How to apply EMF model refactorings

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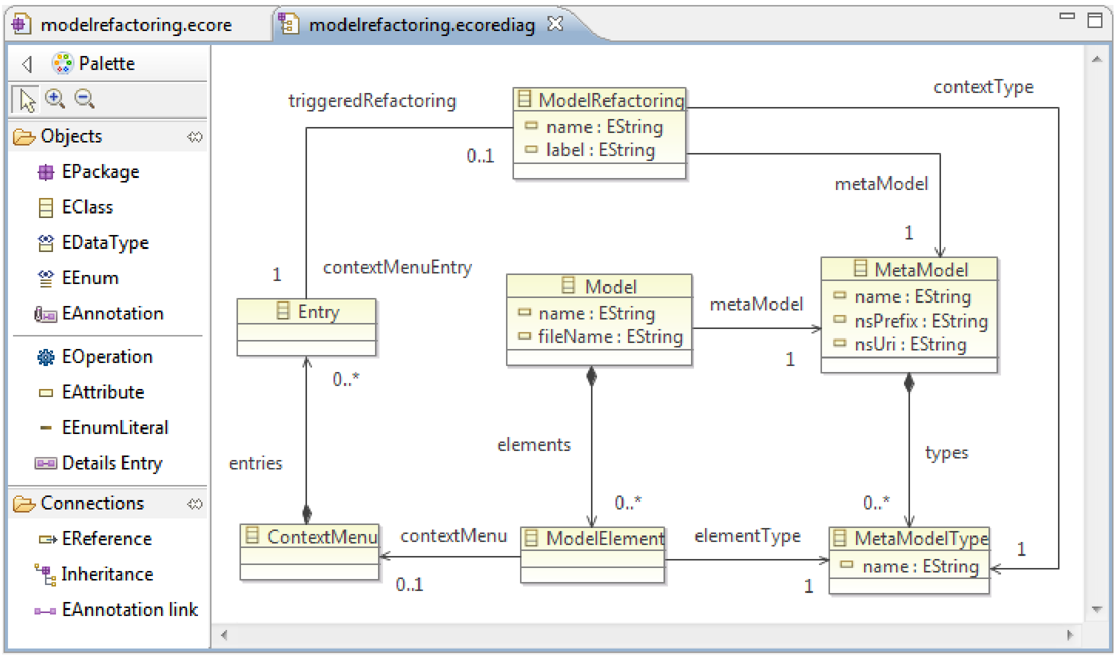
January 7, 2011

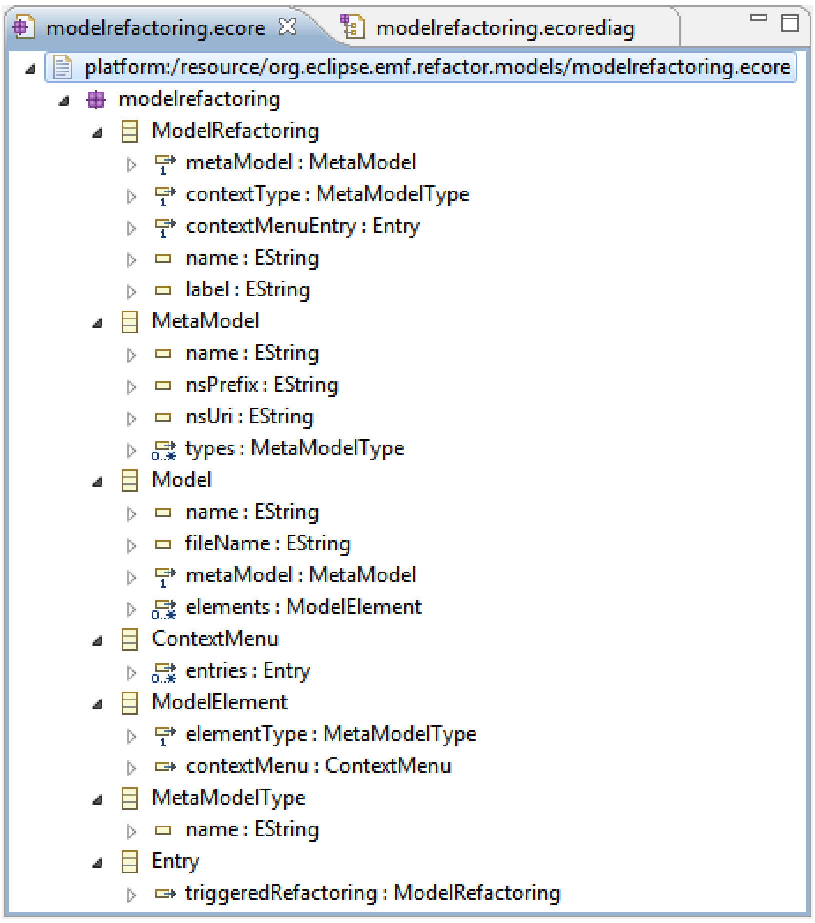
This manual presents the application of a EMF model refactoring using **EMF Refactor**. More precisely, we demonstrate the model refactoring **Move EAttribute** for Ecore models. Please note, that EMF Refactor can be used for refactorings of any models whose meta model is based on EMF Ecore.

First, please take a look to the following Ecore diagram presenting a first model concerning EMF model refactorings in an early stage of the EMF Refactor development process. A `ModelRefactoring` has a name and conforms to a `MetaModel` that is specified by name, namespace prefix, and namespace URI. Furthermore, it has a label that should be shown as an `Entry` in the `ContextMenu` of an arbitrary `ModelElement`. A `ModelElement` belongs to a `Model` that is specified by a name and stored in a file with a specific name. Furthermore, a `Model` conforms to a `MetaModel` and each `ModelElement` is typed over a specific `MetaModelType` belonging to the corresponding `MetaModel`. Besides the afore mentioned attributes, each `ModelRefactoring` is related to a `MetaModelType` representing the type of the contextual element the refactoring can be applied on.



During software design it became questionable whether attribute `label` of class `ModelRefactoring` could be better placed in class `Entry`. So, model refactoring **Move EAttribute** is the next task to be performed.

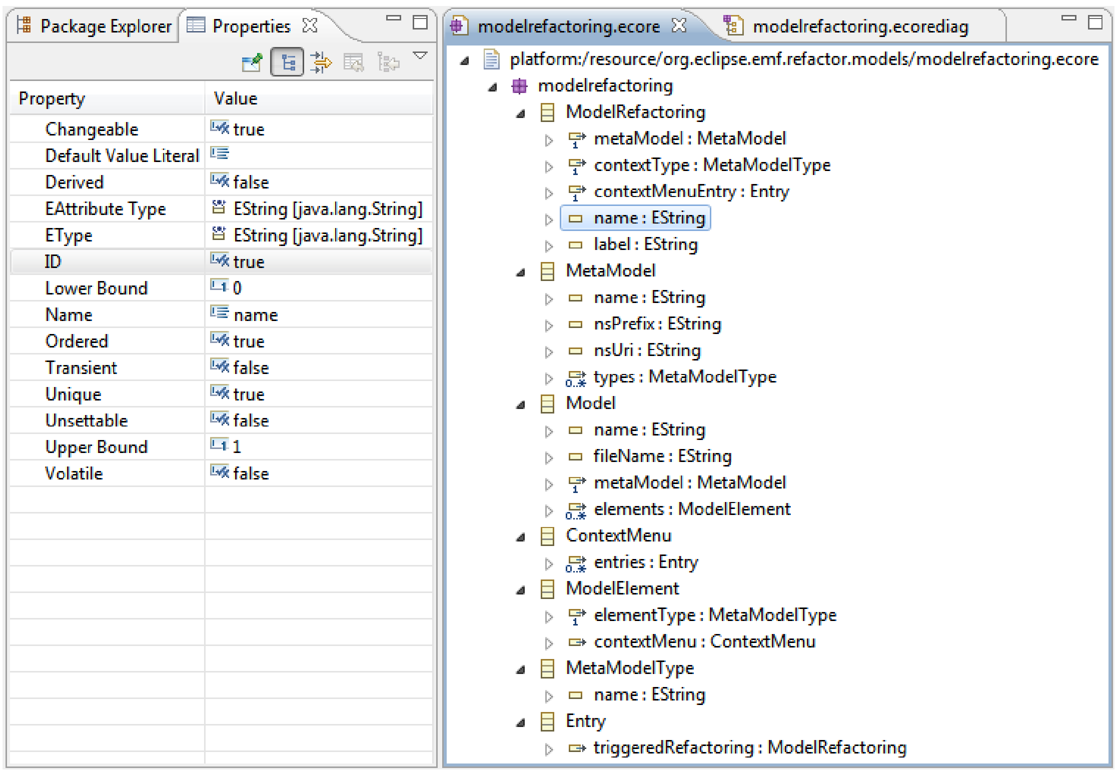
Since **EMF Refactor** can be used on arbitrary EMF based models the application of a specific refactoring is mainly triggered from within the EMF instance editor. The next figure shows the example model from above using this tree-based editor.



```
platform:/resource/org.eclipse.emf.refactor.models/modelrefactoring.ecore
  modelrefactoring
    ModelRefactoring
      metaModel : MetaModel
      contextType : MetaModelType
      contextMenuEntry : Entry
      name : EString
      label : EString
    MetaModel
      name : EString
      nsPrefix : EString
      nsUri : EString
      types : MetaModelType
    Model
      name : EString
      fileName : EString
      metaModel : MetaModel
      elements : ModelElement
    ContextMenu
      entries : Entry
    ModelElement
      elementType : MetaModelType
      contextMenu : ContextMenu
    MetaModelType
      name : EString
    Entry
      triggeredRefactoring : ModelRefactoring
```

EMF model refactoring **Move EAttribute** can be specified in the following way: First, it has to be checked whether the contextual `EAttribute` is not marked as ID of the containing class, and whether this class has at least one referenced class. If these (initial) checks pass the user has to put in the name of the class the attribute has to be moved to. Then, it has to be checked whether the containing class has a referenced class with the specified name, and whether this class does not already owns an attribute with the same name as the contextual attribute. If these (final) checks pass the contextual attribute can finally be moved to the specified class.

Before applying the refactoring let us first present some erroneous situations. The following figure shows that attribute `name` of class `ModelRefactoring` represents the ID of this class. So, the application of refactoring **Move EAttribute** on attribute `name` is not possible.

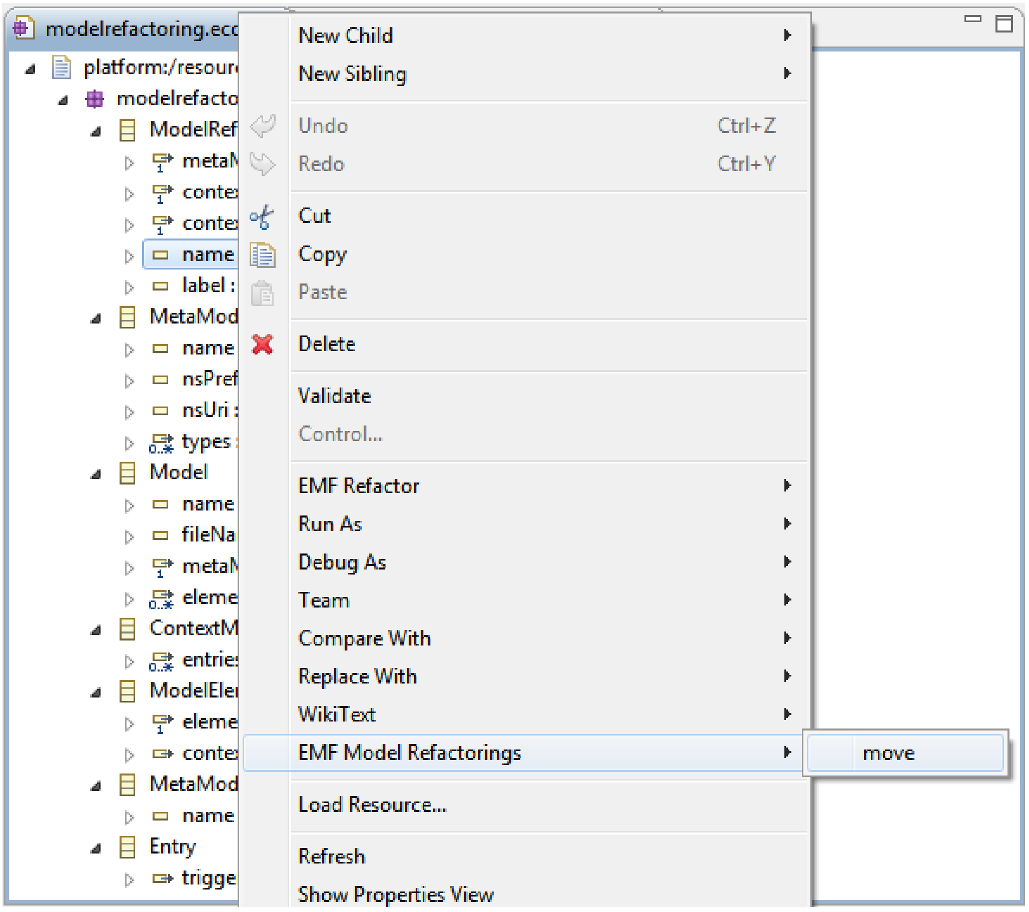


Package Explorer | Properties | modelrefactoring.ecore | modelrefactoring.ecorediag

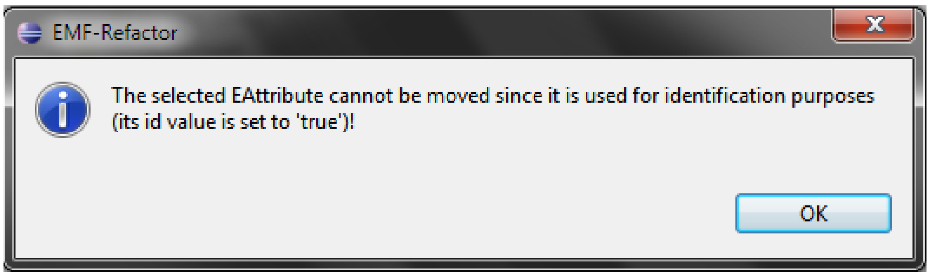
Property	Value
Changeable	true
Default Value Literal	
Derived	false
EAttribute Type	EString [java.lang.String]
EType	EString [java.lang.String]
ID	true
Lower Bound	0
Name	name
Ordered	true
Transient	false
Unique	true
Unsettable	false
Upper Bound	1
Volatile	false

```
platform:/resource/org.eclipse.emf.refactor.models/modelrefactoring.ecore
  modelrefactoring
    ModelRefactoring
      metaModel : MetaModel
      contextType : MetaModelType
      contextMenuEntry : Entry
      name : EString
      label : EString
    MetaModel
      name : EString
      nsPrefix : EString
      nsUri : EString
      types : MetaModelType
    Model
      name : EString
      fileName : EString
      metaModel : MetaModel
      elements : ModelElement
    ContextMenu
      entries : Entry
    ModelElement
      elementType : MetaModelType
      contextMenu : ContextMenu
    MetaModelType
      name : EString
    Entry
      triggeredRefactoring : ModelRefactoring
```

Each refactoring can be triggered from within the context menu of a specific contextual model element. The next figure shows the context menu of attribute `name`.



As expected, **EMF Refactor** does not apply refactoring **Move EAttribute** because of the violated precondition. The following figure shows the corresponding error message.

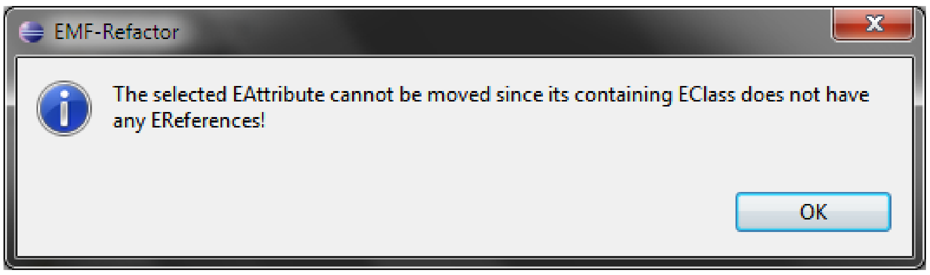

EMF-Refactor

The selected EAttribute cannot be moved since it is used for identification purposes (its id value is set to 'true')!

OK

The second erroneous situation occurs if we try to apply refactoring **Move EAttribute** on attribute `name` of class `MetaModelElement`. As you see in the diagram on page 1, this class does not have any (outgoing) references to other classes in our example model.

We trigger refactoring **Move EAttribute** from within the context menu of attribute `name` of class `MetaModelElement` and again, **EMF Refactor** does not apply refactoring **Move EAttribute** because of the violated precondition. The following figure shows the corresponding error message.

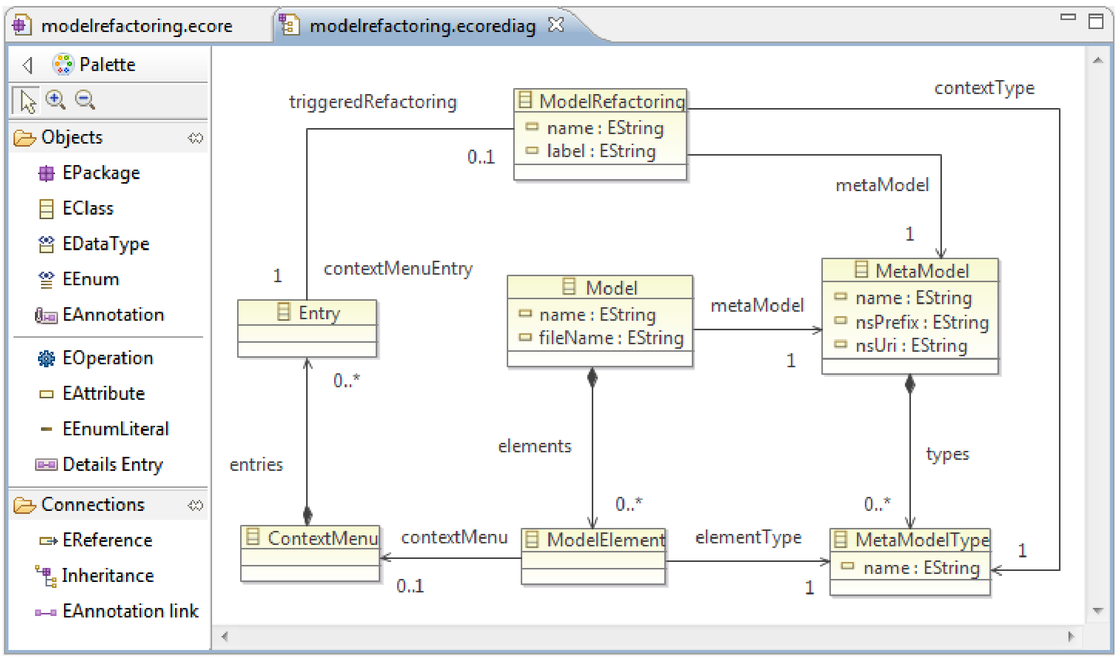


EMF-Refactor

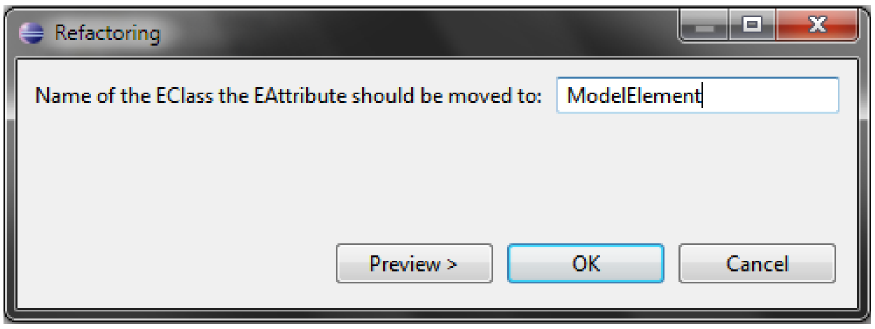
The selected EAttribute cannot be moved since its containing EClass does not have any EReferences!

OK

Now, let's try to apply refactoring **Move EAttribute** on attribute `name` of class `MetaModel`. The initial checks pass, i.e. the attribute is not the ID of its containing class and this class is referenced to class `MetaModelType` (see following figure).

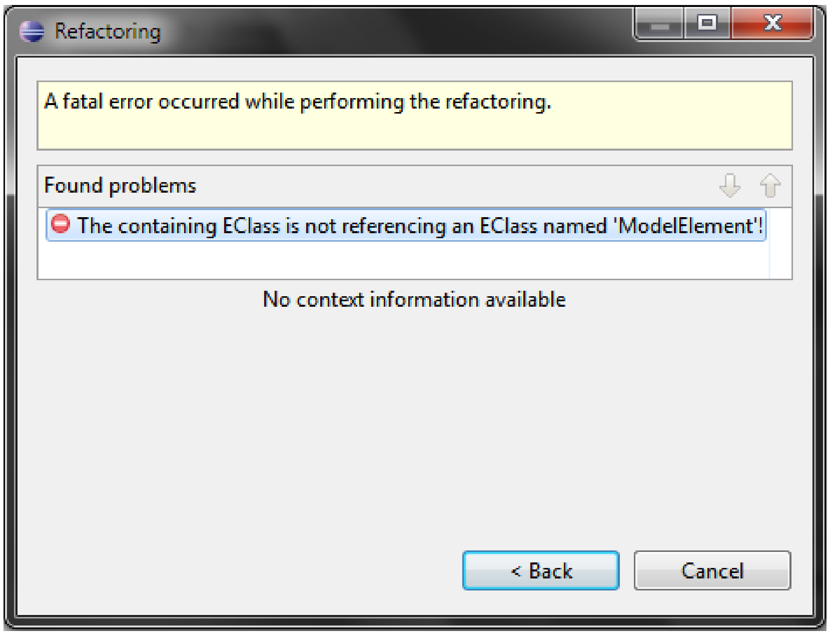


We trigger refactoring **Move EAttribute** from within the context menu of attribute `name` of class `MetaModel`. The initial precondition checks pass, i.e. **EMF Refactor** does not display any error messages, and a user input form appears specific to the triggered EMF model refactoring. For refactoring **Move EAttribute** we now have to input the name of the class the contextual attribute should be moved to. The following figure shows the input dialog. Here, another erroneous situation arises if we type in a name of a class that is not referenced by the containing class of the contextual attribute (or even a complete invalid name), for example `ModelElement`.


Refactoring

Name of the EClass the EAttribute should be moved to: ModelElement

Again, **EMF Refactor** does not apply refactoring **Move EAttribute** because of the violated precondition. The following figure shows the corresponding error message.


Refactoring

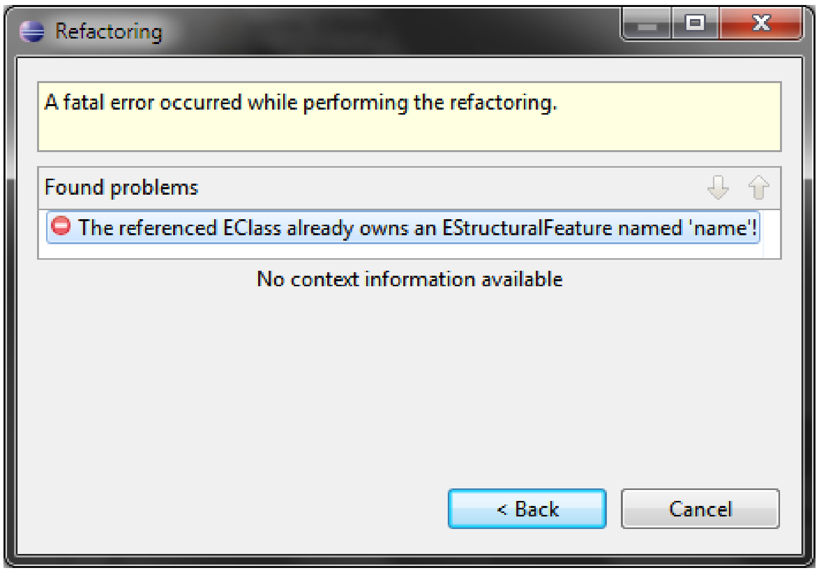
A fatal error occurred while performing the refactoring.

Found problems

The containing EClass is not referencing an EClass named 'ModelElement'!

No context information available

The last erroneous situation occurs if we try to move attribute `name` of class `MetaModel` to the referenced class `MetaModelType`. Here, class `MetaModelType` already owns an attribute `name` (see diagram on page 5). We trigger refactoring **Move EAttribute** from within the context menu of attribute `name` of class `MetaModel`. In the refactoring parameter dialog we type in name `MetaModelType`. Again, **EMF Refactor** does not apply refactoring **Move EAttribute** because of the violated precondition. The following figure shows the corresponding error message.


Refactoring

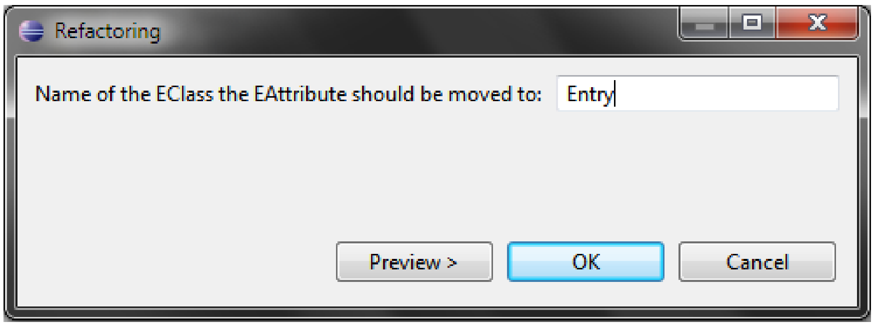
A fatal error occurred while performing the refactoring.

Found problems

The referenced EClass already owns an EStructuralFeature named 'name'!

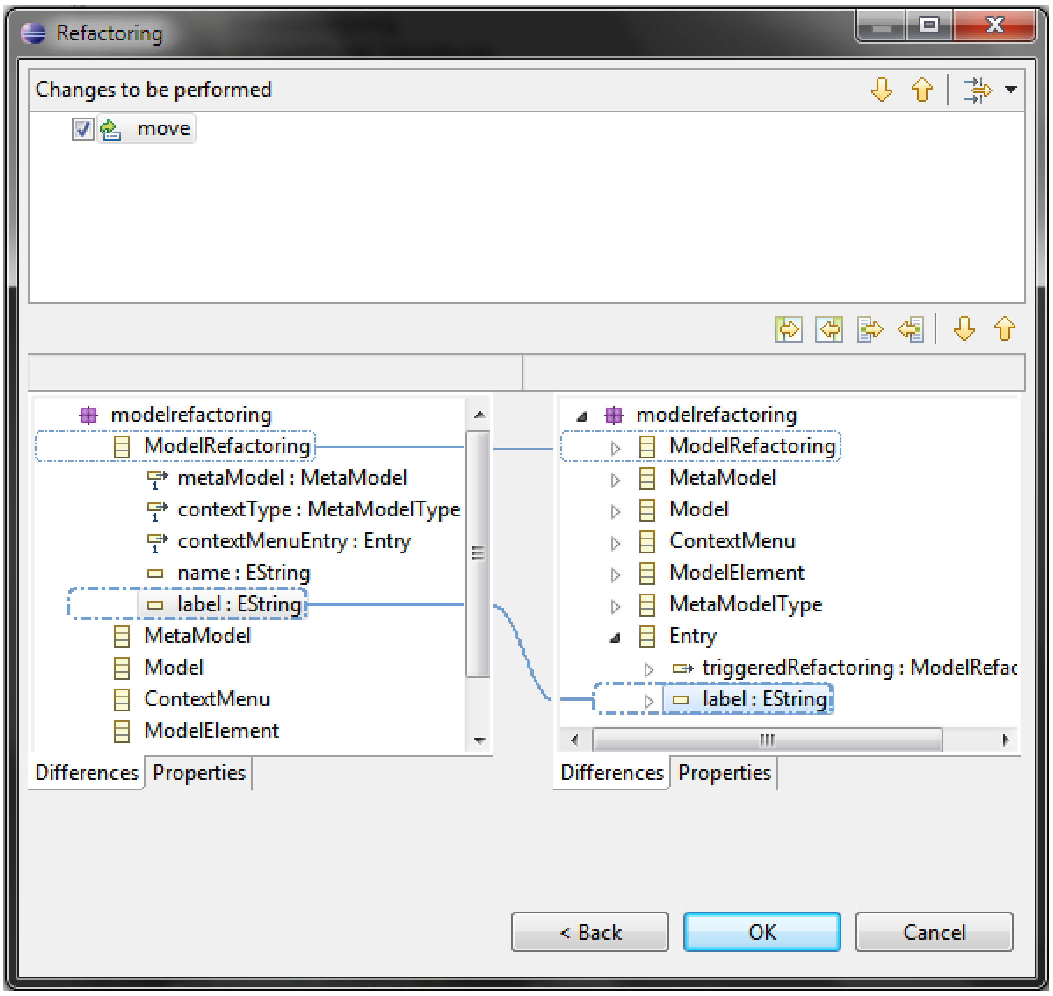
No context information available

Now, all possible erroneous situations of EMF refactoring **Move EAttribute** are presented and we can continue with a successful refactoring application. As already mentioned above, attribute `label` of class `ModelRefactoring` could be better placed in class `Entry` and should be moved (see diagrams on page 1 and 5). We trigger refactoring **Move EAttribute** from within the context menu of attribute `label` of class `ModelRefactoring`. Since the initial precondition checks pass the parameter dialog appears and we type in class name `Entry` (see following figure).


Refactoring

Name of the EClass the EAttribute should be moved to: Entry

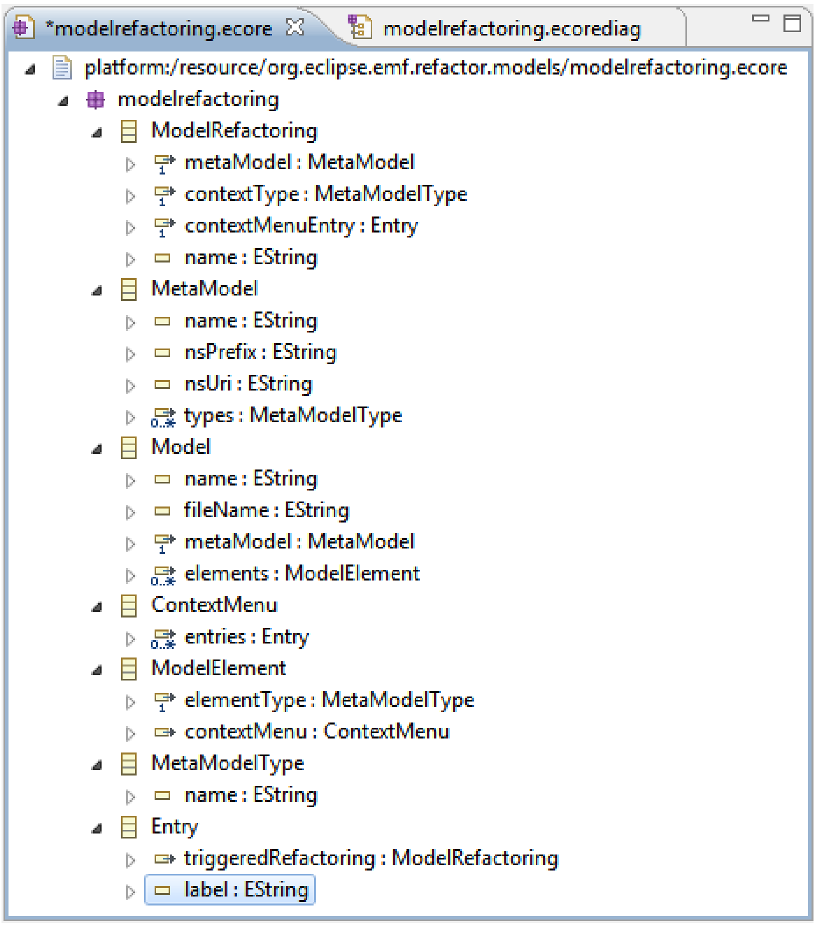
It is possible to obtain a preview of the refactoring action. Here, **EMF Refactor** uses **EMF Compare**. The left hand side of the following figure shows the original model whereas the right hand side presents the refactored model. Model changes are highlighted by colored connections. Here, the dialog shows that attribute `label` was removed from class `ModelRefactoring` and inserted into class `Entry`, i.e. the attribute was moved.



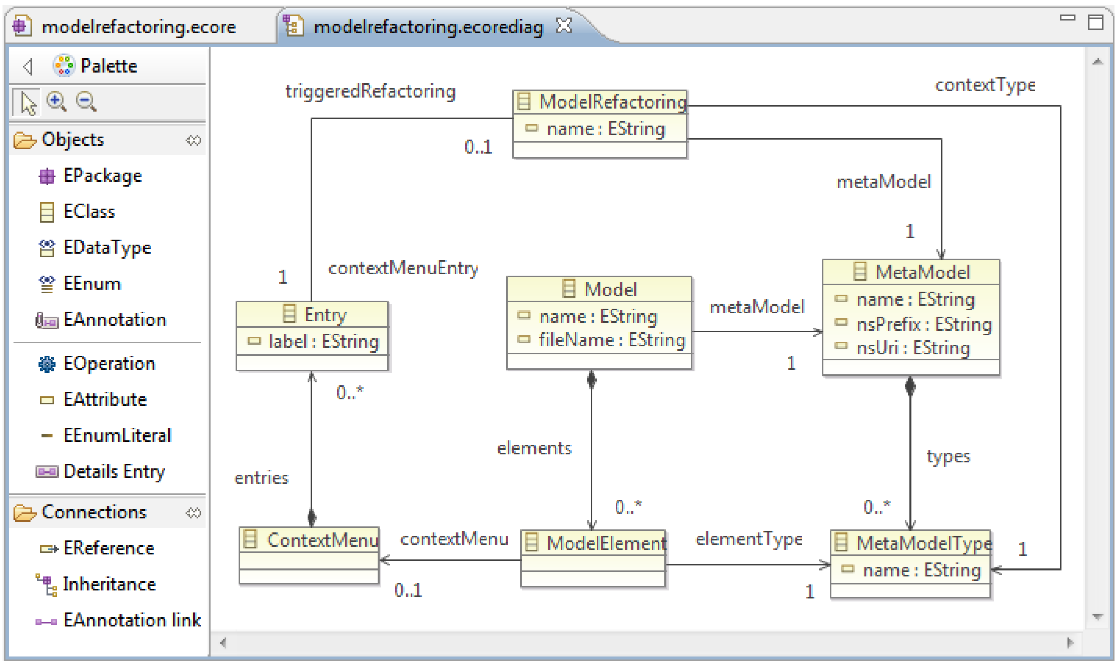
```
modelrefactoring
  ModelRefactoring
    metaModel : MetaModel
    contextType : MetaModelType
    contextMenuEntry : Entry
    name : EString
    label : EString
  MetaModel
  Model
  ContextMenu
  ModelElement
```

```
modelrefactoring
  ModelRefactoring
  MetaModel
  Model
  ContextMenu
  ModelElement
  MetaModelType
  Entry
    triggeredRefactoring : ModelRefac
    label : EString
```

Now, these changes can be committed and refactoring **Move EAttribute** can take place. Of course, **EMF Refactor** provides undo and redo functionality. The following figures show the refactored model using the tree-based EMF instance editor respectively the graphical diagram view of **Ecore Tools**.



```
*modelrefactoring.ecore    modelrefactoring.ecorediag
platform:/resource/org.eclipse.emf.refactor.models/modelrefactoring.ecore
  modelrefactoring
    ModelRefactoring
      metaModel : MetaModel
      contextType : MetaModelType
      contextMenuEntry : Entry
      name : EString
    MetaModel
      name : EString
      nsPrefix : EString
      nsUri : EString
      types : MetaModelType
    Model
      name : EString
      fileName : EString
      metaModel : MetaModel
      elements : ModelElement
    ContextMenu
      entries : Entry
    ModelElement
      elementType : MetaModelType
      contextMenu : ContextMenu
    MetaModelType
      name : EString
    Entry
      triggeredRefactoring : ModelRefactoring
      label : EString
```


modelrefactoring.ecore
modelrefactoring.ecorediag
Palette
Objects
EPackage
EClass
EDataType
EEnum
EAnnotation
EOperation
EAttribute
EEnumLiteral
Details Entry
Connections
EReference
Inheritance
EAnnotation link
ModelRefactoring
name : EString
triggeredRefactoring
0..1
contextType
metaModel
1
1
contextMenuEntry
Entry
label : EString
Model
name : EString
fileName : EString
metaModel
MetaModel
name : EString
nsPrefix : EString
nsUri : EString
1
0..*
elements
types
entries
0..*
0..*
ContextMenu
contextMenu
ModelElement
elementType
MetaModelType
name : EString
1
0..1
1

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