Representing feature models as class diagrams

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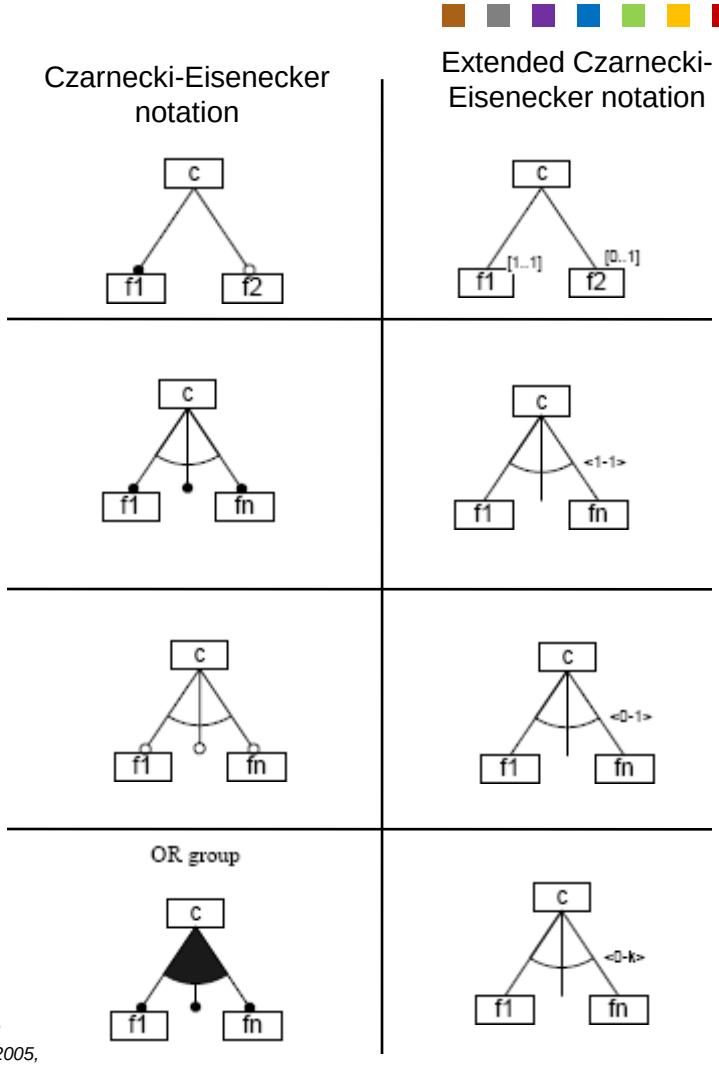
Metamodels

Notation

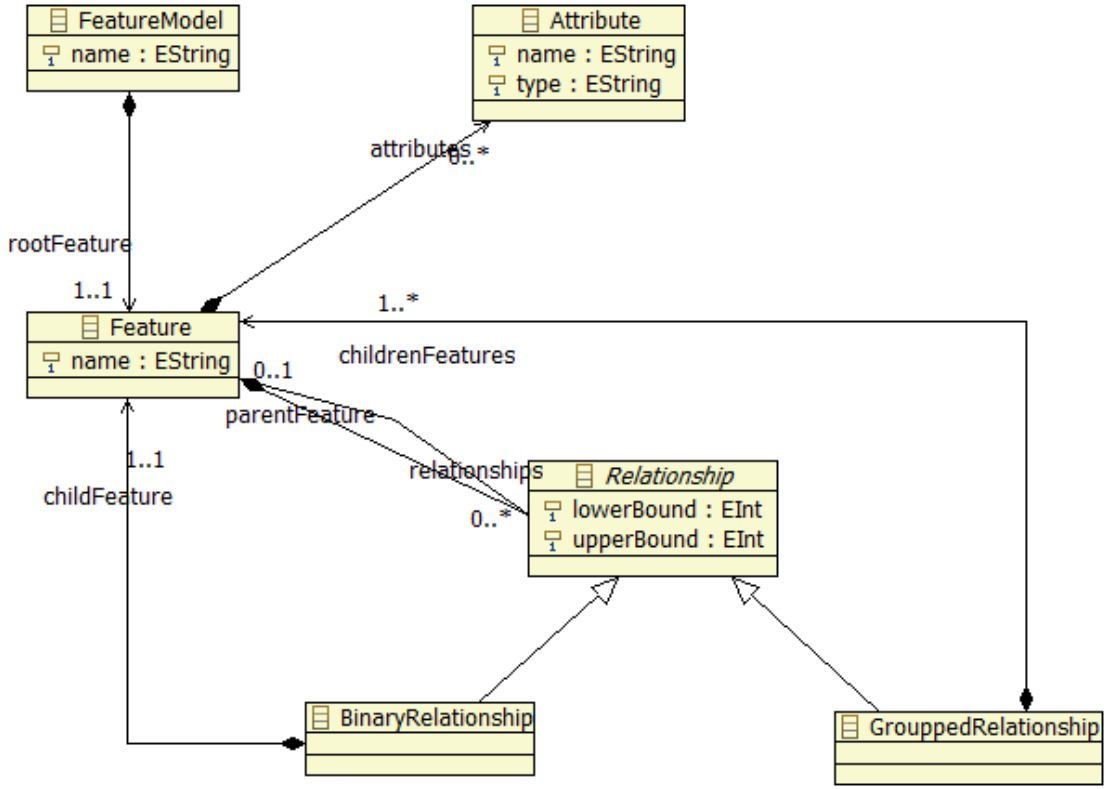
- Binary relationships:
  - Mandatory
  - Optional
- Groupped relationships:
  - Alternative (XOR)
    - XOR
    - XOR with optional subfeatures
  - Optional (OR)



* Figures from *ŠÍPKA, M.: Exploring the Commonality in Feature Modeling Notations. In: IIT.SRC 2005 – Informatics and Information Technology Student Research Conference. Bratislava, April 2005, V. Vranić (supervisor), – pp. 139–144.*

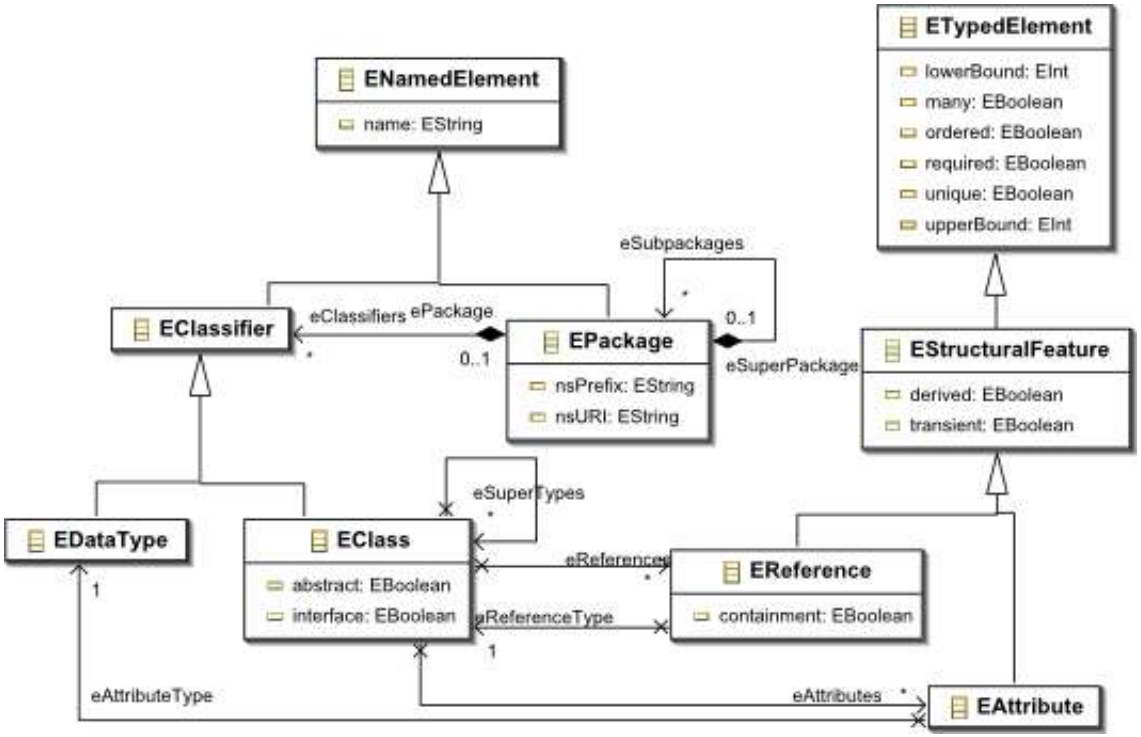
Feature metamodel

- In the feature metamodel the previous relationships are described by using the *lowerBound* and *upperBound* attributes.
- We have also extended the metamodel in order to enrich the features with attributes.



Simplified UML-Class diagram metamodel

- We use Ecore as a simplified version of the UML Class diagram metamodel.



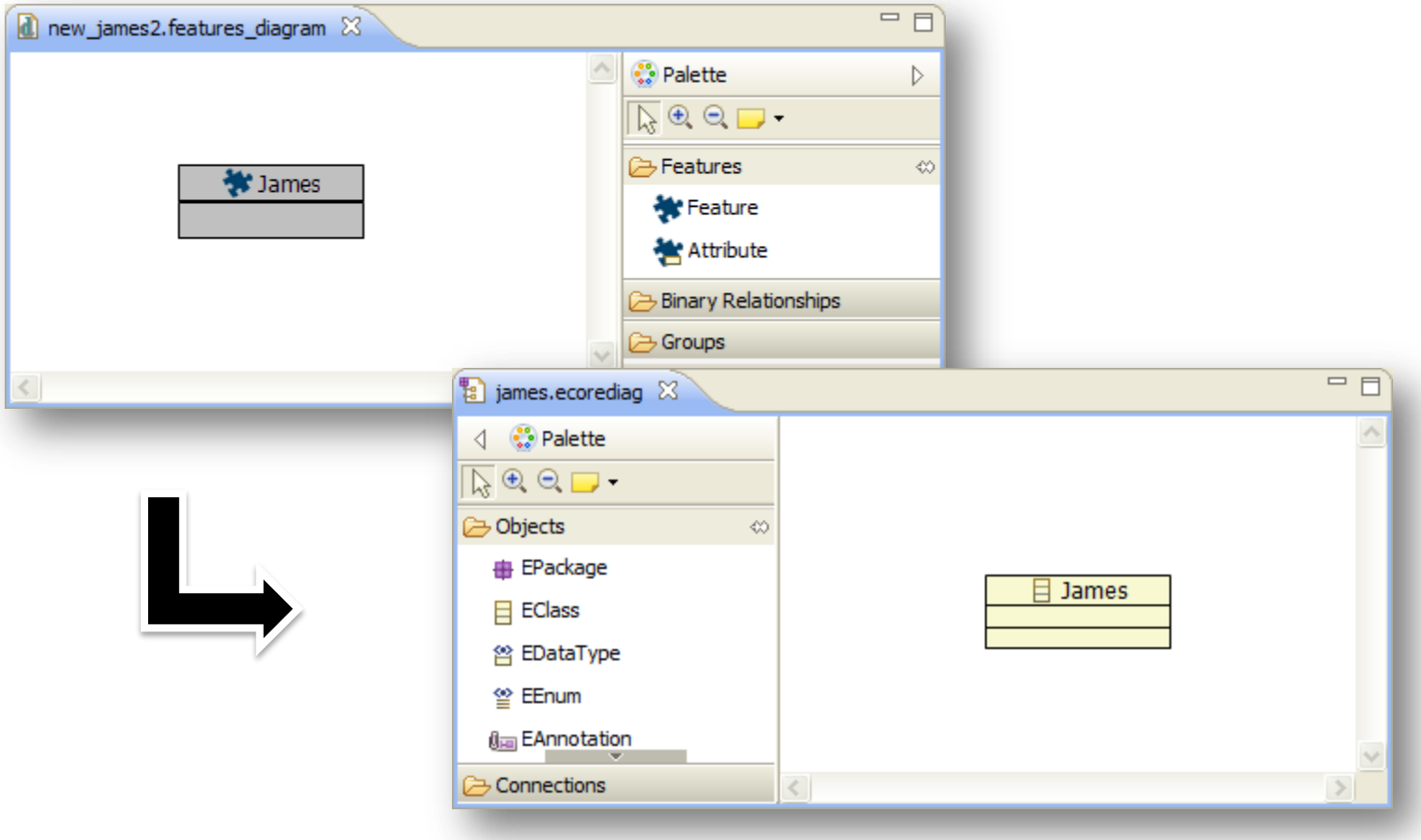
* Simplified subset of the Ecore metamodel

Transformation

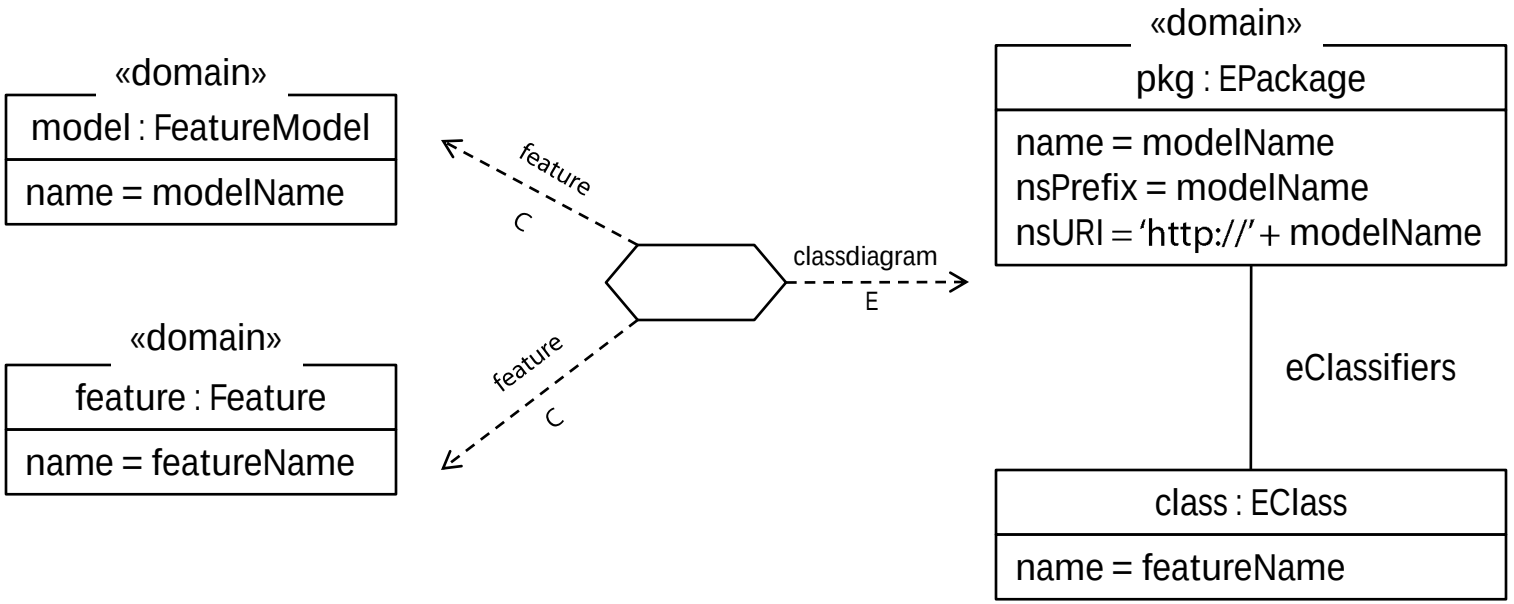
From feature models to class diagrams

Relation Feature2Class

- Each *feature* is transformed to a *class* (Eclass).

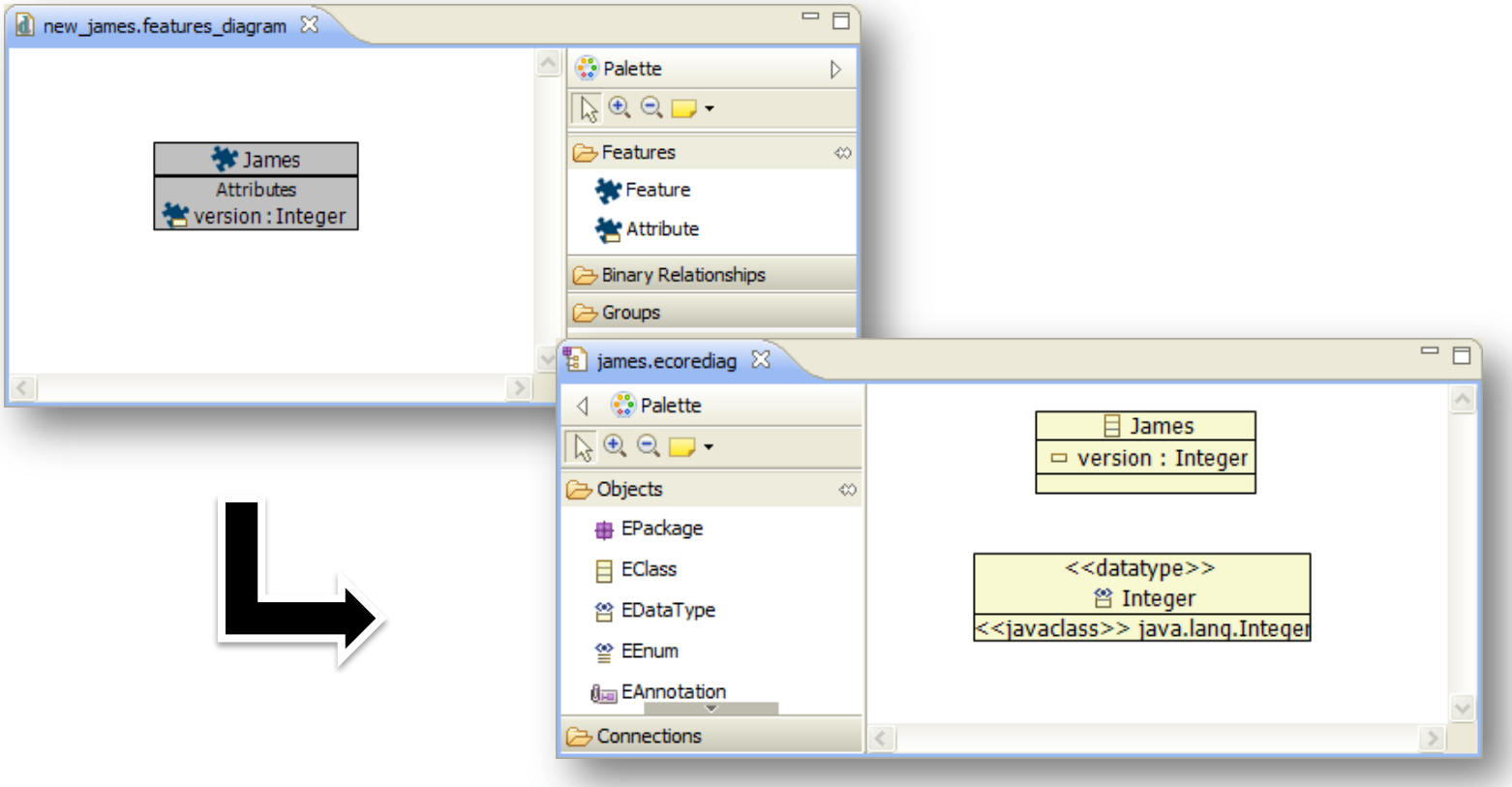


Relation Feature2Class

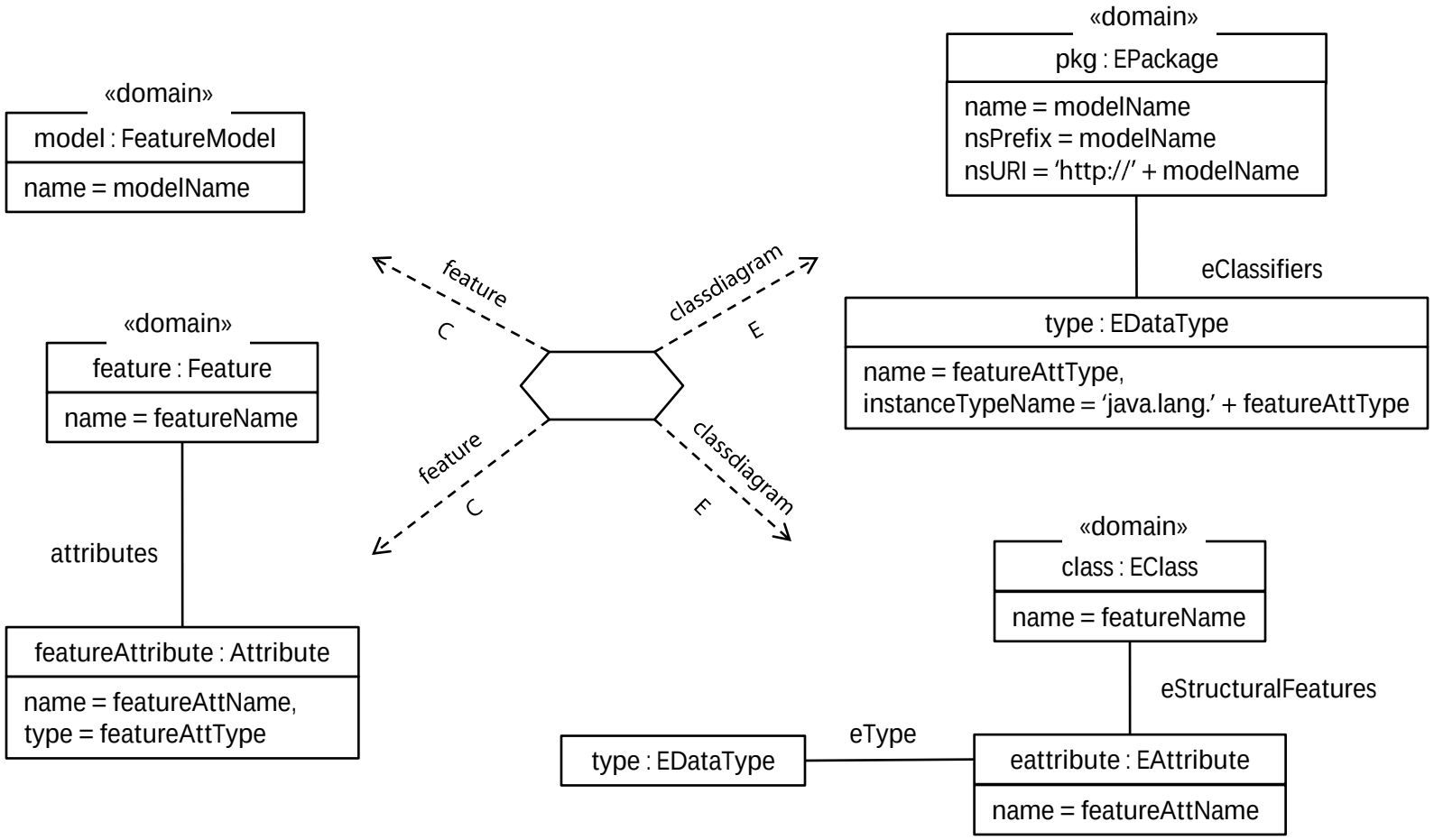


Relation FeatureAttribute2ClassAttribute

- Each feature *attribute* is transformed to a *class attribute* (EAttribute).
- The *type* of the attribute is transformed to a *EDataType*.

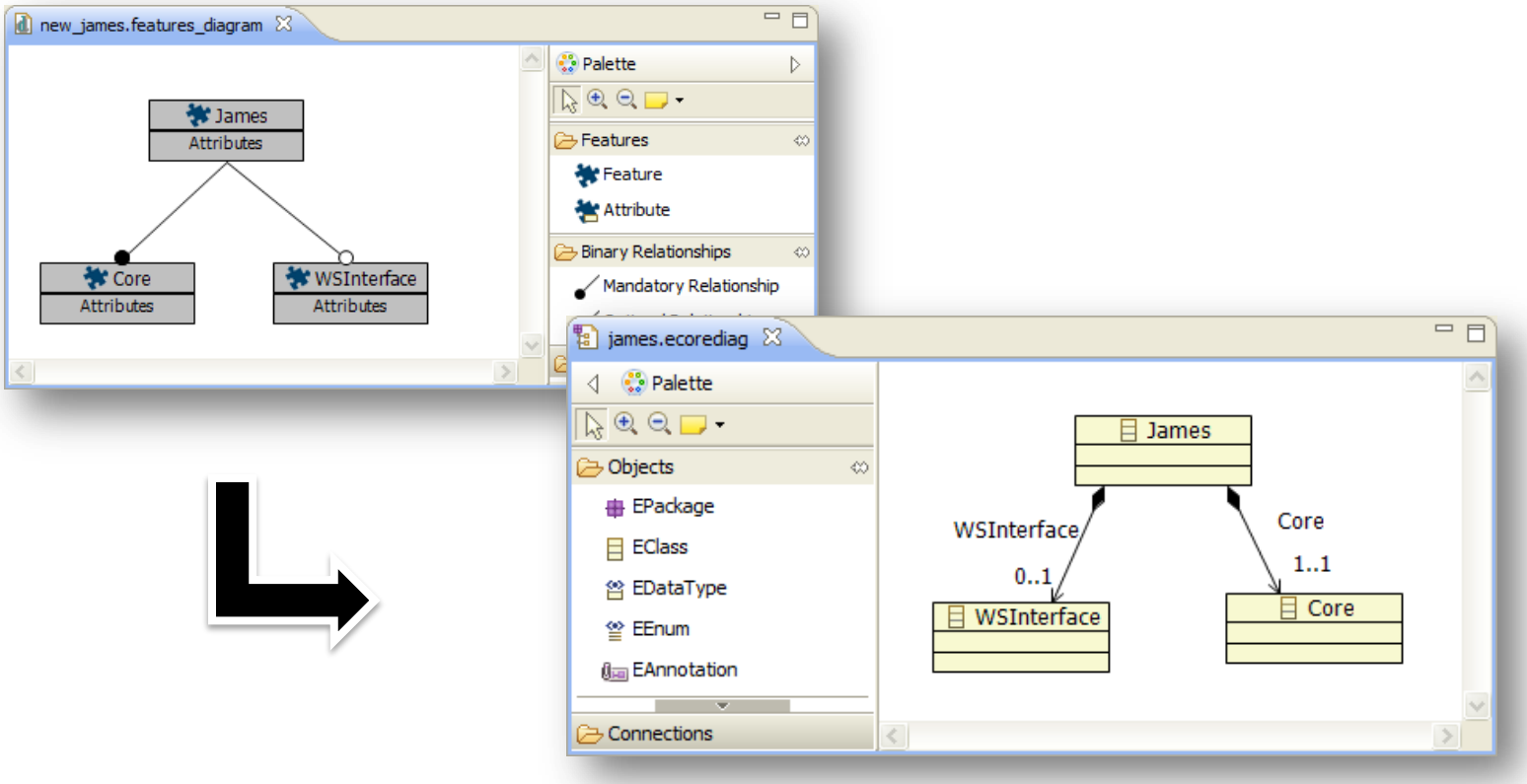


Relation FeatureAttribute2ClassAttribute

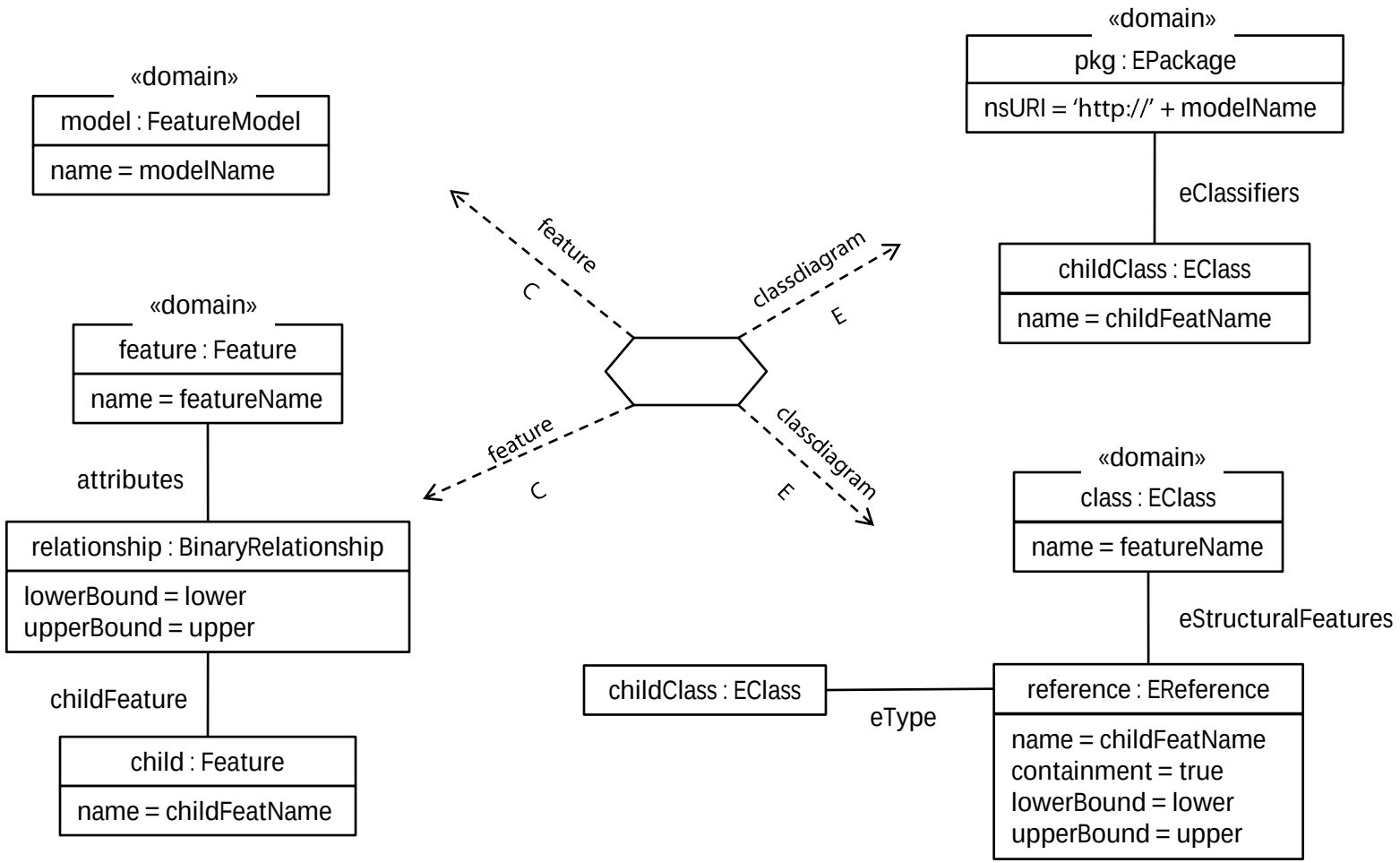


Relation SimpleRelationship2Reference

- Each *BinaryRelationship* is transformed to a UML composition (*containment EReference*).
- The type of relationship determines de multiplicity of the *EReference*.

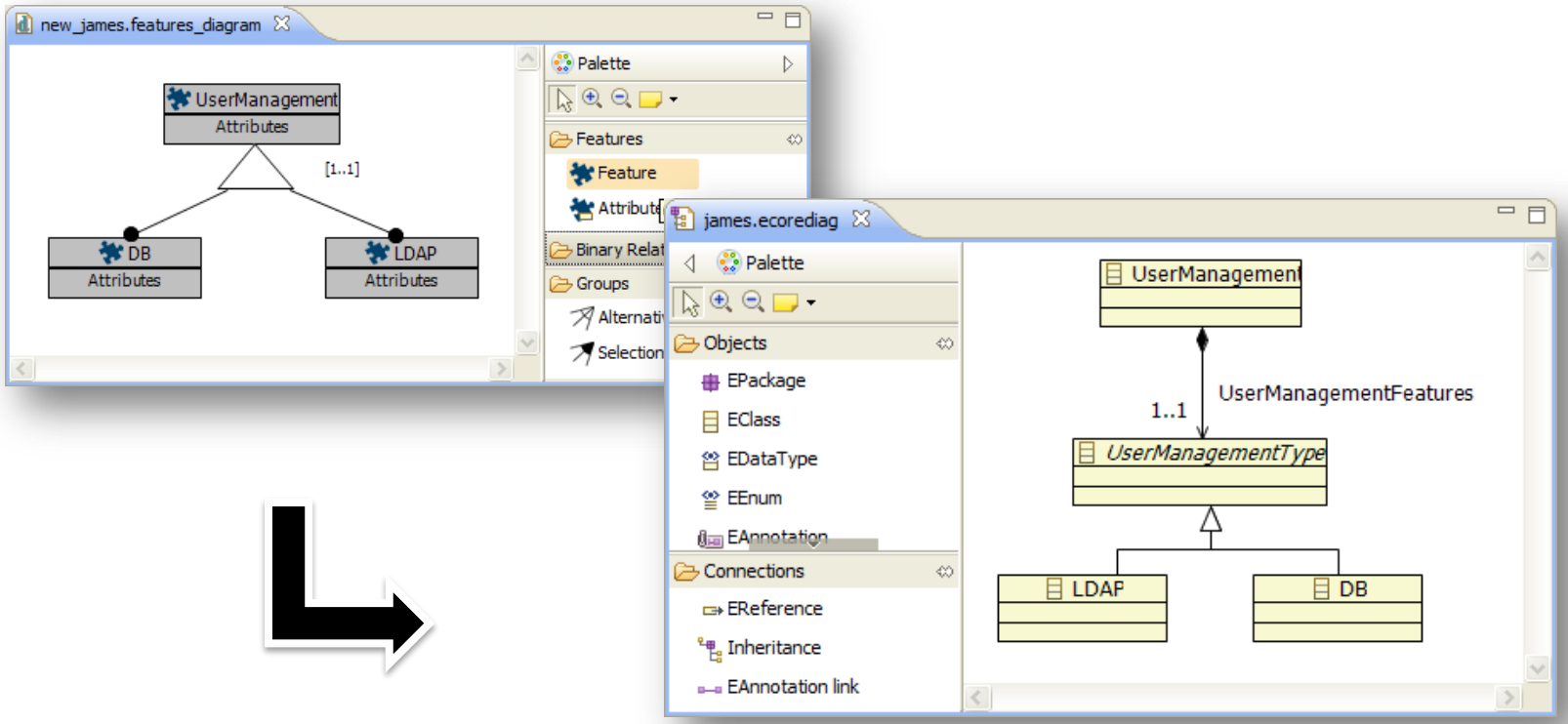


Relation SimpleRelationship2Reference

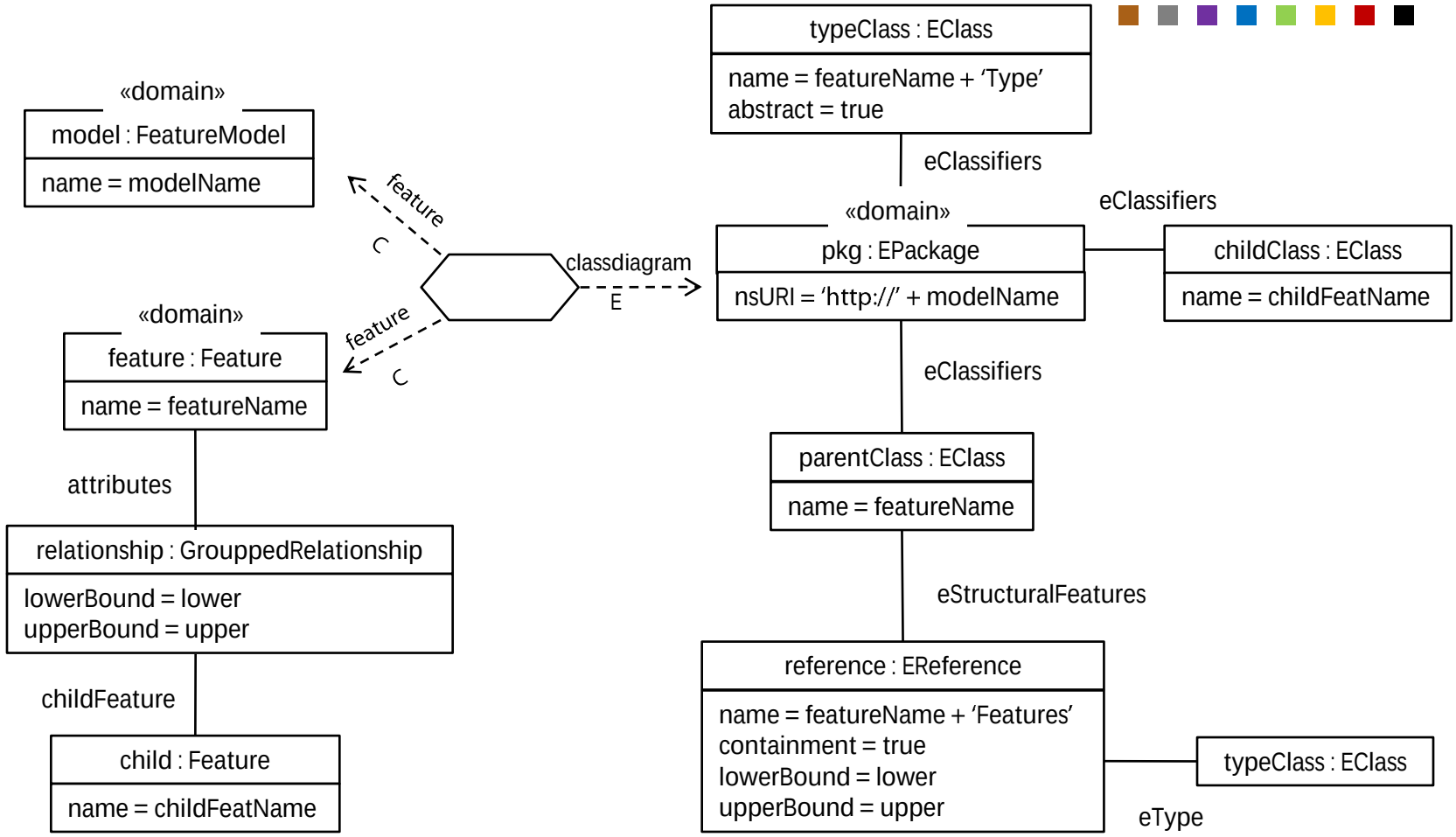


Relation MultipleRelationship2Reference

- Each *GrouppedRelationship* is transformed to a *containment EReference*.
- Each *child feature* inherits from a new class whose name derives from the parent feature. The inheritance relationship is set in the relation «*MultipleRelationshipChilds2Classes*»



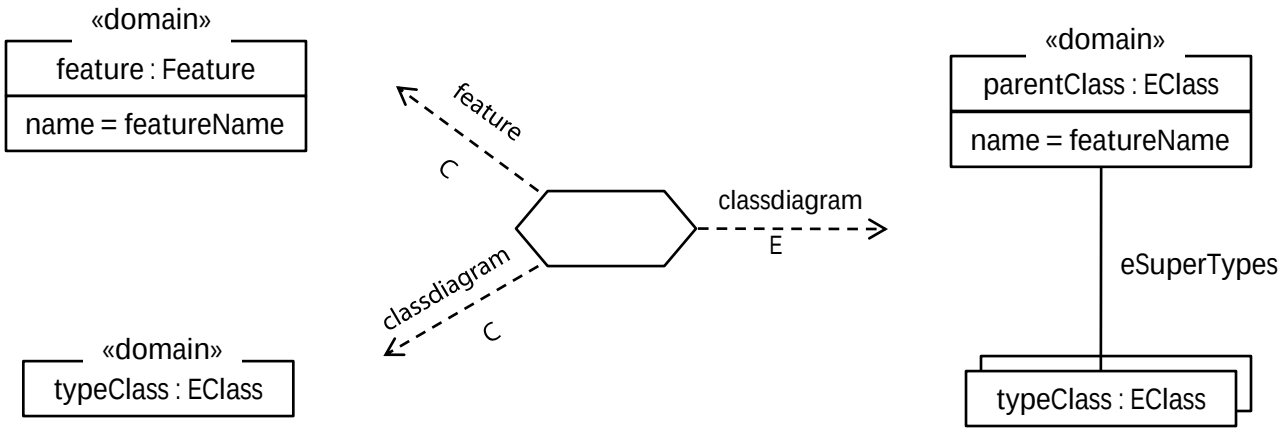
Relation MultipleRelationship2Reference



where

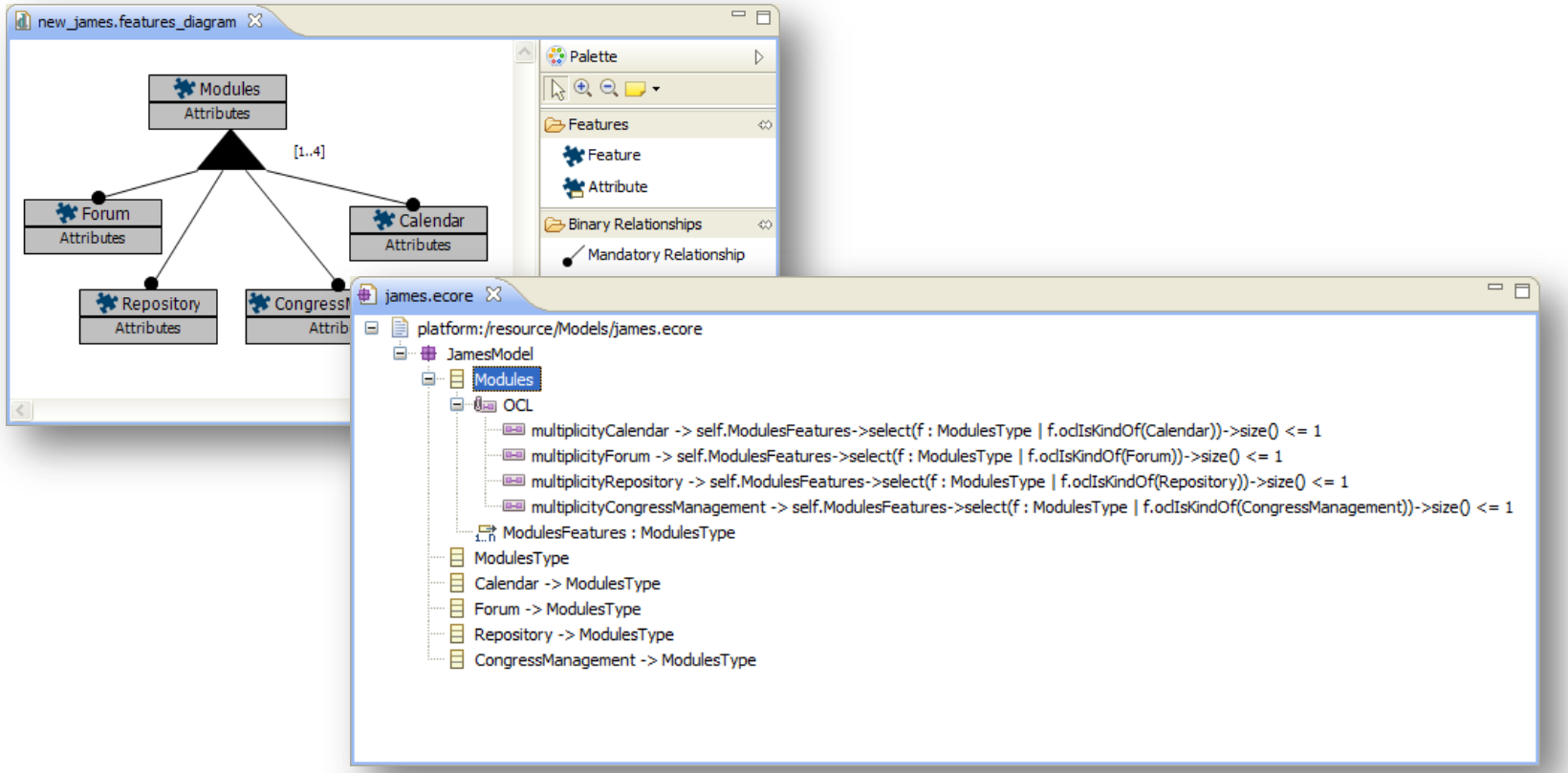
MultipleRelationshipChilds2Classes(childFeature, typeClass, childClass);
MultipleRelationshipChilds2Annot(childFeature, featureName, parentClass);

Relation MultipleRelationshipChilds2Classes

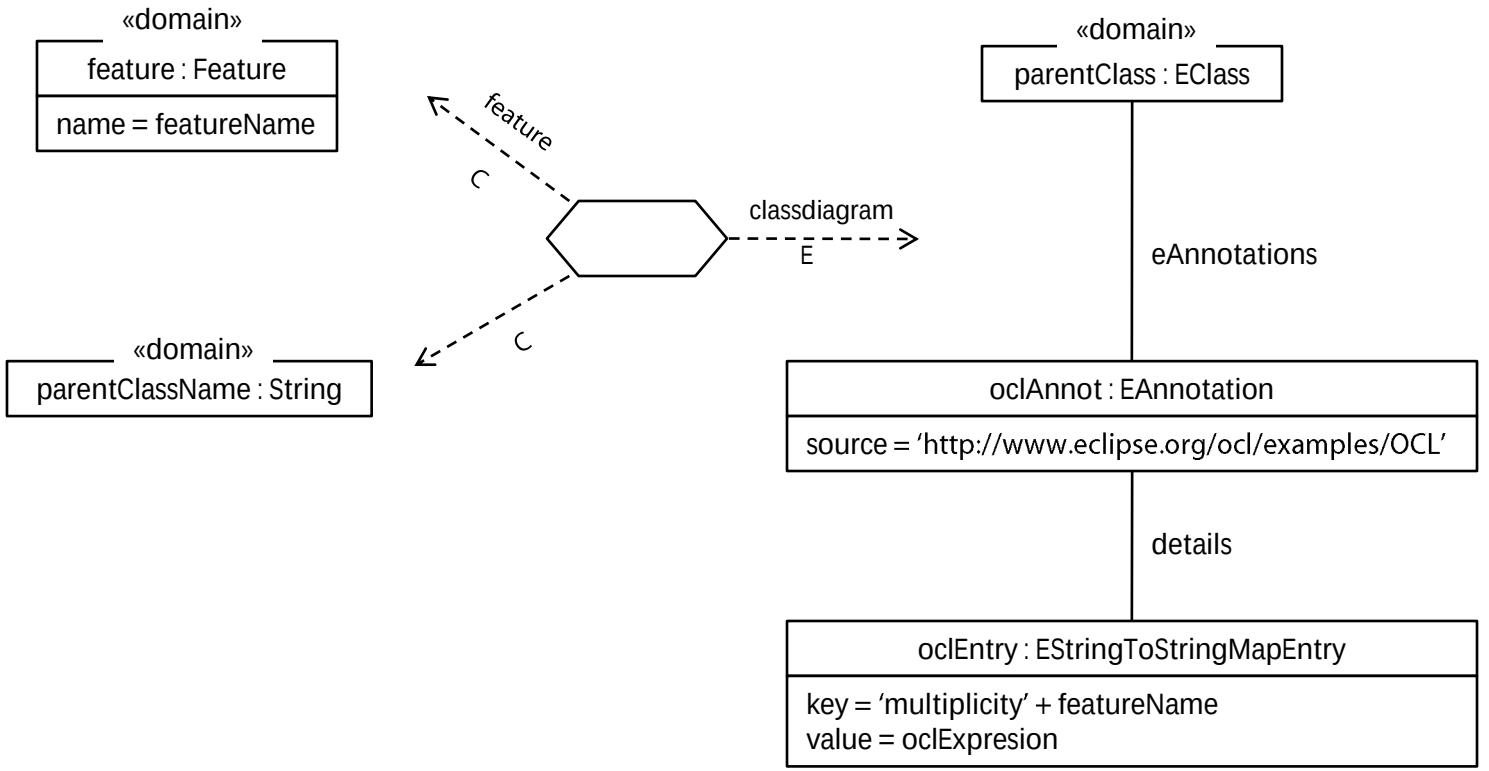


Relation MultipleRelationshipChilds2Annot

- When the *upperBound* of the *GrouppedRelationship* is greater than 1, we can automatically generate OCL invariants to avoid duplicated elements in the feature model instance.



Relation MultipleRelationshipChilds2Annot

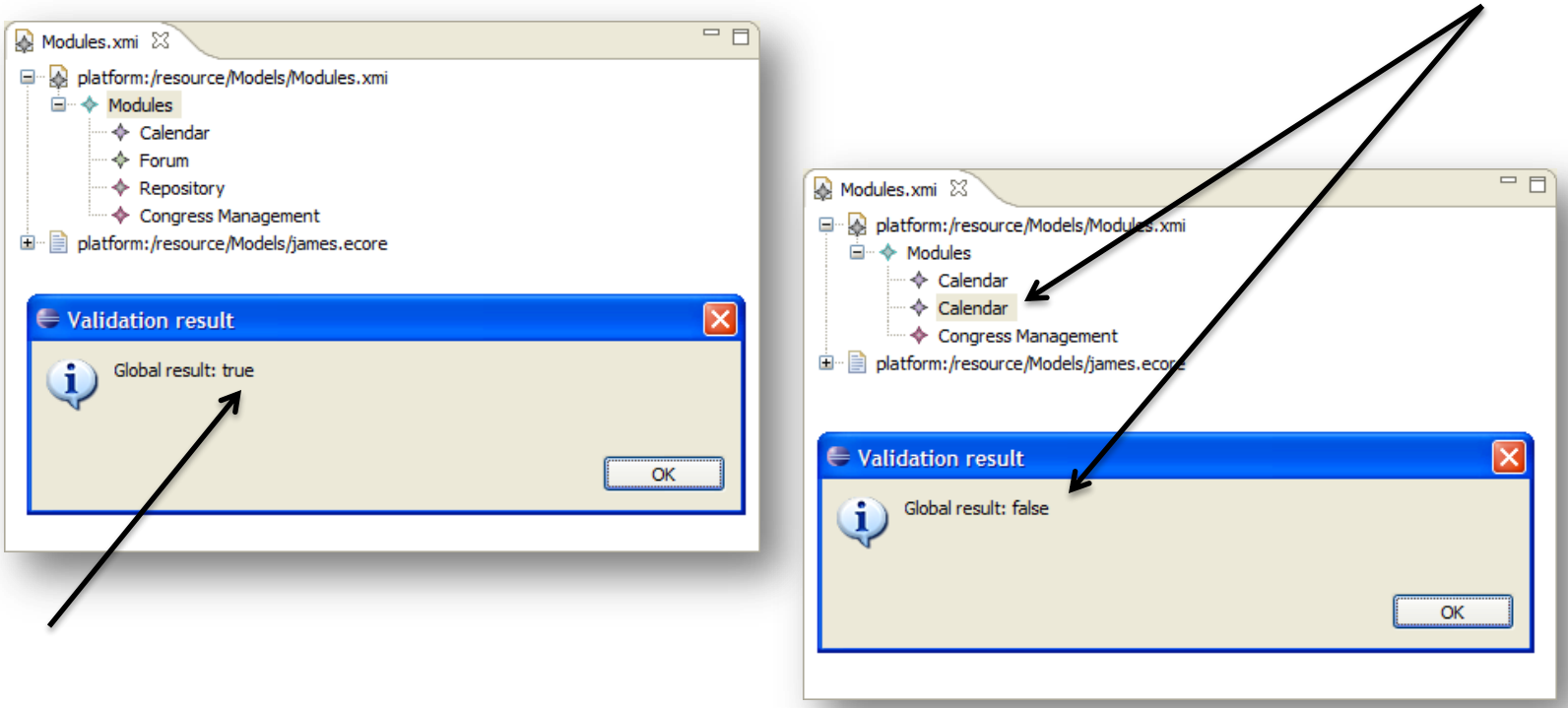


where

oclExpression =
'self.' + parentClassName + 'Features->select(f : ' + parentClassName + 'Type | f.oclIsKindOf(' + featureName + '))->size() <= 1'

Relation MultipleRelationshipChilds2Annot

- These OCL invariants can be checked automatically. In the example, the screenshot on the right has a duplicated module (Calendar).



- Moreover, any OCL invariant can be defined in order to check the consistency of the feature model instance.

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