Kermeta tutorial

How to create an EMF meta model?

François Tanguy, Didier Vojtisek, Zoé Drey, Marie Gouyette

Abstract

This tutorial show how to create an EMF model for the FSM example.

Published Build date: 3-November-2010
2006-09-25T10:35:34
19/07/2006

List of Figures

CHAPTER

Preface

Kermeta is a Domain Specific Language dedicated to metamodel engineering. It fills the gap let by MOF which defines only the structure of metamodels, by adding a way to specify static semantic (similar to OCL) and dynamic semantic (using operational semantic in the operation of the metamodel). Kermeta uses the object-oriented paradigm like Java or Eiffel. This document presents various aspects of the language, including the textual syntax, the metamodel (which can be viewed as the abstract syntax) and some more advanced features typically included in its framework.

Important

Kermeta is an evolving software and despite that we put a lot of attention to this document, it may contain errors (more likely in the code samples). If you find any error or have some information that improves this document, please send it to us using the bug tracker in the forge: **http://gforge.inria.fr/tracker/?group_id=32** or using the developer mailing list (kermeta-developers@lists.gforge.inria.fr) Last check: v0.3.1

Tip

The most update version of this document is available on line from http://www.kermeta.org .

CHAPTER 1

Create a meta-model for Kermeta programs

For simplicity sake, the different steps (meta-model, model creation, as well as model handling through Kermeta) introduced in the scope of this tutorial are illustrated by means of the finite state machines classical example.

1.1. Editing a new meta-model with the EMF sample editor

1. Create a new General project if no project is ever created (for instance **MyFirstEMFSamples).**
2. Select in the tool bar menu (on top of Eclipse window)**File > New > Other > Eclipse Modeling Framework** folder **> Ecore Model**

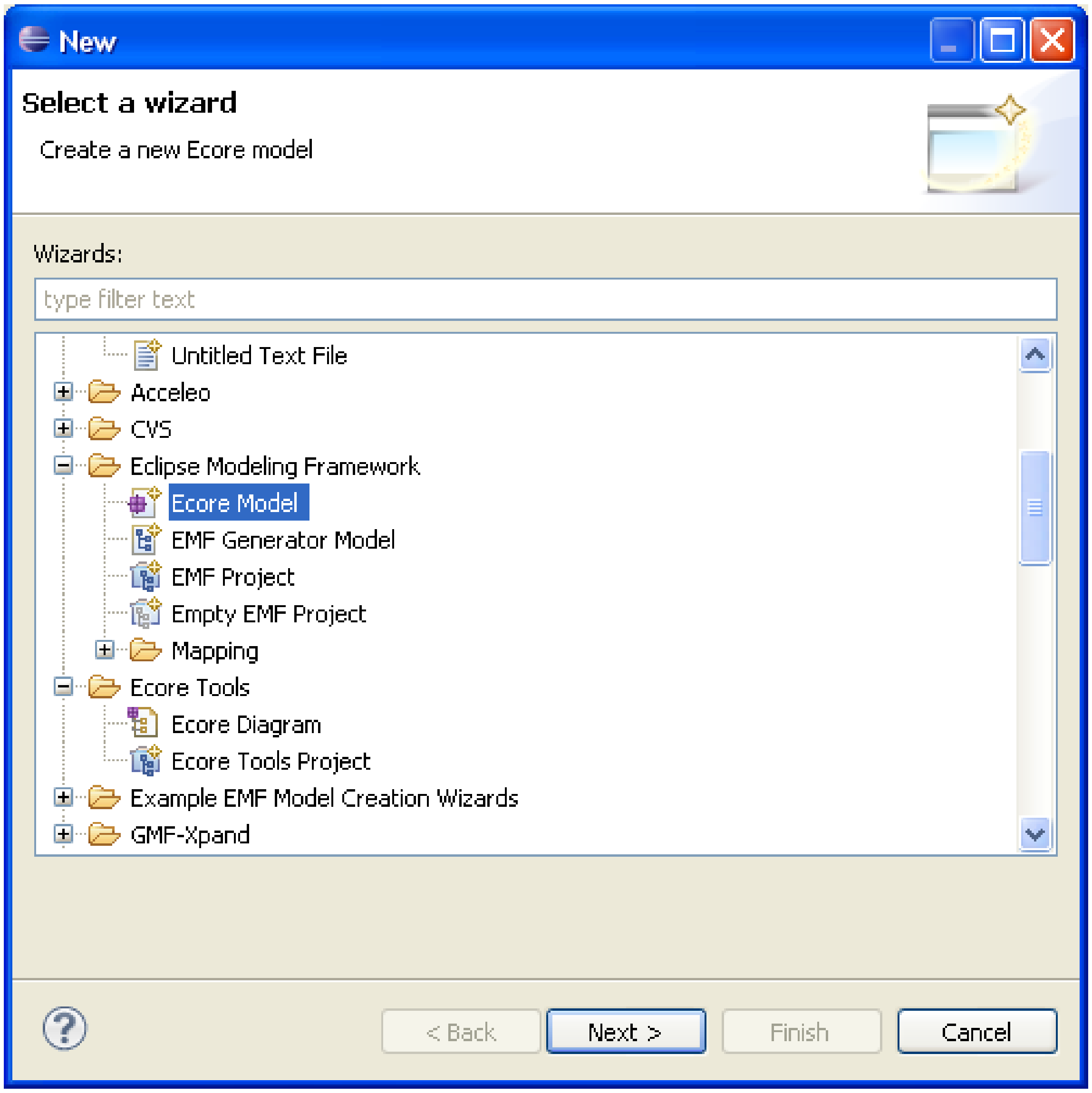
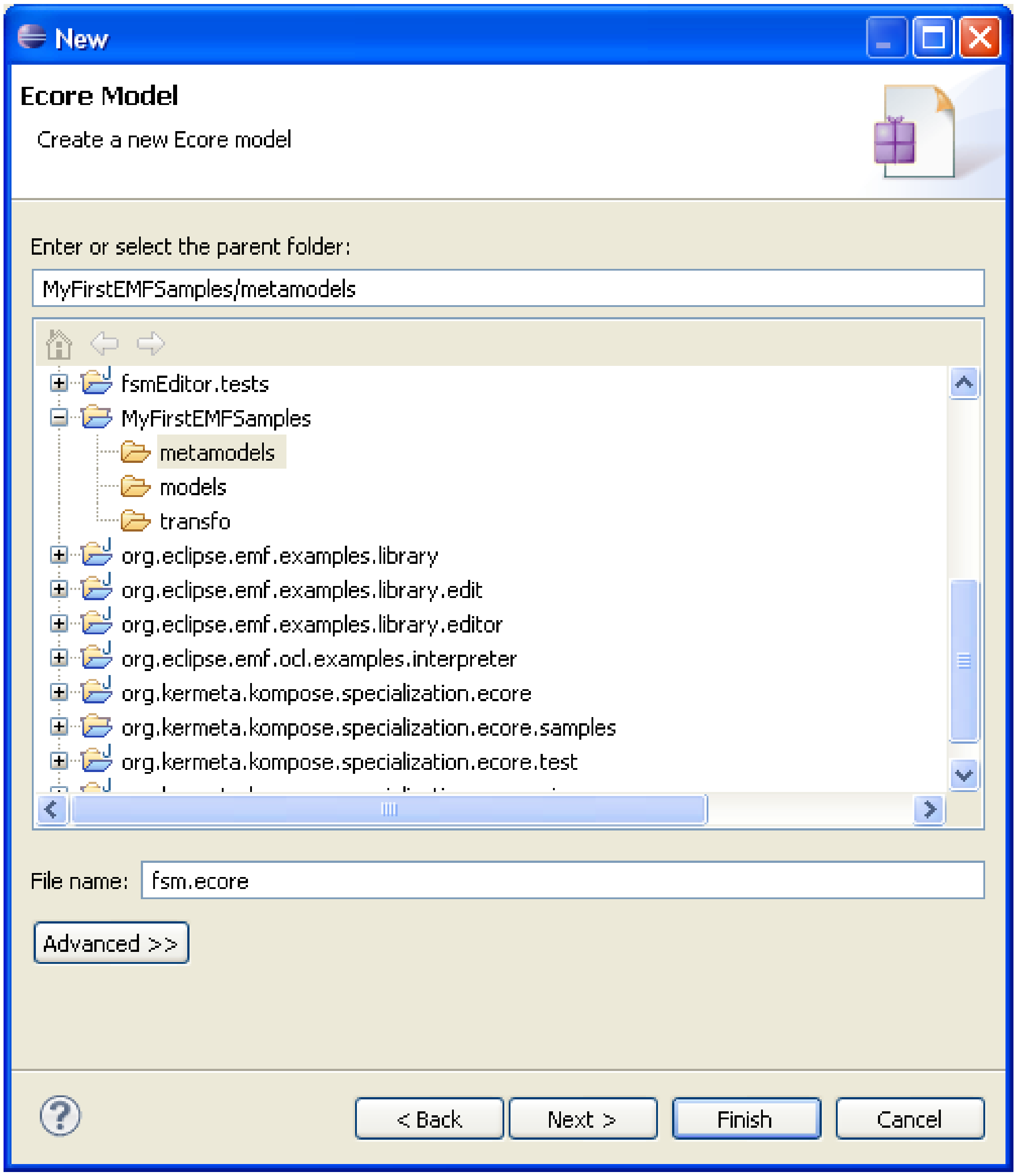


Figure 1.1. Selection of the model object (root element)

3. Enter a name for the meta-model file (e.g. *fsm.ecore*), then click on **Next** button.


New

Ecore Model

Create a new Ecore model

Enter or select the parent folder:

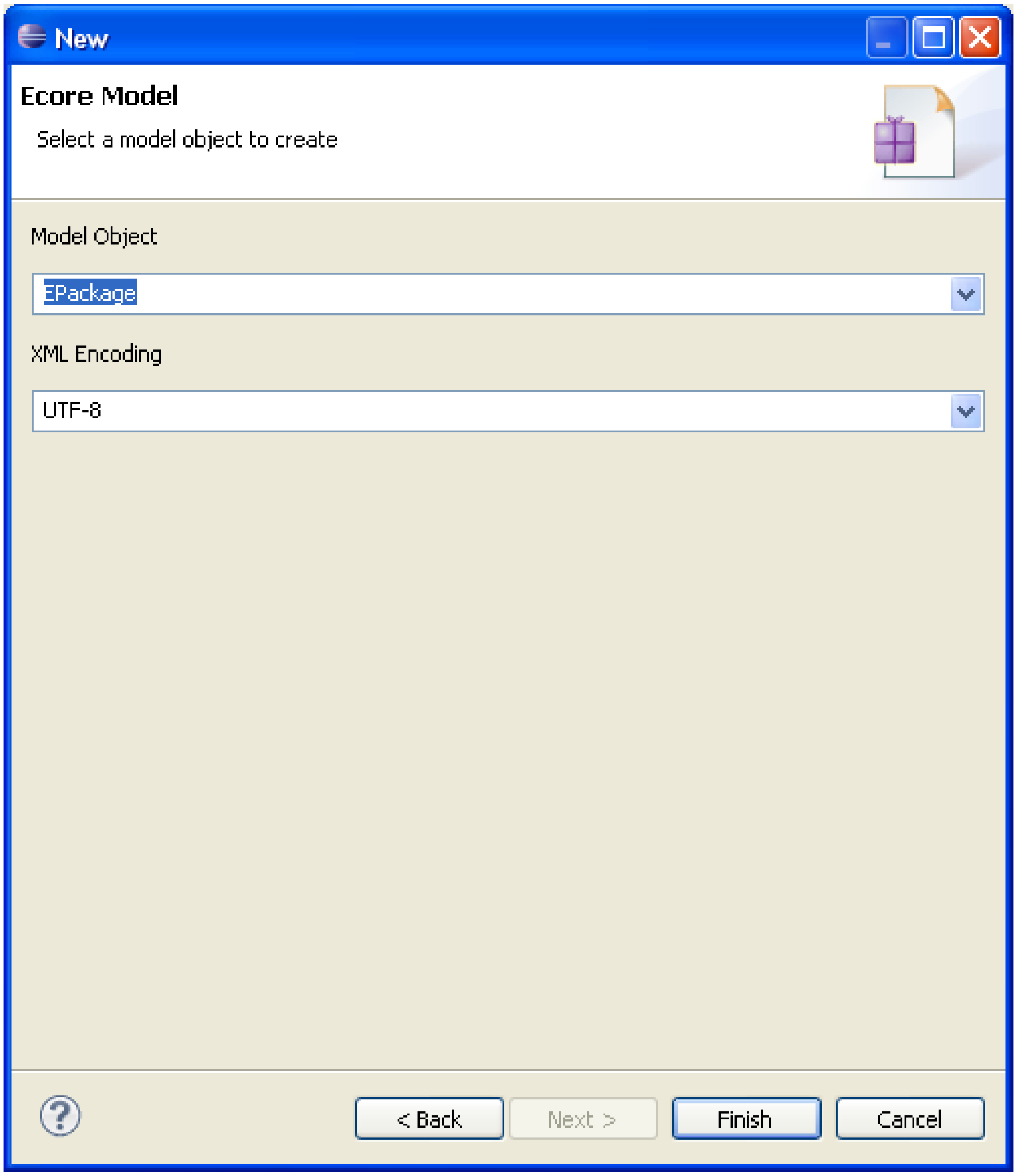
MyFirstEMFSamples/metamodels

```
fsmEditor.tests
MyFirstEMFSamples
    metamodels
    models
    transfo
org.eclipse.emf.examples.library
org.eclipse.emf.examples.library.edit
org.eclipse.emf.examples.library.editor
org.eclipse.emf.ocl.examples.interpreter
org.kermeta.kompose.specialization.ecore
org.kermeta.kompose.specialization.ecore.samples
org.kermeta.kompose.specialization.ecore.test
```

File name: fsm.ecore

Figure 1.2. Choose a name for your new ecore model

4. Choose **EPackage** as the Model Object (i.e. the root of the meta-model), and click on the **Finish** button.

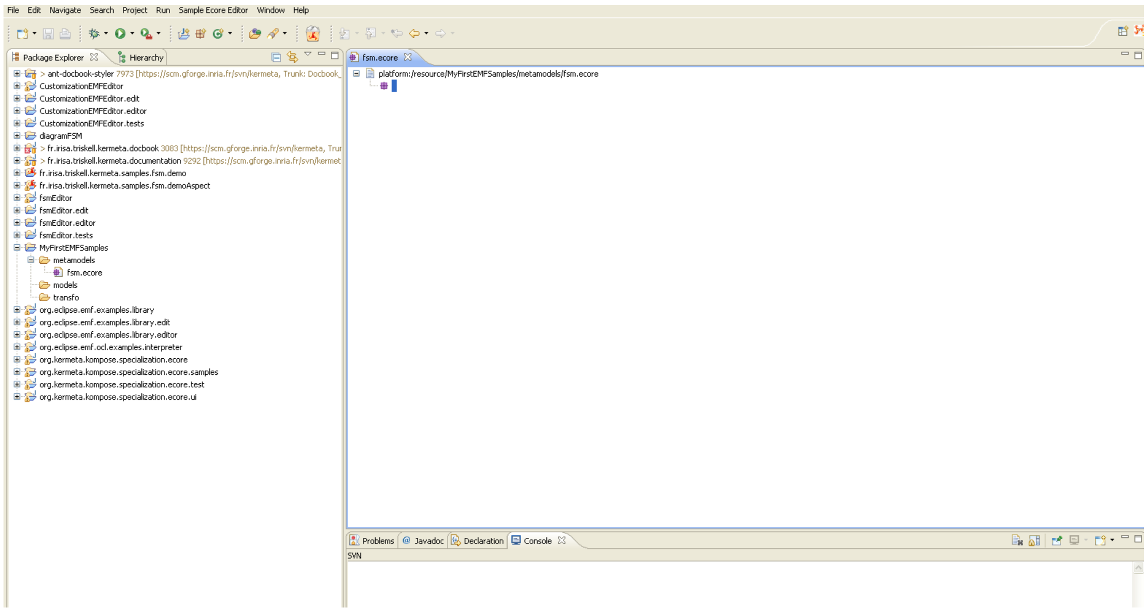


Model Object: EPackage

XML Encoding: UTF-8

Figure 1.3. Selection of the model object (root element)

5. If Omondo is installed, the meta-model can be edited by means of the Omondo graphical editor. However, this tutorial focuses on the creation of meta-models using the **Sample Ecore Editor**. In case the Omondo editor is set as the default editor, the sample Ecore editor can be opened (after having closed the Omondo editor) by right-clicking onto the Ecore file and selecting **Open with > Sample Ecore Model Editor**. (Another way is *Window* > *Show View* > *Other* > *General folder* > *Properties* like shown in the next figure). Then click on the created EPackage.



```
> ant-docbook-styler 7973 [https://scm.gforge.inria.fr/svn/kermeta, Trunk: Docbook_
CustomizationEMFEditor
CustomizationEMFEditor.edit
CustomizationEMFEditor.editor
CustomizationEMFEditor.tests
diagramFSM
> fr.irisa.triskell.kermeta.docbook 3083 [https://scm.gforge.inria.fr/svn/kermeta, Trur
> fr.irisa.triskell.kermeta.documentation 9292 [https://scm.gforge.inria.fr/svn/kermet
fr.irisa.triskell.kermeta.samples.fsm.demo
fr.irisa.triskell.kermeta.samples.fsm.demoAspect
fsmEditor
fsmEditor.edit
fsmEditor.editor
fsmEditor.tests
MyFirstEMFSamples
    metamodels
        fsm.ecore
    models
    transfo
org.eclipse.emf.examples.library
org.eclipse.emf.examples.library.edit
org.eclipse.emf.examples.library.editor
org.eclipse.emf.ocl.examples.interpreter
org.kermeta.kompose.specialization.ecore
org.kermeta.kompose.specialization.ecore.samples
org.kermeta.kompose.specialization.ecore.test
org.kermeta.kompose.specialization.ecore.ui
```

```
platform:/resource/MyFirstEMFSamples/metamodels/fsm.ecore
```

Figure 1.4. New empty ecore model

6. If the **Properties** view is not visible at the bottom (or left, or right) part of the Eclipse window, open it clicking into the file -> *Show Property View*;

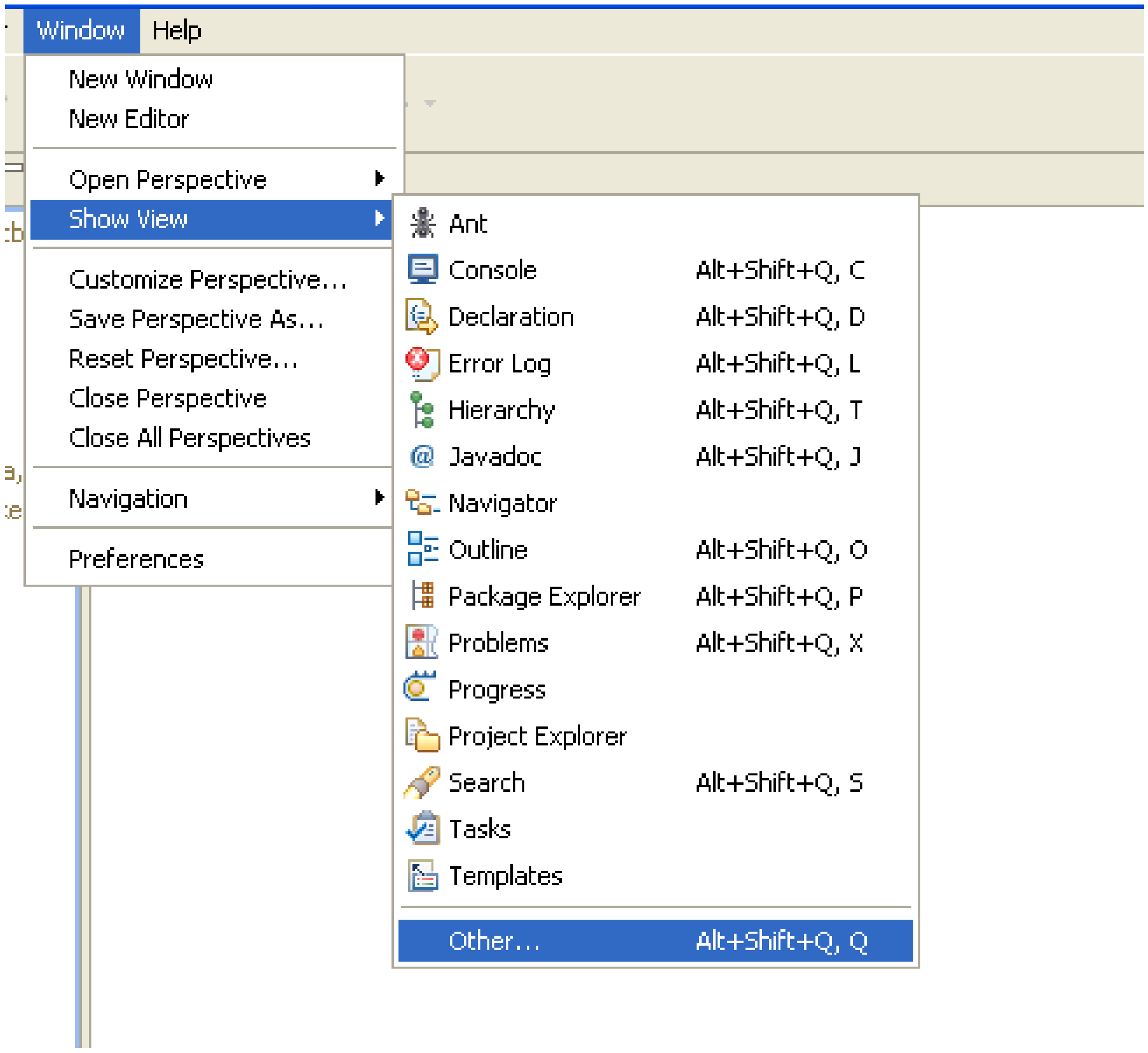
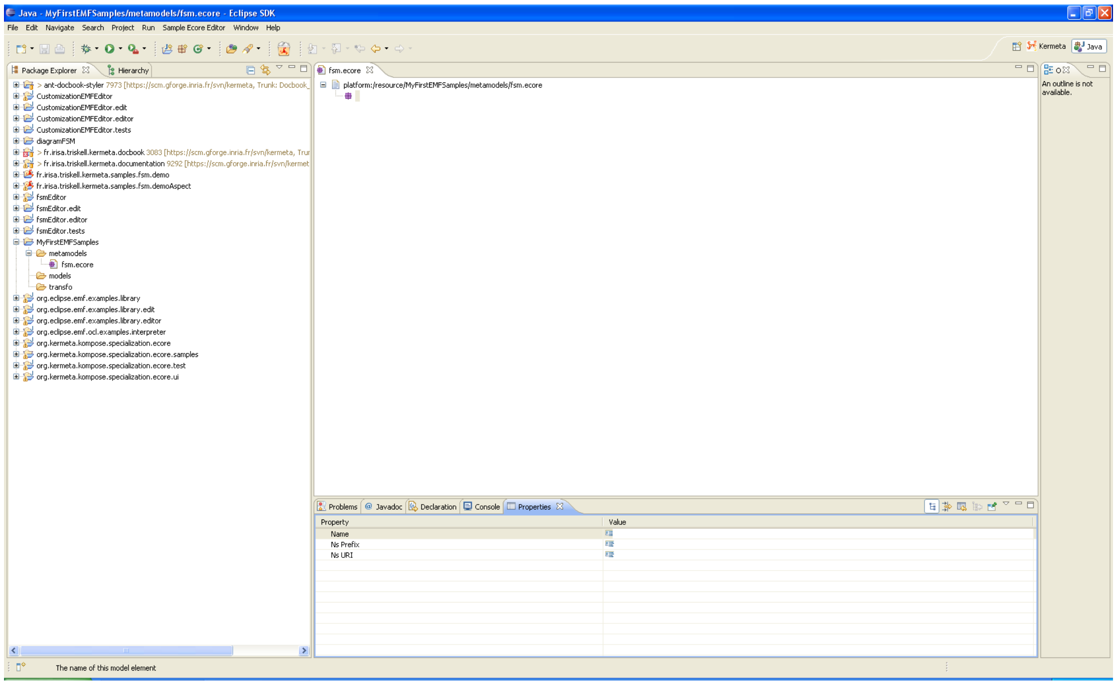


Figure 1.5. How to show properties view

7. Two properties of the created EPackage (which is initially displayed as *null*) have to be set through the **Properties** tab:

   a. its **Name**: *fsm*, for example;

   b. its **Ns URI**: the namespace URI of the Ecore model is mandatory to allow Kermeta being able to correctly load its potential instances, as well as for the Dynamic creation of instances tool. So put it *http://www.kermeta.org/fsm* which is the NSURI of the fsm metamodel.


Java - MyFirstEMFSamples/metamodels/fsm.ecore - Eclipse SDK
File Edit Navigate Search Project Run Sample Ecore Editor Window Help
Kermeta
Java
Package Explorer
Hierarchy
> ant-docbook-styler 7973 [https://scm.gforge.inria.fr/svn/kermeta, Trunk: Docbook_
CustomizationEMFEditor
CustomizationEMFEditor.edit
CustomizationEMFEditor.editor
CustomizationEMFEditor.tests
diagramFSM
> fr.irisa.triskell.kermeta.docbook 3083 [https://scm.gforge.inria.fr/svn/kermeta, Trur
> fr.irisa.triskell.kermeta.documentation 9292 [https://scm.gforge.inria.fr/svn/kermet
fr.irisa.triskell.kermeta.samples.fsm.demo
fr.irisa.triskell.kermeta.samples.fsm.demoAspect
fsmEditor
fsmEditor.edit
fsmEditor.editor
fsmEditor.tests
MyFirstEMFSamples
metamodels
fsm.ecore
models
transfo
org.eclipse.emf.examples.library
org.eclipse.emf.examples.library.edit
org.eclipse.emf.examples.library.editor
org.eclipse.emf.ocl.examples.interpreter
org.kermeta.kompose.specialization.ecore
org.kermeta.kompose.specialization.ecore.samples
org.kermeta.kompose.specialization.ecore.test
org.kermeta.kompose.specialization.ecore.ui
fsm.ecore
platform:/resource/MyFirstEMFSamples/metamodels/fsm.ecore
An outline is not available.
Problems
Javadoc
Declaration
Console
Properties
The name of this model element

Property	Value
Name	
Ns Prefix	
Ns URI	

Figure 1.6. ecore file into Eclipse

8. At this stage, it is now possible to add children to the created root (which is *fsm* EPackage in the considered example). This could be achieved by right-clicking on the class and choosing the **New child** item. In the scope of the FSM example, three classes are added, one of them (the class *Fsm*) being considered as the “root class” (this should not be not mandatory, but allows a better EMF working):

   a. a *Fsm* class, for which the **Name** attribute (in the properties view) has to be set (other properties do not need to be considered at this stage);

   b. a *Transition* class (idem as for the *Fsm* class);

   c. a *State* class (idem as for previous classes).

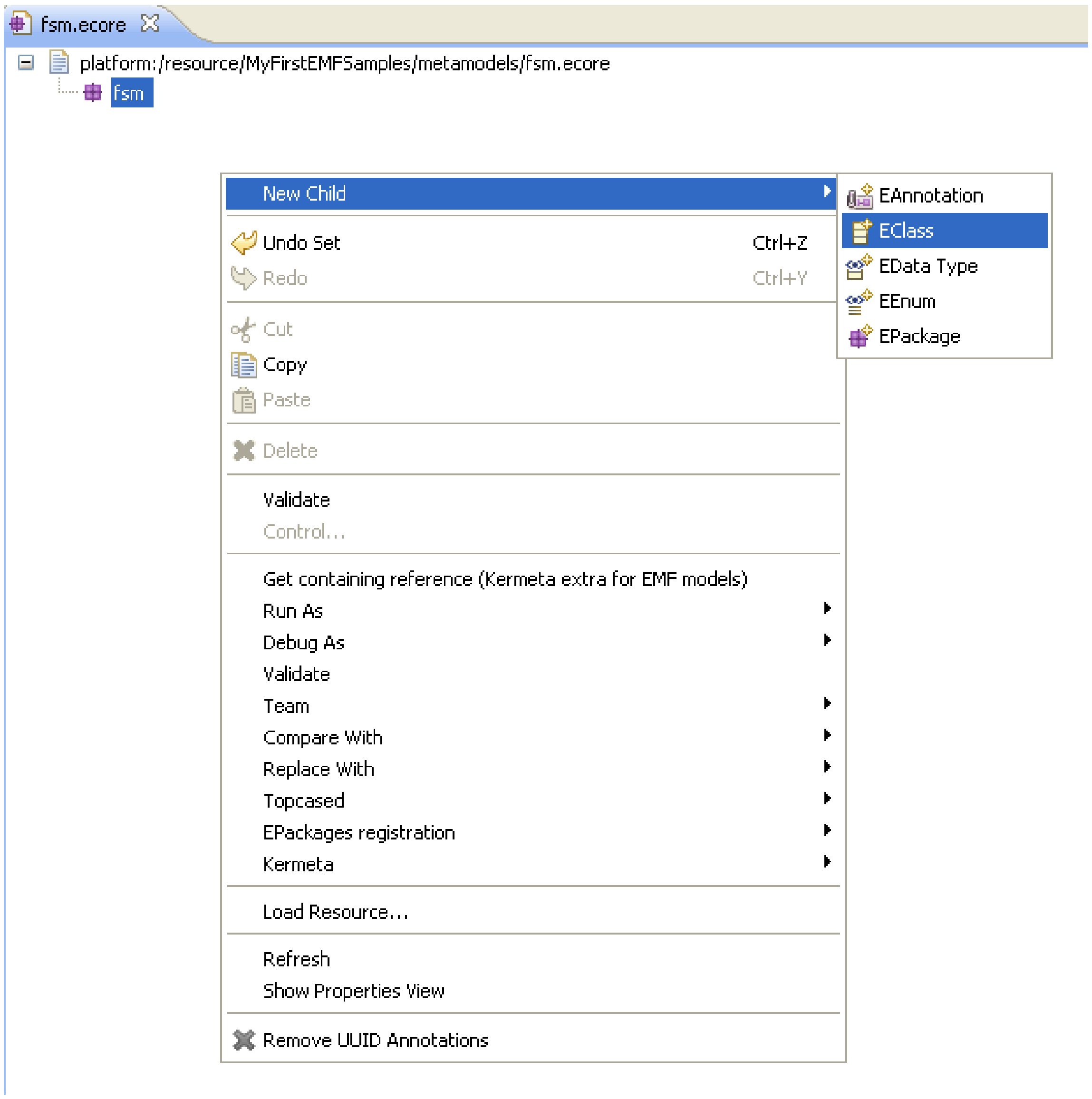
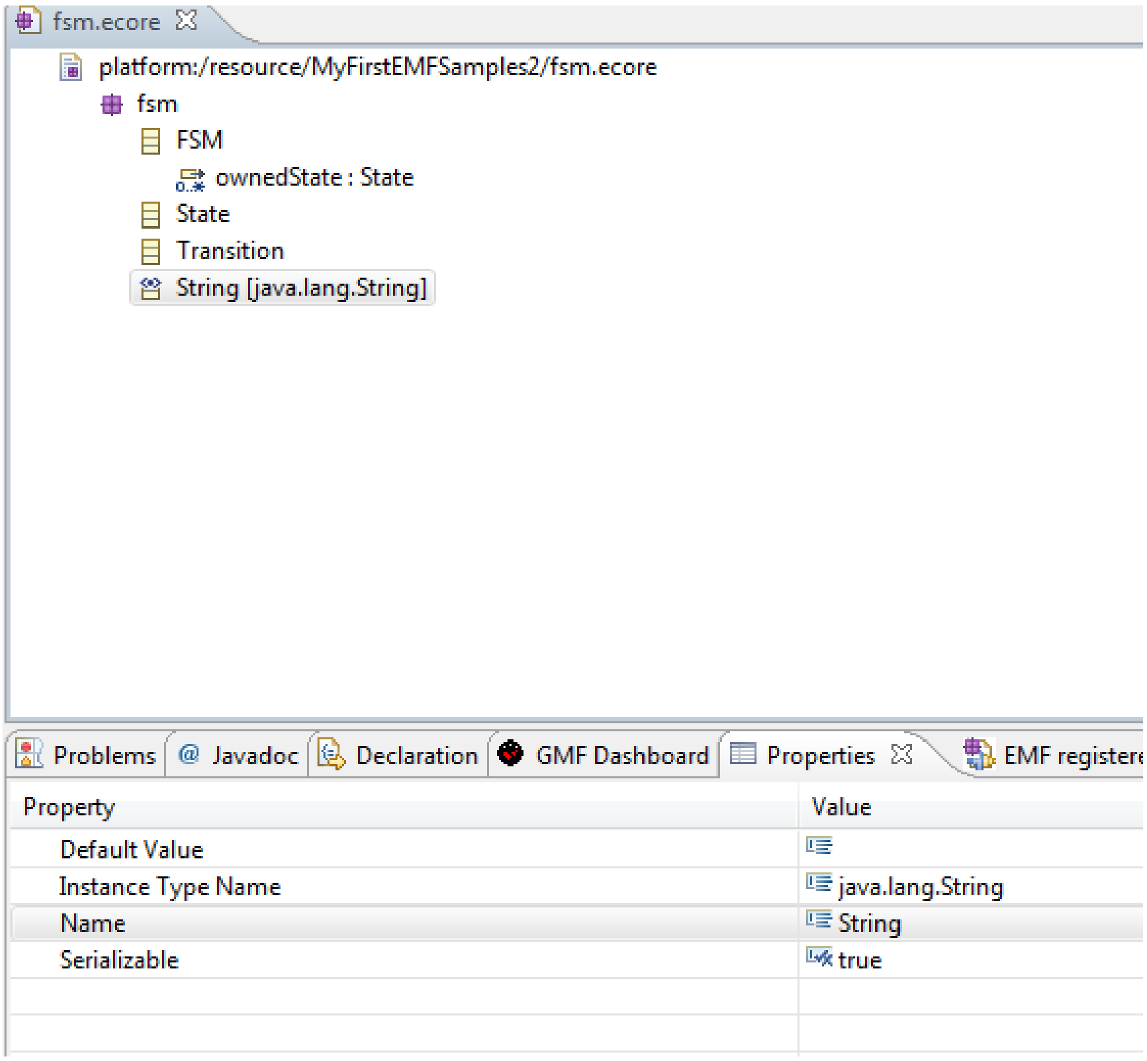


Figure 1.7. New child on EPackage root node

9. To add a new DataType, right click on thge fsm EPackage -> EData Type and set its name as String and its Instance Type Name as java.lang.String.


fsm.ecore

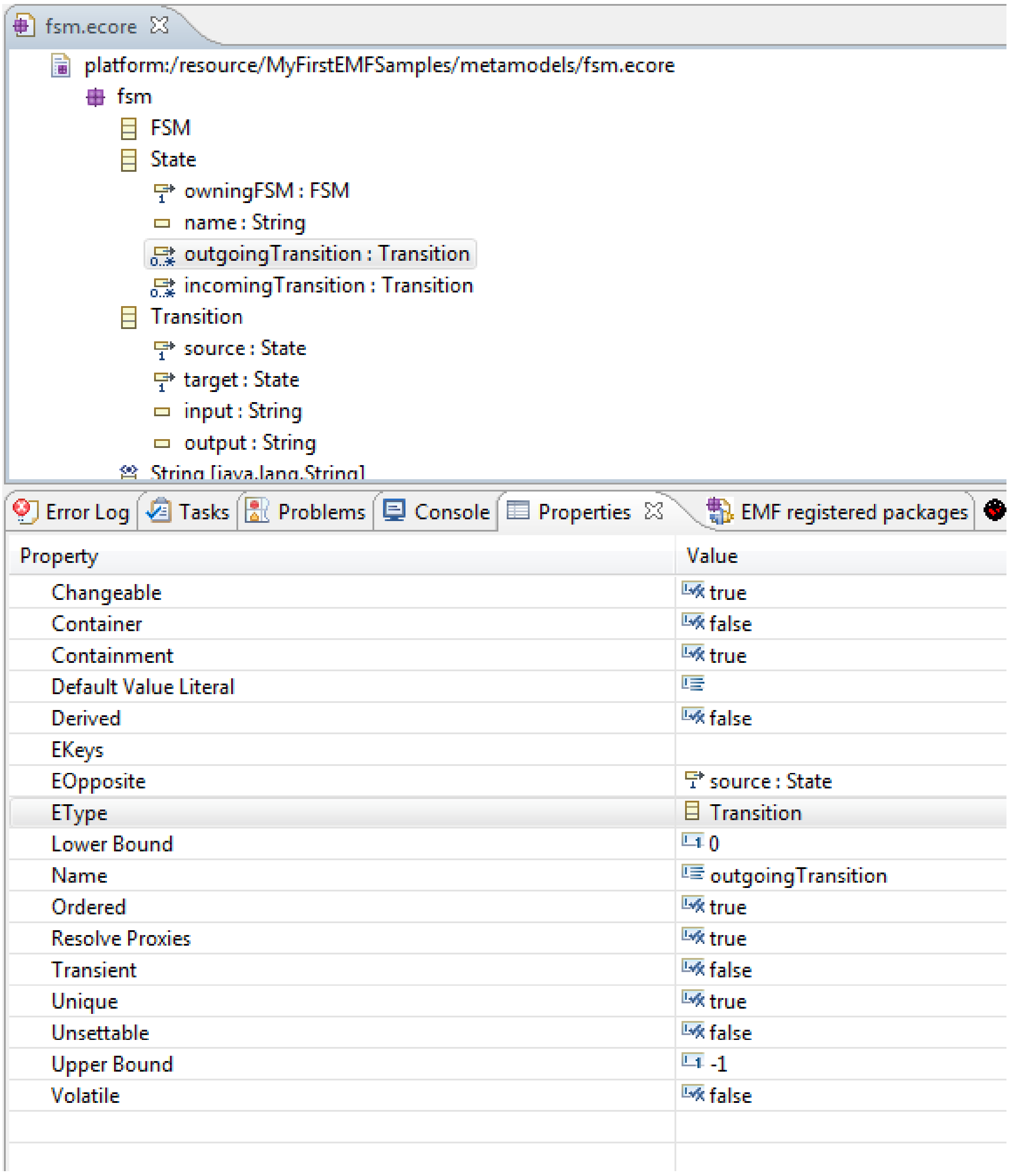
platform:/resource/MyFirstEMFSamples2/fsm.ecore
- fsm
  - FSM
    - ownedState : State
  - State
  - Transition
  - String [java.lang.String]

Property	Value
Default Value	
Instance Type Name	java.lang.String
Name	String
Serializable	true

Figure 1.8. New child on EPackage root node

10. Adding operations, attributes, or references to the newly created classes is achieved in the same way classes have been added to the root EPackage, i.e. using **New child** on each created element.

11. Still through the **Properties** tab, the **EContainment** property will have to be set to *true* for each reference which intended to contain instances. In the scope of the automaton example, the *state* reference of the *Fsm* class are defined as containment reference, and also the outgoingTransition reference in the State meta-class. By this mean, it will be possible to create, in an EMF model of it, a collection of transitions and states.



platform:/resource/MyFirstEMFSamples/metamodels/fsm.ecore
- fsm
  - FSM
  - State
    - owningFSM : FSM
    - name : String
    - outgoingTransition : Transition
    - incomingTransition : Transition
  - Transition
    - source : State
    - target : State
    - input : String
    - output : String
  - String [java.lang.String]

Property	Value
Changeable	true
Container	false
Containment	true
Default Value Literal	
Derived	false
EKeys	
EOpposite	source : State
EType	Transition
Lower Bound	0
Name	outgoingTransition
Ordered	true
Resolve Proxies	true
Transient	false
Unique	true
Unsettable	false
Upper Bound	-1
Volatile	false

Figure 1.9. Setting the properties of an EReference

12. Setting properties, such as the upper and lower bounds, the type (**EType**), of the attributes, operations, and references is achieved through the **Properties** view. The main properties to consider are: ESuperType, EType, Name, Upper Bound, Lower Bound, Containment (for the diamond-ed associations), Ordered, Unique, and EOpposite (opposite property). For simplicity purpose, other properties can be ignored in the scope of this tutorial.

Lower and upper bound properties: 0, 1, -1 (stands for *) are allowed.

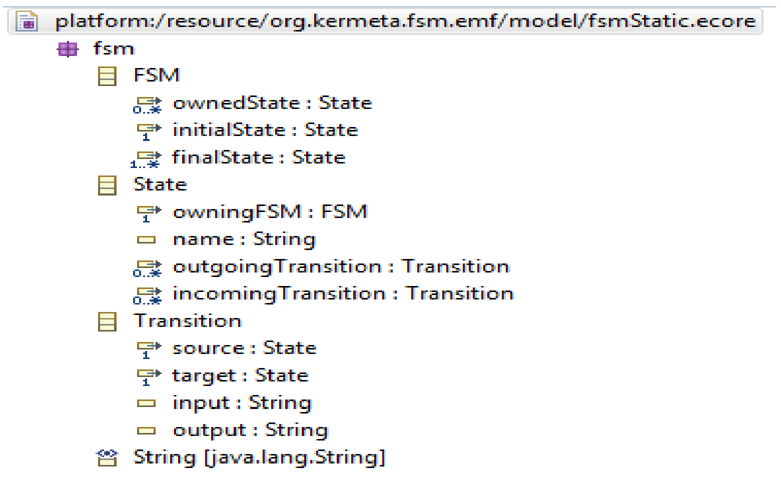
13 Do not forget to save the created meta-model.

.

1.2. Resulting meta-model

1.2.1. Metamodel with EMF sample editor

At this stage of the tutorial, the designed meta-model should look like the following meta-model:

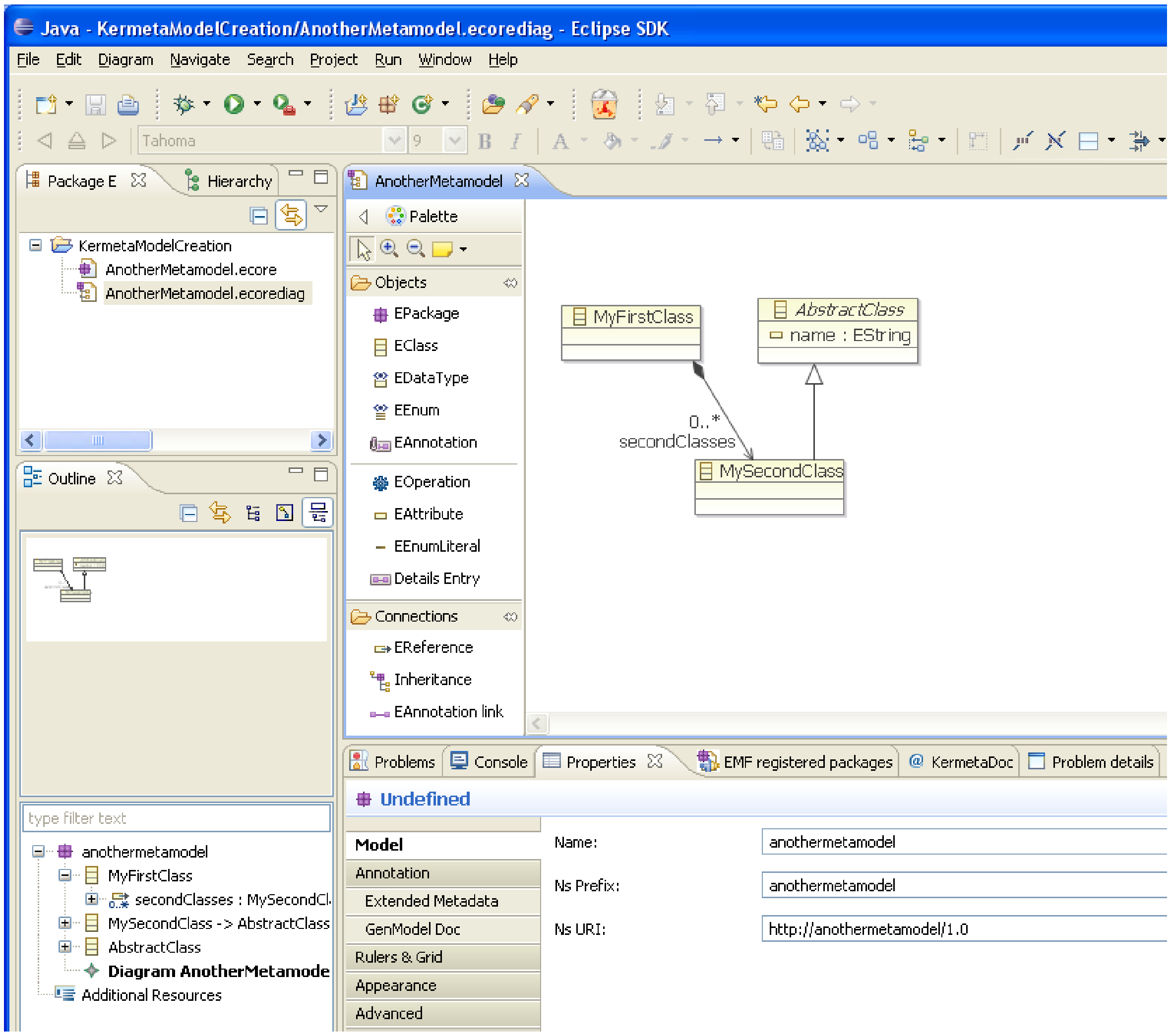


```
platform:/resource/org.kermeta.fsm.emf/model/fsmStatic.ecore
  fsm
    FSM
      ownedState : State
      initialState : State
      finalState : State
    State
      owningFSM : FSM
      name : String
      outgoingTransition : Transition
      incomingTransition : Transition
    Transition
      source : State
      target : State
      input : String
      output : String
    String [java.lang.String]
```

Figure 1.10. A simple FSM meta-model

1.2.2. Metamodel with Ecore Tools Diagram Editor

You can also edit these ecore file using a diagram editor from Eclipse Ecore Tools Project. For example, the ecore tools project provides a class diagram editor that works on top of ecore files. The diagram informations (ie. shape and position of the classes on the sheet) are stored in a separated file : *.ecorediag. To create this .ecorediag file rignt click on the .ecore file -> Initialize ecore diagram file ... and name the new .ecorediag file. Another way to create this file is File-> New -> Others -> Ecore Tools -> Ecore Diagram. Then select the .ecore file needed or create a new metamodel.



Name: anothermetamodel

Ns Prefix: anothermetamodel

Ns URI: http://anothermetamodel/1.0

Figure 1.11. Sample use of Ecore tool diagram editor on top of an ecore file

1.3. EMF meta-model creation tips

Creating a good meta-model is sometime difficult due to limitations of the used tools. For a better experience in using EMF tools and Kermeta, it is advised to respect the following rule:

Create an element that will contain directly or indirectly all the other elements. The reflexive editor and the editor generated by EMF allow to create only one root element and then, from this element, create contained elements.

This problem occurs only for model element creation from the editors. The editors correctly display models from meta-models that do not follow this rule if you are able to create such models by another mean. Kermeta is **not** affected by this constraint.

1.4. External documentation

Additional documentation on EMF can be found at the following links:

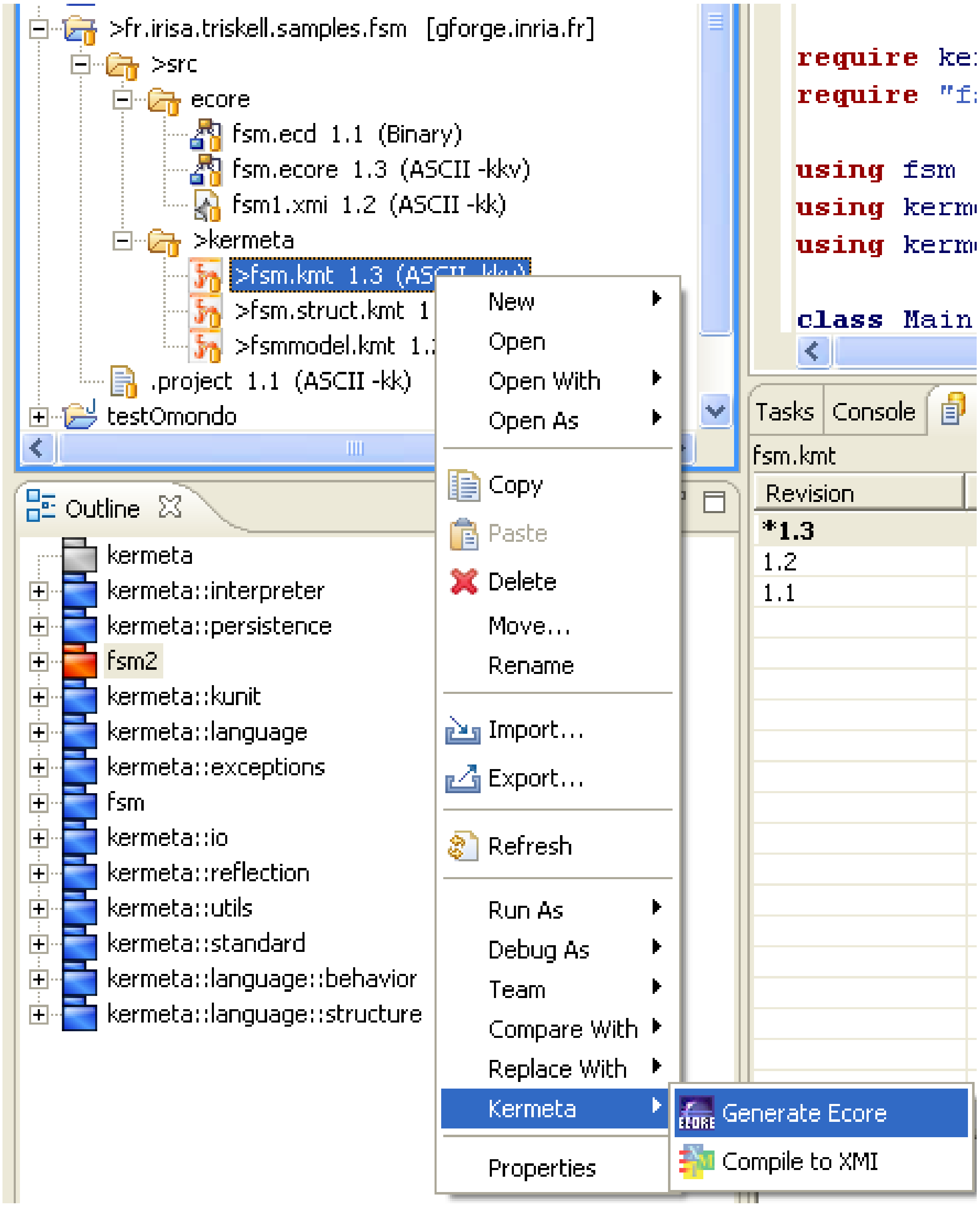
1. EMF Documentation
2. Eclipse Corner Article : Using EMF

More generally, most of EMF documentation can be found onto the Eclipse website.

1.5. Alternative ways to create a meta-model

EMF tools are not the only way to create Ecore meta-models. Any tool that can manipulate Ecore can do the same. Here is a small list of tools that can be used to create your meta-model:

1. Omondo / Eclipse UML has a nice graphical editor for Ecore models. It even enables to directly generate the EMF editor from this tool.
2. **Kermeta allows users to specify meta-models by means of the Kermeta syntax and then translate them into Ecore using the Kermeta2Ecore function.**



```
require ke
require "f
using fsm
using kerm
using kerm
class Main
```

Figure 1.12. Generate Ecore meta-model from Kermeta

The Ecore import/export function and the Omondo editor can be used in order to graphically display the Kermeta classes of a model. It will act as a basic manual roundtrip editor.

CHAPTER 2

Conclusion

This tutorial gives you the basis to create an EMF metamodel. It may be useful to use it with Kermeta for :

1. Creating model instances conform to an ecore metamodel (cf the tutorial FSM example chapter Editor) ;
2. Thanks to the Kermeta key word **require** you can load the ecore metaclasses and use it into a Kermeta program;
3. Kermeta use EMF to save and load programmaticaly a model (cf the tutorial FSM example chapter Model manipulation in Kermeta)