

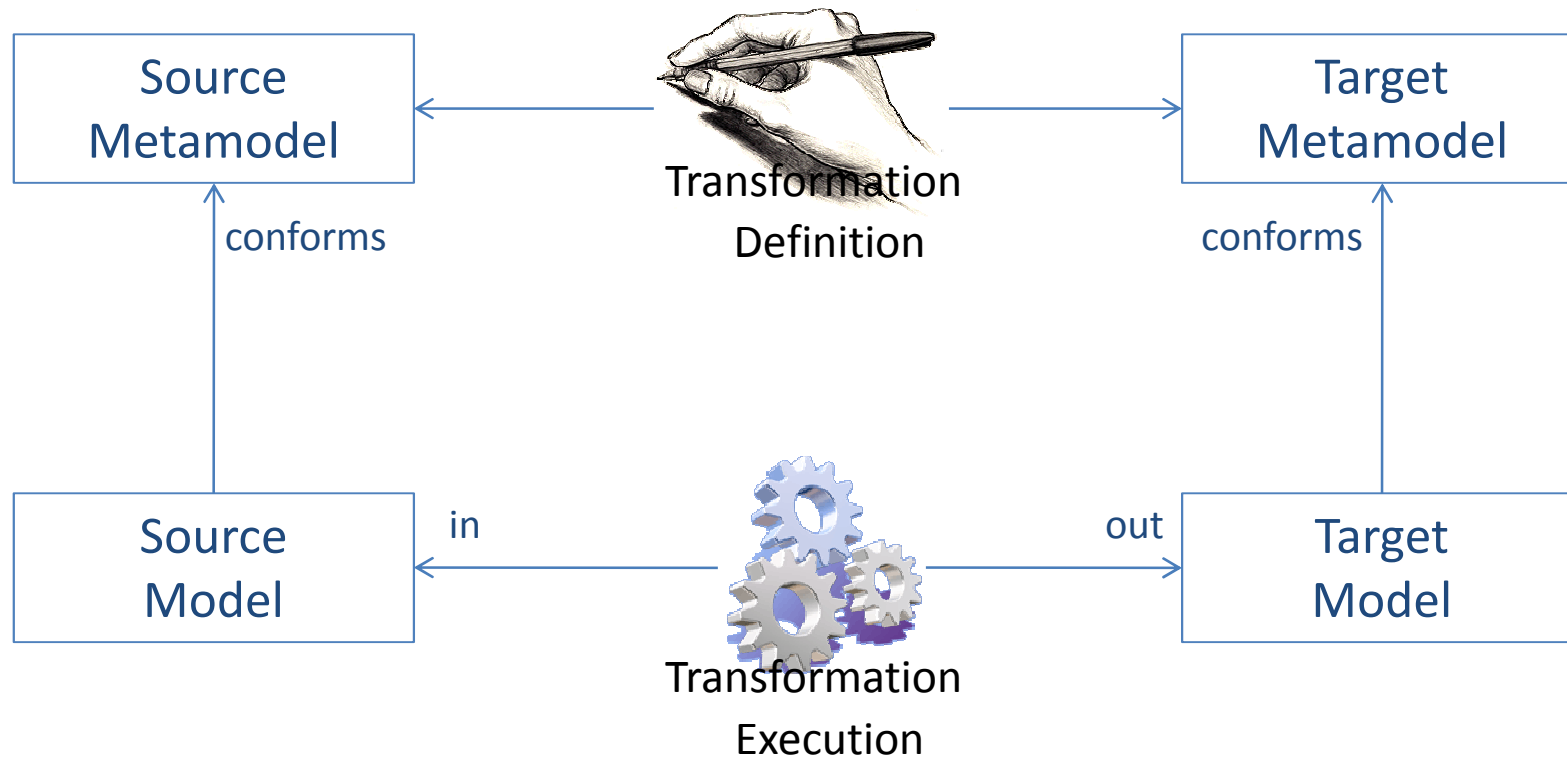
# Towards Transformation Migration After Metamodel Evolution

David Méndez<sup>1,2</sup>, Anne Etien<sup>2</sup>, Alexis Muller<sup>2</sup>,  
Rubby Casallas<sup>1</sup>

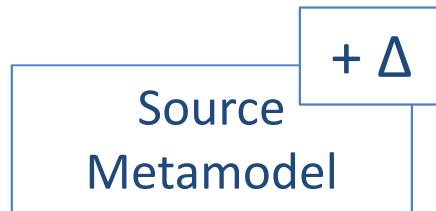
<sup>1</sup> TICSw Research Group,  
Universidad de los Andes, Colombia  
[df.mendez73,rcasallas}@uniandes.edu.co](mailto:{df.mendez73,rcasallas}@uniandes.edu.co)

<sup>2</sup> LIFL CNRS UMR 8022,  
Université Lille 1, INRIA Lille Nord Europe, France  
[Anne.Etien,Alexis.Muller}@lfl.fr](mailto:{Anne.Etien,Alexis.Muller}@lfl.fr)

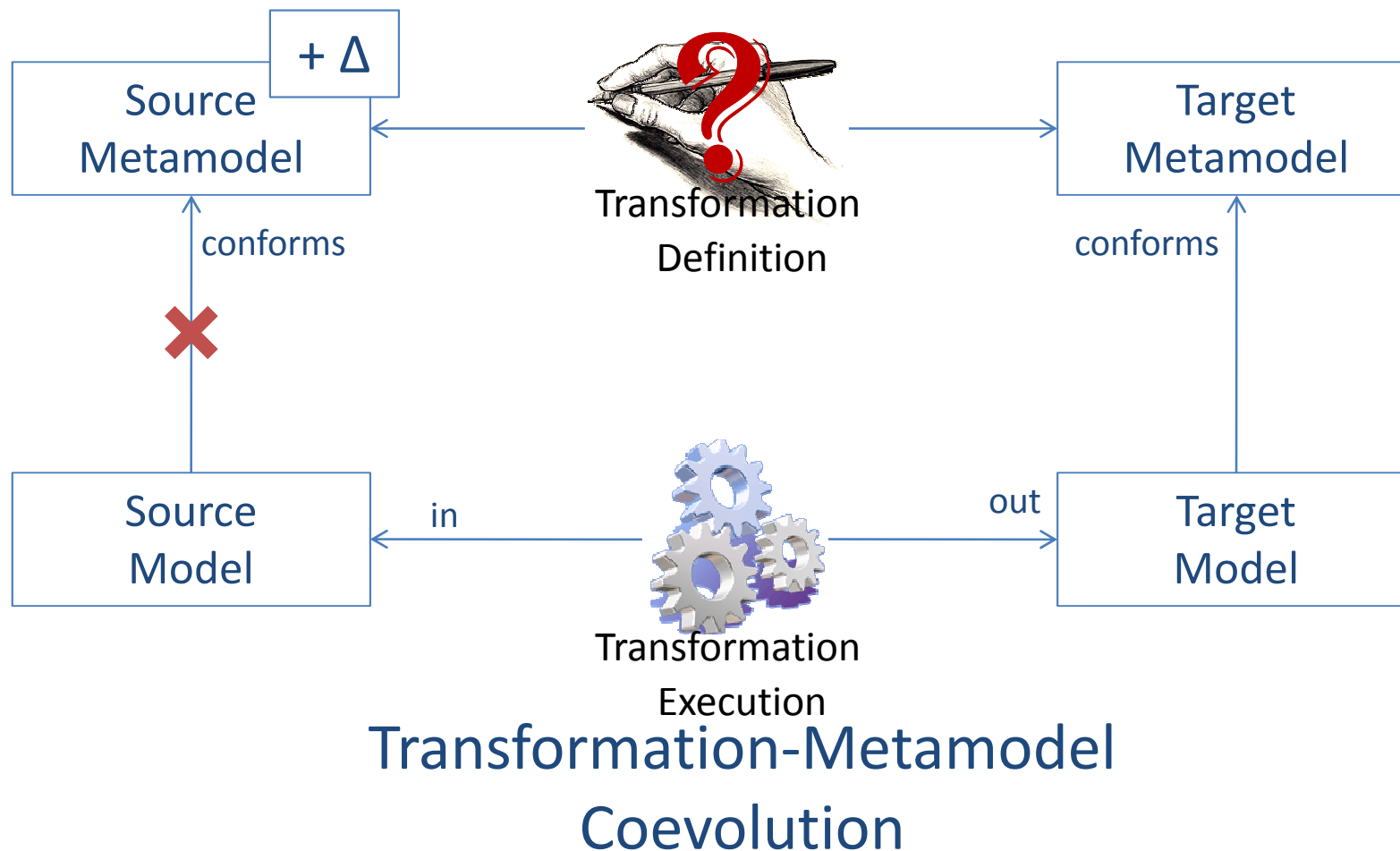
# Context



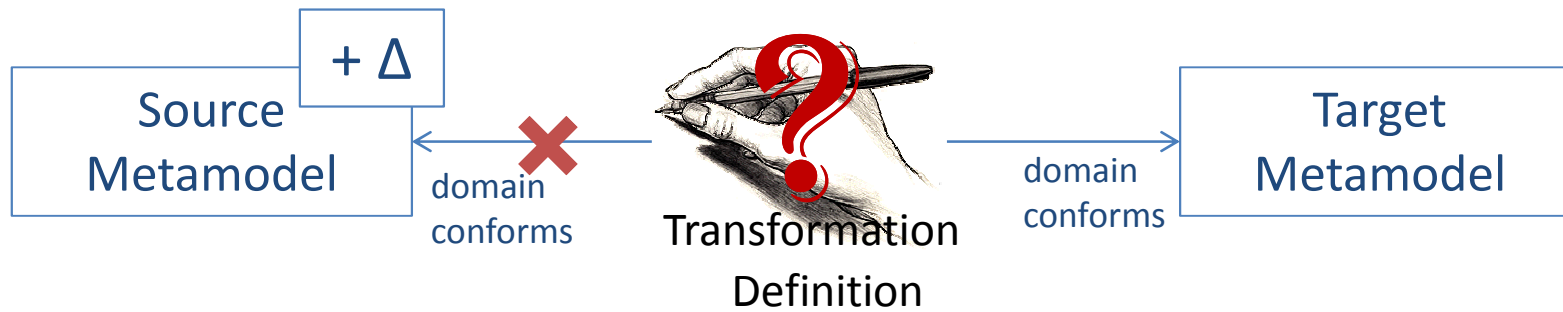
# Challenge



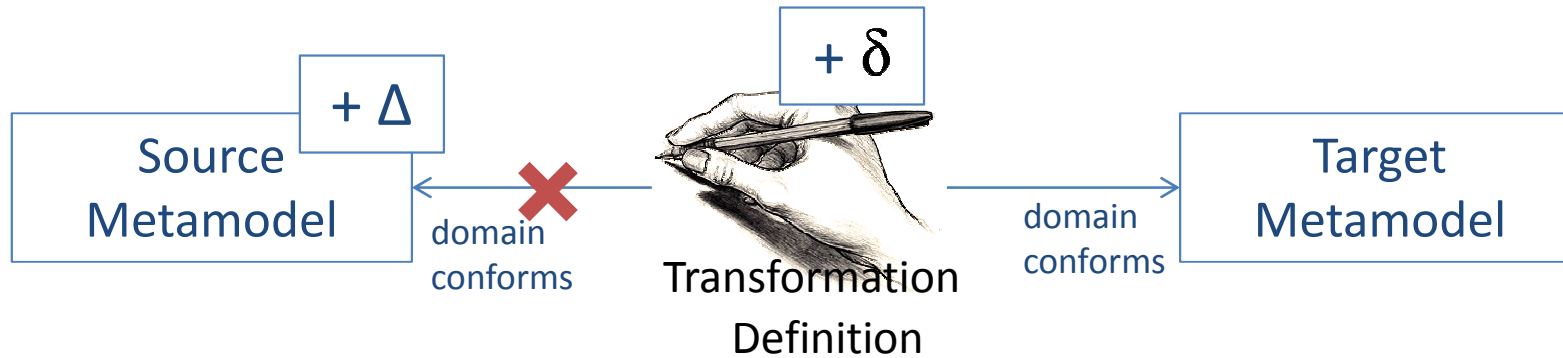
# Challenge



# Our proposition



# Our proposition



# Our proposition

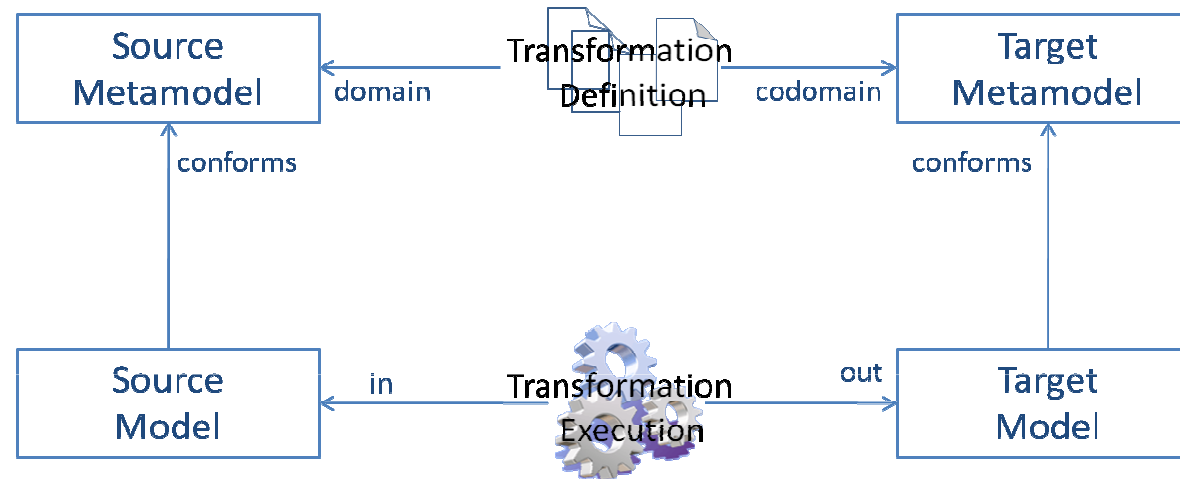


# Agenda

- Domain conformance
- Transformation migration process
- Impact analysis phase
- Example
- Conclusion

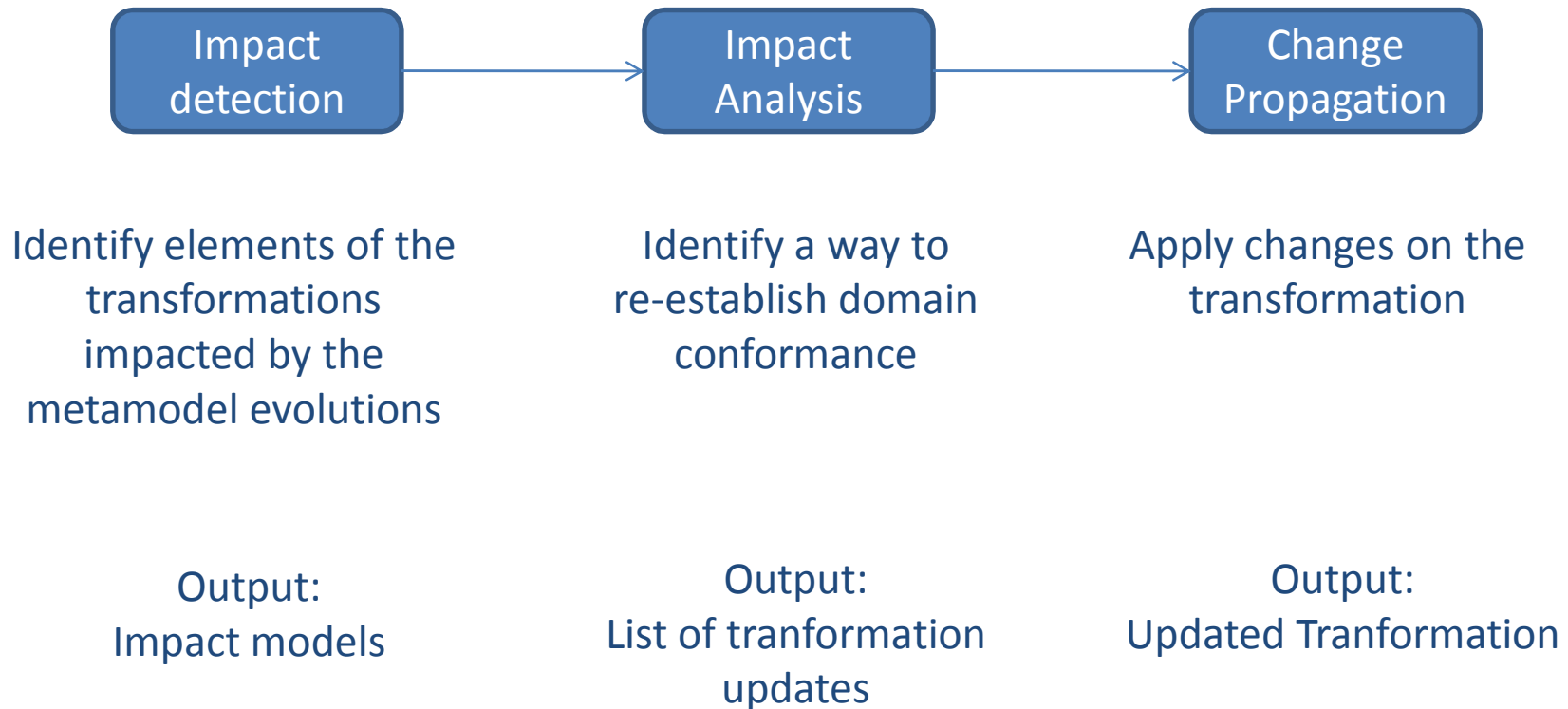


# Domain conformance relationship

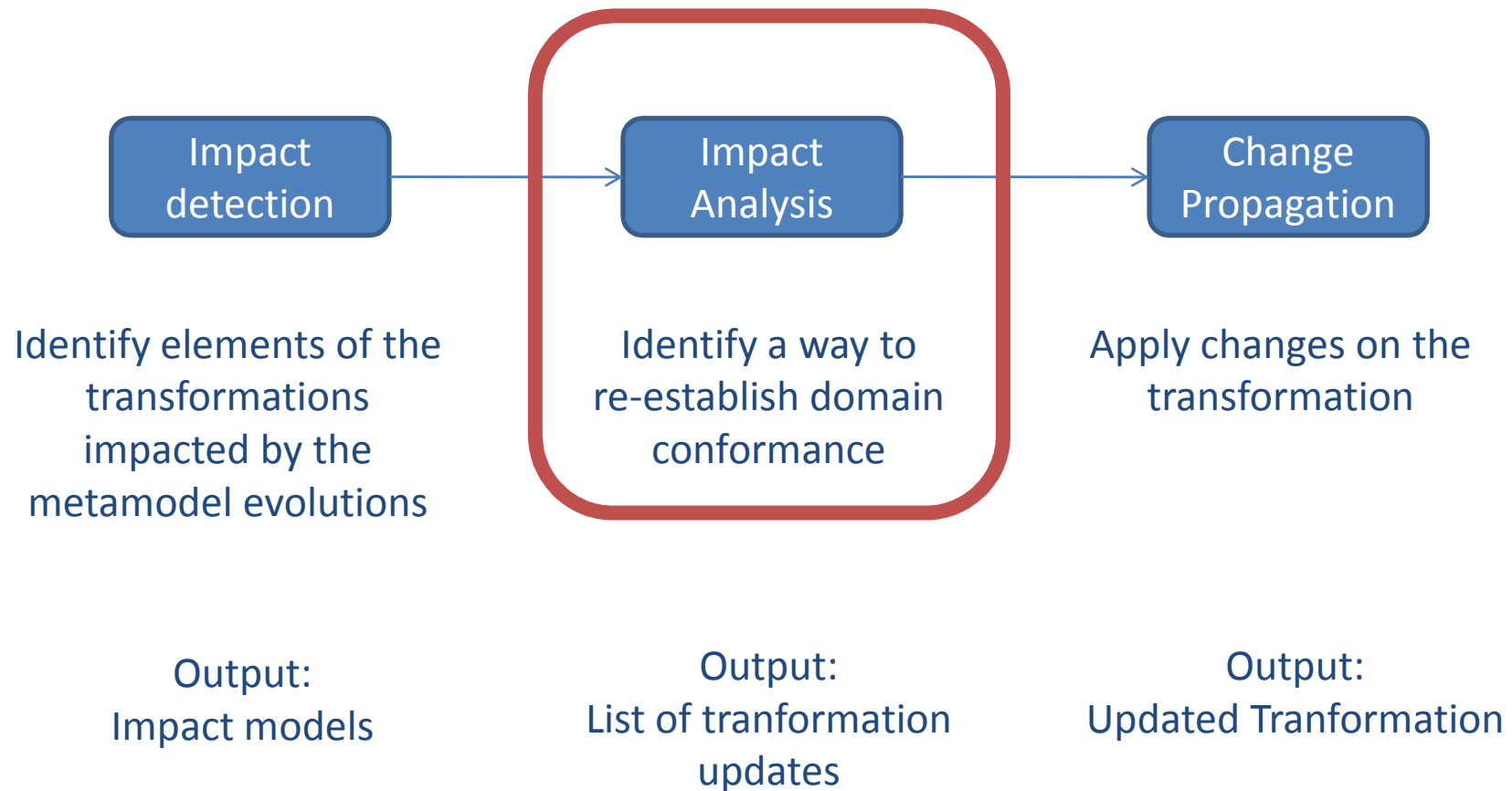


- Domain is the set of elements involved in the source patterns of the rules
- Codomain is the set of elements involved in the target patterns of the rules
- $T$ ,  $MM_s$  and  $MM_t$  respect the domain conformance if
  - $\text{domain}(T) \subset MM_s$
  - $\text{codomain}(T) \subset MM_t$
  - Inclusion of the well formedness constraints defined in  $MM_t$  in the  $\text{codomain}(T)$

# Transformation migration process



# Transformation migration process



# Impact analysis phase

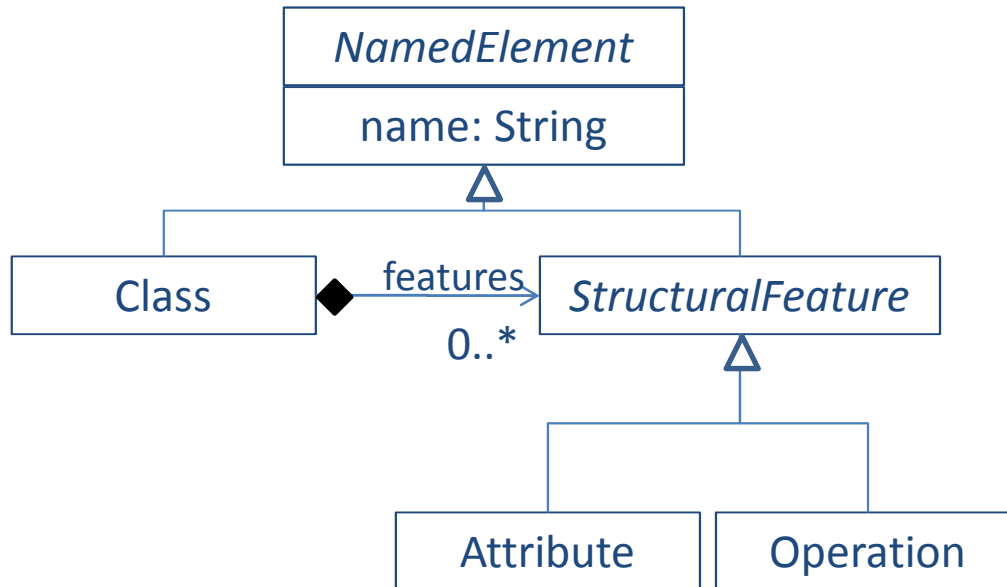
- Objective:
  - Identifying a set of modifications to perform on the transformation that might re-establish domain conformance.
- Those actions depend on:
  - Metamodel on which change was performed (source or target)
  - Type of change

# Impact analysis phase

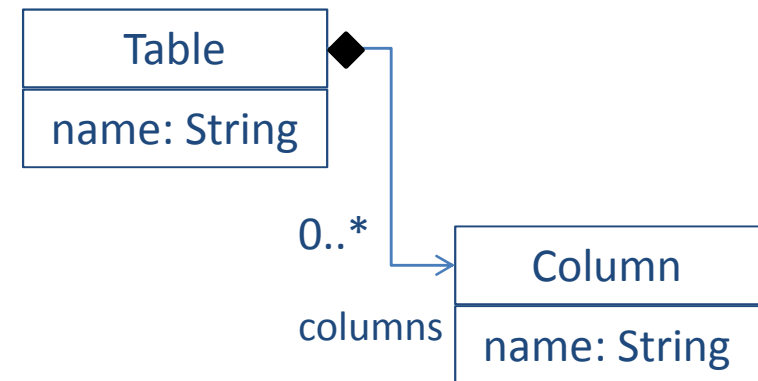
- First identification of a set of potential actions
  - Rename Class/Property in the metamodel
    - ➔ Changing the name of the renamed class / property in the transformation
  - Introduce a Class in the source metamodel
    - ➔ The domain conformance is not affected; the propagation depends of the purpose of the transformation
  - Introduce a Class in the target metamodel
    - ➔ The domain conformance may be affected (multiplicities 1, 1..\*, 1..n).  
Creating a new rule or modifying an existing one

# Example: Input and Output metamodel

Excerpt of the Input Metamodel

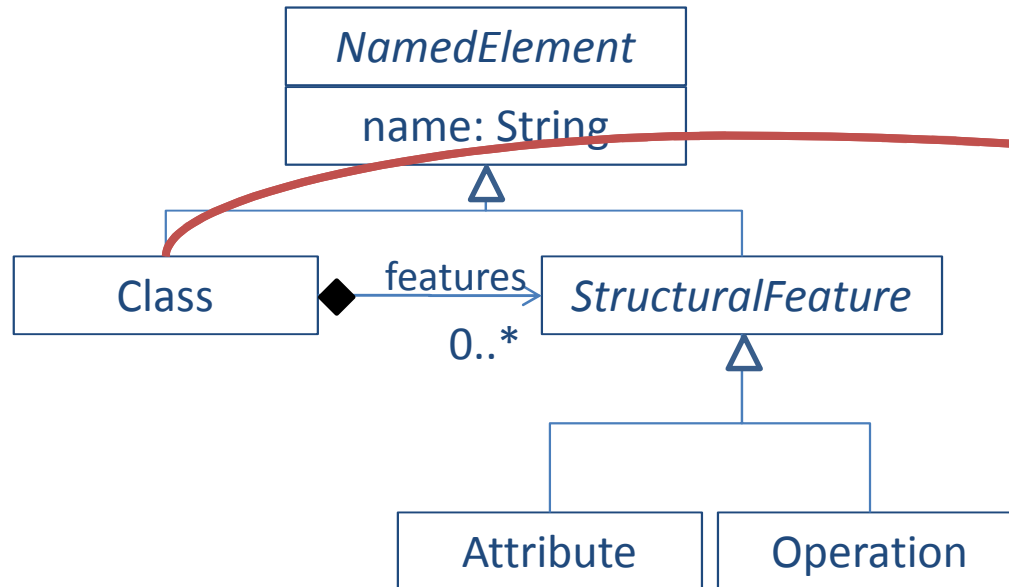


Excerpt of the Output Metamodel

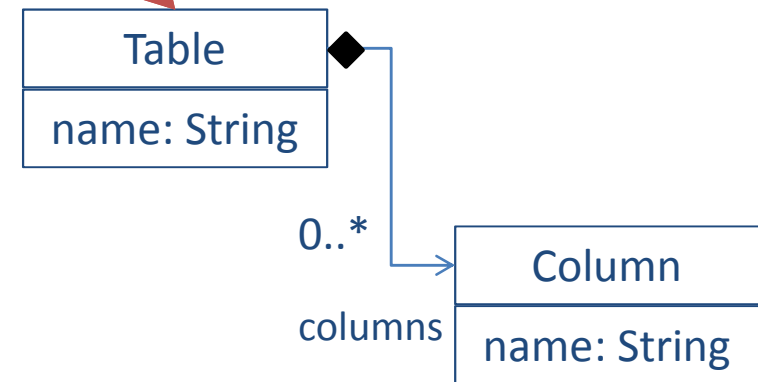


# Example: UML2RDBMS transformation

## Excerpt of the Input Metamodel



## Excerpt of the Output Metamodel

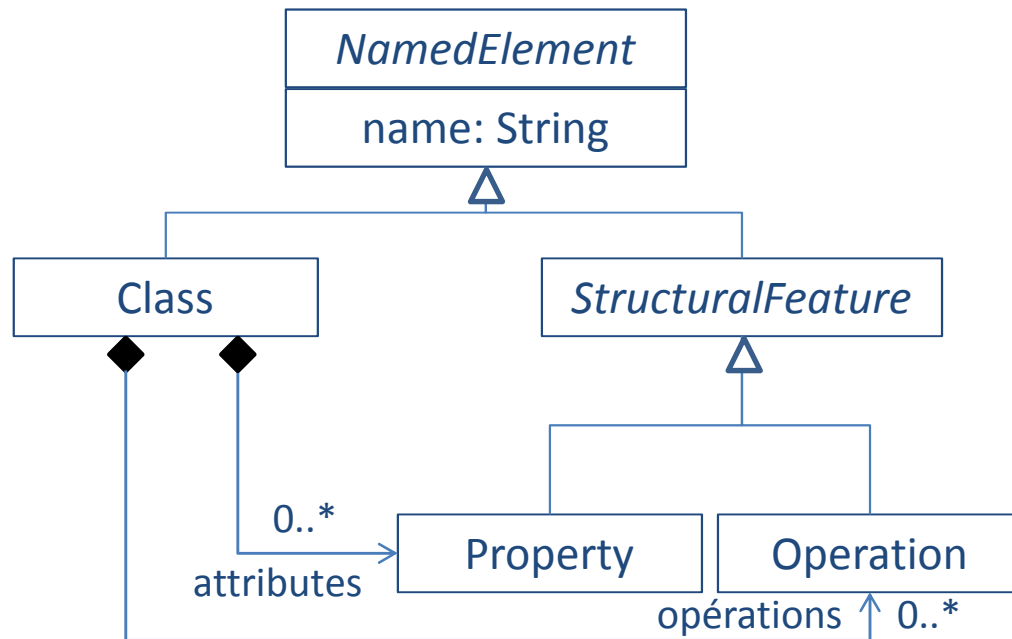


## Excerpt of the transformation

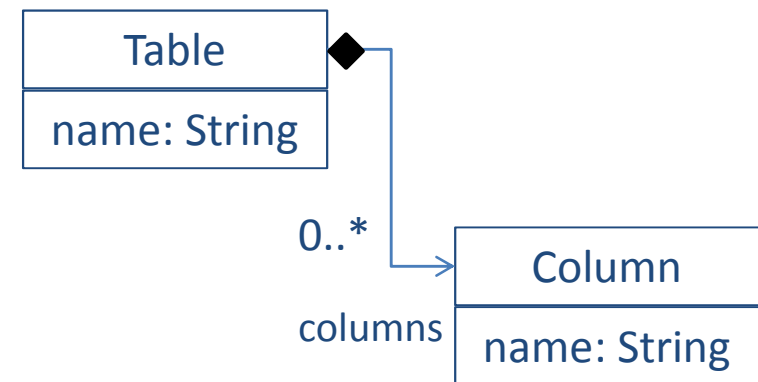
```
mapping UML::Class::ClassToTable() : RDBS : Table {
  name := self.name;
  columns += self.features[UML::Attribute]->map DataTypeAttributeToColumn();
}
```

# Example: Evolution of the source MM

Excerpt of the Input Metamodel



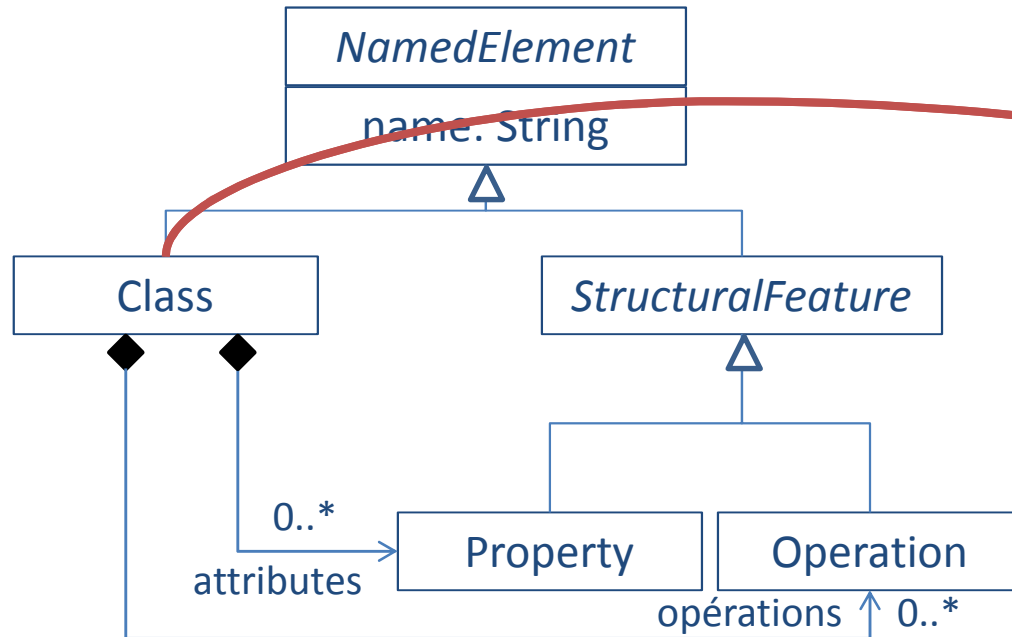
Excerpt of the Output Metamodel



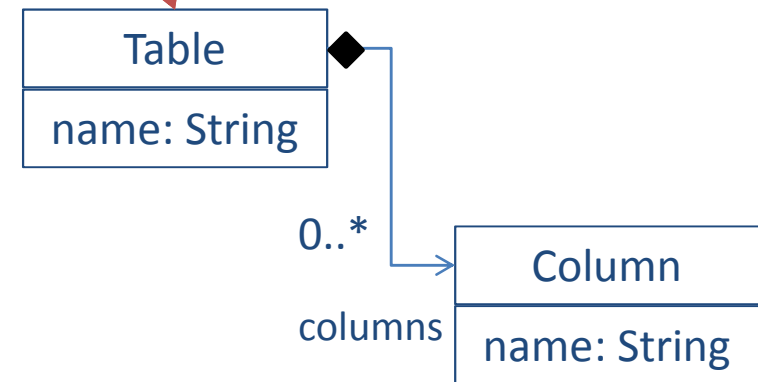


# Example: Impact detection phase

Excerpt of the Input Metamodel



Excerpt of the Output Metamodel



Excerpt of the original transformation

```

mapping UML::Class::ClassToTable() : RDBS : Table {
  name := self.name;
  columns += self.features[UML::Attribute]->map DataTypeAttributeToColumn();
}
    
```

**ERROR**

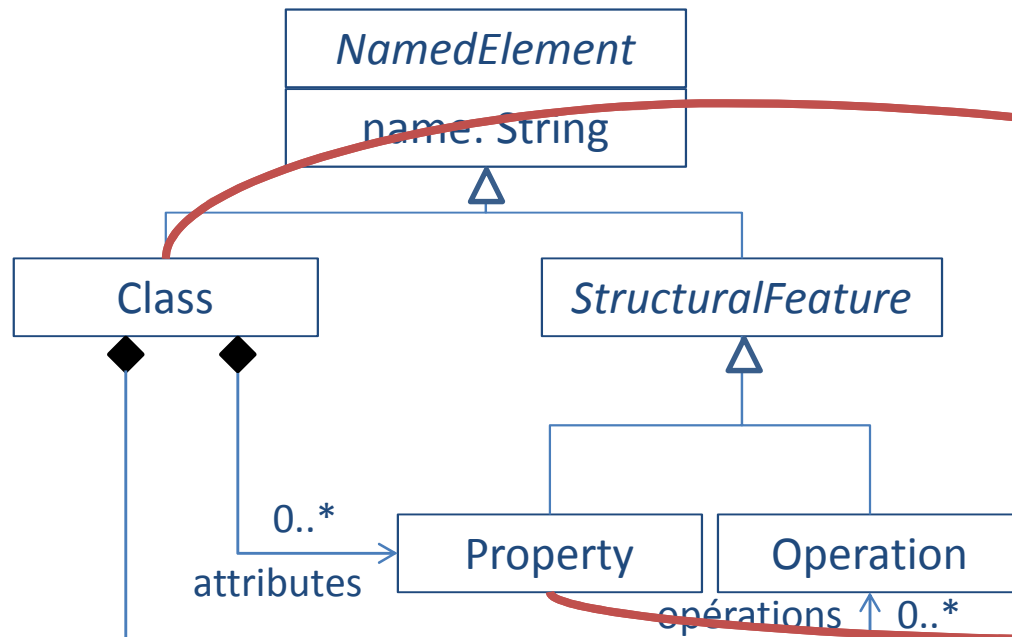
**ERROR**

# Example: Impact analysis

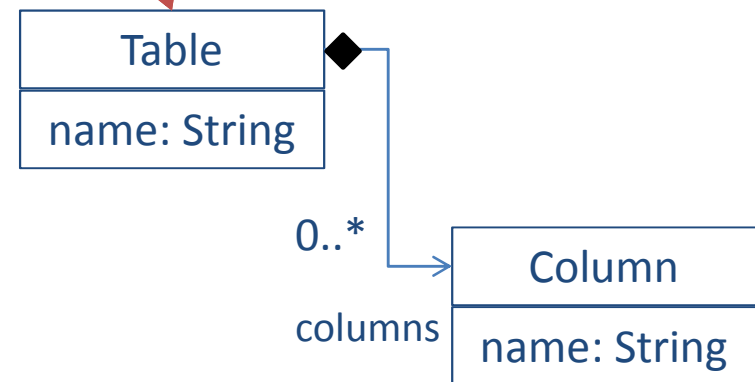
- Modifications to apply on the transformation
  - Replace the *features* collection by the *attributes* one
  - Replace the *Attribute Class* by the *Property Class*
  - ...
- Some modifications may be automatically identified; other only assisted.

# Example: Impact analysis

Excerpt of the Input Metamodel



Excerpt of the Output Metamodel



Excerpt of the updated transformation

```

mapping UML::Class::ClassToTable() : RDBS : Table {
  name := self.name;
  columns += self.attributes[UML::Property]->map DataTypeAttributeToColumn();
}

```

# Conclusion

- Transformation-Metamodel coevolution: a new research area
- Introduction of the domain conformance relationship
- Propositions for the impact analysis phase

# Open questions ????



Identify elements of the transformations impacted by the metamodel evolutions

Difference / Comparison between metamodels

Identify a way to re-establish domain conformance

Apply changes on the transformation

High order Transformation, Adapted language, Co-evolution operators?

Managing model-metamodel and transformation-metamodel jointly?