Technical Report

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Testing the osCommerce conceptual schema by using CSTL

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July 2009

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1. Introduction

Testing increases confidence in quality.

In several scientific and industrial contexts, such as medical research, civil engineering or aeronautics, testing is, clearly, a critical activity. Trying and analyzing the resultant effects of applying our solutions in concrete situations is the most used mechanism to increase our confidence about the quality of products developed by humans.

Nowadays, software has become an intrinsic part of business and society and, consequently, software testing is widely accepted as an important activity to enhance the quality of information systems during its development.

Nowadays, most work in conceptual modeling assumes that conceptual schemas are executable. Our proposal is based on the idea that conceptual schemas are software artifacts and consequently, they can also be tested. Testing conceptual schemas has some similarities with the well-known activity of testing software programs but there are also important differences: On the one hand, we test explicit representations of domain knowledge (entity types, relationship types, derivation rules, integrity constraints, etc.) instead of code. On the other hand, our aim is driving the correctness of the conceptual schema by aligning the knowledge of domain experts and the knowledge specified in the schema.

In this context, our work is addressed to explore the use of validation testing during the elicitation of the conceptual schema as an early error detection practice to help increasing software quality.

We developed the Conceptual Schema Testing Language (CSTL), a language for writing automated tests of executable conceptual schemas.

In this report, we present this language and some example results of its application to the conceptual schema of a real-world information system. We use the conceptual schema of the *osCommerce* system [9], a widespread e-commerce solution which is the base of thousands of online stores around the world.

2. The CSTL language

2.1 Five design principles of CSTL

The essential purpose of CSTL is providing a textual, procedural, formal and executable notation for writing automated tests of conceptual schemas written in UML/OCL [5,6].

CSTL syntax has been designed by finding a balance between expressiveness, simplicity and understandability of the specified tests. In order to achieve this purpose, CSTL design is based in the following principles:

- **CSTL allows defining the tests kinds applicable to conceptual schemas**. We proposed a list of five kinds of tests that can be applied to conceptual schemas. CSTL allows specifying them in test cases by writing assertions applied to IB state definitions:

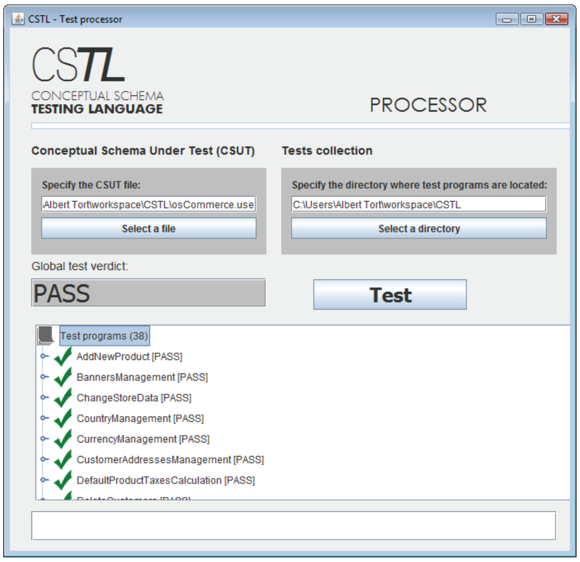
    - Asserting the consistency of an IB state.
    - Asserting the inconsistency of an IB state.
    - Asserting the occurrence of domain events.
    - Asserting the non-occurrence of domain events.
    - Asserting the contents of an IB state.

- **CSTL facilitates the task of writing tests**. CSTL provides a set of basic constructs that allows defining the collection of test kinds listed above. Moreover, a set of additional constructs are provided in order to facilitate the task of writing tests. CSTL statements find a balance between simplicity and expressiveness, an objective which is more feasible in a specialized conceptual schema testing language like CSTL.

- **CSTL is focused on enhancing tests understandability:** The main purpose of CSTL is providing a language for writing tests to validate the knowledge of the conceptual schema according to the knowledge of the domain experts. This is the main reason why tests should be understandable at a conceptual level. In fact, these tests are executable specifications of concrete scenarios of requirements, but with the particularity that they can be executed automatically as many times as needed. Consequently, they are an interesting approach for requirements validation. In this context, CSTL syntax has been designed to be easy understandable and as close as possible to the natural way of defining scenarios of requirements. The definition of associated pattern sentences to each language statement was a key technique that guided the CSTL design.

- **CSTL follows the style of the modern xUnit testing frameworks:** CSTL syntax is inspired on existing languages that are used for testing in other context and fields, but not suitable at all to test conceptual schemas. CSTL follows the style of xUnit [2] testing languages in the field of programming. CSTL includes the usual instantiation, assignment, conditional and iteration statements needed to write test cases but it also includes built-in constructs that correspond to the elements found in the modern xUnit testing frameworks, and the formalization of test assertions [2].

- **CSTL tests can be executed by an interpreter:** The proposed language has been designed to be executable. We developed an interpreter that makes possible the execution of tests written in CSTL. The test interpreter assumes that the Conceptual Schema Under Test (CSUT) is formally specified in the executable form used in the USE tool [1] but enriched to enhance its expressiveness as explained in section 3.2.



Specify the CSUT file: Albert Tort\workspace\CSTL\osCommerce.use

Specify the directory where test programs are located: C:\Users\Albert Tort\workspace\CSTL

Global test verdict: PASS

Test programs (38)
- AddNewProduct [PASS]
- BannersManagement [PASS]
- ChangeStoreData [PASS]
- CountryManagement [PASS]
- CurrencyManagement [PASS]
- CustomerAddressesManagement [PASS]
- DefaultProductTaxesCalculation [PASS]

Fig. 1. Test processor screenshot

2.2 Test program structure

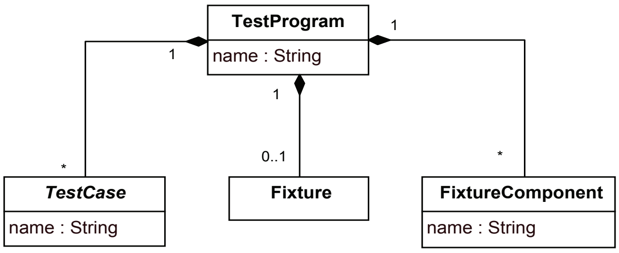


Figure 2. CSTL metamodel fragment of test programs

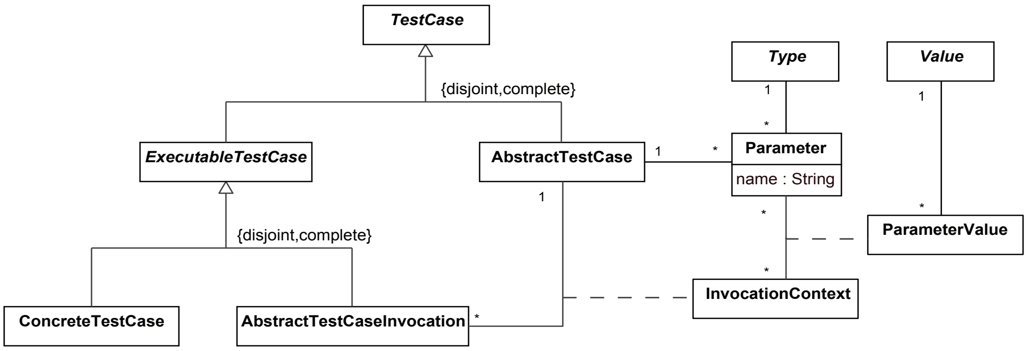
Figure 2 shows the fragment of the metamodel of *test programs*. A test program is the top-level structure of CSTL. It consists of:

- A set of **test cases**: A test case is a "specification of one case to test the system including what to test with, which input, result, and under which conditions" [7]. The execution of a test case comprises the execution of an ordered set of statements that specify IB states and assertions about.

- A **fixture**: The fixture is a set of statements that define a fragment of the state of the IB state and the initial values of the common program variables. The fixture of a test program is the definition of the initial state configuration shared by all the test cases included in a test program. The set of fixture statements is executed before the execution of each test case grouped into the test program.

- A set of **fixture components**: A fixture component is a named set of statements that create a fragment of the state of the IB and define the values of a set of variables. In contrast with the program fixture, fixture components can be selectively loaded in test cases or in the program fixture when needed.

2.3 Kinds of test cases



```
context InvocationContext inv valuesForEachParameter:
   self.parameter = self.abstractTestCase.parameter
```

Figure 3. CSTL metamodel fragment of test cases.

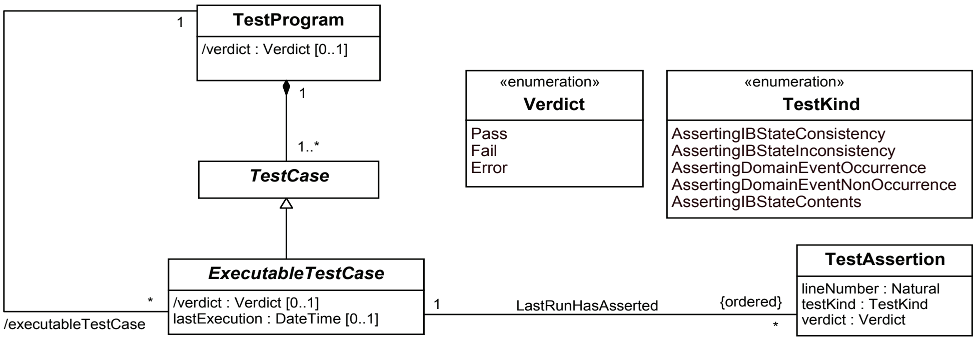
CSTL allows specifying three kinds of tests:

- **Concrete test case:** A concrete test case is an executable set of statements that builds a state of the IB, define and assign values to variables and executes one or more test kinds.

- **Abstract test case:** An abstract test case is a parameterized test case that can be invoked several times in a test program. An abstract test case is not executable.

- **Abstract test case invocation:** Abstract test cases can be invoked by giving a concrete context (defined by the desired values assigned to parameters).

2.4 Test verdicts



```
context TestProgram::executableTestCase:ExecutableTestCase
derive:
   self.testCase->select(tc | tc.oclIsTypeOf(ExecutableTestCase))


context ExecutableTestCase::verdict:Verdict
derive:
   if self.testAssertion->notEmpty() then
     if   self.testAssertion.verdict -> includes (Verdict::Error)
     then Verdict::Error
     else
        if    self. testAssertion.verdict -> includes (Verdict::Fail)
        then  Verdict::Fail
        else  Verdict::Pass
        endif
     endif
   else Set{}
   endif

context TestProgram::verdict:Verdict
derive:
   if self.executableTestCase->forAll(verdict->notEmpty()) then
     if   self.executableTestCase.verdict -> includes (Verdict::Error)
     then Verdict::Error
     else
        if    self.executableTestCase.verdict -> includes (Verdict::Fail)
        then  Verdict::Fail
        else  Verdict::Pass
        endif
     endif
   else Set{}
   endif
```

Figure 4. CSTL metamodel fragment of test verdicts.

The execution of a test case gives a **Verdict** as a result. Verdict values can be *Pass*, *Fail* or *Error*. The verdict of a test case is obtained from the verdicts of the test assertions executed by the test case. Test programs also have a verdict as a composite result of the test cases it groups. If the conceptual schema or the test case is ill-formed (is not a valid instance of the corresponding metaschema) the verdict is *Error*.

Figure 4 shows the fragment of the CSTL metamodel corresponding to verdicts. Note that the derivation rules specify how test cases and test program verdicts are obtained.

2.5 CSTL types and value expressions

CSTL allows the value types defined in the OCL 2.0 metamodel [5]. Moreover, the language introduces a specific type called *FixtureComponentType*. This specific type allows declaring fixture components and using them as parameters for abstract test cases. CSTL permits the use, as values, of the different kinds of *ValueSpecifications* defined in the UML 2.0 metamodel [6]. A fixture is also a valid value in CSTL.

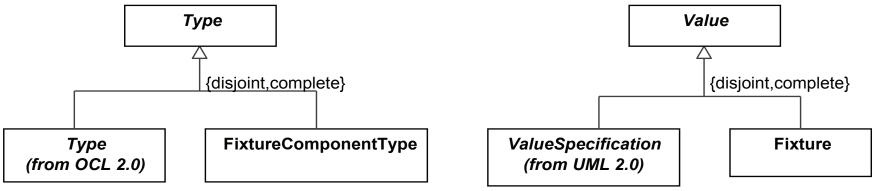


Figure 5. CSTL metamodel fragment of CSTL values and types.

2.6 Language syntax

In the previous sections we explained the abstract syntax of the main elements of CSTL. In this section we present the CSTL grammar of test programs. The syntax and the semantics of CSTL statements are explained in more detail in the following section.

testProgram :
testprogram <programID> { *fixture fixtureComponent* testCase** **}**

fixture :
*fixtureStatement**

fixtureComponent :
fixturecomponent <fixtureComponentID> { *statement** **}**

testCase :
concreteTest
| *abstractTest*
| *abstractTestInvocation*

concreteTest :
test <testID> { *statement** **}**

abstractTest :
abstract test <abstractTestID> *paramList* **{** *statement** **}**

paramList :
(*parameter* [**,** *parameter*]* **)**

parameter :
parameterType **<parameterID>**

type :
<oclPrimitiveType>
| <entityTypeID>

parameterType :
type
| Fixture

abstractTestInvocation :
test <abstractTestID> *parametersAssignment*

parametersAssignment :
(*parameterAssignment* [**,** *parameterAssignment*]* **)**

parameterAssignment :
<parameterName> := *expression*

expression :
<oclExpressionWithVariableIDs>

statement :
stateStatement **;**
| *variableStatement* **;**
| *assertion* **;**
| *controlFlowStatement*

stateStatement :
entityCreation
| *entityDeletion*
| *binaryPropertySetting*
| *nAryRelationshipCreation*
| *fixtureComponentLoading*

variableStatement :
variableDeclaration
| *variableAssignment*

assertion :
assertTrue
| *assertFalse*
| *assertEquals*
| *assertNotEquals*
| *assertConsistency*
| *assertInconsistency*
| *assertDomainEventOccurrence*
| *assertDomainEventNonOccurrence*

controlFlowStatement :
conditional
| *whileLoop*
| *forLoop*
| *forEachLoop*

entityCreation :
new <entityTypeID> [**, <entityTypeID>**]* *propertiesAssignment*? **;**

propertiesAssignment :
(*propertyAssignment* [**,** *propertyAssignment*]*)

propertyAssignment :
<propertyID> := *expression*

entityDeletion :
delete *expression*

binaryPropertySetting :
expression **:=** *expression*

nAryRelationshipCreation :
new <assocID> *participantsAssignment* **;**

participantsAssignment :
(*participantAssignment* [**,** *participantAssignment*]+)

prarticipantAssignment :
<roleID> := *expression*

fixtureComponentLoading :
load <fixtureComponentID>

variableDeclaration :
type **<varID>**

variableAssignment :
[**<varID>** | *varDeclaration*] **:=** [*expression* | *entityCreation* | *nAryRelationshipCreation*]

assertTrue :
assert true *expression*

assertFalse :
assert false *expression*

assertEquals :
assert equals *expression expression*

assertNotEquals :
assert not equals *expression expression*

assertConsistency :
assert consistency

assertInconsistency :
assert inconsistency

assertDomainEventOccurrence :
assert occurrence <domainEventID>

assertDomainEventNonOccurrence :
assert non-occurrence <domainEventID>

assertDomainEventNonOccurrence :
assert non-occurrence <domainEventID>

condition :
if _expression_ **then** _statement_*
[**else if** _expression_ **then** _statement_*]*
[**else** _statement_*]?
endif

whileLoop :
while _expression_ **do** _statement_* **endwhile**

forLoop :
for _variableAssignment_ **to** _expression_ **step** _expression_ **do** _statement_* **endfor**

forEachLoop :
for each [_variableDeclaration_ | _varID_] **in** _expression_ **do** _statement_* **endfor**

```
testprogram TestProgramName{

       //FIXTURE
       //State statements located here define the fixture

       //FIXTURE COMPONENTS
       fixturecomponent FixtureComponentName1{
          //State statements and variable statements
       }
       fixturecomponent FixtureComponentName2{
          //State statements variable statements
       }
       …

      //TEST CASES
      test TestName{
        //Test instructions
      }
      abstract test abstractTestName
      (ParamType1 paramName1, paramType2 paramName2,…){
        //Test instructions
      }

      test abstractTestName
      (paramName1 := paramValue1, paramName2 := paramValue2,…);

…

}
```

Figure 6. Generic test program structure that conforms to CSTL syntax

2.7 CSTL statements

2.7.1 State statements

We can define a state of the Information Base by applying a set of state statements. In this section we present the syntax for:

- Creating and deleting entities.
- Setting binary properties of an entity (attributes or binary relationships).
- Creating new n-ary relationships between entities.
- Loading a fixture component.

State statements can be used in fixtures, fixture components and test cases.

Entity creation

Syntax

```
[entityID :=] new EntityType_1,...,EntityType_n
                 [(propertyID_1:=OCLExpression_1,..., propertyID_n:=OCLExpression_n)];
```

Pattern Sentence

"An entity `entityID` *is a new instance of the entity types* `EntityType`$_1$`,...,EntityType`$_n$. *The value of* `OCLExpression`$_1$ *is assigned to the property* `propertyID`$_1$*,... and the value of* `OCLExpression`$_n$ *is assigned to the property* `propertyID`$_n$*".*

All entities are identified in the Information Base by an internal Object Identifier (OID) which is not known by users. If we need to refer the created entity in subsequent statements, we need to specify an `entityID`.

The order in which properties are specified is irrelevant. This is an interesting characteristic of CSTL. If we add, remove or reorder properties in the *Conceptual Schema Under Test* (CSUT) we don't need to change already done tests. Moreover, properties can be attributes or binary association ends. If we change the way of representing a property, we do not need to change the already written tests.

The type of `OCLExpression`$_i$ must be compatible with the type of `propertyID`$_i$.

Note that we allow multiple classification: an entity can be instance of several entity types at the same time.

We adopt the approach that events are modeled in the CSUT as stereotyped entities [4] with an *effect*() operation. Consequently, domain event types can be created like those of entity types:

Syntax

```
[eventID :=] new EventTypeID
(c_1:=OCLExpression_1,..., c_n:=OCLExpression_n)
```

Pattern Sentence

"The `eventID` *is a new event of type* `EventTypeID`*. The characteristic* `c`$_1$ *has the value of* `OCLExpression`$_1$*,... and the characteristic* c_n *has the value of* `OCLExpression`$_n$*)"*

Entity deletion

Syntax

```
delete entityExpr;
```

Pattern Sentence

"Delete the entity given by the OCL expression `entityExpr`*"*

Binary property setting

Syntax

```
entityExpr.propertyID := participants;
```

Pattern Sentence

"The entity given by the expression `entityExpr` *is related with the role* `propertyID` *in a binary link (an instance of an association) to one or more entities given by the OCL expression* `participants`*"*

Note that this statement can be used for assigning UML attributes or association ends. CSTL considers that an entity has binary properties regardless how they are expressed in UML (as an association or as an attribute). This is a remarkable characteristic of CSTL if used in a test-driven conceptual modeling environment in which tests are written incrementally during the iterative development of the conceptual schema [10]. This abstraction avoids changing the already done tests if we decide to change the way of representing a binary property in UML.

The type of the expression `participants` must be compatible with the type of `propertyID`.

N-ary relationship creation

Syntax

```
[associationClassID :=] new AssociationID (roleID1 := entityExpr1 ,...,
                              roleIDn := entityExprn) ;
```

Pattern Sentence

"*A new instance of the association* `AssociationID` *relates entities given by expressions* `entityExpr`$_1$`,...,entityExpr`$_n$ *with roles* `roleID`$_1$`,...,roleID`$_n$"

This statement requires two or more entities to be related ($n \geq 2$). For n=2, the *binary property setting* statement can be applied with the same result in the IB state.

The order in which we assign entities to roles is irrelevant and it does not depend on the order in which they are specified in the CSUT.

The type of expression `entityExpr`$_i$ must be compatible with the type of `roleID`$_i$.

If `AssociationID` is an association class, then the above statement returns the identifier of the instance of that class (`associationClassID`) .

Fixture component loading

Syntax

```
load fixtureComponentID ;
```

Pattern Sentence

"*Load the IB state changes as specified by the fixture component* `fixtureComponentID`"

The loading process executes the state instructions specified by the fixture component. Therefore, the IB state is modified as indicated by the state instructions specified in the loaded fixture component.

2.7.2 Variable statements

CSTL allows storing values in variables to be used in subsequent statements. In this section we present the syntax for declaring variables and for assigning values to these variables.

Variables are only visible in its scope which is determined by the location in which they are declared. The scope of a variable makes it visible in the structure (test program, fixture component, test case, or control flow statement) where it has been declared and its nested substructures.

Note that some of the state statements described in the previous section make implicit assignments to variables.

Variable declaration

Syntax

```
varType varID ;
```

Pattern Sentence

"*The variable* . `varID` *of type* `varType` *is declared*"

Variable declaration is useful for explicitly declaring a variable in the desired context (in order to make it visible in the desired scope). The initial value is undefined.

Variable assignment

Syntax

```
varID := OCLExpression;
```

Pattern Sentence

"*The value of the expression* `OCLExpression` is assigned to the variable `varID`".

If the variable `varID` is not declared, the statement behaves as a *VariableAssignmentAndDeclaration* statement (see below). If the variable `varID` is already declared, the types of `varID` and `valueExpr` must be compatible.

Variable assignment and declaration

Syntax

```
[varType] varID := OCLExpression;
```

Pattern Sentence

"*The value of the expression* `OCLExpression` *is assigned to the new variable* `varID` [*of type* `varType`]".

This is a composite statement that allows declaring a new variable and assigning a value to it.

`varID` must be a new variable identifier.

If the `varType` is not specified, it is assumed that the type of the new variable corresponds to the predefined type of the assigned value expression. If `varType` is specified, the type of `varID` must be compatible with `varType`.

2.7.3 Assert statements

Assert statements allow formalizing assertions about the current Information Base state. These assertions contribute to make the tests automatically executable. Once defined the assertions of a test case, these can be checked automatically as many times as needed. All the assertions require a consistent IB state. If not, the verdict of any assertion is Error (by definition, any assertion about an inconsistent state is erroneous).

Assert true

Syntax

```
assert true booleanOCLExpression;
```

Pattern Sentence

"*Assert that the expression* `booleanOCLExpression` *is true in the current state of the IB*".

Assert false

Syntax

```
assert false booleanOCLExpression;
```

Pattern Sentence

"Assert that the expression `booleanOCLExpression` *is false in the current state of the IB".*

Assert equals

Syntax

```
assert equals OCLExpression₁ OCLExpression₂ ;
```

Pattern Sentence

"Assert that the value of expression `OCLExpression₁` *is equal to the value of* `OCLExpression₂`*".*

Assert not equals

Syntax

```
assert not equals OCLExpression₁ OCLExpression₂;
```

Pattern Sentence

"Assert that the value of expression `OCLExpression₁` *is not equal to the value of* `OCLExpression₂`*".*

A value expression is an OCL expression evaluated on the current state of the IB.

Assert consistency

Syntax

```
assert consistency;
```

Pattern Sentence

"The current state of the IB is consistent".

The first action of this statement is materializing the derived constant attributes and relationship types for the new objects, if any.

After that, this statement asserts that the IB state satisfies the static and temporal constraints defined in the conceptual schema under test. The materialized state (taking into account those derived attributes which have been explicitly instantiated) is also checked.

Assert inconsistency

Syntax

```
assert inconsistency;
```

Pattern Sentence

"The current state of the IB is inconsistent".

The first action of this statement is materializing the derived constant attributes and relationship types for the new objects, if any.

After that, this statement asserts that the IB:

- does not satisfy at least one of the static or temporal constraints defined in the conceptual schema under test, or
- the materialized state corresponding to the instantiated derived types is inconsistent.

The last IB state is discarded after the execution of this statement.

Assert the occurrence of a domain event

Syntax

```
assert occurrence domainEventID;
```

Pattern Sentence

"Assert that the domain event `domainEventID` *occurs in the current state of the IB".*

The occurrence of an event is performed as follows:

1. Check that the current IB state is consistent. The verdict is *Error* if that checking fails.
2. Check that the constraints of the event are satisfied. The verdict is *Fail* if any of the event constraints is not satisfied.
3. Execute the method of the corresponding *effect*() operation.
4. Check that the new IB state is consistent. The verdict is *Fail* if any of the constraints is not satisfied; otherwise the verdict is *Pass*.
5. Check that the event postconditions are satisfied. The verdict is *Fail* if any of the postconditions is not satisfied.

Assert the non-occurrence of a domain event

Syntax

```
assert non-occurrence domainEventID;
```

Pattern Sentence

"Assert that the domain Event `domainEventID` *cannot occur in the current state of the IB".*

A domain event may not occur if the event constraints are not satisfied in the IB state.

The verdict of this assertion is determined as follows:

1. Check that the current IB state is consistent. The verdict is *Error* if that checking fails.
2. Check the satisfaction of the event constraints. The verdict is *Fail* if the event constraints are satisfied, and *Pass* if one or more event constraints are not satisfied.

2.7.4 Control flow statements

Control flow statements allow altering the sequential order in which a set of statements are executed. CSTL provides conditional statements to execute alternative sets of statements depending on the evaluation of a specified condition over the IB state. CSTL also provides loop structures to automatically repeat the execution of a set of statements while a specified condition is satisfied.

Conditional statement

Syntax

```
if booleanOCLExpression_1 then statements_1
[else if booleanOCLExpression_2 then statements_2]
 …
[else if booleanOCLExpression_n-1 then statements_n-1]
[else statements_n]
endif
```

Pattern Sentence

"If the expression $\texttt{booleanOCLExpression}_i$ *evaluates true, the set of statements* $\texttt{statements}_i$ *is executed. Otherwise, the set of statements* $\texttt{statements}_n$ *is executed".*

For statement

Syntax

```
for [varType] varID := OCLExpr_1 to OCLExpr_2 step OCLExpr_3
do statements
endfor
```

Pattern Sentence

"Given a variable `varID` *initialized with the value of* $\texttt{OCLExpr}_1$*, the set of statements* `statements` *are repeated until* `varID` *is equal to the value of* $\texttt{OCLExpr}_2$*. In each iteration the value obtained by evaluating the expression* $\texttt{OCLExpr}_3$ *is assigned to* `varID`".

If the variable `varID` has not been declared yet in the scope, it is declared automatically with the specified type (`varType`). If the variable type is not explicitly specified, `varID` is declared automatically with the predefined type of the assigned expression ($\texttt{OCLExpr}_1$).

If the variable has been already declared, `varType` (if specified) and the type of the variable `varID` must be compatible.

The *for statement* is the scope of the variables declared within it.

Note that the type of expressions $\texttt{OCLExpr}_2$ and $\texttt{OCLExpr}_3$ must also be compatible with `varType`.

For each statement

Syntax

```
for each [varType] varID in collectionOCLExpression
do statements
endfor
```

Pattern Sentence

"*For each element of the resultant collection of* `collectionOCLExpression,` *do the set of statements* `statements.` *Statement can use the current element of the collection, which is stored in the variable* `varID`".

If the variable `varID` has not been declared yet, the declaration is performed automatically with the type `varType`. If `varitype` is not explicitly specified, it is assumed that the type of the new value is the predefined type resulting of the evaluation of the expression `collectionOCLExpr`.

If the variable has been already declared, `varType` (if specified) and the type of the variable `varID` must be compatible.

The type of `varID` and the type of the elements of the `collectionExpr` must be compatible.

The *for each statement* is the scope of the variables declared within it.

While statement

Syntax

```
while booleanOCLExpr
do statements
endfor
```

Pattern Sentence

"*While* `booleanOCLExpr` *evaluates true, repeat the set of statements* `statements`".

The *while statement* is the scope of the variables declared within it.

3. CSTL application to the *osCommerce* case study

3.1 The case study

E-commerce allows people exchanging goods and services with no barriers of time or distance.

***osCommerce* [8]** is an e-commerce solution available as free software under the GNU (General Public License). *osCommerce* project was started in March 2000 in Germany and since then, it has become the base of thousands of online stores around the world. *osCommerce* can be customized to operate in different countries (with different languages, taxes, currencies,…) and to be used in several kinds of online stores.

In this section we provide a set of representative test programs taking the osCommerce conceptual schema [9] as the Conceptual Schema Under Test (CSUT).

The osCommerce conceptual schema models the real *osCommerce* system that includes a considerable number of concepts, relationships and events. Therefore, it is necessary to structure the schema in subschemas to improve its comprehension. The osCommerce CS models the structural knowledge of the system in UML/OCL and gives the specification of the more relevant use cases in an informal textual description. Uses cases are linked to the events wich are formally defined in UML/OCL by adopting the approach of modeling events as entities [4].

We start by introducing how we specify the osCommerce conceptual schema in an executable form. Then, we give a general overview of the main concepts of the osCommerce domain. After that, example test programs are presented as follows: for each substructural schema, we show the most relevant use cases that require the static knowledge represented in the substructural schema. Then, we show its associated events. Given that CSTL tests can be used to test incomplete fragments of conceptual schemas or concrete scenarios of use cases, test programs are inserted after them to exemplify relevant tests that could be applied to the parts of the conceptual schema.

Some of the example test programs are inspired in real and live online stores based on *osCommerce*.

3.2 Executable CSUT

The CSTL interpreter assumes that the CSUT is specified in the executable syntax used in the USE tool. The USE syntax is explained in detail in [1]. Note that, although the syntax is much closed to the standard UML/OCL syntax, USE adopts some particular notation for some OCL expressions. For example: data types must be specified as UML classes and enumeration values are referenced with the symbol ‘#’.

USE does not allow the specification of derived types or the definition of event constraints.

In order to improve the expressiveness of the conceptual schemas under test, we enriched the USE syntax as follows:

- **Derived Types**. An attribute *Attr* is assumed to be derived if it is preceeded by the character '_'. Therefore, it is assumed that *_Attr* is a derived attribute named *Attr*. The derivation rule must be specified as an operation without parameters named *Attr().* Consider the following class definition as an example:

```
class Category
attributes
    imagePath:String
    _subcategories:Integer -This is a derived attribute
operations
    subcategories():Integer=self.child->size()
```

- **Initial Integrity Constraints.** Creation-time constraints are also allowed by using the enriched syntax of USE used in the CSTL interpreter. This particular type of constraints can be explicitly defined by adding the string "_iniIC_" before the constraint name as indicated in the following example:

```
context OrderConfirmation inv _iniIC_ShippingMethodIsEnabled:
   self.shippingMethod.status= #enabled
```

Moreover, the information processor of USE has been extended to deal with richer conceptual schemas because: (1) it allows derived entity and relationship types; (2) in particular, it allows derived constant relationship types; (3) events and predefined queries are conceptualized as entities and not as operation invocations [4]; (4) it allows the definition and checking of temporal constraints; (5) it allows the materialization of derived properties; and (6) it deals with conceptual schemas that allow multiple classification of entities.

3.3 Main domain concepts

The products in the store are manufactured by **manufacturers**, are grouped into **categories** and belong to a **tax class**. Moreover, customers can write **reviews** of a product.

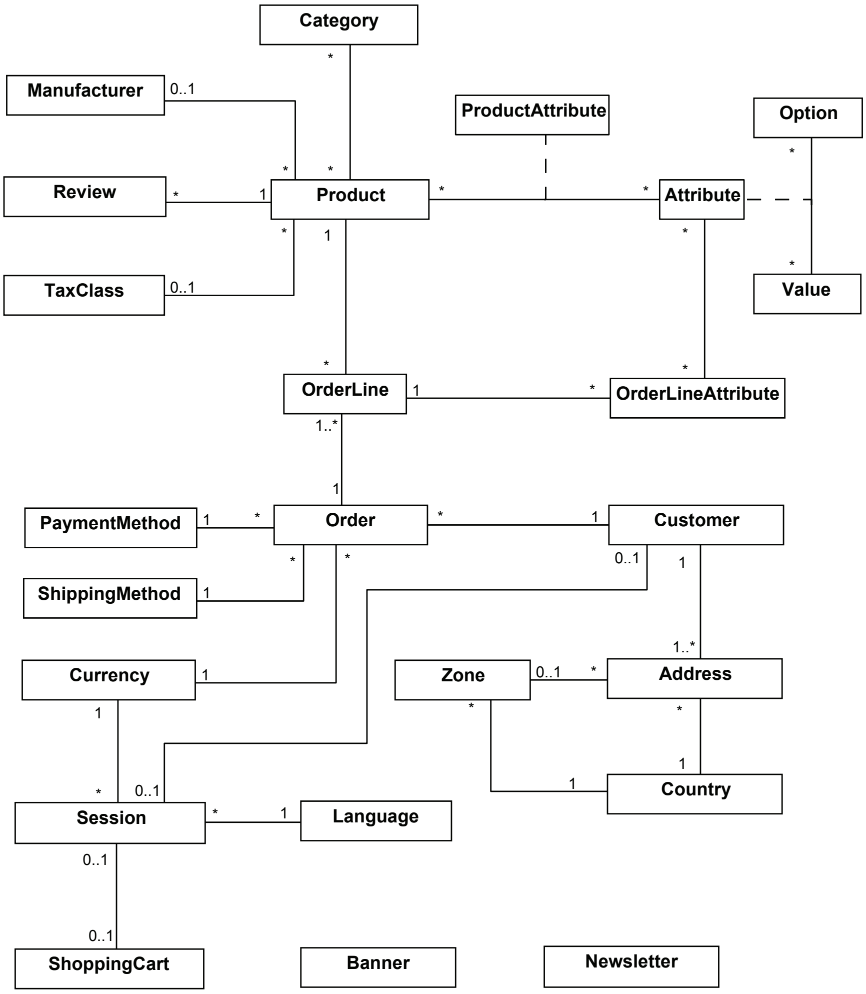
osCommerce is a multilingual system able to deal with any number of **languages**. Likewise, osCommerce allows working with different tax classes and **currencies**.

Products may have **attributes**. An attribute is an **option/value** pair which is used to offer multiple varieties of a product without needing to create many separate but very similar products. The price of a product is increased or decreased depending on the chosen attributes. The price variation produced by an attribute is indicated, for each product, by **product attribute** entity types.

Customers have one or more **addresses**. Each address is located in a **country**. If the country has **zones** (states or provinces) then the address must be located in one of its zones.

Every use of the online store is conceptually represented by a **session**. Sessions can be anonymous or belong to a customer. Moreover, every session has always a current currency and a current language.

In the context of sessions, users can surfing the online store. **Shopping carts** contain one or more selected items (not shown in the figure) each of which is a quantity of a product with a set of attributes.



When a customer confirms that he wants to buy the contents of his shopping cart the system generates an **order**. An order is made by a customer using a **payment method**. Furthermore, order prices are expressed in a specified **currency** and take into account the shipping costs, according to the chosen **shipping method.**

An order contains one or more **order lines**, each of which is a quantity of a product with a set of attributes.

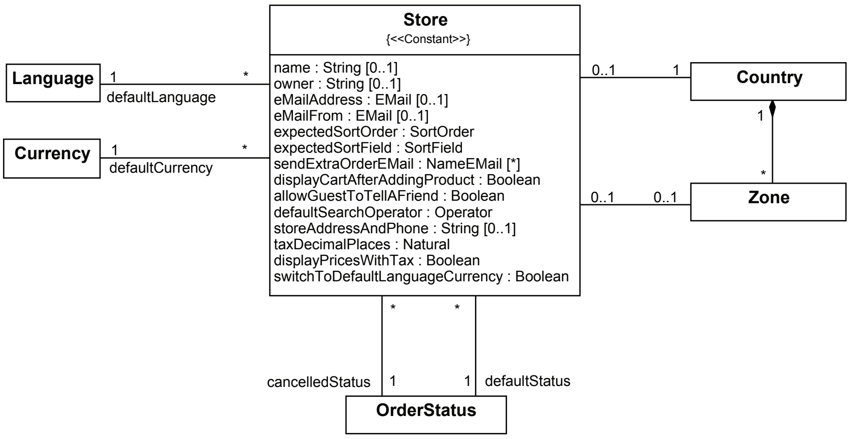
Finally, osCommerce offers some administration tools like **banners**, used to customize the online advertisements in the store, and **newsletters**, used to send information by email to customers.

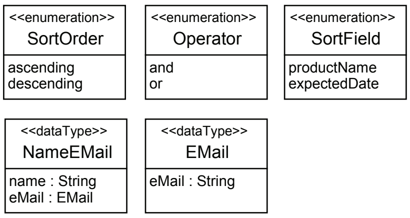
3.4 CSTL application

Store Data

Structural schema

osCommerce keeps general data about the store and some other information which is used to customize the behavior of the system.


Store
{<<Constant>>}
name : String [0..1]
owner : String [0..1]
eMailAddress : EMail [0..1]
eMailFrom : EMail [0..1]
expectedSortOrder : SortOrder
expectedSortField : SortField
sendExtraOrderEMail : NameEMail [*]
displayCartAfterAddingProduct : Boolean
allowGuestToTellAFriend : Boolean
defaultSearchOperator : Operator
storeAddressAndPhone : String [0..1]
taxDecimalPlaces : Natural
displayPricesWithTax : Boolean
switchToDefaultLanguageCurrency : Boolean
Language
1
*
defaultLanguage
Currency
1
*
defaultCurrency
0..1
1
Country
1
*
0..1
0..1
Zone
*
*
cancelledStatus
1
1
defaultStatus
OrderStatus



[IC1] There is only one instance of *Store*

```
context Store::alwaysOneInstance: Boolean
  body : Store.allInstances() -> size() = 1
```

[IC2] The store's zone is part of the country where the store is located.

```
context Store::zoneIsPartOfCountry: Boolean
  body : self.zone -> notEmpty() implies self.country.zone -> includes (self.zone)
```

Example test program

```
testprogram InitializeStore{

        english:=new Language(name:='English', code:='EN');
        dollar:=new Currency(title:='USDollar', code:='USD');
        usa:=new Country(name:='United States', isoCode2:='US', isoCode3:='USA');
        spain:=new Country(name:='Spain', isoCode2:='ES', isoCode3:='ESP');
        newjersey := new Zone(name:='New Jersey', code:='NJ', country:=usa);
        catalonia := new Zone(name:='Catalonia', code:='CAT', country:=spain);
        cos:=new OrderStatus;
        cosl:=new OrderStatusInLanguage(language:=english,orderStatus:=cos);
        cosl.name:='cancelled';

        dos:=new OrderStatus;
        dosl:=new OrderStatusInLanguage(orderStatus:=dos, language:=english);
        dosl.name:='pending';

        test StoreInitializationWithDefaultMandatoryValues{
                s:=new Store(name:='JustArt');
                assert inconsistency;

                s.defaultLanguage:=english;
                assert inconsistency;

                s.defaultCurrency:=dollar;
                assert inconsistency;

                s.country:=usa;
                assert inconsistency;

                s.cancelledStatus:=cos;
                assert inconsistency;

                s.defaultStatus:=dos;
                assert consistency;
        }

        test OnlyOneStoreInstance{
                //We create the store 'JustArt'
                s:=new Store(name:='JustArt');
                s.defaultLanguage:=english;
                s.defaultCurrency:=dollar;
                s.country:=usa;
                s.cancelledStatus:=cos;
                s.defaultStatus:=dos;
                assert consistency;

                //If we create another store, the state should be inconsistent
                s2:=new Store(name:='VirtualGallery');
                s2.defaultLanguage:=english;
                s2.defaultCurrency:=dollar;
                s2.country:=usa;
                s2.cancelledStatus:=cos;
                s2.defaultStatus:=dos;
                assert inconsistency;
        }

        test StoreZoneMustBePartOfTheCountryWhereItIsLocated{
                //We create the store 'VirtualGallery'
                s:=new Store(name:='VirtualGallery');
                s.defaultLanguage:=english;
                s.defaultCurrency:=dollar;
                s.country:=usa;
                s.cancelledStatus:=cos;
                s.defaultStatus:=dos;
                assert consistency;

                //We specify a zone which is not part of the USA
                s.zone := catalonia;
                assert inconsistency;

                //We specify a correct zone
                s.zone := newjersey;
                assert consistency;
        }
}
```

Use Cases

Change Store Data

Primary Actor: System administrator

Precondition: None.

Trigger: The system administrator wants to change the initial values of the store data.

Main Success Scenario:

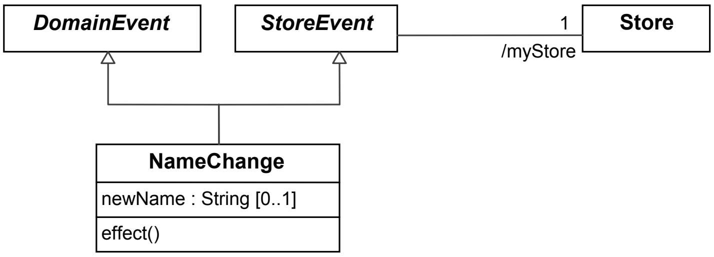
1. The system displays the current values of the store data.
2. The system administrator provides a new value for one of the store attributes:
    [→*MameChange*]
    [→*OwnerChange*]
    [→*EMailAddressChange*]
    [→*EMailFromChange*]
    [→*ExpectedSortOrderChange*]
    [→*ExpectedSortFieldChange*]
    [→*SendExtraOrderChange*]
    [→*DisplayCartAfterAddingProductChange*]
    [→*AllowGuestToTellAFriendChange*]
    [→*DefaultSearchOperatorChange*]
    [→*StoreAddressAndPhoneChange*]
    [→*TaxDecimalPlacesChange*]
    [→*DisplayPricesWithTaxChange*]
    [→*SwitchToDefaultLanguageCurrencyChange*]
    [→*CountryChange*]
    [→*ZoneChange*]
3. The system validates that the value is correct.
4. The system saves the new value.
5. The system displays the new values of the store data.

   The system administrator repeats steps 2-5 until he is done.

Note that if there are many similar events, we only reproduce the complete specification of the selected representative events used in the test program examples. The other similar events can be found in [9].

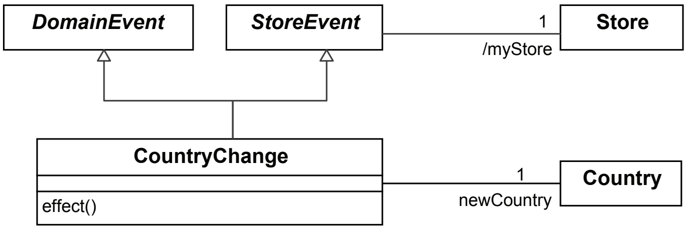
Events

NameChange



context NameChange::effect()
  post : self.myStore.name = self.newName

CountryChange



context CountryChange::effect()
  post : myStore.country = self.newCountry

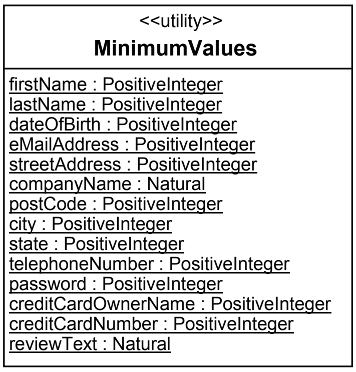
Example test program

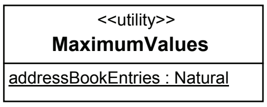
```
testprogram ChangeStoreData{

        //FIXTURE:InitializeStore
        s := new Store(name:='JustsArt');

        english := new Language(name:='English', code:='EN');
        s.defaultLanguage:=english;

        dollar := new Currency(title:='USDollar', code:='USD');
        s.defaultCurrency := dollar;


        spain := new Country
        (name:='Spain', isoCode2:='ES', isoCode3:='ESP');
        s.country:=spain;

        cos := new OrderStatus;
        cosl := new OrderStatusInLanguage(language:=english,orderStatus:=cos);
        cosl.name := 'cancelled';
        s.cancelledStatus := cos;

        dos := new OrderStatus;
        dosl := new OrderStatusInLanguage(orderStatus:=dos, language:=english);
        dosl.name:='pending';
        s.defaultStatus:=dos;

        //We test that name and country can be correctly changed.
        test NameAndCountryChange{
                assert equals s.name 'JustsArt';
                enc := new NameChange(newName:='JustArt');
                assert occurrence enc;
                assert equals s.name 'JustArt';

                assert equals s.country spain;
                usa := new Country
                    (name:='United States', isoCode2:='US', isoCode3:='USA');
                ecc := new CountryChange(newCountry:=usa);
                assert occurrence ecc;
                assert equals s.country usa;
        }
}
```

Configuration values

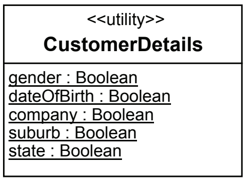
Structural schema

osCommerce allows defining and changing the minimum and maximum length for some *String* attributes related to customer details.

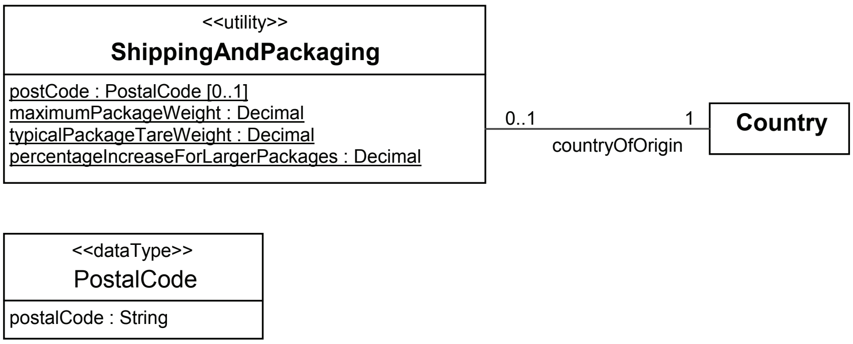

<<utility>>
MinimumValues
firstName : PositiveInteger
lastName : PositiveInteger
dateOfBirth : PositiveInteger
eMailAddress : PositiveInteger
streetAddress : PositiveInteger
companyName : Natural
postCode : PositiveInteger
city : PositiveInteger
state : PositiveInteger
telephoneNumber : PositiveInteger
password : PositiveInteger
creditCardOwnerName : PositiveInteger
creditCardNumber : PositiveInteger
reviewText : Natural



The system also allows specifying whether some customer attributes are shown and required when creating, editing or showing an account.



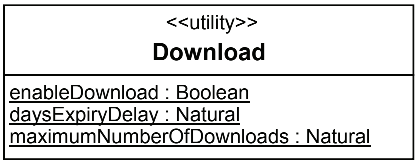
The system allows setting up some configuration values used in shipping costs calculation.


<<utility>>
ShippingAndPackaging
postCode : PostalCode [0..1]
maximumPackageWeight : Decimal
typicalPackageTareWeight : Decimal
percentageIncreaseForLargerPackages : Decimal
0..1
1
countryOfOrigin
Country
<<dataType>>
PostalCode
postalCode : String

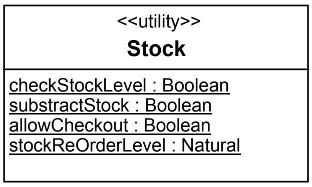
[IC1] The package tare weight must be less than the maximum package weight.

```
context ShippingAndPackaging::tareIsLessThanMaximumWeight: Boolean
body :  self.typicalPackageTareWeight < self.maximumPackageWeight
```

The system allows customizing the most important general downloadable product properties.



The system allows configuring some options about the stock administration.



Use Cases

Assign minimum values

Primary Actor: System administrator

Precondition: None.

Trigger: The system administrator wants to change the minimum values of some attributes.

Main Success Scenario:

The system displays the current minimum values.

1. The system administrator provides a new value for one of the minimum values:

   [→*FirstNameMinimumChange*]

   [→*LastNameMinimumChange*]

   [→*DateOfBirthMinimumChange*]

[→*EMailAddressMinimumChange*]

[→*StreetAddressMinimumChange*]

[→*CompanyNameMinimumChange*]

[→*PostCodeMinimumChange*]

[→*CityMinimumChange*]

[→*StateMinimumChange*]

[→*TelephoneMinimumChange*]

[→*PasswordMinimumChange*]

[→*CreditCardOwnerNameMinimumChange*]

[→*CreditCardNumberMinimumChange*]

[→*ReviewTextMinimumChange*]

2. The system validates that the value is correct.
3. The system saves the new value.
4. The system displays the new current minimum values.

The system administrator repeats steps 2-5 until he is done.

Assign maximum values

Primary Actor: System administrator

Precondition: None.

Trigger: The system administrator wants to change the maximum number of address book entries permitted for each customer.

Main Success Scenario:

1. The system displays the current maximum number of address book entries for each customer.
2. The system administrator provides the new maximum value:

   [→*AddressBookEntriesMaximumChange*]

3. The system validates that the value is correct.
4. The system saves the new value.
5. The system displays the new current maximum value.

Change shown customer details

Primary Actor: System administrator

Precondition: None.

Trigger: The system administrator wants to change whether some customer attributes are shown.

Main Success Scenario:

1. The system displays the current values of customer details configuration (shown or not shown).
2. The system administrator provides the new value for one of the customer details:

[→*GenderCustomerDetailChange*]

[→*DateOfBirthCustomerDetailChange*]

[→*CompanyCustomerDetailChange*]

[→*SuburbCustomerDetailChange*]

[→*StateCustomerDetailChange*]

3. The system validates that the value is correct.
4. The system saves the new value.
5. The system displays the new current values of customer details configuration.

The system administrator repeats steps 2-5 until he is done.

Assign shipping and packaging configuration values

Primary Actor: System administrator

Precondition: None.

Trigger: The system administrator wants to change the shipping and packaging configuration values.

Main Success Scenario:

1. The system displays the current shipping and packaging configuration values.
2. The system administrator provides the new value for one of the shipping and packaging configurable options:

[→*PostCodeShippingConfigurationChange*]

[→*MaximumPackageWeightShippingConfigurationChange*]

[→*TypicalPackageTareWeightShippingConfigurationChange*]

[→*PercentageIncreaseForLargerPackagesShippingConfigurationChange*]

[→*CountryShippingConfigurationChange*]

3. The system validates that the value is correct.
4. The system saves the new value.
5. The system displays the new current shipping and packaging configuration values.

The system administrator repeats steps 2-5 until he is done.

Change download configuration values

Primary Actor: System administrator

Precondition: None.

Trigger: The system administrator wants to change the download configuration values.

Main Success Scenario:

1. The system displays the current download configuration values.
2. The system administrator provides the new value for one of the download configuration options:

[→*EnableDownloadConfigurationChange*]

[→*DaysExpiryDelayDownloadConfigurationChange*]

[→*MaximumNumberDownloadConfigurationChange*]

3. The system validates that the value is correct.
4. The system saves the new value.
5. The system displays the new current download configuration values.

   The system administrator repeats steps 2-5 until he is done.

Change stock configuration values

Primary Actor: System administrator

Precondition: None.

Trigger: The system administrator wants to change the stock configuration values.

Main Success Scenario:

1. The system displays the current stock configuration values.
2. The system administrator provides the new value for one of the stock configuration options:

   [→*CheckLevelStockConfigurationChange*]

   [→*SubstractStockConfigurationChange*]

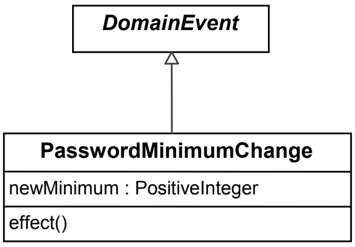
   [→*AllowCheckoutStockConfigurationChange*]

   [→*ReorderLevelStockConfigurationChange*]
3. The system validates that the value is correct.
4. The system saves the new value.
5. The system displays the new current stock configuration values.

   The system administrator repeats steps 2-5 until he is done.

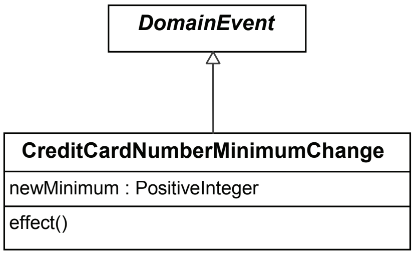
Events

PasswordMinimumChange



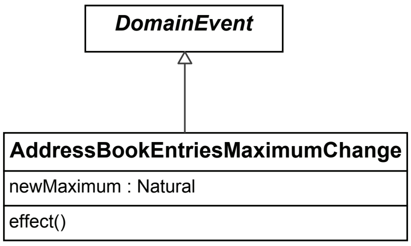
```
context  PasswordMinimumChange::effect()
  post :  MinimumValues.password = self.newMinimum
```

CreditCardNumberMinimumChange


DomainEvent
CreditCardNumberMinimumChange
newMinimum : PositiveInteger
effect()

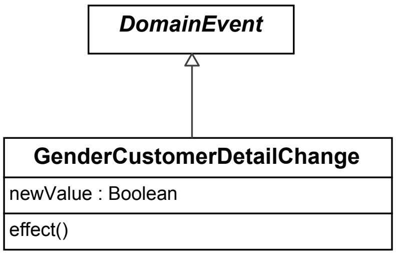
context CreditCardNumberMinimumChange::effect()
post : MinimumValues.creditCardNumber = self.newMinimum

AddressBookEntriesMaximumChange



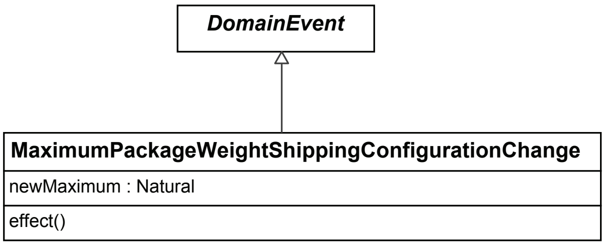
context AddressBookEntriesMaximumChange::effect()
post : MaximumValues.addressBookEntries = self.newMaximum

GenderCustomerDetailChange



context GenderCustomerDetailChange::effect()
post : CustomerDetails.gender = self.newValue

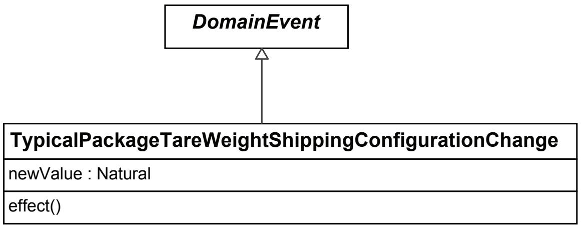
MaximumPackageWeightShippingConfigurationChange



«IniIC»
context MaximumPackageWeightShippingConfigurationChange::maxIsGreaterThanTypicalWeight():Boolean
body : self.newMaximum > ShippingAndPackaging.typicalPackageTareWeight

context MaximumPackageWeightShippingConfigurationChange::effect()
post : ShippingAndPackaging.maximumPackageWeight = self.newMaximum

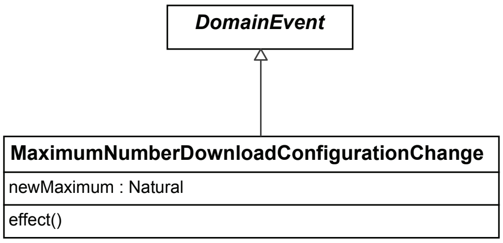
TypicalPackageTareWeightShippingConfigurationChange



context TypicalPackageTareWeightShippingConfigurationChange::effect()
post : ShippingAndPackaging.typicalPackageTareWeight = self.newValue

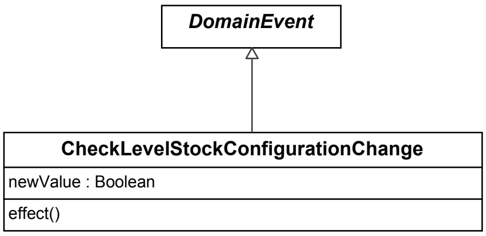
«IniIC»
context TypicalPackageTareWeightShippingConfigurationChange::valueDoesNotExceedMaxWeight():Boolean
body : self.newValue < ShippingAndPackaging.maximumPackageWeight

MaximumNumberDownloadConfigurationChange



context MaximumNumberDownloadConfigurationChange::effect()
post : Download.maximumNumberOfDownloads= self.newMaximum

CheckLevelStockConfigurationChange



context CheckLevelStockConfigurationChange::effect()
post : Stock.checkStockLevel= self.newValue

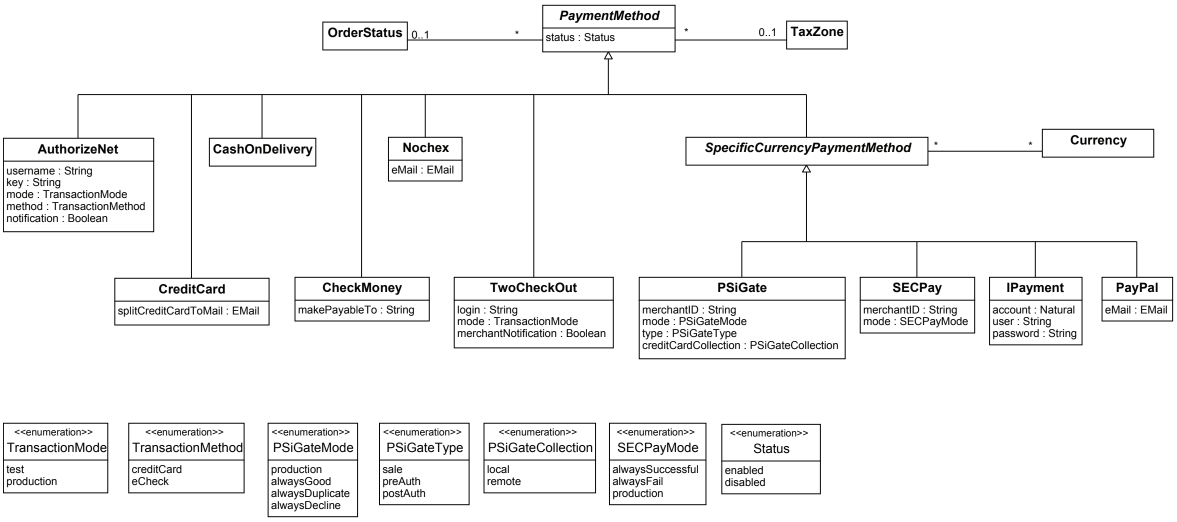
Example test program

```
testprogram ConfigurationValues{

        //We create an instance of the entity types
        //MaximumValues and MinimumValues (multiple classification)

        configurationValues := new MaximumValues, MinimumValues,
                                   CustomerDetails, ShippingAndPackaging, Download, Stock;
        spain:=new Country(name:='Spain', isoCode2:='ES', isoCode3:='ESP');
        configurationValues.countryOfOrigin := spain;
        configurationValues.maximumPackageWeight := 30;
        configurationValues.typicalPackageTareWeight := 15;

        test ChangeMinimumAndMaximumValues{
                //The postconditions of the following events are automatically checked
                pmc := new PasswordMinimumChange(newMinimum:=8);
                assert occurrence pmc;
                ccnmc := new CreditCardNumberMinimumChange(newMinimum:=16);
                assert occurrence ccnmc;
                abemc := new AddressBookEntriesMaximumChange(newMaximum:=3);
                assert occurrence abemc;
                gcdc := new GenderCustomerDetailChange(newValue:=true);
                assert occurrence gcdc;
                mndcc := new MaximumNumberDownloadConfigurationChange(newMaximum:=5);
                assert occurrence mndcc;
                clscc := new CheckLevelStockConfigurationChange(newValue:=false);
                assert occurrence clscc;
                tptc := new TypicalPackageTareWeightShippingConfigurationChange(newValue:=10);
                assert occurrence tptc;
                mpwsc := new MaximumPackageWeightShippingConfigurationChange(newMaximum:=25);
                assert occurrence mpwsc;
        }

        test InconsistentShippingConfigurations{
                //The typical package weight cannot be greater than the maximum package weight
                tptc := new TypicalPackageTareWeightShippingConfigurationChange(newValue:=40);
                assert non-occurrence tptc;
                mpwsc := new MaximumPackageWeightShippingConfigurationChange(newMaximum:=10);
                assert non-occurrence mpwsc;
        }
}
```

Payment methods

Structural schema

The system allows operating with different payment methods.



[IC1] There is at least one enabled payment method

context PaymentMethod::atLeastOneEnabled: Boolean
 body : PaymentMethod.allInstances() -> select (pm | pm.status=Status::enabled) -> size() >= 1

Use Cases

Install a payment method

Primary Actor: Store administrator

Precondition: The payment method is not installed yet.

Trigger: The store administrator wants to install a payment method.

Main Success Scenario:

1. The system shows all the available payment methods and which of they are installed.
2. The store administrator selects a non installed payment method.
3. The store administrator provides the data of the payment method:
   [→*InstallAuthorizeNetPaymentMethod*]
   [→*InstallCreditCardPaymentMethod*]
   [→*InstallCashOnDeliveryPaymentMethod*]
   [→*InstallIPaymentPaymentMethod*]
   [→*InstallCheckMoneyPaymentMethod*]
   [→*InstallNochexPaymentMethod*]
   [→*InstallPayPalPaymentMethod*]
   [→*InstallTwoCheckOutPaymentMethod*]
   [→*InstallPSiGatePaymentMethod*]
   [→*InstallSECPaymentMethod*]
4. The system validates that the data is correct.
5. The system uninstalls the new payment method and enables it.

Uninstall a payment method

Primary Actor: Store administrator

Precondition: The payment method is installed and there is at least another payment method enabled.

Trigger: The store administrator wants to uninstall a payment method.

Main Success Scenario:

1. The system shows all the payment methods and which of they are installed.
2. The store administrator selects an installed payment method.

    [→*UninstallAuthorizeNetPaymentMethod*]

    [→*UninstallCreditCardPaymentMethod*]

    [→*UninstallCashOnDeliveryPaymentMethod*]

    [→*UninstallIPaymentPaymentMethod*]

    [→*UninstallCheckMoneyPaymentMethod*]

    [→*UninstallNochexPaymentMethod*]

    [→*UninstallPayPalPaymentMethod*]

    [→*UninstallTwoCheckOutPaymentMethod*]

    [→*UninstallPSiGatePaymentMethod*]

    [→*UninstallSECPaymentMethod*]
3. The system uninstalls the selected payment method.

Extensions:

2a. The payment method is used in an existing order:

> 2a1. The system warns the store administrator that the payment method is used in the information of existing orders and that is only possible to disable the payment method.
>
> 2a2. The system changes the status of the payment method to disabled.
>
> [→*StatusPaymentMethodChange*]
>
> 2a3. The use case ends.

Change payment method values

Primary Actor: System administrator

Precondition: The payment method is installed.

Trigger: The system administrator wants to change the configuration values of an installed payment method.

Main Success Scenario:

1. The system displays the installed payment methods.
2. The customer selects an installed payment method.
3. The system displays the current values of the payment method.
4. The system administrator provides the new values for the configurable attributes of the payment method:

    [→*EditAuthorizeNetPaymentMethod*]

[→*EditCreditCardPaymentMethod*]

[→*EditCashOnDeliveryPaymentMethod*]

[→*EditIPaymentPaymentMethod*]

[→*EditCheckMoneyPaymentMethod*]

[→*EditNochexPaymentMethod*]

[→*EditPayPalPaymentMethod*]

[→*EditTwoCheckOutPaymentMethod*]

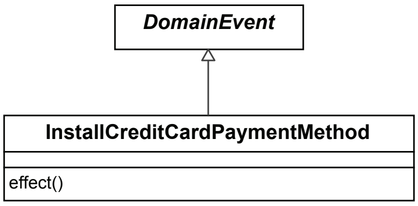
[→*EditPSiGatePaymentMethod*]

[→*EditSECPaymentMethod*]

5. The system validates that the new values are correct.
6. The system saves the new values.
7. The system displays the new values of the payment method.

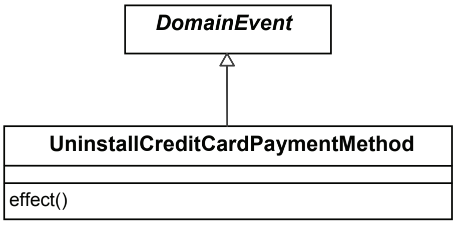
Events

InstallCreditCardPaymentMethod



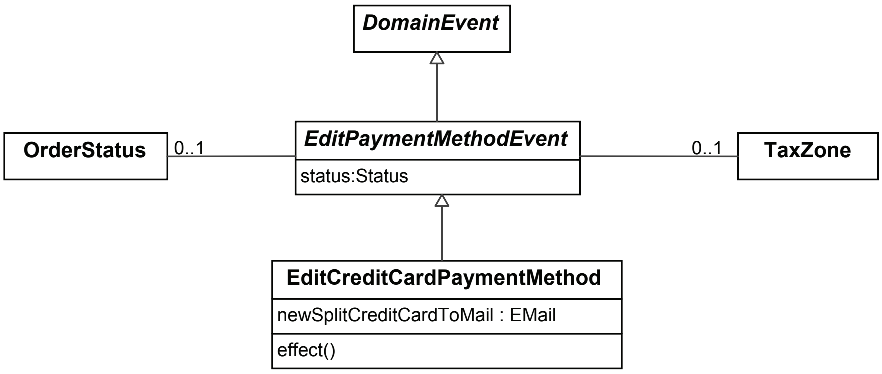
```
«IniIC»
context  InstallCreditCardPaymentMethod::paymentMethodIsNotInstalled():Boolean
   body : CreditCard.allInstances() -> isEmpty()

context InstallCreditCardPaymentMethod::effect()
   post : pm.oclIsNew() and pm.oclIsTypeOf(CreditCard) and pm.status=Status::enabled
```

UninstallCreditCardPaymentMethod



```
«IniIC»
context  UninstallCreditCardPaymentMethod::paymentMethodCanBeUninstalled():Boolean
   body : CreditCard.allInstances() -> notEmpty() and
   (PaymentMethod.allInstances-Set{CreditCard.allInstances->any(true)})->exists(pm|pm.status=#enabled)

context UninstallCreditCardPaymentMethod::effect()
   post :  CreditCard.allInstances() -> any(true)@pre.oclIsKindOf(OclAny)
```

EditCreditCardPaymentMethod



```
«IniIC»
context  EditCreditCardPaymentMethod::paymentMethodIsInstalled():Boolean
   body :  CreditCard.allInstances() -> notEmpty()

«IniIC»
context  EditCreditCardPaymentMethod::atLeastOneEnabled():Boolean
   body :
      self.status=Status::disabled
       implies
      (PaymentMethod.allInstances-Set{CreditCard.allInstances->any(true)})
            ->exists(pm | pm.status=Status::enabled)

context  EditCreditCardPaymentMethod::effect()
   post :
       let  pm:CreditCard = CreditCard.allInstances() -> any(true) in
       pm.splitCreditCardToMail=self.newSplitCreditcardToMail and  pm.status=self.status and
       pm.orderStatus=self.orderStatus and  pm.taxZone=self.taxZone
```

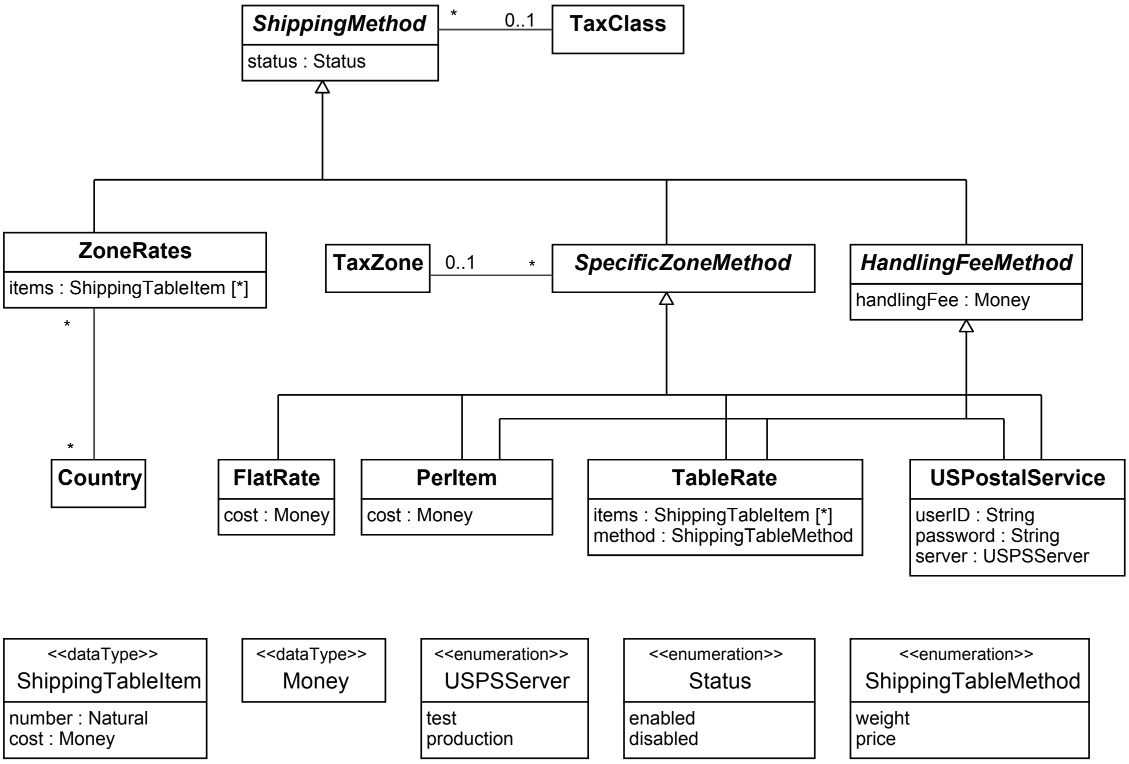
Example test program

```
testprogram InstallUninstallAndEditPaymentMethods{

        test InstallCreditCardOnce{
                iccpm := new InstallCreditCardPaymentMethod;
                assert occurrence iccpm;
        }

        test InstallCreditCardTwice{
                iccpm := new InstallCreditCardPaymentMethod;
                assert occurrence iccpm;
                iccpm2  := new InstallCreditCardPaymentMethod;
                assert non-occurrence iccpm2;
        }

        test UninstallCreditCardAlreadyInstalled{
                iccpm := new InstallCreditCardPaymentMethod;
                assert occurrence iccpm;
                //We cannot uninstall the credit card method because
                //there is no other payment method enabled
                uccpm := new UninstallCreditCardPaymentMethod;
                assert non-occurrence uccpm;
                icodpm := new InstallCashOnDeliveryPaymentMethod;
                assert occurrence icodpm;
                assert occurrence uccpm;
        }

        test AtLeastOnePaymentMethodEnabled{
                iccpm := new InstallCreditCardPaymentMethod;
                assert occurrence iccpm;
                //We cannot disable the credit card method because
                //there is no other payment method enabled
                eccpm := new EditCreditCardPaymentMethod(status:=#disabled);
                assert non-occurrence eccpm;
                icodpm := new InstallCashOnDeliveryPaymentMethod;
                assert occurrence icodpm;
                eccpm2 := new EditCreditCardPaymentMethod(status:=#disabled);
                assert occurrence eccpm2;
        }

        test UninstallCreditCardNotInstalledYet{
                uccpm := new UninstallCreditCardPaymentMethod;
                assert non-occurrence uccpm;
        }
```

Shipping methods

Structural schema

The system allows operating with different shipping methods.



[IC1] There is at least one enabled shipping method.

context ShippingMethod::atLeastOneEnabled: Boolean
  body : ShippingMethod.allInstances() -> select (sm | sm.status=Status::enabled) -> size() >= 1

Use Cases

Install a shipping method

Primary Actor: Store administrator

Precondition: The shipping method is not installed yet.

Trigger: The store administrator wants to install a shipping method.

Main Success Scenario:

1. The system shows all the available shipping methods and which of they are installed.
2. The store administrator selects a non installed shipping method.
3. The store administrator provides the data of the shipping method.
    [→*InstallZoneRatesShippingMethod*]
    [→*InstallFlatRateShippingMethod*]
    [→*InstallPerItemShippingMethod*]
    [→*InstallTableRateShippingMethod*]
    [→*InstallUSPostalServiceShippingMethod*]
4. The system validates that the data is correct.
5. The system creates an instance of the new shipping method and enables it.

Uninstall a shipping method

Primary Actor: Store administrator

Precondition: The shipping method is installed and there is at least another shipping method enabled.

Trigger: The store administrator wants to uninstall a shipping method.

Main Success Scenario:

1. The system shows all the available shipping methods and which of they are installed.
2. The store administrator selects an installed shipping method.
    [→*UninstallZoneRatesShippingMethod*]
    [→*UnistallFlatRateShippingMethod*]
    [→*UninstallPerItemShippingMethod*]
    [→*UninstallTableRateShippingMethod*]
    [→*UninstallUSPostalServiceShippingMethod*]
3. The system deletes the instance of the selected shipping method.

Extensions:

2a. The shipping method is the shipping method used in an existing order:

2a1. The system warns the store administrator that the shipping method is used in the information of existing orders and that is only possible to disable the shipping method.

2a2. The system changes the *enabled* attribute of the shipping method to false:

[→*StatusShippingMethodChange*]

2a3. The use case ends.

Change shipping method values

Primary Actor: System administrator

Precondition: The shipping method is installed.

Trigger: The system administrator wants to change the configuration values of an installed shipping method.

Main Success Scenario:

1. The system displays the installed shipping methods.
2. The customer selects an installed shipping method.
3. The system displays the current values of the selected shipping method.
4. The system administrator provides the new values for the configurable attributes of the shipping method:

   [→*EditZoneRatesShippingMethod*]

   [→*EditFlatRateShippingMethod*]

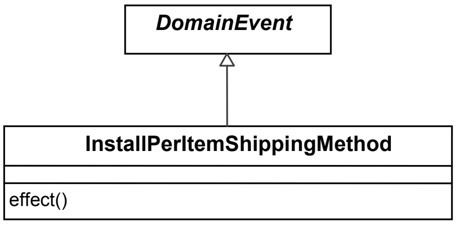
   [→*EditPerItemShippingMethod*]

   [→*EditTableRateShippingMethod*]

   [→*EditUSPostalServiceShippingMethod*]
5. The system validates that the new values are correct.
6. The system saves the new values.
7. The system displays the new values of the shipping method.

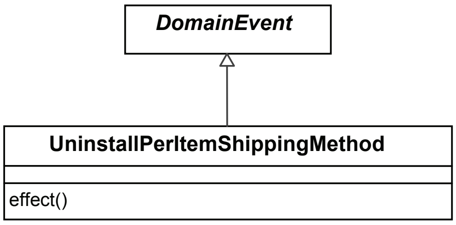
Events

InstallPerItemShippingMethod



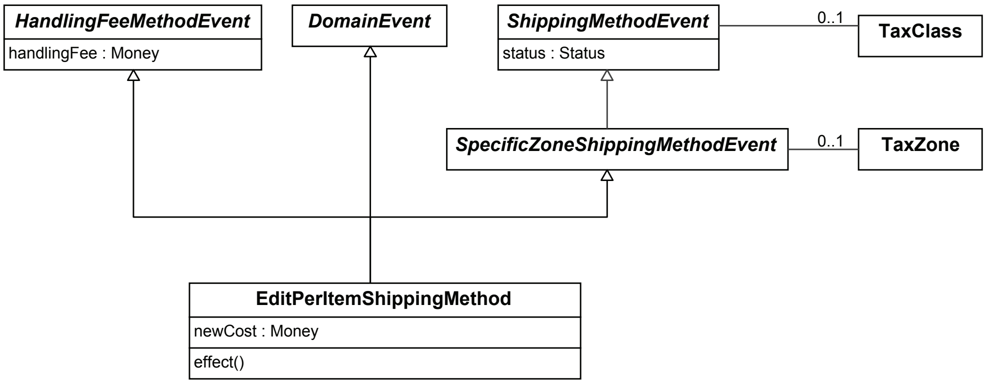
```
«IniIC»
context  InstallPerItemShippingMethod::ShippingMethodIsNotInstalled():Boolean
  body :  PerItem.allInstances() -> isEmpty()
context InstallPerItemShippingMethod::effect()
  post :  sm.oclIsNew() and sm.oclIsTypeOf(PerItem) and sm.status=Status::enabled
```

UninstallPerItemShippingMethod



```
«IniIC»
context  UninstallPerItemShippingMethod::ShippingMethodCanBeUninstalled():Boolean
  body :
      PerItem.allInstances() -> notEmpty() and
      (ShippingMethod.allInstances-Set{PerItem.allInstances->any(true)})->exists(sm|sm.status=#enabled)

context  UninstallPerItemShippingMethod::effect()
  post :  PerItem.allInstances() -> any(true)@pre.oclIsKindOf(OclAny)
```

EditPerItemShippingMethod



```
«IniIC»
context  EditPerItemShippingMethod::paymentMethodIsInstalled():Boolean
  body :  PerItem.allInstances() -> notEmpty()

«IniIC»
context  EditPerItemShippingMethod::atLeastOneEnabled:Boolean
   body:
        self.status=Status::disabled
       implies
       (ShippingMethod.allInstances-Set{PerItem.allInstances->any(true)})
          ->exists(pm | pm.status=Status::enabled)

context  EditPerItemShippingMethod::effect()
  post :
     let  sm: PerItem= PerItem.allInstances() -> any(true) in
     sm.cost=self.newCost and
     sm.handlingFee=self.handlingFee and
     sm.taxZone=self.taxZone and
     sm.taxClass=self.taxClass and
     sm.status = self.status
```

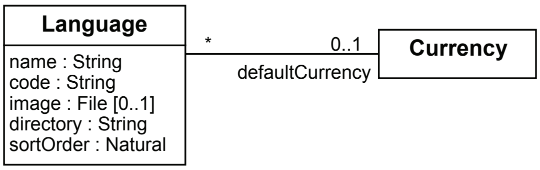
Example test program

```
testprogram InstallUninstallShippingMethods{

        test InstallPerItemShippingMethodOnce{
                ipism := new InstallPerItemShippingMethod;
                assert occurrence ipism;
        }

        test InstallPerItemShippingMethodTwice{
                ipism := new InstallPerItemShippingMethod;
                assert occurrence ipism;
                ipism2 := new InstallPerItemShippingMethod;
                assert occurrence ipism2;
        }

        test UninstallPerItemShippingMethodAlreadyInstalled{
                ipism := new InstallPerItemShippingMethod;
                assert occurrence ipism;
                ifrsm := new InstallFlatRateShippingMethod occurs;
                assert occurrence ifrsm;
                upism := new UninstallPerItemShippingMethod occurs;
                assert occurrence upism;
        }
        test UninstallCreditCardNotInstalledYet{
                upism := new UninstallPerItemShippingMethod;
                assert occurrence upism;
        }

        test AtLeastOneShippingMethodEnabled{
                ipism := new InstallPerItemShippingMethod;
                assert occurrence ipism;
                epism := new EditPerItemShippingMethod(status:=#disabled);
                assert non-occurrence epism;
                //Only if there is another shipping method enabled,
                //we can change PerItem to disabled
                ifrsm := new InstallFlatRateShippingMethod;
                assert occurrence ifrsm;
                assert occurrence epism;
        }
}
```

Languages

Structural schema

osCommerce is a multilingual system able to deal with any number of languages.



[IC1] A language is identified by its name and by its code

context Language::codeAndNameAreUnique: Boolean
body : Language.allInstances() -> isUnique(name) **and** Language.allInstances() -> isUnique(code)

Use Cases

Add a language

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to add a new language.

Main Success Scenario:

1. The store administrator provides the details of the new language:

   [→*NewLanguage*]

2. The system validates that the data is correct.
3. The system saves the new language.

Edit a language

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to edit a language.

Main Success Scenario:

1. The store administrator selects the language to be edited.
2. The store administrator provides the new details of the selected language:

   [→*EditLanguage*]

3. The system validates that the data is correct.
4. The system saves the changes.

Delete a language

Primary Actor: Store administrator

Precondition: There are at least two languages.

Trigger: The store administrator wants to delete a language.

Main Success Scenario:

1. The store administrator selects the language to be deleted.
2. The store administrator confirms that he wants to delete the language:

   [→*DeleteLanguage*]

3. The system deletes the language.

Extensions:

2a. The deleted language is the default language of the store.

  2a1. The system sets any of the available languages as the default language:

    [→*SetDefaultLanguage*]

2b. The deleted language is the current language of any active session.

2b1. The system sets any of the available languages as the current language:

[→*SetCurrentLanguage*]

Set the default language

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to change the default language.

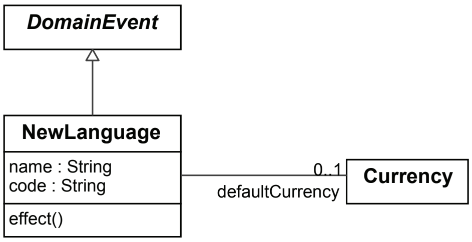
Main Success Scenario:

1. The store administrator selects the language which will become the default language.
2. The system updates the default language:

[→*SetDefaultLanguage*]

Events

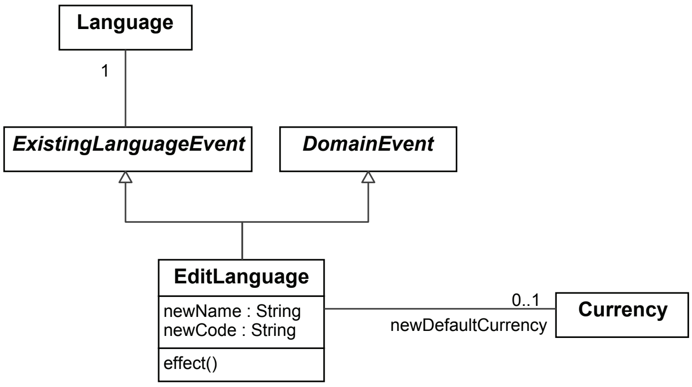
NewLanguage



```
«IniIC»
context NewLanguage::languageDoesNotExist(): Boolean
  body :
     not Language.allInstances() -> exists (l | l.name=self.name and
                                              l.code = self.code)
```

```
context  NewLanguage::effect()
   post :
      l.oclIsNew()  and
      l.oclIsTypeOf(Language) and
      l.name = self.name and
      l.code = self.code and
      l.defaultCurrency = self.defaultCurrency
```

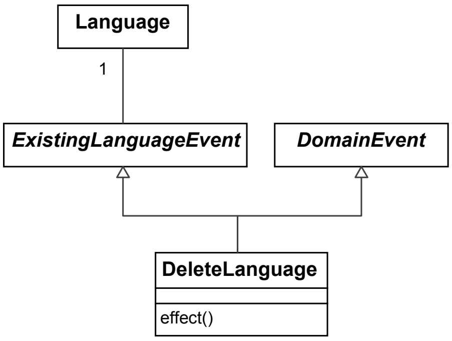
EditLanguage



«IniIC»
context EditLanguage::languageDoesNotExist(): Boolean
  body:
    not ((Language.allInstances-Set{self.language})
      ->exists(name=self.newName or code=self.newCode))

context EditLanguage::effect()
  post :
    self.language.name = self.newName **and**
    self.language.code = self.newCode **and**
    self.language.defaultCurrency = self.newDefaultCurrency

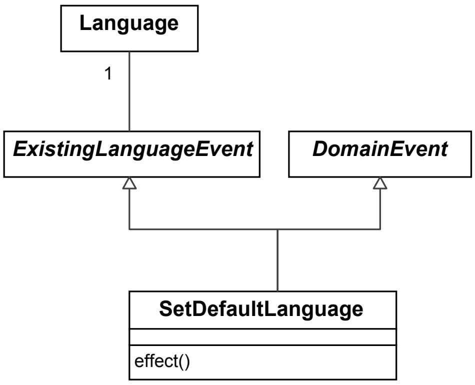
DeleteLanguage



«IniIC»
context DeleteLanguage::AtLeastTwoLanguages(): Boolean
  body : Language.allInstances() -> size() >= 2

context DeleteLanguage::effect()
  post: **not** self.language@pre.oclIsKindOf(OclAny)

SetDefaultLanguage



context SetDefaultLanguage::effect()
post : Store.allInstances() -> any(true).defaultLanguage = self.language

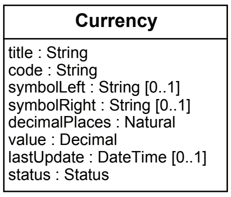
Example test program

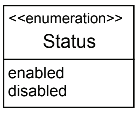
```
testprogram LanguageManagement{

        dollar:=new Currency(title:='USDollar', code:='USD');

        test InstallLanguage{
                nl := new NewLanguage(newName:='English', newCode:='EN');
                assert occurrence nl;

        }

        test InstallLanguagesTwice{
                nl := new NewLanguage(newName:='English', newCode:='EN');
                assert occurrence nl;
                assert non-occurrence nl;
        }

        test InstallLanguageWithDefaultCurrency{
                nl := new NewLanguage(newName:='English', newCode:='EN',
                                      defaultCurrency:=dollar);
                assert occurrence nl;
        }

        test EditLanguage{
                nl := new NewLanguage(newName:='Englishhh', newCode:='EN');
                assert occurrence nl;
                l:=Language.allInstances->select(name='Englishhh')->any(true);
                el := new EditLanguage
                   (language:=l, newName:='English', newCode:='EN');
                assert occurrence el;
                assert equals l.name 'English';

                //We cannot edit a language if it causes duplicated languages
                catalan := new Language(name:='Catalan', code:='CAT');
                el2 : = new EditLanguage(language:=l,newName:='Catalan',
                                        newCode:='EN');
                assert non-occurrence el2;
        }

        test DeleteLanguage{
                //We cannot delete a language if there are no other languages enabled
                english := new Language(name:='English', code:='EN', defaultCurrency:=dollar);
                dl := new DeleteLanguage(language:=english);
                assert non-occurrence dl;
                catalan := new Language(name:='Catalan', code:='CAT');
                assert occurrence dl;
        }
        test SetDefaultLanguage{
                //Initialize store
                english:=new Language(name:='English', code:='EN');
                usa:=new Country(name:='United States', isoCode2:='US', isoCode3:='USA');
                cos:=new OrderStatus;
                cosl:=new OrderStatusInLanguage(language:=english,orderStatus:=cos);
                cosl.name:='cancelled';
                dos:=new OrderStatus;
                dosl:=new OrderStatusInLanguage(orderStatus:=dos, language:=english);
                dosl.name:='pending';
                s:=new Store(name:='VirtualGallery');
                s.defaultCurrency:=dollar;
                s.country:=usa;
                s.cancelledStatus:=cos;
                s.defaultStatus:=dos;
                s.defaultLanguage:=english;

                //We test that a new language is set as default language
                spanish:=new Language(name:='Spanish', code:='ESP');
                sdf := new SetDefaultLanguage(language:=spanish);
                assert occurrence sdf;
                assert equals s.defaultLanguage spanish;
                assert not equals s.defaultLanguage english;
        }
}
```

Currencies

Structural schema

osCommerce allows working with different currencies.





[IC1] A currency is identified by its title and by its code.

context Currency::codeAndTitleAreUnique: Boolean
body :
Currency.allInstances() -> isUnique(title) **and**
Currency.allInstances() -> isUnique(code)

[IC2] At least one currency is enabled

context Currency::codeAndTitleAreUnique: Boolean
body : Currency.allInstances()->one(status=Status::enabled)

Use Cases

Add a currency

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to add a new currency.

Main Success Scenario:

1. The store administrator provides the details of the new currency:

   [→*NewCurrency*]

2. The system validates that the data is correct.
3. The system saves the new currency and enables it.

Edit a currency

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to edit a currency.

Main Success Scenario:

1. The store administrator selects the currency to be edited.
2. The store administrator provides the new details of the selected currency:

   [→*EditCurrency*]

3. The system validates that the data is correct.
4. The system saves the changes.

Delete a currency

Primary Actor: Store administrator

Precondition: There is at least another enabled currency.

Trigger: The store administrator wants to delete a currency.

Main Success Scenario:

1. The store administrator selects the currency to be deleted.
2. The store administrator confirms that he wants to delete the currency:

   [→*DeleteCurrency*]

3. The system deletes the currency.

Extensions:

2a. The deleted currency was the default currency.

- 2a1. The system sets any of the available currencies as the default currency:

  [→*SetDefaultCurrency*]

2b. The deleted currency is the current currency of an active session.

- 2b1. The system sets any of the available currencies as the current currency:

  [→*SetCurrentCurrency*]

2c. The currency is the currency of an order:

- 2c1. The system changes the status of the currency to disable.

  [→*CurrencyStatusChange*]

- 2c2. The use case ends.

Update currencies

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to update automatically via Internet the change values for currencies.

Main Success Scenario:

1. The system connects to the change information server.
2. The value change is automatically updated for all the currencies:

   [→*UpdateCurrencyValueChange*]

Set the default currency

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to change the default currency.

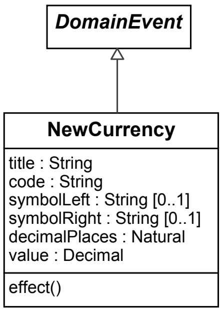
Main Success Scenario:

1. The store administrator selects the currency which will become the default currency.
2. The system updates the default currency:

   [→*SetDefaultCurrency*]

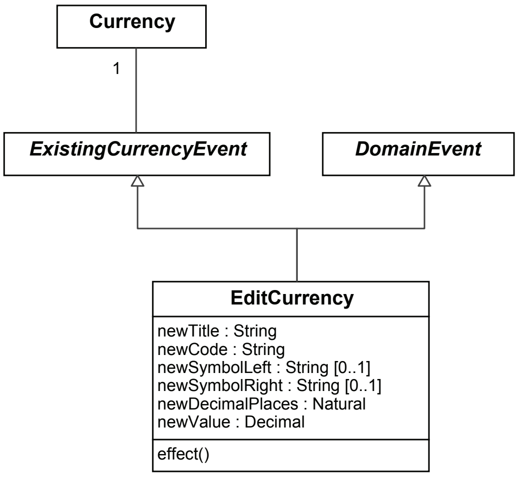
Events

NewCurrency



```
«IniIC»
context NewCurrency::currencyDoesNotExist(): Boolean
  body :
     not Currency.allInstances() -> exists(c | c.title=self.title and
                                                c.code=self.code)

context  NewCurrency::effect()
   post :
      c.oclIsNew()  and
      c.oclIsTypeOf(Currency) and
      c.title = self.title and
      c.code = self.code and
      c.symbolLeft = self.symbolLeft and
      c.symbolRight = self.symbolRight and
      c.decimalPlaces = self.decimalPlaces and
      c.value = self.value  and
     c.status = Status::enabled
```

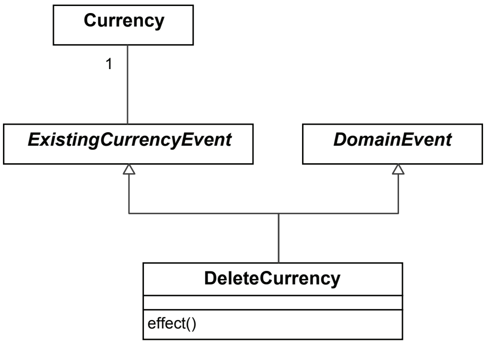
EditCurrency



```
«IniIC»
context EditCurrency::currencyDoesNotExist(): Boolean
   body:
        not ((Currency.allInstances-Set{self.currency})->exists(title=self.newTitle or code=self.newCode))
```

context EditCurrency::effect()
  post :
    currency.title = self.newTitle **and**
    currency.code = self.newCode **and**
    currency.symbolLeft = self.newSymbolLeft **and**
    currency.symbolRight = self.newSymbolRight **and**
    currency.decimalPlaces = self.newDecimalPlaces **and**
    currency.value = self.newValue

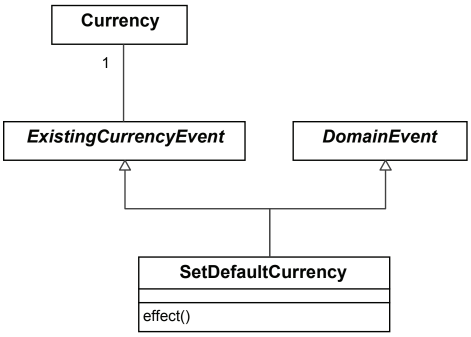
DeleteCurrency



«IniIC»
context DeleteCurrency::AtLeastTwoCurrencies(): Boolean
  body : Currency.allInstances() -> size() >= 2

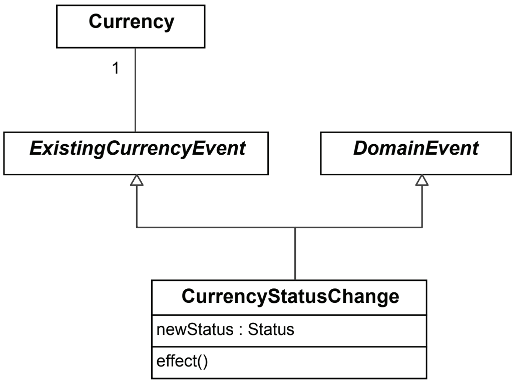
context DeleteCurrency::effect()
  post: **not** self.currency@pre.oclIsKindOf(OclAny)

SetDefaultCurrency



context SetDefaultCurrency::effect()
  post : Store.allInstances() -> any(true).defaultCurrency = self.currency

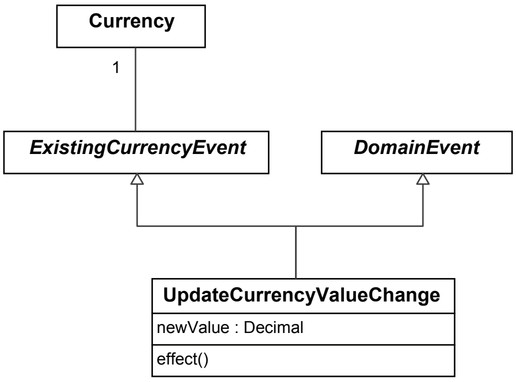
CurrencyStatusChange



«IniIC»
context CurrencyStatusChange::atLeastOneCurrencyEnabled():Boolean
body:
self.newStatus=Status::disabled
implies
(Currency.allInstances-Set{self.currency})->exists(c|c.status=Status::enabled)

context CurrencyStatusChange::effect()
post : self.currency.status = self.newStatus

UpdateCurrencyValueChange



context UpdateCurrencyValueChange::effect()
post : self.currency.value = self.newValue
post : self.currency.lastUpdated = Now()

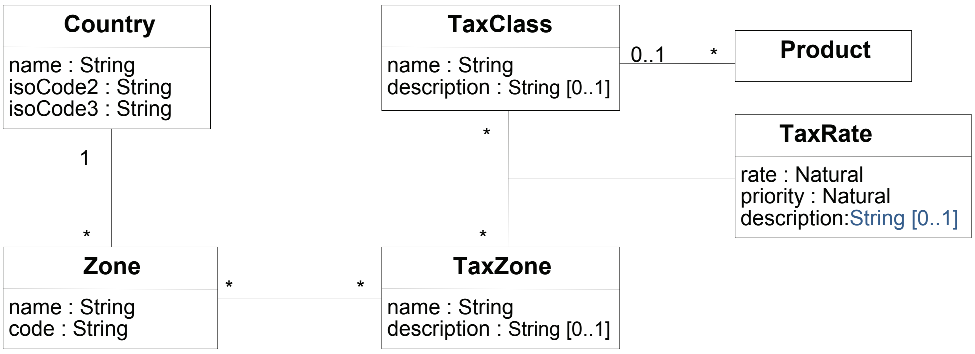
Example test program

```
testprogram CurrencyManagement{
        test CreateCurrency{
                nc := new NewCurrency(title:='Euro', code:='EUR', decimalPlaces:=2);
                assert occurrence nc;
        }

        test CreateTheSameCurrencyTwice{
                nc := new NewCurrency(title:='Euro', code:='EUR', decimalPlaces:=2);
                assert occurrence nc;
                assert non-ccurrence nc;
        }
        test EditCurrency{
                nc := new NewCurrency(title:='Euro', code:='EUR', decimalPlaces:=0);
                assert occurrence nc;
                createdCurrency:=Currency.allInstances->select(title='Euro')->any(true);
                ec := new EditCurrency(currency:=createdCurrency,newTitle:='Euro',
                                  newCode:='EUR', newDecimalPlaces:=2);
                assert occurrence ec;
                assert equals createdCurrency.decimalPlaces 2;
                //Edition cannot cause duplicates
                euro:=new Currency
                      (title:='Dollar', code:='USD', decimalPlaces:=2, status:=#enabled);
                ec2 := new EditCurrency(currency:=createdCurrency,newTitle:='Euro',
                                  newCode:='USD', newDecimalPlaces:=2);
                assert non-ccurrence ec2;
        }

        test DeleteCurrency{
                euro:=new Currency(title:='Euro', code:='EUR', decimalPlaces:=2);
                //We cannot delete a currency if there is no other currency enabled
                dc := new DeleteCurrency(currency:=euro);
                assert non-occurrence dc;
                new Currency(title:='Dollar', code:='USD', status:=#enabled);
                assert occurrence dc;
        }

        test ChangeCurrencyStatus{
                usd:=new Currency(title:='Dollar', code:='USD',
                                    decimalPlaces:=2,status:=#enabled);

                euro:=new Currency(title:='Euro', code:='EUR',
                                    decimalPlaces:=2,status:=#disabled);
                csc := new CurrencyStatusChange(currency:=euro, newStatus:=#enabled);
                assert occurrence csc;
                asert equals euro.status #enabled;

                //We cannot disable a currency if there is no other currency enabled
                csc2 := new CurrencyStatusChange(currency:=euro, newStatus:=#disabled);
                assert occurrence csc2;
        }

        test SetDefaultCurrency{
                //Initialize store
                franc:=new Currency(title:='Franc', code:='FR');
                french:=new Language(name:='French', code:='FR');
                france:=new Country(name:='France', isoCode2:='FR', isoCode3:='FRA');
                cos:=new OrderStatus;
                cosl:=new OrderStatusInLanguage(language:=french,orderStatus:=cos);
                cosl.name:='annulé';
                dos:=new OrderStatus;
                dosl:=new OrderStatusInLanguage(orderStatus:=dos, language:=french);
                dosl.name:='en attenté';
                s:=new Store(name:='CréaPlaisir');
                s.defaultCurrency:=franc;
                s.country:=france;
                s.cancelledStatus:=cos;
                s.defaultStatus:=dos;
                s.defaultLanguage:=french;

                //We test that a new currency is set as default currency
                euro := new Currency(title:='Euro', code:='EUR', decimalPlaces:=2);
                sdf := new SetDefaultCurrency(currency:=euro);
                assert occurrence sdf;
                assert equals s.defaultCurrency euro;
                assert not equals s.defaultCurrency franc;
        }
}
```

Location & Taxes

Structural schema

In order to supply a flexible use of taxes, product prices are stored tax free. This allows calculating the final price of products depending on the customer's location and the tax class applied to it.



[IC1] A *Country* is identified either by its name or its ISO codes.

context Country::nameAndCodesAreUnique: Boolean
body :
Country.allInstances() -> isUnique (name) **and**
Country.allInstances() -> isUnique (isoCode2) **and**
Country.allInstances() -> isUnique (isoCode3)

[IC2] A *Zone* is identified either by its name and country or its code and country.

context Zone::nameAndCountryAndCodeAndCountryAreUnique: Boolean
body :
Zone.allInstances() -> isUnique (Tuple{n:name, c:country}) **and**
Zone.allInstances() -> isUnique (Tuple{n:code, c:country})

[IC3] A *TaxZone* is identified by its name.

context TaxZone::nameIsUnique: Boolean
body : TaxZone.allInstances() -> isUnique (name)

[IC4] A *TaxClass* is identified by its name

context TaxClass::nameIsUnique: Boolean
body : TaxClass.allInstances() -> isUnique (name)

Use Cases

Add a country

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to add a country.

Main Success Scenario:

1. The store administrator provides the details of the new country:

   [→*NewCountry*]
2. The system validates that the data is correct.
3. The system saves the new country.

Edit a country

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to edit a country.

Main Success Scenario:

1. The store administrator selects the country to be edited.
2. The store administrator provides the new details of the selected country:

   [→*EditCountry*]
3. The system validates that the data is correct.
4. The system saves the changes.

Delete a country

Primary Actor: Store administrator

Precondition: The country is not the location of any address.

Trigger: The store administrator wants to delete a country.

Main Success Scenario:

1. The store administrator selects the country to be deleted.
2. The system warns the store administrator of the number of zones which are part of the country to be deleted.
3. The store administrator confirms that he wants to delete the country and their zones:

   [→*DeleteCountry*]
4. The system deletes the country and their zones.

Add a zone

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to add a zone.

Main Success Scenario:

1. The store administrator provides the details of the new zone:

   [→*NewZone*]
2. The system validates that the data is correct.
3. The system saves the new zone.

Edit a zone

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to edit a zone.

Main Success Scenario:

1. The store administrator selects the zone to be edited.
2. The store administrator provides the new details of the selected zone:

   [→*EditZone*]
3. The system validates that the data is correct.
4. The system saves the changes.

Delete a zone

Primary Actor: Store administrator

Precondition: The zone is not the location of any address.

Trigger: The store administrator wants to delete a zone.

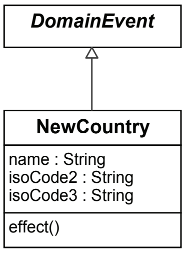
Main Success Scenario:

1. The store administrator selects the zone to be deleted.
2. The store administrator confirms that he wants to delete the zone:

   [→*DeleteZone*]
3. The system deletes the zone.

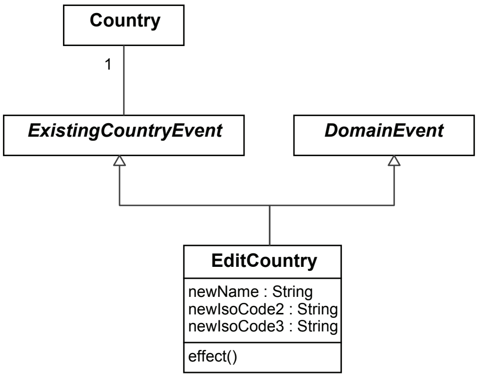
Events

NewCountry



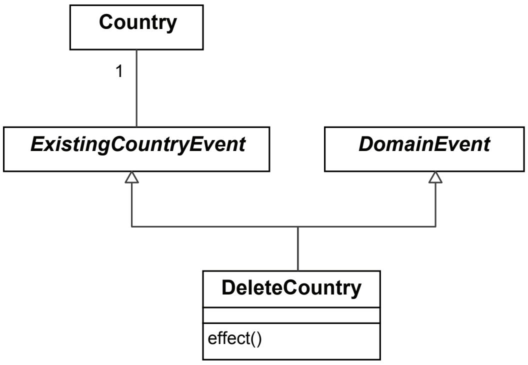
```
«IniIC»
context NewCountry::countryDoesNotExist(): Boolean
  body :
      not Country.allInstances() -> exists(c | c.name=self.name and
                                                c.isoCode2=self.isoCode2 and
                                                c.isoCode3=self.isoCode3)
context  NewCountry::effect()
   post :
       c.oclIsNew()  and
       c.oclIsTypeOf(Country) and
       c.name = self.name and
       c.isoCode2 = self.isoCode2 and  c.isoCode3 = self.isoCode3
```

EditCountry



```
«IniIC»
context EditCountry::countryDoesNotExist(): Boolean
  body :  (Country.allInstances() - Set{self.country}).name->excludes(self.newName)   and
          (Country.allInstances() - Set{self.country}).isoCode2->excludes(self.newIsoCode2)and
          (Country.allInstances() - Set{self.country}).isoCode3->excludes(self.newIsoCode3)

context  EditCountry::effect()
   post :
       country.name = self.newName and
       country.isoCode2 = self.newIsoCode2 and
       country.isoCode3 = self.newIsoCode3
```

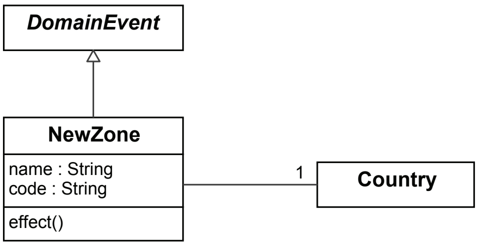
DeleteCountry



«IniIC»
context DeleteCountry::countryIsNotALocation():Boolean
  body :
    Store.allInstances() -> any(true).country <> self.country and
    Address.allInstances().country -> excludes(self.country)

context DeleteCountry::effect()
  post : not self.country@pre.oclIsKindOf(OclAny)

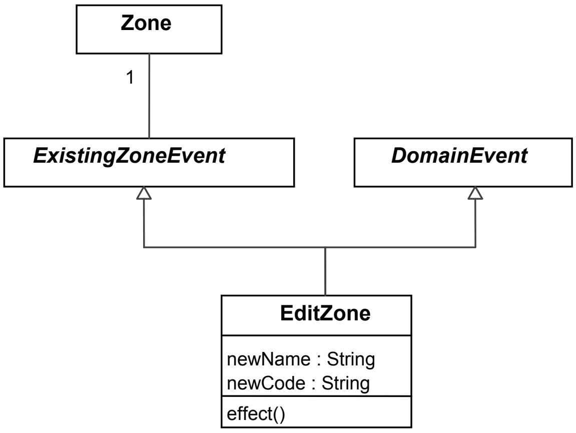
NewZone



«IniIC»
context NewZone::ZoneDoesNotExist(): Boolean
  body :
    not Zone.allInstances() -> exists (z | z.name = self.name and z.country = self.country or
      z.code = self.code and z.country = self.country)

context NewZone::effect()
  post :
    z.oclIsNew() and
    z.oclIsTypeOf(Zone) and
    z.name = self.name and
    z.code = self.code and
    z.country = self.country

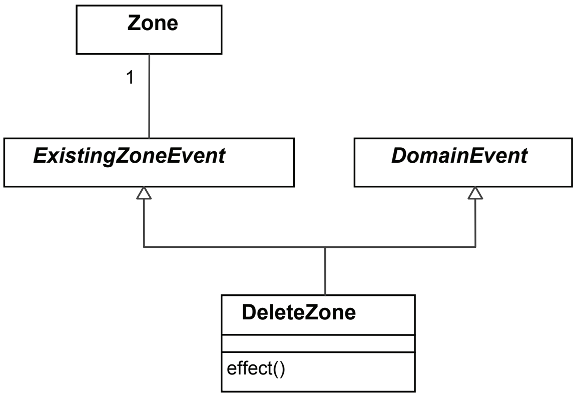
EditZone



«IniIC»
context EditZone::zoneDoesNotExist(): Boolean
  body : (Zone.allInstances() - Set{self.zone}).name->excludes(self.newName) and
        (Zone.allInstances() - Set{self.zone}).code->excludes(self.newCode)

context EditZone::effect()
  post : self.zone.name = self.newName and self.zone.code = self.newCode

DeleteZone



«IniIC»
context DeleteZone::ZoneIsNotALocation():Boolean
  body : Store.allInstances() -> any(true).zone <> self.zone and
        Address.allInstances().zone -> excludes(self.zone)

context DeleteZone::effect()
  post : not self.zone@pre.oclIsKindOf(OclAny)
  post : self.country@pre.zone -> forAll(z | Zone.allInstances()->excludes(z))

Example test programs

```
testprogram LocationsManagement{
        fixturecomponent DeutschlandCountryCreated{
                de:=new Country(name:='Deutschland', isoCode2:='GE', isoCode3:='DEU');
        }

        test CreateCountry{
                nc := new NewCountry(name:='Deutschland', isoCode2:='DE', isoCode3:='DEU');
                assert occurrence nc;
        }

        test CreateTheSameCountryTwice{
                nc := new NewCountry(name:='Deutschland', isoCode2:='DE', isoCode3:='DEU');
                assert occurrence nc;
                assert non-occurrence nc;
        }

        test EditCountry{
                 load DeutschlandCountryCreated;
                 ec := new EditCountry(country:=de,newName:='Deutschland',
                                 newIsoCode2:='DE', newIsoCode3:='DEU');
                 assert occurrence ec;
                 assert equals de.isoCode2 'DE';
        }

        test DeleteCountryWithoutZones{
                load DeutschlandCountryCreated;
                dc := new DeleteCountry(country:=de);
                assert occurrence dc;
        }

        test DeleteTheCountryWhereTheStoreIsLocated{

                //Initialize store
                load DeutschlandCountryCreated;
                mark:=new Currency(title:='Mark', code:='MK');
                deutsch:=new Language(name:='Deutsch', code:='DE');
                cos:=new OrderStatus;
                cosl:=new OrderStatusInLanguage(language:=deutsch,orderStatus:=cos);
                cosl.name:='abgebrochen';
                dos:=new OrderStatus;
                dosl:=new OrderStatusInLanguage(orderStatus:=dos, language:=deutsch);
                dosl.name:='unentschieden';
                s:=new Store(name:='Geschenkwelt24');
                s.defaultCurrency:=mark;
                s.country:=de;
                s.cancelledStatus:=cos;
                s.defaultStatus:=dos;
                s.defaultLanguage:=deutsch;

                dc := new DeleteCountry(country:=de);
                assert non-occurrence dc;
        }

        test CreateZone{
                load DeutschlandCountryCreated;
                nz := new NewZone(country:=de,name:='Waden-Wurttemberg', code:='WW');
                assert occurrence nz;
        }


        test CreateTheSameZoneTwice{
                load DeutschlandCountryCreated;
                ww:=new Zone(country:=de,name:='Waden', code:='WW');
                nz := new NewZone(country:=de,name:='Waden-Wurttemberg', code:='WW');
                assert non-occurrence nz;
        }

        test EditZone{
                load DeutschlandCountryCreated;
                ww:=new Zone(country:=de,name:='Waden', code:='WW');
                nz := new EditZone(zone:=ww, newName:='Waden-Wurttemberg', newCode:='WW');
                assert occurrence nz;
                assert equals ww.name 'Waden-Wurttemberg';
        }
```

```
test DeleteZone{
        load DeutschlandCountryCreated;
        nz := new NewZone(country:=de,name:='Waden-Wurttemberg', code:='WW');
        assert occurrence nz;
        ww:=Zone.allInstances->any(code='WW');
        dz := new DeleteZone(zone:=ww);
        assert occurrence dz;
}

test DeleteCountryWithZones{
        load DeutschlandCountryCreated;
        nz := new NewZone(country:=de,name:='Waden-Wurttemberg', code:='WW');
        dc := new DeleteCountry(country:=de);
        assert occurrence dc;
}
```

Use Cases

Add a tax zone

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to add a tax zone.

Main Success Scenario:

1. The store administrator provides the details of the new tax zone:

   [→*NewTaxZone*]

2. The system validates that the data is correct.
3. The system saves the new tax zone.

Edit a tax zone

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to edit a tax zone.

Main Success Scenario:

1. The store administrator selects the tax zone to be edited.
2. The store administrator provides the new details of the selected tax zone:

   [→*EditTaxZone*]

3. The system validates that the data is correct.
4. The system saves the changes.

Delete a tax zone

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to delete a tax zone.

Main Success Scenario:

1. The store administrator selects the tax zone to be deleted.
2. The store administrator confirms that he wants to delete the tax zone:

   [→*DeleteTaxZone*]
3. The system deletes the tax zone and all the associated tax rates.

Add a tax class

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to add a tax class.

Main Success Scenario:

1. The store administrator provides the details of the new tax class:

   [→*NewTaxClass*]
2. The system validates that the data is correct.
3. The system saves the new tax class.

Edit a tax class

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to edit a tax class.

Main Success Scenario:

1. The store administrator selects the tax class to be edited.
2. The store administrator provides the new details of the selected tax class:

   [→*EditTaxClass*]
3. The system validates that the data is correct.
4. The system saves the changes.

Delete a tax class

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to delete a tax class.

Main Success Scenario:

1. The store administrator selects the tax class to be deleted.
2. The system informs the store administrator about how many products are associated to the deleted tax class.
3. The store administrator confirms that he wants to delete the tax class:

   [→*DeleteTaxClass*]
4. The system deletes the tax class and all the associated tax rates.

Extensions:

2a. The store administrator don't want to delete the tax class.

2a1. The use case ends.

Add a tax rate

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to add a tax rate.

Main Success Scenario:

1. The store administrator provides the details of the new tax rate:

   [→*NewTaxRate*]
2. The system validates that the data is correct.
3. The system saves the new tax rate.

Edit a tax rate

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to edit a tax rate.

Main Success Scenario:

1. The store administrator selects the tax rate to be edited.
2. The store administrator provides the new details of the selected tax rate:

   [→*EditTaxRate*]
3. The system validates that the data is correct.
4. The system saves the changes.

Delete a tax rate

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to delete a tax rate.

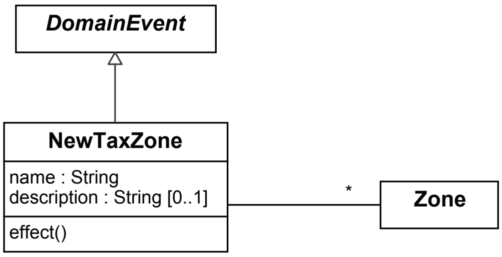
Main Success Scenario:

1. The store administrator selects the tax rate to be deleted.
2. The store administrator confirms that he wants to delete the tax rate:

   [→*DeleteTaxRate*]
3. The system deletes the tax rate.

Events

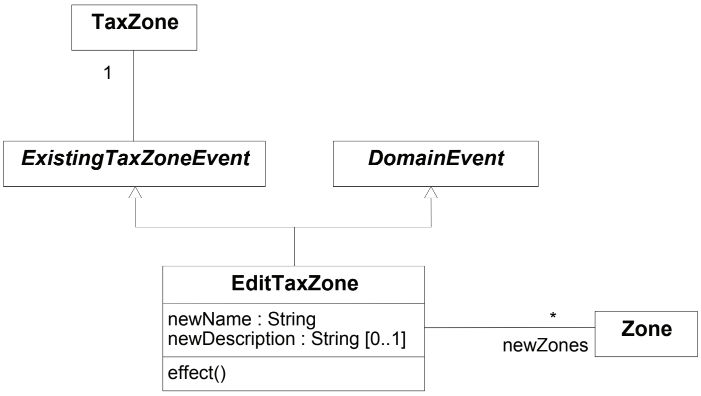
NewTaxZone



«IniIC»
context NewTaxZone::TaxZoneDoesNotExist(): Boolean
body : **not** TaxZone.allInstances() -> exists (tz | tz.name = self.name)

context NewTaxZone::effect()
post :
tz.oclIsNew() **and**
tz.oclIsTypeOf(TaxZone) **and**
tz.name = self.name **and**
tz.description = self.description **and**
tz.zone = self.zone

EditTaxZone

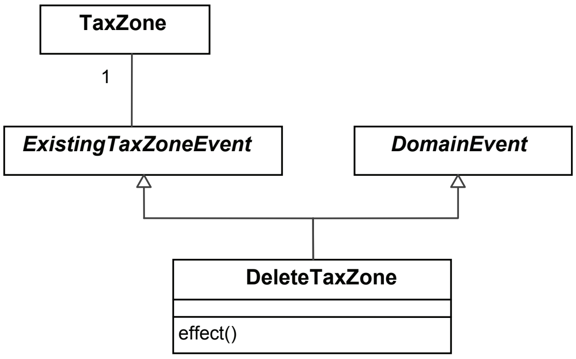


«IniIC»
context EditTaxZone::TaxZoneDoesNotExist(): Boolean
body : (TaxZone.allInstances() - Set{self.taxZone}).name->excludes(self.newName)

context EditTaxZone::effect()
post :

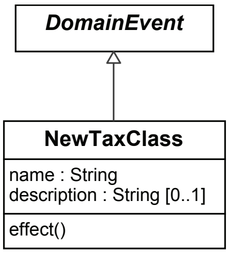
self.taxZone.name = self.newName **and**
self.taxZone.description = self.newDescription **and**
self.taxZone.zone = self.newZones

DeleteTaxZone



context DeleteTaxZone::effect()
post deleteTaxZone:
not self.taxZone@pre.oclIsKindOf(OclAny)
post deleteAssociatedTaxRates:
self.taxZone@pre.taxRate@pre -> forAll(tr | tr.oclIsKindOf(OclAny))

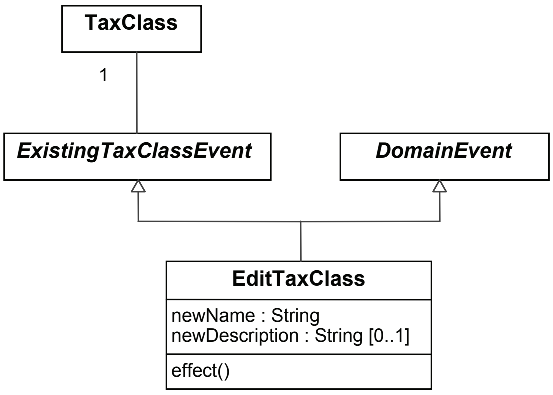
NewTaxClass



«IniIC»
context NewTaxClass::TaxClassDoesNotExist(): Boolean
body : **not** TaxClass.allInstances() -> exists (tc | tc.name = self.name)

context NewTaxClass::effect()
post :
tc.oclIsNew() **and**
tc.oclIsTypeOf(TaxClass) **and** tc.name = self.name **and** tc.description = self.description

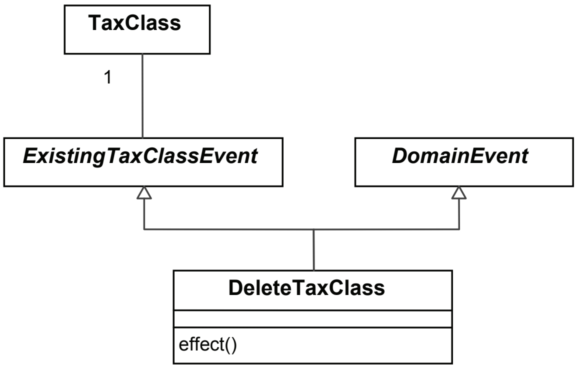
EditTaxClass



«IniIC»
context EditTaxClass::TaxClassDoesNotExist(): Boolean
  body : (TaxClass.allInstances() - Set{self.taxClass}).name->excludes(self.newName)

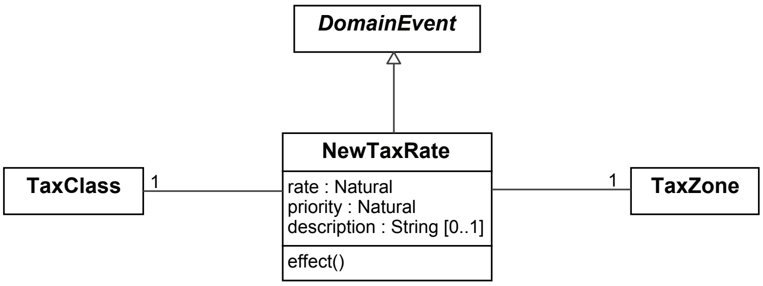
context EditTaxClass::effect()
  post :
    self.taxClass.name = self.newName **and** self.taxClass.description = self.newDescription

DeleteTaxClass



context DeleteTaxClass::effect()
  post deleteTaxClass:
    not self.taxClass@pre.oclIsKindOf(OclAny)
  post deleteAssociatedTaxRates:
    self.taxClass@pre.taxRate@pre -> forAll(tr | tr.oclIsKindOf(OclAny))

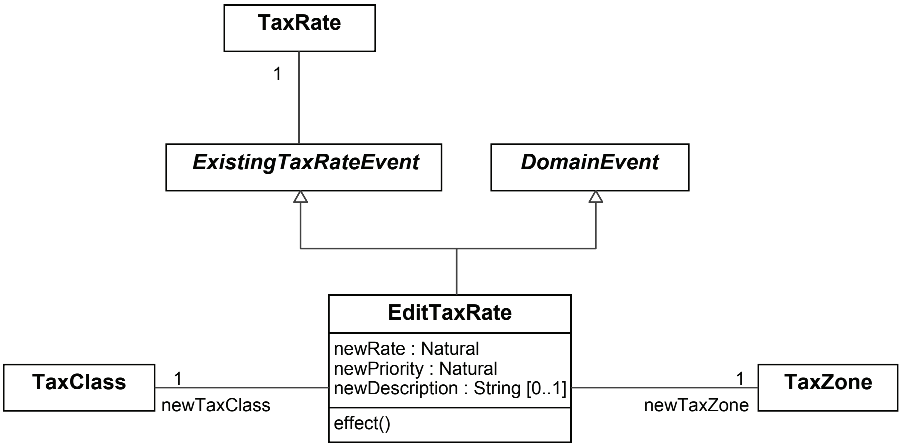
NewTaxRate



«IniIC»
context NewTaxRate::TaxRateDoesNotExist(): Boolean
  body :
    not TaxRate.allInstances() -> exists (tr | tr.taxClass = self.taxClass and tr.taxZone = self.taxZone)

context NewTaxRate::effect()
  post :
    tr.oclIsNew() and tr.oclIsTypeOf(TaxRate) and
    tr.rate = self.rate and
    tr.priority = self.priority and
    tr.description = self.description and
    tr.taxClass = self.taxClass and
    tr.taxZone = self.taxZone

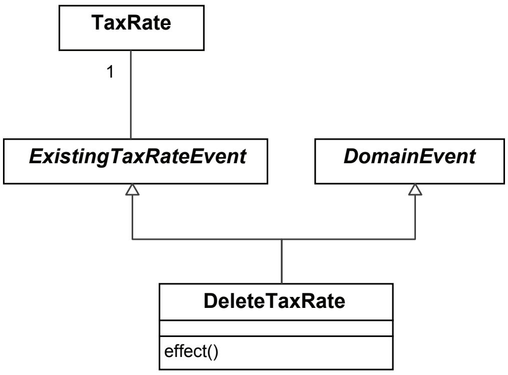
EditTaxRate



«IniIC»
context EditTaxRate::TaxRateDoesNotExist(): Boolean
  body : (TaxRate.allInstances - Set{self.taxRate})->select(tr |
    tr.taxClass = self.newTaxClass and tr.taxZone = self.newTaxZone) -> size()=0

context EditTaxRate::effect()
  post :
    self.taxRate.rate = self.newRate and
    self.taxRate.priority = self.newPriority and
    self.taxRate.description = self.newDescription and
    self.taxRate.taxClass = self.newTaxClass and
    self.taxRate.taxZone = self.newTaxZone

DeleteTaxRate



context DeleteTaxRate::effect()
post : **not** self.taxRate@pre.oclIsKindOf(OclAny)

Example test programs

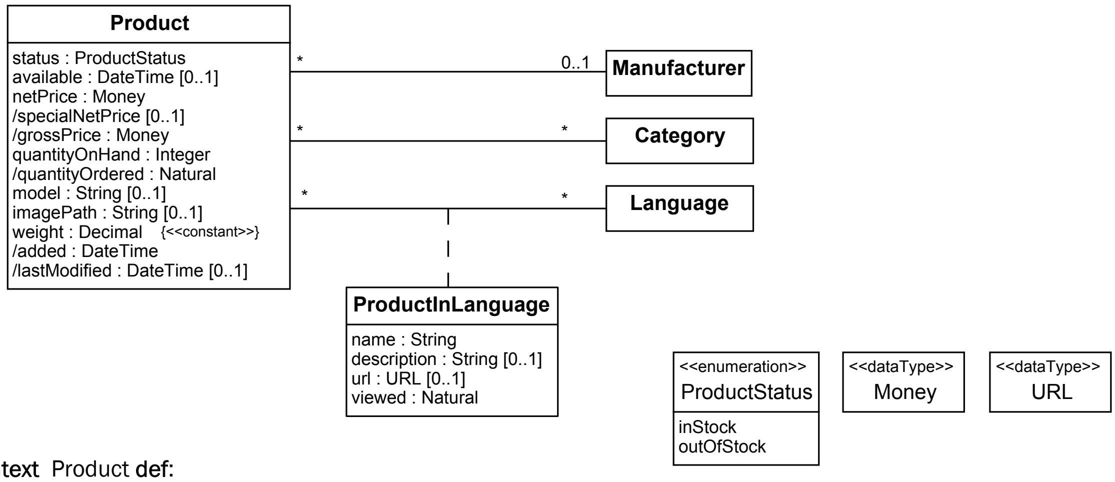
```
testprogram TaxesConfigurationManagement{

        spain:=new Country(name:='Spain', isoCode2:='ESP', isoCode3:='ES');
        catalonia:=new Zone(name:='Catalonia', code:='CAT', country:=spain);
        andalucia:=new Zone(name:='Andalucia', code:='AND', country:=spain);
        zones:=spain.zone;

        test AddTaxZone{
                ntz := new NewTaxZone(name:='SpanishVAT', zone:=catalonia,andalucia);
                assert occurrence ntz;
        }

        test EditTaxZone{
                zones:=spain.zone;
                tz:=new TaxZone(name:='SpanishVAT', zone:=zones);
                etz:=new EditTaxZone(taxZone:=tz, newName:='SpanishVAT',
                                       newZones:=catalonia);
                assert true tz.zone->excludes(andalucia);
                assert true tz.zone->includes(catalonia);
        }

        test DeleteTaxZoneWithoutTaxRates{
                tz:=new TaxZone(name:='SpanishVAT', zone:=zones);
                dtz:=new DeleteTaxZone(taxZone:=tz);
                assert occurrence dtz;
        }

        test DeleteTaxZoneWithTaxRates{
                tz:=new TaxZone(name:='SpanishVAT', zone:=zones);
                tc:=new TaxClass(name:='GeneralVAT');
                tc2:=new TaxClass(name:='ReducedVAT');
                new TaxRate(taxClass:=tc,taxZone:=tz);
                new TaxRate(taxClass:=tc2,taxZone:=tz);
                dtz:=new DeleteTaxZone(taxZone:=tz);
                assert occurrence dtz;
        }

        test AddTaxClass{
                ntc:=new NewTaxClass(name:='SpanishVAT');
                assert occurrence ntc;
                assert non-occurrence ntc;
        }


        test EditTaxClass{
                tc:=new TaxClass(name:='VAT');
                etc:=new EditTaxClass(taxClass:=tc,newName:='GeneralVAT');
                assert occurrence etc;
        }

        test DeleteTaxClassWithoutZoneRates{
                tc:=new TaxClass(name:='GeneralVAT');
                dtc:=new DeleteTaxClass(taxClass:=tc);
                assert occurrence dtc;
        }

        test DeleteTaxClassWithZoneRates{
                tz:=new TaxZone(name:='SpanishVAT', zone:=zones);
                tc:=new TaxClass(name:='GeneralVAT');
                new TaxRate(taxClass:=tc,taxZone:=tz);
                dtc:=new DeleteTaxClass(taxClass:=tc);
                assert occurrence dtc;
        }

        test AddTaxRate{
                tz:=new TaxZone(name:='SpanishVAT', zone:=zones);
                tc:=new TaxClass(name:='GeneralVAT');
                ntr:=new NewTaxRate(taxClass:=tc, taxZone:=tz, rate:=16, priority:=1);
                assert occurrence ntr;
        }

        test EditTaxRate{
                tz:=new TaxZone(name:='SpanishVAT', zone:=zones);
                tc:=new TaxClass(name:='GeneralVAT');
                tc2:=new TaxClass(name:='ReducedVAT');
                tr:=new TaxRate(taxClass:=tc,taxZone:=tz);
                tr.rate:=7;
                etr:=new EditTaxRate(taxRate:=tr,newTaxClass:=tc2,newTaxZone:=tz,newRate:=7);
                assert occurrence etr;
        }

        test DeleteTaxRate{
                tz:=new TaxZone(name:='SpanishVAT', zone:=zones);
                tc:=new TaxClass(name:='GeneralVAT');
                tr:=new TaxRate(taxClass:=tc,taxZone:=tz);
                dtr:=new DeleteTaxRate(taxRate:=tr);
                assert occurrence dtr;
        }
}
```

```
testprogram DefaultProductTaxesCalculation{
        /*This test program checks that the default gross
        price  (shown in the online store) of a product is well-calculated. The default
        gross price is calculated by taking into account the
        zone where the store is located*/

        //FIXTURE
        //Languages
        english:=new Language(name:='English', code:='EN');
        spanish:=new Language(name:='Spanish', code:='ES');

        //Currencies
        cad:=new Currency(title:='Canadian Dollar', code:='CAD');
        eur:=new Currency(title:='Euro', code:='EUR');

        //Countries
        canada:=new Country(name:='Canada', isoCode2:='CA', isoCode3:='CAN');
        spain:=new Country(name:='Spain', isoCode2:='ES', isoCode3:='ESP');
        //Zones
        andalucia:=new Zone(name:='Andalucia', code:='AND', country:=spain);
        ontario:=new Zone(name:='Ontario', code:='ONT', country:=canada);
        quebec:=new Zone(name:='Quebec', code:='QUE', country:=canada);

        //Order Status
        cos:=new OrderStatus;
        cosInEnglish:=new OrderStatusInLanguage(language:=english,orderStatus:=cos);
        cosInEnglish.name:='Cancelled';
        cosInSpanish:=new OrderStatusInLanguage(language:=spanish,orderStatus:=cos);
        cosInSpanish.name:='Cancelado';
        dos:=new OrderStatus;
        dosInEnglish:=new OrderStatusInLanguage(orderStatus:=dos, language:=english);
        dosInEnglish.name:='Pending';
        dosInSpanish:=new OrderStatusInLanguage(orderStatus:=dos, language:=spanish);
        dosInEnglish.name:='Pendiente';

        //FIXTURE COMPONENTS
        /*We create two different shop configurations:
        A canadian store (with only one tax class)
        An spanish store (with three different tax classes)
        We apply them in the test cases two check the gross
        price calculation in different tax configurations*/

        fixturecomponent CanadianStoreInitialization{
                //Store initialization
                s:=new Store(name:='CanadianStore');
                s.defaultLanguage:=english;
                s.defaultCurrency:=cad;
                s.country:=canada;
                s.cancelledStatus:=cos;
                s.defaultStatus:=dos;

                //Tax configuration
                //We create a tax zone for Canada
                canadaFederalTaxes:=new TaxZone(name:='Canada Federal Taxes');
                canadaFederalTaxes.zone:=quebec,ontario;

                //We create an specific tax zone for Quebec
                quebecLocalTaxes:=new TaxZone(name:='QuebecLocalTaxes');
                quebecLocalTaxes.zone:=quebec;

                //We consider a single tax class
                general:=new TaxClass(name:='general');

                //For each TaxClass, there is a different tax rate applied in each zone
                canadianFederalTaxRate:=new TaxRate
                               (taxClass:=general, taxZone:=canadaFederalTaxes);
                canadianFederalTaxRate.rate:=7;
                canadianFederalTaxRate.priority:=1;

                quebecLocalTaxRate:=new TaxRate(taxClass:=general, taxZone:=quebecLocalTaxes);
                quebecLocalTaxRate.rate:=7.5;
                quebecLocalTaxRate.priority:=2;
        }

        fixturecomponent SpanishStoreInitialization{
                //Store initialization
                s:=new Store(name:='SpanishStore');
                s.defaultLanguage:=spanish;
                s.defaultCurrency:=cad;
                s.country:=spain;
                s.cancelledStatus:=cos;
                s.defaultStatus:=dos;

                //We create a specific tax zone
                spanishVAT:=new TaxZone(name:='SpanishVAT',
                   description:='This zone includes all VAT varieties applied in Spain');
                spanishVAT.zone:=andalucia;

                //In Spain there are three types of VAT: general VAT (16%),
               //reduced VAT(7%) and super-reduced VAT(4%)
                general:=new TaxClass(name:='General VAT');
                reduced:=new TaxClass(name:='ReducedVAT');
                superreduced:=new TaxClass(name:='Super-reduced VAT');

                //For each TaxClass, there is a different tax rate applied in each zone
                generalRate:=new TaxRate(taxClass:=general, taxZone:=spanishVAT);
                generalRate.rate:=16;
                generalRate.priority:=1;

                reducedRate:=new TaxRate(taxClass:=reduced, taxZone:=spanishVAT);
                reducedRate.rate:=7;
                reducedRate.priority:=1;

                superReducedRate:=new TaxRate
                                     (taxClass:=superreduced, taxZone:=spanishVAT);
                superReducedRate.rate:=4;
                superReducedRate.priority:=1;
        }
        test DefaultGrossPriceWithDifferentTaxClasses{
                load SpanishStoreInitialization;

                //We locate the store in the zone Andalucia
                s.zone := andalucia;

                //The reduced VAT is applied to cultural events, among others products
                greaseMusicalAdmission:=new Product(netPrice:=50);
                greaseMusicalAdmission.taxClass:=reduced;
                assert equals greaseMusicalAdmission.grossPrice() 53.5;

                //The super-reduced VAT is applied to books, among other products
                angelsAndDemonsBook:= new Product(netPrice:=25);
                angelsAndDemonsBook.taxClass:=superreduced;
                assert equals angelsAndDemonsBook.grossPrice() 26.0;

                //The general VAT is applied to those products which are not basic needs or
               //cultural products
                whiteWineBottle:= new Product(netPrice:=11);
                whiteWineBottle.taxClass:=general;
                assert equals whiteWineBottle.grossPrice() 12.76;
        }

        test DefaultGrossPriceInDifferentShopLocations{
                /*We test that the gross price (netPrice + taxes) of
                a product is different depending on the store location and the
                taxes configuration.*/

                load CanadianStoreInitialization;

                //We create the example product
                theDaVinciCodeBook:= new Product(netPrice:=50);
                theDaVinciCodeBook.taxClass:=general;

                //First, we locate the store in the zone Ontario
                s.zone:=ontario;
                assert equals theDaVinciCodeBook.grossPrice() 53.5;

                /*If the store is located in Quebec, the gross price
                also takes into account the Quebec Local Tax which is
                compounded with the Federal Tax*/
                s.zone:=quebec;
                assert equals theDaVinciCodeBook.grossPrice() 57.5125;
        }
}
```

Products

Structural schema

The system must know the information about the products offered by the online store.



```
context  Product def:
   addTaxes(z:Zone, basePrice:Money) : Money =
      let appliedTaxRates:Set(TaxRate)=
      z.taxZone.taxRate -> select (tr | tr.taxClass = self.taxClass)
      in
         let  priorities:Set(Natural) =
            if appliedTaxRate -> isEmpty() then set{}
            else appliedTaxRates -> sortedBy(priority).priority -> asSet()
            endif
         in
            if priorities -> isEmpty() then basePrice
            else priorities -> iterate (p:Natural; res:Money = 0 |
                                       res +
                                       (((appliedTaxRates -> select (tr | tr.priority = p).rate
                                        -> sum()) / 100)+1)*basePrice)
            endif
```

[DR1] *Product::**grossPrice*** is the product's *netPrice* taking into account the applied taxes.

```
context Product::grossPrice(): Money
body :  self.addTaxes(Store.allInstances() -> any(true).zone, self.netPrice)
```

[DR2] *Product::**specialNetPrice*** is the special price, if the product is an active special.

```
context Product::specialNetPrice(): Money
body :
   if self.oclIsTypeOf(Special) then
      if self.oclAsType(Special).specialStatus=Status::enabled and
         self.oclAsType(Special).expiryDate < Now()
      then self.oclAsType(Special).specialPrice
      else set{}
      endif
   else set{}
   endif
```

[DR3] *Product::**added*** is the *DateTime* of product creation.

```
context Product::added(): DateTime
  body : Now()
```

[IC1] A product is identified by a name in a language.

```
context Language::nameIsUnique(): Boolean
 body :
      Language.allInstances->forAll(l |
              l.productInLanguage->isUnique(name))
```

Use cases

Add a product

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to add a product to the store catalog.

Main Success Scenario:

1. The store administrator selects the product category.
2. The store administrator provides the product data:

   [→*NewProduct*]
3. The system validates that the data is correct.
4. The system saves the new product.
5. The store administrator provides a product attribute:

   [→*NewProductAttribute*]
6. The system validates that the product attribute is correct.
7. The system saves the new product attribute.

   The store administrator repeats steps 5-7 until he is done.

Extensions:

5a. The product does not have product attributes:

 5a1. The use case ends.

5b. The product option is new:

 5b1. Add a product option.

5c. The product option value is new:

 5c1. Add a product option value.

Edit a product

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to edit a product.

Main Success Scenario:

1. The store administrator selects the product to be edited.
2. The store administrator provides the new values for the attributes of the product:

   [→*EditProduct*]

3. The system validates that the data is correct.
4. The system saves the changes.

Delete a product

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to delete a product.

Main Success Scenario:

1. The store administrator selects the product to be deleted.
2. The system asks for the confirmation of the store administrator.
3. The store administrator confirms that he wants to delete the product:

   [→*DeleteProduct*]

4. The system deletes the product and their product attributes.

Extensions:

3a. The product is part of an order:

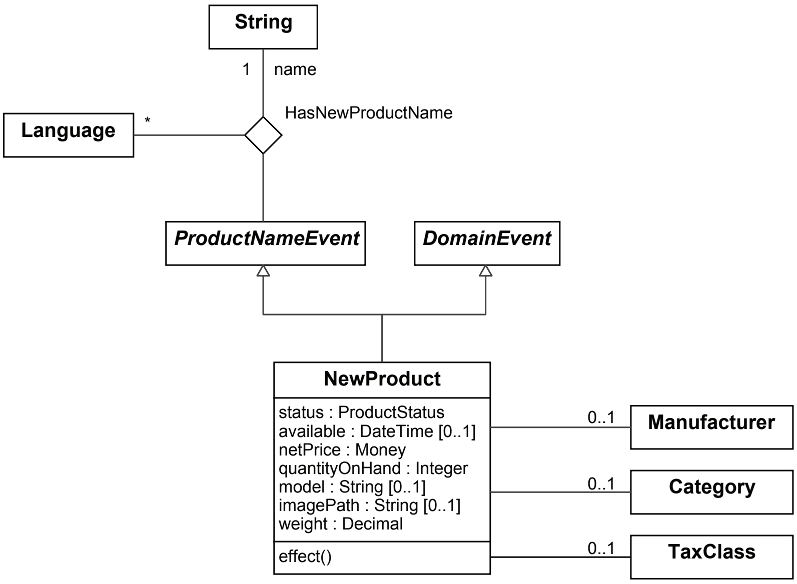
3a1. The system changes the status of the product to out of stock.

[→*ProductStatusChange*]

3a2. The use case ends.

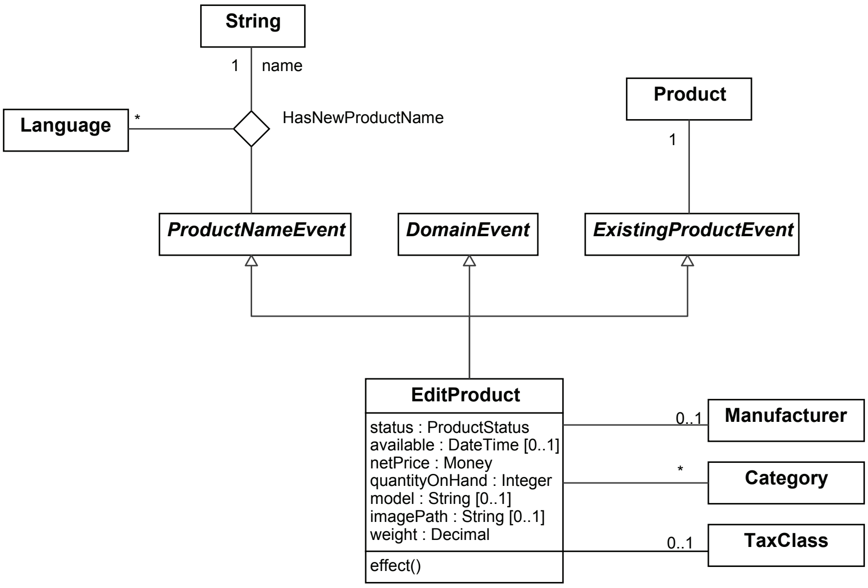
Events

NewProduct



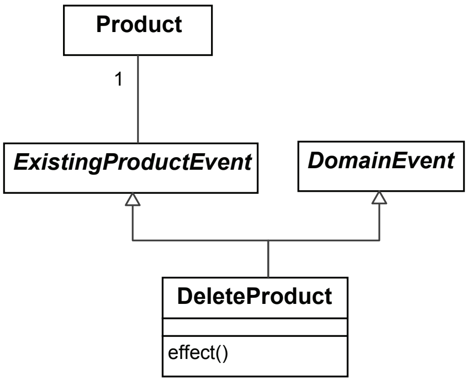
```
«IniIC»
context NewProduct::productDoesNotExist(): Boolean
  body :
      Language.allInstances() -> forAll ( l |
            l.productInLanguage.name
            -> excludes( self.hasNewProductName -> select(language=l).name))

context  NewProduct::effect()
   post :
       p.oclIsNew()  and
       p.oclIsTypeOf(Product) and
       p.status = self.status and
       p.available = self.available and
       p.netPrice = self.netPrice and
       p.quantityOnHand = self.quantityOnHand and
       p.model = self.model and
       p.imagePath = self.imagePath and
       p.weight = self.weight and
       p.category = Set{self.category} and
       p.manufacturer = self.manufacturer and
       p.taxClass = self.taxClass and
       Language.allInstances() ->
          forAll (l|
            self.hasNewProductName -> select(language=l).name =
            p.productInLanguage->select(language=l).name)
```

EditProduct



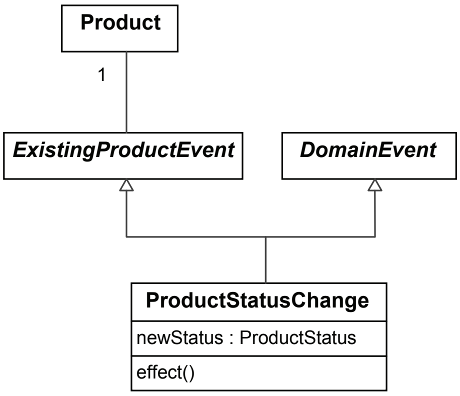
```
«IniIC»
context EditProduct::productDoesNotExist(): Boolean
  body: Language.allInstances() -> forAll ( l |
          l.productInLanguage.name
            -> excludes(self.hasNewProductName -> any(languageOfProduct=l).nameOfProduct) or
          (self.hasNewProductName->any(languageOfProduct=l).nameOfProduct =
          self.product.productInLanguage->any(language=l).name))


context  EditProduct::effect()
  post :
     self.product.status = self.status and
     self.product.available = self.available and
     self.product.netPrice = self.netPrice and
     self.product.quantityOnHand = self.quantityOnHand and
     self.product.model = self.model and
     self.product.imagePath = self.imagePath and
     self.product.weight = self.weight and
     self.product.manufacturer = self.manufacturer and
     self.product.category = self.category and
     self.product.taxClass = self.taxClass and
     Language.allInstances()
        -> forAll (l|
          self.hasNewProductName -> select(language=l).name =
          self.product.productInLanguage->select(language=l).name)
  post :
     self.product.lastModified = Now()
```

DeleteProduct



```
context  DeleteProduct::effect()
  post:
          if product@pre.orderLine -> size()=0
              then Product.allInstances->excludes(product@pre)
           else
              psc.oclIsNew() and
              psc.oclIsTypeOf(ProductStatusChange) and
              psc.newStatus = Status::outOfStock and
              psc.product = self.product@pre
          endif
```

ProductStatusChange



```
context  ProductStatusChange::effect()
  post :  self.product.status = self.newStatus
```

Example test programs

```
testprogram AddNewProducts{

        //Test cases are based on a multilingual online shop with two languages
        italian := new Language(name:='Italian', code:='IT');
        english := new Language(name:='English', code:='EN');


        test NewProductWithoutNames{
                np := new NewProduct(netPrice:=30,quantityOnHand:=50);
                assert non-occurrence np;
        }

        test NewProductWithoutNamesForSomeLanguages{
                //We should specify the product name in each language
                s:=new StringDT(string:='Extra Virgin Oil Jar');
                np:=new NewProduct(netPrice:=10,quantityOnHand:=50);
                new HasNewProductName(nameOfProduct:=s,
                      languageOfProduct:=english,productNameEvent:=np));
                assert non-ccurrence np;
        }

        test NewProductWithAllNamesSpecified{
                //We test a valid invocation of the event
                englishName:=new StringDT(string:='Extra Virgin Oil Jar');
                italianName:=new StringDT(string:='Giara di olio');
                np:=new NewProduct(netPrice:=10,quantityOnHand:=50);
                new HasNewProductName(nameOfProduct:=italianName,
                            languageOfProduct:=italian,productNameEvent:=np);
                new HasNewProductName(nameOfProduct:=englishName,
                            languageOfProduct:=english,productNameEvent:=np);
                assert occurrence np;
                createdProduct := Product.allInstances
                                   ->any(productInLanguage
                                   ->exists(name='Extra Virgin Oil Jar'));

                //Although postconditions are checked,
               //we ensure that we can get the product name in each language
                assert equals createdProduct.productInLanguage->any(language=english).name
                             'Extra Virgin Oil Jar';
                assert equals createdProduct.productInLanguage->any(language=italian).name
                             'Giara di olio';
        }


        test NewProductWithEqualNamesInSomeLanguages{
                //osCommerce allows the same product name for different languages
                s:=new StringDT(string:='Lemoncello');
                np:=new NewProduct(netPrice:=30,quantityOnHand:=50);
                new HasNewProductName(nameOfProduct:=s,
                    languageOfProduct:=italian,productNameEvent:=np);
                new HasNewProductName(nameOfProduct:=s,
                    languageOfProduct:=english,productNameEvent:=np);
                assert occurrence np;
        }

        test NewProductThatAlreadyExists{
                //IB state with a product
                acetoAromatizzato:=new Product(netPrice:=4, quantityOnHand:=70);
                productInItalian:=new ProductInLanguage
                                 (product:=acetoAromatizzato, language:=italian);
                productInItalian.name:='Aceto aromatizzato';
                productInEnglish:=new ProductInLanguage
                                 (product:=acetoAromatizzato, language:=english);
                productInEnglish.name:='Spicy wine vinegar';

                //The creation of a product with the same name in at least one
                //language should not occur
                italianName:=new StringDT(string:='Aceto aromatizzato');
                englishName:=new StringDT(string:='Spicy wine vinegar');
                differentName:=new StringDT(string:='AnyName');
                np:=new NewProduct(netPrice:=10,quantityOnHand:=50);
                new HasNewProductName(nameOfProduct:=italianName,
                           languageOfProduct:=italian,productNameEvent:=np);
                new HasNewProductName(nameOfProduct:=differentName,
                           languageOfProduct:=english,productNameEvent:=np);
                assert non-occurrence np;
                np2:=new NewProduct(netPrice:=10,quantityOnHand:=50);
                new HasNewProductName(nameOfProduct:=differentName,
                           languageOfProduct:=italian,productNameEvent:=np2);
                new HasNewProductName(nameOfProduct:=englishName,
                           languageOfProduct:=english,productNameEvent:=np2);
                assert non-occurrence np2;
                np3:=new NewProduct(netPrice:=10,quantityOnHand:=50);
                new HasNewProductName(nameOfProduct:=italianName,
                           languageOfProduct:=italian,productNameEvent:=np3);
                new HasNewProductName(nameOfProduct:=englishName,
                           languageOfProduct:=english,productNameEvent:=np3);
                assert non-occurrence np3;
        }
}
```

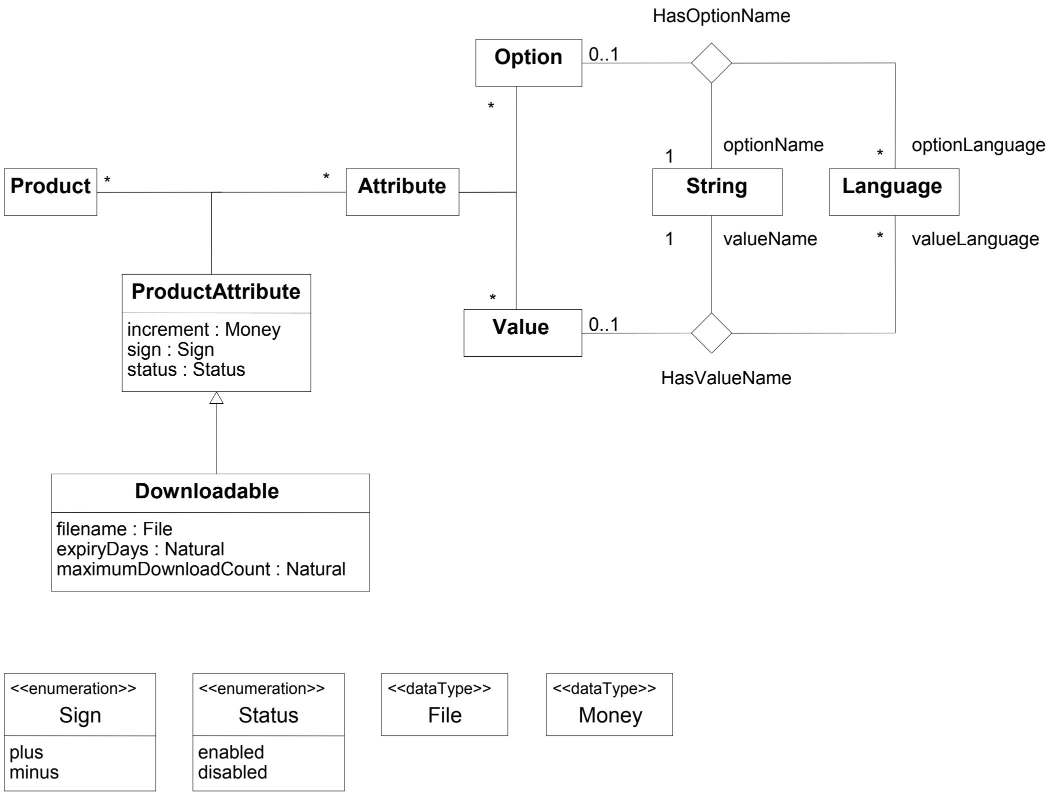
```
testprogram EditProducts{

        english := new Language(name:='English', code:='EN');
        necklace:=new Product(netPrice:=4, quantityOnHand:=70, status:=#outOfStock);
        productInEnglish:=new ProductInLanguage(product:=necklace, language:=english);
        productInEnglish.name:='Necklace';

        test EditProductStatus{
                englishName:=new StringDT(string:='Necklace');
                ep:=new EditProduct(product:=necklace,status:=#inStock,
                                netPrice:=10,quantityOnHand:=50);
                new HasNewProductName(nameOfProduct:=englishName,
                         languageOfProduct:=english,productNameEvent:=ep);
                assert occurrence ep;
                assert equals necklace.status #inStock;
        }

        test EditProductNameInALanguage{
                englishName:=new StringDT(string:='GoldNecklace');
                ep:=new EditProduct(product:=necklace,status:=#inStock,
                                netPrice:=10,quantityOnHand:=50);
                new HasNewProductName(nameOfProduct:=englishName,
                         languageOfProduct:=english,productNameEvent:=ep);
                assert occurrence ep;
        }

        test UnapplicableProductEdition{
                //IB state with a product
                goldnecklace:=new Product(netPrice:=4, quantityOnHand:=70, status:=#inStock);
                productInEnglish:=new ProductInLanguage
                                 (product:=goldnecklace, language:=english);
                productInEnglish.name:='Gold Necklace';

                //A product edition the effect of which violates the product identification
               //constraint cannot occur
                englishName:=new StringDT(string:='GoldNecklace');
                ep:=new EditProduct(product:=necklace,status:=#inStock,
                                netPrice:=10,quantityOnHand:=50);
                new HasNewProductName(nameOfProduct:=englishName,
                        languageOfProduct:=english,productNameEvent:=ep);
                assert occurrence ep;
        }
}
```

```
testprogram DeleteProduct{

        english := new Language(name:='English', code:='EN');
        necklace:=new Product(netPrice:=4, quantityOnHand:=70, status:=#outOfStock);

        productInEnglish:=new ProductInLanguage(product:=necklace, language:=english);
        productInEnglish.name:='Necklace';

        test DeleteProductNotSoldYet{
                dp:=new DeleteProduct(product:=necklace);
                assert occurrence dp;
                assert true Product.allInstances->excludes(necklace);
        }
        test DeleteSoldProduct{
                //We create an order
                ol:= new OrderLine(product:=necklace,order:=o);
                dollar:=new Currency(title:='USDollar', code:='USD');
                dos:=new OrderStatus;
                dosl:=new OrderStatusInLanguage(orderStatus:=dos, language:=english);
                dosl.name:='pending';
                osc:=new OrderStatusChange(order:=o,orderStatus:=dos);
                sm:=new FlatRate(status:=#enabled);
                pm:=new Nochex(status:=#enabled);
                usa:=new Country(name:='United States', isoCode2:='US', isoCode3:='USA');
                a:=new Address(country:=usa);
                c:=new Customer(address:=a,primary:=a);
                o:=new Order(customer:=c, currency:=dollar,
                              shippingMethod:=sm, paymentMethod:=pm);
                dp:=new DeleteProduct(product:=necklace);
                assert occurrence dp;
                assert true Product.allInstances->includes(necklace);
                assert equals necklace.status #outOfStock;
        }
}
```

Product attributes and options

Structural schema

osCommerce allows defining several attributes for each product. Product attributes are used to offer multiple options of a product.



[IC1] In each language, each product option has a unique name.

```
context Language::optionNameIsUnique(): Boolean
  body : self.hasOptionName -> isUnique(optionName)
```

[IC2] In each language, each product value has a unique name.

```
context Language::valueNameIsUnique(): Boolean
  body : self.hasOptionValue -> isUnique(valueName)
```

Use cases

Add a product option

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to add a product option to the store catalog.

Main Success Scenario:

1. The store administrator provides the product option data:

   [→*NewProductOption*]

2. The system validates that the data is correct.
3. The system saves the new product option.

Edit a product option

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to edit a product option.

Main Success Scenario:

1. The store administrator selects the product option to be edited.
2. The store administrator provides the new details of the selected product option:

   [→*EditProductOption*]

3. The system validates that the data is correct.
4. The system saves the changes.

Delete a product option

Primary Actor: Store administrator

Precondition: The product option has no associated products.

Trigger: The store administrator wants to delete a product option.

Main Success Scenario:

1. The store administrator selects the product option to be deleted.
2. The system asks for the confirmation of the store administrator.
3. The store administrator confirms that he wants to delete the product option:

   [→*DeleteProductOption*]
4. The system deletes the product option and its associated values if they are not values of other options.

Add a product option value

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to add a value to a product option.

Main Success Scenario:

1. The store administrator selects the product option.
2. The store administrator provides the product option value data:

   [→*NewProductOptionValue*]
3. The system validates that the data is correct.
4. The system saves the new product option value.

Edit a product option value

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to edit a product option value.

Main Success Scenario:

1. The store administrator selects the product option value to be edited.
2. The store administrator provides the new details of the selected product option value:

   [→*EditProductOptionValue*]
3. The system validates that the data is correct.
4. The system saves the changes.

Delete a product option value

Primary Actor: Store administrator

Precondition: The product option value has not products linked to it.

Trigger: The store administrator wants to delete a product option value.

Main Success Scenario:

1. The store administrator selects the product option value to delete.

2. The system asks for the confirmation of the store administrator.
3. The store administrator confirms that he wants to delete the product option value:

   [→*DeleteProductOptionValue*]
4. The system deletes the product option value.

Add a product attribute

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to assign an attribute to a product.

Main Success Scenario:

1. The store administrator selects the product.
2. The store administrator provides the attribute and the product attribute data (increment and sign):

   [→*NewProductAttribute*]

   [→*NewDownloadableProductAttribute*]
3. The system validates that the data is correct.
4. The system saves the new product attribute.

Extensions:

2a. The product option is new:

2a1. Add a product option.

2b. The product option value is new:

2b1. Add a product option value.

Edit a product attribute

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to edit a product attribute.

Main Success Scenario:

1. The store administrator selects the product attribute to be edited.
2. The store administrator provides the new details for the product attribute:

   [→*AttributeChange*]

   [→*IncrementAndSignAttributeChange*]

   [→*EditDownloadableAttribute*]
3. The system validates that the data is correct.
4. The system saves the changes.

The system repeats steps 2-4 until he is done.

Delete a product attribute

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to delete a product attribute.

Main Success Scenario:

1. The store administrator selects the product attribute to be deleted.
2. The system asks for the confirmation of the store administrator.
3. The store administrator confirms that he wants to delete the product attribute:

    [→*DeleteProductAttribute*]

4. The system deletes the product attribute.

Extensions:

3a. The product attribute is part of an existing order line:

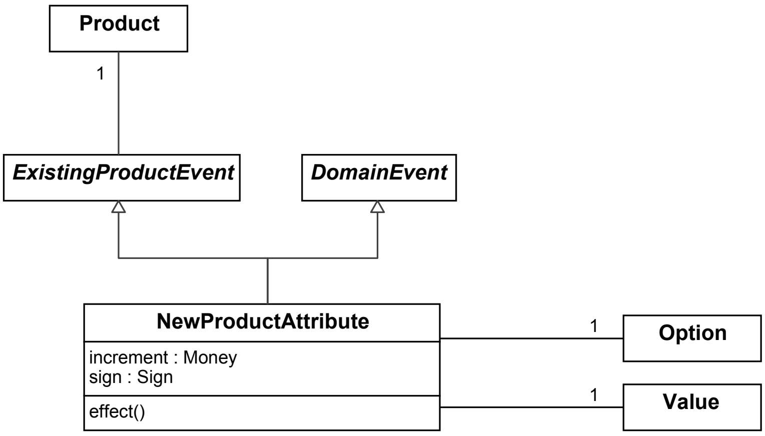
    3a1. The system changes the status of the product attribute to disable.

        [→*ProductAttributeStatusChange*]

    3a2. The use case ends

Events

NewProductAttribute

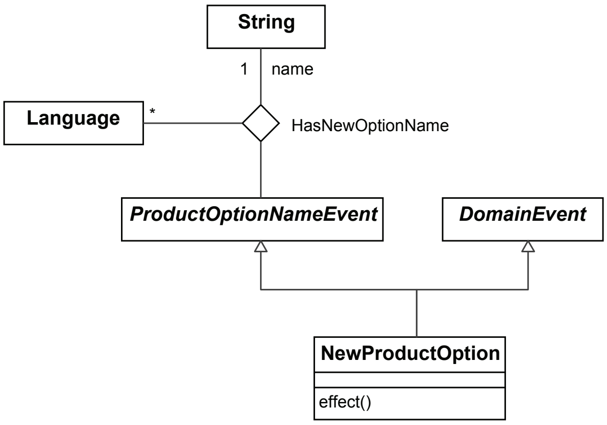


«IniIC»
context NewProductAttribute::productAttributeDoesNotExist(): Boolean
  body :
    not self.product.productAttribute ->
          exists(attribute.value=self.value **and**
            attribute.option = self.option)

«IniIC»
context NewProductAttribute::optionValueIsValid(): Boolean
  body : self.option.value -> includes(self.value)

```
context  NewProductAttribute::effect()
  post :
     pa.oclIsNew()  and
     pa.oclIsTypeOf(ProductAttribute) and
     pa.increment = self.increment and
     pa.sign = self.sign and
     pa.product = self.product and
     pa.attribute.option = self.option and
     pa.attribute.value = self.value
```

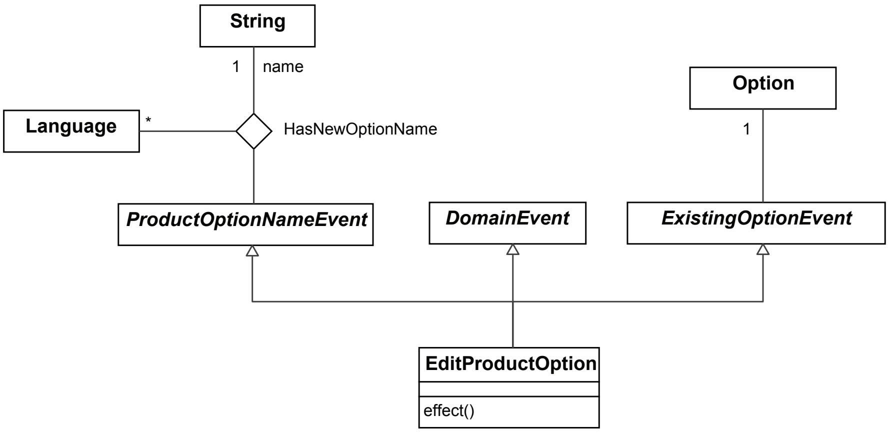
NewProductOption



«IniIC»

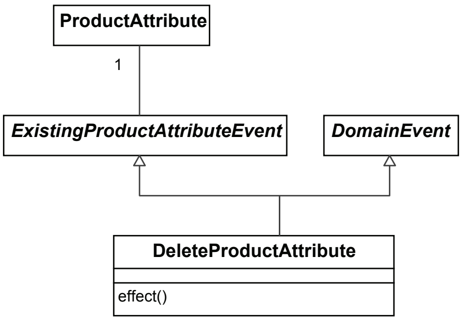
```
context NewProductOption::productOptionDoesNotExist(): Boolean
 body :
    Language.allInstances() -> forAll ( l |
           l.hasOptionName.optionName
           -> excludes(self.hasNewOptionName -> select(language=l).name))

context  NewProductOption::effect()
  post :
     po.oclIsNew()  and
     po.oclIsTypeOf(Option) and
     Language.allInstances() ->
        forAll (l| self.hasNewOptionName -> select(language=l).name =
                    po.hasOptionName->select(optionLanguage=l).optionName)
```

EditProductOption



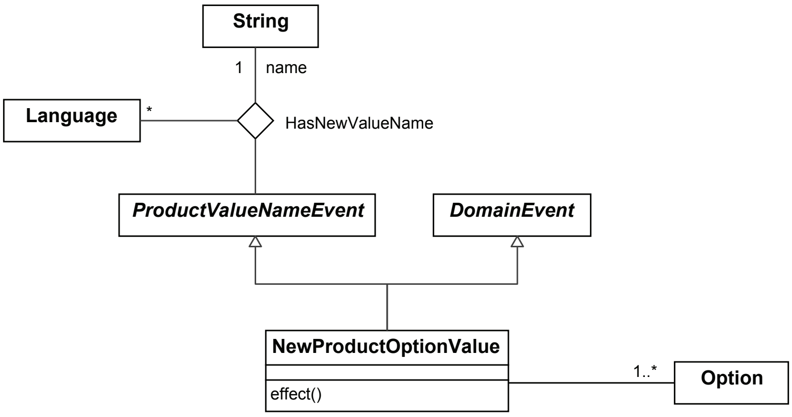
```
«IniIC»
context EditProductOptionproduct::OptionDoesNotExist(): Boolean
  body: Language.allInstances -> forAll ( l |
              l.hasOptionName.optionName
                -> excludes(self.hasNewOptionName -> any(languageOfOption=l).nameOfOption) or
               (self.hasNewOptionName->any(languageOfOption=l).nameOfOption =
                self.option.hasOptionName->any(optionLanguage=l).optionName))

context  EditProductOption::effect()
  post :
     Language.allInstances() ->
        forAll (l| self.hasNewOptionName -> select(language=l).name =
                   option.hasOptionName->select(language=l).optionName)
```

DeleteProductAttribute



```
context  DeleteProductAttribute::effect()
  post:  if OrderLineAttribute.allInstances() -> exists(ola |
              ola.attribute=productAttribute.attribute and
              ola.orderLine.product=productAttribute.product)
         then   productAttribute.status=Status::disabled
         else   ProductAttribute.allInstances->excludes(productAttribute@pre)
         endif
```

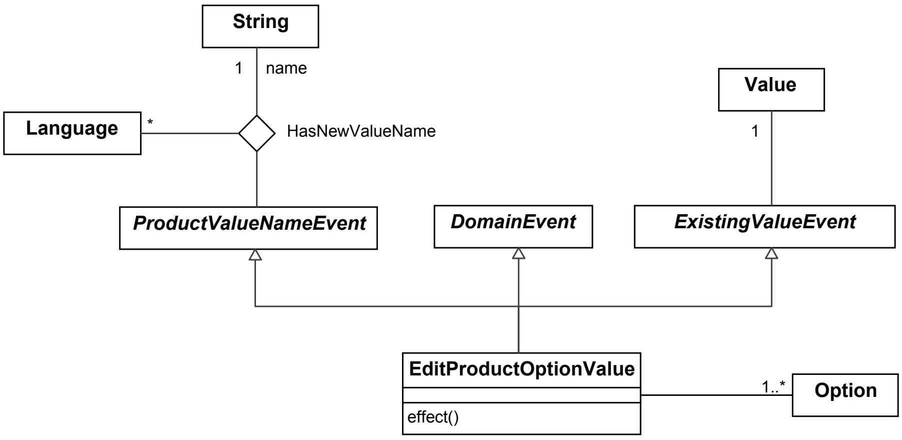
NewProductOptionValue



```
«IniIC»
context NewProductOptionValue::optionValueDoesNotExist(): Boolean
  body :
     Language.allInstances() -> forAll ( l |
          l.hasValueName.valueName
          -> excludes(self.hasNewValueName -> select(language=l).name))
```

```
context  NewProductOptionValue::effect()
  post :
     pov.oclIsNew()  and
     pov.oclIsTypeOf(Value) and
     Language.allInstances() ->
        forAll (l| self.hasNewValueName -> select(language=l).name =
                    pov.hasValueName->select(valueLanguage=l).valueName) and
     pov.option = self.option
```

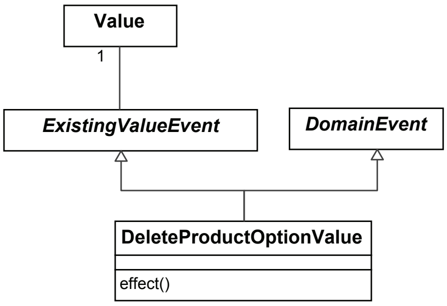
EditProductOptionValue



```
«IniIC»
context EditProductOptionValue ::productOptionValueDoesNotExist(): Boolean
  body: Language.allInstances() -> forAll ( l |
                        l.hasValueName.valueName
                         -> excludes(self.hasNewValueName -> any(language=l).name) or
                        (self.hasNewValueName->any(language=l).name =
                        self.value.hasValueName->any(valueLanguage=l).valueName))
```

```
context  EditProductOptionValue::effect()
  post :
     Language.allInstances() ->
        forAll (l| self.hasNewValueName -> select(language=l).name =
                    value.hasValueName->select(language=l).valueName) and
     self.value.option = self.option
```

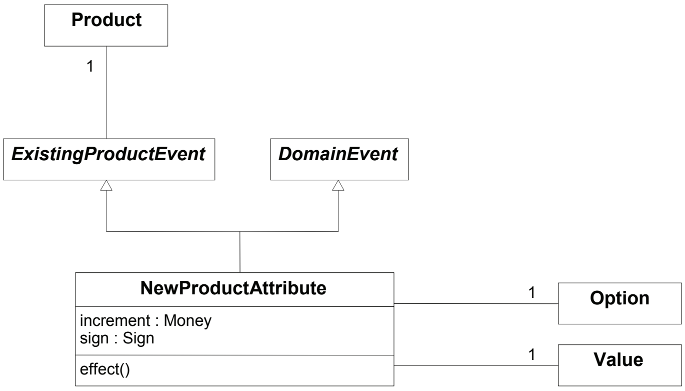
DeleteProductOptionValue



```
«IniIC»
context  DeleteProductOptionValue::HasNotProducts():Boolean
  body : self.value.attribute.product -> isEmpty() and self.value.attribute.orderLineAttribute->isEmpty()
```

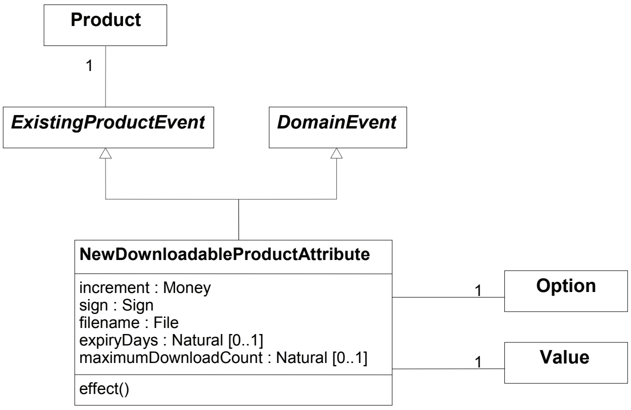
```
context  DeleteProductOptionValue::effect()
  post :  not self.value@pre.oclIsKindOf(OclAny)
```

NewProductAttribute



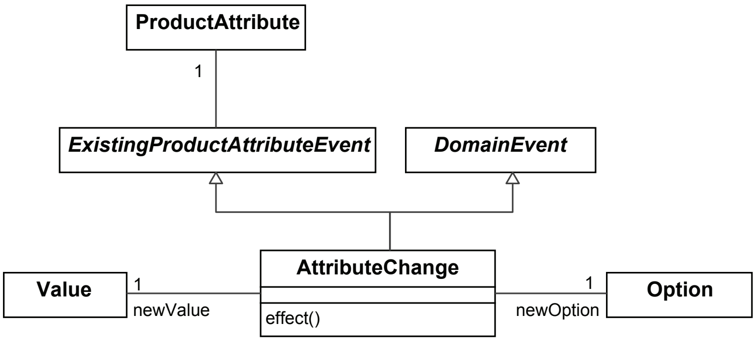
```
«IniIC»
context NewProductAttribute::productAttributeDoesNotExist(): Boolean
  body :
     not self.product.productAttribute ->
              exists(attribute.value=self.value and
                 attribute.option = self.option)

«IniIC»
context NewProductAttribute::optionValueIsValid(): Boolean
  body :  self.option.value -> includes(self.value)

context  NewProductAttribute::effect()
  post :
     pa.oclIsNew()  and
     pa.oclIsTypeOf(ProductAttribute) and
     pa.increment = self.increment and
     pa.sign = self.sign and
     pa.product = self.product and
     pa.attribute.option = self.option and
     pa.attribute.value = self.value
```

NewDownloadableProductAttribute



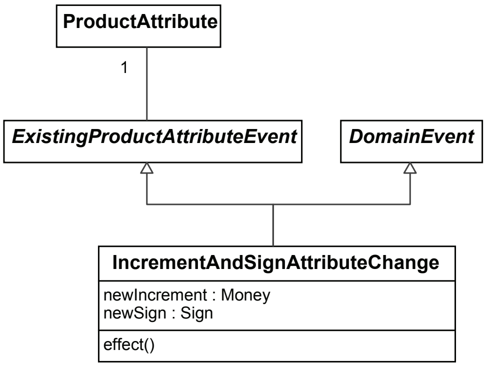
```
«IniIC»
context NewDownloadableProductAttribute::productAttributeDoesNotExist(): Boolean
  body :
    not ProductAttribute.allInstances() -> exists (pa | pa.attribute.option = self.option and
                                                         pa.attribute.value = self.value and
                                                         pa.product = self.product)

context  NewDownloadableProductAttribute::effect()
   post :
      dpa.oclIsNew()  and
      dpa.oclIsTypeOf(Downloadable) and
      dpa.increment = self.increment and
      dpa.sign = self.sign and
      dpa.filename = self.filename and
      dpa.product = self.product and
      dpa.attribute.option=self.option and
      dpa.attribute.value=self.value and
      if self.expiryDays.notEmpty() then dpa.expiryDays = self.expiryDays
      else self.expiryDays = Download.daysExpiryDelay
      endif
      and
      if self.maximumDownloadCount .notEmpty() then
         dpa.maximumDownloadCount = self.maximumDownloadCount
      else self.maximumDownloadCount = Download.maximumNumberOfDownloads
      endif
```

AttributeChange



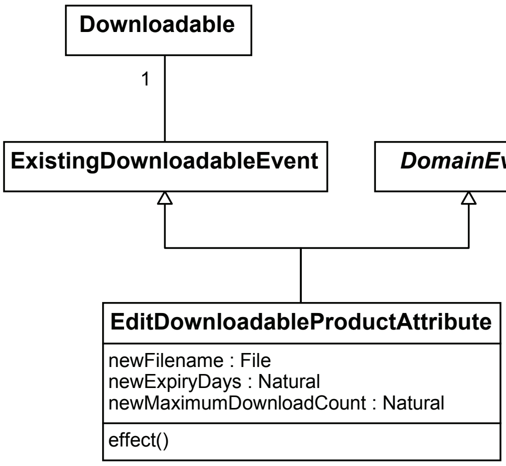
```
«IniIC»
context AttributeChange::OptionAndValueAreAValidAttribute(): Boolean
   body: Attribute.allInstances()->exists(a | a.option=self.newOption and a.value=self.newValue)

context  AttributeChange::effect()
   post :
       self.productAttribute.attribute.value = self.newValue and
       self.productAttribute.attribute.option = self.newOption
```

IncrementAndSignAttributeChange



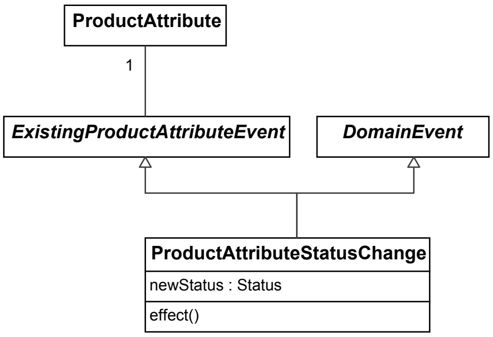
context IncrementAndSignAttributeChange::effect()
post : self.productAttribute.increment = self.newIncrement and
self.productAttribute.sign = self.newSign

EditDownloadableAttribute


Downloadable
1
ExistingDownloadableEvent
DomainEvent
EditDownloadableProductAttribute
newFilename : File
newExpiryDays : Natural
newMaximumDownloadCount : Natural
effect()

context EditDownloadableProductAttribute::effect()
post :
self.downloadable.filename = self.newFilename and
self.downloadable.expiryDays = self.newExpiryDays and
self.downloadable.maximumDownloadCount = self.newMaximumDonwloadCount

ProductAttributeStatusChange



context ProductAttributeStatusChange::effect()
post : self.productAttribute.status = self.newStatus

Example test programs

```
testprogram ProductOptionsManagement{
        catalan := new Language(name:='Catalan', code:='CAT');
        english := new Language(name:='English', code:='EN');

        fixturecomponent optionShirtSizeInitialized{
                shirtSize:=new Option;
                englishName:=new StringDT(string:='Shirt size');
                catalanName:=new StringDT(string:='Mida de samarretes');
                new HasOptionName
                    (option:=shirtSize, optionName:=englishName, optionLanguage:=english);
                new HasOptionName
                    (option:=shirtSize, optionName:=catalanName, optionLanguage:=catalan);
        }

        fixturecomponent valueSmallInitialized{
                small:=new Value;
                englishName:=new StringDT(string:='Small');
                catalanName:=new StringDT(string:='Petit');
                new HasValueName(value:=small,
                                 valueName:=englishName, valueLanguage:=english);
                new HasValueName(value:=small,
                                 valueName:=catalanName, valueLanguage:=catalan);
        }

        test NewProductOptionWithoutNamesForSomeLanguages{
                //We should specify the product option name in each language
                s:=new StringDT(string:='Size');
                npo:=new NewProductOption;
                new HasNewOptionName(nameOfOption:=s,
                           languageOfOption:=english,productOptionNameEvent:=npo);
                assert non-occurrence npo;
        }

        test NewProductOptionsWithAllNamesSpecified{
                //We test a valid invocation of the event
                englishName:=new StringDT(string:='Size');
                catalanName:=new StringDT(string:='Mida');
                npo:=new NewProductOption;
                new HasNewOptionName(nameOfOption:=catalanName,
                           languageOfOption:=catalan,productOptionNameEvent:=npo);
                new HasNewOptionName(nameOfOption:=englishName,
                           languageOfOption:=english,productOptionNameEvent:=npo);
                assert occurrence npo;
        }

        test NewProductOptionThatAlreadyExists{
                load optionShirtSizeInitialized;
                differentName:=new StringDT(string:='AnyName');
                npo:=new NewProductOption;
                new HasNewOptionName(nameOfOption:=catalanName,
                          languageOfOption:=catalan,productOptionNameEvent:=npo);
                new HasNewOptionName(nameOfOption:=differentName,
                         languageOfOption:=english,productOptionNameEvent:=npo);
                assert non-occurrence npo;

                npo2:=new NewProductOption;
                new HasNewOptionName(nameOfOption:=differentName,
                         languageOfOption:=catalan,productOptionNameEvent:=npo2);
                new HasNewOptionName(nameOfOption:=englishName,
                         languageOfOption:=english,productOptionNameEvent:=npo2);
                assert non-occurrence npo2;

                npo3:=new NewProductOption;
                new HasNewOptionName(nameOfOption:=catalanName,
                         languageOfOption:=catalan,productOptionNameEvent:=npo3);
                new HasNewOptionName(nameOfOption:=englishName,
                          languageOfOption:=english,productOptionNameEvent:=npo3);
                assert non-occurrence npo3;
        }

        test EditProductOptionWithoutNamesForSomeLanguages{
                load optionShirtSizeInitialized;
                s:=new StringDT(string:='Size');
                npo:=new EditProductOption(option:=shirtSize);
                new HasNewOptionName(nameOfOption:=s,languageOfOption:=english,
                           productOptionNameEvent:=npo))
                assert non-occurrence npo;
        }
        test EditProductOptionsWithAllNamesSpecified{
                load optionShirtSizeInitialized;
                englishName:=new StringDT(string:='Size');
                catalanName:=new StringDT(string:='Mida');
                epo:=new EditProductOption(option:=shirtSize);
                new HasNewOptionName(nameOfOption:=catalanName,
                          languageOfOption:=catalan,productOptionNameEvent:=epo);
                new HasNewOptionName(nameOfOption:=englishName,
                           languageOfOption:=english,productOptionNameEvent:=epo);
                assert occurrence epo;
        }

        test UnapplicableProductOptionEdition{
                load optionShirtSizeInitialized;
                //We add to the IB another option
                sleeveType:=new Option;
                englishName:=new StringDT(string:='Sleeve type');
                catalanName:=new StringDT(string:='Tipus de maniga');
                new HasOptionName(option:=sleeveType,
                           optionName:=englishName, optionLanguage:=english);
                new HasOptionName(option:=sleeveType,
                           optionName:=catalanName, optionLanguage:=catalan);
                assert consistency;
                differentName:=new StringDT(string:='AnyName');
                epo:=new EditProductOption(option:=shirtSize);
                new HasNewOptionName(nameOfOption:=catalanName,
                           languageOfOption:=catalan,productOptionNameEvent:=epo);
                new HasNewOptionName(nameOfOption:=differentName,
                           languageOfOption:=english,productOptionNameEvent:=epo);
                assert non-occurrence epo;
                epo2:= new EditProductOption(option:=shirtSize);
                new HasNewOptionName(nameOfOption:=differentName,
                           languageOfOption:=catalan,productOptionNameEvent:=epo2);
                new HasNewOptionName(nameOfOption:=englishName,
                           languageOfOption:=english,productOptionNameEvent:=epo2);
                assert non-occurrence epo2;
                epo3:=new EditProductOption(option:=shirtSize);
                new HasNewOptionName(nameOfOption:=catalanName,
                           languageOfOption:=catalan,productOptionNameEvent:=epo3);
                new HasNewOptionName(nameOfOption:=englishName,
                           languageOfOption:=english,productOptionNameEvent:=epo3);
                assert non-occurrence epo3;;
        }
}
```

```
testprogram DeleteProductOptions{

        shoesSize:=new Option;
        shirtSize:=new Option;
        small:=new Value;

        test deleteOptionWithoutValues{
                dpo := new DeleteProductOption(option:=shirtSize);
                assert occurrence epo;
        }

        test deleteOptionThatIsPartOfAProductAttribute{
                barcelonaTShirt:=new Product;
                smallShirt:=new Attribute(option:=shirtSize,value:=small);
                new ProductAttribute(product:=barcelonaTShirt,attribute:=smallShirt);
                dpo := new DeleteProductOption(option:=shirtSize);
                assert non-occurrence dpo;
        }

        test deleteOptionWithAssociatedValuesNotUsedInOtherOptions{
                new Attribute(option:=shirtSize,value:=small);
                dpo := new DeleteProductOption(option:=shirtSize);
                assert occurrence dpo;
                assert true Value.allInstances->excludes(small);
        }

        test deleteOptionWithAssociatedValuesUsedInOtherOptions{
                new Attribute(option:=shirtSize,value:=small);
                new Attribute(option:=shoesSize,value:=small);
                dpo := new DeleteProductOption(option:=shirtSize);
                assert occurrence dpo;
                assert true Value.allInstances->includes(small);
        }
}
```

```
testprogram ProductOptionsValuesManagement{

        catalan := new Language(name:='Catalan', code:='CAT');
        english := new Language(name:='English', code:='EN');

        shirtSize:=new Option;
        englishName:=new StringDT(string:='Shirt size');
        catalanName:=new StringDT(string:='Mida de samarretes');
        new HasOptionName(option:=shirtSize,
                          optionName:=englishName, optionLanguage:=english);
        new HasOptionName(option:=shirtSize,
                          optionName:=catalanName, optionLanguage:=catalan);

        fixturecomponent valueSmallInitialized{
                smallInEnglish:=new StringDT(string:='Small');
                smallInCatalan:=new StringDT(string:='Petit');
                small:=new Value;
                new HasValueName(value:=small,
                                 valueName:=smallInEnglish, valueLanguage:=english);
                new HasValueName(value:=small,
                                 valueName:=smallInCatalan, valueLanguage:=catalan);
        }

        test NewProductOptionValueWithoutNamesForSomeLanguages{
                //We should specify the product option name in each language and an option
                smallInEnglish:=new StringDT(string:='Small');
                npov:=new NewProductOptionValue;
                new HasNewValueName(nameOfValue:=smallInEnglish,
                      languageOfValue:=english,productValueNameEvent:=npov);
                assert non-occurrence npov;
        }

        test NewProductOptionValueWithAllNamesSpecified{
                //We test a valid invocation of the event
                smallInEnglish:=new StringDT(string:='Small');
                smallInCatalan:=new StringDT(string:='Petit');
                npov:=new NewProductOptionValue(option:=shirtSize);
                new HasNewValueName(nameOfValue:=smallInEnglish,
                       languageOfValue:=english,productValueNameEvent:=npov);
                new HasNewValueName(nameOfValue:=smallInCatalan,
                     languageOfValue:=catalan,productValueNameEvent:=npov);
                assert occurrence npov;
        }

        test NewProductOptionValueThatAlreadyExists{
                //IB state with a product option value
                load valueSmallInitialized;
                smallInEnglish:=new StringDT(string:='Small');
                smallInCatalan:=new StringDT(string:='Petit');
                //The creation of a product option value with the same name in at least one
               //language should not occur
                differentName:=new StringDT(string:='AnyName');
                npov1:=new NewProductOptionValue(option:=shirtSize);
                new HasNewValueName(nameOfValue:=smallInCatalan,
                          languageOfValue:=catalan,productValueNameEvent:=npov1);
                new HasNewValueName(nameOfValue:=differentName,
                          languageOfValue:=english,productValueNameEvent:=npov1);
                assert non-occurrence npov1;
                npov2:=new NewProductOptionValue(option:=shirtSize);
                new HasNewValueName(nameOfValue:=differentName,
                          languageOfValue:=catalan,productValueNameEvent:=npov2);
                new HasNewValueName(nameOfValue:=smallInEnglish,
                          languageOfValue:=english,productValueNameEvent:=npov2);
                assert non-occurrence npov2;
                npov3:=new NewProductOptionValue(option:=shirtSize);
                new HasNewValueName(nameOfValue:=smallInCatalan,
                          languageOfValue:=catalan,productValueNameEvent:=npov3);
                new HasNewValueName(nameOfValue:=smallInEnglish,
                          languageOfValue:=english,productValueNameEvent:=npov3);
               assert non-occurrence npov3;
        }

        test EditProductOptionValueWithoutNamesForSomeLanguages{
                //We should specify the product Value name in each language
                load valueSmallInitialized;
                s:=new StringDT(string:='Small');
                epov:=new EditProductOptionValue(option:=shirtSize, value:=small);
                new HasNewValueName(nameOfValue:=s,
                           languageOfValue:=english,productValueNameEvent:= epov);
                assert non-occurrence epov;
        }

        test EditProductValuesWithAllNamesSpecified{
                load valueSmallInitialized;
                smallInEnglish:=new StringDT(string:='Small');
                smallInCatalan:=new StringDT(string:='Petit');
                //We test a valid invocation of the event
                epov:=new EditProductOptionValue(option:=shirtSize,value:=small);
                new HasNewValueName(nameOfValue:=smallInCatalan,
                           languageOfValue:=catalan,productValueNameEvent:=epov);
                new HasNewValueName(nameOfValue:=smallInEnglish,
                           languageOfValue:=english,productValueNameEvent:=epov);
                assert occurrence epov;
        }

        test UnapplicableProductValueEdition{
                load valueSmallInitialized;
                //We add to the IB another Value
                large:=new Value;
                englishName:=new StringDT(string:='Large');
                catalanName:=new StringDT(string:='Gran');
                new HasValueName(value:=large,
                                 valueName:=englishName, valueLanguage:=english);
                new HasValueName(value:=large,
                                 valueName:=catalanName, valueLanguage:=catalan);
                assert consistency;
                differentName:=new StringDT(string:='AnyName');
                epov:=new EditProductOptionValue(value:=small,option:=shirtSize);
                new HasNewValueName(nameOfValue:=catalanName,languageOfValue:=catalan,
                                 productValueNameEvent:=epov);
                new HasNewValueName(nameOfValue:=differentName,languageOfValue:=english,
                                 productValueNameEvent:=epov);
                assert non-occurrence epov;
                epov:=new EditProductOptionValue(value:=small,option:=shirtSize);
                new HasNewValueName(nameOfValue:=differentName,
                                 languageOfValue:=catalan,productValueNameEvent:=epov);
                new HasNewValueName(nameOfValue:=englishName,
                                 languageOfValue:=english,productValueNameEvent:= epov);
                assert non-occurrence epov;
                epov:=new EditProductOptionValue(value:=small,option:=shirtSize);
                new HasNewValueName(nameOfValue:=catalanName,
                            languageOfValue:=catalan,productValueNameEvent:= epov);
                new HasNewValueName(nameOfValue:=englishName,
                            languageOfValue:=english,productValueNameEvent:=epov);
                assert non-occurrence epov;
        }
}

testprogram DeleteProductOptionsValues{
        shoesSize:=new Option;
        shirtSize:=new Option;
        small:=new Value;

        fixturecomponent barcelonaTShirtInitialized{
                barcelonaTShirt:=new Product;
                smallShirt:=new Attribute(option:=shirtSize,value:=small);
                barcelonaSmallTShirt:=new ProductAttribute
                             (product:=barcelonaTShirt,attribute:=smallShirt);
        }

        test deleteValueNotUsed{
                dpov:=new DeleteProductOptionValue(value:=small);
                assert occurrence dpov;
        }

        test deleteValueOfTwoOptions{
                small.option:=shoesSize,shirtSize;
                dpov:=new DeleteProductOptionValue(value:=small);
                assert occurrence dpov;
        }

        test deleteValueThatIsPartOfAProductAttribute{
                load barcelonaTShirtInitialized;
                dpov:=new DeleteProductOptionValue(value:=small);
                assert non-occurrence dpov;
        }

        test deleteValueThatIsPartOfAnOrder{
                load barcelonaTShirtInitialized;
                //We create an order
                o:= new Order;
                ol:= new OrderLine(product:=barcelonaTShirt,order:=o);
                euro:=new Currency;
                o.currency:=euro;
                dos:=new OrderStatus;
                osc := new OrderStatusChange(order:=o,orderStatus:=dos);
                sm:= new FlatRate(status:=#enabled);
                pm:= new Nochex(status:=#enabled);
                o.shippingMethod:=sm;
                o.paymentMethod:=pm;
                usa:=new Country;
                a:= new Address(country:=usa);
                c := new Customer(address:=a,primary:=a);
                o.customer:=c;
                ola:=new OrderLineAttribute(attribute:=smallShirt, orderLine:=ol);
                //We cannot delete a value wich is part of an attribute of an order...
                dpov:=new DeleteProductOptionValue(value:=small);
                assert non-occurrence dpov;
                delete barcelonaSmallTShirt;
                assert consistency;
                //...although the product attribute is not offered
                dpov:=new DeleteProductOptionValue(value:=small);
                assert non-occurrence dpov;
        }
}
```

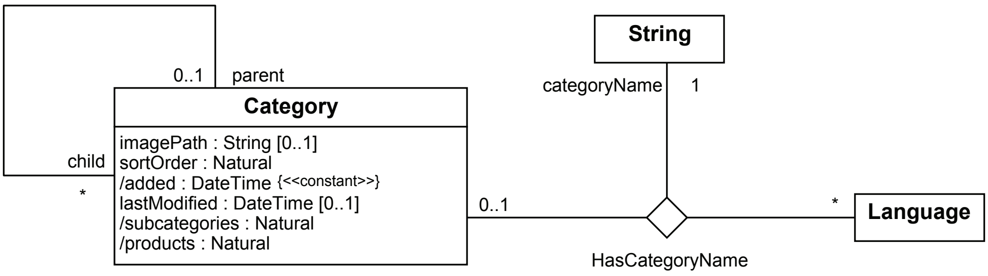
```
testprogram ProductOptionsManagement{
        edition:=new Option; version:=new Option;
        special:=new Value;
        specialWithDirectorComments:=new Value;
        catalan:=new Value;
        vickyCristinaBarcelonaDVD:=new Product(netPrice:=20);
        specialEdition:=new Attribute(option:=edition,value:=special);
        specialWithCommentsEdition:=new Attribute
```

```
                       (option:=edition,value:=specialWithDirectorComments);
        catalanVersion:=new Attribute(option:=version,value:=catalan);

        fixturecomponent vickyCristinaBarcelonaSpecialDVDEditionInitialize{
                vcbSpecialDVDEdition:=new ProductAttribute
                       (product:=vickyCristinaBarcelonaDVD, attribute:=specialEdition);
                vcbSpecialDVDEdition.increment:=3;
                vcbSpecialDVDEdition.sign:=#plus;
        }

        test NewProductAttributeWithValidOptionValuePair{
                npa := new NewProductAttribute
                     (product:=vickyCristinaBarcelonaDVD,option:=edition,
                      value:=special, increment:=3,sign:=#plus);
                assert occurrence npa;
        }

        test NewProductAttributeWithInvalidOptionValuePair{
                npa := new NewProductAttribute(product:=vickyCristinaBarcelonaDVD,
                      option:=edition, value:=catalan,
                      increment:=3,sign:=#plus);
                assert non-occurrence npa;
        }

        test NewProductAttributeThatAlreadyExists{
                load vickyCristinaBarcelonaSpecialDVDEditionInitialize;
                //If a product attribute with the same option and value already exists in the
                //IB, the event NewProduct Attribute should not occur
                npa:=new NewProductAttribute(product:=vickyCristinaBarcelonaDVD,
                                             option:=edition,
                                             value:=special,increment:=5,sign:=#minus);
                assert non-occurrence dpov;
        }

        test EditProductAttribute{
                load vickyCristinaBarcelonaSpecialDVDEditionInitialize;
                ac:=new AttributeChange
                      (productAttribute:=vcbSpecialDVDEdition,
                       newValue:=specialWithDirectorComments, newOption:=edition);
                assert occurrence ac;
        }

        test EditIncrementAndSign{
                load vickyCristinaBarcelonaSpecialDVDEditionInitialize;
                isac:=new IncrementAndSignAttributeChange
                       (productAttribute:=vcbSpecialDVDEdition,
                       newIncrement:=5,newSign:=#plus);
                assert occurrence isac;
        }

        test InvalidEditProductAttribute{
                load vickyCristinaBarcelonaSpecialDVDEditionInitialize;
                vcbCatalanVersion:=new ProductAttribute(product:=vickyCristinaBarcelonaDVD,
                        attribute:=catalanVersion);
                ac:=new AttributeChange(productAttribute:=vcbCatalanVersion,
                        newValue:=catalan, newOption:=edition);
                assert non-occurrence ac;
        }

        test DeleteProductAttributeNotUsedInAnyOrder{
                load vickyCristinaBarcelonaSpecialDVDEditionInitialize;
                dpa:=new DeleteProductAttribute(productAttribute:=vcbSpecialDVDEdition);
                assert occurrence dpa;
                assert true ProductAttribute.allInstances->size()=0;
        }

        test DeleteProductAttributUsedInAnOrder{
                load vickyCristinaBarcelonaSpecialDVDEditionInitialize;
                //We create an order
                o:=new Order;
                ol:=new OrderLine(product:=vickyCristinaBarcelonaDVD,order:=o);
                euro:=new Currency;
                o.currency:=euro;
                dos:=new OrderStatus;
                osc:=new OrderStatusChange(order:=o,orderStatus:=dos);
                sm:=new FlatRate(status:=#enabled);
                pm:=new Nochex(status:=#enabled);
                o.shippingMethod:=sm;
                o.paymentMethod:=pm;
                spain:=new Country;
                a:=new Address(country:=spain);
                c:=new Customer(address:=a,primary:=a);
                o.customer:=c;
                ola:=new OrderLineAttribute(attribute:=specialEdition, orderLine:=ol);
                dpa := new DeleteProductAttribute(productAttribute:=vcbSpecialDVDEdition);
                assert occurrence dpa;
                assert true ProductAttribute.allInstances->includes(vcbSpecialDVDEdition);
                assert equals vcbSpecialDVDEdition.status #disabled;
        }
}
```

Product categories

Structural schema

Products are grouped into categories which are arranged hierarchically.



context Category **def:**
allParents() : Set(Category) = self.parent -> union(self.parent.allParents())

[DR1] *Category::**added*** is the *DateTime* of category creation.

context Category::added():DateTime
body : Now()

[DR2] *Category::**subcategories*** is the number of subcategories owned by the category.

context Category::subcategories(): Natural
body : self.child -> size()

[DR3] *Category::**products*** is the number of products owned by the category.

context Category::products(): Natural
body : Category.allInstances() -> select(c | c.allParents() -> includes(self)) ->union(Set{self}).product -> size()

[IC1] In each language, each category has a unique name.

context Language::categoryNameIsUnique(): Boolean
body : self.hasCategoryName -> isUnique(name)

[IC2] There are no cycles in category hierarchy.

context Category::isAHierarchy(): Boolean
body : not self.allParents() -> includes(self)

Use cases

Add a product category

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to add a category.

Main Success Scenario:

1. The store administrator provides the details of the new product category, including its parent category, if any:
   [→*NewCategory*]
2. The system validates that the data is correct.
3. The system saves the new category.

Edit a product category

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to edit a category.

Main Success Scenario:

1. The store administrator selects the category to be edited.
2. The store administrator provides the new details of the selected category:
   [→*EditCategory*]
3. The system validates that the data is correct.
4. The system saves the changes.

Move a product category

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to change the placement of a category in the category hierarchy.

Main Success Scenario:

1. The store administrator selects the category to be moved.
2. The store administrator indicates the new parent category, if any:
   [→*MoveCategory*]
3. The system validates that the data is correct.
4. The system saves the new placement.

Delete a product category

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to delete a category.

Main Success Scenario:

1. The store administrator selects the category to be deleted.
2. The system warns the store administrator of the number of subcategories and products linked to the category to be deleted.
3. The store administrator confirms that he wants to delete the category:

   [→*DeleteCategory*]

4. The system deletes the selected category and its subcategories. The products linked to the deleted category or its subcategories are removed from the system if they do not participate in any orders. The system changes the status of the products which participate in orders to out of stock.

Move a product

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to change the category of a product.

Main Success Scenario:

1. The store administrator selects the product to be moved.
2. The store administrator indicates the new category of the selected product, if any:

   [→*MoveProduct*]

3. The system validates that the data is correct.
4. The system saves the new placement.

Link a product

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to link a product to another category.

Main Success Scenario:

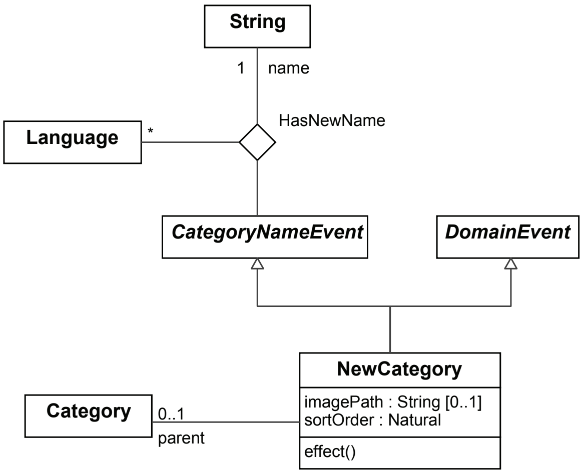
1. The store administrator selects the product to be linked.
2. The store administrator indicates the new category of the selected product, if any :

   [→*LinkProduct*]

3. The system links the product.

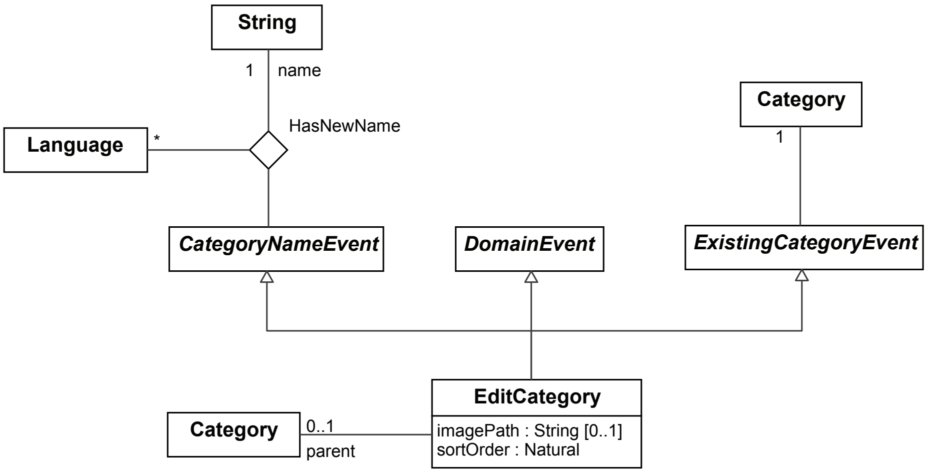
Events

NewCategory



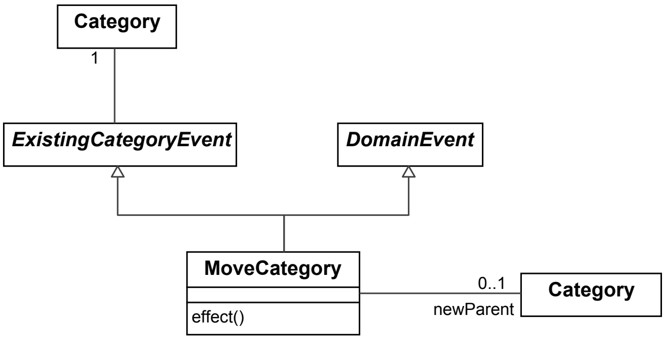
```
«IniIC»
context NewCategory::categoryDoesNotExist(): Boolean
  body :  Language.allInstances() -> forAll ( l |
              l.hasCategoryName.categoryName ->
              excludes(self.hasNewName->select(language=l)->any(true).name))


context  NewCategory::effect()
   post :
       c.oclIsNew()  and
       c.oclIsTypeOf(Category) and
       c.imagePath = self.imagePath and
       c.sortOrder = self.sortOrder and
       c.parent = self.parent and
       Language.allInstances() ->
          forAll (l| self.hasNewName -> select(language=l).name =
                          c.hasCategoryName->select(language=l).categoryName)
```

EditCategory



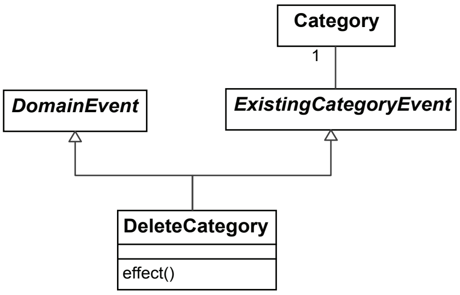
```
«IniIC»
context EditCategory::categoryDoesNotExist():Boolean
  body:  Language.allInstances -> forAll ( l |
         l.hasCategoryName.categoryName.string
         -> excludes(self.hasNewName -> any(language=l).name) or
         (self.hasNewName->any(language=l).name =
         self.category.hasCategoryName->any(language=l).categoryName))

«IniIC»
context EditCategory::cyclesDoNotAppear():Boolean
            self.category.allParents()->union(Set{self.newParent})->excludes(self.category)

context  EditCategory::effect()
   post :
      self.category.imagePath = self.imagePath and
      self.category.sortOrder = self.sortOrder and
      self.category.parent = self.parent and
      Language.allInstances() ->
         forAll(l |

            self.hasNewName->select(language=l)->any(true).name=
            self.category.hasCategoryName->select(language=l).categoryName)
   post :
      self.category.lastModified = Now()
```

MoveCategory



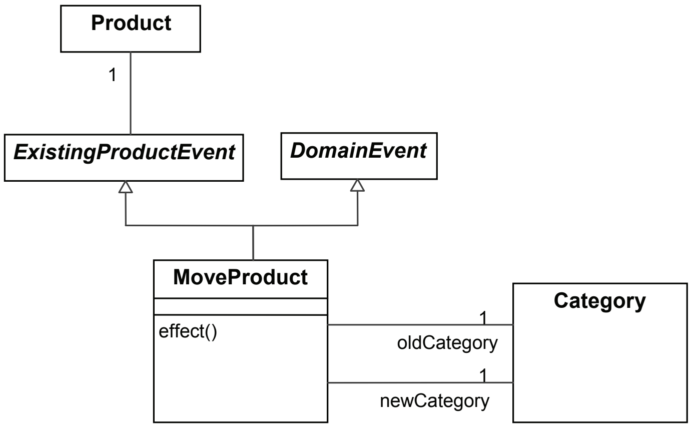
```
«IniIC»
context MoveCategory::cyclesDoNotAppear():Boolean
            self.newParent.allParents()->excludes(self.category)

context  MoveCategory::effect()
   post :  self.category.parent = self.newParent
```

DeleteCategory



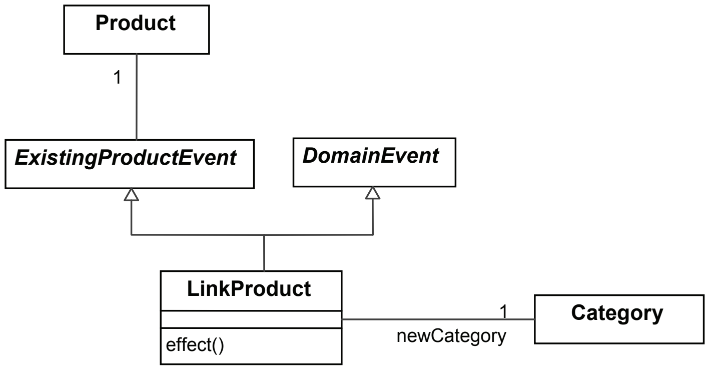
```
context  DeleteCategory::effect()
  post  deleteCategoryAndSubcategories:
        Category.allInstances->excludes(self.category@pre) and
        self.allChilds(category@pre) -> forAll(c | Category.allInstances->excludes(c))
post  deleteProductsOfCategory:
      self.category@pre.product@pre -> forAll(p |
        if p.orderLine -> notEmpty() then p.status = ProductStatus::outOfStock
        else p@pre.oclIsKindOf(OclAny)
        endif )
  post  deleteProductsOfChildCategory:
      self.category@pre.child@pre.product@pre -> forAll(p |
        if p.orderLine -> notEmpty() then p.status = ProductStatus::outOfStock
        else p.oclIsKindOf(OclAny)
        endif )
```

MoveProduct



```
«IniIC»
context  MoveProduct::oldCategoryIsValid(): Boolean
   body: product.category->includes(self.oldCategory)

context MoveProduct::effect()
  post:  self.product.category -> includes(self.newCategory) and
         self.product.category -> excludes(self.oldCategory)
```

LinkProduct



```
context LinkProduct::effect()
  post:  self.product.category -> includes(self.newCategory)
```

Example test programs

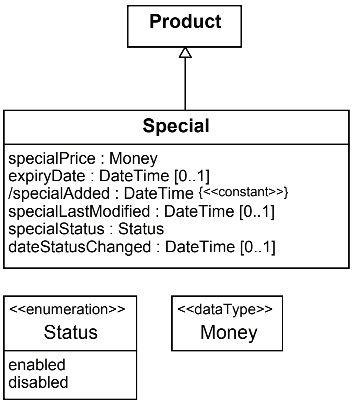
```
testprogram ProductCategoriesManagement{
        //Test cases are based on a multilingual online shop with two languages
        italian := new Language(name:='Italian', code:='IT');
        english := new Language(name:='English', code:='EN');

        fixturecomponent woodenToysCategoryInitialized{
                woodenToysInEnglish:=new StringDT(string:='Wooden toys');
                woodenToysInItalian:=new StringDT(string:='Giocattoli di legno');
                woodenToys:=new Category;
                new HasCategoryName(category:=woodenToys, categoryName:=woodenToysInEnglish,
                            language:=english);
                new HasCategoryName(category:=woodenToys, categoryName:=woodenToysInItalian,
                            language:=italian);
        }

        fixturecomponent gamesCategoryInitialized{
                gamesInEnglish:=new StringDT(string:='Games');
                gamesInItalian:=new StringDT(string:='Giocci di societa');
                games:=new Category;
                new HasCategoryName(category:=games, categoryName:=gamesInEnglish,
                            language:=english);
                new HasCategoryName(category:=games, categoryName:=gamesInItalian,
                            language:=italian);
        }

        test NewCategory{
                //We should specify the product option name in each language and an option
                gamesInEnglish:=new StringDT(string:='Games');
                gamesInItalian:=new StringDT(string:='Giocci di societa');
                nc:=new NewCategory;
                new HasNewName(name:=gamesInEnglish,
                            languageOfCategory:=english,categoryNameEvent:=nc);
                new HasNewName(name:=gamesInItalian,languageOfCategory:=italian,
                            categoryNameEvent:=nc);
                assert occurrence nc;
        }

        test NewSubcategory{
                load woodenToysCategoryInitialized;
                //We should specify the product option name in each language and an option
                trainsInEnglish:=new StringDT(string:='Trains');
                trainsInItalian:=new StringDT(string:='Trenini');
                nc:=new NewCategory(parent:=woodenToys);
                new HasNewName(name:=trainsInEnglish,languageOfCategory:=english,
                             categoryNameEvent:=nc);
                new   HasNewName(name:=trainsInItalian,languageOfCategory:=italian,
                             categoryNameEvent:=nc);
                assert occurrence nc;
        }

        test EditCategory{
                load woodenToysCategoryInitialized;
                trainsInEnglish:=new StringDT(string:='Trains');
                trainsInItalian:=new StringDT(string:='Trenini');
                nc:=new NewCategory(parent:=woodenToys);
                new HasNewName(name:=trainsInEnglish,languageOfCategory:=english,
                             categoryNameEvent:=nc);
                new HasNewName(name:=trainsInItalian,languageOfCategory:=italian,
                             categoryNameEvent:=nc);
                assert occurrence nc;
                ec:=new EditCategory(category:=woodenToys);
                new HasNewName(name:=trainsInEnglish,languageOfCategory:=english,
                             categoryNameEvent:=ec);
                new HasNewName(name:=woodenToysInItalian,languageOfCategory:=italian,
                             categoryNameEvent:=ec);
                assert non-occurrence ec;
        }
        test EditCategoryCausingACycle{
                load woodenToysCategoryInitialized;
                woodenToysInEnglish:=new StringDT(string:='Wooden toys');
                woodenToysInItalian:=new StringDT(string:='Giocattoli di legno');
                ec:=new EditCategory(category:=woodenToys,newParent:=woodenToys);
                new HasNewName(name:=woodenToysInEnglish,languageOfCategory:=english,
                                 categoryNameEvent:=ec);
                new HasNewName(name:=woodenToysInItalian,languageOfCategory:=italian,
                                  categoryNameEvent:=ec);
                assert non-occurrence ec;
        }

        test MoveCategory{
                load woodenToysCategoryInitialized;
                load gamesCategoryInitialized;
                mc:=new MoveCategory(category:=games,newParent:=woodenToys);
                assert occurrence mc;
                assert equals games.parent woodenToys;
        }

        test MoveCategoryCausingCycles{
                load woodenToysCategoryInitialized;
                load gamesCategoryInitialized;
                games.parent:=woodenToys;
                trainsInEnglish:=new StringDT(string:='Trains');
                trainsInItalian:=new StringDT(string:='Trenini');
                nc:=new NewCategory(parent:=games);
                new HasNewName(name:=trainsInEnglish,languageOfCategory:=english,
                                 categoryNameEvent:=nc);
                new HasNewName(name:=trainsInItalian,languageOfCategory:=italian,
                                 categoryNameEvent:=nc);
                assert occurrence nc;
                trains:=HasCategoryName.allInstances
                                 ->any(categoryName=trainsInEnglish).category;
                mc:=new MoveCategory(category:=woodenToys,newParent:=trains);
                assert non-occurrence mc;
        }

        test DeleteCategoryWithoutSubcategories{
                load woodenToysCategoryInitialized;
                dc:=new DeleteCategory(category:=woodenToys) occurs;
        }

        test DeleteCategoryWithSubcategories{
                load woodenToysCategoryInitialized;
                load gamesCategoryInitialized;
                mc:=new MoveCategory(category:=games,newParent:=woodenToys);
                assert occurrence mc;
                dc:=new DeleteCategory(category:=woodenToys);
                assert occurrence dc;
                assert true Category.allInstances->excludes(woodenToys);
                assert true Category.allInstances->excludes(games);
        }
}
```

```
testprogram ProductMovementsInCategories{

        p := new Product;
        c1 := new Category;
        c2 := new Category;
        c3 := new Category;

        test MoveBetweenCategories{
                p.category:=c1;
                mp:=new MoveProduct(product:=p, oldCategory:=c1, newCategory:=c2);
                assert occurrence mp;
                assert equals p.category Set{c2};
        }

        test InvalidMoveBetweenCategories{
                mp:=new MoveProduct(product:=p, oldCategory:=c1, newCategory:=c2);
                assert non-occurrence mp;
        }
        test LinkProduct{
              /*Link a product makes possible to assign a product
                to more than one categories
                LinkProduct add categories of a product
                preserving the already assigned categories*/
                p.category:=c1;
                lp:=new LinkProduct(product:=p, newCategory:=c2);
                assert occurrence lp;
                assert equals p.category Set{c2,c1};
        }

        test SubcategoriesAndProductsDerivedInformation{
                //We add two new products to the IB
                p2:=new Product;
                p3:=new Product;
                //We establish the categories hierarchy
                c1.child:=Set{c2,c3};
                //We organize products
                c1.product:=p;
                c2.product:=Set{p2,p3};
                //We materialize the derived attributes
                c1._subcategories:=2;
                c2._subcategories:=0;
                c3._subcategories:=0;
                c1._products:=3;
                c2._products:=2;
                c3._products:=0;
                assert consistency;
        }
}
```

Specials

Structural schema

osCommerce allows offering specials. That is, lower prices for a set of products can be offered during a specific time period.


Product
Special
specialPrice : Money
expiryDate : DateTime [0..1]
/specialAdded : DateTime {<<constant>>}
specialLastModified : DateTime [0..1]
specialStatus : Status
dateStatusChanged : DateTime [0..1]
<<enumeration>>
Status
enabled
disabled
<<dataType>>
Money

[DR1] *Special::**added*** is the *DateTime* when the special was created

context Special::added():DateTime
body : Now()

Add a special

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to add a special.

Main Success Scenario:

1. The store administrator selects the product which will be offered in a special price.
2. The store administrator provides the details of the special:

   [→*NewSpecial*]
3. The system validates that the data is correct.
4. The system saves the new special.

Edit a special

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to edit a special.

Main Success Scenario:

1. The store administrator selects the special to be edited.
2. The store administrator provides the new details of the selected special:

   [→*EditSpecial*]
3. The system validates that the data is correct.
4. The system saves the changes.

Delete a special

Primary Actor: Store administrator

Precondition: None.

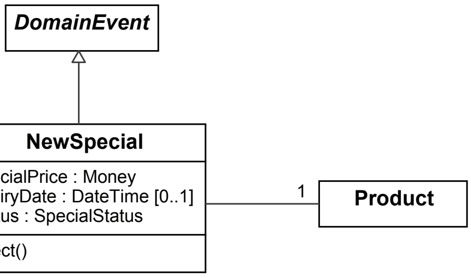
Trigger: The store administrator wants to delete a special.

Main Success Scenario:

1. The store administrator selects the special to be deleted.
2. The system asks for the confirmation of the store administrator.
3. The store administrator confirms that he wants to delete the special:

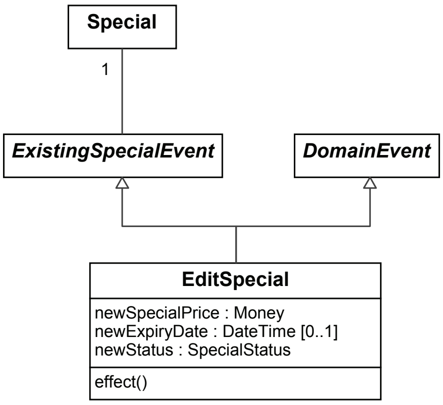
   [→*DeleteSpecial*]
4. The system deletes the special.

NewSpecial



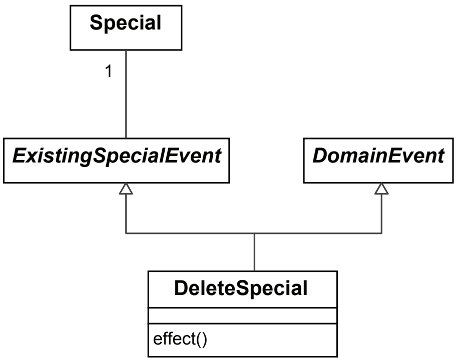
context NewSpecial::effect()
  post :
    self.product.oclIsTypeOf(Special) and
    self.product.oclAsTypeOf(Special).specialPrice=self.specialPrice and
    self.product.oclAsTypeOf(Special).expiryDate=self.expiryDate and
    self.product.oclAsTypeOf(Special).status=self.status

EditSpecial



context EditSpecial::effect()
  post :
    self.special.specialPrice = self.newSpecialPrice and
    self.special.expiryDate = self.newExpiryDate and
    self.special.status = self.newStatus
  post :
    self.special.lastModified = Now()
  post :
    self.special@pre.status <> self.newStatus implies
    self.special.dateStatusChanged = Now()

DeleteSpecial



```
context DeleteSpecial::effect()
   post :
               Special.allInstances()->excludes(special@pre)  and
               (Product.allInstances() - Product.allInstances()@pre) -> one(p:Product |
                         p.status = special@pre.status@pre and
                         p.available = special@pre.available@pre and
                         p.netPrice = special@pre.netPrice@pre and
                         p.quantityOnHand = special@pre.quantityOnHand@pre and
                         p.model = special@pre.model@pre and
                         p.imagePath = special@pre.imagePath@pre and
                         p.weight = special@pre.weight@pre and
                                    p.category = special@pre.category@pre and
                         p.manufacturer = special@pre.manufacturer@pre and
                         p.taxClass = special@pre.taxClass@pre and
                         p.lastModified=Now() and
                         Language.allInstances ->
                                    forAll (l|
                                      special@pre.productInLanguage->select(language=l).name =
                                     p.productInLanguage->select(language=l).name))
```

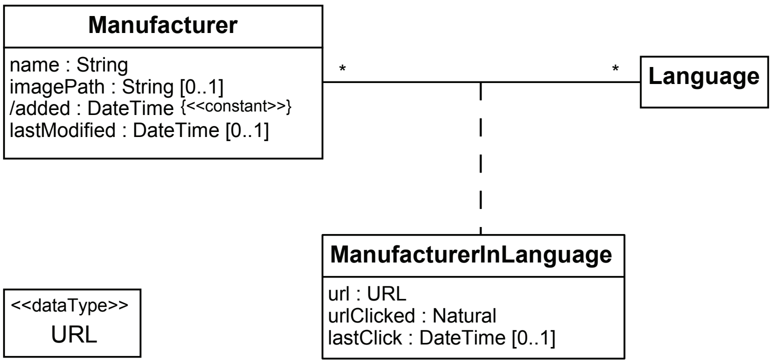
Example test program

```
testprogram SpecialsManagement{

        skypePhone:=new Product(netPrice:=90);

        test AddEditAndDeleteSpecials{
                ns:=new NewSpecial(product:=skypePhone,specialPrice:=60,status:=#disabled);
                assert occurrence ns;
                assert true ns.product.specialNetPrice().isUndefined();
                es:=new EditSpecial(special:=ns.product,newSpecialPrice:=60,
                                    newStatus:=#enabled);
                assert occurrence es;
                assert equals ns.product.specialNetPrice() 60;
                es:=new EditSpecial(special:=ns.product,newSpecialPrice:=55,
                                    newStatus:=#enabled);
                assert occurrence es;
                assert equals ns.product.specialNetPrice() 55;
                specialProduct:=ns.product;
                ds:=new DeleteSpecial(special:=specialProduct);
                assert occurrence ds;
                assert true ns.product.specialNetPrice().isUndefined();
        }
}
```

Manufacturers

Structural schema

In *osCommerce*, the products in the store are manufactured by manufacturers.


Manufacturer
name : String
imagePath : String [0..1]
/added : DateTime {<<constant>>}
lastModified : DateTime [0..1]
*
*
Language
ManufacturerInLanguage
url : URL
urlClicked : Natural
lastClick : DateTime [0..1]
<<dataType>>
URL

[DR1] *Manufacturer::**added*** is the *DateTime* when the *Manufacturer* was created.

context Manufacturer::added():DateTime
 body : Now()

[IC1] A manufacturer is identified by its name

context Manufacturer::nameIsUnique(): Boolean
 body : Manufacturer.allInstances() -> isUnique(name)

[IC2] Each manufacturer must have a URL in each language

context Manufacturer::aURLInEachLanguage(): Boolean
 body : self.language ->size() = Language.allInstances() -> size()

Use cases

Add a manufacturer

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to add a manufacturer.

Main Success Scenario:

1. The store administrator provides the details of the new manufacturer:

   [→*NewManufacturer*]

2. The system validates that the data is correct.
3. The system saves the new manufacturer.

Edit a manufacturer

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to edit a manufacturer.

Main Success Scenario:

1. The store administrator selects the manufacturer to be edited.
2. The store administrator provides the new details of the selected manufacturer:

   [→*EditManufacturer*]
3. The system validates that the data is correct.
4. The system saves the changes.

Delete a manufacturer

Primary Actor: Store administrator

Precondition: None.

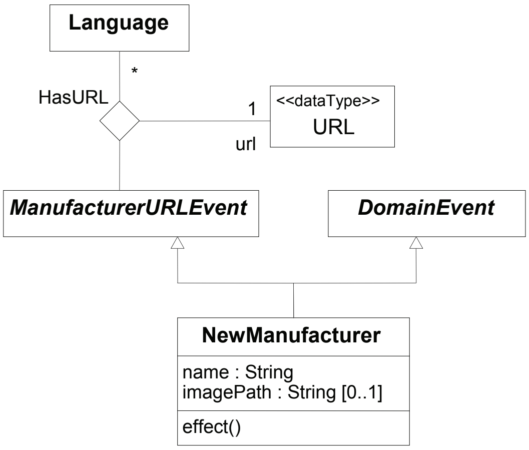
Trigger: The store administrator wants to delete a manufacturer.

Main Success Scenario:

1. The store administrator selects the manufacturer to delete.
2. The system warns the store administrator of the number of products linked to the manufacturer to be deleted.
3. The store administrator confirms that he wants to delete the manufacturer:

   [→*DeleteManufacturer*]
4. The system deletes the manufacturer and, if requested, changes the status of the products manufactured by it to out of stock.

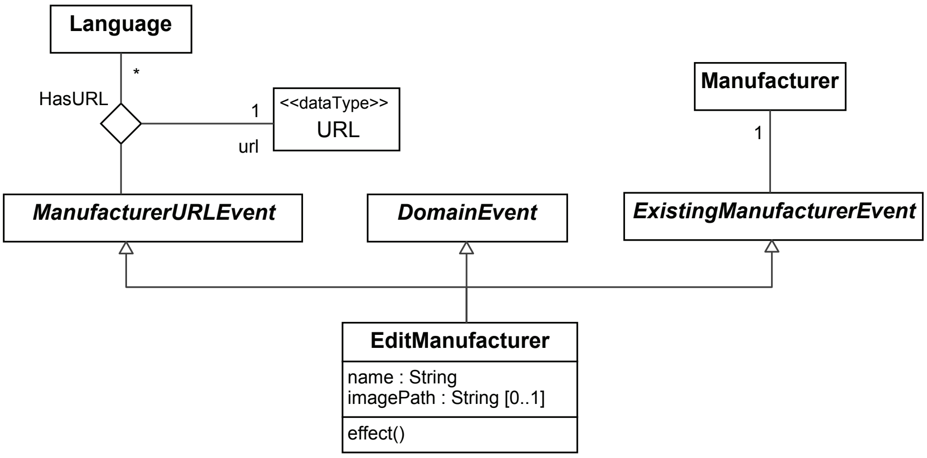
NewManufacturer



```
«IniIC»
context NewManufacturer::manufacturerDoesNotExist(): Boolean
  body :
     not Manufacturer.allInstances() -> exists (m | m.name=self.name)
```

```
context  NewManufacturer::effect()
   post :
       m.oclIsNew()  and
       m.oclIsTypeOf(Manufacturer) and
       m.name = self.name and
       m.imagePath = self.imagePath and
       Language.allInstances() ->
          forAll (l |
            self.hasURL -> select(language=l).url =
            m.manufacturerInLanguage->select(language=l).url)
```

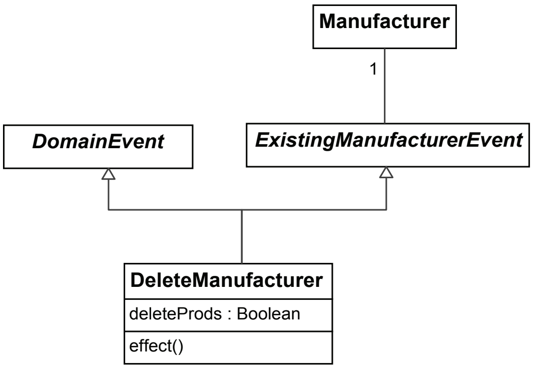
EditManufacturer



```
«IniIC»
context EditManufacturer::manufacturerDoesNotExist(): Boolean
  body :
       (Manufacturer.allInstances() –Set{self.manufacturer}).name-> excludes(self.name)
```

```
context  EditManufacturer::effect()
   post :
       self.manufacturer.name = self.name and
       self.manufacturer.imagePath = self.imagePath and
       Langauge.allInstances() ->
          forAll(l |
             self.hasURL->select(language=l).url=
             self.manufacturer.manufacturerInLanguage->
                 select(language=l).url)
   post :
       self.manufacturer.lastModified = Now()
```

DeleteManufacturer



```
context  DeleteManufacturer::effect()
  post deleteManufacturer:
     not self.manufacturer@pre.oclIsKindOf(OclAny)
  post changeProductsToOutOfStock:
     deleteProds implies
        manufacturer@pre.product@pre ->
          forAll(status = ProductStatus::outOfStock)
```

Example test program

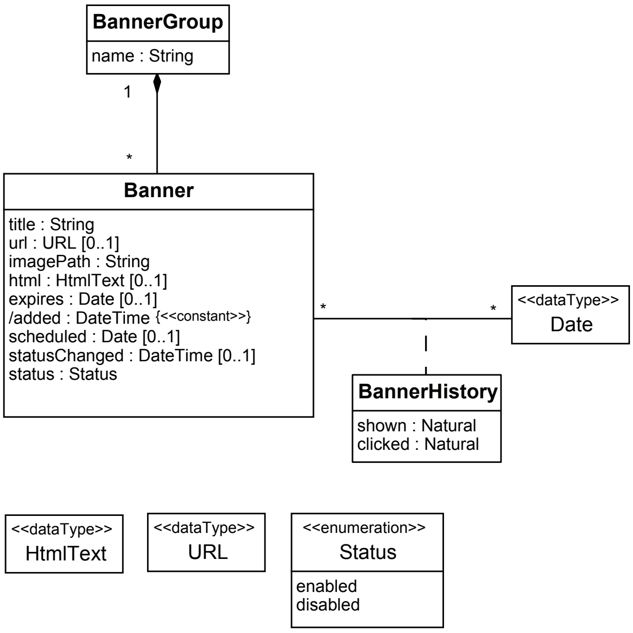
```
testprogram ManufacturersManagement{

        //Test cases are based on a multilingual online shop with two languages
        spanish  := new Language(name:='Spanish', code:='ES');
        english  := new Language(name:='English', code:='EN');

        test NewManufacturerWithoutURLs{
                nm:=new NewManufacturer(name:='BooksEditorial');
                assert non-occurrence nm;
        }

        test NewManufacturer{
                //We test a valid invocation of the event
                englishURL:=new URL(url:='bookseditorial.com/english');
                spanishURL:=new URL(url:='bookseditorial.com/spanish');
                nm:=new NewManufacturer(name:='bookseditorial');
                new HasURL(url:=englishURL,languageOfURL:=english,manufacturerURLEvent:=nm);
                new HasURL(url:=spanishURL,languageOfURL:=spanish,manufacturerURLEvent:=nm);
                assert occurrence nm;
                createdManufacturer := Manufacturer.allInstances->any(name='bookseditorial');
                assert equals createdManufacturer.manufacturerInLanguage
                       ->any(language=english).url.url
                      'bookseditorial.com/english';
                assert equals createdManufacturer.manufacturerInLanguage
                       ->any(language=spanish).url.url
                      'bookseditorial.com/spanish';

                //We cannot create the same manufacturer again
                nm2:=new NewManufacturer(name:='bookseditorial');
                new HasURL(url:=englishURL,languageOfURL:=english,manufacturerURLEvent:=nm2);
                new HasURL(url:=spanishURL,languageOfURL:=spanish,manufacturerURLEvent:=nm2);
                assert non-occurrence nm2;
        }

        test EditManufacturer{
                //IB state with already existing manufacturers
                englishURL1:=new URL(url:='bookseditorial.com/english');
                spanishURL1:=new URL(url:='bookseditorial.com/english');
                bookseditorial:=new Manufacturer(name:='bookseditorial');
                miEnglish:=new ManufacturerInLanguage
                              (manufacturer:=bookseditorial,language:=english);
                miEnglish.url:=englishURL1;
                miSpanish:=new ManufacturerInLanguage
                               (manufacturer:=bookseditorial,language:=spanish);
                miSpanish.url:=spanishURL1;

                //We create the manufacturer to be modified
                englishURL2:=new URL(url:='www.salamandra.info');
                spanishURL2:=new URL(url:='www.salamandra.info');
                nm:=new NewManufacturer(name:='Salamandra');
                new HasURL
                    (url:=englishURL2,languageOfURL:=english,manufacturerURLEvent:=nm);
                new HasURL
                   (url:=spanishURL2,languageOfURL:=spanish,manufacturerURLEvent:=nm);
                assert occurrence nm;
                salamandra:=Manufacturer.allInstances->any(name='Salamandra');

                assert equals salamandra.name 'Salamandra';
                em:=new EditManufacturer(manufacturer:=salamandra,
                                        name:='Ediciones Salamandra');
                new HasURL(url:=englishURL2,
                           languageOfURL:=english,manufacturerURLEvent:=em);
                new HasURL(url:=spanishURL2,
                           languageOfURL:=spanish,manufacturerURLEvent:=em);
                assert occurrence em;
                assert equals salamandra.name 'Ediciones Salamandra';
                em2:=new EditManufacturer(manufacturer:=salamandra,name:='bookseditorial');
                new HasURL(url:=englishURL2,
                          languageOfURL:=english,manufacturerURLEvent:=em2);
                new HasURL(url:=spanishURL2,
                          languageOfURL:=spanish,manufacturerURLEvent:=em2);
                assert non-occurrence em2;
        }


        test DeleteManufacturerWithNoProducts{
                englishURL1:=new URL(url:='bookseditorial.com/english');
                spanishURL1:=new URL(url:='bookseditorial.com/english');
                nm:=new NewManufacturer(name:='bookseditorial');
                new HasURL(url:=englishURL1,languageOfURL:=english,
                           manufacturerURLEvent:=nm);
                new HasURL(url:=spanishURL1,languageOfURL:=spanish,
                           manufacturerURLEvent:=nm);
                assert occurrence nm;
                bookseditorial:=Manufacturer.allInstances->any(name='bookseditorial');
                dm:=new DeleteManufacturer(manufacturer:=bookseditorial, deleteProds:=false);
                assert occurrence dm;
                assert true Manufacturer.allInstances->excludes(bookseditorial);
        }

        abstract test DeleteManufacturerWithProducts(Boolean deleteProds){
                englishURL2:=new URL(url:='www.salamandra.info');
                spanishURL2:=new URL(url:='www.salamandra.info');
                nm:=new NewManufacturer(name:='Salamandra');
                new HasURL(url:=englishURL2,languageOfURL:=english,
                           manufacturerURLEvent:=nm);
                new HasURL(url:=spanishURL2,languageOfURL:=spanish,
                           manufacturerURLEvent:=nm);
                assert occurrence nm;
                salamandra:=Manufacturer.allInstances->any(name='Salamandra');
                bookNameInEnglish:=new StringDT(string:='The Boy in the Striped Pyjamas');
                bookNameInSpanish:=new StringDT(string:='El niño con el pijama de rayas');
                np:=new NewProduct(manufacturer:=salamandra,netPrice:=30,quantityOnHand:=50);
                new HasNewProductName(nameOfProduct:=bookNameInEnglish,
                                     languageOfProduct:=english,productNameEvent:=np);
                new HasNewProductName(nameOfProduct:=bookNameInSpanish,
                             languageOfProduct:=spanish,productNameEvent:=np);
                assert occurrence np;
                book:=Product.allInstances->any(productInLanguage
                                ->exists(name='El niño con el pijama de rayas'));
                dm:=new DeleteManufacturer(manufacturer:=salamandra,
                                            deleteProds:=$deleteProds);
                assert occurrence dm;
                assert true Manufacturer.allInstances->excludes(salamandra);
                if $deleteProds
                then assert equals book.status #outOfStock;
                endif
        }
```

```
        test DeleteManufacturerWithProducts($deleteProds:=false);
        test DeleteManufacturerWithProducts($deleteProds:=true);
}
```

Banners

Structural schema

osCommerce allows administrating banners published in the *online* store.



[DR1] *Banner::**added*** is the *DateTime* when the banner was created.

context Banner::added():DateTime
 body : Now()

[IC1] A Banner is identified by its title.

context Banner::titleIsUnique: Boolean
 body : Banner.allInstances() -> isUnique(title)

[IC2] A Banner Group is identified by its name.

context BannerGroup::nameIsUnique: Boolean
 body : BannerGroup.allInstances() -> isUnique(name)

Use Cases

Add a banner

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to add a new banner.

Main Success Scenario:

1. The store administrator provides the details of the new banner:
   [→*NewBanner*]
2. The system validates that the data is correct.
3. The system saves the new banner.

Edit a banner

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to edit a banner.

Main Success Scenario:

1. The store administrator selects the banner to be edited.
2. The store administrator provides the new details of the selected banner:
   [→*EditBanner*]
3. The system validates that the data is correct.
4. The system saves the changes.

Delete a banner

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to delete a banner.

Main Success Scenario:

1. The store administrator selects the banner to be deleted.
2. The store administrator confirms that he wants to delete the banner:
   [→*DeleteBanner*]
3. The system deletes the banner.

Add a banner group

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to add a new banner group.

Main Success Scenario:

1. The store administrator provides the details of the new banner group:

   [→*NewBannerGroup*]
2. The system validates that the data is correct.
3. The system saves the new banner.

Edit a banner group

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to edit a banner group.

Main Success Scenario:

1. The store administrator selects the banner group to be edited.
2. The store administrator provides the new details of the selected banner group:

   [→*EditBannerGroup*]
3. The system validates that the data is correct.
4. The system saves the changes.

Delete a banner group

Primary Actor: Store administrator

Precondition: The banner group doesn't contain any banners.

Trigger: The store administrator wants to delete a banner.

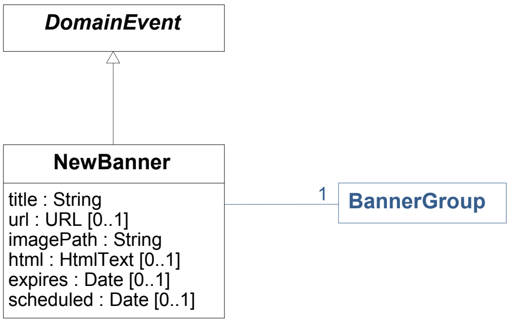
Main Success Scenario:

1. The store administrator selects the banner group to be deleted.
2. The store administrator confirms that he wants to delete the banner group:

   [→*DeleteBannerGroup*]
3. The system deletes the banner.

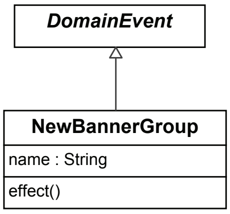
Events

NewBanner



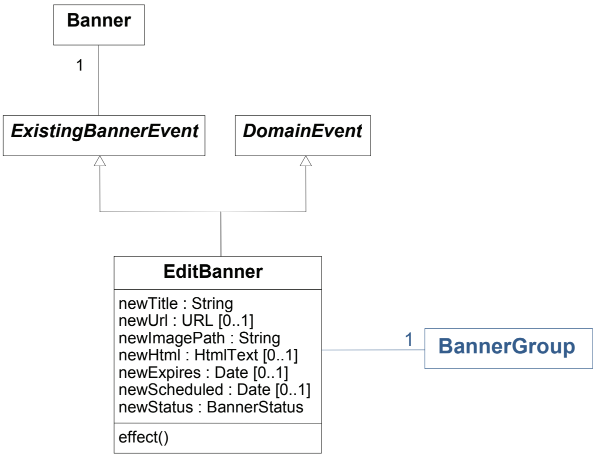
```
«IniIC»
context NewBanner::bannerDoesNotExist(): Boolean
  body :  not Banner.allInstances() ->exists (b | b.title= self.title)

context  NewBanner::effect()
   post :
       b.oclIsNew()  and
       b.oclIsTypeOf(Banner) and
       b.title = self.title and
       b.url = self.url and
       b.imagePath = self.imagePath and
       b.html = self.html and
       b.expires = self.expires and
       b.scheduled = self.scheduled and
       b.status = BannerStatus::enabled  and
      b.bannerGroup=self.bannerGroup
```

NewBannerGroup



```
«IniIC»
context NewBannerGroup::bannerGroupDoesNotExist(): Boolean
  body : not BannerGroup.allInstances() ->exists (bg | bg.name= self.name)

context  NewBannerGroup::effect()
   post :
       bg.oclIsNew()  and
       bg.oclIsTypeOf(BannerGroup) and
       bg.name = self.name
```

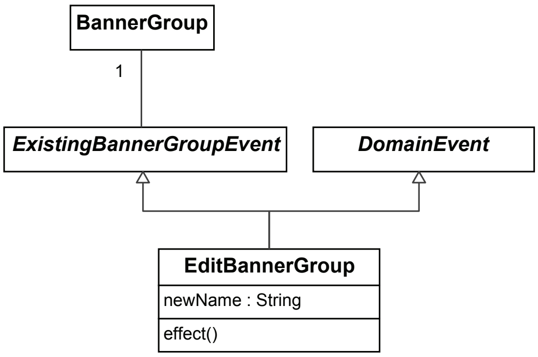
EditBanner



«IniIC»
context EditBanner::bannerDoesNotExist():Boolean
body: (Banner.allInstances - Set{self.banner}).title->excludes(self.newTitle)

```
context  EditBanner::effect()
  post :
     self.banner.title = self.newTitle and
     self.banner.url = self.newUrl and
     self.banner.imagePath = self.newImagePath and
     self.banner.html = self.newHtml and
     self.banner.expires = self.newExpires and
     self.banner.scheduled = self.newScheduled and
     self.banner.status = self.newStatus and
     self.banner.bannerGroup=self.bannerGroup
  post :
     self.banner@pre.status <> self.newStatus implies self.banner.statusChanged = Now()
```

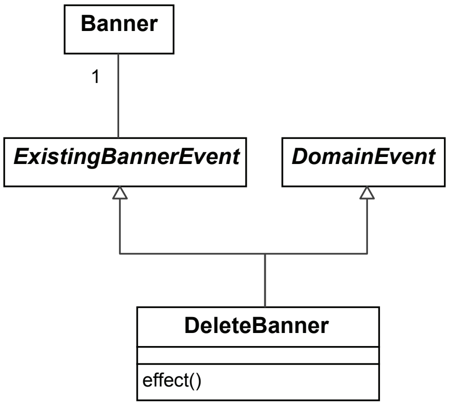
EditBannerGroup



«IniIC»
context EditBannerGroup::bannerGroupDoesNotExist():Boolean
body: (BannerGroup.allInstances - Set{self.bannerGroup}).name->excludes(self.newName)

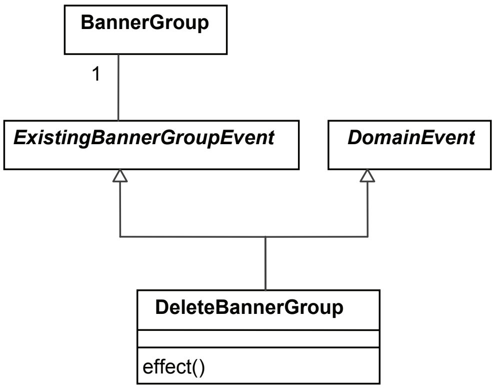
```
context  EditBannerGroup::effect()
  post :  self.bannerGroup.name = self.newName
```

DeleteBanner



context DeleteBanner::effect()
  post : not self.banner@pre.oclIsKindOf(OclAny)

DeleteBannerGroup



«IniIC»
context DeleteBannerGroup::BannerGroupIsEmpty():Boolean
  body : self.bannerGroup.banner -> isEmpty()

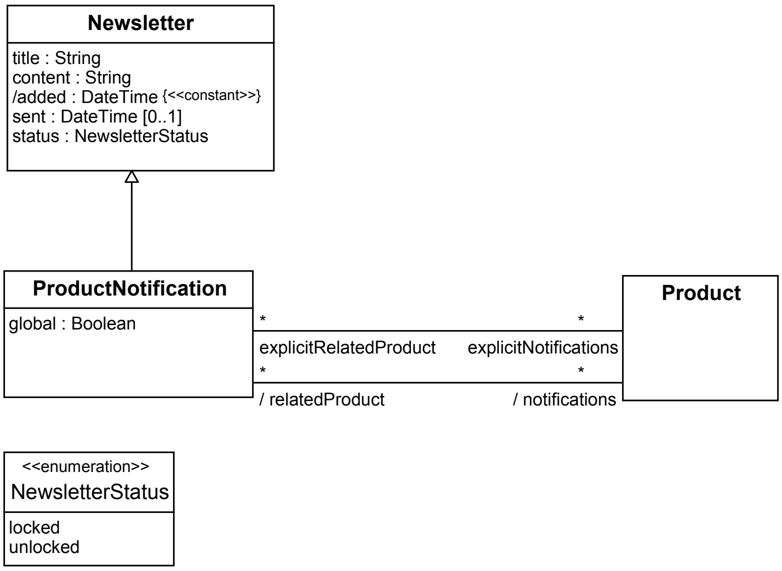
context DeleteBannerGroup::effect()
  post : not self.bannerGroup@pre.oclIsKindOf(OclAny)

Example test program

```
testprogram BannersManagement{

        test NewBannerGroup{
                nbg:=new NewBannerGroup(name:='Advertisements');
                assert occurrence nbg;
                //We cannot create an already existing banner group
                assert non-occurrence nbg;
        }

        test EditBannerGroup{
                nbg:=new NewBannerGroup(name:='Advertisements');
                assert occurrence nbg;
                bgroup:=BannerGroup.allInstances->any(name='Advertisements');
                ebg:=new EditBannerGroup(bannerGroup:=bgroup,newName:='TopAdvertisements');
                assert occurrence ebg;
                assert equals bgroup.name 'TopAdvertisements';

                //We can edit a banner group without changes
                ebg2:=new EditBannerGroup(bannerGroup:=bg,newName:='TopAdvertisements');
                assert occurrence ebg2;

                //We cannot create duplicates when editing a banner group
                nbg2:=new NewBannerGroup(name:='ChristmasSpecials');
                assert non-occurrence nbg2;
                ebg3:=new EditBannerGroup(bannerGroup:=bgroup,newName:='ChristmasSpecials');
                assert non-occurrence ebg3;
        }

        test BannerGroupRequiredForEachBanner{
                new Banner(title:='ChristmasSpecialOffer', imagePath:='special.jpg');
                assert inconsistency;
        }

        test NewBanner{
                bg:=new BannerGroup(name:='Advertisements');
                nb:=new NewBanner(title:='ChristmasSpecialGift',bannerGroup:=bg);
                assert occurrence nb;
                //We cannot create already existing banners
                assert non-occurrence nbg;
        }

        test EditBanner{
                bg:=new BannerGroup(name:='Advertisements');
                bg2:=new BannerGroup(name:='CustomerFidelityCampaign');
                b1:=new Banner(title:='WinTheSpecialPrix', bannerGroup:=bg);
                eb:=new EditBanner(banner:=b1,newTitle:='WinACar!', newBannerGroup:=bg2);
                assert occurrence eb;
                assert equals b1.title 'WinACar!';
                assert equals b1.bannerGroup bg2;

                //We cannot generate duplicate banners when edit
                b2:=new Banner(title:='25% off', bannerGroup:=bg2);
                eb:=new EditBanner(banner:=b2,newTitle:='25% off', newBannerGroup:=bg2);
                assert occurrence eb;
                eb2:=new EditBanner(banner:=b1,newTitle:='25% off', newBannerGroup:=bg);
                assert non-occurrence eb2;
        }

        test deleteBanner{
                bg:=new BannerGroup(name:='Advertisements');
                b1:=new Banner(title:='NewBabiesSection', bannerGroup:=bg);
                db:=new DeleteBanner(banner:=b1);
                assert occurrence db;
                assert true Banner.allInstances->size()=0;
        }

        test deleteBannerGroup{
                //A banner group with banners cannot be deleted
                bg:=new BannerGroup(name:='Sponsors');
                b1:=new Banner(title:='ParisTourism', bannerGroup:=bg);
                dbg:=new DeleteBannerGroup(bannerGroup:=bg);
                assert non-occurrence dbg;
                db:=new DeleteBanner(banner:=b1);
                assert occurrence db;
                assert occurrence dbg;
        }
}
```

Newsletters

osCommerce allows store administrators sending emails and product notifications to customers.



[DR1] *ProductNotification::**notifications*** is the set of implied products in the notification.

```
context ProductNotification::notifications():Set(Product)
body :
   if self.global then Product.allInstances()
   else self.explicitNotifications
   endif
```

[DR2] *ProductNotification::**added*** is the *DateTime* when the newsletter was created.

```
context Newsletter::added():DateTime
  body : Now()
```

[IC1] A Newsletter is identified by its title.

```
context Newsletter::titleIsUnique: Boolean
 body :  Newsletter.allInstances() -> isUnique(title)
```

Use Cases

Create a newsletter

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to create a new newsletter.

Main Success Scenario:

1. The store administrator selects the type of the newsletter (newsletter or product nofitification).

2. The store administrator provides the title and the content of the newsletter:
   [→*NewNewsletter*]
   [→*NewProductNotification*]
3. The system validates that the data is correct.
4. The system saves the newsletter.

Edit a newsletter

Primary Actor: Store administrator

Precondition: The newsletter is unlocked.

Trigger: The store administrator wants to edit a newsletter.

Main Success Scenario:

1. The store administrator selects the newsletter to be edited.
2. The store administrator provides the new details of the selected newsletter:
   [→*EditNewsletter*]
   [→*EditProductNotification*]
3. The system validates that the data is correct.
4. The system saves the changes.

Delete a newsletter

Primary Actor: Store administrator

Precondition: The newsletter is unlocked.

Trigger: The store administrator wants to delete a newsletter.

Main Success Scenario:

1. The store administrator selects the newsletter to be deleted.
2. The store administrator confirms that he wants to delete the newsletter:
   [→*DeleteNewsletter*]
3. The system deletes the newsletter.

Lock a newsletter

Primary Actor: Store administrator

Precondition: The newsletter is unlocked.

Trigger: The store administrator wants to indicate to the other administrators that a newsletter is pending to be delivered.

Main Success Scenario:

1. The store administrator selects the newsletter to be locked.

[→*LockNewsletter*]

2. The system saves the change.

Unlock a newsletter

Primary Actor: Store administrator

Precondition: The newsletter is locked.

Trigger: The store administrator wants to indicate to the other administrators that a newsletter ceases to be locked.

Main Success Scenario:

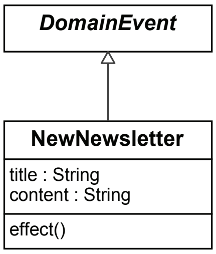
1. The store administrator selects the newsletter to be unlocked.

   [→*UnlockNewsletter*]

2. The system saves the change.

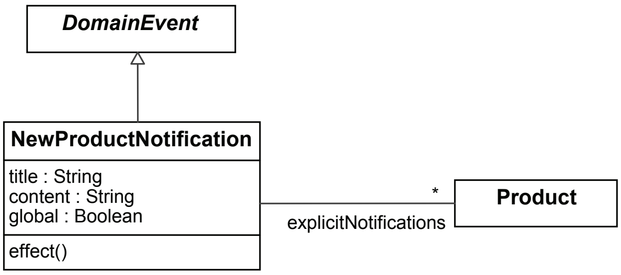
Events

NewNewsletter



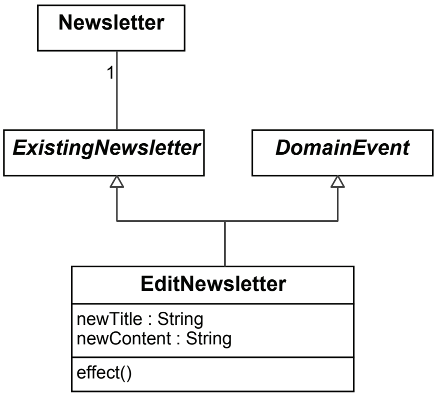
```
«IniIC»
context NewNewsletter::newsletterDoesNotExist(): Boolean
  body :  not Newsletter.allInstances() -> exists (n | n.title=self.title)

context  NewNewsletter::effect()
   post :
       n.oclIsNew()  and
       n.oclIsTypeOf(Newsletter) and
       n.title = self.title and
       n.content = self.content and
       n.status = NewsletterStatus::unlocked
```

NewProductNotification



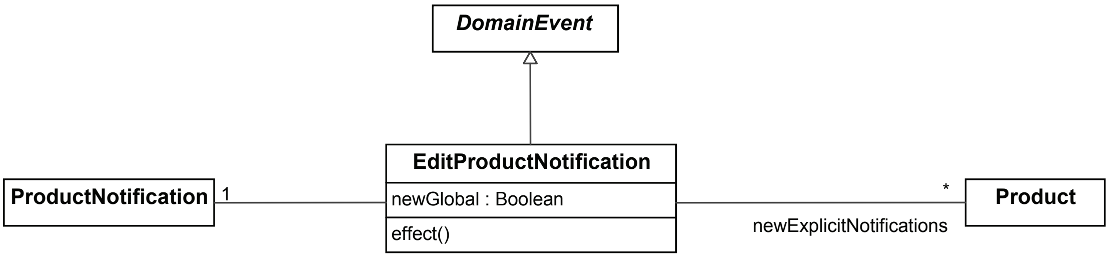
```
«IniIC»
context NewProductNotification::ProductNotificationDoesNotExist(): Boolean
  body : not Newsletter.allInstances() -> exists (n | n.title = self.title)

context  NewProductNotification::effect()
   post :
       n.oclIsNew()  and
       n.oclIsTypeOf(ProductNotification) and
       n.title = self.title and
       n.content = self.content and
       n.global = self.global and
       n.explicitNotifications = self.explicitNotifications and
       n.status = self.NewsletterStatus::unlocked
```

EditNewsletter



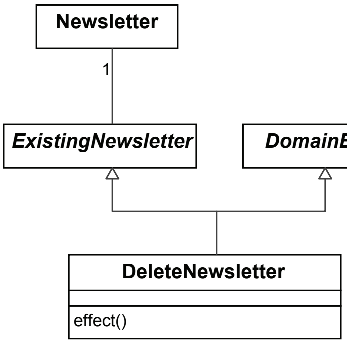
```
«IniIC»
context  EditNewsletter::newsletterIsUnlocked():Boolean
    body: self.newsletter.status = Status::unlocked

«IniIC»
context EditNewsletter::newsletterDoesNotExist():Boolean
    body:  (Newsletter.allInstances - Set{self.newsletter}).title->excludes(self.newTitle)

context  EditNewsletter::effect()
   post :
       newsletter.title = self.newTitle and
       newsletter.content = self.newContent
```

EditProductNotification



```
context  EditProductNotification::effect()
   post :
       self.productNotification.global = self.newGlobal and
       self.productNotification.explicitNotifications = self.newExplicitNotifications
```

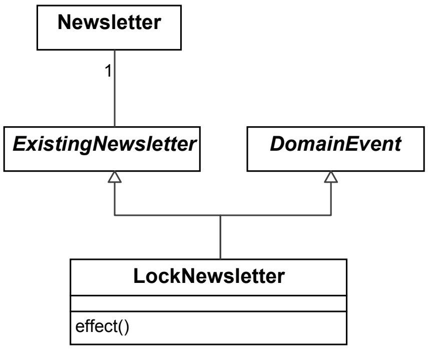
DeleteNewsletter



«IniIC»
context DeleteNewsletter::newsletterIsUnlocked():Boolean
body: self.newsletter.status = Status::unlocked

context DeleteNewsletter::effect()
post : not self.newsletter@pre.oclIsKindOf(OclAny)

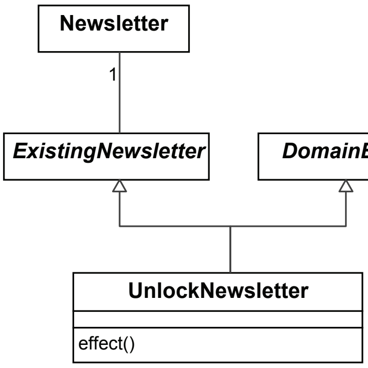
LockNewsletter



«IniIC»
context LockNewsletter::newsletterIsNotLocked():Boolean
body: self.newsletter.status <> Status::locked

context LockNewsletter::effect()
post : self.newsletter.status = NewsletterStatus::locked

UnlockNewsletter



«IniIC»
context UnlockNewsletter::newsletterIstLocked():Boolean
body: self.newsletter.status <>Status::unlocked

context UnlockNewsletter::effect()
post : self.newsletter.status = NewsletterStatus::unlocked

Example test programs

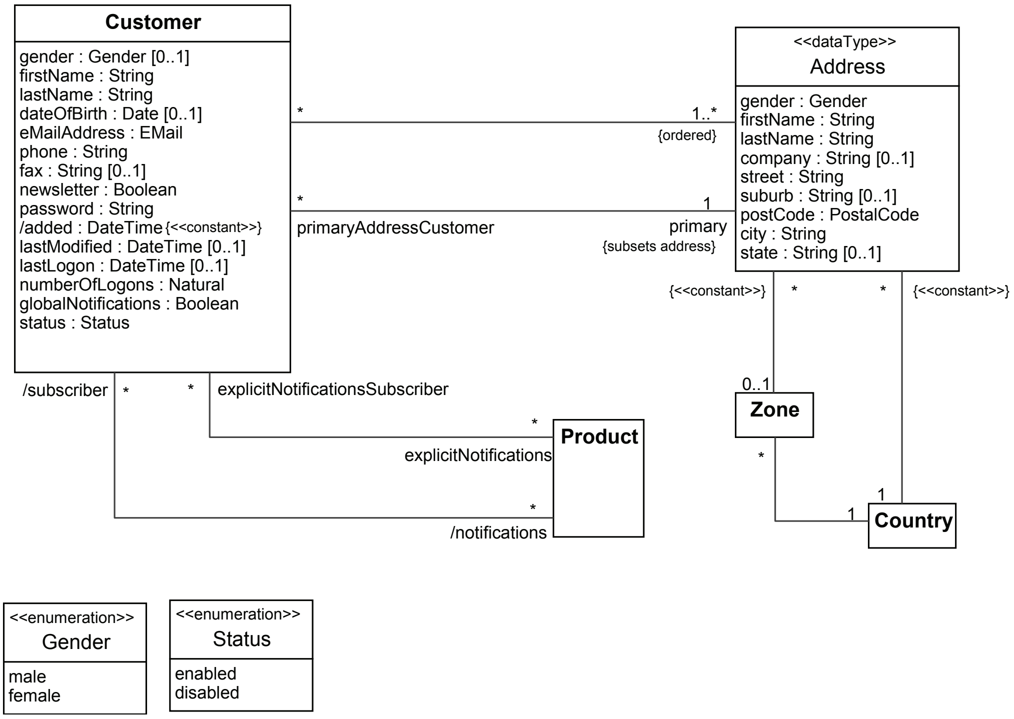
```
testprogram NewslettersManagement{

        test NewNewsletter{
                nn:=new NewNewsletter(title:='NewSection',
                                 content:='Our new sports section is now opened !');
                assert occurrence nn;

                //We cannot create an already existing newsletter
                assert non-occurrence nn;
                //...even if it is a product notification (because a product noficitaion is
                //is also a newsletter
                p:=new Product;
                npn:=new NewProductNotification(title:='NewSection',
                    content:='New section of products similar to p is now opened',
                    explicitNotifications:=p);
                assert non-occurrence npn;
        }

        test EditNewsletter{
                nn:=new NewNewsletter(title:='NewSection',
                                  content:='Our new sports section is now opened !');
                assert occurrence nn;
                n1:=Newsletter.allInstances->any(title='NewSection');

               //We cannot lock already locked newsletters
                ln:=new LockNewsletter(newsletter:=n1);
                assert occurrence ln;
                assert non-occurrence ln;

                //We cannot edit locked newsletters
                en:=new EditNewsletter(newsletter:=n1,newTitle:='NewTitle');
                assert non-occurrence en;
                un:=new UnlockNewsletter(newsletter:=n1);
                assert occurrence un;
                assert non-occurrence un;

                //Valid newsletter editions
                en:=new EditNewsletter(newsletter:=n1,newTitle:='NewSection');
                assert occurrence en;
                en2:=new EditNewsletter(newsletter:=n1,newTitle:='NewSectionAnnouncement');
                assert occurrence en2;
                assert equals n.title 'NewSectionAnnouncement';
                //We cannot create duplicates when editing a newsletter
                nn2:=new NewNewsletter(title:='NewSpringFashionSection',
                       content:='Our new spring fashion section is now opened !');
                assert occurrence nn2;
                n2:=Newsletter.allInstances->any(title='NewSpringFashionSection');
                en3:=new EditNewsletter(newsletter:=n2,newTitle:='NewSectionAnnouncement');
                assert non-occurrence en3;
                }

        test DeleteNewsletter{
                nn:=new NewNewsletter(title:='NewSection',
                                  content:='Our new sports section is now opened !');
                assert occurrence nn;
                n:=Newsletter.allInstances->any(title='NewSection');

                //A locked newsletter cannot be deleted
                ln:=new LockNewsletter(newsletter:=n);
                assert occurrence ln;
                dn:=new DeleteNewsletter(newsletter:=n);
                assert non-occurrence dn;

                //Only unlocked newsletter can be deleted
                un:=new UnlockNewsletter(newsletter:=n);
                assert occurrence un;
                assert occurrence dn;
                assert true Newsletter.allInstances->excludes(n);
        }
}
```

```
testprogram ProductNotifications{

        //In this test program we exercise the specific properties of product notifications

        aucaSenyorEsteveBook := new Product;
        tirantLoBlancBook := new Product;

        npn:=new NewProductNotification(title:='Frankfurt 2007',
                                   content:='Catalan culture will be the guest of honour at
                                   the 2007 Frankfurt Book Fair.',
                                   global:=false,
                                   explicitNotifications := aucaSenyorEsteveBook);

        test globalNotificationsDisabled{
                assert occurrence npn;
                pn1:=ProductNotification.allInstances->any(title='Frankfurt 2007');
                //We test the derived relationship notifications using materialitzation
                pn1._notifications:=Set{aucaSenyorEsteveBook};
                assert consistency;
        }

        test globalNotificationsEnabled{
                assert occurrence npn;
                pn1:=ProductNotification.allInstances->any(title='Frankfurt 2007');
                pn1.global:=true;
                //We test the derived relationship notifications using materialitzation
                pn1._notifications:=Set{aucaSenyorEsteveBook,tirantLoBlancBook};
                assert consistency;
        }
}
```

Customers

Structural schema

osCommerce keeps information about customers and their addresses, one of which is the primary address.



[DR1] *Customer::**notifications*** is the set of subscriptions to product notifications.

```
context Customer::notifications():Set(Product)
body :
   if self.globalNotifications then Product.allInstances()
   else self.explicitNotifications
   endif
```

[DR2] *Customer::**added*** is the *DateTime* of the customer creation.

```
context Customer::added():DateTime
  body : Now()
```

[IC1] Customers are identified by their email address.

```
context Customer::eMailIsUnique(): Boolean
body : Customer.allInstances() -> isUnique(eMailAddress)
```

[IC2] Addresses have zone if needed.

```
context Country::addressesHaveZoneIfNeeded(): Boolean
body :   self.zone -> notEmpty() implies self.address -> forAll
         (a | a.state = a.zone.name and self = a.zone.country)
```

Use Cases

Create a customer

Primary Actor: Customer

Precondition: None.

Trigger: A customer wants to open an account in the store.

Main Success Scenario:

1. The customer provides the required customer data:

   [→*NewCustomer*]
2. The system validates the customer data.
3. The system saves the new account.

Change password

Primary Actor: Customer

Precondition: The customer is logged in.

Trigger: A customer wants to change his password.

Main Success Scenario:

1. The customer provides the old password.
2. The customer provides the new password twice.

   [→*PasswordChange*]
3. The system validates that the data is correct.
4. The system saves the changes.

Change customer details

Primary Actor: Customer

Precondition: The customer is logged in.

Trigger: A customer wants to change its customer details.

Main Success Scenario:

1. The customer provides the new customer details.

   [→*EditCustomerDetails*]
2. The system validates that the data is correct.
3. The system saves the changes.

Administrate address book

Primary Actor: Customer

Precondition: The customer is logged in and the number of addresses is less than the maximum number of address entries permitted.

Trigger: A customer wants to view or change the address book.

Main Success Scenario:

1. The system displays the current address book entries of the customer.
2. The customer selects an address book entry to be edited :

   [→*EditCustomerAddress*]

3. The system validates that the data is correct.
4. The system saves the changes and displays the new address book.

   The customer repeats steps 1-4 until he is done.

Extensions:

2a. The customer doesn't want to change the address book:

  2a1. The use case ends.

2b. The customer wants to add a new address book entry:

  2b1. The customer provides the required data:

    [→*NewCustomerAddress*]

  2b2. The use case continues at step 3.

2c. The customer wants to delete an address book entry:

  2c1. The customer selects the address book entry:

    [→*DeleteCustomerAddress*]

  2c2. The use case continues at step 3.

2d. The customer wants to change the default address book entry:

  2d1. The customer selects the new default address book entry:

    [→*PrimaryCustomerAddressChange*]

  2d2. The use case continues at step 3.

Edit a customer

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to edit a customer.

Main Success Scenario:

1. The store administrator selects the customer to be edited.
2. The store administrator provides the new details of the selected customer:

   [→*EditCustomer*]

3. The system validates that the data is correct.
4. The system saves the changes.

Delete a customer

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to delete a customer.

Main Success Scenario:

1. The store administrator selects the customer to be deleted.
2. The system asks for the confirmation of the store administrator.
3. The store administrator confirms that he wants to delete the customer:
   [→*DeleteCustomer*]
4. The system deletes the customer and their addresses, reviews, notification subscriptions and shopping carts.

Extensions:

3a. The customer has orders:

   3a1. The system changes the status of the customer to disable.
      [→*CustomerStatusChange*]

   3a2. The system deletes customer's addresses, reviews, notification subscriptions and shopping carts.

   3a3. The use case ends.

Administrate subscriptions

Primary Actor: Customer

Precondition: The customer is logged in.

Trigger: A customer wants to view or change their product notification subscriptions.

Main Success Scenario:

1. The system displays the details of the current product notification subscriptions of the customer.
2. The customer adds a new product subscription:
   [→*NewProductNotificationSubscription*]
3. The system validates that the data is correct.
4. The system saves the changes and displays the new product notification subscriptions.

   The customer repeats steps 1-4 until he is done.

Extensions:

2a. The customer doesn't want to change their product notification subscriptions:

   2a1. The use case ends.

2b. The customer wants to be subscribed or unsubscribed to all product notifications:
   [→ *EditGlobalNotifications*]

2c. The customer wants to delete a product notification subscription:

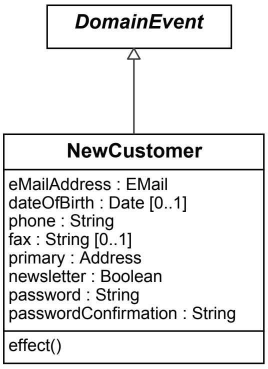
  2c1. The customer selects the product:

    [→*DeleteProductNotificationSubscription*]

  2c2. The use case continues at step 3.

Events

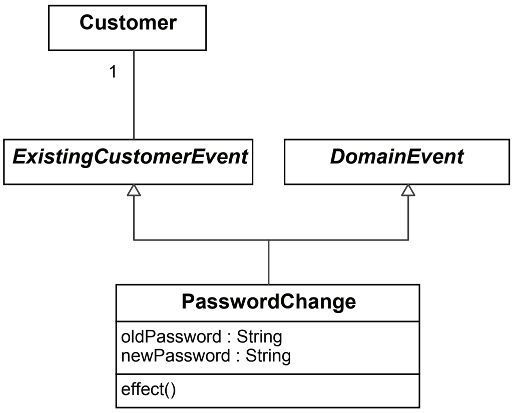
NewCustomer



```
«IniIC»
context NewCustomer::customerDoesNotExist(): Boolean
  body : not Customer.allInstances() -> exists (c | c.eMailAddress = self.eMailAddress)

«IniIC»
context NewCustomer::passwordCorrect(): Boolean
  body : password = passwordConfirmation

«IniIC»
context NewCustomer::firstNameRight(): Boolean
  body : self.primary.firstName.size() >= MinimumValues.firstName

«IniIC»
context NewCustomer::lastNameRight(): Boolean
  body : self.primary.lastName.size() >= MinimumValues.lastName

«IniIC»
context NewCustomer::dateOfBirthRight(): Boolean
  body :   CustomerDetails.dateOfBirth implies
           self.dateOfBirth -> notEmpty() and
           self.dateOfBirth.size() >= MinimumValues.dateOfBirth

«IniIC»
context NewCustomer::genderRight(): Boolean
  body : CustomerDetails.gender implies self.gender->notEmpty()

«IniIC»
context NewCustomer::suburbRight(): Boolean
  body : CustomerDetails.suburb implies self.suburb->notEmpty()

«IniIC»
context NewCustomer::eMailRight(): Boolean
  body : self.eMailAddress.size() >= MinimumValues.eMailAddress
```

```
«IniIC»
context NewCustomer::streetAddressRight(): Boolean
  body : self.primary.street.size() >= MinimumValues.streetAddress
«IniIC»
context NewCustomer::companyRight(): Boolean
  body :
       CustomerDetails.company implies
       self.primary.company -> notEmpty() and
       self.primary.company.size() >= MinimumValues.companyName

«IniIC»
context NewCustomer::postCodeRight(): Boolean
  body : self.primary.postCode.size() >= MinimumValues.postCode

«IniIC»
context NewCustomer::cityRight(): Boolean
  body : self.primary.city.size() >= MinimumValues.city

«IniIC»
context NewCustomer::stateRight(): Boolean
  body :
       CustomerDetails.state implies
       self.primary.state -> notEmpty() and
       self.primary.state.size() >= MinimumValues.state


«IniIC»
context NewCustomer::telephoneRight(): Boolean
  body : self.telephone.size() >= MinimumValues.telephoneNumber

«IniIC»
context NewCustomer::passwordRight(): Boolean
  body : self.password.size() >= MinimumValues.password
context  NewCustomer::effect()
   post :
       c.oclIsNew() and
       c.oclIsTypeOf(Customer) and
       c.gender = self.primary.gender and
       c.firstName = self.primary.firstName and
       c.lastName = self.primary.lastName and
       c.dateOfBirth = self.dateOfBirth and
       c.eMailAddress = self.eMailAddress and
       c.phone = self.phone and
       c.fax = self.fax and
       c.newsletter = self.newsletter and
       c.password = self.password and
       c.numberOfLogons = 0 and
       c.address = Set{primary}  and
       c.primary = primary
```

PasswordChange

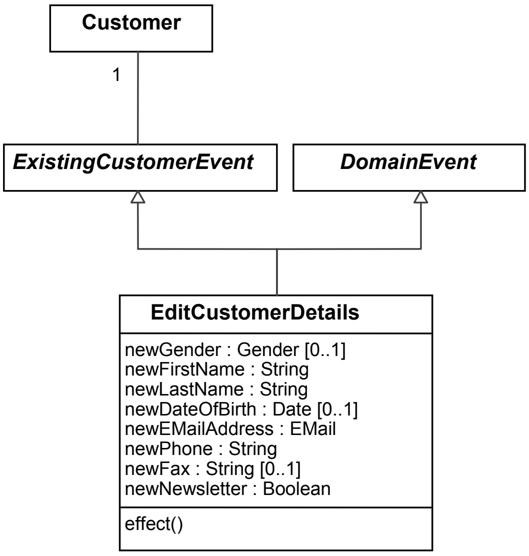


«IniIC»
context ChangePassword::passwordRight(): Boolean
  body : self.password.size() >= MinimumValues.password

«IniIC»
context ChangePassword::OldPasswordIsCorrect(): Boolean
  body : customer.password = self.oldPassword

context ChangePassword::effect()
   post : self.customer.password = self.newPassword

EditCustomerDetails



«IniIC»
context EditCustomerDetails::firstNameRight(): Boolean
  body : self.newFirstName.size() >= MinimumValues.firstName

«IniIC»
context EditCustomerDetails::lastNameRight(): Boolean
  body : self.newLastName.size() >= MinimumValues.lastName

«IniIC»
context EditCustomerDetails::dateOfBirthRight(): Boolean
body :
CustomerDetails.dateOfBirth **implies**
self.newDateOfBirth->notEmpty()
self.newDateOfBirth.size() >= MinimumValues.dateOfBirth

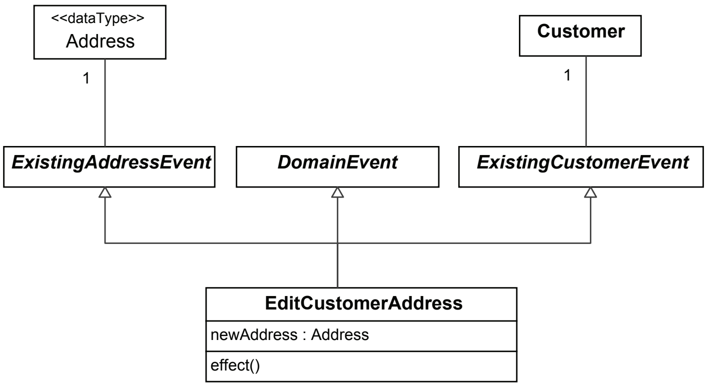
«IniIC»
context EditCustomerDetails::genderRight(): Boolean
body : CustomerDetails.gender **implies** self.newGender->notEmpty()

«IniIC»
context EditCustomerDetails::eMailRight(): Boolean
body : self.newEMailAddress.size() >= MinimumValues.eMailAddress

«IniIC»
context EditCustomerDetails::telephoneRight(): Boolean
body : self.newTelephone.size() >= MinimumValues.telephoneNumber

context EditCustomerDetails::effect()
post :
customer.gender = self.newGender **and**
customer.firstName = self.newFirstName **and**
customer.lastName = self.newLastName **and**
customer.dateOfBirth = self.newDateOfBirth **and**
customer.eMailAddress = self.newEMailAddress **and**
customer.phone = self.newPhone **and**
customer.fax = self.newFax **and**
customer.newsletter = self.newNewsletter

EditCustomerAddress



«IniIC»
context EditCustomerAddress::AddressOfCustomer(): Boolean
body : self.customer.address -> includes(self.address)

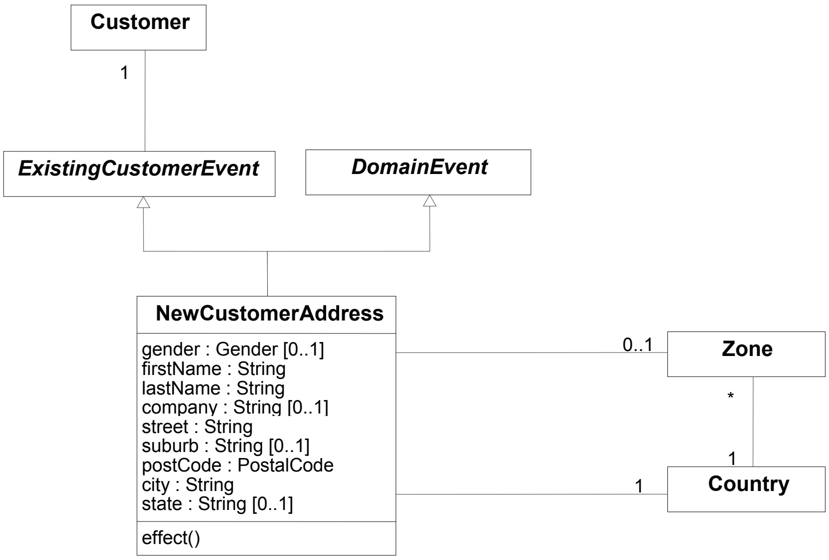
«IniIC»
context EditCustomerAddress::firstNameRight(): Boolean
body : self.newAdress.firstName.size() >= MinimumValues.firstName

«IniIC»
context EditCustomerAddress::lastNameRight(): Boolean
body : self. newAdress.lastName.size() >= MinimumValues.lastName

«IniIC»
context EditCustomerAddress::genderRight(): Boolean
body : CustomerDetails.gender **implies** self. newAdress.gender->notEmpty()

```
«IniIC»
context EditCustomerAddress::suburbRight(): Boolean
  body : CustomerDetails.suburb implies self. newAdress.suburb->notEmpty()

«IniIC»
context EditCustomerAddress::streetAddressRight(): Boolean
  body : self.newAdress.street.size() >= MinimumValues.streetAddress

«IniIC»
context EditCustomerAddress::companyRight(): Boolean
  body :
      CustomerDetails.company implies
      self.newAdress.company -> notEmpty() and
      self.newAdress.company.size() >= MinimumValues.companyName

«IniIC»
context EditCustomerAddress::postCodeRight(): Boolean
  body : self.newAdress.postCode.size() >= MinimumValues.postCode

«IniIC»
context EditCustomerAddress::cityRight(): Boolean
  body : self.newAdress.city.size() >= MinimumValues.city

«IniIC»
context EditCustomerAddress::stateRight(): Boolean
  body :
      CustomerDetails.state implies
      self.newAdress.state -> notEmpty() and
      self.newAdress.state.size() >= MinimumValues.state

«IniIC»
context EditCustomerAddress::addressesHaveZoneIfNeeded(): Boolean
  body :
     self.newAdress.zone -> notEmpty() implies
     self.newAdress.state = self.newAdress.zone.name and
     self.newAdress.country = self.newAdress.zone.country


context  EditCustomerAddress::effect()
   post :
      self.customer.address -> excludes(self.address) and
      self.customer.address ->includes(self.newAddress)
```

NewCustomerAddress



«IniIC»
context NewCustomerAddress::firstNameRight(): Boolean
body : self.primary.firstName.size() >= MinimumValues.firstName

«IniIC»
context NewCustomerAddress::lastNameRight(): Boolean
body : self.primary.lastName.size() >= MinimumValues.lastName

«IniIC»
context NewCustomerAddress::genderRight(): Boolean
body : CustomerDetails.gender **implies** self.gender->notEmpty()

«IniIC»
context NewCustomerAddress::suburbRight(): Boolean
body : CustomerDetails.suburb **implies** self.suburb->notEmpty()

«IniIC»
context NewCustomerAddress::streetAddressRight(): Boolean
body : self.primary.street.size() >= MinimumValues.streetAddress

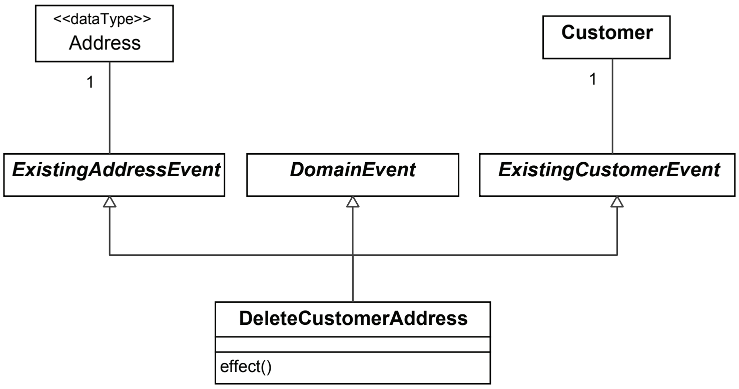
«IniIC»
context NewCustomerAddress::companyRight(): Boolean
body :
CustomerDetails.company **implies**
self.primary.company -> notEmpty() **and**
self.primary.company.size() >= MinimumValues.companyName

«IniIC»
context NewCustomerAddress::postCodeRight(): Boolean
body : self.primary.postCode.size() >= MinimumValues.postCode

«IniIC»
context NewCustomerAddress::cityRight(): Boolean
body : self.primary.city.size() >= MinimumValues.city

```
«IniIC»
context NewCustomerAddress::stateRight(): Boolean
  body :
     CustomerDetails.state implies
     self.primary.state -> notEmpty() and
     self.primary.state.size() >= MinimumValues.state

«IniIC»
context NewCustomerAddress::addressesHaveZoneIfNeeded(): Boolean
  body :
     self.country.zone->size()>0
     implies
    (self.state = self.zone.name and
     self.country = self.zone.country)

«IniIC»
context NewCustomerAddress::numberOfAddressesRight(): Boolean
  body : self.customer.address -> size() < MaximumValues.addressBookEntries


context  NewCustomerAddress::effect()
   post :
        Address.allInstances() ->exists (a  |
        a.gender = self.gender and
        a.firstName = self.firstName and
        a.lastName = self.lastName and
        a.company = self.company and
        a.street = self.street and
        a.suburb = self.suburb and
        a.postCode = self.postCode and
        a.city = self.city and
        a.state = self.state and
        a.zone = self.zone and
        a.country = self.country and
        self.customer.address -> includes(a))
```

DeleteCustomerAddress

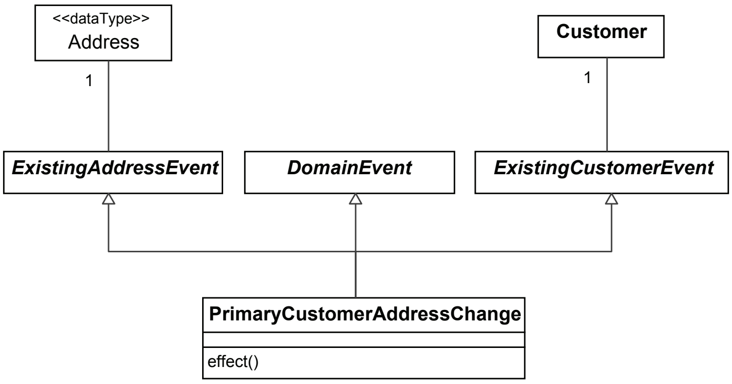


```
«IniIC»
context DeleteCustomerAddress::AddressOfCustomer(): Boolean
  body :  self.customer.address -> includes(self.address)

«IniIC»
context DeleteCustomerAddress::AtLeastTwoAddresses(): Boolean
  body :  self.customer.address.size() >= 2
```

«IniIC»
context DeleteCustomerAddress::PrimaryAddressCannotBeDeleted():Boolean
  self.address <> self.customer.primary

context DeleteCustomerAddress::effect()
  post : self.customer.address -> excludes(self.address)

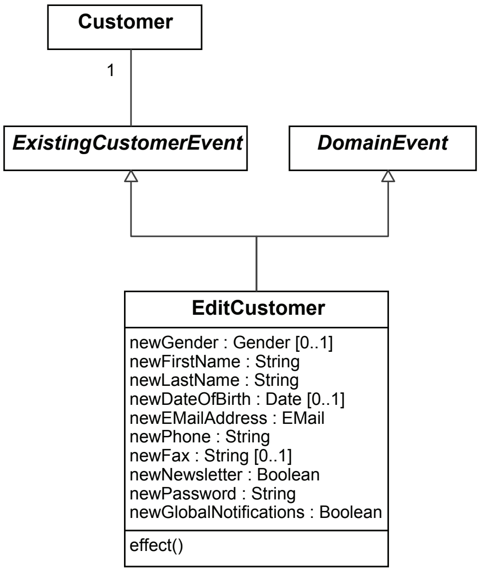
PrimaryCustomerAddressChange



«IniIC»
context PrimaryCustomerAddressChange::AddressOfCustomer(): Boolean
  body : self.customer.address -> includes(self.address)

context PrimaryCustomerAddressChange::effect()
  post : self.customer.primary = self.address

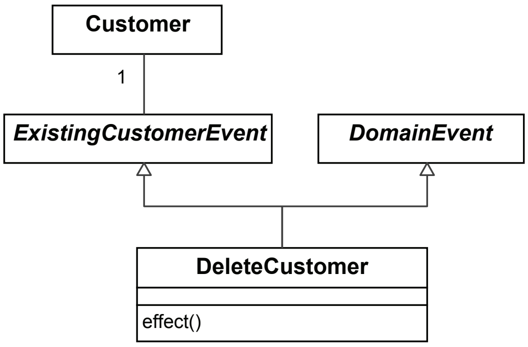
EditCustomer



«IniIC»
context EditCustomer::firstNameRight(): Boolean
  body : self.newFirstName.size() >= MinimumValues.firstName

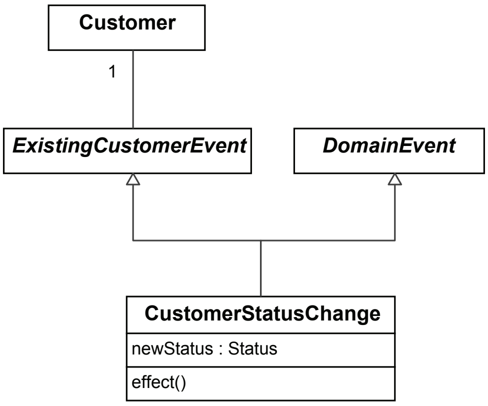
```
«IniIC»
context EditCustomer::lastNameRight(): Boolean
  body : self.newLastName.size() >= MinimumValues.lastName

«IniIC»
context EditCustomer::dateOfBirthRight(): Boolean
  body :
     CustomerDetails.dateOfBirth implies
     self.newDateOfBirth->notEmpty() and
     self.newDateOfBirth.size() >= MinimumValues.dateOfBirth

«IniIC»
context EditCustomer::genderRight(): Boolean
  body : CustomerDetails.gender implies self.newGender->notEmpty()

«IniIC»
context EditCustomer::eMailRight(): Boolean
  body : self.newEMailAddress.size() >= MinimumValues.eMailAddress
«IniIC»
context EditCustomer::telephoneRight(): Boolean
  body : self.newTelephone.size() >= MinimumValues.telephoneNumber

context  EditCustomer::effect()
   post :
      customer.gender = self.newGender and
      customer.firstName = self.newFirstName and
      customer.lastName = self.newLastName and
      customer.dateOfBirth = self.newDateOfBirth and
      customer.eMailAddress = self.newEMailAddress and
      customer.phone = self.newPhone and
      customer.fax = self.newFax and
      customer.newsletter = self.newNewsletter and
      customer.password = self.newPassword and
      customer.globalNotifications = self.newGlobalNotifications and
   post :
      customer.lastModified = Now()
```

DeleteCustomer



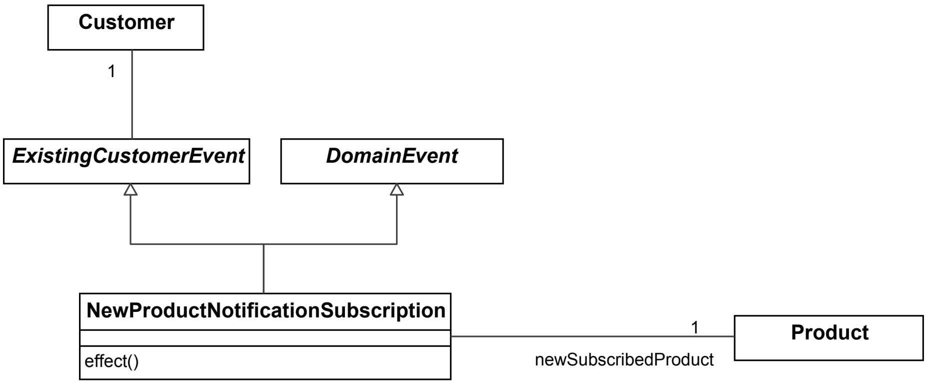
```
context  DeleteCustomer::effect()
   post deleteCustomer:
      not customer@pre.oclIsKindOf(OclAny)
   post deleteReviewsAndShoppingCart:
      not customer@pre.review@pre -> forAll (r | r.oclIsKindOf(OclAny)) and
      (customer@pre.customerShoppingCart->notEmpty()
      implies
      not customer@pre.customerShoppingCart@pre.oclIsKindOf(OclAny)))
```

CustomerStatusChange



context CustomerStatusChange::effect()
post : self.customer.status = self.newStatus

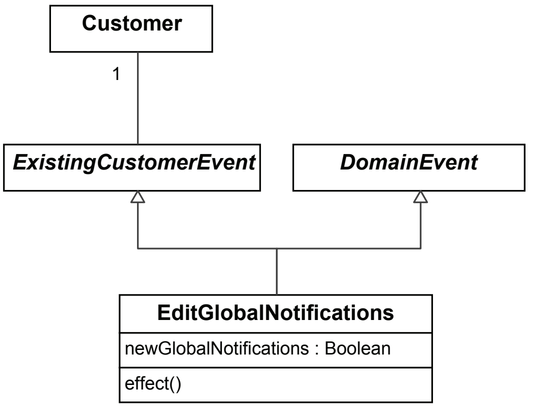
NewProductNotificationSubscription



«IniIC»
context NewProductNotificationSubscription::ProductIsUnsubscribed(): Boolean
body :
not self.customer.globalNotifications **and**
self.customer.explicitNotifications -> excludes(self.newSubscribedProduct)

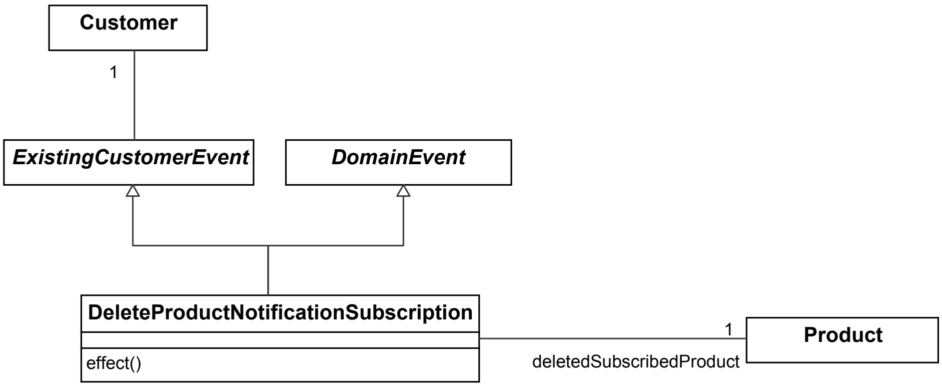
context NewProductNotificationSubscription::effect()
post : self.customer.explicitNotifications -> includes(self.newSubscribedProduct)

EditGlobalNotifications



context EditGlobalNotifications::effect()
post : self.customer.globalNotifications = self.newGlobalNotifications

DeleteProductNotificationSubscription



context DeleteProductNotificationSubscription::effect()
post : customer.explicitNotifications -> excludes(self.deletedSubscribedProduct)

Example test programs

```
testprogram NewCustomer{

        textConfigurationValues:=new MinimumValues, MaximumValues;
        textConfigurationValues.firstName:=1;
        textConfigurationValues.lastName:=1;
        textConfigurationValues.dateOfBirth:=6;
        textConfigurationValues.eMailAddress:=1;
        textConfigurationValues.streetAddress:=1;
        textConfigurationValues.companyName:=0;
        textConfigurationValues.postCode:=1;
        textConfigurationValues.city:=1;
        textConfigurationValues.state:=1;
        textConfigurationValues.telephoneNumber:=9;
        textConfigurationValues.password:=4;
        textConfigurationValues.addressBookEntries:=2;
```

```
customerDetailsConfiguration :=  new CustomerDetails;
customerDetailsConfiguration.gender:=false;
customerDetailsConfiguration.dateOfBirth:=false;
customerDetailsConfiguration.company:=true;
customerDetailsConfiguration.state:=false;
customerDetailsConfiguration.suburb:=false;
d:= new Date(date:='X/XX/XXXX');

abstract test validNewCustomer(String mail, String phone, String company,
                               String fax, String firstName, String lastName,
                               String street, String postCode, String city,
                               String country, Boolean newsletter,
                               String password, String passwordConfirmation){
        e := new EMail(eMail:=$mail);
        pc:= new PostalCode(postalCode:=$postCode);
        c := new Country(name:=$country);
        a := new Address
                (firstName:=$firstName, lastName:=$lastName, company:=$company,
                 street:=$street, postCode:=pc, city:=$city, country:=c);
        nc:=new NewCustomer(eMailAddress:=e, dateOfBirth:=d, phone:=$phone,
                       fax:=$fax, primary:=a, newsletter:=$newsletter,
                       password:=$password,
                       passwordConfirmation:=$passwordConfirmation);
        assert occurrence nc;
}

abstract test invalidNewCustomer(String mail, String phone, String company,
                                 String fax, String firstName, String lastName,
                                 String street, String postCode, String city,
                                 String country, Boolean newsletter, String password,
                                 String passwordConfirmation){
        e := new EMail(eMail:=$mail);
        pc:= new PostalCode(postalCode:=$postCode);
        c := new Country(name:=$country);
        a := new Address
                (firstName:=$firstName, lastName:=$lastName, company:=$company,
                 street:=$street, postCode:=pc, city:=$city, country:=c);
        nc:=new NewCustomer(eMailAddress:=e, dateOfBirth:=d, phone:=$phone,
                        fax:=$fax, primary:=a, newsletter:=$newsletter,
                        password:=$password,
                        passwordConfirmation:=$passwordConfirmation);
        assert non-occurrence nc;
}

//We can easily test the NewCustomer event in different valid or invalid contexts

test validNewCustomer
    ($mail:='atort@lsi.upc.edu', $phone:='XXXXXXXXX', $company:='UPC',
     $fax:='XXXXXXXXX', $firstName:='Albert', $lastName:='Tort',
     $street:='Jordi Girona,1', $postCode:='08034', $city:='Barcelona',
     $country:='Espanya', $newsletter:=true, $password:='password',
     $passwordConfirmation:='password');

test validNewCustomer
     ($mail:='olive@lsi.upc.edu', $phone:='XXXXXXXXX', $company:='UPC',
      $fax:='XXXXXXXXX', $firstName:='Antoni', $lastName:='Olive',
      $street:='Jordi Girona,1', $postCode:='08034', $city:='Barcelona',
      $country:='Espanya', $newsletter:=false, $password:='password',
      $passwordConfirmation:='password');

//Incorrect password confirmation
test invalidNewCustomer
    ($mail:='olive@lsi.upc.edu', $phone:='XXXXXXXXX', $company:='UPC',
     $fax:='XX XXX XX XX', $firstName:='Antoni', $lastName:='Olive',
     $street:='Jordi Girona,1', $postCode:='08034', $city:='Barcelona',
     $country:='Espanya', $newsletter:=false, $password:='password',
     $passwordConfirmation:='password2');



//Incorrect minimumValues
test invalidNewCustomer
     ($mail:='', $phone:='XXXXXXXXX', $company:='UPC', $fax:='XXXXXXXXX',
      $firstName:='Albert', $lastName:='Tort', $street:='Jordi Girona,1',
      $postCode:='08034', $city:='Barcelona', $country:='Espanya', $newsletter:=true,
      $password:='password', $passwordConfirmation:='password');
```

```
        test invalidNewCustomer($mail:='', $phone:='XXXXXXXXX', $company:='UPC',
                                $fax:='XXXXXXXXX', $firstName:='Albert', $lastName:='Tort',
                                $street:='Jordi Girona,1', $postCode:='08034',
                                $city:='Barcelona', $country:='Espanya', $newsletter:=true,
                                $password:='pass', $passwordConfirmation:='pass');

        test invalidNewCustomer($mail:='olive@lsi.upc.edu', $phone:='XX', $company:='UPC',
                                $fax:='XXXXXXXXX', $firstName:='Antoni', $lastName:='Olive',
                                $street:='Jordi Girona,1', $postCode:='08034',
                                $city:='Barcelona', $country:='Espanya', $newsletter:=false,
                                $password:='password', $passwordConfirmation:='password');

        test invalidNewCustomer($mail:='atort@lsi.upc.edu', $phone:='XXXXXXXXX',
                                $company:='UPC', $fax:='XXXXXXXXX', $firstName:='Albert',
                                $lastName:='Tort', $street:='', $postCode:='',
                                $city:='Barcelona', $country:='Espanya', $newsletter:=true,
                                $password:='password', $passwordConfirmation:='password');
}
```

```
testprogram EditCustomers{

        textConfigurationValues := new MinimumValues, MaximumValues;
        textConfigurationValues.firstName:=1;
        textConfigurationValues.lastName:=1;
        textConfigurationValues.dateOfBirth:=6;
        textConfigurationValues.eMailAddress:=1;
        textConfigurationValues.streetAddress:=1;
        textConfigurationValues.companyName:=0;
        textConfigurationValues.postCode:=1;
        textConfigurationValues.city:=1;
        textConfigurationValues.state:=1;
        textConfigurationValues.telephoneNumber:=9;
        textConfigurationValues.password:=4;
        textConfigurationValues.addressBookEntries:=2;

        customerDetailsConfiguration :=  new CustomerDetails;
        customerDetailsConfiguration.gender:=false;
        customerDetailsConfiguration.dateOfBirth:=false;
        customerDetailsConfiguration.company:=false;
        customerDetailsConfiguration.state:=false;
        customerDetailsConfiguration.suburb:=false;

        //Customer already created
        e := new EMail(eMail:='john@xxxx.xxx');
        d:= new Date;
        pc:= new PostalCode(postalCode:='XXXXX');
        c := new Country;
        a := new Address(firstName:='John', lastName:='Junior', street:='Major', postCode:=pc,
                         city:='xxxxxxxx', country:=c);

        nc:=new NewCustomer(eMailAddress:=e, dateOfBirth:=d,
                            phone:='XXXXXXXXX', fax:='XXXXXXXXX',
                            primary:=a, newsletter:=true, password:='password',
                            passwordConfirmation:='password');
        assert occurrence nc;

        john:=Customer.allInstances->any(eMailAddress=e);


        //Password change
        test validPasswordChange{
                pc:=new PasswordChange(customer:=john,
                                   oldPassword:='password',
                                   newPassword:='newPassword');
                assert occurrence pc;
                assert equals john.password 'newPassword';
        }

        test invalidPasswordChange{
                //The password cannot be changed if the old password is not correct
                pc:=new PasswordChange(customer:=john,
                                   oldPassword:='asdfasdf',
                                   newPassword:='newPassword');
                assert non-occurrence pc;

                //The password cannot be changed if the new password does not satisfies
               //the minimum and maximum configuration values
                pc:=new PasswordChange(customer:=john,
                                   oldPassword:='password',
                                   newPassword:='as');
                assert non-occurrence pc;
        }
        //Edit customer details
        test validCustomerDetailsEditions{
                e2 := new EMail(eMail:='john@yyyyy.yyy');
                d2:= new Date(date:='YY/YY/YYYY');
                ecd:=new EditCustomerDetails(customer:=john,
                                       newFirstName:='Johnatan', newLastName:='JR.',
                                       newEMailAddress:=e2, newDateOfBirth:=d2,
                                       newPhone:='YYYYYYYYY', newFax:='YYYYYYYYY');
                assert occurrence ecd;
        }

        test invalidCustomerDetailsEditions{
                e2 := new EMail(eMail:='');
                d2:= new Date(date:='YY/YY');
                ecd:=new EditCustomerDetails(customer:=john,
                                        newFirstName:='', newLastName:='',
                                        newEMailAddress:=e2, newDateOfBirth:=d2,
                                        newPhone:='YYYYYY', newFax:='YY');
                assert non-occurrence ecd;
        }

        //Edit customer
        /*Edit customer can only be executed by the store administrator
        (who can edit the customer details including its password and the
        global notifications option*/

        test validCustomerEdition{
                e2 := new EMail(eMail:='john@yyyyy.yyy');
                d2:= new Date(date:='YY/YY/YYYY');
                ec:=new EditCustomer(customer:=john,newPassword:='zxcvxcv',
                                 newGlobalNotifications:=false,
                                 newFirstName:='Johnatan', newLastName:='JR.',
                                 newEMailAddress:=e2, newDateOfBirth:=d2,
                                 newPhone:='YYYYYYYYY', newFax:='YYYYYYYYY');
                assert occurrence ec;
        }

        test invalidCustomerEdition{
                e2 := new EMail(eMail:='');
                d2:= new Date(date:='YY/YY');
                ec:=new EditCustomer(customer:=john,
                                 newPassword:='xy', newGlobalNotifications:=false,
                                 newFirstName:='', newLastName:='', newEMailAddress:=e2,
                                 newDateOfBirth:=d2, newPhone:='YYYYYY', newFax:='YY');
                assert non-occurrence ec;
        }
}
```

```
testprogram CustomerAddressesManagement{

        //Customer initialization
        spain:=new Country(name:='Spain', isoCode2:='ES', isoCode3:='ESP');
        catalonia:=new Zone(name:='Catalonia', code:='CAT', country:=spain);
        a:= new Address(country:=spain, zone:=catalonia,
                        state:='Catalonia', street:='Lluis Companys', city:='Sitges');
        c := new Customer(address:=a,primary:=a);

        //Other locations to be used
        germany:=new Country(name:='Germany', isoCode2:='DE', isoCode3:='DEU');
        saxony:=new Zone(name:='Saxony', code:='SAX', country:=germany);
        pc:=new PostalCode(postalCode:='XXXXX');

        //Minimum and maximum values
        textConfigurationValues := new MinimumValues, MaximumValues;
        textConfigurationValues.firstName:=1;
        textConfigurationValues.lastName:=1;
        textConfigurationValues.dateOfBirth:=6;
        textConfigurationValues.eMailAddress:=1;
        textConfigurationValues.streetAddress:=1;
        textConfigurationValues.companyName:=0;
        textConfigurationValues.postCode:=1;
        textConfigurationValues.city:=1;
        textConfigurationValues.state:=1;
        textConfigurationValues.telephoneNumber:=9;
        textConfigurationValues.password:=4;
        textConfigurationValues.addressBookEntries:=2;
        customerDetailsConfiguration :=  new CustomerDetails;
        customerDetailsConfiguration.gender:=false;
        customerDetailsConfiguration.dateOfBirth:=true;
        customerDetailsConfiguration.company:=false;
        customerDetailsConfiguration.state:=false;
        customerDetailsConfiguration.suburb:=false;

        test validAddressCreations{
                pc:=new PostalCode(postalCode:='XXXXX');
                nca:=new NewCustomerAddress(customer:=c, firstName:='XXXX',
                                       lastName:='XXXXXX',
                                       street:='XXXXX', postCode:=pc, city:='XXXXX',
                                       country:=spain, zone:=catalonia, state:='Catalonia');
                assert occurrence nca;
        }

        test invalidAddressCreations{
                //Zone must be coherent with the state if it is assigned
                nca1:=new NewCustomerAddress(customer:=c, zone:=catalonia, firstName:='XXXX',
                                      lastName:='XXXXXX', street:='XXXXX', postCode:=pc,
                                      city:='XXXXX', country:=spain);
                assert non-occurrence nca1;
                nca2:=new NewCustomerAddress(customer:=c, zone:=saxony, country:=spain,
                                       firstName:='XXXX', lastName:='XXXXXX', street:='XXXXX',
                                      postCode:=pc, city:='XXXXX');
                assert non-occurrence nca2;
                //Minimum values cannot be violated
                nca3:=new NewCustomerAddress(customer:=c, zone:=saxony, country:=spain,
                                       firstName:='', lastName:='', street:='XXXXX',
                                       postCode:=pc, city:='');
                assert non-occurrence nca3;
        }

        test AddressEdition{
                //We add to the customer another address
                nca:=new NewCustomerAddress(customer:=c, zone:=saxony, country:=germany,
                                       firstName:='XXXXXXXX', lastName:='XXXXXXXX',
                                       street:='XXXXX', postCode:=pc, city:='Dresden',
                                       state:='Saxony');
                assert occurrence nca;

                //Now, the customer has addresses in Spain and in Germany
                assert equals c.address.country->asSet() Set{spain,germany};
                assert true c.address->exists(street='Lluis Companys');

                //We try to change the spanish address
                //(we test what if the user lives now in another street)
                //In order to edit an address of a customer we should provide the new address
                na:=new Address(country:=spain, zone:=catalonia, state:='Catalonia',
                                city:='Sitges', street:='Passeig Maritim',
                                postCode:=pc,firstName:='XXXX', lastName:='XXXXXX');

                eca:=new EditCustomerAddress(customer:=c, address:=a, newAddress:=na);
                assert occurrence eca;
                assert false c.address->exists(street='Lluis Companys');
                assert true c.address->exists(street='Passeig Maritim');

                //We can change the primary address
                //We put the address from Germany as the primary
                pcac:=new PrimaryCustomerAddressChange(address:=c.address
                                                       ->any(country=germany),
                                                       customer:=c);
                assert occurrence pcac;
                //We cannot put as primary an address which is not an address of the customer
                a2:= new Address(country:=spain, zone:=catalonia, state:='Catalonia',
                                 street:='Anselm Clavé', city:='Tarragona');
                pcac2:=new PrimaryCustomerAddressChange(address:=a2, customer:=c);
```

```
                assert non-occurrence pcac2;

                //Minimum values cannot be violated when editing an address
                //We try to edit an address with no city and street information
                na2:=new Address(country:=spain, zone:=catalonia, state:='Catalonia',
                                 city:='', street:='',postCode:=pc,firstName:='XXXX',
                                 lastName:='XXXXXX');
                eca:=new EditCustomerAddress(customer:=c, address:=a, newAddress:=na2);
                assert non-occurrence eca;

                //Finally, we delete an address of a customer;
                assert equals c.address->size() 2;
                dca:=new DeleteCustomerAddress(address:=c.address->any(country=spain),
                                               customer:=c);
                assert occurrence dca;
                //We cannot delete the primary address
                dca2:=new DeleteCustomerAddress(address:=c.primary, customer:=c);
                assert non-occurrence dca2;
        }
}
```

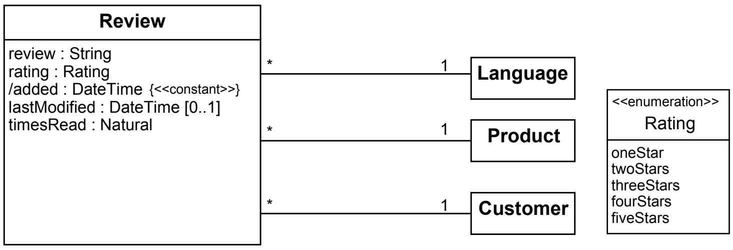
```
tesprogram ProductSubscriptionsManagement{

        //Customer initialization
        spain:=new Country(name:='Spain', isoCode2:='ES', isoCode3:='ESP');
        catalonia:=new Zone(name:='Catalonia', code:='CAT', country:=spain);
        a:= new Address(country:=spain, zone:=catalonia, state:='Catalonia',
                        street:='Lluis Companys', city:='Sitges');
        c := new Customer(address:=a,primary:=a, globalNotifications:=false);

        //Products initialization
        p1:=new Product;
        p2:=new Product;

        test ProductNotificationSubscriptions{
                assert equals c.notifications()->size() 0;
                npns:=new NewProductNotificationSubscription(customer:=c,
                                                             newSubscribedProduct:=p1);
                assert occurrence npns;
                assert equals c.notifications() Set{p1};

                //We cannot subscribe an already subscribed product
                assert non-occurrence npns;

                //We can subscribe more than one product
                npns2:=new NewProductNotificationSubscription(customer:=c,
                                                              newSubscribedProduct:=p2);
                assert occurrence npns;
                assert equals c.notifications() Set{p1,p2};

                //We can delete subscriptions
                dpns:=new DeleteProductNotificationSubscription(customer:=c,
                                                          deletedSubscribedProduct:=p2);
                assert occurrence dpns;
                assert equals c.notifications() Set{p1};

                //If global notifications is enabled, explicit notification subscriptions
                //are not taken into account and all products are considered to be subscribed
                egn:=new EditGlobalNotifications(customer:=c, newGlobalNotifications:=true);
                assert occurrence egn;
                assert equals c.notifications() Set{p1,p2};
        }
}
```

```
testprogram DeleteCustomers{

        //Customer initialization
        co:= new Country;
        a:= new Address(country:=co);
        c:= new Customer(address:=a, primary:=a);
        cu:=new Currency(status:=#enabled);
        //Language initialization
        l:= new Language;


        //Products initialization
        p1:=new Product;
        p2:=new Product;

        //MinimumValues
        mv:=new MinimumValues;
        mv.reviewText:=0;

        //The customer write reviews
        nr1:=new NewReview(customer:=c, product:=p1, language:=l, rating:=#fourStars,
                      review:='reviewText');
        nr2:=new NewReview(customer:=c, product:=p2, language:=l, rating:=#twoStars,
                      review:='reviewText2');

        //The customer has an active shopping cart
        sc := new CustomerShoppingCart(customer:=c);
        item1 := new ShoppingCartItem(product:=p1, quantity:=3, shoppingCart:=sc);

        test deleteCustomerWithNoOrders{
                assert occurrence nr1;
                assert non-occurrence nr2;

                //The customer is deleted and also its active shopping carts and reviews
                dc:=new DeleteCustomer(customer:=c);
                assert occurrence dc;

                //Reviews of customer are also deleted
                assert equals p1.review->size() 0;
                assert equals p2.review->size() 0;

                //The active shopping cart of the customer is also deleted
                assert true c.customerShoppingCart->isEmpty();
        }

        test deleteCustomerWithOrders{

                //Store initialization
                s:=new Store;
                s.defaultLanguage:=l;
                s.defaultCurrency:=cu;
                s.country:=co;
                cos:=new OrderStatus;
                cosl:=new OrderStatusInLanguage(language:=l,orderStatus:=cos);
                cosl.name:='cancelled';
                s.cancelledStatus:=cos;
                dos:=new OrderStatus;
                dosl:=new OrderStatusInLanguage(orderStatus:=dos, language:=l);
                dosl.name:='pending';
                s.defaultStatus:=dos;

                //We create an order of the customer
                stock := new Stock;
                stock.checkStockLevel:=false;
                stock.allowCheckout:=true;
                stock.substractStock:=false;

                pm:=new CashOnDelivery(status:=#enabled);
                sm:=new PerItem(status:=#enabled, handlingFee:=5, cost:=10);

                oc:=new OrderConfirmation(shoppingCart:=sc, currency:=cu ,
                                     shippingMethod:=sm, paymentMethod:=pm);
                assert occurrence oc;

                dc:=new DeleteCustomer(customer:=c);
                assert occurrence dc;

                assert occurrence nr1;
                assert non-occurrence nr2;

                //The customer becomes disabled and also its active shopping carts and reviews
                assert equals c.status #disabled;
                //Reviews of customer are also deleted
                assert equals p1.review->size() 0;
                assert equals p2.review->size() 0;

                //The active shopping cart of the customer is also deleted
                assert true c.customerShoppingCart->isEmpty();
        }
}
```

Reviews

Structural schema

In order to allow users reading evaluations of a product, customers can write reviews.



[1] *Review::**added*** is the *DateTime* of the review creation.

context Review::added():DateTime
  body : Now()

Use cases

Add a review

Primary Actor: Customer

Precondition: None.

Trigger: A customer wants to write a review of a product.

Main Success Scenario:

1. The customer selects a product.
2. The customer provides the content and the rate of the review:

    [→*NewReview*]

3. The system validates that the data is correct.
4. The system saves the review.

Extensions:

2a. The customer is not logged in:

  2a1. The customer logs in:

[→*LogIn*]

2a2. The use case continues at step 2.

Edit a review

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to edit a review.

Main Success Scenario:

1. The store administrator selects the review to be edited.
2. The store administrator provides the modified text and the new rating of the selected review.

   [→*EditReview*]
3. The system validates that the data is correct.
4. The system saves the changes.

Delete a review

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to delete a review.

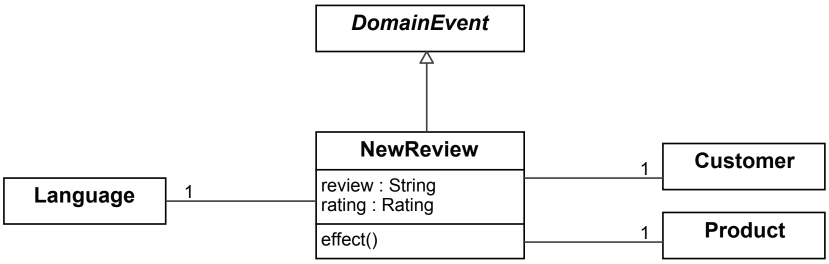
Main Success Scenario:

1. The store administrator selects the review to be deleted.
2. The system asks for the confirmation of the store administrator.
3. The store administrator confirms that he wants to delete the review:

   [→*DeleteReview*]
4. The system deletes the review.

Events

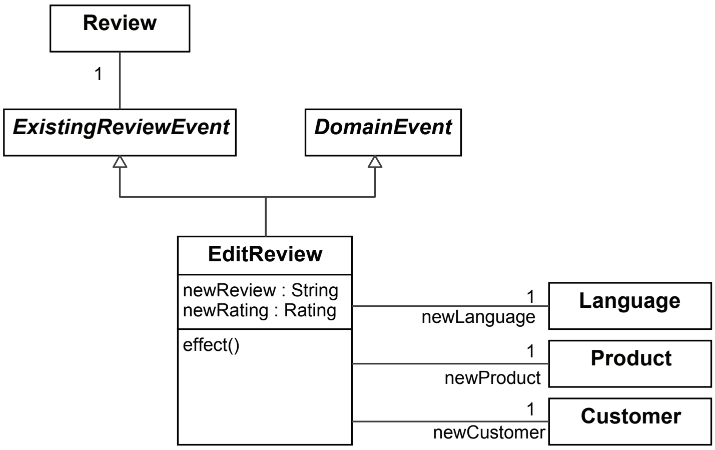
NewReview



«IniIC»
context NewReview::reviewRight(): Boolean
  body : self.review.size() >= MinimumValues.reviewText

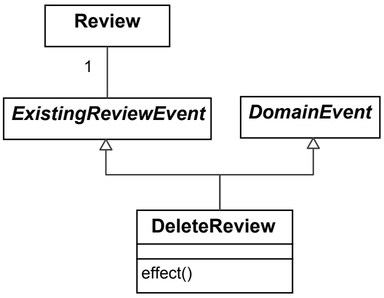
context NewReview::effect()
  post :
    r.oclIsNew() and
    r.oclIsTypeOf(Review) and
    r.review = self.review and
    r.rating = self.rating and
    r.customer = self.customer and
    r.product = self.product and
    r.language = self.language

EditReview



context EditReview::effect()
  post :
    self.review.review = self.newReview and
    self.review.rating = self.newRating and
    self.review.language = self.newLanguage and
    self.review.product = self.newProduct and
    self.review.customer = self.newCustomer
  post :
    self.review.lastModified = Now()

DeleteReview



context DeleteReview::effect()
  post : not self.review@pre.oclIsKindOf(OclAny)

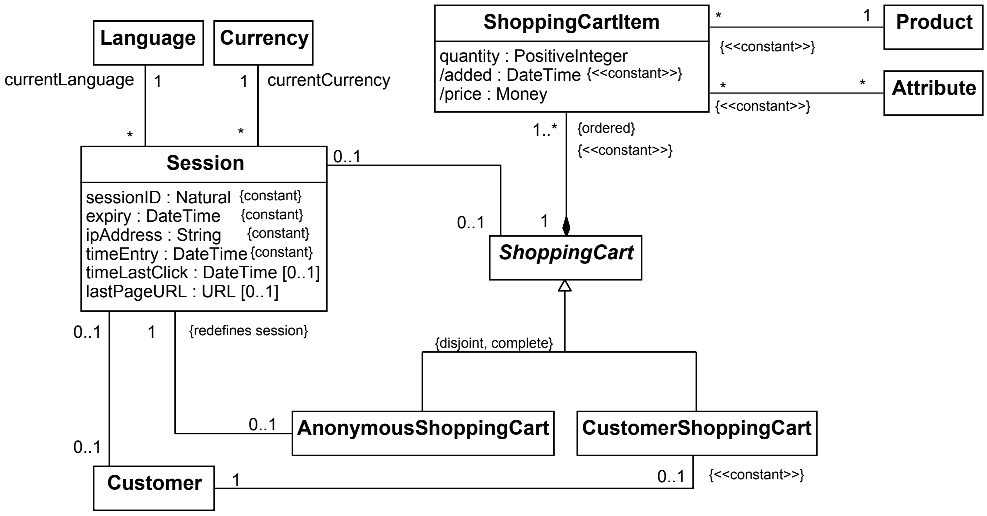
Example test programs

```
testprogram ReviewsManagement{

                english:=new Language(name:='English', code:='EN');
                spanish:=new Language(name:='Spanish', code:='ES');
                usa:=new Country;
                a1:= new Address(country:=usa);
                e1:= new EMail(eMail:='xxxx1@x.com');
                c1:=new Customer(eMailAddress:=e1,address:=a1,primary:=a1);
                a2:= new Address(country:=usa);
                e2:= new EMail(eMail:='xxxx2@x.com');
                c2:=new Customer(eMailAddress:=e2,address:=a2,primary:=a2);
                hotelcomfort:=new Product;

                new MinimumValues(reviewText:=1);

                test newReview{
                        nr:=new NewReview(customer:=c1, product:=hotelcomfort,
                                     language:=english, rating:=#fourStars,
                                      review:='Very easy to find the hotel near Notting Hill
                                              gate. Generally very polite and helpful people
                                              in the area') ;
                assert occurrence nr;
                }

                test ThreeReviewsOfProduct{
                        nr1:=new NewReview(customer:=c1, product:=hotelcomfort,
                                     language:=english, rating:=#fourStars,
                                      review:='Very easy to find the hotel near Notting Hill
                                              gate. Generally very polite and helpful people
                                              in the area');
                        assert occurrence nr1;
                        nr2:=new NewReview(customer:=c2, product:=hotelcomfort,
                                     language:=spanish, rating:=#twoStars,
                                      review:='Muy bien localizado, al lado del mercado de
                                              Porto Bello. És un hotel con una distribución
                                              estraña al ocupar varios edificios lo que hace
                                              que el laberinto de pasillos sea de lo más
                                              divertido. El personal es distante.');
                        assert occurrence nr2;
                        //A customer can review a product more than once
                        rr3:=new NewReview(customer:=c1, product:=hotelcomfort,
                                     language:=english, rating:=#fourStars,
                                      review:='Easy accessible by public transport';
                        assert occurrence nr3;

                        assert equals hotelcomfort.review->size() 3;
                }

                test InvalidReviewCreation{
                        //Minimum values configuration must be taken into account
                        nr:=new NewReview(customer:=c1, product:=hotelcomfort,
                                     language:=english, rating:=#fourStars,
                                      review:='');
                        assert non-occurrence nr;
                }

                test ReviewEdition{
                        //A customer can publish a review
                        nr:=new NewReview(customer:=c1, product:=hotelcomfort,
                                     language:=english, rating:=#fiveStars,
                                      review:='I hate this hotel. Call me for more
                                     details 12345');
                        assert occurrence nr;

                        //And the store administrator can edit it
                        er:=new EditReview(review:=nr.createdReview, newLanguage:=english,
                                      newCustomer:=c1, newRating:=#oneStar,
                                      newProduct:=hotelcomfort,
                                      newReview:='I do not like this hotel');
                        assert occurrence er;
                }

                test DeleteReview{
                        //A customer can publish a review
                        nr:=new NewReview(customer:=c1, product:=hotelcomfort,
                                         language:=english, rating:=#fiveStars,
                                          review:='asdfasdfñjñasdf');
                        assert occurrence nr;
                        assert equals hotelcomfort.review->size() 1;

                        //And the store administrator can delete it
                        r:=nr.createdReview;
                        dr:=new DeleteReview(review:=r);
                        assert occurrence dr;
                        assert equals hotelcomfort.review->size() 0;
                }


}
```

Shopping carts & Orders

Structural schema

Customers can add or remove products from their shopping carts while they are surfing the *online* store.



[DR1] *ShoppingCartItem::**price*** is the net price for an item taking into account the selected product attributes.

```
context ShoppingCartItem::price():Money
body :
   let netPriceWithSpecial:Money =
           if self.product.specialNetPrice ->notEmpty() then self.product.specialNetPrice
           else self.product.netPrice
           endif
 in
   if  self.attribute -> isEmpty() then netPriceWithSpecial
```

```
  else
     self.attribute.productAttribute -> select (pa | pa.product = self.product) -> collect
     (if sign = Sign::plus
     then increment
      else –increment
     endif) -> sum() + netPriceWithSpecial
  endif
```

[DR2] *ShoppingCartItem::****added*** is the *DateTime* when the item was created.

```
context ShoppingCartItem::added():DateTime
  body : Now()
```

[IC1] If a customer shopping cart exists in the context of a session then its customer is the customer of the session

```
context CustomerShoppingCart::sameCustomer(): Boolean
  body : self.session.customer -> notEmpty() implies self.session.customer = self.customer
```

[IC2] The shopping cart item specifies the selected product attributes, which must be a subset of all the product attributes.

```
context ShoppingCartItem::productHasTheAttributes(): Boolean
  body : self.product.attribute -> includesAll(self.attribute)
```

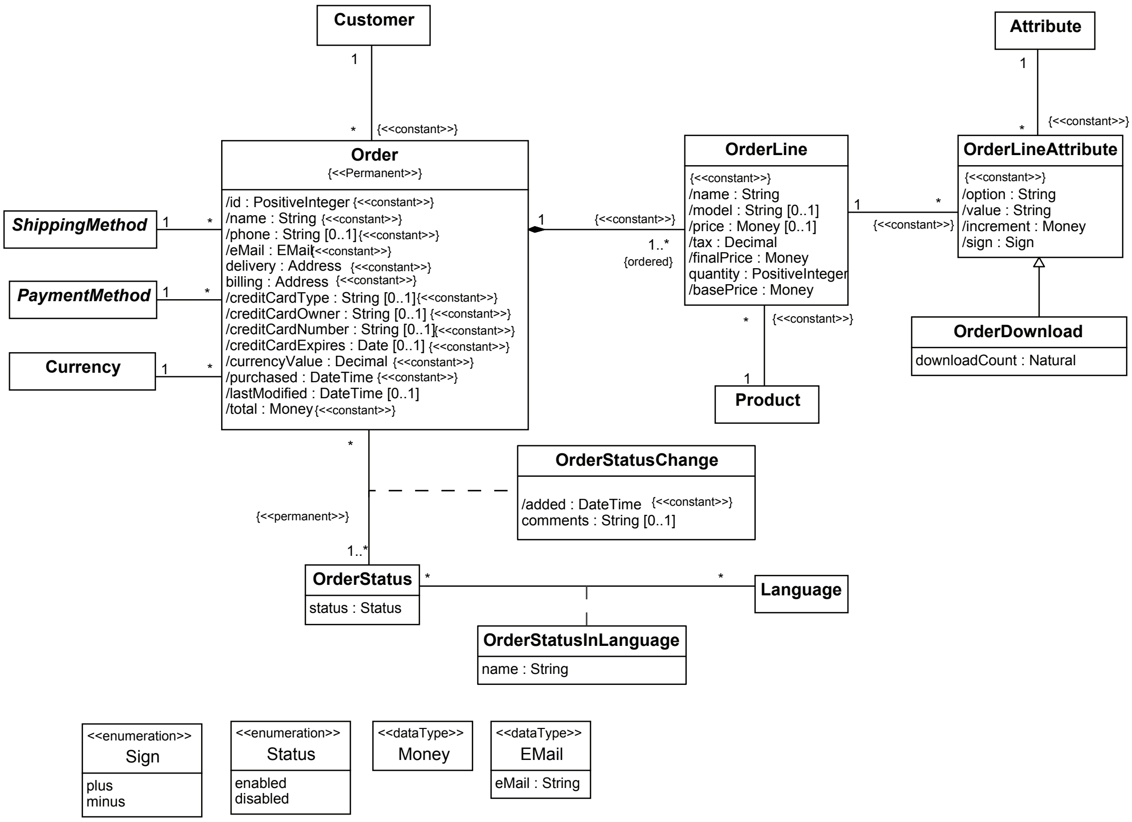
[IC3] The shopping cart item specifies only one attribute per option.

```
context ShoppingCartItem::onlyOneAttributePerOption(): Boolean
  body : self.attribute -> isUnique(option)
```

[IC4] Sessions are identified by its sessionID.

```
context Session::sessionIDIsUnique(): Boolean
  body : Session.allInstances() -> isUnique (sessionID)
```

Orders are the confirmation that a customer wants to buy the contents of his shopping cart.



```
context  ShippingMethod def:
   addTaxes(z:Zone, basePrice:Money) : Money =
      let appliedTaxRates:Set(TaxRate)=
         z.taxZone.taxRate -> select (tr | tr.taxClass = self.taxClass) -> asSet()
       in
         let  priorities:set(Natural) =
            if appliedTaxRates -> isEmpty() then set{}
            else appliedTaxRates -> sortedBy(priority).priority -> asSet()
            endif
         in
            if priorities -> isEmpty() then basePrice
            else priorities -> iterate (p:Natural; res:Money = 0 |
                    res +
                    (((appliedTaxRates -> select (tr | tr.priority = p).rate
                    -> sum()) / 100)+1)*basePrice)
            endif

context  ShippingMethod def:
   shippingCosts(totalWeight:Decimal, totalPrice:Money, quantity:PositiveInteger): Money = 0

context  FlatRate def:
   shippingCosts(totalWeight:Decimal, totalPrice:Money, quantity:PositiveInteger): Money = self.cost

context  PerItem def:
   shippingCosts(totalWeight:Decimal, totalPrice:Money, quantity:PositiveInteger): Money =
      self.cost*quantity

context  TableRate def:
   shippingCosts(totalWeight:Decimal, totalPrice:Money, quantity:PositiveInteger): Money =
      if self.method = ShippingTableMethod::weight
      then
         self.items -> select (i | i.number <= (totalWeight*quantity)) -> sortedBy(number) ->last().cost
      else
         self.items -> select (i | i.number <= (totalPrice*quantity)) -> sortedBy(number) ->last().cost
      endif

context  USPostalService def:
   shippingCosts(totalWeight:Decimal, totalPrice:Money, quantity:PositiveInteger): Money =
     calculateFromUSPS (self.userID, self.password, self.server, totalWeight, totalPrice, quantity)
```

[DR1] *Order::**id*** identifies the order and it is assigned automatically.

```
context Order::id():PositiveInteger
body :
   if Order.allInstances() -> size() = 0 then 0
   else Order.allInstances() -> sortedBy(id) -> last().id + 1
   endif
```

[DR2] *Order::**primary*** address of an order is that of its customer.

```
context Order::primary():Address
  body : self.customer.primary
```

[DR3] *Order::**eMailAddress*** of an order is that of its customer.

```
context Order::eMailAddress():EMail
  body : self.customer.eMailAddress
```

[DR4] *Order::**phone*** of an order is that of its customer.

```
context Order::phone():String
   body : self.customer.phone
```

[DR5] *Order::**purchased*** is the *DateTime* when the order was created

```
context Order::purchased():DateTime
  body : Now()
```

[DR6] *Order::**lastModified*** is the last *DateTime* when the status order was modified

```
context Order::lastModified():DateTime
  body : self.orderStatusChange -> sortedBy(added)  -> last().added
```

[DR7] *Order::**statuts*** is the current status of the order

```
context Order::status():OrderStatus
  body : self.orderStatusChange -> sortedBy(added) -> last().orderStatus
```

[DR8] *Order::**total*** gives the total amount of an order

```
context Order::total():Money
body :
   let totalWithoutShippingCosts:Money =
      self.orderLine -> collect(finalPrice*quantity) -> sum()
   let totalWeight:Decimal =
      self.orderLine -> collect(product.weight*quantity) -> sum()
   let quantity:PositiveInteger =
      self.orderLine.quantity -> sum()
```

```
  let handlingFee:Money =
    if self.shippingMethod.oclIsKindOf(HandlingFeeMethod)
    then
      self.shippingMethod.oclAsType(HandlingFeeMethod).handlingFee
    else 0
    endif
  in
    let totalWeightIncreased:Decimal =
        if totalWeight* (ShippingAndPackaging.percentageIncreaseForLargerPackages/100) >
          ShippingAndPackaging.typicalPackageTareWeight
        then
         totalWeight * (1 +totalWeight*
         ShippingAndPackaging.percentageIncreaseForLargerPackages/100)
       else totalWeight + ShippingAndPackaging.typicalPackageTareWeight
       endif
     in
       totalWithoutShippingCosts +
           self.shippingMethod.shippingCosts
           (totalWeightIncreased, totalWithoutShippingCosts, quantity) + handlingFee
```

[DR9] *OrderStatusChange::**added*** is the *DateTime* when the change is done.

```
context OrderStatusChange::added():DateTime
body :  Now()
```

[10] *OrderLine::**name*** is that of its product in the default language

```
context OrderLine::name():String
body :
  self.product.productInLanguage
  ->select(pil | pil.language = Store.allInstances() -> any(true).defaultLanguage).name
```

[DR11] *OrderLine::**model*** is that of its product

```
context OrderLine::model():String
body :  self.product.model
```

[DR12] *OrderLine::**basePrice*** is the net price of the product without taking into account the selected attributes.

```
context OrderLine::basePrice():Money
body :
  if self.product.specialNetPrice ->notEmpty()
  then self.product.specialNetPrice
  else self.product.netPrice
  endif
```

[DR13] *OrderLine::**price*** is the net price of the product with the selected attributes

```
context OrderLine::price():Money
body :
  if  self.orderLineAttribute  -> isEmpty() then self.basePrice
  else
    self.orderLineAttribute -> collect
    (if sign = Sign::plus then increment
    else –increment
    endif) -> sum() + self.basePrice
 endif
```

[DR14] *OrderLine::**finalPrice*** is the price of the product with the selected attributes and taking into account the taxes

```
context OrderLine::finalPrice():Money
body :
   if self.billing.zone -> notEmpty() then
      self.product.addTaxes(self.billing.zone, self.price)
   else self.price
   endif
```

[DR15] *OrderLineAttribute::**option*** is the option name in the default language

```
context OrderLineAttribute::option():String
body :
   self.attribute.option.hasOptionName
      -> select (hon | hon.optionLanguage = Store.allInstances()  -> any(true).defaultLanguage).optionName
```

[DR16] *OrderLineAttribute::**value*** is the option value in the default language

```
context OrderLineAttribute::value():String
body :
   self.attribute.value.hasValueName
      -> select (hvn | hon.valueLanguage = Store.allInstances() -> any(true).defaultLanguage).valueName
```

[DR17] *OrderLineAttribute::**increment*** is the increment applied in the product price by the attribute

```
context OrderLineAttribute::increment():Money
body :
   self.attribute.productAttribute
      -> select (pa | pa.product = self.orderLine.product).increment
```

[DR18] *OrderLineAttribute::**sign*** is the sign of the increment applied in the product price by the attribute

```
context OrderLineAttribute::sign():Sign
body :
   self.attribute.productAttribute
   -> select (pa | pa.product = self.orderLine.product).sign
```

[IC1] A specific zone shipping method with a specific tax zone can only be applied if the delivery address zone is included in the tax zone.

```
context Order::ApplicableZoneShippingMethod: Boolean
body :
   self.shippingMethod.oclIsTypeOf(SpecificZoneMethod) and
   self.shippingMethod.oclAsType(SpecificZoneMethod).taxZone -> notEmpty implies
   self.shippingMethod.oclAsType(SpecificZoneMethod).taxZone.zone
   -> includes(self.delivery.zone)
```

[IC2] The *Zone Rates* shipping method can only be applied in the specified countries.

```
context Order::ApplicableZoneRatesShippingMethod: Boolean
body :
   self.shippingMethod.oclIsTypeOf(ZoneRates)  implies
   self.shippingMethod.oclAsType(ZoneRates).country -> includes(self.delivery.country)
```

[IC3] Payment methods with a specified tax zone can only be applied in orders with a billing address located in a zone included in the tax zone.

```
context Order::ApplicableZonesPaymentMethod: Boolean
body :
   self.paymentMethod.taxZone -> notEmpty()  implies
   self.paymentMethod.taxZone.zone -> includes(self.billing.zone)
```

[IC4] Payment methods with a specified set of applicable currencies can only be applied if the current currency is included in that set.

```
context Order::ApplicableCurrenciesPaymentMethod: Boolean
body :
   self.shippingMethod.oclIsTypeOf(SpecificCurrenciesMethod)  implies
   self.shippingMethod.oclAsType(SpecificCurrenciesMethod).currency -> includes(self.currency)
```

[IC5] Orders are identified by its id

```
context Order::IDIsUnique: Boolean
body :  Order.allInstances() -> isUnique(id)
```

[IC6] Order status are identified by its name

```
context OrderStatus::NameIsUnique: Boolean
body :  OrderStatus.allInstances() -> isUnique(name)
```

Use Cases

Open session

Primary Actor: Customer

Precondition: None.

Trigger: A customer starts using the system.

Main Success Scenario:

1. The system creates an anonymous session :

   [→*NewSession*]

Finish session

Primary Actor: Customer

Precondition: None.

Trigger: A customer finishes using the system.

Main Success Scenario:

1. The system deletes the current session.

   [→*DeleteSession*]

Extensions:

1a. The customer is logged in and the session has a non empty shopping cart.

1a1. The shopping cart is saved.

Log in

Primary Actor: Customer

Precondition: The customer is not logged in yet.

Trigger: A customer logs in the system.

Main Success Scenario:

1. The customer introduces their identification data.
2. The system validates the identification data.
3. The customer becomes the owner of the current session.

[→*LogIn*]

Extensions:

3a. The customer has a shopping cart from a previous session.

3a1. The previous shopping cart is restored.

[→*RestorePreviousShoppingCart*]

3b. The current session has a non-empty and anonymous shopping cart

3b1. The anonymous shopping cart becomes the current shopping cart of the customer.

LogOut

Primary Actor: Customer

Precondition: The customer is logged in.

Trigger: A customer logs out from the system.

Main Success Scenario:

1. The current session becomes anonymous.

[→*LogOut*]

Extensions:

1a. The customer has a non empty shopping cart.

1a1. The shopping cart is saved.

Change the current language

Primary Actor: Customer

Precondition: None.

Trigger: A customer wants to change the current language of the session.

Main Success Scenario:

1. The store administrator selects the language which will become the current language.
2. The system updates the current language.

   [→*SetCurrentLanguage*]

Change the current currency

Primary Actor: Customer

Precondition: None.

Trigger: A customer wants to change the current currency of the session.

Main Success Scenario:

1. The store administrator selects the currency which will become the current currency.
2. The system updates the current currency.

   [→*SetCurrentCurrency*]

Place and order

Primary Actor: Customer

Precondition: None.

Trigger: A customer wants to place and order.

Main Success Scenario:

1. At any time before step 10 the customer logs in:

   [→*LogIn*]

The system adds the contents of the anonymous shopping cart to the customer shopping cart.

2. The system displays the contents of the shopping cart.
3. The customer browses the product catalog.

   [→*ReadProductInfo*]

4. The customer selects a product to buy:

   [→*AddProductToShoppingCart*]

5. The system adds the product to the shopping cart.
6. The system displays the contents of the shopping cart.
7. The customer changes the contents of the shopping cart:

[→*UpdateShoppingCart*]

8. The system updates the shopping cart.
9. The system displays the contents of the updated shopping cart.

The customer repeats steps 3,4 and 7 as necessary to build his order.

10. The customer checks out the order.
11. The system shows the shipping address and the available shipping methods.
12. The customer selects the preferred shipping method.
13. The system shows the billing address and the available payment methods.
14. The customer selects the preferred payment method.
15. The system displays a summary of the order.
16. The customer confirms the order:

    [→*OrderConfirmation*]

17. The system saves the order.
18. The system sends an email to the customer and to the store extra order emails with the information about the order.

Extensions:

1a. The customer is new:

1a1. Create customer.

5a. The configurable option *Display cart after adding a product* is disabled

The customer repeats steps 3 and 4 as necessary.

5a1. The customer continues with the checkout procedure at step 9.

16a. The customer wants to change the contents of the shopping cart:

16a1. The customer changes the contents of the shopping cart:

[→*UpdateShoppingCart*]

16a2. The customer continues with the checkout procedure at step 11.

11a, 16a. The customer wants to change the shipping address:

11a1. The system shows the know addresses of the customer.

11a2. The customer selects a different shipping address.

11a3. The customer continues with the checkout procedure at step 11.

13a, 16b. The customer wants to change the billing address:

13a1. The system shows the know addresses of the customer.

13a2. The customer selects a different billing address.

13a3. The customer continues with the checkout procedure at step 13.

16c. The customer wants to change the shipping method:

16c1. The customer selects the new shipping method.

16c2. The customer continues with the checkout procedure at step 13.

16d. The customer wants to change the payment method:

16d1. The customer selects the new payment method.

16d2. The customer continues with the checkout procedure at step 15.

11a2a,16a2a. The customer wants to define a new shipping address:

11a2a1. The customer gives the new address:

[→*NewCustomerAddress*]

11a2a2. The system saves the address.

11a2a3. The customer continues with the checkout procedure at step 11.

13a2a,16b2a. The customer wants to define a new billing address:

13a2a1. The customer gives the new address:

[→*NewCustomerAddress*]

13a2a2. The system saves the address.

13a2a3. The customer continues with the checkout procedure at step 13.

Cancel an order

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to cancel an order.

Main Success Scenario:

1. The store administrator selects the order to be cancelled.
2. The system asks for the confirmation of the store administrator.
3. The store administrator confirms that he wants to cancel the order:

   [→*CancelOrder*]
4. The system sets the order status to cancelled.

Add an order status

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to add a new order status.

Main Success Scenario:

1. The store administrator provides the details of the new order status:

   [→*NewOrderStatus*]
2. The system validates that the data is correct.
3. The system saves the new order status.

Edit an order status

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to edit an order status.

Main Success Scenario:

1. The store administrator selects the order status to be edited.
2. The store administrator provides the new details of the selected order status:

   [→*EditOrderStatus*]
3. The system validates that the data is correct.
4. The system saves the changes.

Delete an order status

Primary Actor: Store administrator

Precondition: The deleted order status is not the current status of any order.

Trigger: The store administrator wants to delete an order status.

Main Success Scenario:

1. The store administrator selects the order status to be deleted.
2. The store administrator confirms that he wants to delete the order status:

   [→*DeleteOrderStatus*]
3. The system deletes the order status.

Extensions:

2a. The order status has been an status of an order:

  2a1. The system changes the status of the order status to disabled.

  2a2. The use case ends.

Change the status of an order

Primary Actor: Store administrator

Precondition: None.

Trigger: The store administrator wants to change the status of an order.

Main Success Scenario:

1. The system shows the orders and their status.
2. The store administrator selects the order which will be edited.
3. The system shows the applicable order status.
4. The store administrator selects the new status.

   [→*UpdateOrderStatus*]
5. The system validates that the data is correct.
6. The system saves the changes.

Set cancelled order status

Primary Actor: Store administrator

Precondition: The order status is not yet the cancelled status.

Trigger: The store administrator wants to indicate to the system which order status is used to indicate that an order is cancelled.

Main Success Scenario:

1. The store administrator selects an order status.
2. The system register that the selected order status represents cancelled orders.

   [→*SetCancelledOrderStatus*]

Set default order status

Primary Actor: Store administrator

Precondition: The order status is not yet the default status.

Trigger: The store administrator wants to indicate to the system which order status is assign when an order is created.

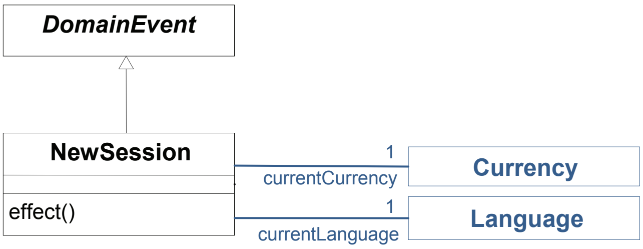
Main Success Scenario:

1. The store administrator selects an order status.
2. The system register that the selected order status is the default order status.

   [→*SetDefaultOrderStatus*]

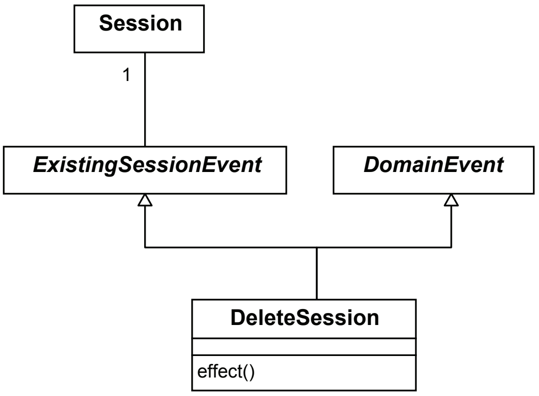
Events

NewSession



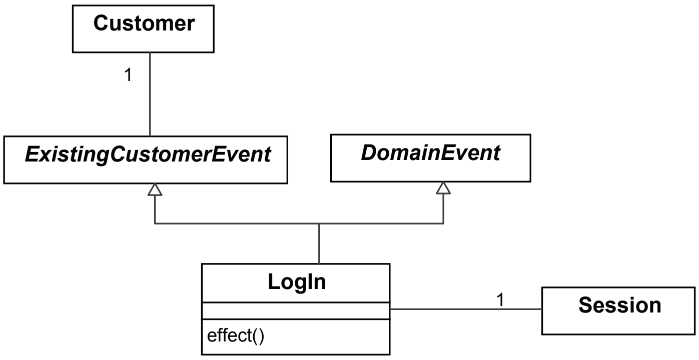
```
context  NewSession::effect()
  post :
     s.oclIsNew() and
     s.oclIsTypeOf(Session) and
     s.currentCurrency=self.currentCurrency and
     s.currentLanguage=self.currentLanguage and
     s.sessionID=Session.allInstances->size()
```

DeleteSession



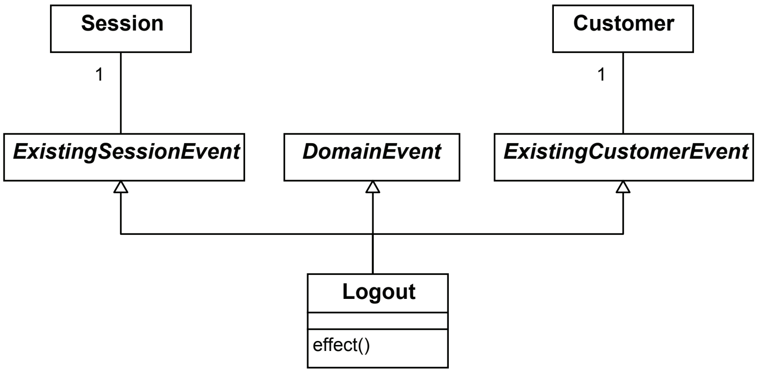
```
context DeleteSession::effect()
  post : not self.session@pre.oclIsKindOf(OclAny)
```

LogIn



```
«IniIC»
context LogIn::customerIsNotLoggedIn (): Boolean
 body : self.customer.session -> isEmpty()


context  LogIn::effect()
  post :
     self.session.customer = self.customer
  post :
     self.customer.numberOfLogons = self.customer.numberOfLogons@pre + 1
  post:
   if self.customer.customerShoppingCart->size()>0 then
       rpsc.oclIsNew() and
       rpsc.oclIsTypeOf(RestorePreviousShoppingCart) and
       rpsc.customer=self.customer and
       rpsc.session=self.session
   else
       if self.session.shoppingCart->notEmpty() then
           csc.oclIsNew() and
           csc.oclIsTypeOf(CustomerShoppingCart) and
           csc.shoppingCartItem = self.session.shoppingCart.shoppingCartItem and
           csc.customer=self.customer and
           self.session.shoppingCart=csc
        else true
        endif
   endif
```

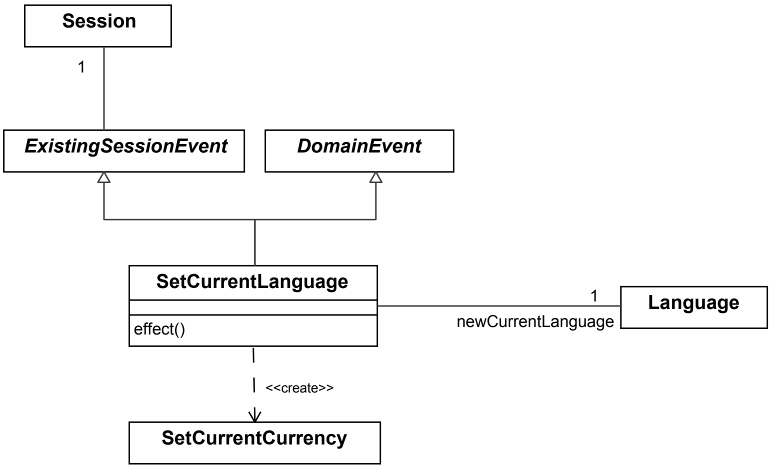
LogOut



«IniIC»
context LogOut::customerIsLoggedIn (): Boolean
  body : self.session.customer = self.customer

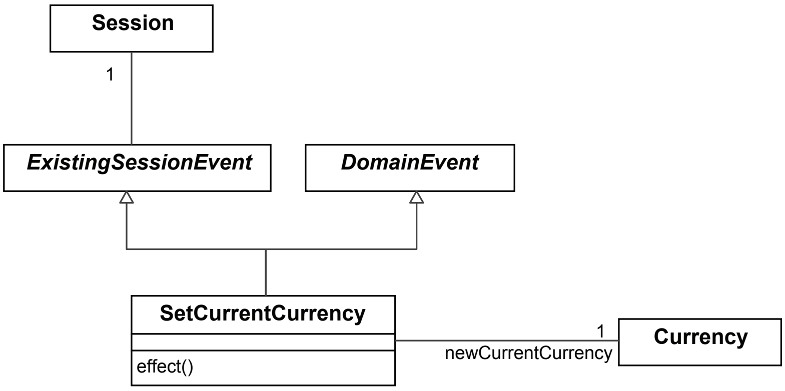
context LogOut::effect()
  post : self.session.customer -> isEmpty()

SetCurrentLanguage



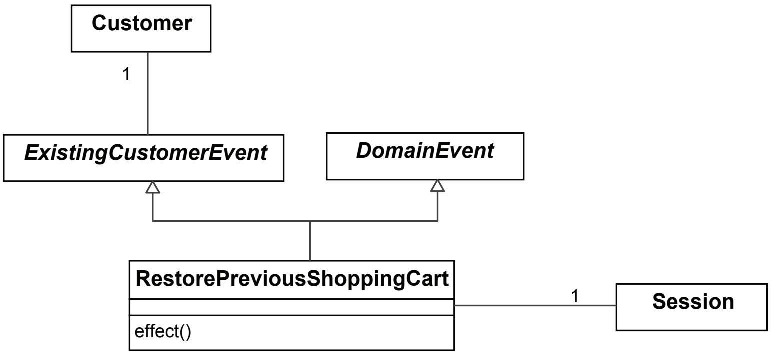
context ChangeCurrentLanguage::effect()
  post :
    session.currentLanguage = self.newCurrentLanguage
  post :
    Store.allInstances() -> any(true).switchToDefaultLanguageCurrency and
    self.newCurrentLanguage.defaultCurrency -> notEmpty()
    implies
    ccc.oclIsNew() and
    ccc.oclIsTypeOf(ChangeCurrentCurrency) and
    ccc.session = self.session and
    ccc.newCurrentCurrency = self.language.defaultCurrency

SetCurrentCurrency



context SetCurrentCurrency::effect()
post : self.session.currentCurrency = self.newCurrentCurrency

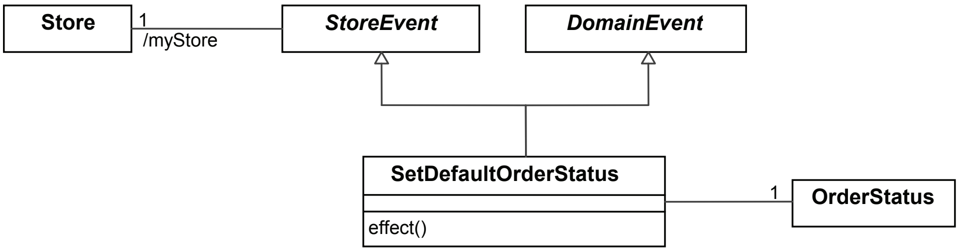
RestorePreviousShoppingCart



«IniIC»
context RestorePreviousShoppingCart::CustomerHasAPreviousShoppingCart(): Boolean
body : self.customer.customerShoppingCart->notEmpty()

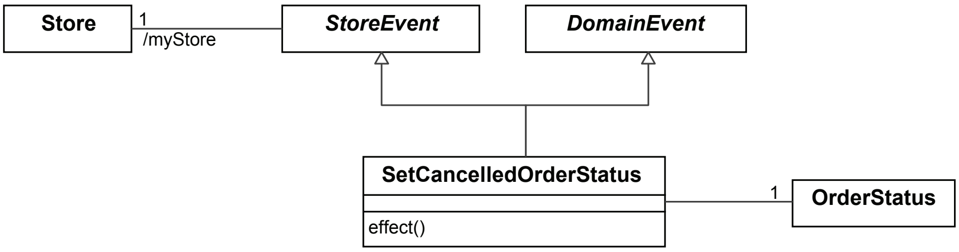
context RestorePreviousShoppingCart::effect()
post : self.session.shoppingCart = self.customer.customerShoppingCart

SetDefaultOrderStatus



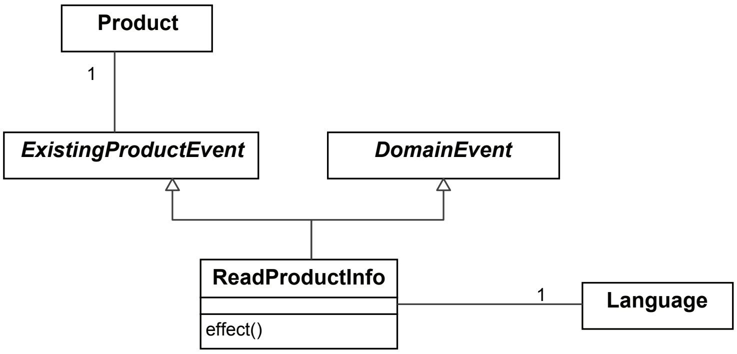
context SetPendingOrderStatus::effect()
post : self.myStore.defaultStatus = self.orderStatus

SetCancelledOrderStatus



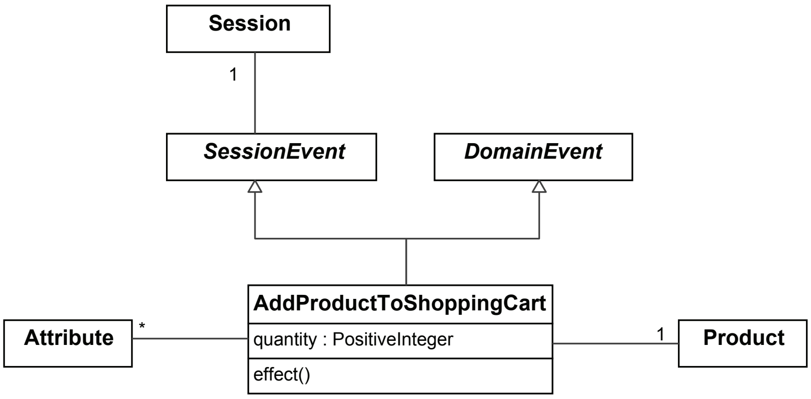
context SetCancelledOrderStatus::effect()
post : self.myStore.cancelledStatus = self.orderStatus

ReadProductInfo



context ReadProductInfo::effect()
post : self.product.productInLanguage->select(pil | pil.language=self.language).viewed =
self.product@pre.productInLanguage@pre->select(pil | pil.language=self.language).viewed + 1

AddProductToShoppingCart

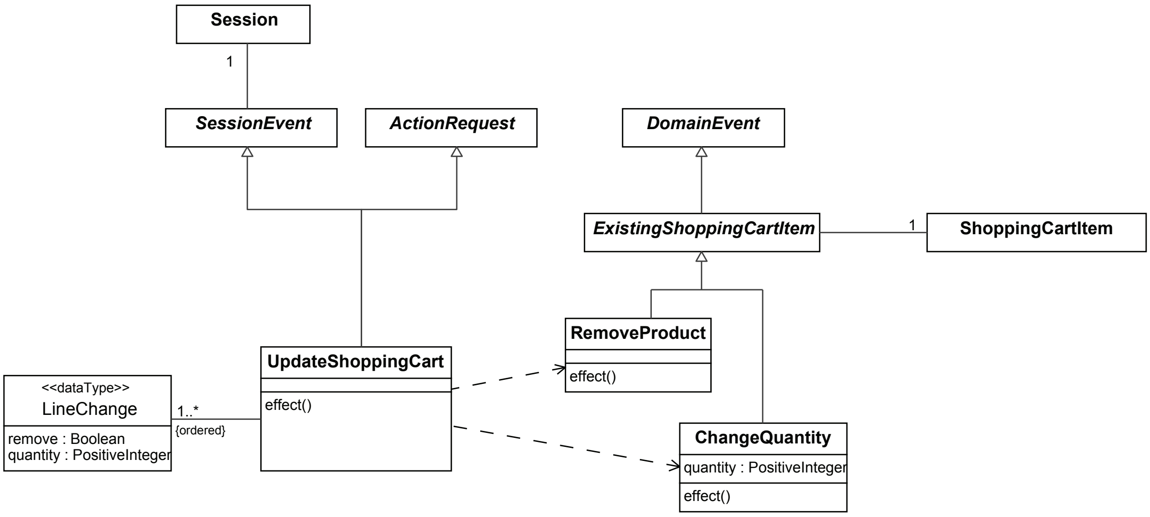


«IniIC»
context AddProductToShoppingCart::AttributesAreFromProduct(): Boolean
body : self.product.attribute -> includesAll(self.attribute)

«IniIC»
context AddProductToShoppingCart::AttributesAreOfDifferentOptions(): Boolean
body : self.attribute -> isUnique(option)

```
context  AddProductToShoppingCart::effect()
  post ShoppingCartItemIsCreated :
     sci.oclIsNew and
     sci.oclIsTypeOf(ShoppingCartItem) and
     sci.quantity = self.quantity and
     sci.product = self.product and
     sci.attribute = self.attribute and
     if self.session.shoppingCart -> notEmpty() then
        --The session has a shopping cart
        self.session.shoppingCart.shoppingCartItem -> includes(sci)
     else
        --The session does not have a shopping cart
        if self.session.customer -> isEmpty() then
        --The session is Anonymous
           sc.oclIsNew()  and
           sc.oclIsTypeOf(AnonymousShoppingCart)  and
           self.session.shoppingCart = sc and
           sc.shoppingCartItem -> includes(sci)
       else
        --The customer has logged in
           if self.session.customer.customerShoppingCart -> notEmpty()  then
              --The customer has a previous shopping cart
             self.session.shoppingCart.shoppingCartItem -> includes(sci)
           else
              --The customer does not have a previous shopping cart
              csc.oclIsNew()  and
              csc.oclIsTypeOf(CustomerShoppingCart)  and
              self.session.shoppingCart = csc and
              csc.shoppingCartItem -> includes(sci)
          endif
       endif
     endif
```

UpdateShoppingCart

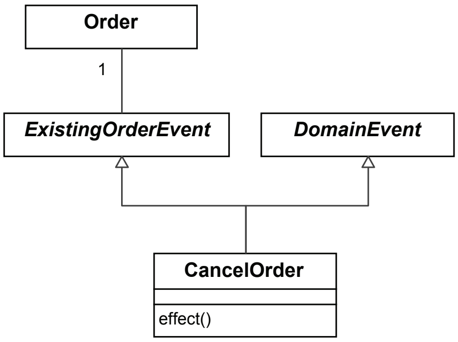


```
«IniIC»
context UpdateShoppingCart::complete(): Boolean
  body : self.lineChange->size() = self.session.shoppingCart.shoppingCartItem->size()
```

```
context  RemoveProduct::effect()
  post :  not self.shoppingCartItem@pre.oclIsKindOf(OclAny)
```

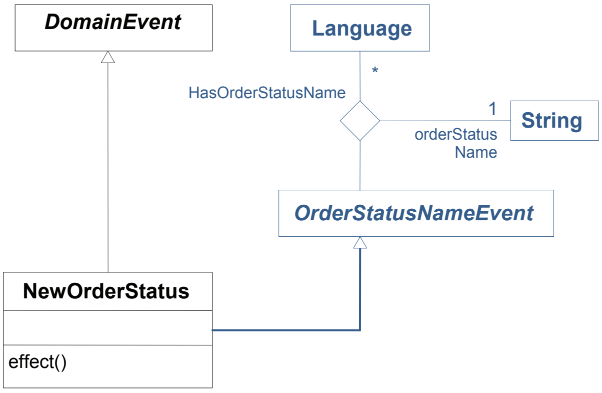
```
context  ChangeQuantity::effect()
   post :  self.shoppingCartItem.quantity = self.quantity

context  UpdateShoppingCart::effect()
   post :
       self.lineChange ->forAll
         (lc|let cartItem:ShoppingCartItem =
                       self.shoppingCart.shoppingCartItem->
                       at(lineChange->indexOf(lc))
              in
                   (lc.remove or lc.quantity <> cartItem.quantity)
                     implies
                        if lc.remove then
                          rp.oclIsNew and
                          rp.oclIsTypeOf(RemoveProduct) and
                          rp.shoppingCartItem = cartItem
                        else
                          cq.oclIsNew() and
                          cq.oclIsTypeOf(ChangeQuantity) and
                          cq.shoppingCartItem = cartItem and
                          cq.quantity = quantity
                        endif )
```

CancelOrder



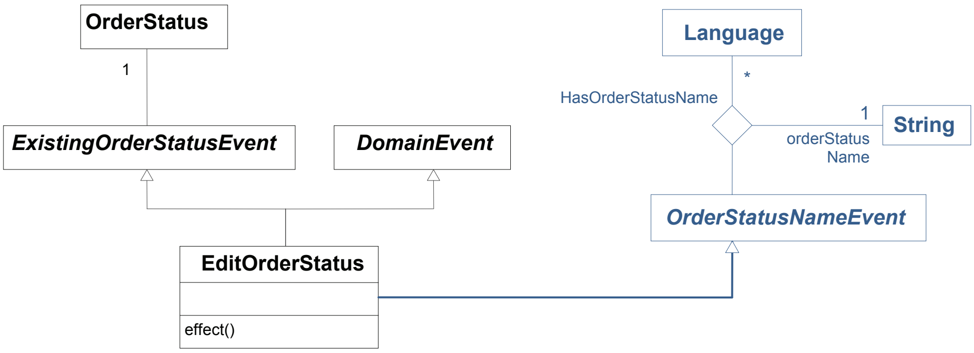
```
context  CancelOrder::effect()
   post:
        self.order.orderStatusChange -> sortedBy(added) -> last().orderStatus =
        Store.allInstances() ->any(true).cancelledStatus
```

NewOrderStatus



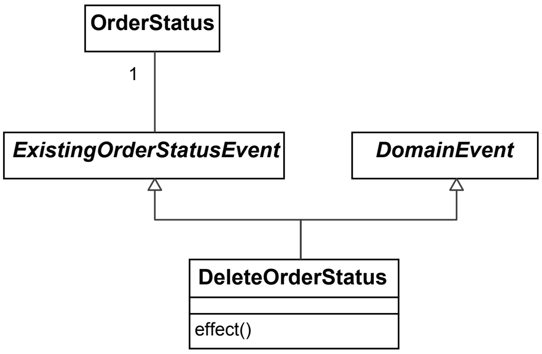
```
«IniIC»
context NewOrderStatus::orderStatusDoesNotExist(): Boolean
  body :
      not OrderStatus.allInstances -> exists (os |
           Language.allInstances->
            exists(l|
                  self.hasOrderStatusName->select(languageOfOrderStatus=l).orderStatusName =
                  os.orderStatusInLanguage-> select(language=l).name))

context  NewOrderStatus::effect()
   post :
      os.oclIsNew()  and
      os.oclIsTypeOf(OrderStatus) and
      Language.allInstances->
       forAll(l|
            self.hasOrderStatusName->select(languageOfOrderStatus=l).orderStatusName.string=
            os.orderStatusInLanguage->select(language=l).name)
```

EditOrderStatus



```
«IniIC»
context EditOrderStatus::orderStatusDoesNotExist():Boolean
   body:
     Language.allInstances -> forAll ( l |
           l.orderStatusInLanguage.name
              ->excludes(self.hasOrderStatusName -> any(languageOfOrderStatus=l).orderStatusName)
          or
          l.orderStatusInLanguage->any(orderStatus=self.orderStatus).name =
          self.hasOrderStatusName->any(languageOfOrderStatus=l).orderStatusName)

context  EditOrderStatus::effect()
   post :
     Language.allInstances ->  forAll(l|
            self.hasOrderStatusName->select(languageOfOrderStatus=l).orderStatusName =
            self.orderStatus.orderStatusInLanguage->
                select(language=l).name)
```

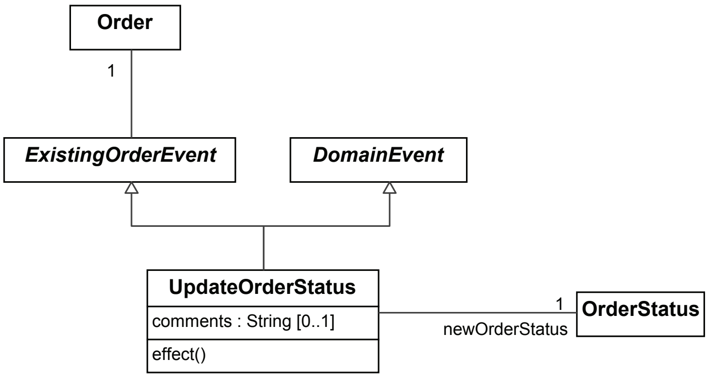
DeleteOrderStatus



«IniIC»
context DeleteOrderStatus:: IsNotTheCurrentStatusOfAnyOrder(): Boolean
  body :
    Order.allInstances() -> forAll (o | o.orderStatusChange -> sortedBy(added)
                                              -> last().orderStatus <> self.orderStatus)
«IniIC»
context DeleteOrderStatus::IsNotADefaultStatus():Boolean
   body:
    Store.allInstances->forAll(s| s.defaultStatus <> self.orderStatus and s.cancelledStatus <> self.orderStatus)

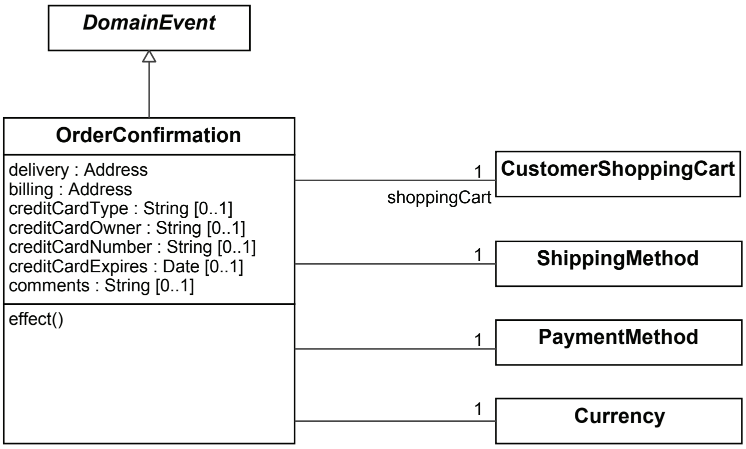
context DeleteOrderStatus::effect()
  post :
      if Order.allInstances.orderStatus->includes(self.orderStatus)
      then self.orderStatus.status=Status::disabled
      else OrderStatus.allInstances->excludes(self.orderStatus@pre)
      endif

UpdateOrderStatus



context ChangeOrderStatus::effect()
  post :
     osc.oclIsNew() and
     osc.oclIsTypeOf(OrderStatusChange) and
     osc.comments = self.comments and osc.order = self.order and
     osc.orderStatus = self.newOrderStatus

OrderConfirmation



```
«IniIC»
context OrderConfirmation::ShippingMethodIsEnabled(): Boolean
  body : self.shippingMethod.status= Status::enabled

«IniIC»
context OrderConfirmation::PaymentMethodIsEnabled(): Boolean
  body : self.paymentMethod.status= Status::enabled

«IniIC»
context OrderConfirmation::CurrencyIsEnabled(): Boolean
  body : self.currency.status = Status::enabled

«IniIC»
context OrderConfirmation::CreditCardDetailsNeeded(): Boolean
  body :
      self.paymentMethod.oclIsTypeOf(AuthorizeNet) or
      self.paymentMethod.oclIsTypeOf(CreditCard) or
      self.paymentMethod.oclIsTypeOf(IPayment) or
      self.paymentMethod.oclIsTypeOf(TwoCheckOut) or
      self.paymentMethod.oclIsTypeOf(PSiGate)
      implies
      creditCardType.notEmpty() and
      creditCardOwner.notEmpty() and
      creditCardNumber.notEmpty() and
      creditCardExpires.notEmpty()

«IniIC»
context OrderConfirmation::StockAllowsOrder(): Boolean
  body :
      Stock.allowCheckout or
      not Stock.checkStockLevel or
      self.shoppingCart.shoppingCartItem.product -> forAll (p | p.quantityOnHand > 0)

context  OrderConfirmation::effect()
   post theOrderIsCreated:
       o.oclIsNew() and
       o.oclIsTypeOf(Order) and
       o.customer = self.shoppingCart@pre.customer@pre and
       o.billing = self.billing and
       o.delivery = self.delivery and
       o.shippingMethod = self.shippingMethod and
       o.paymentMethod = self.paymentMethod and
       o.currency = self.currency and
```

```
    –The initial status of the order is pending
    osc.oclIsNew() and
    osc.oclIsTypeOf(OrderStatusChange) and
    osc.comments = self.comments and
    osc.orderStatus = Store.allInstances() -> any(true).defaultStatus and
    osc.order = o and
    –There is an order line for each shopping cart item
   shoppingCart@pre.shoppingCartItem@pre->forAll
     (i|OrderLine.allInstances() -> one
       (ol|ol.order = o  and
           ol.product = i.product@pre  and
           ol.quantity = i.quantity@pre  and
           i.attribute@pre->forAll
              (iAtt|OrderLineAttribute.allInstances() -> one
              (olAtt|olAtt.orderLine = ol and
                     olAtt.attribute = iAtt))))

  post theShoppingCartIsRemoved:
    not self.shoppingCart@pre.oclIsKindOf(OclAny)
  post updateProductQuantities:
    let productsBought:Set(Product) =
         self.shoppingCart@pre.shoppingCartItem@pre.product@pre->asSet()
    in  productsBought -> forAll (p|
          let quantityBought:PositiveInteger =
               self.shoppingCart@pre.shoppingCartItem@pre->select
                 (sc | sc.product = p).quantity -> sum()
          in
               p.quantityOrdered = p.quantityOrdered@pre + quantityBought  and
               Stock.substractStock implies
               p.quantityOnHand = p.quantityOnHand@pre – quantityBought)
```

Example test programs

```
testprogram SessionsManagement{
        co:= new Country;
        a:= new Address(country:=co);
        c:= new Customer(address:=a, primary:=a);
        //Language l has no default currency
        l:= new Language(name:='Language1', code:='L1');
        cu:=new Currency(title:='Currency1',code:='C1');
        cu2:=new Currency(title:='Currency2',code:='C2');
        //Language l2 has a default currency
        l2:=new Language(name:='Language2', code:='L2',defaultCurrency:=cu2);
        //Language l3 has no default currency
        l3:= new Language(name:='Language3', code:='L3');

        test OpenSession{
                ns:=new NewSession(currentLanguage:=l, currentCurrency:=cu);
                assert occurrence ns;
        }

        test InvalidLogIn{
                ns:=new NewSession(currentLanguage:=l, currentCurrency:=cu);
                assert occurrence ns;
                li:=new LogIn(session:=ns.createdSession, customer:=c);
                assert occurrence li;
                //A logged-in customer cannot log in
                assert non-occurrence li;
        }

        test InvalidLogOut{
                //We cannot log out if the customer is not logged in the session
                ns:=new NewSession(currentLanguage:=l, currentCurrency:=cu);
                assert occurrence ns;
                lo:=new LogOut(session:=ns.createdSession, customer:=c);
                assert non-occurrence lo;
        }
```

```
test LogInLogOutWithoutPreviousShoppingCart{
        ns:=new NewSession(currentLanguage:=l, currentCurrency:=cu);
        assert occurrence ns;
        li:=new LogIn(session:=ns.createdSession, customer:=c);
        assert occurrence li;
        lo:=new LogOut(session:=ns.createdSession, customer:=c);
        assert occurrence lo;
}

test LogInLogOutWithPreviousShoppingCart{
        //The customer navigates in the store in an anonymous session
        ns:=new NewSession(currentLanguage:=l, currentCurrency:=cu);
        assert occurrence ns;
        p:= new Product;
        assert true ns.createdSession.customer.isUndefined();

        aptsc:=new AddProductToShoppingCart(session:=ns.createdSession, product:=p,
                                     quantity:=1);
        assert occurrence aptsc;
        assert true ns.createdSession.shoppingCart.oclIsTypeOf(AnonymousShoppingCart);
        assert equals ns.createdSession.shoppingCart.shoppingCartItem.product->asSet()
                     Set{p};

        //The customer logs in
        li:=new LogIn(session:=ns.createdSession, customer:=c);
        assert occurrence li;
        assert true ns.createdSession.shoppingCart.oclIsTypeOf(CustomerShoppingCart);
        assert equals
          ns.createdSession.shoppingCart.oclAsType(CustomerShoppingCart).customer  c;
        assert equals ns.createdSession.shoppingCart.shoppingCartItem.product->asSet()
                     Set{p};

        //The customer adds another product
        p2:=new Product;
        aptsc:=new AddProductToShoppingCart(session:=ns.createdSession, product:=p2,
                                              quantity:=2);
        assert occurrence aptsc;

        //The customer logs out
        lo:=new LogOut(session:=ns.createdSession, customer:=c);
        assert occurrence lo;

        //If the customer logs in again,
        //the previous customer shopping cart is restored
        li:=new LogIn(session:=ns.createdSession, customer:=c);
        assert occurrence li;
        assert true ns.createdSession.shoppingCart.oclIsTypeOf(CustomerShoppingCart);
        assert equals
           ns.createdSession.shoppingCart.oclAsType(CustomerShoppingCart).customer c;
        assert equals ns.createdSession.shoppingCart.shoppingCartItem.product->asSet()
                      Set{p,p2};

        //The session is finished
        ds:=new DeleteSession(session:=ns.createdSession);
        assert occurrence ds;
}

abstract test changeCurrentLanguage
             (Boolean switch, Language newLanguage,
              Language expectedLanguage, Currency expectedCurrency){

        //Store Initialization
        s:=new Store(name:='FashionTShirts');
        english:=new Language(name:='English', code:='EN');
        s.defaultLanguage:=english;
        dollar:=new Currency(title:='USDollar', code:='USD', status:=#enabled);
        s.defaultCurrency:=dollar;
        usa:=new Country(name:='United States', isoCode2:='US', isoCode3:='USA');
        s.country:=usa;
        cos:=new OrderStatus;
        cosl:=new OrderStatusInLanguage(language:=english,orderStatus:=cos);
        cosl.name:='cancelled';
        s.cancelledStatus:=cos;
        dos:=new OrderStatus;
        dosl:=new OrderStatusInLanguage(orderStatus:=dos, language:=english);
        dosl.name:='pending';
```

```
                s.defaultStatus:=dos;
                //Switch to default language currency initialization
                s.switchToDefaultLanguageCurrency:=switch;

                ns:=new NewSession(currentLanguage:=l, currentCurrency:=cu);
                assert occurrence ns;
                scl:=new SetCurrentLanguage(session:=ns.createdSession,
                                       newCurrentLanguage:=newLanguage);
                assert occurrence scl;
                assert equals ns.createdSession.currentLanguage expectedLanguage;
                assert equals ns.createdSession.currentCurrency expectedCurrency;
        }
        //We test the effect of the "switch to default language" configuration value
        test changeCurrentLanguage(switch:=false, newLanguage:=l,
                                   expectedLanguage:=l, expectedCurrency:=cu);
        test changeCurrentLanguage(switch:=true, newLanguage:=l3,
                                   expectedLanguage:=l3, expectedCurrency:=cu);
        test changeCurrentLanguage(switch:=true, newLanguage:=l2,
                                   expectedLanguage:=l2, expectedCurrency:=cu2);
}

testprogram OrderConfirmation{
                //Store initialization
                s:=new Store(name:='FashionTShirts');
                english:=new Language(name:='English', code:='EN');
                s.defaultLanguage:=english;
                dollar:=new Currency(title:='USDollar', code:='USD', status:=#enabled);
                s.defaultCurrency:=dollar;
                usa:=new Country(name:='United States', isoCode2:='US', isoCode3:='USA');
                s.country:=usa;
                cos:=new OrderStatus;
                cosl:=new OrderStatusInLanguage(language:=english,orderStatus:=cos);
                cosl.name:='cancelled';
                s.cancelledStatus:=cos;
                dos:=new OrderStatus;
                dosl:=new OrderStatusInLanguage(orderStatus:=dos, language:=english);
                dosl.name:='pending';
                s.defaultStatus:=dos;

                //Product attributes initialization
                ssize := new Option;
                extraLarge:=new Value;
                small:=new Value;
                smallSize:=new Attribute(option:=ssize, value:=small);
                extraLargeSize:=new Attribute(option:=ssize, value:=extraLarge);

                sizeName := new StringDT(string:='size');
                new HasOptionName(option:=ssize,
                                 optionName:=sizeName, optionLanguage:=english);

                extraLargeName := new StringDT(string:='extraLarge');
                new HasValueName(value:=extraLarge,
                                 valueName:=extraLargeName, valueLanguage:=english);

                smallName := new StringDT(string:='small');
                new HasValueName(value:=small, valueName:=smallName, valueLanguage:=english);

                stock := new Stock;
                stock.checkStockLevel:=true;
                stock.substractStock:=true;

                //Products initialization
                fashionTShirt := new Product(netPrice:=10, quantityOnHand:=50);

                smallFashionTShirt:= new ProductAttribute(product:=fashionTShirt,
                                                         attribute:=smallSize);
                smallFashionTShirt.increment:=2;
                smallFashionTShirt.sign:=#minus;

                extraLargeFashionTShirt:= new ProductAttribute(product:=fashionTShirt,
                                                               attribute:=extraLargeSize);
                extraLargeFashionTShirt.increment:=1;
                extraLargeFashionTShirt.sign:=#plus;

                //Customer session initialization and log in
                a:= new Address(country:=usa);
                c := new Customer(address:=a,primary:=a);
                fixturecomponent addRegularSizedTShirts{
                        sci:=new ShoppingCartItem(product:=fashionTShirt,quantity:=3);
                        sci.shoppingCart:=s.shoppingCart;
                        assert occurrence aptsc;
                }

                fixturecomponent addSpecialSizedTShirts{
                        sci1:=new ShoppingCartItem(product:=fashionTShirt,quantity:=2,
                                                    attribute:=Set{smallSize});
                        sci1.shoppingCart:=s.shoppingCart;
                        sci1:=new ShoppingCartItem(product:=fashionTShirt,quantity:=1,
                                                    attribute:=Set{extraLargeSize});
                        sci2.shoppingCart:=s.shoppingCart;
                }
                abstract test confirmedOrderTotal (Fixture itemsAddition, Real expectedTotal){
                        s:=new NewSession(currentLanguage:=english, currentCurrency:=dollar);
                        assert occurrence ns;
                        li:=new LogIn(session:=ns.createdSession, customer:=c);
                        assert occurrence li;
                        load $itemsAddition;
                        sm:= new FlatRate(status:=#enabled);
                        pm:= new Nochex(status:=#enabled);
                        oc := new OrderConfirmation
                                 (shoppingCart:=ns.createdSession.shoppingCart,
                                  currency:=dollar , shippingMethod:=sm, paymentMethod:=pm)
                                  occurs;
                        assert equals oc.orderCreated.total() expectedTotal;
                }

                test confirmedOrderTotal
                    (itemsAddition:=addRegularSizedTShirts,expectedTotal:=30.0);
                test confirmedOrderTotal
                    (itemsAddition:=addSpecialSizedTShirts,expectedTotal:=27.0);
}
```

```
testprogram CreateAndEditStatus{

        english:=new Language(name:='English', code:='EN');

        test newOrderStatus{
                pendingInEnglish:=new StringDT(string:='pending');
                nos:=new NewOrderStatus;
                new HasOrderStatusName(orderStatusName:=pendingInEnglish,
                         languageOfOrder Status:=english, orderStatusNameEvent:=nos);
                assert occurrence nos;
                //We cannot create two order status with the same name
                nos2:=new NewOrderStatus;
                new HasOrderStatusName(orderStatusName:=pendingInEnglish,
                languageOfOrderStatus:=english, orderStatusNameEvent:=nos2);
                assert non-ocurrence nos2;
        }

        test editOrderStatus{
                pendingInEnglish:=new StringDT(string:='pending');
                nos:=new NewOrderStatus;
                new HasOrderStatusName(orderStatusName:=pendingInEnglish,
                           languageOfOrderStatus:=english, orderStatusNameEvent:=nos);
                assert occurrence nos;
                cancelledInEnglish:=new StringDT(string:='cancelled');
                nos2:=new NewOrderStatus;
                new HasOrderStatusName(orderStatusName:=cancelledInEnglish,
                                      languageOfOrderStatus:=english,
                                      orderStatusNameEvent:=nos2);
                assert occurrence nos2;
                //VALID EDITIONS
                deliveredInEnglish:=new StringDT(string:='delivered');
                //It is possible to edit an order status without no name changes
                eos:=new EditOrderStatus(orderStatus:=nos.createdOrderStatus);
                new HasOrderStatusName(orderStatusName:=cancelledInEnglish,
                         languageOfOrderStatus:=english, orderStatusNameEvent:=eos);
                assert occurrence eos;
                eos2:=new EditOrderStatus(orderStatus:=nos.createdOrderStatus);
                new HasOrderStatusName(orderStatusName:=deliveredInEnglish,
                      languageOfOrderStatus:=english, orderStatusNameEvent:=eos2);
                assert occurrence eos2;

                //INVALID EDITIONS
                //The edition of an order status cannot cause duplicated order status
                eos3:=new EditOrderStatus(orderStatus:=nos.createdOrderStatus);
                new HasOrderStatusName(orderStatusName:=pendingInEnglish,
                   languageOfOrderStatus:=english, orderStatusNameEvent:=eos3);
                assert non-ocurrence eos3;
        }
}
```

```
testprogram DeleteOrderStatus{

                english:=new Language(name:='English', code:='EN');

                //We create the order statuses
                pending:=new OrderStatus;
                posl:=new OrderStatusInLanguage(orderStatus:=pending, language:=english);
                posl.name:='pending';

                cancelled:=new OrderStatus;
                cosl:=new OrderStatusInLanguage(orderStatus:=cancelled, language:=english);
                cosl.name:='cancelled';

                delivered:=new OrderStatus;
                dosl:=new OrderStatusInLanguage(orderStatus:=delivered, language:=english);
                dosl.name:='delivered';

                returned:=new OrderStatus;
                rosl:=new OrderStatusInLanguage(orderStatus:=returned, language:=english);
                rosl.name:='returned';

                //We initialize an store
                usa:=new Country(name:='USA', isoCode2:='US', isoCode3:='USA');
                euro:=new Currency(title:='Euro', code:='EUR', status:=#enabled);

                //Store configuration
                s:=new Store;
                s.defaultLanguage:=english;
                s.defaultCurrency:=euro;
                s.country:=usa;
                s.defaultStatus:=pending;
                s.cancelledStatus:=cancelled;
                //Stock configuration
                stock := new Stock;
                stock.checkStockLevel:=true;
                stock.substractStock:=true;
                //Products configuration
                standardLaptop := new Product(netPrice:=949, quantityOnHand:=300);
                //Payment methods configuration
                pm:=new CashOnDelivery(status:=#enabled);
                //Shipping configuration
                sm:=new PerItem(status:=#enabled, handlingFee:=5, cost:=10);

                //We create an order which, initially, has the pending status (by default)
                //Customer initialization and login
                a:= new Address(country:=usa);
                c := new Customer(address:=a,primary:=a);
                ns:=new NewSession(currentLanguage:=english, currentCurrency:=euro) occurs;
                new LogIn(session:=ns.createdSession, customer:=c) occurs;
                new AddProductToShoppingCart(session:=ns.createdSession,
                                             product:=standardLaptop,quantity:=2) occurs;
                oc := new OrderConfirmation(shoppingCart:=ns.createdSession.shoppingCart,
                         currency:=euro , shippingMethod:=sm, paymentMethod:=pm, billing:=a);


                test deleteOrderStatusIfNoOrdersUsedIt{
                        assert occurrence oc;
                        //If the order status has not been used, it can be deleted at all
                        dos:=new DeleteOrderStatus(orderStatus:=delivered);
                        assert occurrence dos;
                        assert false OrderStatus.allInstances->exists(orderStatusInLanguage
                                       ->any(language=english).name='delivered');
                }

                test deleteStoreDefaultOrderStatus{
                        //A default status of the store cannot be deleted
                        dos:=new DeleteOrderStatus(orderStatus:=pending);
                        assert non-occurrence dos;
                        dos2:=new DeleteOrderStatus(orderStatus:=cancelled);
                        assert occurrence dos2;
                }

                test deleteOrderStatusIfItIsTheCurrentStatusOfAnOrder{
                        assert occurrence oc;
                        orderCreated:=oc.orderCreated;
                        //If the order status is the current status of an order,
                        //the status cannot be deleted
                        uos:=new UpdateOrderStatus(order:=orderCreated,
                                                   newOrderStatus:=delivered);
                        dos:=new DeleteOrderStatus(orderStatus:=delivered);
                        assert non-occurrence dos;
                }

                test deleteOrderStatusIfItWasTheStatusOfAnOrder{
                        assert occurrence oc;
                        orderCreated:=oc.orderCreated;
                        //If the order status was the status of an order (not the current
                        //status) the system disables the order status.
                        uos:=new UpdateOrderStatus(order:=orderCreated,
                                                   newOrderStatus:=delivered);
                        assert occurrence uos;
                        uos2:=new UpdateOrderStatus(order:=orderCreated,
                                                    newOrderStatus:=returned);
                        assert occurrence uos2;
                        dos:=new DeleteOrderStatus(orderStatus:=delivered);
                        assert occurrence dos;
                        assert equals delivered.status #disabled;
                }
}
```

Finally, we present a test program that tests a typical scenario of the use case “Place and Order” which is the main functionallity of the system from the customers point of view.

```
testprogram PlaceAndOrder{

                //STORE INITIALIZATION
                //Location, currencies and languages
                spain:=new Country(name:='Spain', isoCode2:='ES', isoCode3:='ESP');
                catalonia:=new Zone(name:='Catalonia', code:='CAT', country:=spain);
                english:=new Language(name:='English', code:='EN');
                euro:=new Currency(title:='Euro', code:='EUR', status:=#enabled);

                //Store configuration
                s:=new Store(name:='CustomizedComputers');
                s.defaultLanguage:=english;
                s.defaultCurrency:=euro;
                s.country:=spain;
                s.zone:=catalonia;

                //Default order status
                cancelled:=new OrderStatus;
                cosl:=new OrderStatusInLanguage(language:=english,orderStatus:=cancelled);
                cosl.name:='cancelled';
                s.cancelledStatus:=cancelled;
                pending:=new OrderStatus;
                dosl:=new OrderStatusInLanguage(orderStatus:=pending, language:=english);
                dosl.name:='pending';
                s.defaultStatus:=pending;
                delivered:=new OrderStatus;
                deosl:=new OrderStatusInLanguage(orderStatus:=delivered, language:=english);
                deosl.name:='delivered';

                //Stock configuration
                stock := new Stock;
```

```
stock.checkStockLevel:=true;
stock.substractStock:=true;

//Product attributes initialization
warranty := new Option;
premium:=new Value;
plus:=new Value;

premiumWarranty:=new Attribute(option:=warranty, value:=premium);
plusWarranty:=new Attribute(option:=warranty, value:=plus);

warrantyName := new StringDT(string:='Warranty');
new HasOptionName(option:=warranty,
                 optionName:=warrantyName, optionLanguage:=english);

premiumName := new StringDT(string:='Premium');
new HasValueName(value:=premium,
                valueName:=premiumName, valueLanguage:=english);

plusName := new StringDT(string:='Plus');
new HasValueName(value:=plus, valueName:=plusName, valueLanguage:=english);

//Products initialization
standardLaptop := new Product(netPrice:=949, quantityOnHand:=300);

plusWarrantyLaptop:= new ProductAttribute(product:=standardLaptop,
                                         attribute:=plusWarranty);
plusWarrantyLaptop.increment:=60;
plusWarrantyLaptop.sign:=#plus;

premiumWarrantyLaptop:= new ProductAttribute(product:=standardLaptop,
                                            attribute:=premiumWarranty);
premiumWarrantyLaptop.increment:=112;
premiumWarrantyLaptop.sign:=#plus;

illustratedStartGuide:= new Product(netPrice:=15,quantityOnHand:=50);

//Taxes configuration
spanishVAT:=new TaxZone(name:='SpanishVAT');
spanishVAT.zone:=catalonia;

//We allow two types of VAT: general VAT (16%) and super-reduced VAT(4%)
general:=new TaxClass(name:='generalVAT');
superreduced:=new TaxClass(name:='super-reducedVAT');

//For each TaxClass, there is a different tax rate applied in each zone
generalRate:=new TaxRate(taxClass:=general, taxZone:=spanishVAT);
generalRate.rate:=16;
generalRate.priority:=1;

superReducedRate:=new TaxRate(taxClass:=superreduced, taxZone:=spanishVAT);
superReducedRate.rate:=4;
superReducedRate.priority:=1;

standardLaptop.taxClass:=general;
illustratedStartGuide.taxClass:=superreduced;

//Payment methods configuration
pm:=new CashOnDelivery(status:=#enabled);

//Shipping configuration
sm:=new PerItem(status:=#enabled, handlingFee:=5, cost:=10);

test placeAndOrder{
        //Customer initialization
        a:= new Address(country:=spain, zone:=catalonia, state:='Catalonia');
        c := new Customer(address:=a,primary:=a);
        //The customer opens a anonymous session
        ns:=new NewSession(currentLanguage:=english, currentCurrency:=euro);
        assert occurrence ns;

        /*
        The customer adds to the shopping cart the following items:
                - 2 standard laptops with no warranty
                - Standard laptop with Premium warranty
                - Illustrated Start guide
        */
```

```
                        apsc1:=new AddProductToShoppingCart(session:=ns.createdSession,
                                                product:=standardLaptop,quantity:=2);
                        assert occurrence apsc1;
                        apsc2:=new AddProductToShoppingCart(session:=ns.createdSession,
                                                    product:=standardLaptop,quantity:=1,
                                                    attribute:=premiumWarranty);
                        assert occurrence apsc2;
                        apsc3:=new AddProductToShoppingCart(session:=ns.createdSession,
                                          product:=illustratedStartGuide,quantity:=1);
                        assert occurrence apsc3;

                        li:=new LogIn(session:=ns.createdSession, customer:=c);
                        assert occurrence li;

                        sc:=ns.createdSession.shoppingCart;
                        oc := new OrderConfirmation
                              (shoppingCart:=ns.createdSession.shoppingCart, currency:=euro,
                               shippingMethod:=sm, paymentMethod:=pm, billing:=a);
                        assert occurrence oc;
                        orderCreated:=oc.orderCreated;

                        assert equals orderCreated.orderLine.product->asSet()->size() 2;
                        assert equals orderCreated.orderLine
                                      ->select(product=standardLaptop).quantity->sum() 3;
                        assert equals orderCreated.orderLine
                                    ->select(product=illustratedStartGuide).quantity->sum() 1;

                        assert equals standardLaptop.quantityOnHand 297;
                        assert equals illustratedStartGuide.quantityOnHand 49;

                        /*
                        Order total details
                        =========================
                        2 x standard laptop (no warranty)       x 949   =       1898,00
                        1 x standard laptop (premium warranty)  x 1061  =       1061,00
                        Subtotal ............................................  2959,00
                        VAT 16%..............................................   473,44
                        Total (16%)..........................................  3432,44

                        1 x illustrated start guide             x 15    =         15,00
                        Subtotal ............................................    15,00
                        VAT 4%...............................................    0,60
                        Total (4%)...........................................   15,60

                        ---Shipping costs (Per Item)
                        Handling fee ........................................    5,00
                        4 x Per Item Rate                       x 10    =        40,00

                        Order Total _________________________________________  3493,04
                        */

                        assert equals orderCreated.total() 3493.04;

                        //The store administrator can change the status of the order...
                        uos:=new UpdateOrderStatus(order:=orderCreated,
                                                   newOrderStatus:=delivered);
                        assert occurrence uos;
                        assert equals orderCreated.orderStatus Sequence{pending,delivered};

                        //...or he can cancel the order (order information cannot be deleted)
                        co:=new CancelOrder(order:=orderCreated);
                        assert occurrence oc;
                        assert equals
                              orderCreated.orderStatus  Sequence{pending,delivered,cancelled};
                }
}
```

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Appendix A: Executable Conceptual Schema of the osCommerce System

```
model osCommerce

-- Enumerations
enum SortOrder{ascending,descending}
enum SortField{productName,expectedDate}
enum Operator{AND,OR}
enum TransactionMode{test,production}
enum TransactionMethod{creditCar,eCheck}
enum PSiGateMode{production,alwaysGood,alwaysDuplicate,alwaysDecline}
enum PSiGateType{sale,preAuth,postAuth}
enum PSiGateCollection{local,remote}
enum SECPayMode{alwaysSuccessful,alwaysFall,production}
enum Status{enabled,disabled}
enum USPSServer{test,production}
enum ShippingTableMethod{weight,price}
enum ProductStatus{inStock,outOfStock}
enum Sign{plus,minus}
enum NewsletterStatus{locked,unlocked}
enum Gender{male,female}
enum Rating{oneStar, twoStars, threeStars, fourStars, fiveStars}

-- DataTypes
class EMail
attributes
   eMail:String
end

class File
attributes
       fileName:String
end

class URL
attributes
       url:String
end

class PostalCode
attributes
    postalCode:String
end

class ShippingTableItem
attributes
    number:Integer
    cost:Integer
end

class DateTime
attributes
    dateTime:String
end

class Date
attributes
    date:String
end
---STRUCTURAL SCHEMA

-- STORE CONFIGURATION

-- Store Data

class Store
attributes
    name:String
    owner:String
    eMailAddress:EMail
    eMailFrom:EMail
    expectedSortOrder:SortOrder
    expectedSortField:SortField
    displayCartAfterAddingProduct:Boolean
    allowGuestToTellAFriend:Boolean
    defaultSearchOperator:Operator
    storeAddressAndPhone:String
    taxDecimalPlaces:Integer
    displayPricesWithTax:Boolean
    switchToDefaultLanguageCurrency:Boolean
end

class NameEMail
end

association store_sendExtraOrderEMail between
    Store [*]
    NameEMail[*] role sendExtraOrderEMail
end

association store_defaultLanguage between
    Store [*]
    Language[1] role defaultLanguage
end

association store_defaultCurrency between
    Store [*]
    Currency[1] role defaultCurrency
end

association store_Country between
    Store [0..1]
    Country[1]
end

association store_zone between
    Store [0..1]
    Zone[0..1]
end

association store_cancelledStatus between
    Store [*] role storeOfCancelledStatus
    OrderStatus[1] role cancelledStatus
end

association store_defaultStatus between
    Store [*] role storeOfDefaultStatus
    OrderStatus[1] role defaultStatus
end


-- Minimum and maximum values

class MinimumValues
attributes
    firstName:Integer
    lastName:Integer
    dateOfBirth:Integer
    eMailAddress:Integer
    streetAddress:Integer
    companyName:Integer
    postCode:Integer
    city:Integer
    state:Integer
    telephoneNumber:Integer
    password:Integer
    creditCardOwnerName:Integer
    creditCardNumber:Integer
    reviewText:Integer
end
```

```
class MaximumValues
attributes
    addressBookEntries:Integer
end

-- Customer details configuration
class CustomerDetails
attributes
    gender:Boolean
    dateOfBirth:Boolean
    company:Boolean
    suburb:Boolean
    state:Boolean
end

-- Shipping and Packaging configuration
class ShippingAndPackaging
attributes
    postCode:PostalCode
    maximumPackageWeight:Integer
    typicalPackageTareWeight:Integer
    percentageIncreaseForLargerPackages:Integer
end

association shippingAndPackaging_countryOfOrigin between
    ShippingAndPackaging [0..1]
    Country[1] role countryOfOrigin
end

-- Download configuration
class Download
attributes
    enableDownload:Boolean
    daysExpiryDelay:Integer
    maximumNumberOfDownloads:Integer
end

-- Stock configuration
class Stock
attributes
    checkStockLevel:Boolean
    substractStock:Boolean
    allowCheckout:Boolean
    stockReOrderLevel:Integer
end

-- Payment methods
abstract class PaymentMethod
attributes
    status:Status
end

association paymentMethod_orderStatus between
    PaymentMethod [*]
    OrderStatus[0..1]
end

association paymentMethod_taxZone between
    PaymentMethod[*]
    TaxZone[0..1]
end

class AuthorizeNet < PaymentMethod
attributes
    username:String
    key:String
    mode:TransactionMode
    method:TransactionMethod
    notification:Boolean
end
```

```
class CreditCard < PaymentMethod
attributes
    splitCreditCardToMail:EMail
end

class CashOnDelivery < PaymentMethod
end

class CheckInteger < PaymentMethod
attributes
    makePayableTo:String
end

class Nochex < PaymentMethod
attributes
    eMail:EMail
end

class TwoCheckOut < PaymentMethod
attributes
    login:String
    mode: TransactionMode
    merchantNotification:Boolean
end

abstract class SpecificCurrencyPaymentMethod < PaymentMethod
end

association specificCurrencyPaymentMethod_currency between
    SpecificCurrencyPaymentMethod[*]
    Currency[*]
end

class PSiGate < SpecificCurrencyPaymentMethod
attributes
    merchantID:String
    mode:PSiGateMode
    type:PSiGateType
    creditCardCollection:PSiGateCollection
end

class SECPay  < SpecificCurrencyPaymentMethod
attributes
    merchantID:String
    mode:SECPayMode
end

class IPayment  < SpecificCurrencyPaymentMethod
attributes
    account:Integer
    user:String
    password:String
end

class PayPal  < SpecificCurrencyPaymentMethod
attributes
    eMail:EMail
end

class CheckMoney < PaymentMethod
attributes
    makePayableTo:String
end

-- Shipping methods
class ShippingMethod
attributes
    status:Status
operations
        addTaxes(z:Zone, basePrice:Real) : Real =
        let appliedTaxRates:Set(TaxRate)=
            z.taxZone.taxRate -> select (tr | tr.taxClass = self.taxClass)->asSet()
```

```
          in
              let  priorities:Set(Integer) =
                  if appliedTaxRates -> isEmpty() then oclEmpty(Set(Integer))
                  else appliedTaxRates -> sortedBy(priority).priority -> asSet()
                  endif
              in
                  if priorities -> isEmpty() then basePrice
                  else priorities -> iterate (p:Integer; res:Real = 0 |
                            res +
                            (((appliedTaxRates -> select (tr | tr.priority = p).rate
                            -> sum()) / 100)+1)*basePrice)
                  endif


        shippingCosts(totalWeight:Real, totalPrice:Real, quantity:Integer): Real=
               if self.oclIsTypeOf(PerItem) then
                      self.oclAsType(PerItem).shippingCosts(totalWeight, totalPrice,
                      quantity)
                      else 0.0
                      endif
end

association shippingMethod_taxClass between
    ShippingMethod[*]
    TaxClass[0..1]
end

class ZoneRates < ShippingMethod
end

association zoneRates_items between
    ZoneRates[*]
    ShippingTableItem[*] role items
end

association zoneRates_country between
    ZoneRates[*]
    Country[*]
end

abstract class SpecificZoneMethod < ShippingMethod
end

association specificZoneMethod_taxZone between
    SpecificZoneMethod[*]
    TaxZone[0..1]
end

abstract class HandlingFeeMethod < ShippingMethod
attributes
    handlingFee:Real
end

class FlatRate < SpecificZoneMethod
attributes
    cost:Real
operations
    shippingCosts3(totalWeight:Real, totalPrice:Real, quantity:Integer): Real =
self.cost
end

class PerItem < SpecificZoneMethod,HandlingFeeMethod
attributes
    cost:Real
operations
    shippingCosts(totalWeight:Real, totalPrice:Real, quantity:Integer): Real =
    self.cost*quantity
end

class TableRate < SpecificZoneMethod,HandlingFeeMethod
attributes
    method:ShippingTableMethod
```

```
operations
        shippingCosts3(totalWeight:Real, totalPrice:Real, quantity:Integer): Real =
        if self.method = #weight
        then
          self.items -> select (i | i.number <= (totalWeight*quantity)) ->
          sortedBy(number) ->last().cost
        else
            self.items -> select (i | i.number <= (totalPrice*quantity)) ->
            sortedBy(number) ->last().cost
        endif
end

association tableRate_items between
    TableRate[*]
    ShippingTableItem[*] role items
end

class USPostalService < SpecificZoneMethod,HandlingFeeMethod
attributes
   userID:String
   password:String
   server:USPSServer
operations
    shippingCosts3(totalWeight:Real, totalPrice:Real, quantity:Integer): Real =
    -- we should call USPS service to calculate the shipping costs
end

-- Languages
class Language
attributes
    name:String
    code:String
    image:File
    directory:String
    sortOrder:Integer
    _prova:Integer
End


association language_defaultCurrency between
    Language[*]
    Currency[0..1] role defaultCurrency
end


-- Currencies
class Currency
attributes
    title:String
    code:String
    symbolLeft:String
    symbolRight:String
    decimalPlaces:Integer
    value:Real
    lastUpdate:DateTime
    status:Status
end

-- Location & Taxes
class Country
attributes
    name:String
    isoCode2:String
    isoCode3:String
end

class Zone
attributes
    name:String
    code:String
end
```

```
association country_zone between
  Country [1]
  Zone[*]
end


class TaxZone
attributes
    name:String
    description:String
end

association zone_taxZone between
    Zone[*]
    TaxZone[*]
end

class TaxClass
attributes
    name:String
    description:String
end

association taxClass_product between
    TaxClass[0..1]
    Product[*]
end

associationclass TaxRate between
    TaxClass[*]
    TaxZone[*]
attributes
    rate:Real
    priority:Integer
    description:String
end

-- STORE ADMINISTRATION
-- Products

class Product
attributes
    status:ProductStatus
    available:Date
    netPrice:Real
    quantityOnHand:Integer
    quantityOrdered:Integer
    modelM:String
    imagePath:String
    added:DateTime
    weight:Real
operations
    specialNetPrice():Real =
        if self.oclIsTypeOf(Special) then
            if self.oclAsType(Special).specialStatus=#enabled
            then self.oclAsType(Special).specialPrice
            else oclEmpty(Set(Real))->any(true)
            endif
        else oclEmpty(Set(Real))->any(true)
        endif

    timesViewed():Integer =
        self.productInLanguage.viewed->sum()

    grossPrice():Real=
    self.addTaxes(Store.allInstances -> any(true).zone, self.netPrice)

    addTaxes(z:Zone,basePrice:Real):Real=
        let appliedTaxRates:Set(TaxRate)=
        TaxRate.allInstances->select(tr| z.taxZone->includes(tr.taxZone)) -> select (tr
            | tr.taxClass = self.taxClass)
        in
```

```
            let  priorities:Set(Integer) =
                if appliedTaxRates-> isEmpty() then oclEmpty(Set(Integer))
                else appliedTaxRates -> sortedBy(priority).priority -> asSet()
                endif
            in
                if priorities -> isEmpty() then basePrice
                else priorities -> iterate (p:Integer; res:Real = basePrice |
                                                          res +
                                                          (((appliedTaxRates -> select
                                                           (tr | tr.priority = p).rate
                                                           -> sum()) / 100))*res)
                endif
end

association product_manufacturer between
    Product[*]
    Manufacturer[0..1]
end

association product_category between
    Product[*]
    Category[*]
end

associationclass ProductInLanguage between
    Product[*]
    Language[*]
attributes
    name:String
    description:String
    url:URL
    viewed:Integer
end

-- Product attributes and options
class Option
end

class Value
end

associationclass Attribute between
    Option[*]
    Value[*]
end

associationclass ProductAttribute between
    Product[*]
    Attribute[*]
attributes
    increment:Real
    sign:Sign
    status:Status
end

class Downloadable < ProductAttribute
attributes
    filename:File
    expiryDays:Integer
    maximumDownloadCount:Integer
end

class StringDT
attributes
    string:String
end

associationclass HasOptionName between
    Option[0..1]
    StringDT[1] role optionName
    Language[*] role optionLanguage
end
```

```
associationclass HasValueName between
    Value[0..1]
    StringDT[1] role valueName
    Language[*] role valueLanguage
end


-- Product categories
class Category
attributes
    imagePath:String
    sortOrder:Integer
    _subcategories:Integer
    _products:Integer
operations
    subcategories():Integer=self.child->size()
    products():Integer=Category.allInstances
                        -> select(c|c.allParents()->includes(self))
                        ->union(Set{self}).product->size()
    allParents():Set(Category)=if self.parent.isDefined()
                                               then self.parent
                                         ->union(self.parent.allParents())
                                               else Set{self}
                                               endif-Set{self}
end

association parent_child between
    Category[0..1] role parent
    Category[*] role child
end

associationclass HasCategoryName between
    Category[0..1]
    StringDT[1] role categoryName
    Language[*]
end

-- Specials
class Special < Product
attributes
    specialPrice:Real
    expiryDate:Date
    specialLastModified:String
    specialStatus:Status
    dateStatusChanged:DateTime
end

-- Manufacturers
class Manufacturer
attributes
    name:String
    imagePath:String
    lastModified:DateTime
end

associationclass ManufacturerInLanguage between
    Manufacturer[*]
    Language[*]
attributes
    url:URL
    urlClicked:Integer
    lastClick:DateTime
end

-- Banners
class BannerGroup
attributes
    name:String
end
```

```
class Banner
attributes
    title:String
    url:URL
    imagePath:String
    html:String
    expires:Date
    scheduled:Date
    statusChanged:DateTime
    status:Status
end

association banner_bannerGroup between
    Banner[*]
    BannerGroup[1]
end

associationclass BannerHistory between
    Banner[*]
    Date[*]
attributes
    shown:Integer
    clicked:Integer
end

-- Newsletters

class Newsletter
attributes
    title:String
    content:String
    sent:DateTime
    status:NewsletterStatus
end

class ProductNotification < Newsletter
attributes
    global:Boolean
    _notifications:Set(Product)
operations
    notifications():Set(Product)=
        if self.global then Product.allInstances
        else self.explicitNotifications
        endif
end

association explicitRelatedProduct_explicitNotifications between
    ProductNotification[*] role explicitRelatedProduct
    Product[*] role explicitNotifications
end


-- CUSTOMERS
-- Customers

class Customer
attributes
    gender:Gender
    firstName:String
    lastName:String
    dateOfBirth:Date
    eMailAddress:EMail
    phone:String
    fax:String
    newsletter:Boolean
    password:String
    lastModified:DateTime
    lastLogon:DateTime
    numberOfLogons:Integer
    globalNotifications:Boolean
    status:Status
```

```
operations
    notifications():Set(Product)=
    if self.globalNotifications then Product.allInstances
    else self.explicitNotifications
    endif

end

association explicitNotificationSubscriber_explicitNotifications between
        Customer[*] role explicitNotificationSubscriber
        Product[*] role explicitNotifications
end


class Address
attributes
    gender:Gender
    firstName:String
    lastName:String
    company:String
    street:String
    suburb:String
    postCode:PostalCode
    city:String
    state:String
end

association address_zone between
    Address[*]
    Zone[0..1]
end

association address_country between
    Address[*]
    Country[1]
end

association customer_address between
    Customer[*]
    Address[1..*]
end

association primaryAddressCustomer_primary between
    Customer[*] role primaryAddressCustomer
    Address[1] role primary
end

-- ONLINE CATALOG
-- Reviews
class Review
attributes
    review:String
    rating:Rating
    lastModified:DateTime
    timesRead:Integer
end

association review_language between
    Review[*]
    Language[1]
end

association review_product between
    Review[*]
    Product[1]
end

association review_customer between
    Review[*]
    Customer[1]
end
```

```
-- Shopping carts
class Session
attributes
    sessionID:Integer
    expiry:DateTime
    ipAddress:String
    timeEntry:DateTime
    timeLastClick:DateTime
    lastPageURL:URL
end

association session_currentLanguage between
    Session[*]
    Language[1] role currentLanguage
end

association session_currentCurrency between
    Session[*]
    Currency[1] role currentCurrency
end

association session_customer between
    Session[0..1]
    Customer[0..1]
end

class ShoppingCart
end

class AnonymousShoppingCart < ShoppingCart
end

class CustomerShoppingCart < ShoppingCart
end

association customerShoppingCart_customer between
    CustomerShoppingCart[0..1]
    Customer[1]
end

association shoppingCart_session between
    ShoppingCart[0..1]
    Session[0..1] role sessionOfShoppingCart
end

class ShoppingCartItem
attributes
    quantity:Integer
operations
    price():Real=
    let netPriceWithSpecial:Real =
           if self.product.specialNetPrice().isUndefined() then
self.product.specialNetPrice()
           else self.product.netPrice
           endif
    in
    if  self.attribute -> isEmpty() then netPriceWithSpecial
    else
        self.attribute.productAttribute -> select (pa | pa.product = self.product) ->
collect
        (if sign = #plus
        then increment
         else (-increment)
        endif) -> sum() + netPriceWithSpecial
    endif
end

association shoppingCartItem_product between
    ShoppingCartItem[*]
    Product[1]
end
```

```
association shoppingCartItem_attribute between
    ShoppingCartItem[*]
    Attribute[*]
end

association shoppingCart_shoppingCartItem between
    ShoppingCart[0..1]
    ShoppingCartItem[1..*] ordered
end


-- Orders
class OrderStatus
attributes
    status:Status
end

class Order
attributes
    delivery:Address
    billing:Address
operations
    id():Integer=
        if Order.allInstances -> size() = 0 then 0
        else Order.allInstances -> sortedBy(id()) -> last().id() + 1
        endif
    name():String=
        self.customer.firstName
    phone():String=
        self.customer.phone
    eMail():EMail=
        self.customer.eMailAddress
    primary():Address=
        self.customer.primary
    currencyValue():Real=
        self.currency.value
    total():Real=
            let totalWithoutShippingCosts:Real =
                self.orderLine -> collect(finalPrice()*quantity) -> sum()
            in
                let totalWeight:Real =
                    self.orderLine -> collect(product.weight*quantity) -> sum()
                in
                    let quantity:Integer =
                        self.orderLine.quantity -> sum()
                    in
                        let handlingFee:Real =
                            if self.shippingMethod.oclIsKindOf(HandlingFeeMethod)
                            then
                            self.shippingMethod.oclAsType(HandlingFeeMethod).handlingFee
                            else 0.0
                            endif
                        in
                            let totalWeightIncreased:Real =
                                if totalWeight* ((ShippingAndPackaging.allInstances
                                 ->any(true)).percentageIncreaseForLargerPackages/100) >
                                    (ShippingAndPackaging.allInstances
                                     ->any(true)).typicalPackageTareWeight
                                then
                                     totalWeight * (1 +totalWeight*
                                     ((ShippingAndPackaging.allInstances
                                  ->any(true)).percentageIncreaseForLargerPackages/100))
                                else totalWeight + (ShippingAndPackaging.allInstances
                                ->any(true)).typicalPackageTareWeight
                                endif
                            in
                                totalWithoutShippingCosts
                                +
                                self.shippingMethod.shippingCosts(totalWeightIncreased,
                                totalWithoutShippingCosts, quantity)
                                + handlingFee
end
```

```
association order_customer between
    Order[*]
    Customer[1]
end

association order_shippingMethod between
    Order[*]
    ShippingMethod[1]
end

association order_paymentMethod between
    Order[*]
    PaymentMethod[1]
end

association order_currency between
    Order[*]
    Currency[1]
end

associationclass OrderStatusChange between
    Order[*]
    OrderStatus[1..*] ordered
attributes
    comments:String
end

associationclass OrderStatusInLanguage between
    OrderStatus[*]
    Language[*]
attributes
    name:String
end

class OrderLine
attributes
    quantity:Integer
operations

    name():String=
        self.product.productInLanguage
        ->select(pil | pil.language = Store.allInstances ->
        any(true).defaultLanguage).name->any(true)

    modelM():String=
    self.product.modelM

    basePrice():Real=
       if self.product.specialNetPrice().isDefined()
       then self.product.specialNetPrice()
       else self.product.netPrice
       endif

    price():Real=
        if  self.orderLineAttribute  -> isEmpty() then self.basePrice()
        else
            self.orderLineAttribute -> collect
            (if sign() = #plus then increment()
            else (-increment())
            endif) -> sum() + self.basePrice()
       endif

   finalPrice():Real=
       if self.order.billing.zone -> notEmpty() then
        self.product.addTaxes(self.order.billing.zone, self.price())
        else self.price()
        endif

end
```

```
association order_orderLine between
    Order[1]
    OrderLine[1..*] ordered
end

association orderLine_product between
    OrderLine[*]
    Product[1]
end

class OrderLineAttribute
operations
    option():String=
        self.attribute.option.hasOptionName
        -> select (hon | hon.optionLanguage = Store.allInstances
        -> any(true).defaultLanguage).optionName->any(true).string
    value():String=
        self.attribute.value.hasValueName
        -> select (hvn | hvn.valueLanguage = Store.allInstances
        -> any(true).defaultLanguage).valueName->any(true).string

    increment():Real=
        self.attribute.productAttribute
        -> select (pa | pa.product = self.orderLine.product).increment->any(true)

    sign():Sign=
        self.attribute.productAttribute
        -> select (pa | pa.product = self.orderLine.product).sign->any(true)


end

class OrderDownload < OrderLineAttribute
attributes
    downloadCount:Integer
end

association orderLineAttribute_attribute between
    OrderLineAttribute[*]
    Attribute[1]
end

association orderLine_orderLineAttribute between
    OrderLine[1]
    OrderLineAttribute[*] ordered
end


-- BEHAVIOURAL SCHEMA
class Time
end

abstract class Event
attributes
  time:DateTime
operations
  effect()
end

abstract class DomainEvent < Event
end

abstract class ActionRequest < Event
end

abstract class Query < ActionRequest
end

abstract class SessionEvent
end

association sessionEvent_session between
```

```
    SessionEvent[*]
    Session[1]
end

class AddProductToShoppingCart < SessionEvent, DomainEvent
attributes
    quantity:Integer
operations
    effect()
end

association addProductToShoppingCart_attribute between
    AddProductToShoppingCart[*]
    Attribute[*]
end

association addProductToShoppingCart_product between
    AddProductToShoppingCart[*]
    Product[1]
end

class AddressBookEntriesMaximumChange < DomainEvent
attributes
    newMaximum:Integer
operations
    effect()
end

class AllowCheckoutStockConfigurationChange < DomainEvent
attributes
    newValue:Boolean
operations
    effect()
end

abstract class StoreEvent
operations
    myStore():Store=Store.allInstances->any(true)
end

class AllowGuestToTellAFriendChange < DomainEvent,StoreEvent
attributes
    newAllowGuestToTellAFriend:Boolean
operations
    effect()
end

abstract class ExistingProductAttributeEvent
end

association existingProductAttributeEvent_productAttribute between
    ExistingProductAttributeEvent[*]
    ProductAttribute[0..1]
end

class AttributeChange < DomainEvent,ExistingProductAttributeEvent
operations
    effect()
end

association attributeChange_Value between
    AttributeChange[*]
    Value[1] role newValue
end

association attributeChange_Option between
    AttributeChange[*]
    Option[1] role newOption
end

abstract class ExistingOrderEvent
end
```

```
association existingOrderEvent_Order between
    ExistingOrderEvent[*]
    Order[1]
end

class CancelOrder < DomainEvent,ExistingOrderEvent
operations
    effect()
end

class CheckLevelStockConfigurationChange < DomainEvent
attributes
    newValue:Boolean
operations
    effect()
end

class CityMinimumChange < DomainEvent
attributes
    newMinimum:Integer
operations
    effect()
end

abstract class ExistingBannerEvent
end

association existingBannerEvent_banner between
    ExistingBannerEvent[*]
    Banner[0..1]
end


class ClickBanner < DomainEvent, ExistingBannerEvent
operations
    effect()
end

abstract class ExistingManufacturerEvent
end

association existingManufacturerEvent_banner between
    ExistingManufacturerEvent[*]
    Manufacturer[0..1]
end


class ClickManufacturer < DomainEvent, ExistingManufacturerEvent
operations
    effect()
end

association clickManufacturer_language between
    ClickManufacturer[*]
    Language[1]
end

class CompanyCustomerDetailChange < DomainEvent
attributes
    newValue:Boolean
operations
    effect()
end

class CompanyNameMinimumChange < DomainEvent
attributes
    newMinimum:Integer
operations
    effect()
end
```

```
class CountryChange < DomainEvent,StoreEvent
operations
    effect()
end

association countryChange_country between
    CountryChange[*]
    Country[1] role newCountry
end


class CountryShippingConfigurationChange < DomainEvent
operations
    effect()
end

association countryShippingConfigurationChange_country between
    CountryShippingConfigurationChange[*]
    Country[1] role newCountryOfOrigin
end

class CreditCardNumberMinimumChange < DomainEvent
attributes
    newMinimum:Integer
operations
    effect()
end


class CreditCardOwnerNameMinimumChange < DomainEvent
attributes
    newMinimum:Integer
operations
    effect()
end


abstract class ExistingCurrencyEvent
end

association existingCurrencyEvent_currency between
    ExistingCurrencyEvent[*]
    Currency[0..1]
end

class CurrencyStatusChange < DomainEvent, ExistingCurrencyEvent
attributes
    newStatus:Status
operations
    effect()
end

abstract class ExistingCustomerEvent
end

association existingCustomerEvent_customer between
    ExistingCustomerEvent[*]
    Customer[0..1]
end


class CustomerStatusChange < DomainEvent, ExistingCustomerEvent
attributes
    newStatus:Status
operations
    effect()
end

class DateOfBirthCustomerDetailChange < DomainEvent
attributes
    newValue:Boolean
```

```
operations
    effect()
end

class DateOfBirthMinimumChange < DomainEvent
attributes
    newMinimum:Integer
operations
    effect()
end

class DaysExpiryDelayDownloadConfigurationChange < DomainEvent
attributes
    newValue:Integer
operations
    effect()
end

class DefaultSearchOperatorChange < DomainEvent, StoreEvent
attributes
    newDefaultSearchOperator:Operator
operations
    effect()
end

class DeleteBanner < DomainEvent, ExistingBannerEvent
operations
    effect()
end

abstract class ExistingBannerGroupEvent
end

association existingBannerGroupEvent_bannerGroup between
    ExistingBannerGroupEvent[*]
    BannerGroup[0..1]
end

class DeleteBannerGroup < DomainEvent, ExistingBannerGroupEvent
operations
    effect()
end

abstract class ExistingCategoryEvent
end

association existingCategoryEvent_category between
    ExistingCategoryEvent[*]
    Category[0..1]
end


class DeleteCategory < DomainEvent, ExistingCategoryEvent
operations
    effect()
    allChilds(cat:Category):Set(Category)= if cat.child->isEmpty()
                                              then oclEmpty(Set(Category))
                                              else cat.child->iterate(c;
a:Set(Category)=cat.child | a->union(self.allChilds(c)))
                                              endif
end

abstract class ExistingCountryEvent
end

association existingCountryEvent_country between
    ExistingCountryEvent[*]
    Country[0..1]
end
```

```
class DeleteCountry < DomainEvent, ExistingCountryEvent
operations
    effect()
end

class DeleteCurrency < DomainEvent, ExistingCurrencyEvent
operations
    effect()
end

class DeleteCustomer < DomainEvent, ExistingCustomerEvent
operations
    effect()
end

abstract class ExistingAddressEvent
end

association existingAddressEvent_address between
    ExistingAddressEvent[*]
    Address[1]
end


class DeleteCustomerAddress < DomainEvent, ExistingCustomerEvent, ExistingAddressEvent
operations
    effect()
end

abstract class ExistingLanguageEvent
end

association existingLanguageEvent_language between
    ExistingLanguageEvent[*]
    Language[0..1]
end


class DeleteLanguage < DomainEvent, ExistingLanguageEvent
operations
    effect()
end

class DeleteManufacturer < DomainEvent, ExistingManufacturerEvent
attributes
    deleteProds:Boolean
operations
    effect()
end

abstract class ExistingNewsletterEvent
end

association existingNewsletterEvent_newsletter between
    ExistingNewsletterEvent[*]
    Newsletter[0..1]
end


class DeleteNewsletter < DomainEvent, ExistingNewsletterEvent
operations
    effect()
end

abstract class ExistingOrderStatusEvent
end

association existingOrderStatusEvent_orderStatus between
    ExistingOrderStatusEvent[*]
    OrderStatus[0..1]
end
```

```
class DeleteOrderStatus < DomainEvent, ExistingOrderStatusEvent
operations
    effect()
end

abstract class ExistingProductEvent
end

association existingProductEvent_product between
    ExistingProductEvent[*]
    Product[0..1]
end


class DeleteProduct < DomainEvent, ExistingProductEvent
operations
    effect()
end

class DeleteProductAttribute < DomainEvent, ExistingProductAttributeEvent
operations
    effect()
end


class DeleteProductNotificationSubscription < DomainEvent, ExistingCustomerEvent
operations
    effect()
end

association deleteProductNotificationSubscription_product between
    DeleteProductNotificationSubscription[*]
    Product[1] role deletedSubscribedProduct
end

abstract class ExistingOptionEvent
end

association existingOptionEvent_option between
    ExistingOptionEvent[*]
    Option[0..1]
end


class DeleteProductOption < DomainEvent, ExistingOptionEvent
operations
    effect()
end

abstract class ExistingValueEvent
end

association existingValueEvent_option between
    ExistingValueEvent[*]
    Value[0..1]
end


class DeleteProductOptionValue < DomainEvent, ExistingValueEvent
operations
    effect()
end

abstract class ExistingReviewEvent
end

association existingReviewEvent_review between
    ExistingReviewEvent[*]
    Review[0..1]
end
```

```
class DeleteReview < DomainEvent, ExistingReviewEvent
operations
    effect()
end

abstract class ExistingSessionEvent
end

association existingSessionEvent_Session between
    ExistingSessionEvent[*]
    Session[0..1]
end

class DeleteSession < DomainEvent, ExistingSessionEvent
operations
    effect()
end

abstract class ExistingSpecialEvent
end

association existingSpecialEvent_special between
    ExistingSpecialEvent[*]
    Special[0..1]
end

class DeleteSpecial < DomainEvent, ExistingSpecialEvent
operations
    effect()
end

abstract class ExistingTaxClassEvent
end

association existingTaxClassEvent_taxClass between
    ExistingTaxClassEvent[*]
    TaxClass[0..1]
end

class DeleteTaxClass < DomainEvent, ExistingTaxClassEvent
operations
    effect()
end

abstract class ExistingTaxRateEvent
end

association existingTaxRateEvent_taxRate between
    ExistingTaxRateEvent[*]
    TaxRate[0..1]
end

class DeleteTaxRate < DomainEvent, ExistingTaxRateEvent
operations
    effect()
end

abstract class ExistingTaxZoneEvent
end

association existingTaxZoneEvent_taxZone between
    ExistingTaxZoneEvent[*]
    TaxZone[0..1]
end

class DeleteTaxZone < DomainEvent, ExistingTaxZoneEvent
operations
    effect()
end

abstract class ExistingZoneEvent
end
```

```
association existingZoneEvent_zone between
    ExistingZoneEvent[*]
    Zone[0..1]
end

class DeleteZone < DomainEvent, ExistingZoneEvent
operations
    effect()
end

class DisplayCartAfterAddingProductChange < DomainEvent, StoreEvent
attributes
    newDisplayCartAfterAddingProduct:Boolean
operations
    effect()
end

class DisplayPricesWithTaxChange < DomainEvent, StoreEvent
attributes
    newDisplayPricesWithTax:Boolean
operations
    effect()
end

abstract class EditPaymentMethodEvent
attributes
    status:Status
end

association editPaymentMethodEvent_taxZone between
    EditPaymentMethodEvent[*]
    TaxZone[0..1]
end

association editPaymentMethodEvent_orderStatus between
    EditPaymentMethodEvent[*]
    OrderStatus[0..1]
end

class EditAuthorizeNetPaymentMethod < DomainEvent, EditPaymentMethodEvent
attributes
    newUsername:String
    newKey:String
    newMode:TransactionMode
    newMethod:TransactionMethod
    newNotification:Boolean
operations
    effect()
end

class EditBanner < DomainEvent, ExistingBannerEvent
attributes
    newTitle:String
    newUrl:URL
    newImagePath:String
    newHtml:String
    newExpires:Date
    newScheduled:Date
    newStatus:Status
operations
    effect()
end

association editBanner_bannerGroup between
       EditBanner[*]
       BannerGroup[1] role newBannerGroup
end

class EditBannerGroup < DomainEvent, ExistingBannerGroupEvent
attributes
    newName:String
```

```
operations
    effect()
end

class EditCashOnDeliveryPaymentMethod < DomainEvent, EditPaymentMethodEvent
operations
    effect()
end

abstract class CategoryNameEvent
end

associationclass HasNewName between
    CategoryNameEvent[*]
    Language[*] role languageOfCategory
    StringDT[1] role name
end

class EditCategory < DomainEvent, ExistingCategoryEvent, CategoryNameEvent
attributes
    imagePath:String
    sortOrder:Integer
operations
    effect()
end

association editCategory_category between
    EditCategory[*]
    Category[0..1] role newParent
end

class EditCheckMoneyPaymentMethod < DomainEvent, EditPaymentMethodEvent
attributes
    newMakePayableTo:String
operations
    effect()
end

class EditCountry < DomainEvent, ExistingCountryEvent
attributes
    newName:String
    newIsoCode2:String
    newIsoCode3:String
operations
    effect()
end

class EditCreditCardPaymentMethod < DomainEvent, EditPaymentMethodEvent
attributes
    newSplitCreditCardToMail:EMail
operations
    effect()
end

class EditCurrency < DomainEvent, ExistingCurrencyEvent
attributes
    newTitle:String
    newCode:String
    newSymbolLeft:String
    newSymbolRight:String
    newDecimalPlaces:Integer
    newValue:Real
operations
    effect()
end

class EditCustomer < DomainEvent, ExistingCustomerEvent
attributes
    newGender:Gender
    newFirstName:String
    newLastName:String
    newDateOfBirth:Date
    newEMailAddress:EMail
    newPhone:String
    newFax:String
    newNewsletter:Boolean
    newPassword:String
    newGlobalNotifications:Boolean
operations
    effect()
end

class EditCustomerAddress < DomainEvent, ExistingCustomerEvent, ExistingAddressEvent
attributes
    newAddress:Address
operations
    effect()
end

class EditCustomerDetails < DomainEvent, ExistingCustomerEvent
attributes
    newGender:Gender
    newFirstName:String
    newLastName:String
    newDateOfBirth:Date
    newEMailAddress:EMail
    newPhone:String
    newFax:String
    newNewsletter:Boolean
operations
    effect()
end

abstract class ExistingDownloadableEvent
end

association existingDownloadableEvent_Downloadable between
    ExistingDownloadableEvent[*]
    Downloadable[1]
end

class EditDownloadableAttribute < DomainEvent, ExistingDownloadableEvent
attributes
    newFilename:File
    newExpiryDays:Integer
    newMaximumDownloadCount:Integer
operations
    effect()
end

abstract class ShippingMethodEvent
attributes
    status:Status
end

association  ShippingMethodEvent_taxClass between
     ShippingMethodEvent[*]
     TaxClass[0..1]
end

abstract class  SpecificZoneShippingMethodEvent < ShippingMethodEvent
end

association  SpecificZoneShippingMethodEvent_taxZone between
     SpecificZoneShippingMethodEvent[*]
     TaxZone[0..1]
end

class EditFlatRateShippingMethod < DomainEvent, SpecificZoneShippingMethodEvent
attributes
    newCost:Real
operations
    effect()
end
```

```
class EditGlobalNotifications < DomainEvent, ExistingCustomerEvent
attributes
    newGlobalNotifications:Boolean
operations
    effect()
end

class EditIPaymentPaymentMethod < DomainEvent, EditPaymentMethodEvent
attributes
    newAccount:Integer
    newUser:String
    newPassword:String
operations
    effect()
end

class EditLanguage < DomainEvent, ExistingLanguageEvent
attributes
    newName:String
    newCode:String
operations
    effect()
end

association editLanguage_currency between
    EditLanguage[*]
    Currency[0..1] role newDefaultCurrency
end

abstract class ManufacturerURLEvent
end

associationclass HasURL between
    ManufacturerURLEvent[*]
    Language[*] role languageOfURL
    URL[1] role url
end

class EditManufacturer < DomainEvent, ExistingManufacturerEvent, ManufacturerURLEvent
attributes
    imagePath:String
    name:String
operations
    effect()
end

class EditNewsletter < DomainEvent, ExistingNewsletterEvent
attributes
    newTitle:String
    newContent:String
operations
    effect()
end


class EditNochexPaymentMethod < DomainEvent, EditPaymentMethodEvent
attributes
    newEMail:EMail
operations
    effect()
end

abstract class OrderStatusNameEvent
end

associationclass HasOrderStatusName between
    OrderStatusNameEvent[*]
    Language[*] role languageOfOrderStatus
    StringDT[1] role orderStatusName
end

class EditOrderStatus < DomainEvent, ExistingOrderStatusEvent, OrderStatusNameEvent
```

```
operations
    effect()
end

class EditPayPalPaymentMethod < DomainEvent, EditPaymentMethodEvent
attributes
    newEMail:EMail
operations
    effect()
end

association editPayPalMethod_currency between
    EditPayPalPaymentMethod[*]
    Currency[0..1]
end

abstract class HandlingFeeMethodEvent
attributes
    handlingFee:Real
end

class EditPerItemShippingMethod < DomainEvent, SpecificZoneShippingMethodEvent,
HandlingFeeMethodEvent
attributes
    newCost:Real
operations
    effect()
end

abstract class ProductNameEvent
end

associationclass HasNewProductName between
    ProductNameEvent[*]
    Language[*] role languageOfProduct
    StringDT[1] role nameOfProduct
end

class EditProduct < DomainEvent, ExistingProductEvent, ProductNameEvent
attributes
    status:ProductStatus
    available:Date
    netPrice:Real
    quantityOnHand:Integer
    modelM:String
    imagePath:String
    weight:Real
operations
    effect()
end

association editProduct_manufacturer between
    EditProduct[*]
    Manufacturer[0..1]
end

association editProduct_category between
    EditProduct[*]
    Category[*]
end

association editProduct_taxClass between
    EditProduct[*]
    TaxClass[0..1]
end

class EditProductNotification < DomainEvent
attributes
    newGlobal:Boolean
operations
    effect()
end
```

```
association editProductNotification_product between
    EditProductNotification[*]
    Product[*] role newExplicitNotifications
end

association editProductNotification_productNotification between
    EditProductNotification[*]
    ProductNotification[1]
end


abstract class ProductOptionNameEvent
end

associationclass HasNewOptionName between
    ProductOptionNameEvent[*]
    Language[*] role languageOfOption
    StringDT[1] role nameOfOption
end

class EditProductOption < DomainEvent, ExistingOptionEvent, ProductOptionNameEvent
operations
    effect()
end

abstract class ProductValueNameEvent
end

associationclass HasNewValueName between
    ProductValueNameEvent[*]
    Language[*] role languageOfValue
    StringDT[1] role nameOfValue
end

class EditProductOptionValue < DomainEvent, ExistingValueEvent, ProductValueNameEvent
operations
    effect()
end

association editProductOptionValue_Option between
    EditProductOptionValue[*]
    Option[1..*]
end

class EditPSiGatePaymentMethod < DomainEvent, EditPaymentMethodEvent
attributes
    newMerchantID:String
    newMode:PSiGateMode
    newType:PSiGateType
    newCreditCardCollection:PSiGateCollection
operations
    effect()
end

association editPSiGatePaymentMethod_currency between
    EditPSiGatePaymentMethod[*]
    Currency[0..1]
end

class EditReview < DomainEvent, ExistingReviewEvent
attributes
    newReview:String
    newRating:Rating
operations
    effect()
end

association editReview_Language between
    EditReview[*]
    Language[1] role newLanguage
end
```

```
association editReview_Product between
    EditReview[*]
    Product[1] role newProduct
end

association editReview_Customer between
    EditReview[*]
    Customer[1] role newCustomer
end

class EditSECPaymentMethod < DomainEvent, EditPaymentMethodEvent
attributes
    newMerchantID:String
    newMode:SECPayMode
operations
    effect()
end

association editSECPaymentMethod_currency between
    EditSECPaymentMethod[*]
    Currency[0..1]
end

class EditSpecial < DomainEvent, ExistingSpecialEvent
attributes
    newSpecialPrice:Real
    newExpiryDate:Date
    newStatus:Status
operations
    effect()
end

class EditTableRateShippingMethod < DomainEvent, SpecificZoneShippingMethodEvent,
HandlingFeeMethodEvent
attributes
    newMethod:ShippingTableMethod
operations
    effect()
end

association editTableRateShippingMethod_newItems between
    EditTableRateShippingMethod[*]
    ShippingTableItem[*] role newItems
end

class EditTaxClass < DomainEvent, ExistingTaxClassEvent
attributes
    newName:String
    newDescription:String
operations
    effect()
end

class EditTaxRate < DomainEvent, ExistingTaxRateEvent
attributes
    newRate:Integer
    newPriority:Integer
    newDescription:String
operations
    effect()
end

association editTaxRate_taxZone between
    EditTaxRate[*]
    TaxZone[1] role newTaxZone
end

association editTaxRate_taxClass between
    EditTaxRate[*]
    TaxClass[1] role newTaxClass
end
```

```
class EditTaxZone < DomainEvent, ExistingTaxZoneEvent
attributes
    newName:String
    newDescription:String
operations
    effect()
end

association editTaxZone_mewZones between
    EditTaxZone[*]
    Zone[*] role newZones
end

class EditTwoCheckOutPaymentMethod < DomainEvent, EditPaymentMethodEvent
attributes
    newLogin:String
    newMode:TransactionMode
    newMerchantNotification:Boolean
operations
    effect()
end

class EditUSPostalServiceShippingMethod < DomainEvent, SpecificZoneShippingMethodEvent,
HandlingFeeMethodEvent
attributes
    newUserID:String
    newPassword:String
    newServer:USPSServer
operations
    effect()
end

class EditZone < DomainEvent, ExistingZoneEvent
attributes
    newName:String
    newCode:String
operations
    effect()
end

class EditZoneRatesShippingMethod < DomainEvent, ShippingMethodEvent
operations
    effect()
end

association editZoneRatesShippingMethod_country between
    EditZoneRatesShippingMethod[*]
    Country[*]
end

association editZoneRatesShippingMethod_mewItems between
    EditZoneRatesShippingMethod[*]
    ShippingTableItem[*] role newItems
end

class EMailAddressChange < DomainEvent, StoreEvent
attributes
    newEmailAddress:EMail
operations
    effect()
end

class EMailAddressMinimumChange < DomainEvent
attributes
    newMinimum:Integer
operations
    effect()
end
```

```
class EMailFromChange < DomainEvent, StoreEvent
attributes
    newEmailFrom:EMail
operations
    effect()
end

class EnableDownloadConfigurationChange < DomainEvent
attributes
    newValue:Boolean
operations
    effect()
end


class ExpectedSortFieldChange < DomainEvent, StoreEvent
attributes
    newExpectedSortField:SortField
operations
    effect()
end

class ExpectedSortOrderChange < DomainEvent, StoreEvent
attributes
    newExpectedSortOrder:SortOrder
operations
    effect()
end

class FirstNameMinimumChange < DomainEvent
attributes
    newMinimum:Integer
operations
    effect()
end

class GenderCustomerDetailChange < DomainEvent
attributes
    newValue:Boolean
operations
    effect()
end

class IncrementAndSignAttributeChange < DomainEvent, ExistingProductAttributeEvent
attributes
    newIncrement:Real
    newSign:Sign
operations
    effect()
end


class InstallAuthorizeNetPaymentMethod < DomainEvent
operations
    effect()
end

class InstallCashOnDeliveryPaymentMethod < DomainEvent
operations
    effect()
end

class InstallCheckMoneyPaymentMethod < DomainEvent
operations
    effect()
end

class InstallCreditCardPaymentMethod < DomainEvent
operations
    effect()
end
```

```
class InstallFlatRateShippingMethod < DomainEvent
operations
    effect()
end

class InstallIPaymentPaymentMethod < DomainEvent
operations
    effect()
end

class InstallNochexPaymentMethod < DomainEvent
operations
    effect()
end

class InstallPayPalPaymentMethod < DomainEvent
operations
    effect()
end

class InstallPerItemShippingMethod < DomainEvent
operations
    effect()
end

class InstallPSiGatePaymentMethod < DomainEvent
operations
    effect()
end

class InstallSECPaymentMethod < DomainEvent
operations
    effect()
end

class InstallTableRateShippingMethod < DomainEvent
operations
    effect()
end

class InstallTwoCheckOutPaymentMethod < DomainEvent
operations
    effect()
end

class InstallUSPostalServiceShippingMethod < DomainEvent
operations
    effect()
end

class InstallZoneRatesShippingMethod < DomainEvent
operations
    effect()
end

class LastNameMinimumChange < DomainEvent
attributes
    newMinimum:Integer
operations
    effect()
end

class LinkProduct < DomainEvent, ExistingProductEvent
operations
    effect()
end

association linkProduct_category between
    LinkProduct[*]
    Category[1] role newCategory
end
```

```
class LockNewsletter < DomainEvent, ExistingNewsletterEvent
operations
    effect()
end

class LogIn < DomainEvent, ExistingCustomerEvent
operations
    effect()
end

association logIn_session between
    LogIn[*]
    Session[0..1]
end

class LogOut < DomainEvent, ExistingCustomerEvent, ExistingSessionEvent
operations
    effect()
end

class NameChange < DomainEvent, StoreEvent
attributes
    newName:String
operations
    effect()
end

class MaximumNumberDownloadConfigurationChange < DomainEvent
attributes
    newMaximum:Integer
operations
    effect()
end

class MaximumPackageWeightShippingConfigurationChange < DomainEvent
attributes
    newMaximum:Integer
operations
    effect()
end

class MoveCategory < DomainEvent, ExistingCategoryEvent
operations
    effect()
end

association moveCategory_newParent between
    MoveCategory[*]
    Category[0..1] role newParent
end

class MoveProduct < DomainEvent, ExistingProductEvent
operations
    effect()
end

association moveProduct_oldCategory between
    MoveProduct[*] role moveProductOfOldCategory
    Category[1] role oldCategory
end

association moveProduct_newCategory between
    MoveProduct[*] role moveProductOfNewCategory
    Category[1] role newCategory
end

class NewBanner < DomainEvent
attributes
    title:String
    url:URL
    imagePath:String
    html:String
    expires:Date
    scheduled:Date
operations
    effect()
end

class NewBannerGroup < DomainEvent
attributes
    name:String
operations
    effect()
end

association newBanner_bannerGroup between
       NewBanner[*]
       BannerGroup[1];
end

class NewCategory < DomainEvent, CategoryNameEvent
attributes
    imagePath:String
    sortOrder:Integer
operations
    effect()
end

association newCategory_category between
    NewCategory[*]
    Category[0..1] role parent
end

class NewCountry < DomainEvent
attributes
    name:String
    isoCode2:String
    isoCode3:String
operations
    effect()
end

class NewCurrency < DomainEvent
attributes
    title:String
    code:String
    symbolLeft:String
    symbolRight:String
    decimalPlaces:Integer
    value:Real
operations
    effect()
end

class NewCustomer < DomainEvent
attributes
    dateOfBirth:Date
    eMailAddress:EMail
    phone:String
    fax:String
    newsletter:Boolean
    password:String
    passwordConfirmation:String
    primary:Address
    customerCreated:Customer
operations
    effect()
end

class NewCustomerAddress < DomainEvent, ExistingCustomerEvent
attributes
    gender:Gender
    firstName:String
    lastName:String
    company:String
    street:String
    suburb:String
    postCode:PostalCode
    city:String
    state:String
    answer:Address
operations
    effect()
end

association newCustomerAddress_zone between
    NewCustomerAddress[*]
    Zone[0..1]
end

association newCustomerAddress_country between
    NewCustomerAddress[*]
    Country[1]
end

class NewDownloadableProductAttribute < DomainEvent, ExistingProductEvent
attributes
    increment:Real
    sign:Sign
    filename:File
    expiryDays:Integer
    maximumDownloadCount:Integer
operations
    effect()
end

association newDownloadableProductAttribute_option between
    NewDownloadableProductAttribute[*]
    Option[1]
end

association newDownloadableProductAttribute_value between
    NewDownloadableProductAttribute[*]
    Value[1]
end

class NewLanguage < DomainEvent
attributes
    newName:String
    newCode:String
operations
    effect()
end

association NewLanguage_currency between
    NewLanguage[*]
    Currency[0..1] role defaultCurrency
end


class NewManufacturer < DomainEvent, ManufacturerURLEvent
attributes
    imagePath:String
    name:String
operations
    effect()
end

class NewNewsletter < DomainEvent
attributes
    title:String
    content:String
operations
    effect()
end
```

```
class NewOrderStatus < DomainEvent, OrderStatusNameEvent
attributes
    name:String
    createdOrderStatus:OrderStatus;
operations
    effect()
end

class NewProduct < DomainEvent, ProductNameEvent
attributes
    status:ProductStatus
    available:Date
    netPrice:Real
    quantityOnHand:Integer
    modelM:String
    imagePath:String
    weight:Real
operations
    effect()
end

association newProduct_manufacturer between
    NewProduct[*]
    Manufacturer[0..1]
end

association newProduct_category between
    NewProduct[*]
    Category[*]
end

association newProduct_taxClass between
    NewProduct[*]
    TaxClass[0..1]
end

class NewProductAttribute < DomainEvent, ExistingProductEvent
attributes
    increment:Real
    sign:Sign
operations
    effect()
end

association newProductAttribute_option between
    NewProductAttribute[*]
    Option[1]
end

association newProductAttribute_value between
    NewProductAttribute[*]
    Value[1]
end

class NewProductNotification < DomainEvent
attributes
    title:String
    content:String
    global:Boolean
operations
    effect()
end

association newProductNotification_product between
    NewProductNotification[*]
    Product[*] role explicitNotifications
end

class NewProductNotificationSubscription < DomainEvent, ExistingCustomerEvent
operations
    effect()
end
```

```
association newProductNotificationSubscription_product between
    NewProductNotificationSubscription[*]
    Product[1] role newSubscribedProduct
end

class NewProductOption < DomainEvent, ProductOptionNameEvent
operations
    effect()
end

class NewProductOptionValue < DomainEvent, ProductValueNameEvent
operations
    effect()
end

association newProductOptionValue_option between
    NewProductOptionValue[*]
    Option[1..*] role option
end

class NewReview < DomainEvent
attributes
    review:String
    rating:Rating
    createdReview:Review
operations
    effect()
end

association newReview_language between
    NewReview[*]
    Language[1] role language
end

association newReview_product between
    NewReview[*]
    Product[1] role product
end

association newReview_customer between
    NewReview[*]
    Customer[1] role customer
end

class NewSession < DomainEvent
attributes
       createdSession:Session
operations
    effect()
end

association newSession_currentCurrency between
    NewSession[*]
    Currency[1] role currentCurrency
end

association newSession_currentLanguage between
    NewSession[*]
    Language[1] role currentLanguage
end

class NewSpecial < DomainEvent
attributes
    specialPrice:Real
    expiryDate:Date
    status:Status
operations
    effect()
end
```

```
association newSpecial_product between
    NewSpecial[*]
    Product[0..1]
end

class NewTaxClass < DomainEvent
attributes
    name:String
    description:String
operations
    effect()
end

class NewTaxRate < DomainEvent
attributes
    rate:Integer
    priority:Integer
    description:String
operations
    effect()
end

association newTaxRate_taxZone between
    NewTaxRate[*]
    TaxZone[1]
end

association newTaxRate_taxClass between
    NewTaxRate[*]
    TaxClass[1]
end


class NewTaxZone < DomainEvent
attributes
    name:String
    description:String
operations
    effect()
end

association newTaxZone_mewZones between
    NewTaxZone[*]
    Zone[*]
end

class NewZone < DomainEvent
attributes
    name:String
    code:String
operations
    effect()
end

association newZone_country between
    NewZone[*]
    Country[0..1]
end

class OrderConfirmation < DomainEvent
attributes
    delivery:Address
    billing:Address
    creditCardType:String
    creditCardOwner:String
    creditCardNumber:String
    creditCardExpires:Date
    comments:String
    orderCreated:Order
operations
    effect()
end
```

```
association orderConfirmation_customerShoppingCart between
    OrderConfirmation[*]
    CustomerShoppingCart[0..1] role shoppingCart
end

association orderConfirmation_shippingMethod between
    OrderConfirmation[*]
    ShippingMethod[1]
end

association orderConfirmation_paymentMethod between
    OrderConfirmation[*]
    PaymentMethod[1]
end

association orderConfirmation_currency between
    OrderConfirmation[*]
    Currency[1]
end

class OwnerChange < DomainEvent, StoreEvent
attributes
    newOwner:String
operations
    effect()
end

class PasswordChange < DomainEvent, ExistingCustomerEvent
attributes
    oldPassword:String
    newPassword:String
operations
    effect()
end

class PasswordMinimumChange < DomainEvent
attributes
    newMinimum:Integer
operations
    effect()
end

class PercentageIncreaseForLargerPackagesShippingConfigurationChange < DomainEvent
attributes
    newPercentage:Real
operations
    effect()
end

class PostCodeMinimumChange < DomainEvent
attributes
    newMinimum:Integer
operations
    effect()
end

class PostCodeShippingConfigurationChange < DomainEvent
attributes
    newPostCode:PostalCode
operations
    effect()
end

class PrimaryCustomerAddressChange < DomainEvent, ExistingAddressEvent,
ExistingCustomerEvent
operations
    effect()
end
```

```
class ProductAttributeStatusChange < DomainEvent, ExistingProductAttributeEvent
attributes
    newStatus:Status
operations
    effect()
end

class ProductDownload < DomainEvent, ExistingCustomerEvent, ExistingProductEvent
operations
    effect()
end

association productDownload_downloadable between
    ProductDownload[*]
    Downloadable[1]
end

class ProductOptionAttributeChange < DomainEvent, ExistingProductAttributeEvent
operations
    effect()
end

association productOptionAttributeChange_option between
    ProductOptionAttributeChange[*]
    Option[1]
end

class ProductValueAttributeChange < DomainEvent, ExistingProductAttributeEvent
operations
    effect()
end

association productValueAttributeChange_value between
    ProductValueAttributeChange[*]
    Value[1]
end

class ProductStatusChange < DomainEvent, ExistingProductEvent
attributes
    newStatus:ProductStatus
operations
    effect()
end

class ReadProductInfo < DomainEvent, ExistingProductEvent
operations
    effect()
end

association readProductInfo_language between
    ReadProductInfo[*]
    Language[1]
end

class ReadReview < DomainEvent, ExistingReviewEvent
operations
    effect()
end

class ReorderLevelStockConfigurationChange < DomainEvent
attributes
    newValue:Integer
operations
    effect()
end

class RestorePreviousShoppingCart < DomainEvent, ExistingCustomerEvent
operations
    effect()
end
```

```
association restorePreviousShoppingCart_session between
    RestorePreviousShoppingCart[*]
    Session[0..1]
end

class ReviewTextMinimumChange < DomainEvent
attributes
    newMinimum:Integer
operations
    effect()
end

class SendExtraOrderEmailChange < DomainEvent, StoreEvent
operations
    effect()
end

association sendExtraOrderEmailChange_newSendExtraOrderEmail between
    SendExtraOrderEmailChange[*]
    NameEMail[*] role newSendExtraOrderEMail
end

class SendNewsletter < DomainEvent, ExistingNewsletterEvent
operations
    effect()
end

class SetCancelledOrderStatus < DomainEvent, StoreEvent
operations
    effect()
end

association setCancelledOrderStatus_orderStatus between
    SetCancelledOrderStatus[*]
    OrderStatus[1]
end

class SetCurrentCurrency < DomainEvent, ExistingSessionEvent
operations
    effect()
end

association setCurrentCurrency_currency between
    SetCurrentCurrency[*]
    Currency[1] role newCurrentCurrency
end

class SetCurrentLanguage < DomainEvent, ExistingSessionEvent
operations
    effect()
end

association setCurrentLanguage_language between
    SetCurrentLanguage[*]
    Language[1] role newCurrentLanguage
end

class SetDefaultCurrency < DomainEvent, ExistingCurrencyEvent
operations
    effect()
end

class SetDefaultLanguage < DomainEvent, ExistingLanguageEvent
operations
    effect()
end

class SetDefaultOrderStatus < DomainEvent, StoreEvent
operations
    effect()
end
```

```
association setDefaultOrderStatus_orderStatus between
    SetDefaultOrderStatus[*]
    OrderStatus[1]
end

class ShowBanner < DomainEvent, ExistingBannerEvent
operations
    effect()
end

class ShowBestPurchasedProducts < Query
operations
       answer():Set(Tuple(product:String,quantity:Integer)) =
       Product.allInstances
       -> sortedBy(quantityOrdered)
       -> collect (p | Tuple  {product : ProductInLanguage.allInstances ->select
                                                             (pil | pil.product = p  and

pil.language=language)->any(true).name,
                                           quantity : p.quantityOrdered})->asSet()
end

association showBestPurchasedProducts_language between
    ShowBestPurchasedProducts[*]
    Language[1]
end

class ShowBestViewedProducts < Query
operations
       answer():Set(Tuple(product:String,timesViewed:Integer)) =
              Product.allInstances
       -> sortedBy(timesViewed())
       -> collect (p | Tuple  {product : ProductInLanguage.allInstances ->select
                                                             (pil | pil.product = p  and

pil.language=language)->any(true).name,
                                            timesViewed : p.timesViewed()})->asSet()

end

association showBestViewedProducts_language between
    ShowBestViewedProducts[*]
    Language[1]
end

class ShowCustomersOrdersTotal < Query
operations
       answer():Set(Tuple(name:String, total:Real))=
       Customer.allInstances
       -> collect (c | Tuple  {name : c.firstName.concat(c.lastName),
                                           total : c.order.total() -> sum()}) -> asSet()
end

class ShowExpectedProducts < Query
operations
       answer(): Set(Tuple(product:String, dateAvailable:Date))=
       Product.allInstances -> select(p|p.available.isDefined())
       -> sortedBy(available.date)
       -> collect (p | Tuple  {product : ProductInLanguage.allInstances ->select
                                                             (pil | pil.product = p  and

pil.language=language)->any(true).name,
                                           dateAvailable : p.available}) ->asSet()
end

association showExpectedProducts_language between
    ShowExpectedProducts[*]
    Language[1]
End
```

```
class ShowNewProducts < Query
operations
       answer(): Set(Tuple(product:String, added:DateTime))=
        Product.allInstances
       -> sortedBy(added.dateTime)
       -> collect (p | Tuple  {product : ProductInLanguage.allInstances ->select
                                        (pil | pil.product = p  and
                                         pil.language=language)->any(true).name,
                                         added : p.added})->asSet()
end

association showNewProducts_language between
    ShowNewProducts[*]
    Language[1]
end

class ShowOnlineCustomers < Query
operations
       answer(): Set(String)=
        Session.allInstances.customer
       -> collect (c | c.firstName.concat(c.lastName))->asSet()

end

class ShowOrdersOfCustomer < Query, ExistingCustomerEvent
operations
       answer(): Set(Tuple(id:Integer, total:Real, status:OrderStatus))=
       self.customer.order
       -> collect (o | Tuple  {id : o.id(),
                               total : o.total(),
                               status : o.orderStatusChange-> last().orderStatus})
                               ->asSet()
end

class ShowProductsOfCategory < Query, ExistingCategoryEvent
operations
       answer(): Set(String)=
       Product.allInstances -> select(p | p.category -> includes(self.category))
       -> collect (p | ProductInLanguage.allInstances ->select
                       (pil | pil.product = p  and
                        pil.language=language)->any(true).name)->asSet()

end

association showProductsOfCategory_language between
    ShowProductsOfCategory[*]
    Language[1]
end

class ShowProductsOfManufacturer < Query, ExistingManufacturerEvent
operations
       answer(): Set(String)=
       Product.allInstances -> select(p | p.manufacturer=self.manufacturer)
       -> collect (p | ProductInLanguage.allInstances ->select
                                                             (pil | pil.product = p  and

               pil.language=language)->any(true).name)->asSet()
end

association showProductsOfManufacturer_language between
    ShowProductsOfManufacturer[*]
    Language[1]
end

class ShowReviewsOfProduct < Query, ExistingProductEvent
operations
       answer(): Set(Tuple(review:String,rating:Rating))=
       self.product.review -> select (r | r.language = self.language)
       -> collect (r | Tuple  {review : r.review,
                               rating : r.rating})->asSet()

end
```

```
association showReviewsOfProduct_language between
    ShowReviewsOfProduct[*]
    Language[1]
end

class ShowSpecials < Query
operations
       answer(): Set(Tuple(product:String,oldPrice:Real, newPrice:Real))=
       Special.allInstances
       -> collect (s | Tuple  {product : ProductInLanguage.allInstances ->select
                                          (pil | pil.product = s  and
                                           pil.language=language)->any(true).name,
                                            oldPrice : s.netPrice,
                                            newPrice : s.specialPrice})->asSet()
end

association showSpecials_language between
    ShowSpecials[*]
    Language[1]
end

class ShowUnderStockProducts < Query
operations
       answer(): Set(Tuple(product:String,quantity:Integer))=
       Product.allInstances -> select(p | p.quantityOnHand < Stock.allInstances
                             ->any(true).stockReOrderLevel)
       -> collect (p | Tuple  {product : ProductInLanguage.allInstances ->select
               (pil | pil.product = p  and pil.language=language)->any(true).name,
                                            quantity : p.quantityOnHand}) -> asSet()
end

association showUnderStockProducts_language between
    ShowUnderStockProducts[*]
    Language[1]
end

class StateCustomerDetailChange < DomainEvent
attributes
    newValue:Boolean
operations
    effect()
end

class StateMinimumChange < DomainEvent
attributes
    newMinimum:Integer
operations
    effect()
end

class StatusPaymentMethodChange < DomainEvent, ExistingPaymentMethodEvent
attributes
    newStatus:Status
operations
    effect()
end

class StatusShippingMethodChange < DomainEvent, ExistingShippingMethodEvent
attributes
    newStatus:Status
operations
    effect()
end

abstract class ExistingPaymentMethodEvent
end

association existingPaymentMethodEvent_paymentMethod between
    ExistingPaymentMethodEvent[*]
    PaymentMethod[1]
end
```

```
abstract class ExistingShippingMethodEvent
end

association existingShippingMethodEvent_shippingMethod between
    ExistingShippingMethodEvent[*]
    ShippingMethod[1]
end

class StoreAddressAndPhoneChange < DomainEvent, StoreEvent
attributes
    newStoreAddressAndPhone:String
operations
    effect()
end

class StreetAddressMinimumChange < DomainEvent
attributes
    newMinimum:Integer
operations
    effect()
end

class SubstractStockConfigurationChange < DomainEvent
attributes
    newValue:Boolean
operations
    effect()
end

class SuburbCustomerDetailChange < DomainEvent
attributes
    newValue:Boolean
operations
    effect()
end

class SwitchToDefaultLanguageCurrencyChange < DomainEvent, StoreEvent
attributes
    newSwitchToDefaultLanguageCurrency:Boolean
operations
    effect()
end

class TaxDecimalPlacesChange < DomainEvent, StoreEvent
attributes
    newTaxDecimalPlaces:Integer
operations
    effect()
end

class TelephoneMinimumChange < DomainEvent
attributes
    newMinimum:Integer
operations
    effect()
end

class TypicalPackageTareWeightShippingConfigurationChange < DomainEvent
attributes
    newValue:Integer
operations
    effect()
end

class UninstallAuthorizeNetPaymentMethod < DomainEvent
operations
    effect()
end
```

```
class UninstallCashOnDeliveryPaymentMethod < DomainEvent
operations
end

class UninstallCheckMoneyPaymentMethod < DomainEvent
operations
    effect()
end

class UninstallCreditCardPaymentMethod < DomainEvent
operations
    effect()
end

class UninstallFlatRateShippingMethod < DomainEvent
operations
    effect()
end

class UninstallIPaymentPaymentMethod < DomainEvent
operations
    effect()
end

class UninstallNochexPaymentMethod < DomainEvent
operations
    effect()
end

class UninstallPayPalPaymentMethod < DomainEvent
operations
    effect()
end

class UninstallPerItemShippingMethod < DomainEvent
operations
    effect()
end

class UninstallPSiGatePaymentMethod < DomainEvent
operations
    effect()
end

class UninstallSECPaymentMethod < DomainEvent
operations
    effect()
end

class UninstallTableRateShippingMethod < DomainEvent
operations
    effect()
end

class UninstallTwoCheckOutPaymentMethod < DomainEvent
operations
    effect()
end

class UninstallUSPostalServiceShippingMethod < DomainEvent
operations
    effect()
end

class UninstallZoneRatesShippingMethod < DomainEvent
operations
    effect()
end
```

```
class UnlockNewsletter < DomainEvent, ExistingNewsletterEvent
operations
    effect()
end

class UpdateCurrencyValueChange < DomainEvent, ExistingCurrencyEvent
attributes
    newValue:Real
operations
    effect()
end

class UpdateOrderStatus < DomainEvent, ExistingOrderEvent
attributes
    comments:String
operations
    effect()
end

association updateOrderStatus_zone between
    UpdateOrderStatus[*]
    OrderStatus[1] role newOrderStatus
end

class ZoneChange < DomainEvent,StoreEvent
operations
    effect()
end

association zoneChange_zone between
    ZoneChange[*]
    Zone[1] role newZone
end

class UpdateShoppingCart < SessionEvent, ActionRequest
operations
    effect()
end

abstract class ExistingShoppingCartItemEvent
end

association existingShoppingCartItemEvent_shoppingCartItem between
    ExistingShoppingCartItemEvent[*]
    ShoppingCartItem[1]
end

class LineChange
attributes
    index:Integer
    remove:Boolean
    quantity:Integer
end

association updateShoppingCart_lineChange between
    UpdateShoppingCart[*]
    LineChange[1..*] ordered
end

class RemoveProduct < ExistingShoppingCartItemEvent
operations
    effect()
end

class ChangeQuantity < ExistingShoppingCartItemEvent
attributes
    quantity:Integer
operations
    effect()
end
```

```
-- CONSTRAINTS
constraints

context Store inv alwaysOneInstance:
    Store.allInstances->size()=1

context Store inv zoneIsPartOfCountry:
    self.zone->notEmpty() implies self.country.zone->includes(self.zone)

context ShippingAndPackaging inv tareIsLessThanMaximumWeight:
    self.typicalPackageTareWeight < self.maximumPackageWeight

context PaymentMethod inv atLeastOneEnabled:
    PaymentMethod.allInstances
        -> select(pm | pm.status=#enabled)->size() >= 1

context ShippingMethod inv atLeastOneEnabled:
    ShippingMethod.allInstances
        -> select(sm | sm.status=#enabled) -> size() >= 1

context Language inv codeAndNameAreUnique:
    Language.allInstances->isUnique(name) and Language.allInstances->isUnique(code)

context Currency inv codeAndTitleAreUnique:
    Currency.allInstances->isUnique(title) and
    Currency.allInstances->isUnique(code)

context Country inv nameAndCodesAreUnique:
   Country.allInstances->isUnique(name) and
   Country.allInstances->isUnique(isoCode2) and
   Country.allInstances->isUnique(isoCode3)

context Zone inv nameAndCountryAndCodeAndCountryAreUnique:
    Zone.allInstances->isUnique(Tuple{n:name,c:country}) and
    Zone.allInstances->isUnique(Tuple{n:code,c:country})

context TaxZone inv nameIsUnique:
    TaxZone.allInstances->isUnique(name)

context TaxClass inv nameIsUnique:
    TaxClass.allInstances->isUnique(name)

context Language inv nameIsUnique:
    Language.allInstances->forAll(l |
        l.productInLanguage->isUnique(name))

context Language inv optionNameIsUnique:
    self.hasOptionName->isUnique(optionName.string)

context Language inv valueNameIsUnique:
    self.hasValueName->isUnique(valueName.string)

context Language inv categoryNameIsUnique:
    self.hasCategoryName->isUnique(categoryName.string)

context Category inv isAHierarchy:
    not self.allParents() -> includes(self)

context Manufacturer inv nameIsUnique:
    Manufacturer.allInstances->isUnique(name)

context Manufacturer inv aURLInEachLanguage:
    self.language->size()=Language.allInstances->size()

context Banner inv titleIsUnique:
    Banner.allInstances->isUnique(title)

context BannerGroup inv nameIsUnique:
    BannerGroup.allInstances->isUnique(name)

context Newsletter inv titleIsUnique:
    Newsletter.allInstances->isUnique(title)
```

```
context Customer inv eMailIsUnique:
    Customer.allInstances->isUnique(eMailAddress)

context Country inv addressesHaveZoneIfNeeded:
    self.zone->size()>0 implies self.address->forAll
                                    (a|a.state=a.zone.name and self=a.zone.country)

context CustomerShoppingCart inv sameCustomer:
    self.sessionOfShoppingCart.customer->notEmpty() implies
self.sessionOfShoppingCart.customer=self.customer

context ShoppingCartItem inv productHasTheAttributes:
    self.product.attribute->includesAll(self.attribute)

context ShoppingCartItem inv onlyOneAttributePerOption:
    self.attribute->isUnique(option)

context Session inv sessionIDIsUnique:
    Session.allInstances->isUnique(sessionID)

context Order inv ApplicableZoneShippingMethod:
    self.shippingMethod.oclIsTypeOf(SpecificZoneMethod) and
    self.shippingMethod.oclAsType(SpecificZoneMethod).taxZone -> notEmpty implies
    self.shippingMethod.oclAsType(SpecificZoneMethod).taxZone.zone
    -> includes(self.delivery.zone)

context Order inv ApplicableZoneRatesShippingMethod:
    self.shippingMethod.oclIsTypeOf(ZoneRates)  implies
    self.shippingMethod.oclAsType(ZoneRates).country -> includes(self.delivery.country)

context Order inv ApplicableZonesPaymentMethod:
    self.paymentMethod.taxZone -> notEmpty()  implies
    self.paymentMethod.taxZone.zone -> includes(self.billing.zone)

--context Order inv IDIsUnique:
 --   Order.allInstances -> isUnique(id())

context OrderStatus inv NameIsUnique:
    Language.allInstances->forAll(
       l | l.orderStatus->isUnique(orderStatusInLanguage.name)
    )


-- EVENT CONSTRAINTS

context  TypicalPackageTareWeightShippingConfigurationChange inv
_iniIC_valueDoesNotExceedMaxWeight:
   self.newValue < ShippingAndPackaging.allInstances->any(true).maximumPackageWeight

context  MaximumPackageWeightShippingConfigurationChange inv
_iniIC_maxIsGreaterThanTypicalWeight:
  self.newMaximum > ShippingAndPackaging.allInstances
  ->any(true).typicalPackageTareWeight

context  EditCreditCardPaymentMethod inv _iniIC_DoNotImpliesAllPaymentMethodsDisabled:
   PaymentMethod.allInstances -> select(pm | not(pm.oclIsTypeOf(CreditCard)))
               -> exists(pm | pm.status=#enabled)

context EditManufacturer inv _iniIC_manufacturerDoesNotExist:
        (Manufacturer.allInstances - Set{self.manufacturer}).name->excludes(self.name)

context NewCategory inv _iniIC_categoryDoesNotExist:
       Language.allInstances->forAll(l|
               l.hasCategoryName.categoryName.string->excludes(self.hasNewName
               ->select(languageOfCategory=l)->any(true).name.string))

context EditCountry inv _iniIC_countryDoesNotExist:
       (Country.allInstances - Set{self.country}).name->excludes(self.newName)   and
       (Country.allInstances - Set{self.country}).isoCode2->excludes(self.newIsoCode2)
       and
    (Country.allInstances - Set{self.country}).isoCode3->excludes(self.newIsoCode3)
```

```
context EditZone inv _iniIC_zoneDoesNotExist:
        (Zone.allInstances - Set{self.zone}).name->excludes(self.newName)  and
        (Zone.allInstances - Set{self.zone}).code->excludes(self.newCode)

context EditTaxClass inv _iniIC_taxClassDoesNotExist:
        (TaxClass.allInstances - Set{self.taxClass}).name->excludes(self.newName)

context EditTaxZone inv _iniIC_taxZoneDoesNotExist:
        (TaxZone.allInstances - Set{self.taxZone}).name->excludes(self.newName)

context EditBannerGroup inv _iniIC_bannerGroupDoesNotExist:
        (BannerGroup.allInstances - Set{self.bannerGroup}).name->excludes(self.newName)

context EditBanner inv _iniIC_bannerDoesNotExist:
        (Banner.allInstances - Set{self.banner}).title->excludes(self.newTitle)

context LockNewsletter inv _iniIC_newsletterIsNotLocked:
        self.newsletter.status <> #locked

context UnlockNewsletter inv _iniIC_newsletterIsNotUnlocked:
        self.newsletter.status <> #unlocked

context EditNewsletter inv _iniIC_newsletterIsUnlocked:
        self.newsletter.status = #unlocked

context EditNewsletter inv _iniIC_newsletterDoesNotExist:
        (Newsletter.allInstances - Set{self.newsletter}).title->excludes(self.newTitle)

context DeleteNewsletter inv _iniIC_newsletterIsUnlocked:
        self.newsletter.status = #unlocked

context EditTaxRate inv _iniIC_taxRateDoesNotExist:
        (TaxRate.allInstances - Set{self.taxRate})->select(tr |
               tr.taxClass = self.newTaxClass and
               tr.taxZone = self.newTaxZone)->size()=0

context  EditPerItemShippingMethod inv _iniIC_DoNotImpliesAllShippingMethodsDisabled:
   ShippingMethod.allInstances -> select(sm | not(sm.oclIsTypeOf(PerItem)))
               -> exists(sm | sm.status=#enabled)

context AttributeChange inv _iniIC_OptionAndValueAreAValidAttribute:
        Attribute.allInstances->exists(a| a.option=self.newOption and
a.value=self.newValue)

context MoveProduct inv _iniIC_oldCategoryIsValid:
        product.category->includes(self.oldCategory)

context AddProductToShoppingCart inv _iniIC_AttributesAreFromProduct:
  self.product.attribute -> includesAll(self.attribute)

context AddProductToShoppingCart inv _iniIC_AttributesAreOfDifferentOptions:
  self.attribute -> isUnique(option)

 context  DeleteBannerGroup inv _iniIC_BannerGroupIsEmpty:
   self.bannerGroup.banner -> isEmpty()

context  DeleteCountry inv _iniIC_CountryIsNotALocation:
   Store.allInstances -> any(true).country <> self.country and
   Address.allInstances.country -> excludes(self.country)

 context DeleteCurrency inv _iniIC_ExistsAnotherCurrencyEnabled:
    Currency.allInstances -> select (c| c<>self.currency) -> exists(c|c.status=#enabled)

context DeleteCustomerAddress inv _iniIC_AddressOfCustomer:
    self.customer.address -> includes(self.address)

context DeleteCustomerAddress inv _iniIC_AtLeastTwoAddresses:
    self.customer.address->size() >= 2

context DeleteCustomerAddress inv _iniIC_PrimaryAddressCannotBeDeleted:
    self.address <> self.customer.primary
```

```
context DeleteLanguage inv _iniIC_AtLeastTwoLanguages:
    Language.allInstances -> size() >= 2

context DeleteOrderStatus inv _iniIC_IsNotTheCurrentStatusOfAnyOrder:
      Order.allInstances -> forAll (o | o.orderStatusChange -> last().orderStatus <> 
self.orderStatus)

context DeleteOrderStatus inv _iniIC_IsNotADefaultStatus:
      Store.allInstances->forAll(s|
        s.defaultStatus <> self.orderStatus and
        s.cancelledStatus <> self.orderStatus)

context  DeleteProductOption inv _iniIC_HasNotProductsOrValues:
   self.option.attribute.product -> isEmpty()

context  DeleteProductOptionValue inv _iniIC_HasNotProducts:
   self.value.attribute.product -> isEmpty() and
self.value.attribute.orderLineAttribute->isEmpty()

context  DeleteZone inv _iniIC_ZoneIsNotALocation:
   Store.allInstances -> any(true).zone <> self.zone and
   Address.allInstances.zone -> excludes(self.zone)

context  EditAuthorizeNetPaymentMethod inv _iniIC_PaymentMethodIsInstalled:
   AuthorizeNet.allInstances -> notEmpty()

context  EditCashOnDeliveryPaymentMethod inv _iniIC_PaymentMethodIsInstalled:
   CashOnDelivery.allInstances -> notEmpty()

context  EditCheckMoneyPaymentMethod inv _iniIC_PaymentMethodIsInstalled:
   CheckMoney.allInstances -> notEmpty()

context  EditCreditCardPaymentMethod inv _iniIC_PaymentMethodIsInstalled:
   CreditCard.allInstances -> notEmpty()

context  EditPerItemShippingMethod inv _iniIC_atLeastOneEnabled:
   self.status=#disabled implies
   (ShippingMethod.allInstances-Set{PerItem.allInstances->any(true)})->exists(pm |
pm.status=#enabled)

context EditCustomer inv _iniIC_firstNameRight:
   self.newFirstName.size() >= MinimumValues.allInstances->any(true).firstName

context EditCustomer inv _iniIC_lastNameRight:
   self.newLastName.size() >= MinimumValues.allInstances->any(true).lastName

context EditCustomer inv _iniIC_dateOfBirthRight:

      CustomerDetails.allInstances->any(true).dateOfBirth implies
      self.newDateOfBirth.isDefined and
      self.newDateOfBirth.date.size() >= MinimumValues.allInstances
                                        ->any(true).dateOfBirth

context EditCustomer inv _iniIC_genderRight:
   CustomerDetails.allInstances->any(true).gender implies self.newGender.isDefined()

context EditCustomer inv _iniIC_eMailRight:
   self.newEMailAddress.eMail.size() >= MinimumValues.allInstances
                                        ->any(true).eMailAddress

context EditCustomer inv _iniIC_telephoneRight:
   self.newPhone.size() >= MinimumValues.allInstances->any(true).telephoneNumber

context EditLanguage inv _iniIC_languageDoesNotExist:
       not ((Language.allInstances-Set{self.language})->exists(name=self.newName or 
code=self.newCode))

context EditCurrency inv _iniIC_currencyDoesNotExist:
       not ((Currency.allInstances-Set{self.currency})->exists(title=self.newTitle or 
code=self.newCode))
```

```
context CurrencyStatusChange inv _iniIC_atLeastOneCurrencyEnabled:
     self.newStatus=#disabled
     implies
        (Currency.allInstances-Set{self.currency})->exists(c|c.status=#enabled)

context EditCustomerAddress inv _iniIC_AddressOfCustomer:
   self.customer.address -> includes(self.address)

context EditCustomerAddress inv _iniIC_firstNameRight:
   self.newAddress.firstName.size() >= MinimumValues.allInstances->any(true).firstName

context EditCustomerAddress inv _iniIC_lastNameRight:
   self. newAddress.lastName.size() >= MinimumValues.allInstances->any(true).lastName

context EditCustomerAddress inv _iniIC_genderRight:
   CustomerDetails.allInstances->any(true).gender implies self.
newAddress.gender.isDefined()

context EditCustomerAddress inv _iniIC_suburbRight:
   CustomerDetails.allInstances->any(true).suburb implies self.
newAddress.suburb.isDefined()

context EditCustomerAddress inv _iniIC_streetAddressRight:
   self.newAddress.street.size() >= MinimumValues.allInstances->any(true).streetAddress

context EditCustomerAddress inv _iniIC_companyRight:
       CustomerDetails.allInstances->any(true).company implies
       self.newAddress.company .isDefined() and
       self.newAddress.company.size() >= MinimumValues.allInstances
                                         ->any(true).companyName

context EditCustomerAddress inv _iniIC_postCodeRight:
   self.newAddress.postCode.postalCode.size() >= MinimumValues.allInstances
                                                 ->any(true).postCode

context EditCustomerAddress inv _iniIC_cityRight:
   self.newAddress.city.size() >= MinimumValues.allInstances->any(true).city

context EditCustomerAddress inv _iniIC_stateRight:
       CustomerDetails.allInstances->any(true).state implies
       self.newAddress.state .isDefined() and
       self.newAddress.state.size() >= MinimumValues.allInstances->any(true).state

context EditCustomerAddress inv _iniIC_addressesHaveZoneIfNeeded:
      self.newAddress.zone->size()>0 implies
      self.newAddress.state = self.newAddress.zone.name and
      self.newAddress.country = self.newAddress.zone.country

context EditCustomerDetails inv _iniIC_firstNameRight:
   self.newFirstName.size() >= MinimumValues.allInstances->any(true).firstName

context EditCustomerDetails inv _iniIC_lastNameRight:
   self.newLastName.size() >= MinimumValues.allInstances->any(true).lastName

context EditCustomerDetails inv _iniIC_dateOfBirthRight:
      CustomerDetails.allInstances->any(true).dateOfBirth implies
      self.newDateOfBirth.isDefined() and
      self.newDateOfBirth.date.size() >= MinimumValues.allInstances
                                         ->any(true).dateOfBirth

context EditCustomerDetails inv _iniIC_genderRight:
   CustomerDetails.allInstances->any(true).gender implies self.newGender.isDefined()

context EditCustomerDetails inv _iniIC_eMailRight:
   self.newEMailAddress.eMail.size() >= MinimumValues.allInstances
                                        ->any(true).eMailAddress

context EditCustomerDetails inv _iniIC_telephoneRight:
   self.newPhone.size() >= MinimumValues.allInstances->any(true).telephoneNumber
```

```
context  EditFlatRateShippingMethod inv _iniIC_PaymentMethodIsInstalled:
    FlatRate.allInstances -> notEmpty()

context  EditIPaymentPaymentMethod inv _iniIC_PaymentMethodIsInstalled:
   IPayment.allInstances -> notEmpty()

context  EditPerItemShippingMethod inv _iniIC_PaymentMethodIsInstalled:
   PerItem.allInstances -> notEmpty()

context  EditPSiGatePaymentMethod inv _iniIC_PaymentMethodIsInstalled:
   PSiGate.allInstances -> notEmpty()

context  EditSECPaymentMethod inv _iniIC_PaymentMethodIsInstalled:
   SECPay.allInstances -> notEmpty()

context  EditTableRateShippingMethod inv _iniIC_PaymentMethodIsInstalled:
   TableRate.allInstances -> notEmpty()

context  EditTwoCheckOutPaymentMethod inv _iniIC_PaymentMethodIsInstalled:
   TwoCheckOut.allInstances -> notEmpty()


context  EditUSPostalServiceShippingMethod inv _iniIC_PaymentMethodIsInstalled:
   USPostalService.allInstances -> notEmpty()


context  EditZoneRatesShippingMethod inv _iniIC_PaymentMethodIsInstalled:
   ZoneRates.allInstances -> notEmpty()

context  InstallAuthorizeNetPaymentMethod inv _iniIC_PaymentMethodIsNotInstalled:
   AuthorizeNet.allInstances -> isEmpty()

context  InstallCashOnDeliveryPaymentMethod inv _iniIC_PaymentMethodIsNotInstalled:
   CashOnDelivery.allInstances -> isEmpty()

context  InstallCheckMoneyPaymentMethod inv _iniIC_PaymentMethodIsNotInstalled:
   AuthorizeNet.allInstances -> isEmpty()


context  InstallCreditCardPaymentMethod inv _iniIC_PaymentMethodIsNotInstalled:
   CreditCard.allInstances->isEmpty()


context  InstallFlatRateShippingMethod inv _iniIC_ShippingMethodIsNotInstalled:
   FlatRate.allInstances -> isEmpty()


context  InstallIPaymentPaymentMethod inv _iniIC_PaymentMethodIsNotInstalled:
   IPayment.allInstances -> isEmpty()


context  InstallNochexPaymentMethod inv _iniIC_PaymentMethodIsNotInstalled:
   Nochex.allInstances -> isEmpty()


context  InstallPayPalPaymentMethod inv _iniIC_PaymentMethodIsNotInstalled:
   PayPal.allInstances -> isEmpty()


context  InstallPerItemShippingMethod inv _iniIC_ShippingMethodIsNotInstalled:
   PerItem.allInstances -> isEmpty()

context  InstallPSiGatePaymentMethod inv _iniIC_PaymentMethodIsNotInstalled:
   PSiGate.allInstances -> isEmpty()


context  InstallSECPaymentMethod inv _iniIC_PaymentMethodIsNotInstalled:
   SECPay.allInstances -> isEmpty()


context  InstallTableRateShippingMethod inv _iniIC_ShippingMethodIsNotInstalled:
   TableRate.allInstances -> isEmpty()
```

```
context  InstallTwoCheckOutPaymentMethod inv _iniIC_PaymentMethodIsNotInstalled:
   TwoCheckOut.allInstances -> isEmpty()


context  InstallUSPostalServiceShippingMethod inv _iniIC_ShippingMethodIsNotInstalled:
   USPostalService.allInstances -> isEmpty()

context  InstallZoneRatesShippingMethod inv _iniIC_ShippingMethodIsNotInstalled:
   ZoneRates.allInstances -> isEmpty()

context LogIn inv _iniIC_CustomerIsNotLoggedIn:
   self.customer.session -> isEmpty()

context LogOut inv _iniIC_CustomerIsLoggedIn:
  self.session.customer = self.customer

context NewBanner inv _iniIC_bannerDoesNotExist:
  not Banner.allInstances ->exists (b | b.title= self.title)

context NewBannerGroup inv _iniIC_bannerGroupDoesNotExist:
  not BannerGroup.allInstances ->exists (bg | bg.name= self.name)

context NewCountry inv _iniIC_countryDoesNotExist:
  not Country.allInstances -> exists(c | c.name=self.name and
                                             c.isoCode2=self.isoCode2 and
                                                    c.isoCode3 = self.isoCode3)

  context NewCurrency inv _iniIC_currencyDoesNotExist:
   not (Currency.allInstances -> exists(c | c.title=self.title and
                                                c.code=self.code))


context NewCustomer inv _iniIC_passwordCorrect:
   password = passwordConfirmation

context NewCustomer inv _iniIC_firstNameRight:
   self.primary.firstName.size() >= MinimumValues.allInstances->any(true).firstName

context NewCustomer inv _iniIC_lastNameRight:
   self.primary.lastName.size() >= MinimumValues.allInstances->any(true).lastName

context NewCustomer inv _iniIC_dateOfBirthRight:
   CustomerDetails.allInstances->any(true).dateOfBirth implies
   self.dateOfBirth.isDefined() and
   self.dateOfBirth.date.size() >= MinimumValues.allInstances->any(true).dateOfBirth

context NewCustomer inv _iniIC_genderRight:
   CustomerDetails.allInstances->any(true).gender implies
   self.primary.gender.isDefined()

context NewCustomer inv _iniIC_suburbRight:
   CustomerDetails.allInstances->any(true).suburb implies
   self.primary.suburb.isDefined()

context NewCustomer inv _iniIC_eMailRight:
   self.eMailAddress.eMail.size() >= MinimumValues.allInstances->any(true).eMailAddress

context NewCustomer inv _iniIC_streetAddressRight:
   self.primary.street.size() >= MinimumValues.allInstances->any(true).streetAddress

context NewCustomer inv _iniIC_companyRight:
    CustomerDetails.allInstances->any(true).company implies
    self.primary.company.isDefined() and
    self.primary.company.size() >= MinimumValues.allInstances->any(true).companyName

context NewCustomer inv _iniIC_postCodeRight:
   self.primary.postCode.postalCode.size() >= MinimumValues.allInstances
   ->any(true).postCode

context NewCustomer inv _iniIC_cityRight:
   self.primary.city.size() >= MinimumValues.allInstances->any(true).city
```

```
context NewCustomer inv _iniIC_stateRight:
       CustomerDetails.allInstances->any(true).state implies
       self.primary.state.isDefined() and
       self.primary.state.size() >= MinimumValues.allInstances->any(true).state

context NewCustomer inv _iniIC_telephoneRight:
   self.phone.size() >= MinimumValues.allInstances->any(true).telephoneNumber

context NewCustomer inv _iniIC_passwordRight:
   self.password.size() >= MinimumValues.allInstances->any(true).password

context NewCustomerAddress inv _iniIC_firstNameRight:
   self.firstName.size() >= MinimumValues.allInstances->any(true).firstName

context NewCustomerAddress inv _iniIC_lastNameRight:
   self.lastName.size() >= MinimumValues.allInstances->any(true).lastName

context NewCustomerAddress inv _iniIC_genderRight:
   CustomerDetails.allInstances->any(true).gender implies self.gender.isDefined()

context NewCustomerAddress inv _iniIC_suburbRight:
   CustomerDetails.allInstances->any(true).suburb implies self.suburb.isDefined()

context NewCustomerAddress inv _iniIC_streetAddressRight:
   self.street.size() >= MinimumValues.allInstances->any(true).streetAddress

context NewCustomerAddress inv _iniIC_companyRight:
       CustomerDetails.allInstances->any(true).company implies
       self.company.isDefined() and
       self.company.size() >= MinimumValues.allInstances->any(true).companyName

context NewCustomerAddress inv _iniIC_postCodeRight:
   self.postCode.postalCode.size() >= MinimumValues.allInstances->any(true).postCode

context NewCustomerAddress inv _iniIC_cityRight:
   self.city.size() >= MinimumValues.allInstances->any(true).city

context NewCustomerAddress inv _iniIC_stateRight:

       CustomerDetails.allInstances->any(true).state implies
       self.state.isDefined() and
       self.state.size() >= MinimumValues.allInstances->any(true).state

context NewCustomerAddress inv _iniIC_addressesHaveZoneIfNeeded:
      self.country.zone->size()>0 implies
      (self.state = self.zone.name and
      self.country = self.zone.country)

context NewCustomerAddress inv _iniIC_numberOfAddressesRight:
   self.customer.address -> size() < MaximumValues.allInstances
   ->any(true).addressBookEntries

context NewDownloadableProductAttribute inv _iniIC_productAttributeDoesNotExist:
      not ProductAttribute.allInstances -> exists (pa | pa.attribute.option =
          self.option and pa.attribute.value = self.value and
          pa.product = self.product)


context NewLanguage inv _iniIC_languageDoesNotExist:
      not (Language.allInstances -> exists (l | l.name=self.newName and l.code =
self.newCode))

 context NewManufacturer inv _iniIC_manufacturerDoesNotExist:
      not Manufacturer.allInstances -> exists (m | m.name=self.name)

 context NewNewsletter inv _iniIC_newsletterDoesNotExist:
     not Newsletter.allInstances -> exists (n | n.title=self.title)

context NewOrderStatus inv _iniIC_orderStatusDoesNotExist:
      not OrderStatus.allInstances -> exists (os |
       Language.allInstances->
        exists(l|
               self.hasOrderStatusName
               ->select(languageOfOrderStatus=l).orderStatusName.string=
               os.orderStatusInLanguage->
                    select(language=l).name))

context NewProduct inv _iniIC_productDoesNotExist:
      Language.allInstances -> forAll ( l |
              l.productInLanguage.name
              -> excludes(self.hasNewProductName
              -> any(languageOfProduct=l).nameOfProduct.string))

context EditProduct inv _iniIC_productDoesNotExist:
      Language.allInstances -> forAll ( l |
              l.productInLanguage.name
              -> excludes(self.hasNewProductName
              -> any(languageOfProduct=l).nameOfProduct.string) or
              (self.hasNewProductName->any(languageOfProduct=l).nameOfProduct.string =
              self.product.productInLanguage->any(language=l).name))

context EditProductOption inv _iniIC_productOptionDoesNotExist:
       Language.allInstances -> forAll ( l |
          l.hasOptionName.optionName
          -> excludes(self.hasNewOptionName -> any(languageOfOption=l).nameOfOption) or
          (self.hasNewOptionName->any(languageOfOption=l).nameOfOption =
          self.option.hasOptionName->any(optionLanguage=l).optionName))

context EditCategory inv _iniIC_categoryDoesNotExist:
       Language.allInstances -> forAll ( l |
          l.hasCategoryName.categoryName.string
          -> excludes(self.hasNewName -> any(languageOfCategory=l).name.string) or
          (self.hasNewName->any(languageOfCategory=l).name.string =
          self.category.hasCategoryName->any(language=l).categoryName.string))

context EditOrderStatus inv _iniIC_orderStatusDoesNotExist:
    Language.allInstances -> forAll ( l |
          l.orderStatusInLanguage.name
            ->excludes(self.hasOrderStatusName
            -> any(languageOfOrderStatus=l).orderStatusName.string)
    or
    l.orderStatusInLanguage->any(orderStatus=self.orderStatus).name =
    self.hasOrderStatusName->any(languageOfOrderStatus=l).orderStatusName.string
    )


context EditCategory inv _iniIC_cyclesDoNotAppear:
       self.category.allParents()->union(Set{self.newParent})->excludes(self.category)

context MoveCategory inv _iniIC_cyclesDoNotAppear:
       self.newParent.allParents()->excludes(self.category)

context EditProductOptionValue inv _iniIC_productOptionValueDoesNotExist:
       Language.allInstances -> forAll ( l |
          l.hasValueName.valueName
          -> excludes(self.hasNewValueName -> any(languageOfValue=l).nameOfValue) or
         (self.hasNewValueName->any(languageOfValue=l).nameOfValue =
          self.value.hasValueName->any(valueLanguage=l).valueName))


context NewProductAttribute inv _iniIC_productAttributeDoesNotExist:
      not self.product.productAttribute ->
                 exists(attribute.value=self.value and
                     attribute.option = self.option)

context NewProductAttribute inv _iniIC_optionValueIsValid:
    self.option.value -> includes(self.value)

context NewProductNotification inv _iniIC_ProductNotificationDoesNotExist:
    not Newsletter.allInstances -> exists (n | n.title = self.title)

context NewProductNotificationSubscription inv _iniIC_ProductIsUnsubscribed:
    not self.customer.globalNotifications  and
    self.customer.explicitNotifications -> excludes(self.newSubscribedProduct)
```

```
context NewProductOption inv _iniIC_productOptionDoesNotExist:
      Language.allInstances -> forAll ( l |
              l.hasOptionName.optionName
              -> excludes(self.hasNewOptionName
              -> select(languageOfOption=l).nameOfOption->any(true)))


context NewProductOptionValue inv _iniIC_optionValueDoesNotExist:
      Language.allInstances -> forAll ( l |
              l.hasValueName.valueName.string
              -> excludes(self.hasNewValueName -> select(languageOfValue=l).nameOfValue
              ->any(true).string))

context NewReview inv _iniIC_reviewRight:
   self.review.size() >= MinimumValues.allInstances->any(true).reviewText

context NewTaxClass inv _iniIC_TaxClassDoesNotExist:
   not TaxClass.allInstances -> exists (tc | tc.name = self.name)

context NewTaxRate inv _iniIC_TaxRateDoesNotExist:
   not TaxRate.allInstances -> exists (tr | tr.taxClass = self.taxClass and
                                       tr.taxZone = self.taxZone)

context NewTaxZone inv _iniIC_TaxZoneDoesNotExist:
   not TaxZone.allInstances -> exists (tz | tz.name = self.name)

context NewZone inv _iniIC_ZoneDoesNotExist:
    not Zone.allInstances -> exists (z | z.name = self.name and z.country =
    self.country or z.code = self.code and z.country = self.country)

context OrderConfirmation inv _iniIC_ShippingMethodIsEnabled:
   self.shippingMethod.status= #enabled

context OrderConfirmation inv _iniIC_PaymentMethodIsEnabled:
   self.paymentMethod.status= #enabled

context OrderConfirmation inv _iniIC_CurrencyIsEnabled:
   self.currency.status = #enabled

context OrderConfirmation inv _iniIC_CreditCardDetailsNeeded:
      self.paymentMethod.oclIsTypeOf(AuthorizeNet) or
      self.paymentMethod.oclIsTypeOf(CreditCard) or
      self.paymentMethod.oclIsTypeOf(IPayment) or
      self.paymentMethod.oclIsTypeOf(TwoCheckOut) or
      self.paymentMethod.oclIsTypeOf(PSiGate)
      implies
      creditCardType.isDefined() and
      creditCardOwner.isDefined() and
      creditCardNumber.isDefined() and
      creditCardExpires.isDefined()

context OrderConfirmation inv _iniIC_StockAllowsOrder:

      Stock.allInstances->any(true).allowCheckout or
      not Stock.allInstances->any(true).checkStockLevel or
      (self.shoppingCart.shoppingCartItem.product -> forAll (p | p.quantityOnHand > 0))

context PasswordChange inv _iniIC_passwordRight:
    self.newPassword.size() >= MinimumValues.allInstances->any(true).password

 context PasswordChange inv _iniIC_oldPasswordIsCorrect:
    self.customer.password = self.oldPassword

context PrimaryCustomerAddressChange inv _iniIC_AddressOfCustomer:
    self.customer.address -> includes(self.address)

context ProductDownload inv _iniIC_DownloadEnabled:
    Download.allInstances->any(true).enableDownload

context ProductDownload inv _iniIC_ProductWasPurchasedByCustomer:
    self.customer.order.orderLine.product -> includes (self.product)
```

```
context ProductDownload inv _iniIC_DownloadableIsFromProduct:
    self.product.productAttribute -> select(pa | pa.oclIsTypeOf(Downloadable))
              -> includes (self.downloadable)

context ProductDownload inv _iniIC_DownloadsCountNotExceeded:
      let DownloadCountFromProduct:Integer =
            self.customer.order.orderLine.orderLineAttribute
                -> select (ola | ola.oclIsTypeOf(OrderDownload) and
                ola.orderLine.product = self.product)
               ->asSequence()->last().oclAsType(OrderDownload).downloadCount
      in
           DownloadCountFromProduct < self.downloadable.maximumDownloadCount

context RestorePreviousShoppingCart inv _iniIC_CustomerHasAPreviousShoppingCart:
   self.customer.customerShoppingCart->notEmpty()

context  UninstallAuthorizeNetPaymentMethod inv _iniIC_PaymentMethodIsNotUninstalled:
   AuthorizeNet.allInstances -> notEmpty()

context  UninstallCashOnDeliveryPaymentMethod inv _iniIC_PaymentMethodIsNotUninstalled:
   CashOnDelivery.allInstances -> notEmpty()

context  UninstallCheckMoneyPaymentMethod inv _iniIC_PaymentMethodIsNotUninstalled:
   AuthorizeNet.allInstances -> notEmpty()


context  UninstallCreditCardPaymentMethod inv _iniIC_PaymentMethodCanBeUninstalled:
   CreditCard.allInstances -> notEmpty() and
   (PaymentMethod.allInstances-Set{CreditCard.allInstances->any(true)})
   ->exists(pm|pm.status=#enabled)

context  UninstallFlatRateShippingMethod inv _iniIC_ShippingMethodIsNotUninstalled:
   FlatRate.allInstances -> notEmpty()


context  UninstallIPaymentPaymentMethod inv _iniIC_PaymentMethodIsNotUninstalled:
   IPayment.allInstances -> notEmpty()

context  UninstallNochexPaymentMethod inv _iniIC_PaymentMethodIsNotUninstalled:
   Nochex.allInstances -> notEmpty()


context  UninstallPayPalPaymentMethod inv _iniIC_PaymentMethodIsNotUninstalled:
   PayPal.allInstances -> notEmpty()


context  UninstallPerItemShippingMethod inv _iniIC_ShippingMethodCanBeUninstalled:
   PerItem.allInstances -> notEmpty() and
        (ShippingMethod.allInstances-Set{PerItem.allInstances->any(true)})
         ->exists(sm|sm.status=#enabled)


context  UninstallPSiGatePaymentMethod inv _iniIC_PaymentMethodIsNotUninstalled:
   PSiGate.allInstances -> notEmpty()


context  UninstallSECPaymentMethod inv _iniIC_PaymentMethodIsNotUninstalled:
   SECPay.allInstances -> notEmpty()


context  UninstallTableRateShippingMethod inv _iniIC_ShippingMethodIsNotUninstalled:
   TableRate.allInstances -> notEmpty()


context  UninstallTwoCheckOutPaymentMethod inv _iniIC_PaymentMethodIsNotUninstalled:
   TwoCheckOut.allInstances -> notEmpty()


context  UninstallUSPostalServiceShippingMethod inv
_iniIC_ShippingMethodIsNotUninstalled:
   USPostalService.allInstances -> notEmpty()
```

```
context  UninstallZoneRatesShippingMethod inv _iniIC_ShippingMethodIsNotUninstalled:
   ZoneRates.allInstances -> notEmpty()

context UpdateShoppingCart inv _iniIC_complete:
  self.lineChange->size() = self.session.shoppingCart.shoppingCartItem->size()



-- EFFECT OPERATIONS
context  AddProductToShoppingCart::effect()
   post ShoppingCartItemIsCreated :
       (ShoppingCartItem.allInstances - ShoppingCartItem.allInstances@pre)
       -> forAll(sci:ShoppingCartItem |
       sci.oclIsNew and
       sci.oclIsTypeOf(ShoppingCartItem) and
       sci.quantity = self.quantity and
       sci.product = self.product and
       sci.attribute = self.attribute and
       if self.session.shoppingCart -> notEmpty() then
           --The session has a shopping cart
           self.session.shoppingCart.shoppingCartItem -> includes(sci)
       else
           --The session does not have a shopping cart
           if self.session.customer -> isEmpty() then
           --The session is Anonymous
                (AnonymousShoppingCart.allInstances
                - AnonymousShoppingCart.allInstances@pre)
               -> forAll(sc:AnonymousShoppingCart |
               sc.oclIsNew()  and
               sc.oclIsTypeOf(AnonymousShoppingCart)  and
               self.session.shoppingCart = sc and
               sc.shoppingCartItem -> includes(sci))
          else
           --The customer has logged in
               if self.session.customer.customerShoppingCart -> notEmpty()  then
                   --The customer has a previous shopping cart
                  self.session.shoppingCart = self.session.customer.customerShoppingCart
                  and
                  self.session.shoppingCart.shoppingCartItem -> includes(sci)
               else
                   --The customer does not have a previous shopping cart
                   (CustomerShoppingCart.allInstances -
CustomerShoppingCart.allInstances@pre) -> forAll(csc:CustomerShoppingCart |
                   csc.oclIsNew()  and
                   csc.oclIsTypeOf(CustomerShoppingCart)  and
                   self.session.shoppingCart = csc and
                   csc.shoppingCartItem -> includes(sci))
              endif
          endif
       endif)

context  AddressBookEntriesMaximumChange::effect()
  post :  MaximumValues.allInstances->any(true).addressBookEntries = self.newMaximum

context  AllowCheckoutStockConfigurationChange::effect()
   post :  Stock.allInstances->any(true).allowCheckout= self.newValue

context  AllowGuestToTellAFriendChange::effect()
  post :  myStore().allowGuestToTellAFriend = self.newAllowGuestToTellAFriend

context  AttributeChange::effect()
   post :
       self.productAttribute.attribute.value = self.newValue and
       self.productAttribute.attribute.option = self.newOption

 context  CancelOrder::effect()
   post:
        self.order.orderStatusChange -> last().orderStatus =
        Store.allInstances ->any(true).cancelledStatus
```

```
context  CheckLevelStockConfigurationChange::effect()
   post :  Stock.allInstances->any(true).checkStockLevel= self.newValue

context  CityMinimumChange::effect()
  post :  MinimumValues.allInstances->any(true).city = self.newMinimum


context  ClickBanner::effect()
   post :
       BannerHistory.allInstances -> one
          (bh | bh.banner = self.banner and
                   bh.clicked = bh@pre.clicked + 1)

context  ClickManufacturer::effect()
   post :
       let manufacturerLanguageRead:ManufacturerInLanguage =
               ManufacturerInLanguage.allInstances -> select
                   (mil | mil.manufacturer = self.manufacturer and
                             mil.language = self.language)->any(true)
        in
             manufacturerLanguageRead.urlClicked =
             manufacturerLanguageRead@pre.urlClicked + 1

context  CompanyCustomerDetailChange::effect()
  post :  CustomerDetails.allInstances->any(true).company = self.newValue

context  CompanyNameMinimumChange::effect()
  post :  MinimumValues.allInstances->any(true).companyName = self.newMinimum

context  CountryChange::effect()
  post :  myStore().country = self.newCountry


context  CountryShippingConfigurationChange::effect()
  post :  ShippingAndPackaging.allInstances->any(true).countryOfOrigin =
self.newCountryOfOrigin

context  CreditCardNumberMinimumChange::effect()
  post :  MinimumValues.allInstances->any(true).creditCardNumber = self.newMinimum

context  CreditCardOwnerNameMinimumChange::effect()
  post :  MinimumValues.allInstances->any(true).creditCardOwnerName = self.newMinimum

context  CurrencyStatusChange::effect()
  post :  self.currency.status = self.newStatus

context  CustomerStatusChange::effect()
   post :  self.customer.status = self.newStatus

context  DateOfBirthCustomerDetailChange::effect()
  post :  CustomerDetails.allInstances->any(true).dateOfBirth = self.newValue

context  DateOfBirthMinimumChange::effect()
  post :  MinimumValues.allInstances->any(true).dateOfBirth = self.newMinimum

context  DaysExpiryDelayDownloadConfigurationChange::effect()
  post :  Download.allInstances->any(true).daysExpiryDelay= self.newValue

context  DefaultSearchOperatorChange::effect()
  post :  myStore().defaultSearchOperator = self.newDefaultSearchOperator

context  DeleteBanner::effect()
   post :  Banner.allInstances->excludes(self.banner@pre)

context  DeleteBannerGroup::effect()
   post :  BannerGroup.allInstances->excludes(self.bannerGroup@pre)

context  DeleteCategory::effect()
   post  deleteCategoryAndSubcategories:
               Category.allInstances->excludes(self.category@pre) and
               self.allChilds(category@pre) -> forAll(c | Category.allInstances
               ->excludes(c))
   post deleteProductsOfCategory:
               self.category@pre.product -> forAll(p |
                  if p.orderLine->notEmpty() then p.status=#outOfStock
                  else Product.allInstances->excludes(p@pre)
                  endif
               )
   post deleteProductsOfChildCategories:
               self.allChilds(category@pre).product -> forAll(p|
                  if p.orderLine->notEmpty() then p.status=#outOfStock
                  else Product.allInstances->excludes(p@pre)
                  endif
               )


context  DeleteCountry::effect()
   post :  Country.allInstances->excludes(self.country@pre)
   post :  self.country@pre.zone -> forAll(z | Zone.allInstances->excludes(z))

context  DeleteCurrency::effect()
   post:   Currency.allInstances->excludes(self.currency@pre)

context  DeleteCustomer::effect()
   post deleteCustomer:
               if customer@pre.order->size()=0 then
                  Customer.allInstances->excludes(customer@pre)
              else
                  customer.status=#disabled
       endif
   post deleteReviews:
       Review.allInstances->excludesAll(customer@pre.review@pre)
   post deleteShoppingCartIfNeeded:
       customer@pre.customerShoppingCart->size()>0
       implies
       ShoppingCart.allInstances->excludes(customer@pre.customerShoppingCart@pre)

context  DeleteCustomerAddress::effect()
   post :  self.customer.address -> excludes(self.address)

context  DeleteLanguage::effect()
   post:  not Language.allInstances->exists(l | l=self.language@pre)

context  DeleteManufacturer::effect()
   post deleteManufacturer:
       Manufacturer.allInstances->excludes(self.manufacturer@pre)
   post changeProductsToOutOfStock:
       deleteProds implies
          manufacturer@pre.product@pre ->
             forAll(status = #outOfStock)

context  DeleteNewsletter::effect()
   post :  Newsletter.allInstances->excludes(self.newsletter@pre)

context  DeleteOrderStatus::effect()
   post :  if Order.allInstances.orderStatus->includes(self.orderStatus)
                      then self.orderStatus.status=#disabled
                   else OrderStatus.allInstances->excludes(self.orderStatus@pre)
                  endif

context  DeleteProduct::effect()
   post:
   if product@pre.orderLine -> size()=0
   then Product.allInstances->excludes(product@pre)
   else
        (ProductStatusChange.allInstances - ProductStatusChange.allInstances@pre)
        -> forAll(psc:ProductStatusChange |
       psc.oclIsNew() and
       psc.oclIsTypeOf(ProductStatusChange) and
       psc.newStatus = #outOfStock and
       psc.product = self.product@pre)
   endif
```

```
context  DeleteProductAttribute::effect()
   post: if OrderLineAttribute.allInstances -> exists(ola |
                      ola.attribute=productAttribute.attribute and
                      ola.orderLine.product=productAttribute.product)
                then
                      productAttribute.status=#disabled
                else
                      ProductAttribute.allInstances->excludes(productAttribute@pre)
                endif

context  DeleteProductOption::effect()
   post :  Option.allInstances->excludes(self.option@pre)
   post :  self.option@pre.value->select(v|
                      (v.option-Set{self.option@pre})->isEmpty() or
                      v.attribute.orderLineAttribute->isEmpty())
                             -> forAll(v | Value.allInstances->excludes(v))

context  DeleteProductOptionValue::effect()
   post :  Value.allInstances->excludes(self.value@pre)

context DeleteReview::effect()
   post : Review.allInstances->excludes(self.review@pre)


context DeleteSession::effect()
   post : Session.allInstances->excludes(self.session@pre)

context DeleteSpecial::effect()
   post :
       Special.allInstances->excludes(special@pre) and
          (Product.allInstances - Product.allInstances@pre) -> forAll(p:Product |
               p.status = special@pre.status@pre and
               p.available = special@pre.available@pre and
               p.netPrice = special@pre.netPrice@pre and
               p.quantityOnHand = special@pre.quantityOnHand@pre and
               p.modelM = special@pre.modelM@pre and
               p.imagePath = special@pre.imagePath@pre and
               p.weight = special@pre.weight@pre and
                      p.category = special@pre.category@pre and
               p.manufacturer = special@pre.manufacturer@pre and
               p.taxClass = special@pre.taxClass@pre and
               Language.allInstances ->
                      forAll (l|
                      special@pre.productInLanguage->select(language=l).name =
                      p.productInLanguage->select(language=l).name))

context  DeleteTaxClass::effect()
   post deleteTaxClass:
       TaxClass.allInstances->excludes(self.taxClass@pre)
   post deleteAssociatedTaxRates:
       self.taxClass@pre.taxRate@pre -> forAll(tr | TaxRate.allInstances->excludes(tr))

context  DeleteTaxRate::effect()
   post :  TaxRate.allInstances->excludes(self.taxRate@pre)

context  DeleteTaxZone::effect()
   post deleteTaxZone:
       TaxZone.allInstances->excludes(self.taxZone@pre)
   post deleteAssociatedTaxRates:
       self.taxZone@pre.taxRate@pre -> forAll(tr | TaxRate.allInstances->excludes(tr))

context  DeleteZone::effect()
   post :  Zone.allInstances->excludes(self.zone@pre)

context DisplayCartAfterAddingProductChange::effect()
  post :  myStore().displayCartAfterAddingProduct =
          self.newDisplayCartAfterAddingProduct

context  DisplayPricesWithTaxChange::effect()
  post :  myStore().displayPricesWithTax = self.newDisplayPricesWithTax
```

```
context  EditAuthorizeNetPaymentMethod::effect()
   post :
       let  pm:AuthorizeNet = AuthorizeNet.allInstances -> any(true)
        in
       pm.username=self.newUsername and
       pm.key=self.newKey and
       pm.mode=self.newMode and
       pm.method=self.newMethod and
       pm.notification=self.newNotification and
       pm.orderStatus=self.orderStatus and
       pm.status=self.status and
       pm.taxZone=self.taxZone

context  EditBanner::effect()
   post :
       self.banner.title = self.newTitle and
       self.banner.url = self.newUrl and
       self.banner.imagePath = self.newImagePath and
       self.banner.html = self.newHtml and
       self.banner.expires = self.newExpires and
       self.banner.scheduled = self.newScheduled and
       self.banner.status = self.newStatus and
       self.banner.bannerGroup=self.newBannerGroup

context  EditBannerGroup::effect()
   post :  self.bannerGroup.name = self.newName


context  EditCashOnDeliveryPaymentMethod::effect()
   post :
       let  pm:CashOnDelivery = CashOnDelivery.allInstances -> any(true) in
       pm.orderStatus=self.orderStatus and
       pm.status=self.status and
       pm.taxZone=self.taxZone

context  EditCategory::effect()
   post :
       self.category.imagePath = self.imagePath and
       self.category.sortOrder = self.sortOrder and
       self.category.parent = self.newParent and
       Language.allInstances
           -> forAll (l|
              self.hasNewName -> select(languageOfCategory=l)->any(true).name.string =
              self.category.hasCategoryName->select(language=l).categoryName
              ->any(true).string
              )

context  EditCheckMoneyPaymentMethod::effect()
   post :
       let  pm: CheckMoney = CheckMoney.allInstances -> any(true) in
       pm.makePayableTo=self.newMakePayableTo and
       pm.orderStatus=self.orderStatus and
       pm.status=self.status and
       pm.taxZone=self.taxZone

context  EditCountry::effect()
   post :
       country.name = self.newName and
       country.isoCode2 = self.newIsoCode2 and
       country.isoCode3 = self.newIsoCode3

context  EditCreditCardPaymentMethod::effect()
   post :
       let  pm:CreditCard = CreditCard.allInstances -> any(true) in
       pm.splitCreditCardToMail=self.newSplitCreditCardToMail and
       pm.status=self.status and
       pm.orderStatus=self.orderStatus and
       pm.taxZone=self.taxZone

context  EditCurrency::effect()
   post :
       currency.title = self.newTitle and
       currency.code = self.newCode and
       currency.symbolLeft = self.newSymbolLeft and
       currency.symbolRight = self.newSymbolRight and
       currency.decimalPlaces = self.newDecimalPlaces and
       currency.value = self.newValue

context  EditCustomer::effect()
   post :
       customer.gender = self.newGender and
       customer.firstName = self.newFirstName and
       customer.lastName = self.newLastName and
       customer.dateOfBirth = self.newDateOfBirth and
       customer.eMailAddress = self.newEMailAddress and
       customer.phone = self.newPhone and
       customer.fax = self.newFax and
       customer.newsletter = self.newNewsletter and
       customer.password = self.newPassword and
       customer.globalNotifications = self.newGlobalNotifications

context  EditCustomerAddress::effect()
   post :
       self.customer.address -> excludes(self.address) and
       self.customer.address ->includes(self.newAddress)

context  EditCustomerDetails::effect()
   post :
       customer.gender = self.newGender and
       customer.firstName = self.newFirstName and
       customer.lastName = self.newLastName and
       customer.dateOfBirth = self.newDateOfBirth and
       customer.eMailAddress = self.newEMailAddress and
       customer.phone = self.newPhone and
       customer.fax = self.newFax and
       customer.newsletter = self.newNewsletter

context  EditDownloadableAttribute::effect()
   post :
       self.downloadable.filename = self.newFilename and
       self.downloadable.expiryDays = self.newExpiryDays and
       self.downloadable.maximumDownloadCount = self.newMaximumDownloadCount

context  EditFlatRateShippingMethod::effect()
   post :
       let  sm: FlatRate= FlatRate.allInstances -> any(true) in
       sm.cost=self.newCost and
       sm.taxZone=self.taxZone and
       sm.taxClass=self.taxClass and
       sm.status = self.status

context  EditGlobalNotifications::effect()
   post :  self.customer.globalNotifications = self.newGlobalNotifications

context  EditIPaymentPaymentMethod::effect()
   post :
       let  pm:IPayment = IPayment.allInstances -> any(true) in
       pm.account=self.newAccount and
       pm.user=self.newUser and
       pm.password=self.newPassword and
       pm.status=self.status and
       pm.orderStatus=self.orderStatus and
       pm.taxZone=self.taxZone

context  EditLanguage::effect()
   post :
       self.language.name = self.newName and
       self.language.code = self.newCode and
       self.language.defaultCurrency = self.newDefaultCurrency

context  EditManufacturer::effect()
   post :
       self.manufacturer.name = self.name and
       self.manufacturer.imagePath = self.imagePath and
       Language.allInstances ->
           forAll(l|
               self.hasURL->select(languageOfURL=l).url=
               self.manufacturer.manufacturerInLanguage->
                    select(language=l).url)

context  EditNewsletter::effect()
   post :
       newsletter.title = self.newTitle and
       newsletter.content = self.newContent

context  EditNochexPaymentMethod::effect()
   post :
       let  pm: Nochex = Nochex.allInstances -> any(true) in
       pm.eMail=self.newEMail and
       pm.status=self.status and
       pm.orderStatus=self.orderStatus and
       pm.taxZone=self.taxZone

context  EditOrderStatus::effect()
   post :
   Language.allInstances->
   forAll(l|
               self.hasOrderStatusName
               -> select(languageOfOrderStatus=l).orderStatusName.string=
               self.orderStatus.orderStatusInLanguage->
                    select(language=l).name)

context  EditPayPalPaymentMethod::effect()
   post :
       let  pm: PayPal = PayPal.allInstances -> any(true) in
       pm.eMail=self.newEMail and
       pm.status=self.status and
       pm.orderStatus=self.orderStatus and
       pm.taxZone=self.taxZone

context  EditPerItemShippingMethod::effect()
   post :
       let  sm: PerItem= PerItem.allInstances -> any(true) in
       sm.cost=self.newCost and
       sm.handlingFee=self.handlingFee and
       sm.taxZone=self.taxZone and
       sm.taxClass=self.taxClass and
       sm.status = self.status

context  EditProduct::effect()
   post :
       self.product.status = self.status and
       self.product.available = self.available and
       self.product.netPrice = self.netPrice and
       self.product.quantityOnHand = self.quantityOnHand and
       self.product.modelM = self.modelM and
       self.product.imagePath = self.imagePath and
       self.product.weight = self.weight and
       self.product.manufacturer = self.manufacturer and
       self.product.category = self.category and
       self.product.taxClass = self.taxClass and
       Language.allInstances
           -> forAll (l|
              self.hasNewProductName -> select(languageOfProduct=l).nameOfProduct
              ->any(true).string =
              self.product.productInLanguage->select(language=l).name->any(true)
              )

context  EditProductNotification::effect()
   post :
       self.productNotification.global = self.newGlobal and
       self.productNotification.explicitNotifications = self.newExplicitNotifications
```

```
context  EditProductOption::effect()
   post :
       Language.allInstances ->
           forAll (l| self.hasNewOptionName -> select(languageOfOption=l).nameOfOption =
                          option.hasOptionName->select(optionLanguage=l).optionName)

context  EditProductOptionValue::effect()
   post :
       Language.allInstances ->
           forAll (l| self.hasNewValueName -> select(languageOfValue=l).nameOfValue =
                          value.hasValueName->select(valueLanguage=l).valueName) and
       self.value.option = self.option

context  EditPSiGatePaymentMethod::effect()
   post :
       let  pm: PSiGate= PSiGate.allInstances -> any(true) in
       pm.merchantID=self.newMerchantID and
       pm.mode=self.newMode and
       pm.type=self.newType and
       pm.creditCardCollection=self.newCreditCardCollection and
       pm.status=self.status and
       pm.orderStatus=self.orderStatus and
       pm.taxZone=self.taxZone

context EditReview::effect()
   post :
       self.review.review = self.newReview and
       self.review.rating = self.newRating and
       self.review.language = self.newLanguage and
       self.review.product = self.newProduct and
       self.review.customer = self.newCustomer

context  EditSECPaymentMethod::effect()
   post :
       let  pm: SECPay= SECPay.allInstances -> any(true) in
       pm.merchantID=self.newMerchantID and
       pm.mode=self.newMode and
       pm.status=self.status and
       pm.orderStatus=self.orderStatus and
       pm.taxZone=self.taxZone

context EditSpecial::effect()
   post :
       self.special.specialPrice = self.newSpecialPrice and
       self.special.expiryDate = self.newExpiryDate and
       self.special.specialStatus = self.newStatus

context  EditTableRateShippingMethod::effect()
   post :
       let  sm: TableRate= TableRate.allInstances -> any(true) in
       sm.items=self.newItems and
       sm.method=self.newMethod and
       sm.handlingFee=self.handlingFee and
       sm.taxZone=self.taxZone and
       sm.taxClass=self.taxClass and
       sm.status = self.status

context  EditTaxClass::effect()
   post :
       self.taxClass.name = self.newName and
       self.taxClass.description = self.newDescription

context  EditTaxRate::effect()
   post :
       self.taxRate.rate = self.newRate and
       self.taxRate.priority = self.newPriority and
       self.taxRate.description = self.newDescription and
       self.taxRate.taxClass = self.newTaxClass and
       self.taxRate.taxZone = self.newTaxZone

context  EditTaxZone::effect()
   post :
       self.taxZone.name = self.newName and
       self.taxZone.description = self.newDescription and
       self.taxZone.zone = self.newZones


context  EditTwoCheckOutPaymentMethod::effect()
   post :
       let  pm: TwoCheckOut = TwoCheckOut.allInstances -> any(true)
       in
           pm.login=self.newLogin and
           pm.mode=self.newMode and
           pm.merchantNotification=self.newMerchantNotification and
           pm.status=self.status and
           pm.orderStatus=self.orderStatus and
           pm.taxZone=self.taxZone

context  EditUSPostalServiceShippingMethod::effect()
   post :
       let  sm: USPostalService= USPostalService.allInstances -> any(true) in
       sm.userID=self.newUserID and
       sm.password=self.newPassword and
       sm.server=self.newServer and
       sm.handlingFee=self.handlingFee and
       sm.taxZone=self.taxZone and
       sm.taxClass=self.taxClass and
       sm.status = self.status

context  EditZone::effect()
   post :
       self.zone.name = self.newName and
       self.zone.code = self.newCode

context  EditZoneRatesShippingMethod::effect()
   post :
       let  sm:ZoneRates= ZoneRates.allInstances -> any(true) in
       sm.items=self.newItems and
       sm.country=self.country and
       sm.taxClass=self.taxClass and
       sm.status=self.status

context EMailAddressChange::effect()
  post :  myStore().eMailAddress = self.newEmailAddress

context  EMailAddressMinimumChange::effect()
  post :  MinimumValues.allInstances->any(true).eMailAddress = self.newMinimum

context EMailFromChange::effect()
  post :  myStore().eMailFrom = self.newEmailFrom

context  EnableDownloadConfigurationChange::effect()
  post :  Download.allInstances->any(true).enableDownload= self.newValue

context ExpectedSortFieldChange::effect()
  post :  myStore().expectedSortField = self.newExpectedSortField

context ExpectedSortOrderChange::effect()
  post :  myStore().expectedSortOrder = self.newExpectedSortOrder

context  FirstNameMinimumChange::effect()
  post :  MinimumValues.allInstances->any(true).firstName = self.newMinimum

context  GenderCustomerDetailChange::effect()
  post :  CustomerDetails.allInstances->any(true).gender = self.newValue

context  IncrementAndSignAttributeChange::effect()
   post :  self.productAttribute.increment = self.newIncrement and
              self.productAttribute.sign = self.newSign


context InstallAuthorizeNetPaymentMethod::effect()
   post :
   (AuthorizeNet.allInstances - AuthorizeNet.allInstances@pre)
   -> forAll(pm:AuthorizeNet |
   pm.oclIsNew() and pm.oclIsTypeOf(AuthorizeNet) and pm.status=#enabled)

context InstallCashOnDeliveryPaymentMethod::effect()
   post :
   (CashOnDelivery.allInstances - CashOnDelivery.allInstances@pre) ->
forAll(pm:CashOnDelivery |
   pm.oclIsNew() and pm.oclIsTypeOf(CashOnDelivery) and pm.status=#enabled)

context InstallCheckMoneyPaymentMethod::effect()
   post :
   (CheckMoney.allInstances - CheckMoney.allInstances@pre) -> forAll(pm:CheckMoney |
   pm.oclIsNew() and pm.oclIsTypeOf(CheckMoney) and pm.status=#enabled)

context InstallCreditCardPaymentMethod::effect()
   post :
   (CreditCard.allInstances - CreditCard.allInstances@pre) -> forAll(pm:CreditCard |
   pm.oclIsNew() and pm.oclIsTypeOf(CreditCard) and pm.status=#enabled)

context InstallFlatRateShippingMethod::effect()
   post :
   (FlatRate.allInstances - FlatRate.allInstances@pre) -> forAll(sm:FlatRate |
   sm.oclIsNew() and sm.oclIsTypeOf(FlatRate) and sm.status=#enabled)

context InstallIPaymentPaymentMethod::effect()
   post :
   (IPayment.allInstances - IPayment.allInstances@pre) -> forAll(pm:IPayment |
   pm.oclIsNew() and pm.oclIsTypeOf(IPayment)  and pm.status=#enabled)

context InstallNochexPaymentMethod::effect()
   post :
   (Nochex.allInstances - Nochex.allInstances@pre) -> forAll(pm:Nochex |
   pm.oclIsNew() and pm.oclIsTypeOf(Nochex) and pm.status=#enabled)

context InstallPayPalPaymentMethod::effect()
   post :
   (PayPal.allInstances - PayPal.allInstances@pre) -> forAll(pm:PayPal |
   pm.oclIsNew() and pm.oclIsTypeOf(PayPal) and pm.status=#enabled)

context InstallPerItemShippingMethod::effect()
   post :
   (PerItem.allInstances - PerItem.allInstances@pre) -> forAll(sm:PerItem |
   sm.oclIsNew() and sm.oclIsTypeOf(PerItem) and sm.status=#enabled)

context InstallPSiGatePaymentMethod::effect()
   post :
   (PSiGate.allInstances - PSiGate.allInstances@pre) -> forAll(pm:PSiGate |
   pm.oclIsNew() and pm.oclIsTypeOf(PSiGate) and pm.status=#enabled)

context InstallSECPaymentMethod::effect()
   post :
   (SECPay.allInstances - SECPay.allInstances@pre) -> forAll(pm:SECPay |
   pm.oclIsNew() and pm.oclIsTypeOf(SECPay) and pm.status=#enabled)

context InstallTableRateShippingMethod::effect()
   post :
   (TableRate.allInstances - TableRate.allInstances@pre) -> forAll(sm:TableRate |
   sm.oclIsNew() and sm.oclIsTypeOf(TableRate) and sm.status=#enabled)

context InstallTwoCheckOutPaymentMethod::effect()
   post :
   (TwoCheckOut.allInstances - TwoCheckOut.allInstances@pre) -> forAll(pm:TwoCheckOut |
   pm.oclIsNew() and pm.oclIsTypeOf(TwoCheckOut) and pm.status=#enabled)

context InstallUSPostalServiceShippingMethod::effect()
   post :
   (USPostalService.allInstances - USPostalService.allInstances@pre)
    -> forAll(sm:USPostalService |
   sm.oclIsNew() and sm.oclIsTypeOf(USPostalService) and sm.status=#enabled)
```

```
context InstallZoneRatesShippingMethod::effect()
   post :
   (ZoneRates.allInstances - ZoneRates.allInstances@pre) -> forAll(sm:ZoneRates |
   sm.oclIsNew() and sm.oclIsTypeOf(ZoneRates) and sm.status=#enabled)

context  LastNameMinimumChange::effect()
  post :  MinimumValues.allInstances->any(true).lastName = self.newMinimum

context LinkProduct::effect()
   post:  self.product.category -> includes(self.newCategory)

context  LockNewsletter::effect()
   post :  self.newsletter.status = #locked

context  LogIn::effect()
   post :
       self.session.customer = self.customer
   post :
       self.customer.numberOfLogons = self.customer.numberOfLogons@pre + 1
   post:
     if self.customer.customerShoppingCart->size()>0 then
             (RestorePreviousShoppingCart.allInstances -
             RestorePreviousShoppingCart.allInstances@pre)
             -> forAll(rpsc:RestorePreviousShoppingCart |
            rpsc.oclIsNew() and
            rpsc.oclIsTypeOf(RestorePreviousShoppingCart) and
            rpsc.customer=self.customer and
            rpsc.session=self.session)
     else
       if self.session.shoppingCart->notEmpty() then
                (CustomerShoppingCart.allInstances -
                 CustomerShoppingCart.allInstances@pre)
                 -> one(csc:CustomerShoppingCart |
                    csc.oclIsNew() and
                    csc.oclIsTypeOf(CustomerShoppingCart) and
                    csc.shoppingCartItem = self.session.shoppingCart.shoppingCartItem
and
                    csc.customer=self.customer and
                    self.session.shoppingCart=csc)
               else true
               endif
        endif

context  LogOut::effect()
   post :  self.session.customer -> isEmpty()

context NameChange::effect()
  post :  self.myStore().name = self.newName

context  MaximumNumberDownloadConfigurationChange::effect()
   post :  Download.allInstances->any(true).maximumNumberOfDownloads= self.newMaximum

context  MaximumPackageWeightShippingConfigurationChange::effect()
  post :  ShippingAndPackaging.allInstances->any(true).maximumPackageWeight =
self.newMaximum

context  MoveCategory::effect()
   post :  self.category.parent = self.newParent

context MoveProduct::effect()
   post:  self.product.category -> includes(self.newCategory) and
             self.product.category -> excludes(self.oldCategory)

context  NewBanner::effect()
   post :
       (Banner.allInstances - Banner.allInstances@pre) -> forAll(b:Banner |
       b.oclIsNew()  and
       b.oclIsTypeOf(Banner) and
       b.title = self.title and
       b.url = self.url and
       b.imagePath = self.imagePath and
       b.html = self.html and
       b.expires = self.expires and
       b.scheduled = self.scheduled and
       b.status = #enabled)

context  NewBannerGroup::effect()
   post :
   (BannerGroup.allInstances - BannerGroup.allInstances@pre) -> forAll(bg:BannerGroup |
       bg.oclIsNew()  and
       bg.oclIsTypeOf(BannerGroup) and
       bg.name = self.name)

context  NewCategory::effect()
   post :
   (Category.allInstances - Category.allInstances@pre) -> forAll(c:Category |
       c.oclIsNew()  and
       c.oclIsTypeOf(Category) and
       c.imagePath = self.imagePath and
       c.sortOrder = self.sortOrder and
       c.parent = self.parent and
       Language.allInstances ->
           forAll (l| self.hasNewName -> select(languageOfCategory=l)->any(true).name =
                          c.hasCategoryName->select(language=l)
                          ->any(true).categoryName))

context  NewCountry::effect()
   post :
   (Country.allInstances - Country.allInstances@pre) -> forAll(c:Country |
       c.oclIsNew()  and
       c.oclIsTypeOf(Country) and
       c.name = self.name and
       c.isoCode2 = self.isoCode2 and
       c.isoCode3 = self.isoCode3 )

 context  NewCurrency::effect()
   post :
   (Currency.allInstances - Currency.allInstances@pre) -> forAll(c:Currency |
       c.oclIsNew()  and
       c.oclIsTypeOf(Currency) and
       c.title = self.title and
       c.code = self.code and
       c.symbolLeft = self.symbolLeft and
       c.symbolRight = self.symbolRight and
       c.decimalPlaces = self.decimalPlaces and
       c.value = self.value and
       c.status = #enabled)

context  NewCustomer::effect()
   pre:    not Customer.allInstances -> exists (c | c.eMailAddress = self.eMailAddress)
   post :
   (Customer.allInstances - Customer.allInstances@pre) -> forAll(c:Customer |
       c.oclIsNew() and
       c.oclIsTypeOf(Customer) and
       c.gender = self.primary.gender and
       c.firstName = self.primary.firstName and
       c.lastName = self.primary.lastName and
       c.dateOfBirth = self.dateOfBirth and
       c.eMailAddress = self.eMailAddress and
       c.phone = self.phone and
       c.fax = self.fax and
       c.newsletter = self.newsletter and
       c.password = self.password and
       c.numberOfLogons = 0 and
       c.address = Set{primary}  and
       c.primary = primary)

context  NewCustomerAddress::effect()
   post :
           Address.allInstances ->exists (a |
           a.gender = self.gender and
           a.firstName = self.firstName and
           a.lastName = self.lastName and
           a.company = self.company and
           a.street = self.street and
           a.suburb = self.suburb and
           a.postCode = self.postCode and
           a.city = self.city and
           a.state = self.state and
           a.zone = self.zone and
           a.country = self.country and
           self.customer.address -> includes(a))

context  NewDownloadableProductAttribute::effect()
   post :
   (Downloadable.allInstances - Downloadable.allInstances@pre)
    -> forAll(dpa:Downloadable |
              dpa.oclIsNew()  and
      dpa.oclIsTypeOf(Downloadable) and
      dpa.increment = self.increment and
      dpa.sign = self.sign and
      dpa.filename = self.filename and
      dpa.product = self.product and
      dpa.attribute.option=self.option and
      dpa.attribute.value=self.value and
      if self.expiryDays.isDefined() then dpa.expiryDays = self.expiryDays
      else self.expiryDays = Download.allInstances->any(true).daysExpiryDelay
      endif
      and
      if self.maximumDownloadCount.isDefined() then
          dpa.maximumDownloadCount = self.maximumDownloadCount
      else self.maximumDownloadCount = Download.allInstances
           ->any(true).maximumNumberOfDownloads
      endif)

context  NewLanguage::effect()
   post :
   (Language.allInstances - Language.allInstances@pre) -> forAll(l:Language |
      l.oclIsNew()  and
      l.oclIsTypeOf(Language) and
      l.name = self.newName and
      l.code = self.newCode and
      l.defaultCurrency = self.defaultCurrency)

context  NewManufacturer::effect()
   post :
   (Manufacturer.allInstances - Manufacturer.allInstances@pre)-> forAll(m:Manufacturer |
       m.oclIsNew()  and
       m.oclIsTypeOf(Manufacturer) and
       m.name = self.name and
       m.imagePath = self.imagePath and
       Language.allInstances ->
           forAll (l|
              self.hasURL -> select(languageOfURL=l).url =
              m.manufacturerInLanguage->select(language=l).url))

context  NewNewsletter::effect()
   post :
   (Newsletter.allInstances - Newsletter.allInstances@pre) -> forAll(n:Newsletter |
       n.oclIsNew()  and
       n.oclIsTypeOf(Newsletter) and
       n.title = self.title and
       n.content = self.content and
       n.status = #unlocked )

 context  NewOrderStatus::effect()
   post :
   (OrderStatus.allInstances - OrderStatus.allInstances@pre) -> forAll(os:OrderStatus |
       os.oclIsNew()  and
       os.oclIsTypeOf(OrderStatus) and
       Language.allInstances->
        forAll(l|
               self.hasOrderStatusName
               ->select(languageOfOrderStatus=l).orderStatusName.string=
               os.orderStatusInLanguage->
                    select(language=l).name) )
```

```
context  NewProduct::effect()
   post :
   (Product.allInstances - Product.allInstances@pre) -> forAll(p:Product |
       p.oclIsNew()  and
       p.oclIsTypeOf(Product) and
       p.status = self.status and
       p.available = self.available and
       p.netPrice = self.netPrice and
       p.quantityOnHand = self.quantityOnHand and
       p.modelM = self.modelM and
       p.imagePath = self.imagePath and
       p.weight = self.weight and
          p.category = self.category and
       p.manufacturer = self.manufacturer and
       p.taxClass = self.taxClass and
       Language.allInstances ->
           forAll (l|
            self.hasNewProductName -> select(languageOfProduct=l).nameOfProduct.string =
              p.productInLanguage->select(language=l).name))

context  NewProductAttribute::effect()
   post :
   (ProductAttribute.allInstances - ProductAttribute.allInstances@pre)
      -> forAll(pa:ProductAttribute |
      pa.oclIsNew()  and
      pa.oclIsTypeOf(ProductAttribute) and
      pa.increment = self.increment and
      pa.sign = self.sign and
      pa.product = self.product and
      pa.attribute.option = self.option and
      pa.attribute.value = self.value)

context  NewProductNotification::effect()
   post :
   (ProductNotification.allInstances - ProductNotification.allInstances@pre)
       -> forAll(n:ProductNotification |
       n.oclIsNew()  and
       n.oclIsTypeOf(ProductNotification) and
       n.title = self.title and
       n.content = self.content and
       n.global = self.global and
       n.explicitNotifications = self.explicitNotifications and
       n.status = #unlocked )

context  NewProductNotificationSubscription::effect()
   post :  self.customer.explicitNotifications -> includes(self.newSubscribedProduct)

context  NewProductOption::effect()
   post :
   (Option.allInstances - Option.allInstances@pre) -> forAll(po:Option |
       po.oclIsNew()  and
       po.oclIsTypeOf(Option) and
       Language.allInstances ->
           forAll (l| self.hasNewOptionName -> select(languageOfOption=l).nameOfOption =
                          po.hasOptionName->select(optionLanguage=l).optionName))

context  NewProductOptionValue::effect()
   post :
   (Value.allInstances - Value.allInstances@pre) -> forAll(pov:Value |
       pov.oclIsNew()  and
       pov.oclIsTypeOf(Value) and
       Language.allInstances ->
           forAll (l| self.hasNewValueName -> select(languageOfValue=l).nameOfValue =
                          pov.hasValueName->select(valueLanguage=l).valueName) and
       pov.option = self.option)


context  NewReview::effect()
   post :
   (Review.allInstances - Review.allInstances@pre) -> forAll(r:Review |
       r.oclIsNew() and
       r.oclIsTypeOf(Review) and
       r.review = self.review and
       r.rating = self.rating and
       r.customer = self.customer and
       r.product = self.product and
       r.language = self.language)

context  NewSession::effect()
   post :
    (Session.allInstances - Session.allInstances@pre) -> forAll(s:Session |
       s.oclIsNew() and
       s.oclIsTypeOf(Session) and
       s.currentCurrency=self.currentCurrency and
       s.currentLanguage=self.currentLanguage and
       s.sessionID=Session.allInstances->size()
       )


 context NewSpecial::effect()
   post :
       self.product.oclIsTypeOf(Special) and
       self.product.oclAsType(Special).specialPrice=self.specialPrice and
       self.product.oclAsType(Special).expiryDate=self.expiryDate and
       self.product.oclAsType(Special).specialStatus=self.status

context  NewTaxZone::effect()
   post :
   (TaxZone.allInstances - TaxZone.allInstances@pre) -> forAll(tz:TaxZone |
       tz.oclIsNew()  and
       tz.oclIsTypeOf(TaxZone) and
       tz.name = self.name and
       tz.description = self.description and
       tz.zone = self.zone)

 context  NewTaxRate::effect()
   post :
      (TaxRate.allInstances - TaxRate.allInstances@pre) -> forAll(tr:TaxRate |
       tr.oclIsNew()  and
       tr.oclIsTypeOf(TaxRate) and
       tr.rate = self.rate and
       tr.priority = self.priority and
       tr.description = self.description and
       tr.taxClass = self.taxClass and
       tr.taxZone = self.taxZone)

  context  NewTaxClass::effect()
   post :
      (TaxClass.allInstances - TaxClass.allInstances@pre) -> forAll(tc:TaxClass |
       tc.oclIsNew()  and
       tc.oclIsTypeOf(TaxClass) and
       tc.name = self.name and
       tc.description = self.description)


context  NewZone::effect()
   post :
   (Zone.allInstances - Zone.allInstances@pre) -> forAll(z:Zone |
       z.oclIsNew()  and
       z.oclIsTypeOf(Zone) and
       z.name = self.name and
       z.code = self.code and
       z.country = self.country)

context  OrderConfirmation::effect()
   post theOrderIsCreated:
   (Order.allInstances - Order.allInstances@pre) -> forAll(o:Order |
       o.oclIsNew() and
       o.oclIsTypeOf(Order) and
       self.orderCreated=o and
       o.customer = self.shoppingCart@pre.customer@pre and
       o.billing = self.billing and
       o.delivery = self.delivery and
       o.shippingMethod = self.shippingMethod and
       o.paymentMethod = self.paymentMethod and
       o.currency = self.currency and
       --The initial status of the order is pending
       (OrderStatusChange.allInstances - OrderStatusChange.allInstances@pre)
       -> forAll(osc:OrderStatusChange |
       osc.oclIsNew() and
       osc.oclIsTypeOf(OrderStatusChange) and
       osc.comments = self.comments and
       osc.orderStatus = Store.allInstances -> any(true).defaultStatus and
       osc.order = o and
       --There is an order line for each shopping cart item
      shoppingCart@pre.shoppingCartItem@pre->forAll
         (i|OrderLine.allInstances -> one
            (ol|ol.order = o  and
                  ol.product = i.product@pre  and
                  ol.quantity = i.quantity@pre  and
                  i.attribute@pre->forAll
                      (iAtt|OrderLineAttribute.allInstances -> exists
                      (olAtt|olAtt.orderLine = ol and
                                 olAtt.attribute = iAtt))))))
   post theShoppingCartIsRemoved:
       ShoppingCart.allInstances->excludes(self.shoppingCart@pre)
   post updateProductQuantities:
       let productsBought:Set(Product) =
               self.shoppingCart@pre.shoppingCartItem@pre.product@pre->asSet()
       in  productsBought -> forAll (p|
                let quantityBought:Integer =
                       self.shoppingCart@pre.shoppingCartItem@pre->select
                          (sc | sc.product = p).quantity -> sum()
                in
                       p.quantityOrdered = p.quantityOrdered@pre + quantityBought  and
                      Stock.allInstances->any(true).substractStock implies
                       p.quantityOnHand = p.quantityOnHand@pre - quantityBought)


context OwnerChange::effect()
  post :  myStore().owner = self.newOwner

context  PasswordChange::effect()
   post :  self.customer.password = self.newPassword

context  PasswordMinimumChange::effect()
  post :  MinimumValues.allInstances->any(true).password = self.newMinimum

context  PercentageIncreaseForLargerPackagesShippingConfigurationChange::effect()
  post :  ShippingAndPackaging.allInstances
          ->any(true).percentageIncreaseForLargerPackages= self.newPercentage

context  PostCodeMinimumChange::effect()
  post :  MinimumValues.allInstances->any(true).postCode = self.newMinimum

context  PostCodeShippingConfigurationChange::effect()
  post :  ShippingAndPackaging.allInstances->any(true).postCode = self.newPostCode

context  PrimaryCustomerAddressChange::effect()
   post :  self.customer.primary = self.address

context  ProductAttributeStatusChange::effect()
  post :  self.productAttribute.status = self.newStatus

context  ProductDownload::effect()
  post :
      let OrderDownloadFromProduct:OrderDownload=
            self.customer.order.orderLine.orderLineAttribute
                -> select (ola | ola.oclIsTypeOf(OrderDownload) and
ola.orderLine.product = self.product)
                -> asSequence() -> last()
               .oclAsType(OrderDownload)

      in
      let OldOrderDownloadCount:Integer =
            self.customer.order.orderLine.orderLineAttribute@pre
```

```
                -> select (ola | ola.oclIsTypeOf(OrderDownload) and
ola.orderLine.product = self.product)
                -> asSequence() -> last()
               .oclAsType(OrderDownload).downloadCount
      in
         OrderDownloadFromProduct.downloadCount = OldOrderDownloadCount +1


context  ProductOptionAttributeChange::effect()
   post :  productAttribute.attribute.option = self.option

context  ProductValueAttributeChange::effect()
   post :  productAttribute.attribute.value = self.value

context  ProductStatusChange::effect()
  post :  self.product.status = self.newStatus

context  ReadProductInfo::effect()
   post :  self.product.productInLanguage->select(pil | pil.language=self.language)
                 ->any(true).viewed =
                  self.product@pre.productInLanguage@pre->select(pil |
                      pil.language=self.language)->any(true).viewed + 1

context  ReadReview::effect()
   post :  self.review.timesRead = self.review@pre.timesRead + 1

context  ReorderLevelStockConfigurationChange::effect()
   post :  Stock.allInstances->any(true).stockReOrderLevel = self.newValue

context  RestorePreviousShoppingCart::effect()
   post :  self.session.shoppingCart = self.customer.customerShoppingCart

context  ReviewTextMinimumChange::effect()
   post :  MinimumValues.allInstances->any(true).reviewText = self.newMinimum


context SendExtraOrderEmailChange::effect()
  post :  myStore().sendExtraOrderEMail->includesAll(self.newSendExtraOrderEMail)

context  SendNewsletter::effect()
   post :  true

context  SetCancelledOrderStatus::effect()
   post :  self.myStore().cancelledStatus = self.orderStatus

context  SetCurrentCurrency::effect()
   post :  self.session.currentCurrency = self.newCurrentCurrency

context  SetCurrentLanguage::effect()
   post :
       session.currentLanguage = self.newCurrentLanguage
   post :
       Store.allInstances -> any(true).switchToDefaultLanguageCurrency and
       self.newCurrentLanguage.defaultCurrency -> notEmpty()
       implies
       (SetCurrentCurrency.allInstances - SetCurrentCurrency.allInstances@pre)
       -> forAll(ccc:SetCurrentCurrency |
       ccc.oclIsNew() and
       ccc.oclIsTypeOf(SetCurrentCurrency) and
       ccc.session = self.session and
       ccc.newCurrentCurrency = self.newCurrentLanguage.defaultCurrency)

context  SetDefaultCurrency::effect()
   post :  Store.allInstances -> any(true).defaultCurrency = self.currency

context  SetDefaultLanguage::effect()
   post :  Store.allInstances -> any(true).defaultLanguage = self.language

context  SetDefaultOrderStatus::effect()
   post :  self.myStore().defaultStatus = self.orderStatus
```

```
context  ShowBanner::effect()
   post :
       BannerHistory.allInstances -> one
          (bh | bh.banner = self.banner and
                   bh.shown = bh@pre.shown + 1)

context  StateCustomerDetailChange::effect()
  post :  CustomerDetails.allInstances->any(true).state = self.newValue

context  StateMinimumChange::effect()
  post :  MinimumValues.allInstances->any(true).state = self.newMinimum

context  StatusPaymentMethodChange::effect()
   post :   self.paymentMethod.status = self.newStatus

context  StatusShippingMethodChange::effect()
   post :   self.shippingMethod.status = self.newStatus

context  StoreAddressAndPhoneChange::effect()
  post :  myStore().storeAddressAndPhone = self.newStoreAddressAndPhone

context  StreetAddressMinimumChange::effect()
  post :  MinimumValues.allInstances->any(true).streetAddress = self.newMinimum


context  SubstractStockConfigurationChange::effect()
   post :  Stock.allInstances->any(true).substractStock= self.newValue

context  SuburbCustomerDetailChange::effect()
  post :  CustomerDetails.allInstances->any(true).suburb = self.newValue

context  SwitchToDefaultLanguageCurrencyChange::effect()
  post :  myStore().switchToDefaultLanguageCurrency =
self.newSwitchToDefaultLanguageCurrency

context  TaxDecimalPlacesChange::effect()
  post :  myStore().taxDecimalPlaces = self.newTaxDecimalPlaces

context  TelephoneMinimumChange::effect()
  post :  MinimumValues.allInstances->any(true).telephoneNumber = self.newMinimum

context  TypicalPackageTareWeightShippingConfigurationChange::effect()
  post :  ShippingAndPackaging.allInstances->any(true).typicalPackageTareWeight =
          self.newValue

context UninstallAuthorizeNetPaymentMethod::effect()
   post :
      AuthorizeNet.allInstances@pre->any(true).oclIsKindOf(OclAny)

context UninstallCashOnDeliveryPaymentMethod::effect()
   post :
      CashOnDelivery.allInstances@pre->any(true).oclIsKindOf(OclAny)

context UninstallCheckMoneyPaymentMethod::effect()
   post :
      CheckMoney.allInstances@pre->any(true).oclIsKindOf(OclAny)

context UninstallCreditCardPaymentMethod::effect()
   post :
      CreditCard.allInstances@pre->any(true).oclIsKindOf(OclAny)

context UninstallFlatRateShippingMethod::effect()
   post :
       FlatRate.allInstances@pre->any(true).oclIsKindOf(OclAny)

context UninstallIPaymentPaymentMethod::effect()
   post :
       IPayment.allInstances@pre->any(true).oclIsKindOf(OclAny)

context UninstallNochexPaymentMethod::effect()
   post :
       Nochex.allInstances@pre->any(true).oclIsKindOf(OclAny)
```

```
context UninstallPayPalPaymentMethod::effect()
   post :
       PayPal.allInstances@pre->any(true).oclIsKindOf(OclAny)

context UninstallPerItemShippingMethod::effect()
   post :
       PerItem.allInstances@pre->any(true).oclIsKindOf(OclAny)

context UninstallPSiGatePaymentMethod::effect()
   post :
       PSiGate.allInstances@pre->any(true).oclIsKindOf(OclAny)

context UninstallSECPaymentMethod::effect()
   post :
       SECPay.allInstances@pre->any(true).oclIsKindOf(OclAny)

context UninstallTableRateShippingMethod::effect()
   post :
       TableRate.allInstances@pre->any(true).oclIsKindOf(OclAny)

context UninstallTwoCheckOutPaymentMethod::effect()
   post :
       TwoCheckOut.allInstances@pre->any(true).oclIsKindOf(OclAny)

context UninstallUSPostalServiceShippingMethod::effect()
   post :
       USPostalService.allInstances@pre->any(true).oclIsKindOf(OclAny)

context UninstallZoneRatesShippingMethod::effect()
   post :
       ZoneRates.allInstances@pre->any(true).oclIsKindOf(OclAny)

context  UnlockNewsletter::effect()
   post :  self.newsletter.status = #unlocked

context  UpdateCurrencyValueChange::effect()
   post :  self.currency.value = self.newValue

context  UpdateOrderStatus::effect()
   post :
       (OrderStatusChange.allInstances - OrderStatusChange.allInstances@pre)
       -> forAll(osc:OrderStatusChange |
       osc.oclIsNew() and
       osc.oclIsTypeOf(OrderStatusChange) and
       osc.comments = self.comments and
       osc.order = self.order and
       osc.orderStatus = self.newOrderStatus)

context  ZoneChange::effect()
  post :  myStore().zone = self.newZone

context  RemoveProduct::effect()
   post :  not self.shoppingCartItem@pre.oclIsKindOf(OclAny)

context  ChangeQuantity::effect()
   post :  self.shoppingCartItem.quantity = self.quantity

context  UpdateShoppingCart::effect()
   post :
       self.lineChange ->forAll
          (lc|let cartItem:ShoppingCartItem =
                        self.session.shoppingCart.shoppingCartItem->
                        at(lc.index)
                in
                      (lc.remove or lc.quantity <> cartItem.quantity)
                          implies
                              if lc.remove then
                                 (RemoveProduct.allInstances
                                 - RemoveProduct.allInstances@pre)
                                 -> forAll(rp:RemoveProduct |
                                 rp.oclIsNew and
   rp.oclIsTypeOf(RemoveProduct) and
   rp.shoppingCartItem = cartItem)
else
   (ChangeQuantity.allInstances -
   ChangeQuantity.allInstances@pre)
   -> forAll(cq:ChangeQuantity |
   cq.oclIsNew() and
   cq.oclIsTypeOf(ChangeQuantity) and
   cq.shoppingCartItem = cartItem and
   cq.quantity = lc.quantity)
endif )
```

Appendix B: Example CSTL methods of the case study

```
method NameChange{
        self.myStore().name := self.newName;
}

method CountryChange{
        self.myStore().country := self.newCountry;
}

method InstallCreditCardPaymentMethod{
        cc:=new CreditCard;
        cc.status:=#enabled;
}

method InstallCashOnDeliveryPaymentMethod{
        cd:=new CashOnDelivery;
        cd.status:=#enabled;
}

method UninstallCreditCardPaymentMethod{
                delete CreditCard.allInstances->any(true);
}

method InstallPerItemShippingMethod{
        pi:=new PerItem;
        pi.status:=#enabled;
}

method InstallFlatRateShippingMethod{
        fr:=new FlatRate;
        fr.status:=#enabled;
}

method UninstallPerItemShippingMethod{
        delete PerItem.allInstances->any(true);
}

method NewLanguage{
    l:=new Language;
    l.name:=self.newName;
    l.code:=self.newCode;
    l.defaultCurrency:=self.defaultCurrency;
}

method EditLanguage{
    self.language.name:=self.newName;
    self.language.code:=self.newCode;
    self.language.defaultCurrency:=self.newDefaultCurrency;
}

method OrderConfirmation{

        //The order is created
        o:=new Order;
        o.customer := self.shoppingCart.customer;
        o.billing:=self.billing;
        o.delivery:=self.delivery;
        o.shippingMethod := self.shippingMethod;
        o.paymentMethod := self.paymentMethod;
        o.currency := self.currency;

        //The initial status of an order is pending
        OrderStatus os:=Store.allInstances->any(true).defaultStatus;
        osc:=new OrderStatusChange(order:=o, orderStatus:=os);
        osc.comments := self.comments;

        //There is an order line for each shopping cart item

        Integer index:=0;
    Integer indexat:=0;
        while self.shoppingCart.shoppingCartItem->size()>index do
           i := self.shoppingCart.shoppingCartItem->at(index+1);
           ol:=new OrderLine;
           ol.order:=o;
           ol.product:=i.product;
           ol.quantity:=i.quantity;
           while i.attribute->size()>indexat do
                attr:=i.attribute->asSequence()->at(indexat+1);
                ola:=new OrderLineAttribute;
                ola.orderLine:=ol;
                ola.attribute:=attr;
                indexat:=indexat+1;
           endwhile
      index:=index+1;
      indexat:=0;
        endwhile

        //update product quantities
        products:=o.orderLine.product->asSet();
        Integer i:=0;
        while products->size()>i do
               p:=products->asSequence()->at(i+1);
               substract:= Stock.allInstances->any(true).substractStock;
               if substract then
                      var:=o.orderLine->select(product=p).quantity->sum();
                      p.quantityOnHand:=p.quantityOnHand-var;
               endif
               i:=i+1;
        endwhile

        //The shopping cart is removed
        delete self.shoppingCart;

        self.orderCreated:=o;
}

method PasswordMinimumChange{
        MinimumValues.allInstances->any(true).password := self.newMinimum;
}

method CreditCardNumberMinimumChange{
        MinimumValues.allInstances->any(true).creditCardNumber := self.newMinimum;
}

method AddressBookEntriesMaximumChange{
        MaximumValues.allInstances->any(true).addressBookEntries := self.newMaximum;
}

method GenderCustomerDetailChange{
        CustomerDetails.allInstances->any(true).gender := self.newValue;
}

method MaximumNumberDownloadConfigurationChange{
        Download.allInstances->any(true).maximumNumberOfDownloads := self.newMaximum;
}

method CheckLevelStockConfigurationChange {
        Stock.allInstances->any(true).checkStockLevel := self.newValue;
}

method TypicalPackageTareWeightShippingConfigurationChange{
        ShippingAndPackaging.allInstances->any(true).typicalPackageTareWeight :=
        self.newValue;
}

method MaximumPackageWeightShippingConfigurationChange{
        ShippingAndPackaging.allInstances->any(true).maximumPackageWeight :=
         self.newMaximum;
}
```

```
method StatusPaymentMethodChange{
        self.paymentMethod.status:=self.newStatus;
}

method EditCreditCardPaymentMethod{
        CreditCard.allInstances->any(true).splitCreditCardToMail :=
        self.newSplitCreditCardToMail;
        CreditCard.allInstances->any(true).status := self.status;
        CreditCard.allInstances->any(true).orderStatus := self.orderStatus;
        CreditCard.allInstances->any(true).taxZone := self.taxZone;
}

method EditPerItemShippingMethod{
        PerItem.allInstances->any(true).cost := self.newCost;
        PerItem.allInstances->any(true).handlingFee := self.handlingFee;
        PerItem.allInstances->any(true).taxZone := self.taxZone;
        PerItem.allInstances->any(true).taxClass := self.taxClass;
        PerItem.allInstances->any(true).status := self.status;
}

method SetDefaultLanguage{
        Store.allInstances->any(true).defaultLanguage := self.language;
}

method DeleteLanguage{
        delete self.language;
}

method NewCurrency{
        c:= new Currency;
        c.title:=self.title;
        c.code:=self.code;
        c.symbolLeft:=self.symbolLeft;
        c.symbolRight:=self.symbolRight;
        c.decimalPlaces:=self.decimalPlaces;
        c.value:=self.value;
        c.status:=#enabled;
}

method EditCurrency{
        self.currency.title:=self.newTitle;
        self.currency.code:=self.newCode;
        self.currency.symbolLeft:=self.newSymbolLeft;
        self.currency.symbolRight:=self.newSymbolRight;
        self.currency.decimalPlaces:=self.newDecimalPlaces;
        self.currency.value:=self.newValue;
}

method DeleteCurrency{
        delete self.currency;
}

method SetDefaultCurrency{
        Store.allInstances->any(true).defaultCurrency:=self.currency;
}

method CurrencyStatusChange{
        self.currency.status := self.newStatus;
}

method NewCountry{
        c:=new Country;
        c.name:=self.name;
        c.isoCode2:=self.isoCode2;
        c.isoCode3:=self.isoCode3;
}

method EditCountry{
        self.country.name:=self.newName;
        self.country.isoCode2:=self.newIsoCode2;
        self.country.isoCode3:=self.newIsoCode3;
}
```

```
method DeleteCountry{
        Integer i:=0;
        while self.country.zone->size()>i do
                z:=self.country.zone->asSequence()->at(i+1);
                delete z;
        endwhile
        delete self.country;
}

method NewZone{
        z:=new Zone;
        z.name:=self.name;
        z.code:=self.code;
        z.country:=self.country;
}

method EditZone{
        self.zone.name:=self.newName;
        self.zone.code:=self.newCode;
}

method DeleteZone{
        delete self.zone;
}

method NewTaxZone{
        tz := new TaxZone;
        tz.name := self.name;
        tz.description := self.description;
        tz.zone := self.zone;
}

method EditTaxZone{
        self.taxZone.name := self.newName;
        self.taxZone.description := self.newDescription;
        self.taxZone.zone := self.newZones;
}


method DeleteTaxZone{
        delete self.taxZone;
}

method NewTaxClass{
        tc := new TaxClass;
        tc.name := self.name;
        tc.description := tc.description;
}

method EditTaxClass{
        self.taxClass.name := self.newName;
        self.taxClass.description := self.newDescription;
}

method DeleteTaxClass{
        delete self.taxClass;
}

method NewTaxRate{
        tc:=self.taxClass;
        tz:=self.taxZone;
        tr := new TaxRate(taxClass:=tc, taxZone:=tz);
        tr.rate:=self.rate;
        tr.priority:=self.priority;
        tr.description:=self.description;
}

method EditTaxRate{
        tc:=self.newTaxClass;
        tz:=self.newTaxZone;
        tr := new TaxRate(taxClass:=tc, taxZone:=tz);
        tr.rate:=self.newRate;
        tr.priority:=self.newPriority;
        tr.description:=self.newDescription;
        self.taxRate := tr;
}

method DeleteTaxRate{
        delete self.taxRate;
}

method NewProduct{
        p:=new Product;
        p.status := self.status;
        p.available := self.available;
        p.netPrice:= self.netPrice;
        p.quantityOnHand := self.quantityOnHand;
        p.modelM:=self.modelM;
        p.imagePath:=self.imagePath;
        p.weight:=self.weight;
        p.category := self.category;
        p.manufacturer:=self.manufacturer;
        p.taxClass:=self.taxClass;
        Integer index:=0;
        while Language.allInstances->size()>index do
                l:=Language.allInstances->asSequence()->at(index+1);
                hnpn:=HasNewProductName.allInstances->select(languageOfProduct=l)
                ->select(productNameEvent=self)->any(true);
                pil:=new ProductInLanguage(product:=p,language:=l);
                pil.name:=hnpn.nameOfProduct.string;
                index:=index+1;
        endwhile
}


method EditProduct{
        self.product.status := self.status;
        self.product.available := self.available;
        self.product.netPrice:= self.netPrice;
        self.product.quantityOnHand := self.quantityOnHand;
        self.product.modelM:=self.modelM;
        self.product.imagePath:=self.imagePath;
        self.product.weight:=self.weight;
        self.product.category := self.category;
        self.product.manufacturer:=self.manufacturer;
        self.product.taxClass:=self.taxClass;
        Integer i:=0;
        while Language.allInstances->size()>i do
                l:=Language.allInstances->asSequence()->at(i+1);
                hnpn:=HasNewProductName.allInstances->select(languageOfProduct=l)
                ->select(productNameEvent=self)->any(true);
                pil:=self.product.productInLanguage->any(language=l);
                pil.name:=hnpn.nameOfProduct.string;
                i:=i+1;
        endwhile

}

method DeleteProduct{
        if self.product.orderLine->size()=0
           then delete self.product;
        else
       new ProductStatusChange(product:=self.product,newStatus:=#outOfStock);
    endif
}

method ProductStatusChange{
    self.product.status:=self.newStatus;
}

method NewProductOption{
        o:=new Option;
        Integer i:=0;
        while Language.allInstances->size()>i do
```

```
                l:=Language.allInstances->asSequence()->at(i+1);
                hnon:=HasNewOptionName.allInstances->select(languageOfOption=l)
               ->select(productOptionNameEvent=self)->any(true);
                oname:=hnon.nameOfOption;
                pil:=new HasOptionName(option:=o,optionLanguage:=l,optionName:=oname);
                i:=i+1;
        endwhile
}

method EditProductOption{
        o:=self.option;
        Integer i:=0;
        while Language.allInstances->size()>i do
                l:=Language.allInstances->asSequence()->at(i+1);
                hnon:=HasNewOptionName.allInstances->select(languageOfOption=l)
                ->select(productOptionNameEvent=self)->any(true);
                oname:=hnon.nameOfOption;
                pil:=new HasOptionName(option:=o,optionLanguage:=l,optionName:=oname);
            hon:=o.hasOptionName->any(optionLanguage=l);
            delete hon;
                i:=i+1;
        endwhile
}

method DeleteProductOption{
        Integer i:=0;
        valuesNotUsedSize:=self.option.value->select(option->size()=1)
       ->select(attribute.orderLineAttribute->isEmpty())->size();
        while valuesNotUsedSize>i do
                v:=self.option.value->select(option->size()=1)
                ->select(attribute.orderLineAttribute->isEmpty())->asSequence()->at(i+1);
                delete v;
                i:=i+1;
        endwhile
        delete self.option;
}

method NewProductOptionValue{
        v:=new Value;
        Integer i:=0;
        while Language.allInstances->size()>i do
                l:=Language.allInstances->asSequence()->at(i+1);
                hnvn:=HasNewValueName.allInstances->select(languageOfValue=l)
                ->select(productValueNameEvent=self)->any(true);
                vname:=hnvn.nameOfValue;
                new HasValueName(value:=v,valueLanguage:=l,valueName:=vname);
                i:=i+1;
        endwhile
        v.option:=self.option;
}

method EditProductOptionValue{
        v:=self.value;
        Integer i:=0;
        while Language.allInstances->size()>i do
                l:=Language.allInstances->asSequence()->at(i+1);
                hnon:=HasNewValueName.allInstances->select(languageOfValue=l)
                ->select(productValueNameEvent=self)->any(true);
                oname:=hnon.nameOfValue;
                hon:=v.hasValueName->any(valueLanguage=l);
                pil:=new HasValueName(value:=v,valueLanguage:=l,valueName:=oname);
            delete hon;
                i:=i+1;
        endwhile
        v.option:=self.option;
}

method DeleteProductOptionValue{
        delete self.value;
}
```

```
method NewProductAttribute{
        o:=self.option;
        v:=self.value;
        attr:=Attribute.allInstances->select(value=v)->any(option=o);
        pa:=new ProductAttribute(product:=self.product, attribute:=attr);
        pa.sign:=self.sign;
        pa.increment:=self.increment;
}

method AttributeChange{
        o:=self.newOption;
        v:=self.newValue;
        pa:=self.productAttribute;
        attr:=Attribute.allInstances->select(value=v)->any(option=o);
        increment:=pa.increment;
        sign:=pa.sign;
        status:=pa.status;
        product:=pa.product;
        npa:=new ProductAttribute(product:=product,attribute:=attr);
        self.productAttribute:=npa;
        delete pa;
}

method IncrementAndSignAttributeChange{
        pa:=self.productAttribute;
        pa.increment:=self.newIncrement;
        pa.sign:=self.newSign;
}

method DeleteProductAttribute{
        participantOrdersSize:=OrderLineAttribute.allInstances
         ->select(attribute=self.productAttribute.attribute)
         ->select(orderLine.product=self.productAttribute.product)->size();
        if participantOrdersSize=0 then
                delete self.productAttribute;
        else
        new ProductAttributeStatusChange(productAttribute:=self.productAttribute,
                                         newStatus:=#disabled);
    endif
}

method ProductAttributeStatusChange{
    self.productAttribute.status:=#disabled;
}

method NewSpecial{
        p:=self.product;
        s:=new Special;
        s.specialPrice:=self.specialPrice;
        s.expiryDate:=self.expiryDate;
        s.specialStatus:=self.status;
        s.status := p.status;
        s.available := p.available;
        s.netPrice:= p.netPrice;
        s.quantityOnHand := p.quantityOnHand;
        s.modelM:=p.modelM;
        s.imagePath:=p.imagePath;
        s.weight:=p.weight;
        s.category := p.category;
        s.manufacturer:=p.manufacturer;
        s.taxClass:=p.taxClass;
        Integer i:=0;
        while Language.allInstances->size()>i do
                l:=Language.allInstances->asSequence()->at(i+1);
                hnpn:=HasProductName.allInstances->select(languageOfProduct=l)
                ->select(product=p)->any(true);
                pil:=new ProductInLanguage(product:=s,language:=l);
                pil.name:=hnpn.nameOfProduct.string;
                i:=i+1;
        endwhile
        self.product:=s;
}
```

```
method EditSpecial{
        self.special.specialPrice:=self.newSpecialPrice;
        self.special.expiryDate:=self.newExpiryDate;
        self.special.specialStatus:=self.newStatus;
}

method DeleteSpecial{
        s:=self.special;
        p:=new Product;
        //We save the self.product information
        p.status := s.status;
        p.available := s.available;
        p.netPrice:= s.netPrice;
        p.quantityOnHand := s.quantityOnHand;
        p.modelM:=s.modelM;
        p.imagePath:=s.imagePath;
        p.weight:=s.weight;
        p.category := s.category;
        p.manufacturer:=s.manufacturer;
        p.taxClass:=s.taxClass;
        i:=0;
        while Language.allInstances->size()>i do
                l:=Language.allInstances->asSequence()->at(i+1);
                hnpn:=HasProductName.allInstances->select(languageOfProduct=l)
                ->select(product=s)->any(true);
                pil:=new ProductInLanguage(product:=p,language:=l);
                pil.name:=hnpn.nameOfProduct.string;
                i:=i+1;
        endwhile
        delete s;
}

method NewCategory{
        c:=new Category;
        c.imagePath:=self.imagePath;
        c.sortOrder:=self.sortOrder;
        c.parent:=self.parent;
        Integer i:=0;
        while Language.allInstances->size()>i do
                l:=Language.allInstances->asSequence()->at(i+1);
                hncname:=HasNewName.allInstances->any(languageOfCategory=l).name;
                new HasCategoryName(category:=c,language:=l,categoryName:=hncname);
                i:=i+1;
        endwhile
}

method EditCategory{
        c:=self.category;
        c.imagePath:=self.imagePath;
        c.sortOrder:=self.sortOrder;
        c.parent:=self.newParent;
        Integer i:=0;
        while Language.allInstances->size()>i do
                l:=Language.allInstances->asSequence()->at(i+1);
                hnn:=HasNewName.allInstances->select(languageOfCategory=l)
                ->select(categoryNameEvent=self)->any(true);
                cname:=hnn.name;
                cil:=new HasCategoryName(category:=c,language:=l,categoryName:=cname);
            hcn:=c.hasCategoryName->any(language=l);
            delete hcn;
                i:=i+1;
        endwhile

}

method MoveCategory{
        self.category.parent:=self.newParent;
}

method DeleteCategory{
        topCategory:=self.category;
        Integer i:=0;
        while self.allChilds(topCategory)->size()>i do
                c:=self.allChilds(topCategory)->asSequence()->at(i+1);
                delete c;
                i:=i+1;
        endwhile
        delete self.category;
}

method MoveProduct{
        newCat:=self.newCategory;
        oldCat:=self.oldCategory;
        categories:=self.product.category->union(Set{newCat})-Set{oldCat};
        self.product.category:=categories;
}

method LinkProduct{
        newCat:=self.newCategory;
        categories:=self.product.category->union(Set{newCat});
        self.product.category:=categories;
}

method NewCustomer{
        c:=new Customer;
        c.gender:=self.primary.gender;
        c.firstName:=self.primary.firstName;
        c.lastName:=self.primary.lastName;
        c.dateOfBirth:=self.dateOfBirth;
        c.eMailAddress:=self.eMailAddress;
        c.phone:=self.phone;
        c.fax:=self.fax;
        c.newsletter:=self.newsletter;
        c.password:=self.password;
        c.numberOfLogons:=0;
        primaryAddress:=self.primary;
        c.address:=Set{primaryAddress};
        c.primary:=primaryAddress;
}

method PasswordChange{
        self.customer.password:=self.newPassword;
}

method NewManufacturer{
        m:=new Manufacturer;
        m.name := self.name;
        m.imagePath := self.imagePath;
        Integer i:=0;
        while Language.allInstances->size()>i do
                l:=Language.allInstances->asSequence()->at(i+1);
                hurl:=HasURL.allInstances->select(languageOfURL=l)
                ->select(manufacturerURLEvent=self)->any(true);
                mil:=new ManufacturerInLanguage(manufacturer:=m,language:=l);
                mil.url:=hurl.url;
                i:=i+1;
        endwhile
}

method EditManufacturer{
        m:=self.manufacturer;
        m.name := self.name;
        m.imagePath := self.imagePath;
        Integer index:=0;
        while Language.allInstances->size()>index do
                l:=Language.allInstances->asSequence()->at(index+1);
                hurl:=HasURL.allInstances->select(languageOfURL=l)
                ->select(manufacturerURLEvent=self)->any(true);
                mil:=m.manufacturerInLanguage->any(language=l);
                mil.url:=hurl.url;
                index:=index+1;
        endwhile
}
```

```
method DeleteManufacturer{
	m:=self.manufacturer;
	deleteProducts:=self.deleteProds;
	Integer ip:=0;
	if deleteProducts then
		while m.product->size()>ip do
			p:=m.product->asSequence()->at(ip+1);
			p.status:=#outOfStock;
			ip:=ip+1;
		endwhile
	endif

	//Delete the manufacturer
	delete m;
}

method NewBannerGroup{
	bg:=new BannerGroup;
	bg.name:=self.name;
}

method EditBannerGroup{
	self.bannerGroup.name:=self.newName;
}

method NewBanner{
	b:=new Banner;
	b.title:=self.title;
	b.url:=self.url;
	b.imagePath:=self.imagePath;
	b.html:=self.html;
	b.expires:=self.expires;
	b.scheduled:=self.scheduled;
	b.status:=#enabled;
	b.bannerGroup:=self.bannerGroup;
}

method EditBanner{
	b:=self.banner;
	b.title:=self.newTitle;
	b.url:=self.newUrl;
	b.imagePath:=self.newImagePath;
	b.html:=self.newHtml;
	b.expires:=self.newExpires;
	b.scheduled:=self.newScheduled;
	b.status:=self.newStatus;
	b.bannerGroup:=self.newBannerGroup;
}

method DeleteBanner{
	delete self.banner;
}

method DeleteBannerGroup{
	delete self.bannerGroup;
}

method NewNewsletter{
	n:=new Newsletter;
	n.title:=self.title;
	n.content:=self.content;
	n.status:=#unlocked;
}

method NewProductNotification{
	n:=new ProductNotification;
	n.title:=self.title;
	n.content:=self.content;
	n.status:=#unlocked;
	n.global:=self.global;
	n.explicitNotifications:=self.explicitNotifications;
}
```

```
method EditNewsletter{
        n:=self.newsletter;
        n.title:=self.newTitle;
        n.content:=self.newContent;
}

method DeleteNewsletter{
        delete self.newsletter;
}

method LockNewsletter{
        self.newsletter.status:=#locked;
}

method UnlockNewsletter{
        self.newsletter.status:=#unlocked;
}

method NewSession{
        s:=new Session;
        self.createdSession:=s;
        s.currentCurrency:=self.currentCurrency;
        s.currentLanguage:=self.currentLanguage;
        s.sessionID:=Session.allInstances->size();
}

method DeleteSession{
        delete self.session;
}

method LogIn{
        s:=self.session;
        s.customer := self.customer;
        self.customer.numberOfLogons:=self.customer.numberOfLogons+1;
        if c.customerShoppingCart->size()>0 then
                new RestorePreviousShoppingCart(customer:=self.customer,session:=s)
                occurs;
        else
                if self.session.shoppingCart->size()=1 then
                        csc:=new CustomerShoppingCart;
                        csc.customer:=self.customer;
                        csc.shoppingCartItem:=self.session.shoppingCart.shoppingCartItem;

        self.session.shoppingCart.shoppingCartItem:=oclEmpty(Set(ShoppingCartItem));
                        asc:=self.session.shoppingCart;
                        self.session.shoppingCart:=oclEmpty(Set(ShoppingCart));
                        s.shoppingCart:=csc;
                        delete asc;
                endif
        endif
}

method AddProductToShoppingCart{
        //Shopping cart item is created
        sci:=new ShoppingCartItem;
        sci.quantity:=self.quantity;
        sci.product:=self.product;
        sci.attribute:=self.attribute;

        if self.session.shoppingCart->size()>0 then
                //The session has a shopping cart
                self.session.shoppingCart.shoppingCartItem :=
self.session.shoppingCart.shoppingCartItem->asSet()->union(Set{sci})->asSequence();
        else
                //The session does not have a shopping cart
                if self.session.customer.isUndefined() then
                        //The session is anonymous
                        asc := new AnonymousShoppingCart;
                        self.session.shoppingCart:=asc;
                        asc.shoppingCartItem:=sci;
                else
                //The customer is logged in
                        if self.session.customer.customerShoppingCart->size()>0 then
                                //The customer has a previous shopping cart
                                self.session.customer.customerShoppingCart.shoppingCartItem
                                 := self.session.customer.customerShoppingCart
                                    .shoppingCartItem
                                    ->asSet()->union(Set{sci})->asSequence();
                        else
                                //The customer does not have a previous shopping cart
                                csc:=new CustomerShoppingCart;
                                csc.customer:=self.session.customer;

                                 csc.shoppingCartItem:=self.session.shoppingCart
                                 .shoppingCartItem;
                                self.session.shoppingCart:=csc;
                                csc.shoppingCartItem:=sci;
                        endif
                endif
        endif

}

method RestorePreviousShoppingCart{
        self.session.shoppingCart:=self.customer.customerShoppingCart;
}

method LogOut{
        self.session.customer:=oclEmpty(Set(Customer));
}

method NewReview{
        r:=new Review;
        r.review:=self.review;
        r.rating:=self.rating;
        r.customer:=self.customer;
        r.product:=self.product;
        r.language:=self.language;
        self.createdReview:=r;
}

method EditReview{
        r:=self.review;
        r.review:=self.newReview;
        r.rating:=self.newRating;
        r.customer:=self.newCustomer;
        r.product:=self.newProduct;
        r.language:=self.newLanguage;
}

method DeleteReview{
    delete self.review;
}

method NewOrderStatus{
        os:=new OrderStatus;
        osi:=0;
        while Language.allInstances->size()>osi do
                l:=Language.allInstances->asSequence()->at(osi+1);
                osname:=HasOrderStatusName.allInstances->select(languageOfOrderStatus=l)
                ->select(orderStatusNameEvent=self)->any(true).orderStatusName;
                osl:=new OrderStatusInLanguage(orderStatus:=os,language:=l);
                osl.name:=osname.string;
                osi:=osi+1;
        endwhile
        self.createdOrderStatus:=os;
}

method EditOrderStatus{
        os:=self.orderStatus;
        os.language:=oclEmpty(Set(Language));
        i:=0;
        while Language.allInstances->size()>i do
```

```
                l:=Language.allInstances->asSequence()->at(i+1);
                osname:=HasOrderStatusName.allInstances->select(languageOfOrderStatus=l)
                ->select(orderStatusNameEvent=self)->any(true).orderStatusName;
                osl:=new OrderStatusInLanguage(orderStatus:=os,language:=l);
                osl.name:=osname.string;
                i:=i+1;
        endwhile
}

method DeleteOrderStatus{
        os:=self.orderStatus;
        if Order.allInstances.orderStatus->includes(os)
        then
                self.orderStatus.status:=#disabled;
        else
                os.language:=oclEmpty(Set(Language));
                delete os;
        endif
}

method CancelOrder{
        cancelledStatus:=Store.allInstances->any(true).cancelledStatus;
        osc:=new OrderStatusChange(order:=self.order,orderStatus:=cancelledStatus);
}

method SetCancelledOrderStatus{
        self.myStore.cancelledStatus:=self.orderStatus;
}

method SetDefaultOrderStatus{
        self.myStore.defaultStatus:=self.orderStatus;
}


method SetCurrentCurrency{
        self.session.currentCurrency:=self.newCurrentCurrency;
}

method SetCurrentLanguage{
        self.session.currentLanguage:=self.newCurrentLanguage;
        switch:=Store.allInstances->any(true).switchToDefaultLanguageCurrency;
        changeCurrency:= self.newCurrentLanguage.defaultCurrency->notEmpty();
        if changeCurrency
        then
                if switch then
                currentCurrency:=self.newCurrentLanguage.defaultCurrency;
                new SetCurrentCurrency(session:=self.session,
                newCurrentCurrency:=currentCurrency) occurs;
                endif
        endif
}

method UpdateOrderStatus{
        s:=self.newOrderStatus;
        osc:=new OrderStatusChange(order:=self.order, orderStatus:=s);
        osc.comments:=self.comments;
}


method EditCustomerDetails{
        c:=self.customer;
        c.gender:=self.newGender;
        c.firstName:=self.newFirstName;
        c.lastName:=self.newLastName;
        c.dateOfBirth:=self.newDateOfBirth;
        c.eMailAddress:=self.newEMailAddress;
        c.phone:=self.newPhone;
        c.fax:=self.newFax;
        c.newsletter:=self.newNewsletter;
}
```

```
method EditCustomer{
        c:=self.customer;
        c.gender:=self.newGender;
        c.firstName:=self.newFirstName;
        c.lastName:=self.newLastName;
        c.dateOfBirth:=self.newDateOfBirth;
        c.eMailAddress:=self.newEMailAddress;
        c.phone:=self.newPhone;
        c.fax:=self.newFax;
        c.newsletter:=self.newNewsletter;
        c.password:=self.newPassword;
        c.globalNotifications:=self.newGlobalNotifications;
}

method NewCustomerAddress{
        ad:=new Address;
        ad.gender:=self.gender;
        ad.firstName:=self.firstName;
        ad.lastName:=self.lastName;
        ad.company:=self.company;
        ad.street:=self.street;
        ad.suburb:=self.suburb;
        ad.postCode:=self.postCode;
        ad.city:=self.city;
        ad.state:=self.state;
        ad.zone:=self.zone;
        ad.country:=self.country;
        adSet:=Set{ad};
        self.customer.address:=self.customer.address->union(adSet);
}

method EditCustomerAddress{

        changedAddress:=self.address;
        newAddress:=self.newAddress;
        oldAddresses:=self.customer.address;
        if oldAddresses->size()=1 then
                self.customer.address:=Set{newAddress};
                self.customer.address:=self.customer.address-Set{changedAddress};
        else
         self.customer.address:=oldAddresses->union(Set{newAddress});
         self.customer.address:=self.customer.address-Set{changedAddress};
        endif
}

method PrimaryCustomerAddressChange{
        self.customer.primary:=self.address;
}

method DeleteCustomerAddress{
        deletedAddress:=self.address;
        self.customer.address:=self.customer.address-Set{deletedAddress};
}

method NewProductNotificationSubscription{
        previousSubscriptions:=self.customer.explicitNotifications;
        newProduct:=self.newSubscribedProduct;
        if self.customer.explicitNotifications->size()>0 then
                self.customer.explicitNotifications:=previousSubscriptions
                ->union(Set{newProduct});
        else
                self.customer.explicitNotifications:=self.newSubscribedProduct;
        endif
}

method DeleteProductNotificationSubscription{
        deletedSubscription:=self.deletedSubscribedProduct;
        previousSubscriptions:=self.customer.explicitNotifications;
        self.customer.explicitNotifications:=previousSubscriptions
                                              -Set{deletedSubscription};
}
```

```
method EditGlobalNotifications{
        self.customer.globalNotifications:=self.newGlobalNotifications;
}

method DeleteCustomer{
        //Delete reviews of customer
        while self.customer.review->size()>0 do
               r:=self.customer.review->any(true);
               r.product:=oclEmpty(Set(Product));
               r.language:=oclEmpty(Set(Language));
               r.customer:=oclEmpty(Set(Customer));
               delete r;
        endwhile

        //Delete shopping cart if needed
        if self.customer.customerShoppingCart->size()>0 then
               delete self.customer.customerShoppingCart;
        endif

        //Delete customer or set it to disabled
        if self.customer.order->size()>0 then
               new CustomerStatusChange(customer:=self.customer, newStatus:=#disabled)
               occurs;
        else
               delete self.customer;
        endif
}

method CustomerStatusChange{
        self.customer.status:=self.newStatus;
}
```