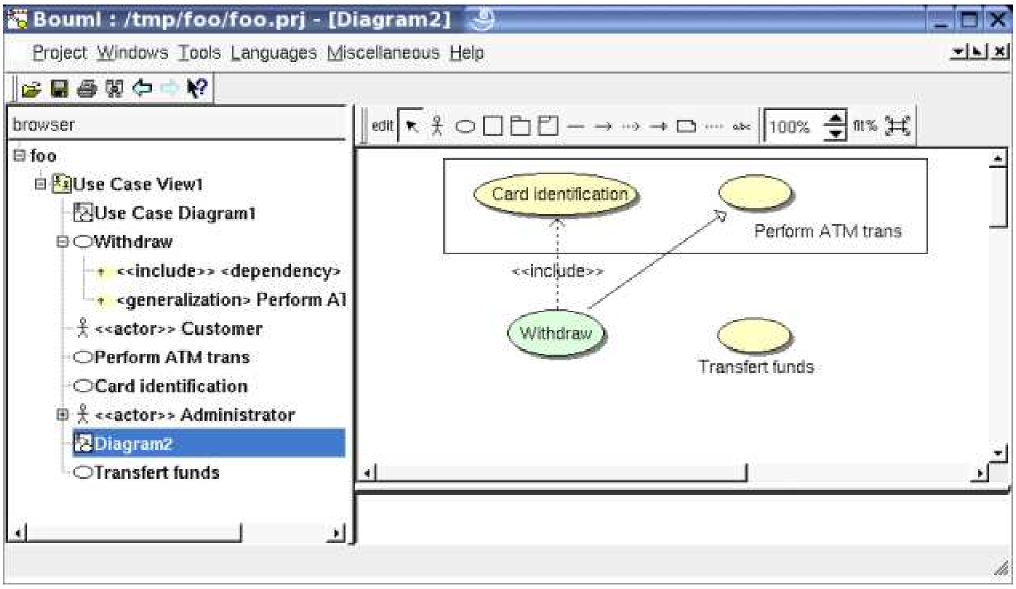
- *control-a* select all
- a left mouse click with the control key down allows to add/remove the pointed element from the selection list
- doing a left mouse click down out of any item and moving the mouse click down define a rectangle, on the mouse clock on al the included items will be selected
- choosing *select linked items* in the menu of an object in a diagram allows to select all the items having any line between them, practical isn't it (all th elements here) ?

z-dimension

Add and remove elements in *Diagram2* to have (the diagram was maximized) :



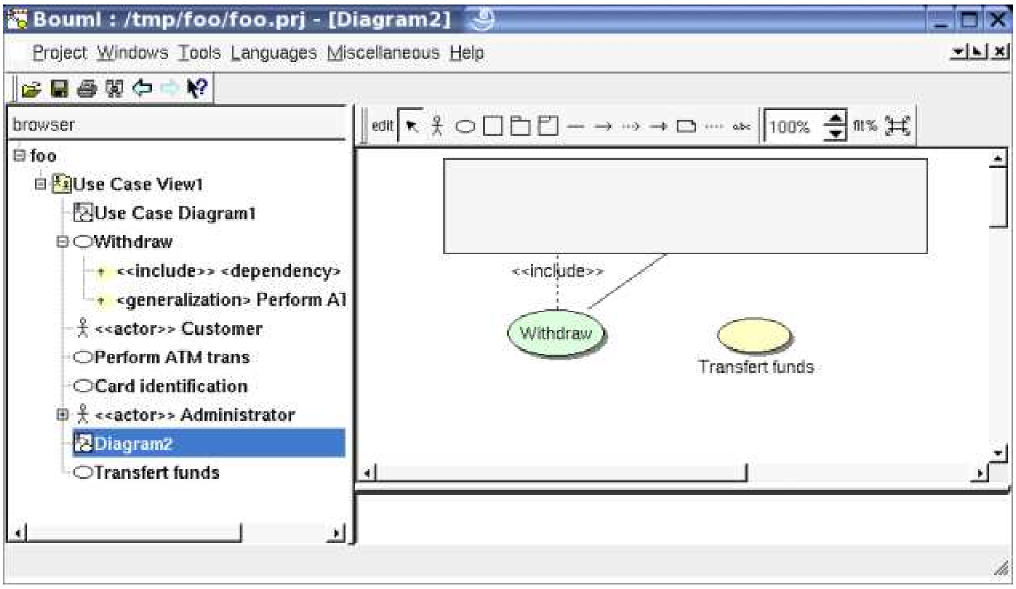
Add a *subject* and resize it to have :



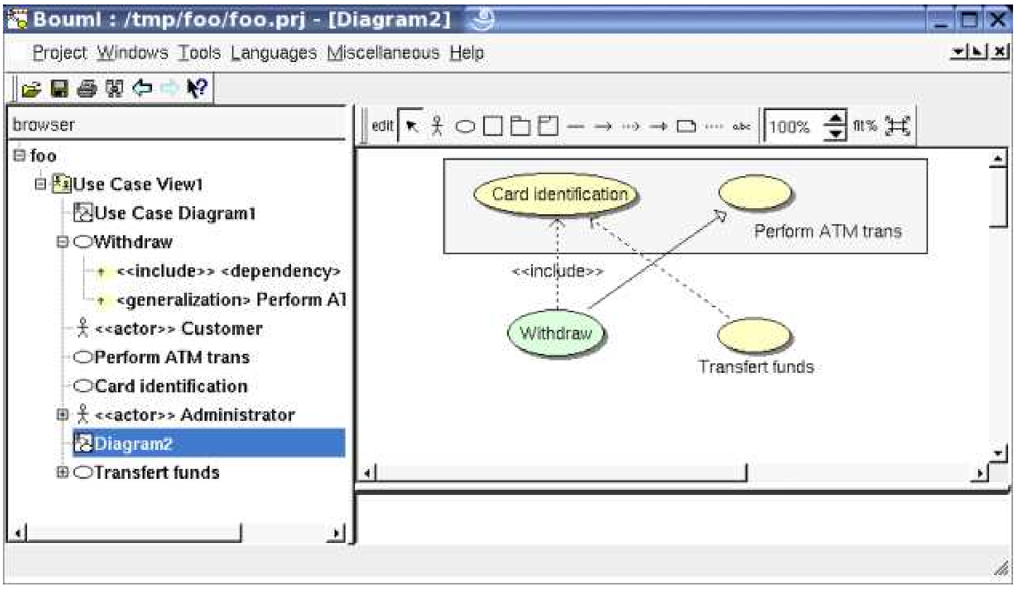
Now try to add a *dependency* from *Transfer funds* to *Card identification* : you can't. What is append ?

Because you add the *subject* after *Card identification*, the *subject* is upper the *use case* and BOUML considers you try to do a dependency from *Transfer funds* to the *subject*.

If you change the color of the *subject* this is more visible :



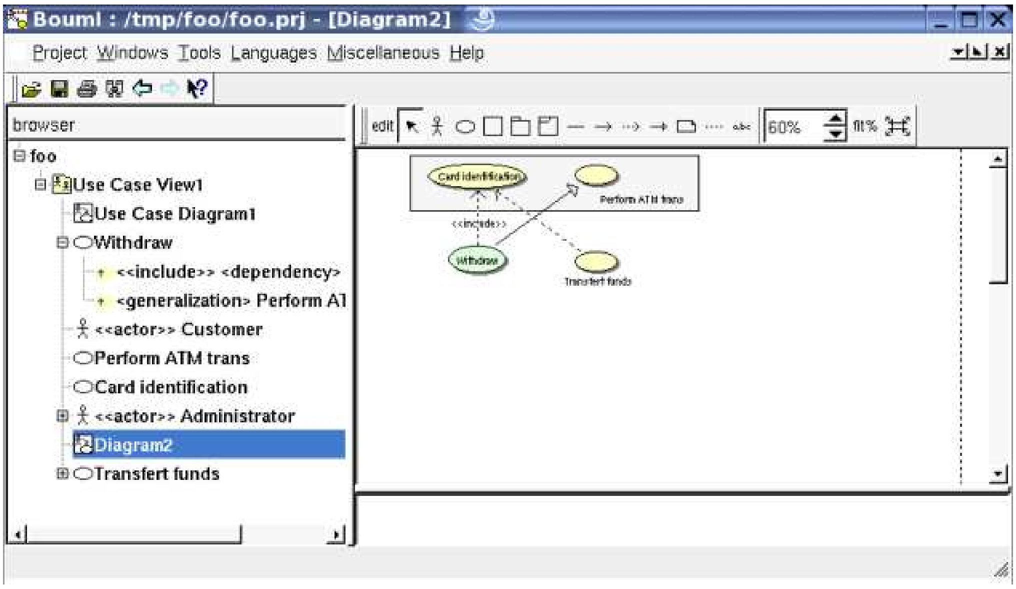
Don't panic, contrarily to other UML tools you don't have to redo all, just call the menu of the *subject* and choose *lower*, and now you may add the *dependency*.



Zoom, window size, diagram format

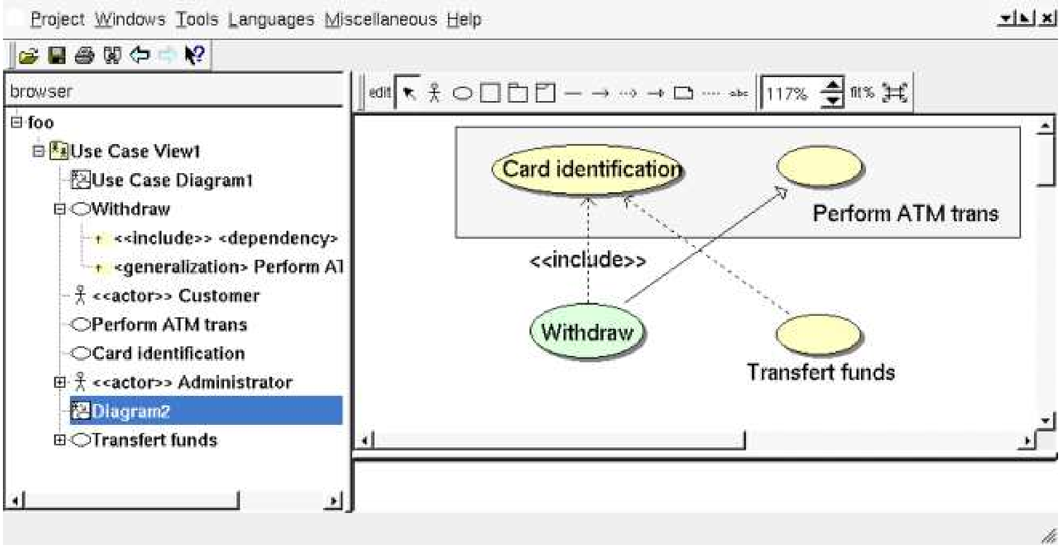
When you open a diagram the scale is set to 100% and the window size is unfixed.

When you change scale using the little arrows or directly writing the desired value inside the spin box (practical to come back exactly to 100%) the size of the arrows is unchanged, this allows to see them even with a small scale, and to not use a large area for that when the scale is hight.

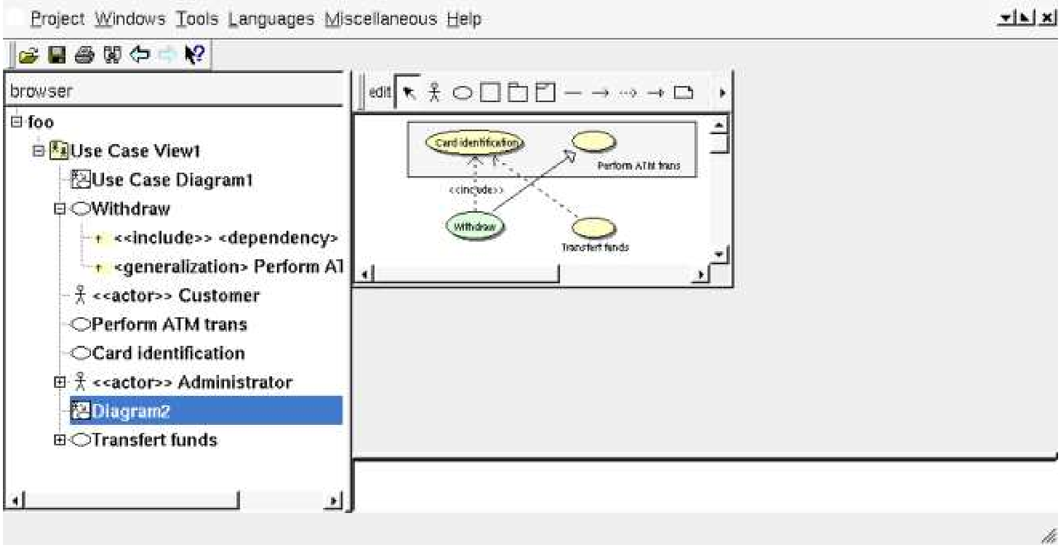


The dashed lines show the limits of the diagram (canvas size), you can see something placed outside these lines. By default the format of a diagram is European ISO A4. To Change the format of a diagram, call its menu from the diagram sub-window and choose the format (the menu of the diagram in the browser doesn't allow to do that). The format 'A' corresponds to the USA letter, 'B' to USA large and 'C' is even larger. To set the format used for the diagram you will create in the future, choose the sub menu *Diagram default format* of the menu *Miscellaneous*.

fit%
change the scale to be the larger one allowing to see all the diagram elements depending on the diagram sub-window size. This ma also be done choosing *optimal scale* in the diagram menu.



In the opposite you can automatically change the size of the diagram sub-window to see all the diagram elements for the current scale choosing *optimal window size* in the same menu or through the button ⌘.



Closing then re-opening the diagram the window size and the scale are reset by default. To save the current window size and sca restore them the next time you re-open the diagram, choose *set preferred size and scale* in the menu of the diagram in the diagram sub-window (not possible from the menu in the browser).

Export diagram picture

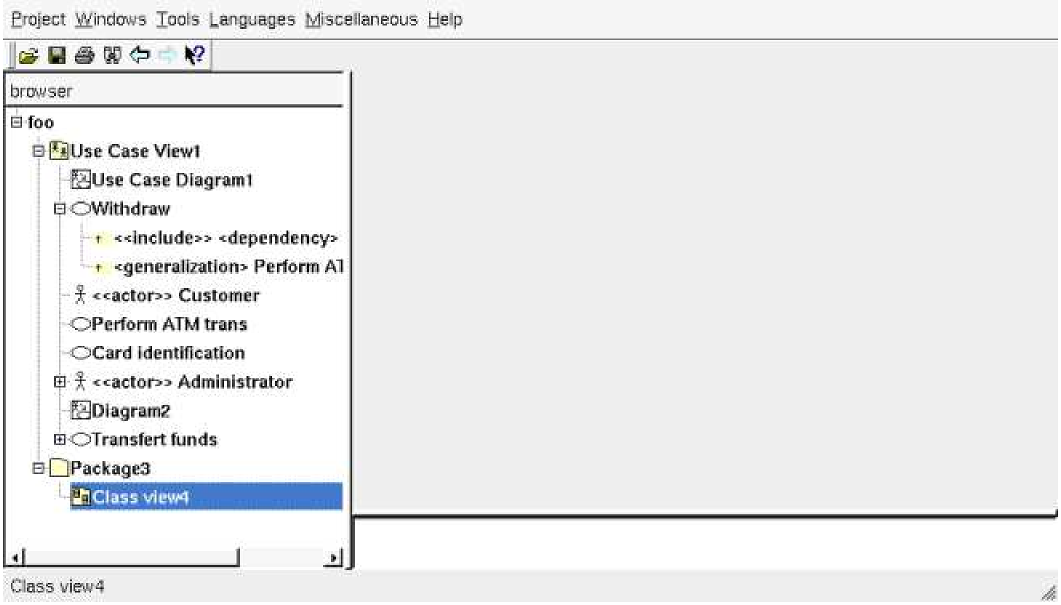
There are several way to export a diagram picture :

- to print it : if needed open the diagram to show it, use the button which icon is a printer on the top left of the BOUML window
- to copy it, for a paste in an other program : if needed open the diagram to show it, choose the entry *copy visible picture part* in the diagram menu (not possible from the menu in the browser). The *visible* part is the part of the diagram which appears depending on the diagram sub-window's scrollbars position. To copy all the elements even the non visible ones, choose *copy optimal picture part*.
- to save the picture in a PNG file : if needed open the diagram to show it, choose the entry *save visible picture part (png)* in the diagram menu (not possible from the menu in the browser). To get all the elements even the non visible ones because of t current size of the sub windows, choose the entry *save optimal picture part (png)*
- to save the picture in a SVG file : if needed open the diagram to show it, choose the entry *save visible picture part (svg)* in the diagram menu (not possible from the menu in the browser). To get all the elements even the non visible ones because of t current size of the sub windows, choose the entry *save optimal picture part (cvg).*
- to use a *plug-out*, for instance the HTML generator. In case an exported diagram is not already opened, the scale and the size of the saved part are the default ones except if you had specify them using *set preferred size and scale*.

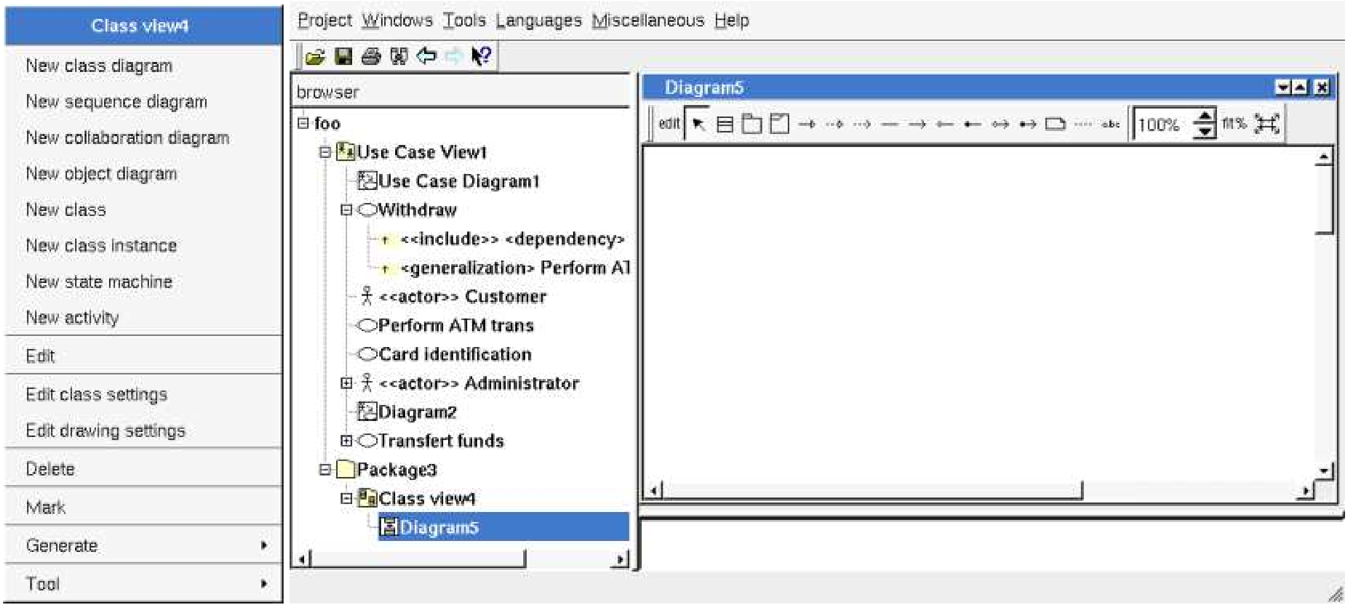
Sub package, class view, class diagram, class

Now we want to design classes to generate code.

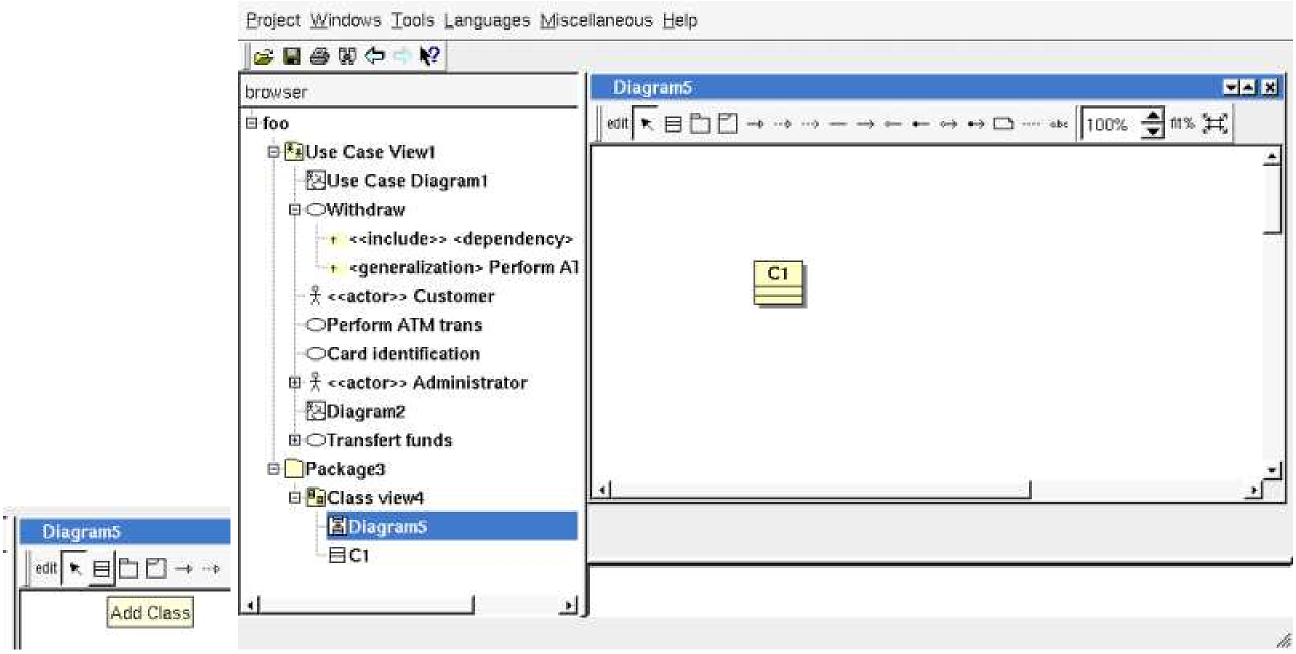
For that we have first to create a *class view*, and why not we don't want to place it directly in the *project package*. First call the *project* menu (right mouse click on the project's name in the browser) and choose *new package*, name it *Package3*. Call the *Package3* menu and choose *new class view* named *Class view4* :



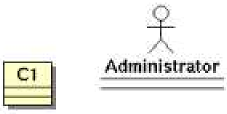
A *class diagram* is not mandatory to define classes (except to add relations), but create a *class diagram* through the *class view* menu, then open this diagram :



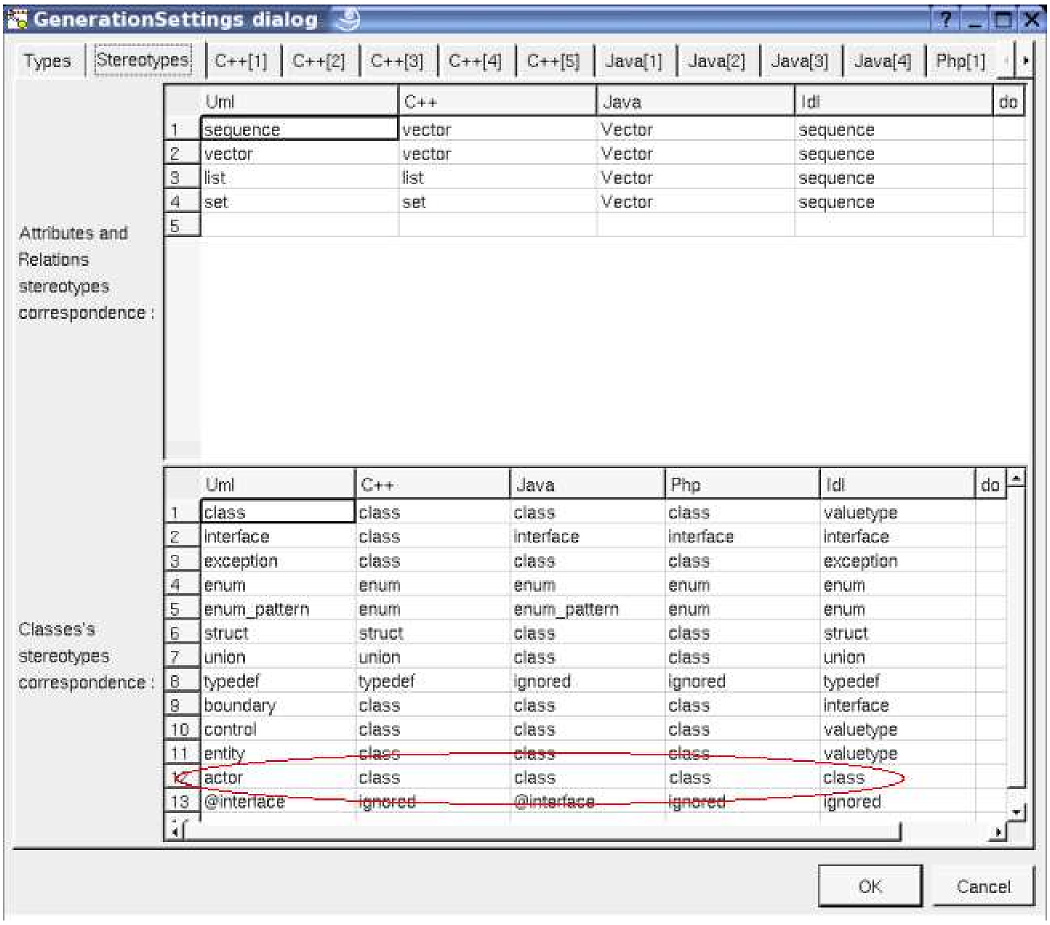
Click on the button which icon is a *class* and click somewhere in the diagram (it is also possible to create the class using the *class view* menu in the browser), name the class *C1*



Because the *actors* are classes, they can be added in the *class diagram*, using a drag & drop from the browser to the diagram sub-window, or using the diagram class icon and choosing for instance *Administrator* hitting 'a' in the *combo box* or using its arrow. The *actor* is drawn as an *actor*, this a default for the classes having the stereotype *actor* (this depend on the *drawing settings* of the class, the other special cases are for the stereotypes *control, boundary* and *entity*) :



However in the normal case the goal of an *actor* is not to be used to generate code, and in the generation settings the stereotype *actor* at class level is translated to *ignored* in the target languages. To continue without this limitation, edit the *generation settings,* go in the tab *stereotype* and replace *ignored* by *class* in C++ and other language in the line for *actor* :



Attributes and Relations stereotypes correspondence :

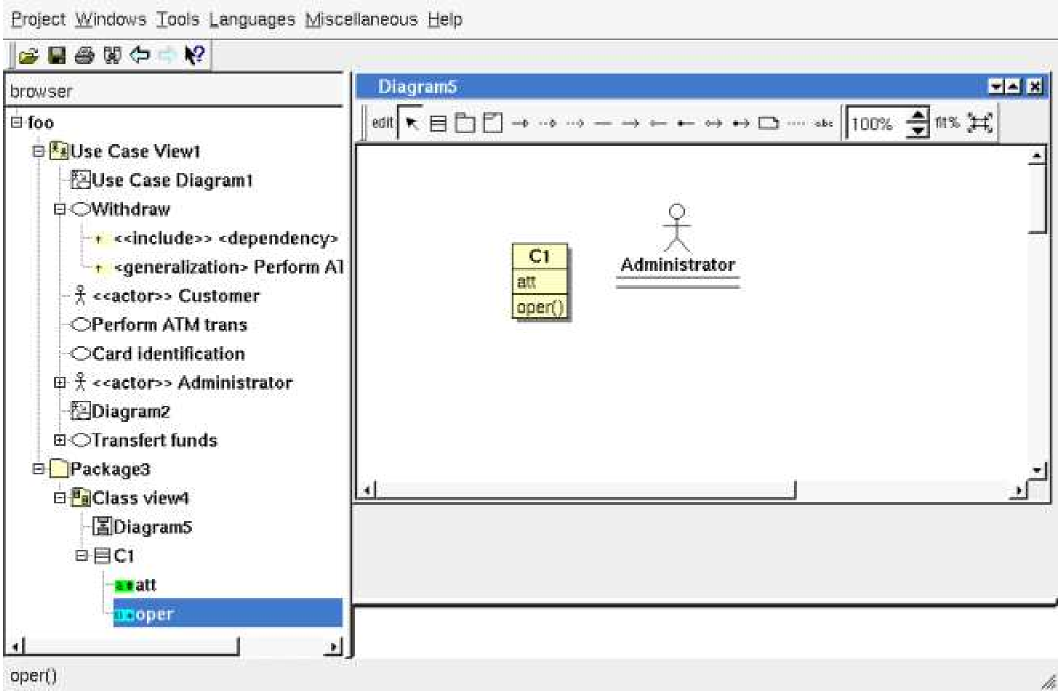
	Uml	C++	Java	Idl	do
1	sequence	vector	Vector	sequence	
2	vector	vector	Vector	sequence	
3	list	list	Vector	sequence	
4	set	set	Vector	sequence	
5					

Classes's stereotypes correspondence :

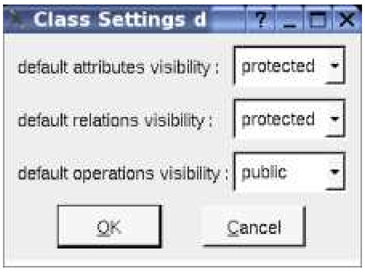
	Uml	C++	Java	Php	Idl	do
1	class	class	class	class	valuetype	
2	interface	class	interface	interface	interface	
3	exception	class	class	class	exception	
4	enum	enum	enum	enum	enum	
5	enum_pattern	enum	enum_pattern	enum	enum	
6	struct	struct	class	class	struct	
7	union	union	class	class	union	
8	typedef	typedef	ignored	ignored	typedef	
9	boundary	class	class	class	interface	
10	control	class	class	class	valuetype	
11	entity	class	class	class	valuetype	
12	actor	class	class	class	class	
13	@interface	ignored	@interface	ignored	ignored	

Add attribute and operation

We want to define an *attribute* named *att*, and an *operation* named *oper*. Call the class menu doing a left mouse click on the class in the diagram or in the browser, choose *add attribute* then *add operation*. When you add the members through the diagram their editor are automatically called, not through the browser. The class members are visible in the browser and the class picture :



Because of the default visibility set through the *class settings* the *attribute* is *protected* and the class is *public*. The *class settings* may be set at the *class view* or *package* levels, following the same principles of the *drawing settings*.



Class Settings d

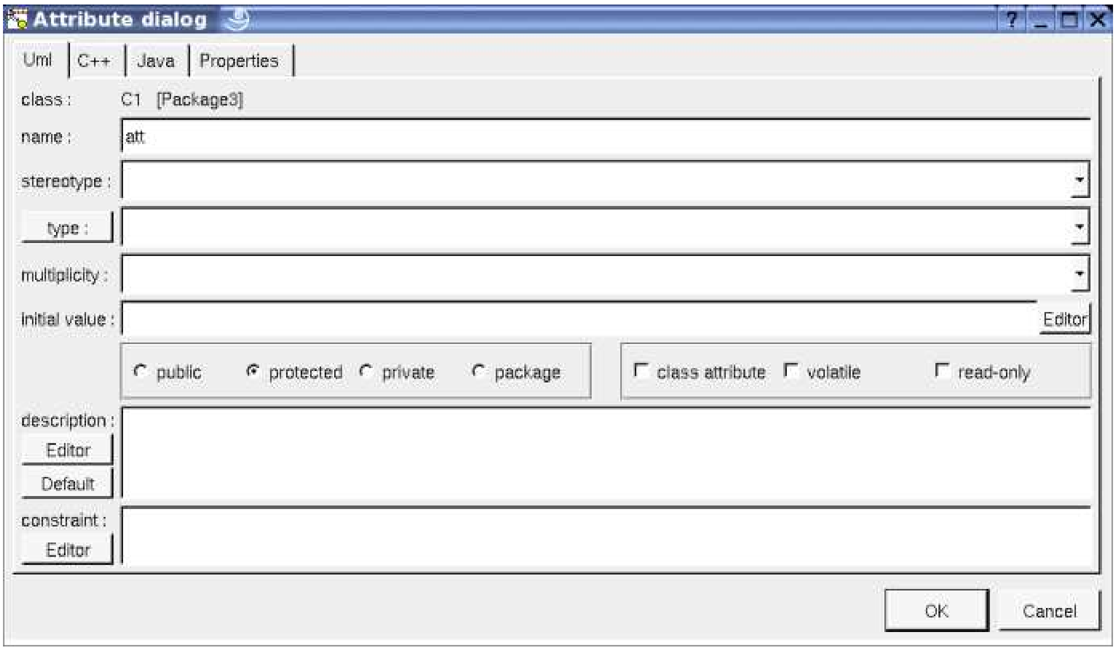
default attributes visibility : protected

default relations visibility : protected

default operations visibility : public

Edit attribute

One decide that *att* must be an *int*, we have to edit it, this may be done through several ways : double click on it in the browser, to call its menu on the browser and choose *edit*, ot to call the menu of its class in the diagram choosing *edit attribute* then *att.* You obtain the dialog :

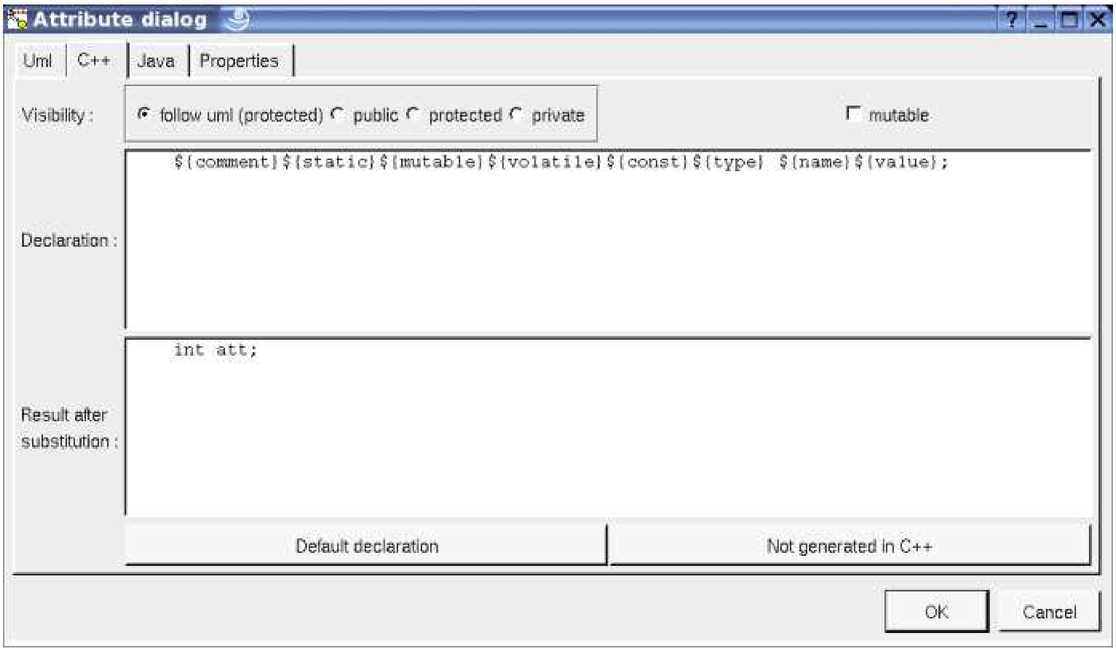


class : C1 [Package3]
name : att
stereotype :
type :
multiplicity :
initial value :
○ public ● protected ○ private ○ package
□ class attribute □ volatile □ read-only
description :
constraint :

The first *tab* concern the UML characteristics, by default an *attribute* is an instance member (not a class member), is not volatile and is not read-only. Each other *tab* is link to a specific language : with BOUML you may design in several languages at the same time. For instance the *HTML generator* implementation is done in C++ and Java both.

Set the type to *int*, choosing among the predefined types list (modifiable through the *generation settings*) or typing *int.*

Go in the C++ *tab* (clicking on C++) :



Visibility : ● follow uml (protected) ○ public ○ protected ○ private
□ mutable

Declaration :

```
${comment}${static}${mutable}${volatile}${const}${type} ${name}${value};
```

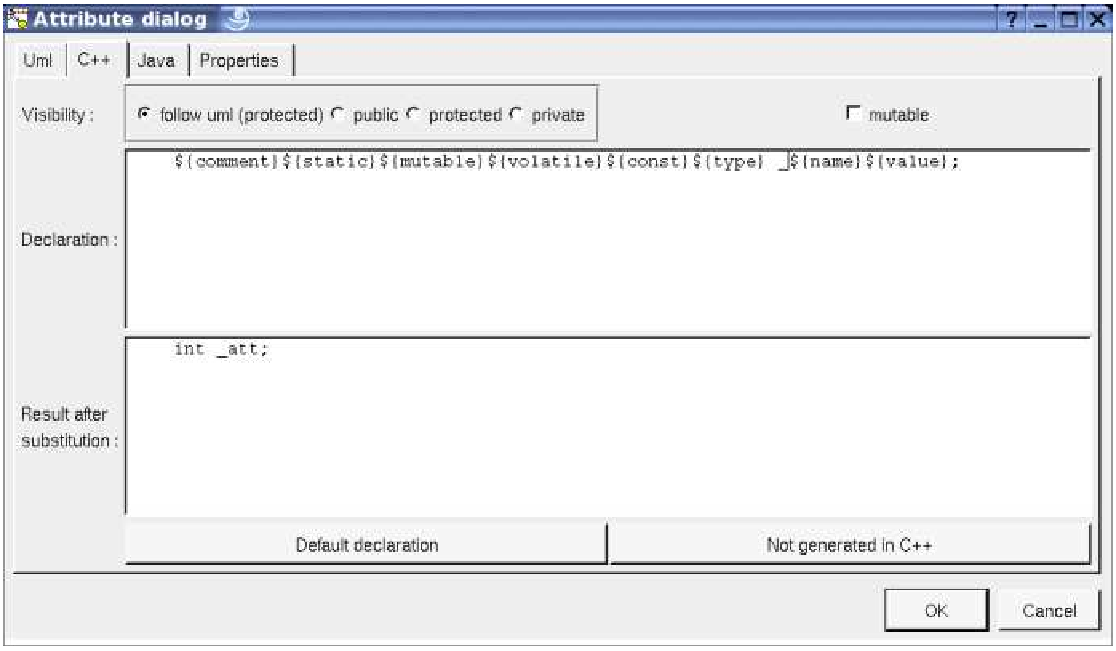
Result after substitution :

```
int att;
```

As you can see, the visibility for C++ is the UML one by default, but this is not mandatory to allow to help to not have the sai visibility for instance in C++ and Java, and in C++ an *attribute* may be *mutable*.

The text behind *declaration* is editable, not the one behind *result after substitution* which shows the source code as it will be generated by the C++ generator (supposing you don't modify it !). Except for the keywords signaled by *${}* and the user properties signaled by *@{}* all the other characters are generated unchanged, including the new line. It is not difficult to understand that *${type}* is replaced by *int* and *${name}* by *att*, both set in the UML *tab*. This also means that if you replace *${type}* by *aze* the generated type for *att* in C++ will be *aze*, etc ...

Perhaps you have coding rules and for instance in C++ the name of an attribute must start by '_' ? Of course you may rename the *attribute _att*, but to see the '_' in the *class diagram* is not very pretty, it is better to add the '_' before *${name}* :



Visibility : ● follow uml (protected) ○ public ○ protected ○ private □ mutable

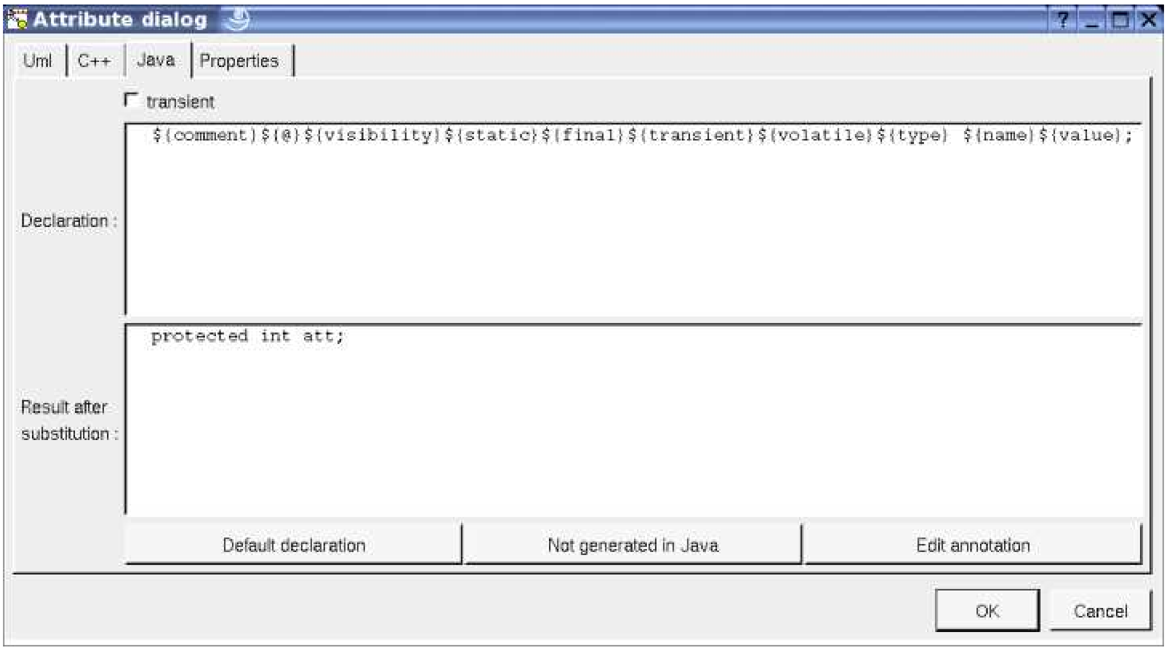
Declaration :

```
${comment}${static}${mutable}${volatile}${const}${type} _${name}${value};
```

Result after substitution :

```
int _att;
```

Go in the Java *tab* :



□ transient

Declaration :

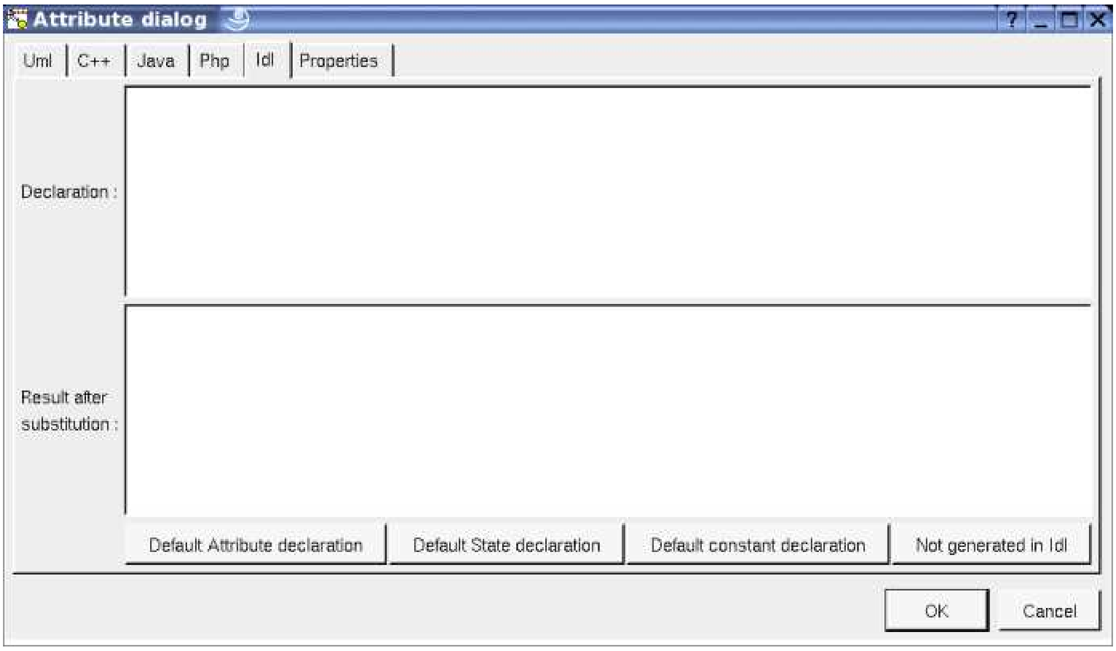
```
${comment}${@}${visibility}${static}${final}${transient}${volatile}${type} ${name}${value};
```

Result after substitution :

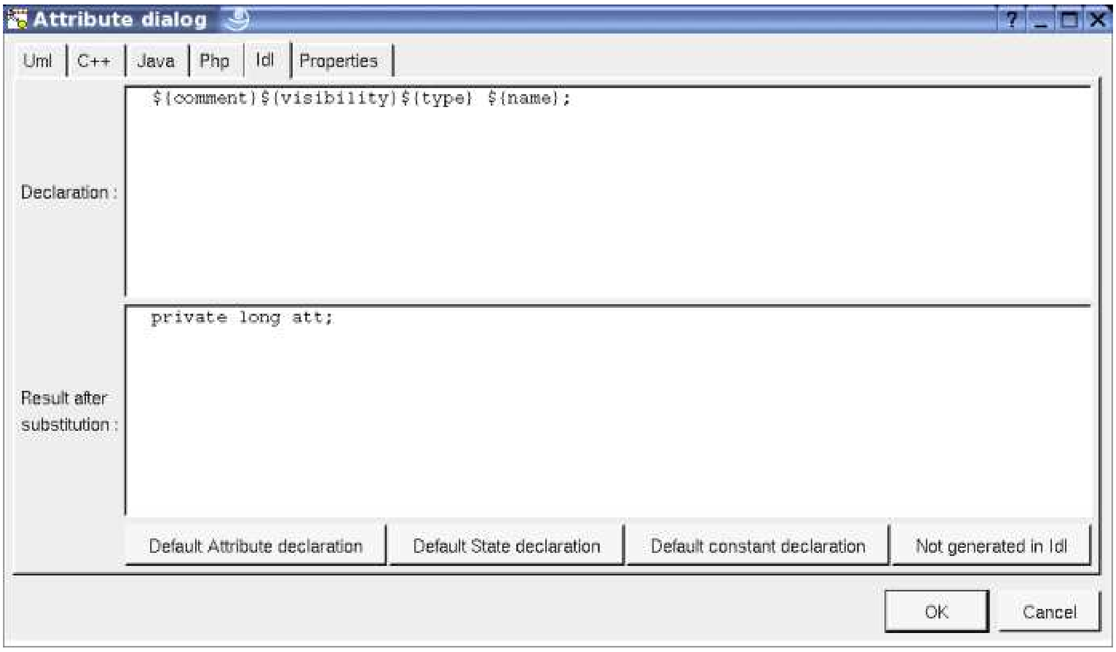
```
protected int att;
```

The principle is the same, applied on Java.

It is not possible to see the Idl and Php definitions. Why ? Remember, at the beginning I ask you set the toggle for C++ and Java in the *Languages* menu, so the definitions for the non toggled languages are hidden. Close the dialog hitting on *ok*, ask for all the languages through the menu *Languages*, reedit the attribute and go in the IDL *tab* :


Attribute dialog
Uml
C++
Java
Php
Idl
Properties
Declaration :
Result after substitution :
Default Attribute declaration
Default State declaration
Default constant declaration
Not generated in Idl
OK
Cancel

The declaration is empty ! This is also because Idl was not set in the menu *Languages*. Hitting the button *Default State declaration* we have :


Attribute dialog
Uml
C++
Java
Php
Idl
Properties
Declaration :
Result after substitution :
Default Attribute declaration
Default State declaration
Default constant declaration
Not generated in Idl
OK
Cancel

Declaration :

```
${comment}${visibility}${type} ${name};
```

Result after substitution :

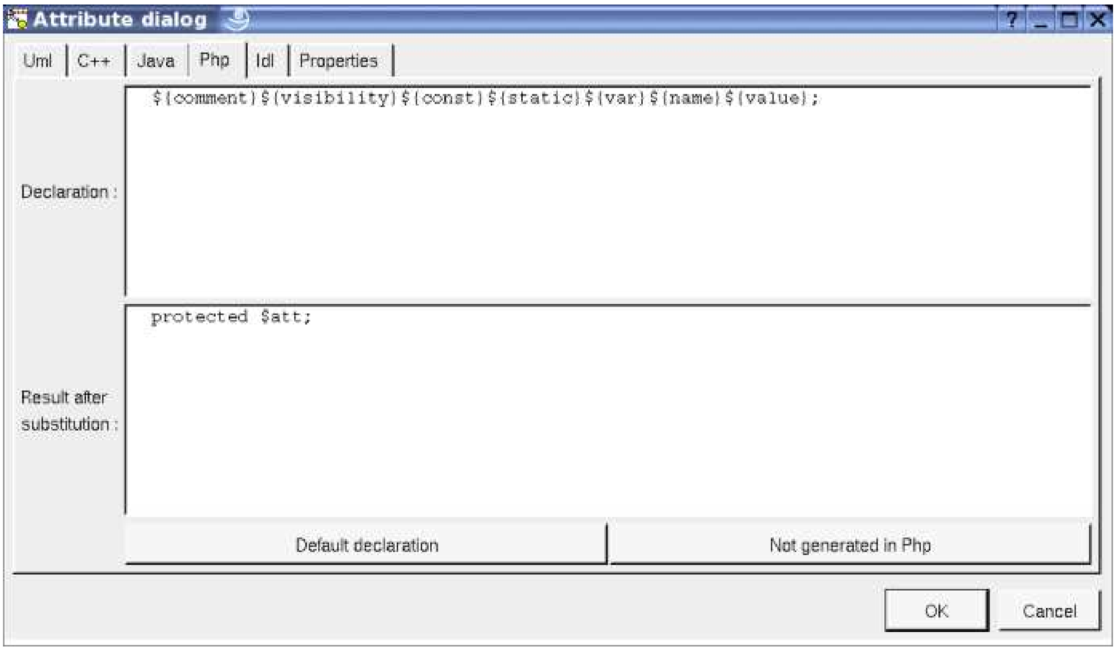
```
private long att;
```

First the visibility is private rather than protected because protected doesn't exist.

Furthermore *${type}* is replaced by *long* rather than *int*, this is because the type *int* doesn't exist in IDL, and the better target is *long*, magic !

They are other type conversions automatically done by BOULM, for instance if you choose *any* in UML you will have *void ** in C++, *Object* in Java and *any* in IDL. Obviously these conversions are not hard coded, they are set through the *generation settings.*

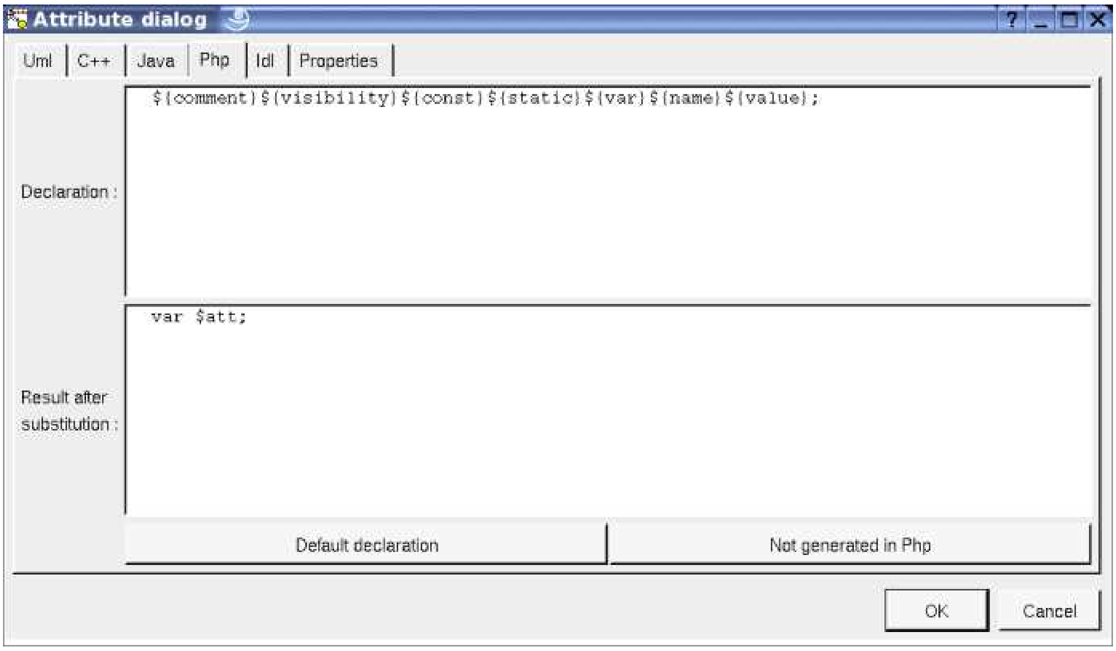
Go in the Php tab and ask for the default declaration :



```
${comment}${visibility}${const}${static}${var}${name}${value};
```

```
protected $att;
```

This is a definition for Php5, if you want to use Php4 the better is to change the visibility to *package*, and the definition will be :



```
${comment}${visibility}${const}${static}${var}${name}${value};
```

```
var $att;
```

The definitions given the default forms with the keywords may also be modified through the *generation settings*, this allows you to add the '_' to name the *attribute* in C++ as above etc ... look at the reference manual for more. Remark : when you change the *generation settings*, the definition of the already existing elements is not changed.

Hit *ok* to validate the changes.

Class drawing settings

In the class diagram only the name of the attribute and the operation are visible, not the types nor the visibility, call the class menu in the diagram and change three *drawing settings* like this :

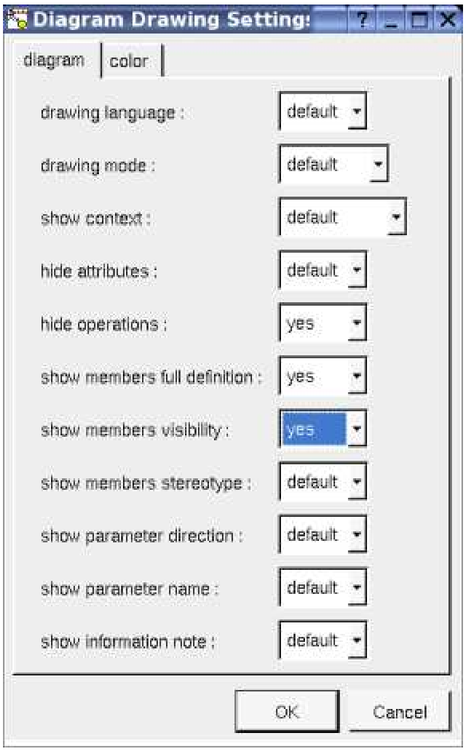


Diagram Drawing Setting:

diagram | color

drawing language : default

drawing mode : default

show context : default

hide attributes : default

hide operations : yes

show members full definition : yes

show members visibility : yes

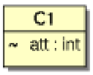
show members stereotype : default

show parameter direction : default

show parameter name : default

show information note : default

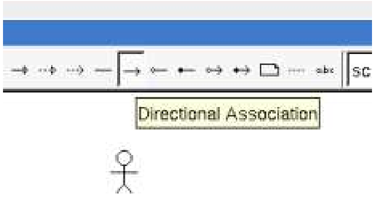
the class picture is now :

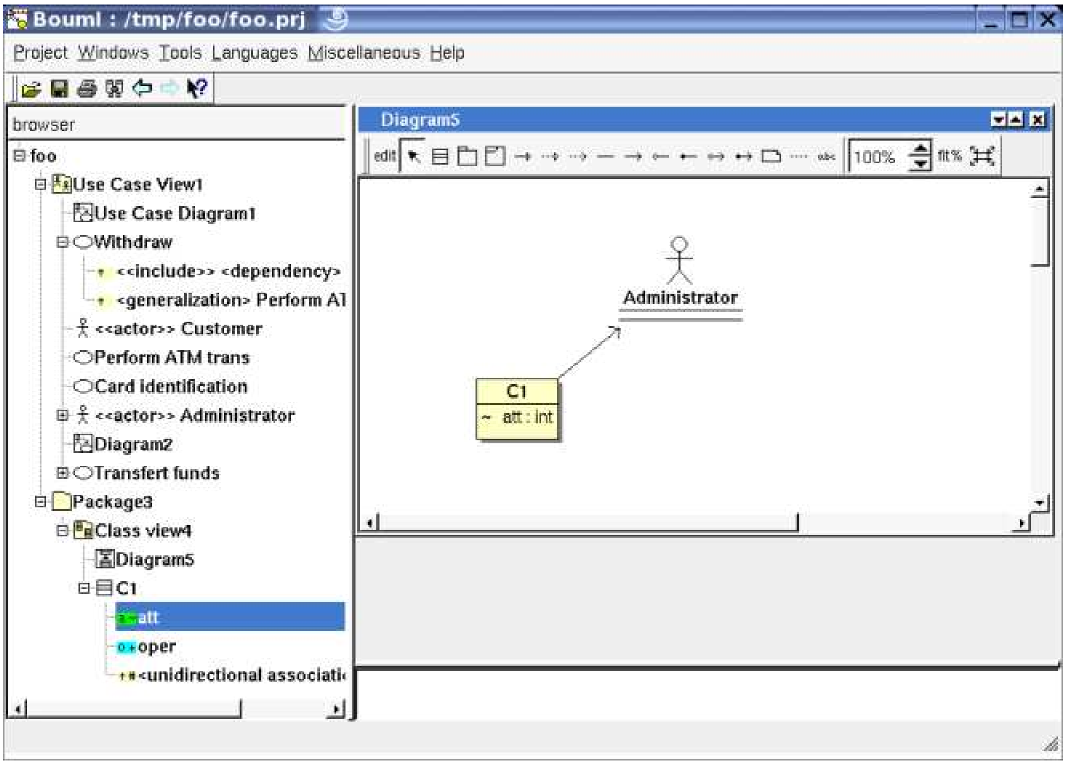


Do not hesitate to try the other drawing settings, and look at the reference manual for details.

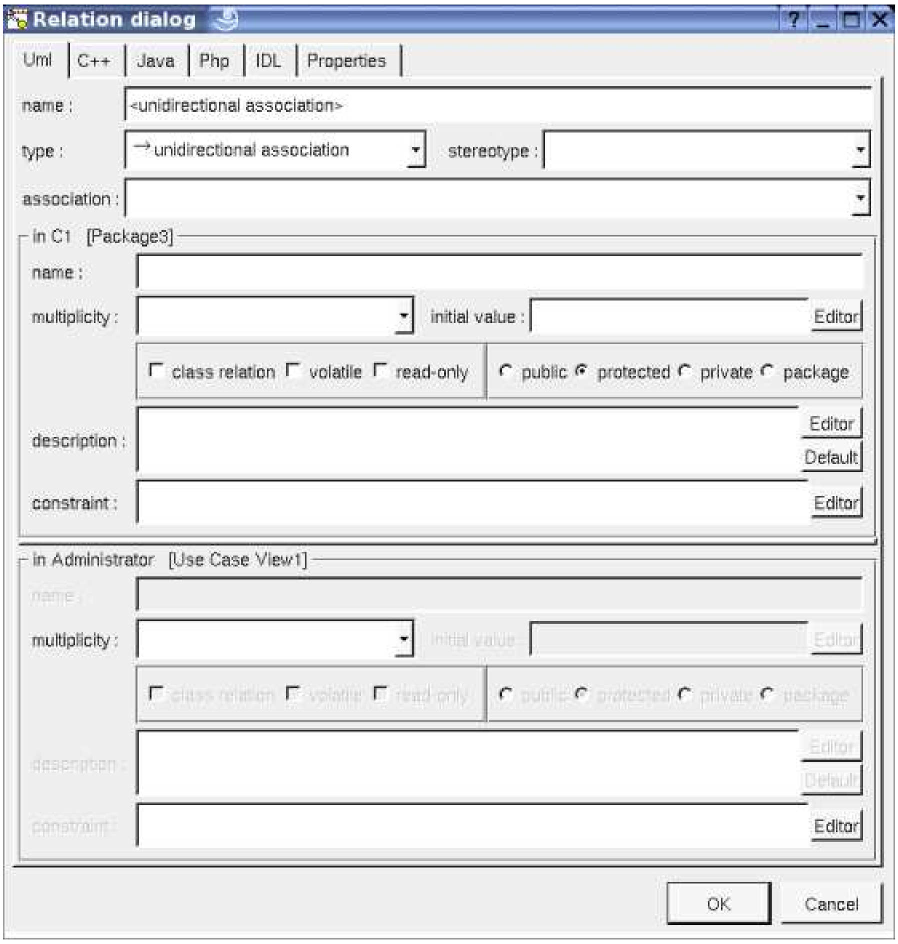
Relations

We want to add a mono directional association from *C1* to *Administrator*, hit the corresponding icon on the top of the diagram sub-window and add draw the relation as for the ones in the *use case diagram* :





As you can see the relation is added in the browser, by default its name is *<unidirectional association>*, edit the relation :



name : <unidirectional association>

type : unidirectional association

stereotype :

association :

in C1 [Package3]

name :

multiplicity :

initial value :

□ class relation □ volatile □ read-only ○ public ● protected ○ private ○ package

description :

constraint :

in Administrator [Use Case View1]

name :

multiplicity :

initial value :

□ class relation □ volatile □ read-only ○ public ○ protected ○ private ○ package

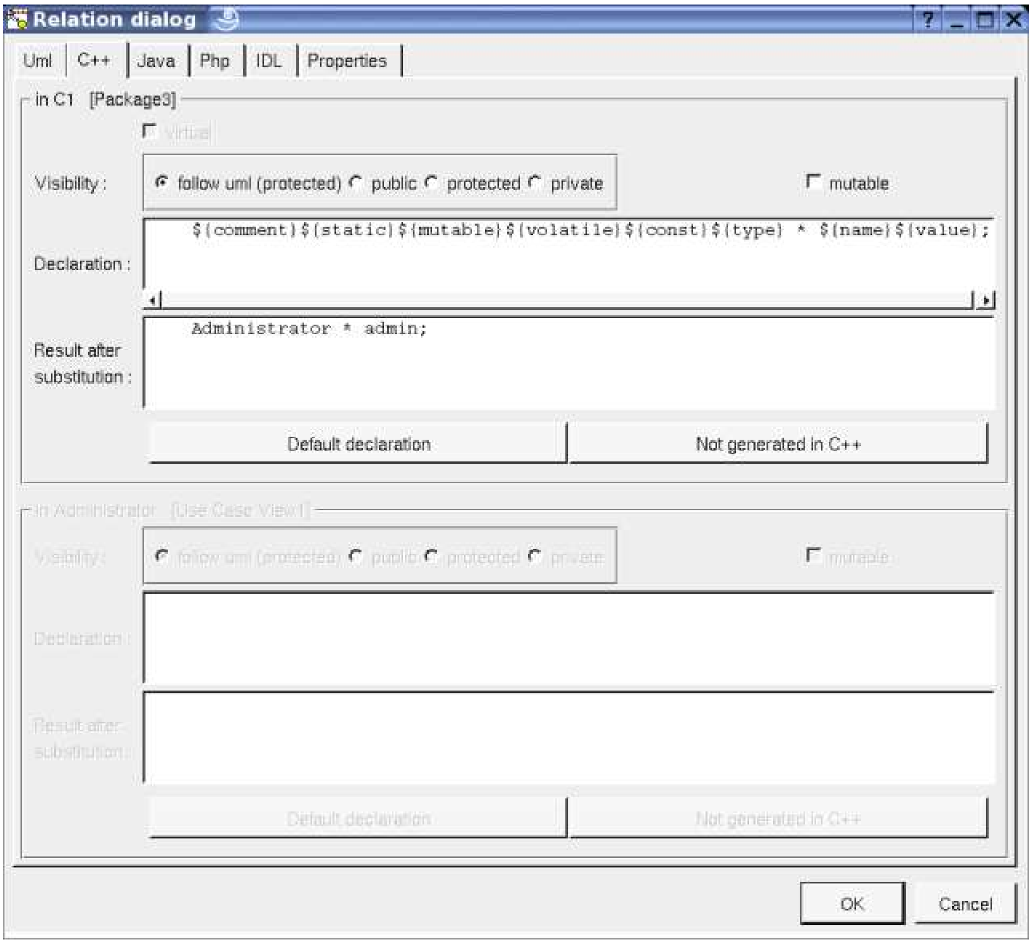
description :

constraint :

Like for the *attributes* we have the *tab* for UML and each language.

Because the relation is unidirectional only one role is editable. Like for the attributes and operation the default *visibility* is specified by the *Class settings.* The *role name* will produce the name of the member, and we found the flags already existing for the attributes : there no difference between a relation and an attribute for the generation point of view.

Name the relation *admin* and go in the C++ *tab* :



in C1 [Package3]

□ Virtual

Visibility : ● follow uml (protected) ○ public ○ protected ○ private □ mutable

Declaration :

```
    ${comment}${static}${mutable}${volatile}${const}${type} * ${name}${value};
```

Result after substitution :

```
    Administrator * admin;
```

in Administrator [Use Case View1]

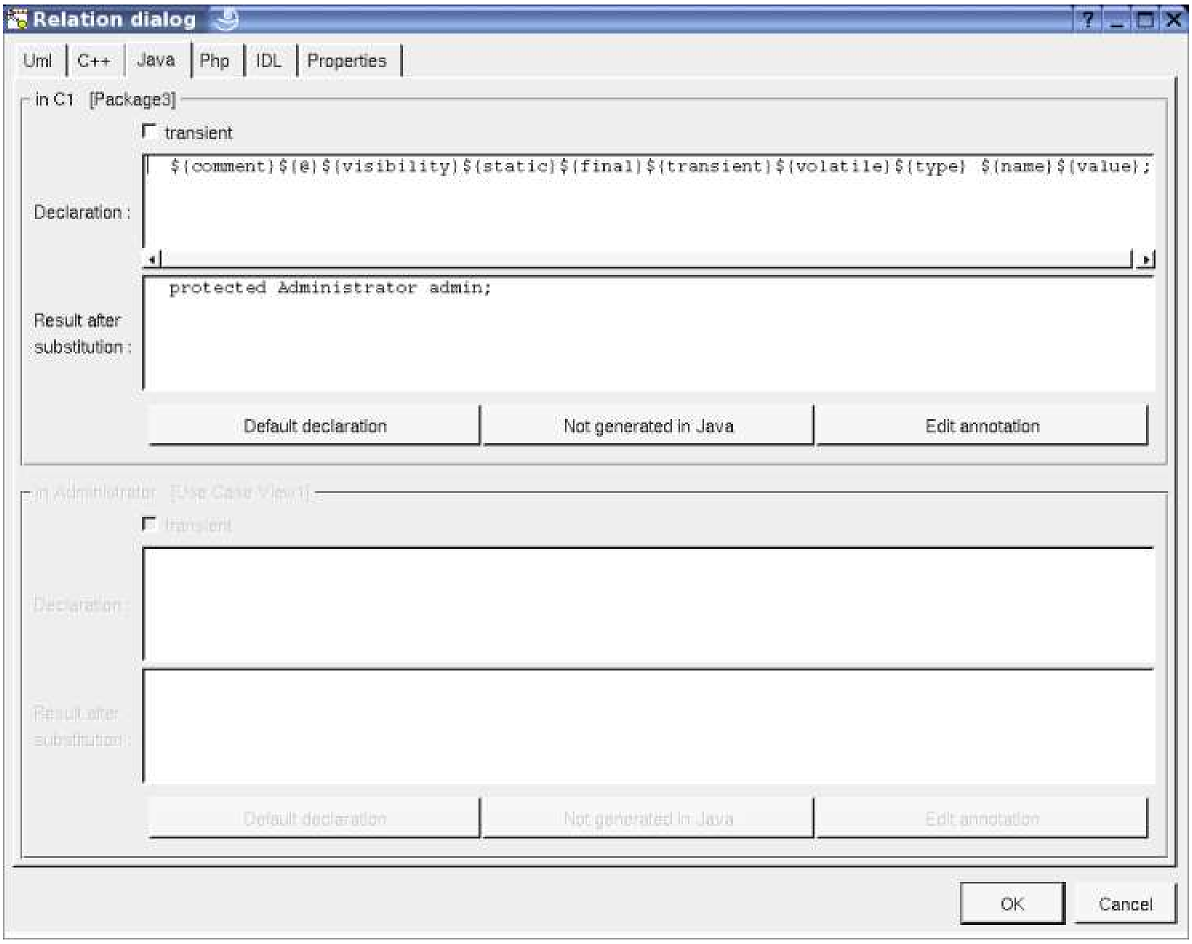
Visibility : ● follow uml (protected) ○ public ○ protected ○ private □ mutable

Declaration :

Result after substitution :

By default an association and an aggregation produce a pointer in C++, an aggregation by value will not produce a pointer. Obviously this default definition may be changed through the *generation settings* or just for this relation.

Go in the Java *tab* :



in C1 [Package3]

□ transient

Declaration :

```
  ${comment}${@}${visibility}${static}${final}${transient}${volatile}${type} ${name}${value};
```

Result after substitution :

```
  protected Administrator admin;
```

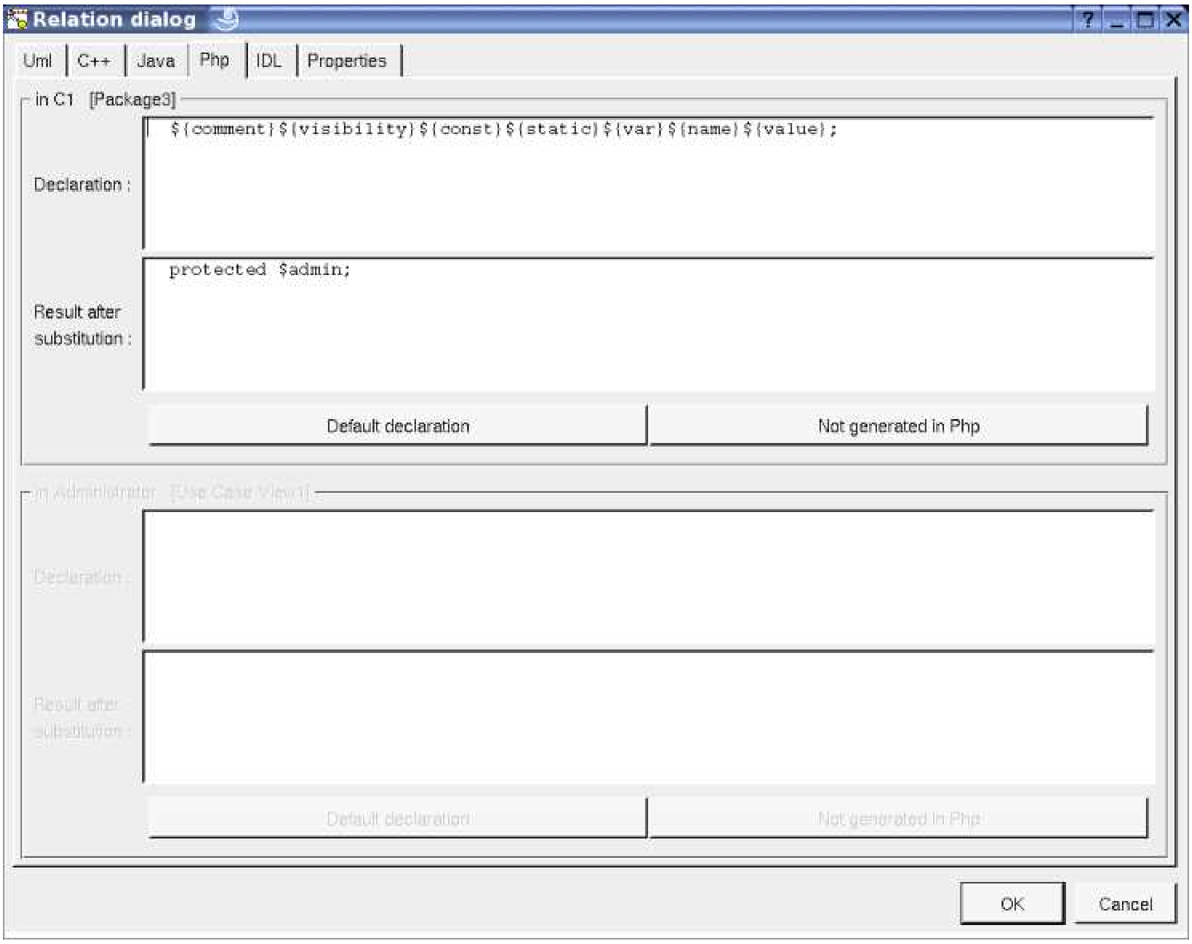
in Administrator [Use Case View1]

□ transient

Declaration :

Result after substitution :

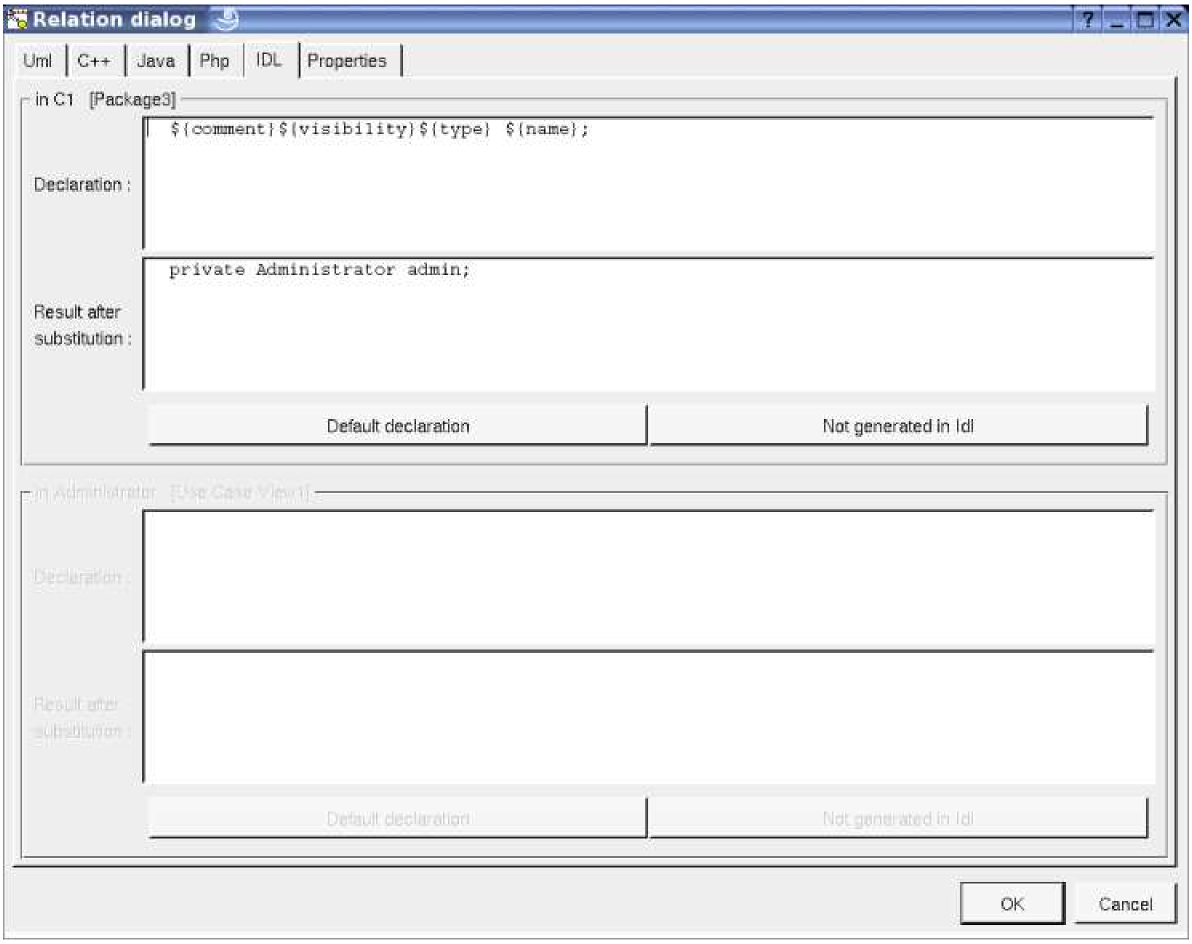
Go in the Php tab :



```
${comment}${visibility}${const}${static}${var}${name}${value};
```

```
protected $admin;
```

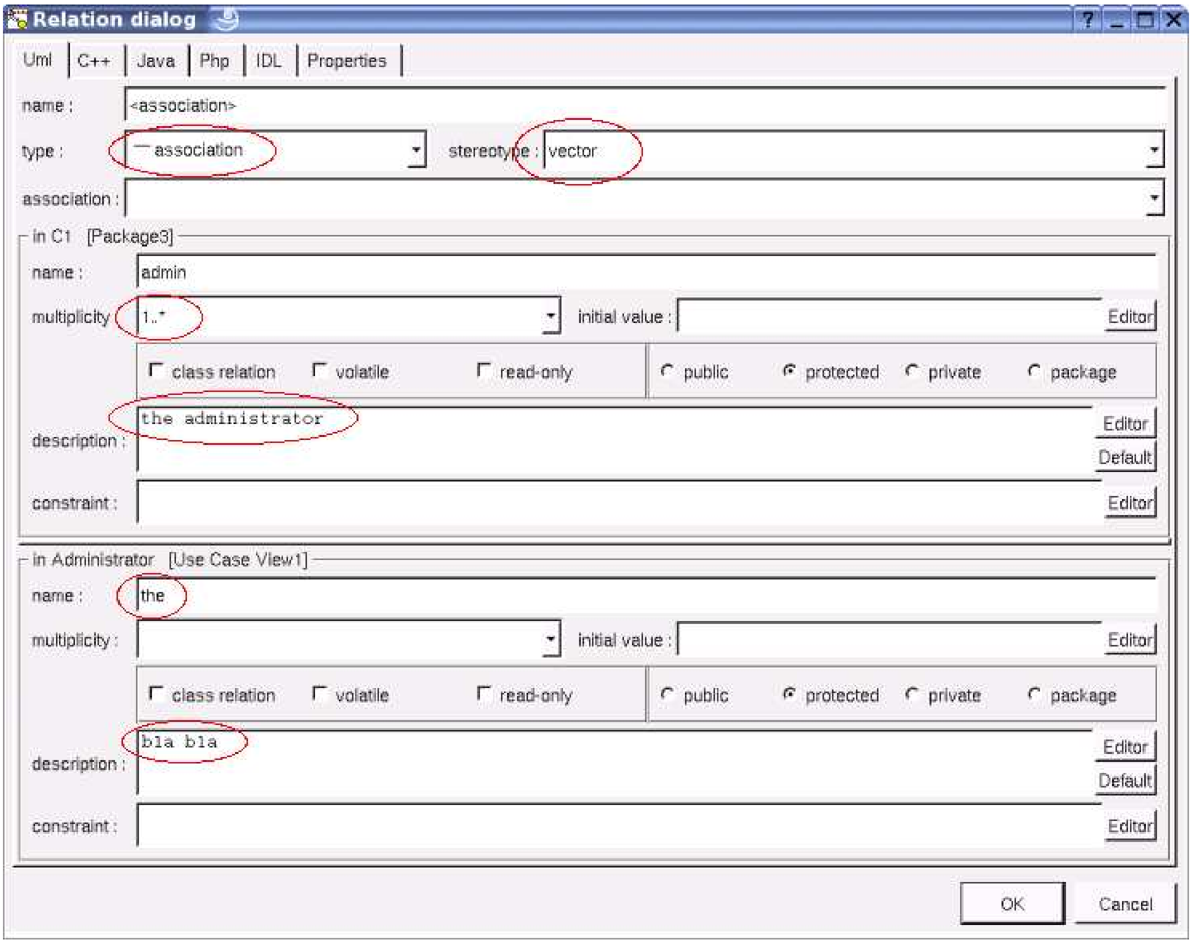
Go in the IDL tab :



```
${comment}${visibility}${type} ${name};
```

```
private Administrator admin;
```

Go back in the UML *tab*, change first the type of the relation to have an association (bi directional) then do the other modifications to have :



name : <association>

type : association   stereotype : vector

association :

in C1 [Package3]

name : admin

multiplicity : 1..*   initial value :

□ class relation □ volatile □ read-only   ○ public ● protected ○ private ○ package

description : the administrator

constraint :

in Administrator [Use Case View1]

name : the

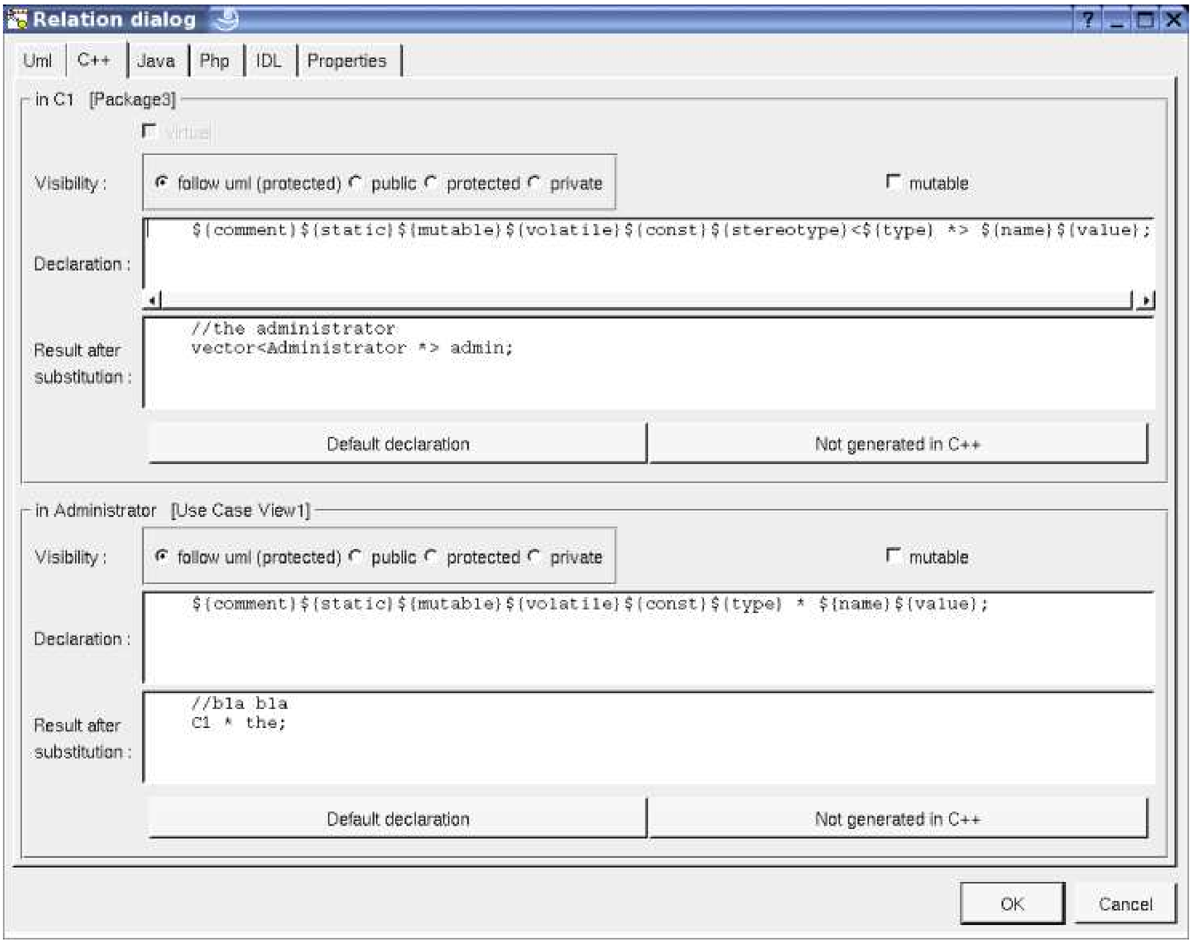
multiplicity :   initial value :

□ class relation □ volatile □ read-only   ○ public ● protected ○ private ○ package

description : bla bla

constraint :

Go in the C++ *tab* and hit the button *Default declaration* for the two roles :



in C1 [Package3]

□ virtual

Visibility : ● follow uml (protected) ○ public ○ protected ○ private   □ mutable

Declaration :

```
    ${comment}${static}${mutable}${volatile}${const}${stereotype}<${type} *> ${name}${value};
```

Result after substitution :

```
    //the administrator
    vector<Administrator *> admin;
```

in Administrator [Use Case View1]

Visibility : ● follow uml (protected) ○ public ○ protected ○ private   □ mutable

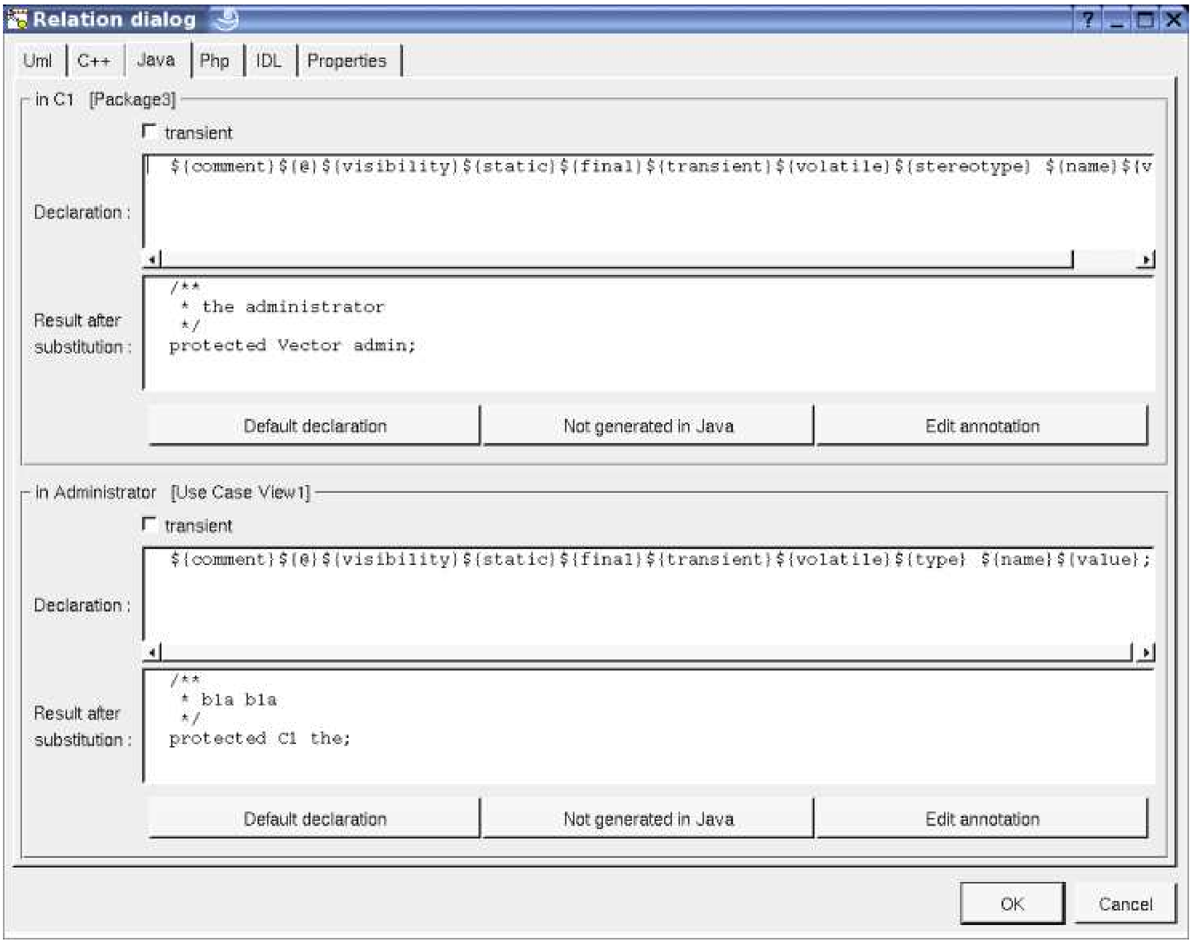
Declaration :

```
    ${comment}${static}${mutable}${volatile}${const}${type} * ${name}${value};
```

Result after substitution :

```
    //bla bla
    C1 * the;
```

Go in the Java *tab* and hit the button *Default declaration* for the two roles :



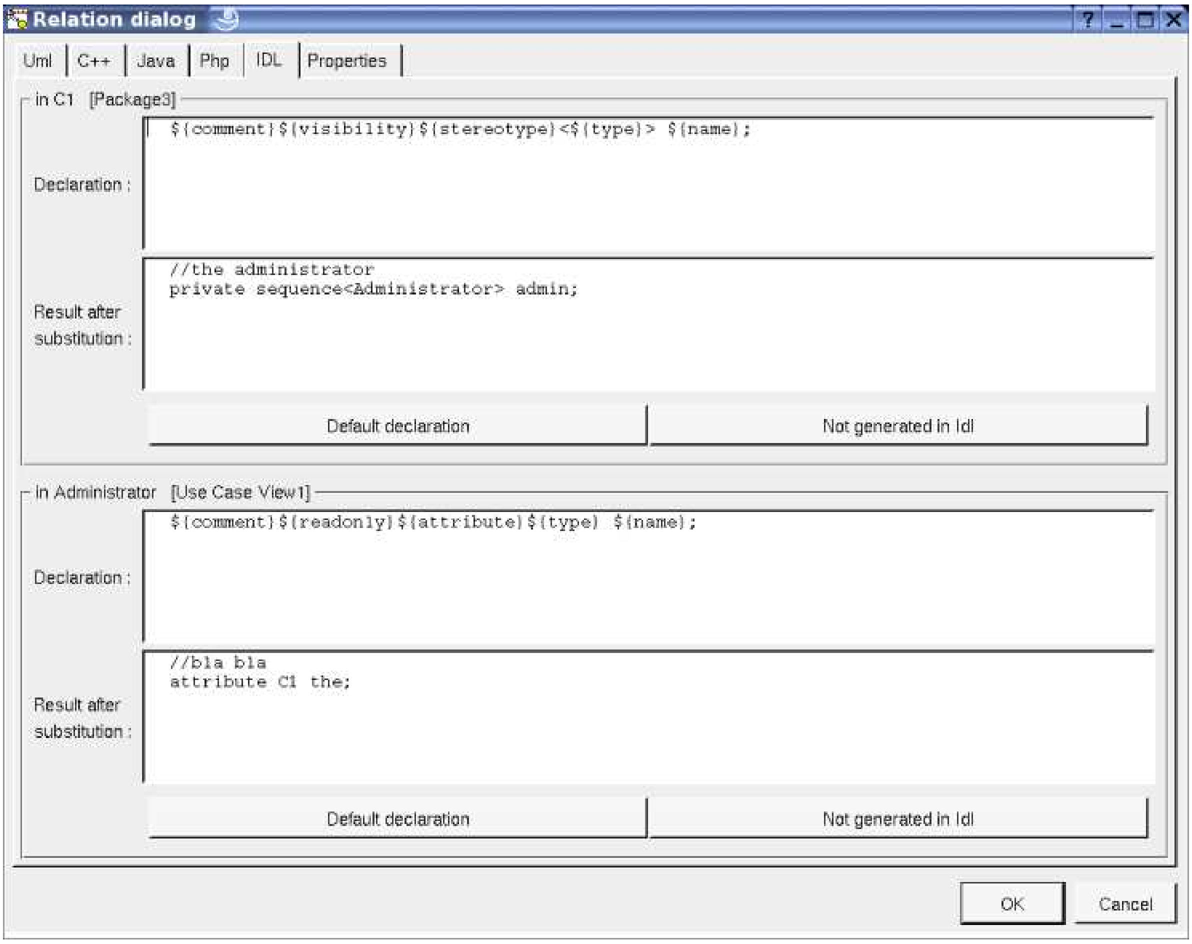
```
${comment}${@}${visibility}${static}${final}${transient}${volatile}${stereotype} ${name}${v
```

```
/**
 * the administrator
 */
protected Vector admin;
```

```
${comment}${@}${visibility}${static}${final}${transient}${volatile}${type} ${name}${value};
```

```
/**
 * bla bla
 */
protected C1 the;
```

Go in the IDL *tab* and hit the button *Default declaration* for the two roles :



```
${comment}${visibility}${stereotype}<${type}> ${name};
```

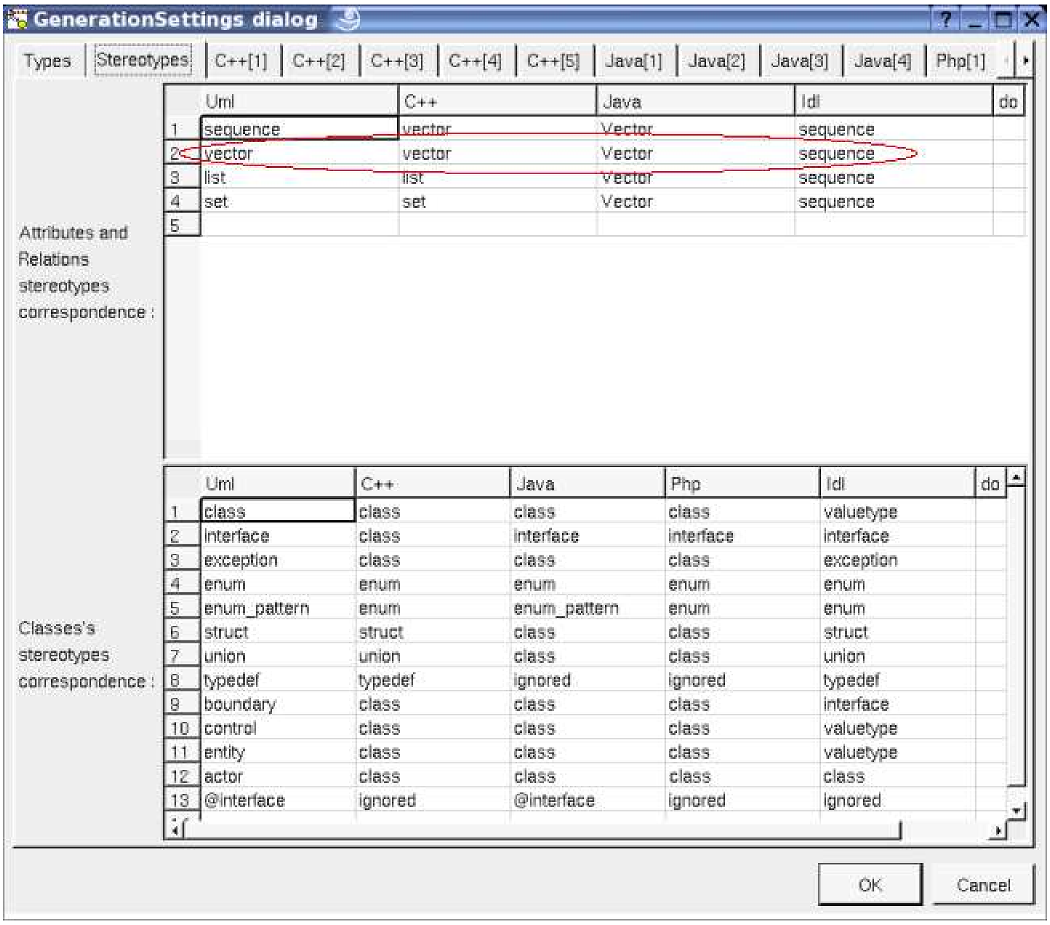
```
//the administrator
private sequence<Administrator> admin;
```

```
${comment}${readonly}${attribute}${type} ${name};
```

```
//bla bla
attribute C1 the;
```

As you can see the default definitions depend on the type of the relation and the multiplicity, of course these defaults are modif through the *generation settings*.

The way a UML stereotype is projected for each language is also modifiable through the generation settings, as you can see above and below *vector* produces *vector* in C++ *Vector* in Java *and* sequence *in IDL* :



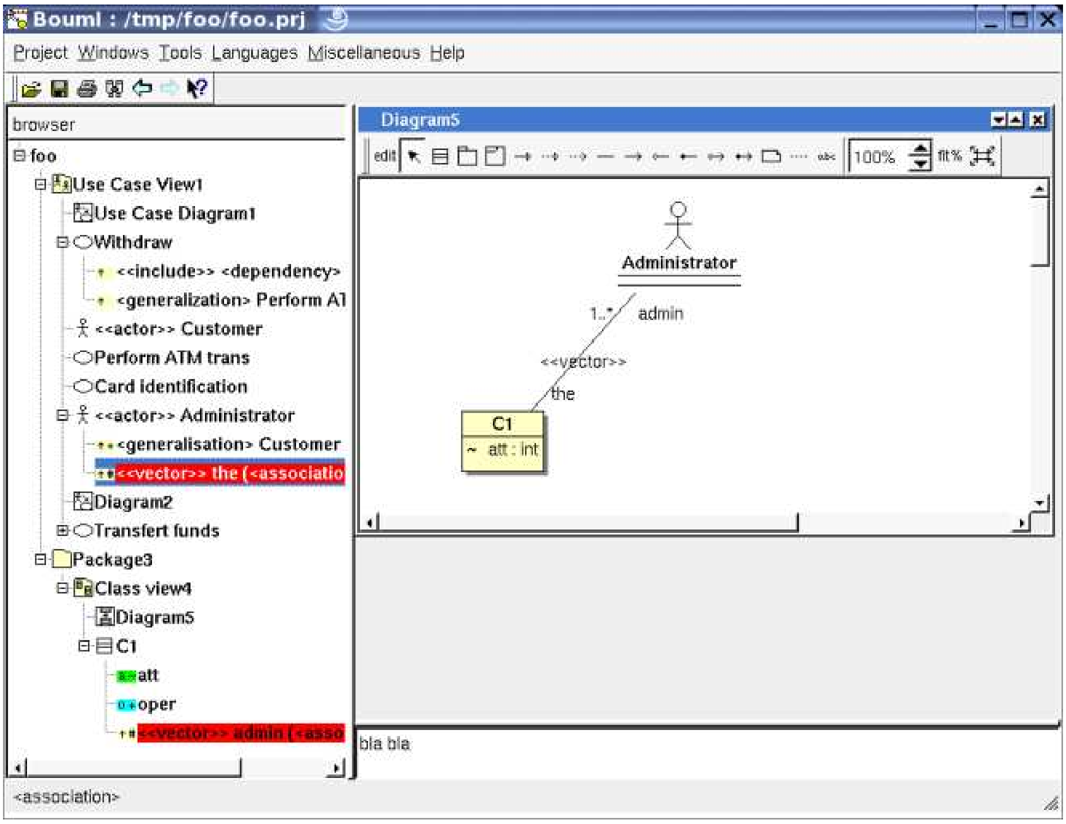
Attributes and Relations stereotypes correspondence :

	Uml	C++	Java	Idl	do
1	sequence	vector	Vector	sequence	
2	vector	vector	Vector	sequence	
3	list	list	Vector	sequence	
4	set	set	Vector	sequence	
5					

Classes's stereotypes correspondence :

	Uml	C++	Java	Php	Idl	do
1	class	class	class	class	valuetype	
2	interface	class	interface	interface	interface	
3	exception	class	class	class	exception	
4	enum	enum	enum	enum	enum	
5	enum_pattern	enum	enum_pattern	enum	enum	
6	struct	struct	class	class	struct	
7	union	union	class	class	union	
8	typedef	typedef	ignored	ignored	typedef	
9	boundary	class	class	class	interface	
10	control	class	class	class	valuetype	
11	entity	class	class	class	valuetype	
12	actor	class	class	class	class	
13	@interface	ignored	@interface	ignored	ignored	

Press the button *Ok* and look at the diagram :



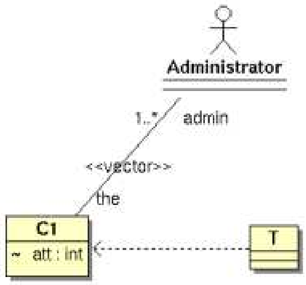
Because the relation is now bi-directional this one appears in the browser in *C1* and *Administrator* (I mark them in the browser : they are red).

Define struct, union, typedef, enum

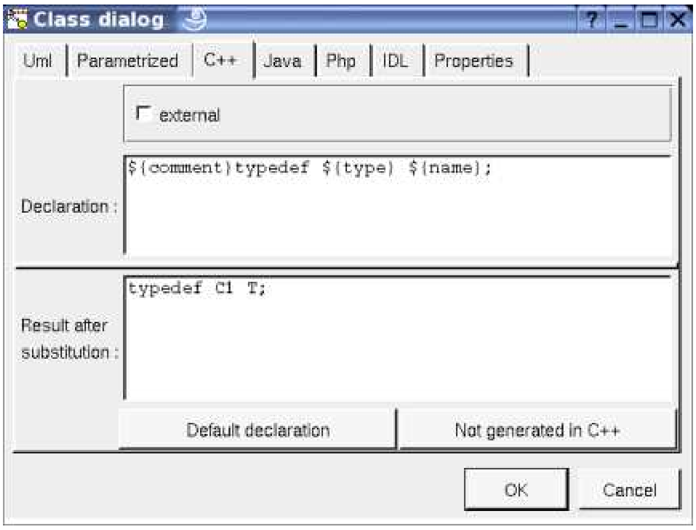
To define a C++ or IDL *struct* use the class stereotype *struct*, and edit the class using the *Default declaration* button on the desired language(s). In Java a *struct* is implemented through a standard class, of course the projection of a class stereotype from UML to a given language may be s through the *generation settings*, look at the dialog already shown below and read the reference manual.

To define a C++ or IDL *union* use the class stereotype *union* as for a *struct*.

To define for instance the C++ *typedef* T which is a pointer to a *C1* : create the class *T*, and draw a dependency from *T* to *C1*



Edit the class and set the stereotype to *typedef* : the dialog is changed to indicate a *base type*, thanks to the *dependency* this one is set to *C1*, but you may change it . Go in the C++ tab :



□ external

Declaration :

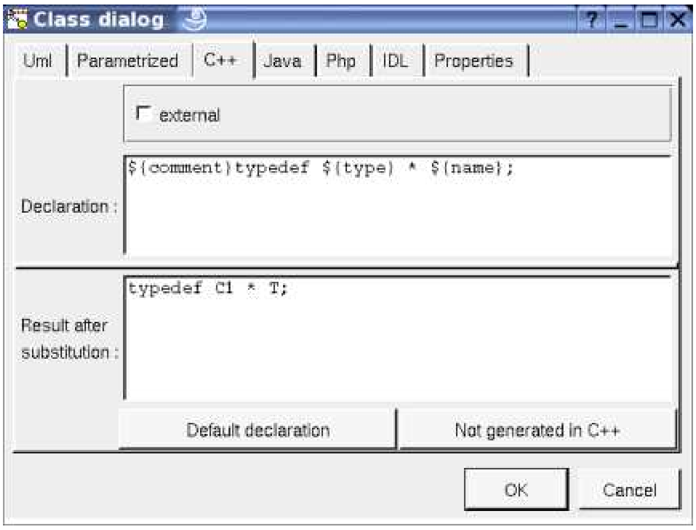
```
${comment}typedef ${type} ${name};
```

Result after substitution :

```
typedef C1 T;
```

Of course the dependency in not mandatory, for instance to define *typedef int turlututu*

Add a '*' between *${type}* and *${name}* :



□ external

Declaration :

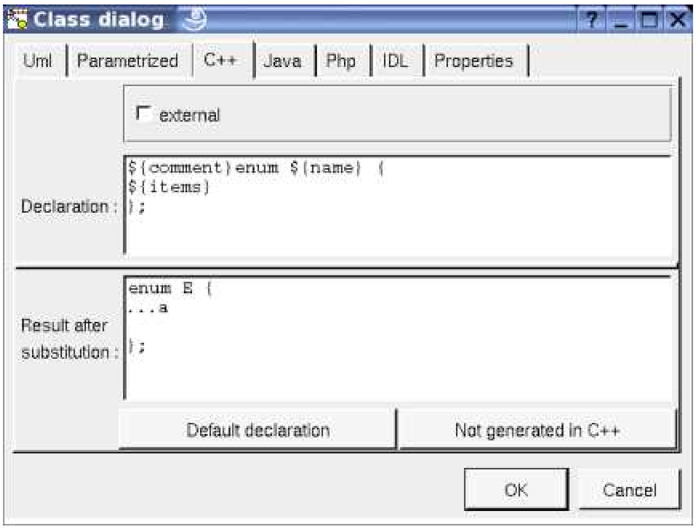
```
${comment}typedef ${type} * ${name};
```

Result after substitution :

```
typedef C1 * T;
```

The *enums* are supported through the stereotypes *enum* and *enum_pattern*.

Create a class *E* , edit E to set its stereotype to *enum* and press *Ok*, call the menu on the class in the browser choose *add item* and name it *a*, then recall the menu and choose *add attribute* and name it *b*. Edit *E* and go in the C++ *tab,* ask for the default declaration :



□ external

Declaration :

```
${comment}enum ${name} {
${items}
};
```

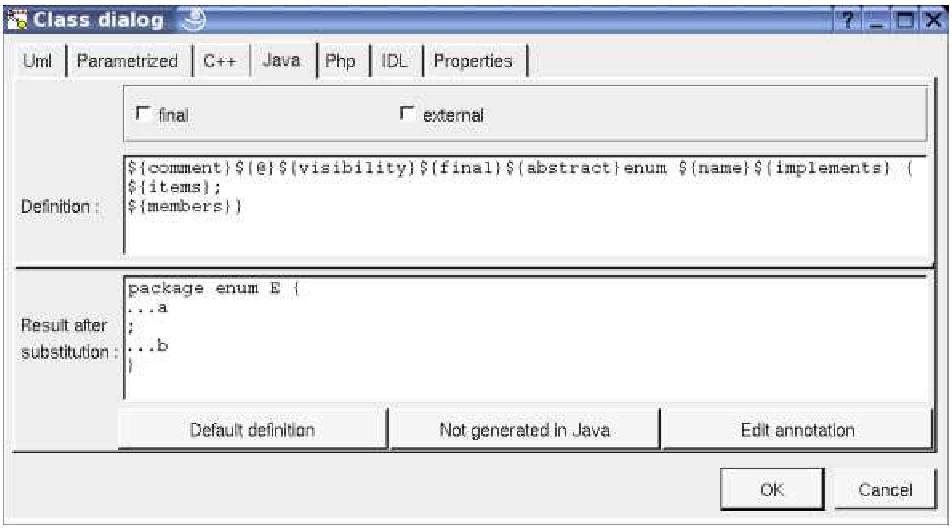
Result after substitution :

```
enum E {
...a

};
```

As you can see, *${items}* produce a (the '...' indicates that only the name is shown, not the full definition) but not *b*, this is because in C++ an *enum* only have items, *attributes* and *operations* are illegal.

Go in the Java *tab*, this is an *enum* for at least the JDK5



□ final □ external

Definition :

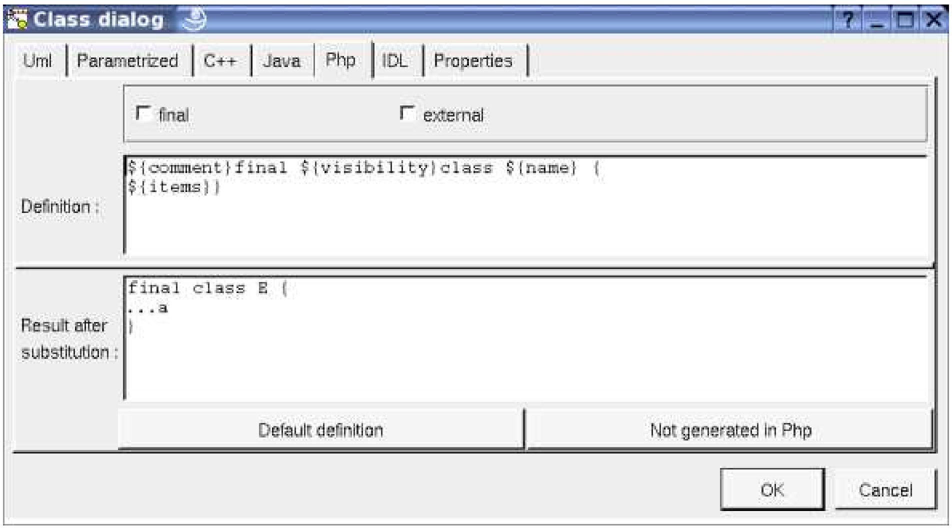
```
${comment}${@}${visibility}${final}${abstract}enum ${name}${implements} {
${items};
${members}}
```

Result after substitution :

```
package enum E {
...a
;
...b
}
```

b is produced by *${member}* because its stereotype is *attribute* allowing to separate the *items* and the *attributes*.

Go in the Php *tab*, *b* doesn't appears like in C++



□ final □ external

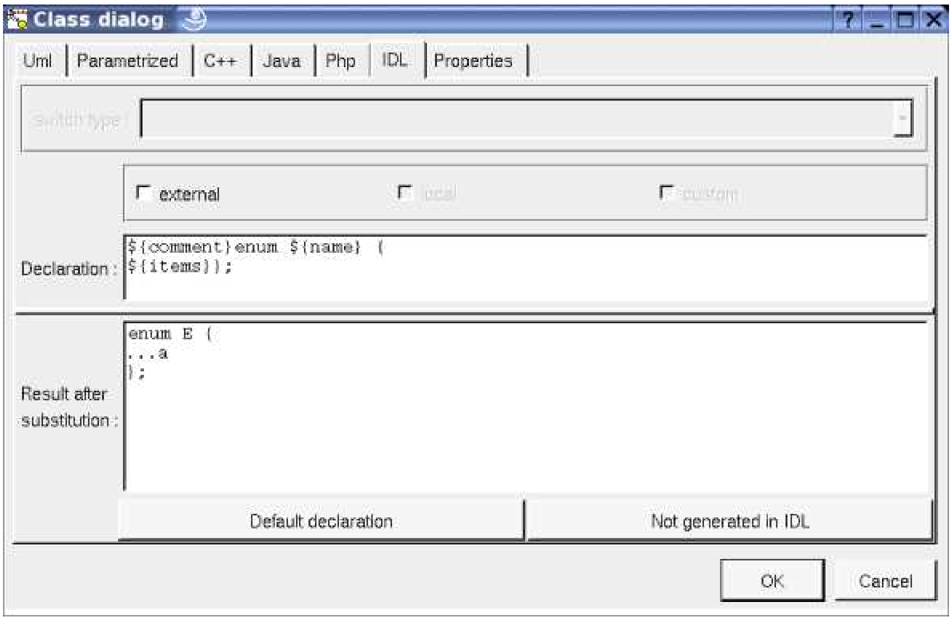
Definition :

```
${comment}final ${visibility}class ${name} {
${items}}
```

Result after substitution :

```
final class E {
...a
}
```

Go in the IDL *tab*, *b* doesn't appears like in C++



Declaration :

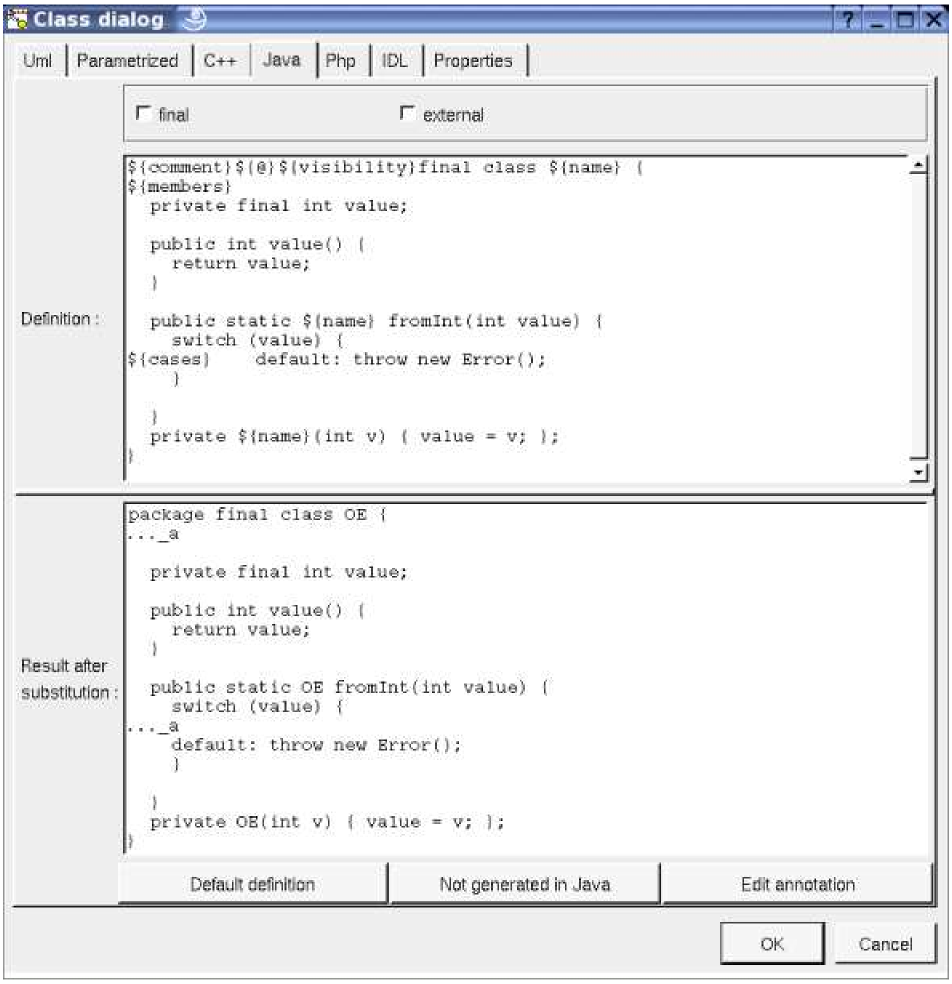
```
${comment}enum ${name} {
${items}};
```

Result after substitution :

```
enum E {
...a
};
```

In the same way, if you add an *operation* in the *enum* this one will not be defined in C++, Php and IDL.

Now create the class *OE*, edit it to set its stereotype to *enum_pattern* and press *Ok*, look at the menu of *OE* : it is only possible to add *items*. There is no difference with the *E* in C++ and IDL, but in Java this is completely different because this kind of *enum* is supported by a class, this is for the Java release before the JDK 5:



Definition :

```
${comment}${@}${visibility}final class ${name} {
${members}
  private final int value;

  public int value() {
    return value;
  }

  public static ${name} fromInt(int value) {
    switch (value) {
${cases}    default: throw new Error();
    }

  }
  private ${name}(int v) { value = v; };
}
```

Result after substitution :

```
package final class OE {
..._a

  private final int value;

  public int value() {
    return value;
  }

  public static OE fromInt(int value) {
    switch (value) {
..._a
    default: throw new Error();
    }

  }
  private OE(int v) { value = v; };
}
```

An other time the form is defined through the *generation settings*.

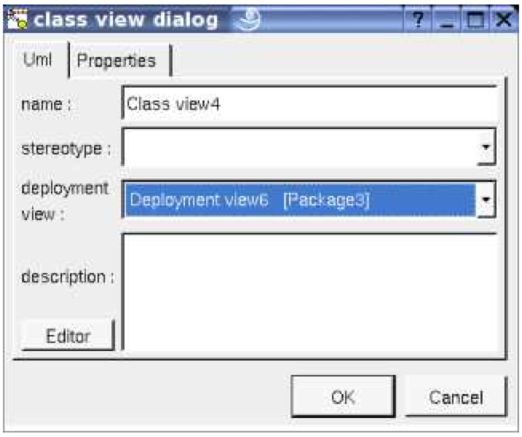
I propose you to edit the item *a* in *E* and *OE* in all the language to see the definitions.

Code generation, deployment view, artifact

Perhaps you had seen the class menu entry *Generate*, try to generate the code for *C1* : whatever the language you have the error “*C1* : does not have associated *artifact*”. in UML 2 the artifacts represent the generated files, sources, object, library, executable, *jar* etc ..., and of course the code generation is done in a source, so you must specify which source. In the first releases of BOUML the generation was associated to the *components* but because this is not compatible with UML 2 (UML 1 was very evasive on the subject) I had prefer to do the change, contrarily many tools ...

An *artifact* may be placed only in a *deployment view*, create a *deployment view* in the *package Package3* (this is not mandatory, you may place it in any *package*), let's suppose this name be *Deployment view6*

Now there are two ways to associate to each class an artifact of kind source and named like the class. The long way is to do for ea class : create an artifact in *Deployment view6*, edit it to name it like the class, to set its stereotype to *source* and to associate it the class. The second way is better to associate several classes : associate *Deployment view6* to *Class view4* (because it contains *C1 etc ...)* editing *Class view4* :



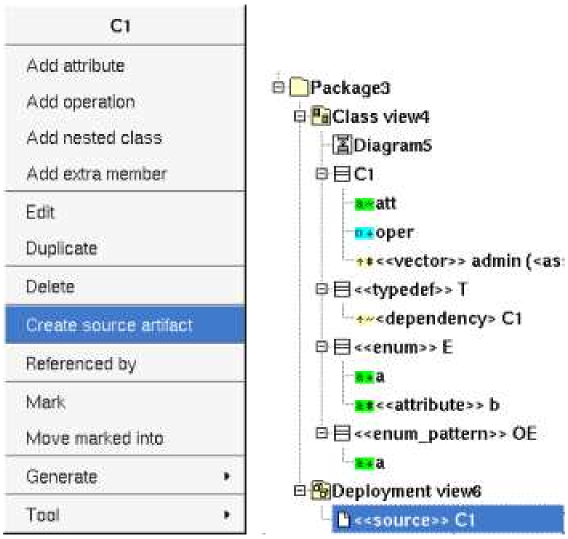
name : Class view4

stereotype :

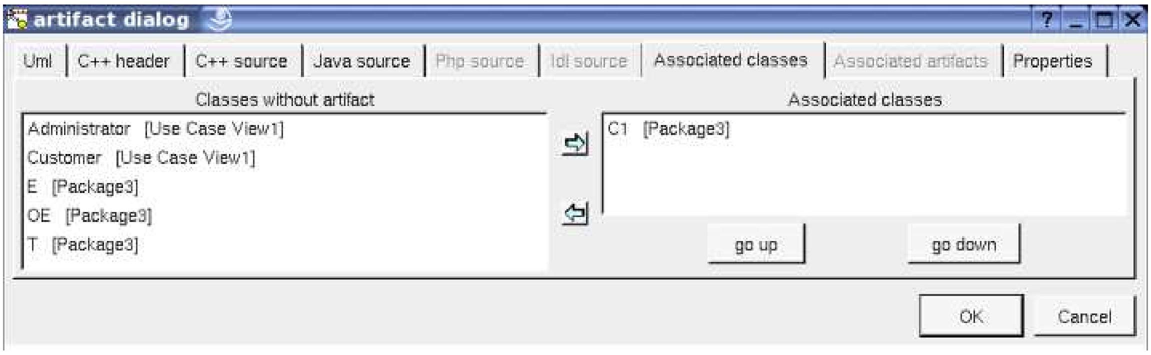
deployment view : Deployment view6 [Package3]

description :

Thanks to this association when you call the menu of *C1* and the other classes in *Class* view4 in the browser you may choose *create source artifact* and the appropriate *artifact* is created, do that for *C1* :



Edit the *artifact* (you may select it calling the menu of C1 and choosing *select associated artifact*) and go in the *tab associated classes* :



Classes without artifact

Administrator [Use Case View1]
Customer [Use Case View1]
E [Package3]
OE [Package3]
T [Package3]

Associated classes

C1 [Package3]

C1 is associated to the *artifact* and you may associate several classes, in this case several classes will be produced in the same source file, you can change their order selecting an associated class and using *go up/down*.

Three *tabs* are not availables :

- *Php source* because the associate classes (here *C1*) doesn't have a definition in Php,
- *Idl source* because the associate classes (here *C1*) doesn't have a definition in IDL,
- *Associated artifact* because the stereotype of the *artifact* is source. If the stereotype is not *source* you may associate *artifacts* to an *artifact* for instance to indicate which artifacts compose an executable (this way is used by the plug-out *genpro*).

Look at the other tabs and refer to the reference manual for details

Create an associated artifact for *T, O* and *OE*.

Try to generate code, this is possible calling the menu on each class, or on their *class view*, or the *package* containing the *view* etc ... up to the project level, in this case you may also call for the generation in the menu *Tools*. If you do that you have an other error because BOUML doesn't know where the files must be generated, the artifacts gives their names not their path !

It is possible to specify an own directory in each *package* (you may also specify a *namespace / package / module*), it is also possible to specify a directory (or a base directory) for all the project in the *generation settings*. Call the menu of the project in the browser (right mouse click on *foo*) and choose *generation settings*, go in the last *tab* named *Directory* and specify a directory for C++ and Java, for instance */tmp* for both (choose another and better directories in the future !), validate (button *Ok*).

Now if you ask for the code generation you will have something generated. Ask for the generation a second time for the same language : the trace indicates that the files are not modified, because this is useless. Note that the code generators really check that the files already have the right contain, in case you change a file through an external editor and re-ask for the generation the modified file will be rewritten. This means that even this is not the faster way, you may ask for the code generation on the project and the date of the already generated files will not change, for the pleasure of your *Makefiles* or equivalent.

Epilogue

Now you are ready to start to use BOUML ... and to read the reference manual because this tutorial only contain a little part of features of BOUML.

To finish don't forget that :

- BOUML may be extended writing *plug-outs*. A *plug-out* may be developed in C++ or Java, look at the existing *plug-outs* as example.
- When you don't know how to do to have a desired generated code, the better is probably to write (a part of) this code by hand in file(s), and to do a reverse in a new and empty project (to not pollute he current one) and to look at the result. Obviousl reverse may also be used to constitute a project.
- Java programmers : use the *plug-out* Java Catalog !

Happy modeling !

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