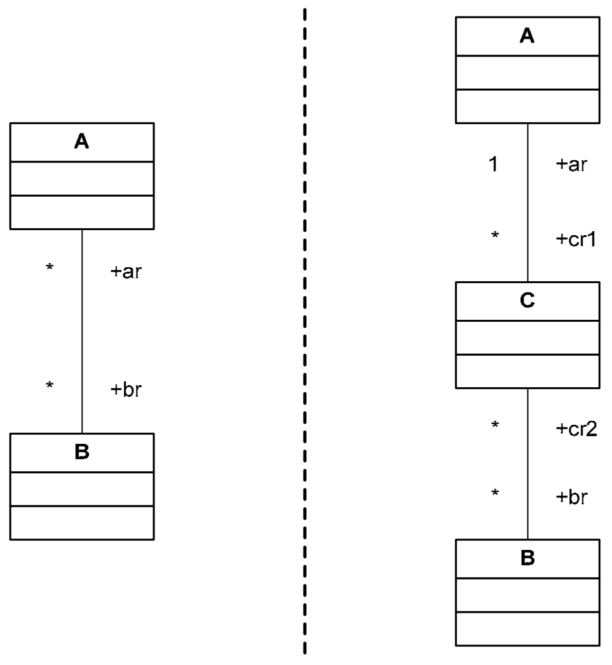
	ATL Transformation Catalogue of Model Transformations	**Author** **Eric Simon** **eric.simon3 <*at*> gmail.com**
INRIA	**Documentation**	Aug 7th 2006

1. ATL Transformation Example: Removal a many-many association

This example is extract from Catalogue of Model Transformations by K. Lano.
Section 1.2: Removal of many-many associations, page 2.



2. ATL Transformation overview

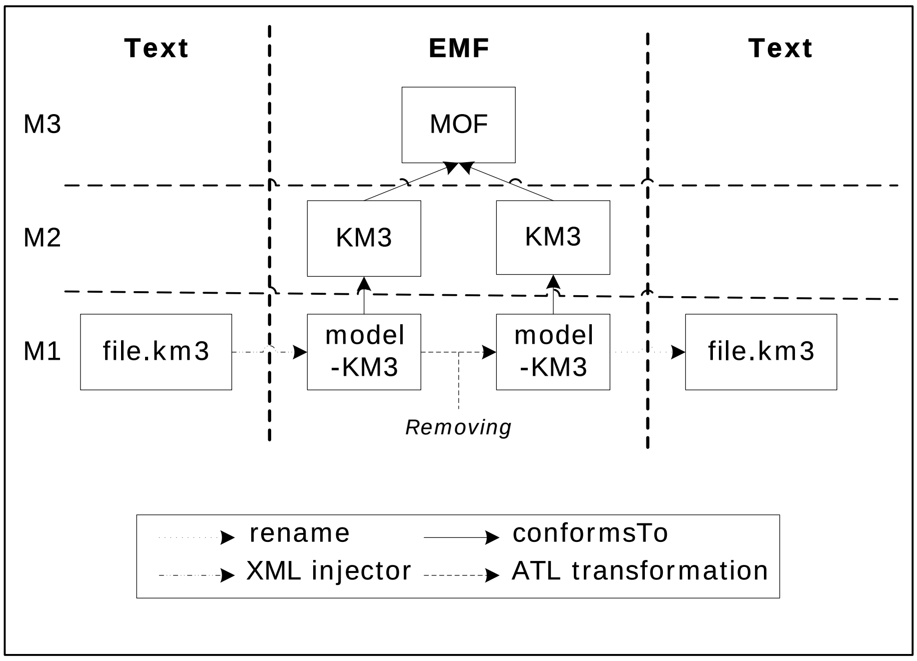


Fig 1. Overview of the transformation

2.1. Description

The purpose of this transformation is to substitute a many-many association by an introduction of class with two many-one associations.

2.2. Purpose

"Explicit many-many associations cannot be implemented using foreign keys in a relational database – an intermediary table would need to be used instead. This transformation is the object-oriented equivalent of introducing such a table."

2.3. Rules specification

- Rule Metamodel: for each *Metamodel* element, another *Metamodel* element is created with the following elements:
  - the attribute *location* is the same,
  - the reference *contents* is the same.
- Rule Package: for each *Package* element, another *Package* element is created with the following elements:
  - the attribute *name* is the same,
  - the reference *contents* is the same.

- Rule DataType: for each *DataType* element, another *DataType* element is created with the following elements:
  - the attributes *name* and *location* are the same.
- Rule EnumLiteral: for each *EnumLiteral* element, another *EnumLiteral* element is created with the following elements:
  - the attributes *name* and *location* are the same,
  - the references enum and package are composed by the same source.
- Rule Enumeration : for each *Enumeration* element, another *Enumeration* element is created with the following elements:
  - the attributes *name* and *location* are the same,
  - the reference *literals* and *package* are composed by the same source.
- Rule Class: for each *Class* element
  - If the *Class* element contained a reference which is not contained by a many-many association
    - another *Class* element is created with the following elements:
      - the attributes *name*, *location* and *isAbstract* are the same,
      - the references *structuralFeatures*, *supertypes* and *package* are the same.
- Rule Attribute: for each *Attribute* element, another *Attribute* element is created with the following elements:
  - the attributes *name*, *lower*, *upper*, *isOrdered* and *isUnique* are the same source value,
  - the references *package*, *owner* and *type*, are filled in with the same value respectively.
- Rule Reference: for each *Reference* element
  - If the *Reference* element is not contained by a many-many association
    - another *Reference* element is created with the following elements:
      - the attributes *name* and *isContainer* are the same,
      - the references *owner*, *opposite, type* and *package* are the same;
- Rule Association: for each pair of *Reference* element which is considered like many-many association
  - a Class element is created with the following elements:
    - the elements of both Class, which are linked by this pair of *Reference*, composed this new Class element

2.4. ATL Code

```
module Removing; -- Module Template
create OUT : KM3Target from IN : KM3;

-- @comment this helper allows to know if a reference oswn the properties necessary for the
rule association
helper context KM3!Reference def: isManyToManyNotContainer : Boolean =
   self.lower = 0 and self.upper < 0 and not self.isContainer
   ;
-- @comment this helper create a Map which uses in the rule isAlreadyConsidered.
helper def: assoMap : Map(KM3!Reference, Sequence(KM3!Reference)) = Map{};
-- @comment this rule allows to know if a pair of element is already considered. E.g.: {A,B}
and {B,A} => {A,B}.
rule isAlreadyConsidered(ref1 : KM3!Reference, ref2 : KM3!Reference) {

   do {
      if (not thisModule.assoMap.get(ref2).oclIsUndefined()) {
         if (thisModule.assoMap.get(ref2)->includes(ref1)) {
            true;
         }
         else {
             if (not thisModule.assoMap.get(ref1).oclIsUndefined()) {
               thisModule.assoMap <-
thisModule.assoMap.including(ref1,thisModule.assoMap.get(ref1)->including(ref2));
               false;
             }
            else {
               thisModule.assoMap <- thisModule.assoMap.including(ref1, Sequence{ref2});
               false;
            }
         }
      }
      else  {
            if (not thisModule.assoMap.get(ref1).oclIsUndefined()) {
               thisModule.assoMap <-
thisModule.assoMap.including(ref1,thisModule.assoMap.get(ref1)->including(ref2));
               false;
             }
            else {
               thisModule.assoMap <- thisModule.assoMap.including(ref1, Sequence{ref2});
               false;
            }
      }

   }
}


2.4.1.  -- @begin rule Metamodel
rule Metamodel {
   from
      inputMm:KM3!Metamodel
   to
      outputMm:KM3Target!Metamodel (
         location <- inputMm.location,
         contents <- inputMm.contents
      )
}
-- @end rule Metamodel
```

2.4.2. -- @begin rule Package
```
rule Package {
   from
      inputPkg:KM3!Package
   to
      outputPkg:KM3Target!Package (
         name <- inputPkg.name,
         contents <- inputPkg.contents
      )
}
-- @end rule Package
```

2.4.3. -- @begin rule DataType
```
rule DataType {
   from
      inputData:KM3!DataType
   to
      outputData:KM3Target!DataType(
         name <- inputData.name,
         location <- inputData.location
      )
}
-- @end rule DataType
```

2.4.4. -- @begin rule EnumLiteral
```
rule EnumLiteral {
   from
      inputL:KM3!EnumLiteral
   to
      outputL:KM3Target!EnumLiteral (
         name <- inputL.name,
         location <- inputL.location,
         enum  <- inputL.enum,
         package <- inputL.package
      )
}
-- @end rule EnumLiteral
```

2.4.5. -- @begin rule Enumeration
```
rule Enumeration {
   from
      inputEnum:KM3!Enumeration
   to
      outputEnum:KM3Target!Enumeration (
         name <- inputEnum.name,
         location <- inputEnum.location,
         package <- inputEnum.package,
         literals <- inputEnum.literals
      )
}
-- @end rule Enumeration
```

2.4.6. -- @begin rule Class
```
rule Class {
   from
      inputC:KM3!Class
      (not inputC.structuralFeatures->select(a|a.oclIsTypeOf(KM3!Reference))->exists(r|
r.isManyToManyNotContainer and r.opposite.isManyToManyNotContainer))
   to
      outputC:KM3Target!Class (
         isAbstract <- inputC.isAbstract,
         supertypes <- inputC.supertypes,
         name <- inputC.name,
         location <- inputC.location,
         package <- inputC.package,
         structuralFeatures <- inputC.structuralFeatures
      )
}
-- @end rule Class
```

2.4.7. -- @begin rule Attribute

```
rule Attribute {
   from
      inputAttr : KM3!Attribute
   to
      outputAttr : KM3Target!Attribute (
         package <- inputAttr.package,
         name <- inputAttr.name,
         lower <- inputAttr.lower,
         upper <- inputAttr.upper,
         isOrdered <- inputAttr.isOrdered,
         isUnique <- inputAttr.isUnique,
         owner <- inputAttr.owner,
         type <- inputAttr.type
      )
}
-- @end rule Attribute
```

2.4.8. -- @begin rule Reference

```
rule Reference {
   from
      inputRef : KM3!Reference
         ( not (inputRef.isManyToManyNotContainer and
inputRef.opposite.isManyToManyNotContainer))
   to
      outputRef : KM3Target!Reference (
         package <- inputRef.package,
         name <- inputRef.name,
         lower <- inputRef.lower,
         upper <- inputRef.upper,
         isOrdered <- inputRef.isOrdered,
         isUnique <- inputRef.isUnique,
         owner <- inputRef.owner,
         type <- inputRef.type,
         isContainer <- inputRef.isContainer,
         opposite <- inputRef.opposite
      )
}
-- @end rule Reference

-- @comment This rule takes a pair of Reference and, if these are not already considered,
creates a class with two many-one association.
```

```
2.4.9.  -- @begin rule Association
rule Association {
   from
      inputA : KM3!Reference,
      inputB : KM3!Reference
      (
         inputA.opposite = inputB
         and inputA.isManyToManyNotContainer
         and inputB.isManyToManyNotContainer
         -- and inputA <> inputB
         and not thisModule.isAlreadyConsidered(inputA, inputB)
      )


   to
      outputA : KM3Target!Class (
         package <- inputA.owner.package,
         name <- inputA.owner.name,
         isAbstract <- inputA.owner.isAbstract,
         structuralFeatures <- inputA.owner.structuralFeatures-
>select(b|b.oclIsTypeOf(KM3!Reference))->select(a| not a.isManyToManyNotContainer),
         structuralFeatures <- inputA.owner.structuralFeatures-
>select(b|b.oclIsTypeOf(KM3!Attribute)),
         structuralFeatures <- referenceAC
      ),
      outputB : KM3Target!Class (
         package <- inputB.owner.package,
         name <- inputB.owner.name,
         isAbstract <- inputB.owner.isAbstract,
         structuralFeatures <- inputB.owner.structuralFeatures-
>select(b|b.oclIsTypeOf(KM3!Reference))->select(a| not a.isManyToManyNotContainer),
         structuralFeatures <- inputB.owner.structuralFeatures-
>select(b|b.oclIsTypeOf(KM3!Attribute)),
         structuralFeatures <- referenceBC
      ),
      outputC : KM3Target!Class (
         package <- inputA.owner.package,
         name <- inputA.owner.name->concat(inputB.owner.name),
         isAbstract <- false,
         structuralFeatures <- referenceCA,
         structuralFeatures <- referenceCB

      ),
      referenceAC : KM3Target!Reference (
         name <- inputA.name,
         lower <- 1,
         upper <- 1,
         isOrdered <- false,
         isUnique <- false,
         owner <- outputA,
         isContainer <- false,
         opposite <- referenceCA
      ),
      referenceCA : KM3Target!Reference (
         name <- outputC.name->concat('1'),
         lower <- 0,
         upper <- 0-1,
         isOrdered <- false,
         isUnique <- false,
         owner <- outputC,
         isContainer <- false,
         opposite <- referenceAC
      ),
      referenceBC : KM3Target!Reference (
         name <- inputB.name,
         lower <- 1,
         upper <- 1,
         isOrdered <- false,
         isUnique <- false,
         owner <- outputB,
         isContainer <- false,
         opposite <- referenceCB
      ),
      referenceCB : KM3Target!Reference (
         name <- outputC.name->concat('2'),
         lower <- 0,
         upper <- 0-1,
         isOrdered <- false,
         isUnique <- false,
         owner <- outputC,
         isContainer <- false,
         opposite <- referenceBC
      )

}
--@end rule Association
```

3. References

[1] Catalogue of Model Transformations
   http://www.dcs.kcl.ac.uk/staff/kcl/tcat.pdf