MAENAD

EAST-ADL

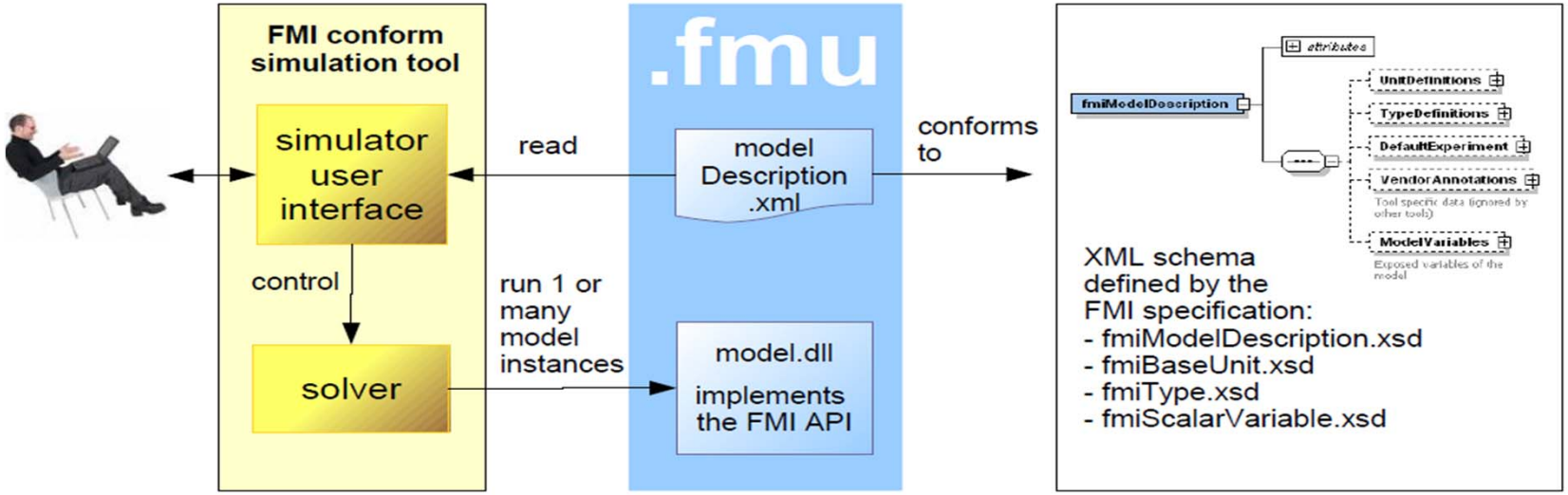
Concept Presentation

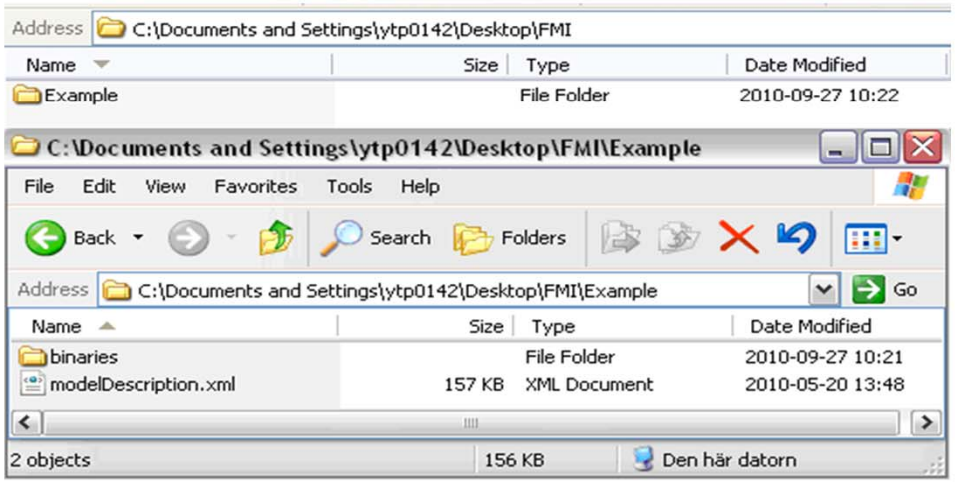
Converting from Modelisar FMU to EAST-ADL

Background

- Function Mockup Unit, FMU, is a central concept in the ITEA Modelisar project
  - Function Mockup Interface defines external interface of FMU
  - FMU is a ZIP archive with both executable function and its FMI

Background


FMI conform simulation tool
simulator user interface
control
solver
read
run 1 or many model instances
.fmu
model Description .xml
model.dll
implements the FMI API
conforms to
fmiModelDescription
attributes
UnitDefinitions
TypeDefinitions
DefaultExperiment
VendorAnnotations
Tool specific data ignored by other tools)
ModelVariables
Exposed variables of the model
XML schema defined by the FMI specification:
- fmiModelDescription.xsd
- fmiBaseUnit.xsd
- fmiType.xsd
- fmiScalarVariable.xsd

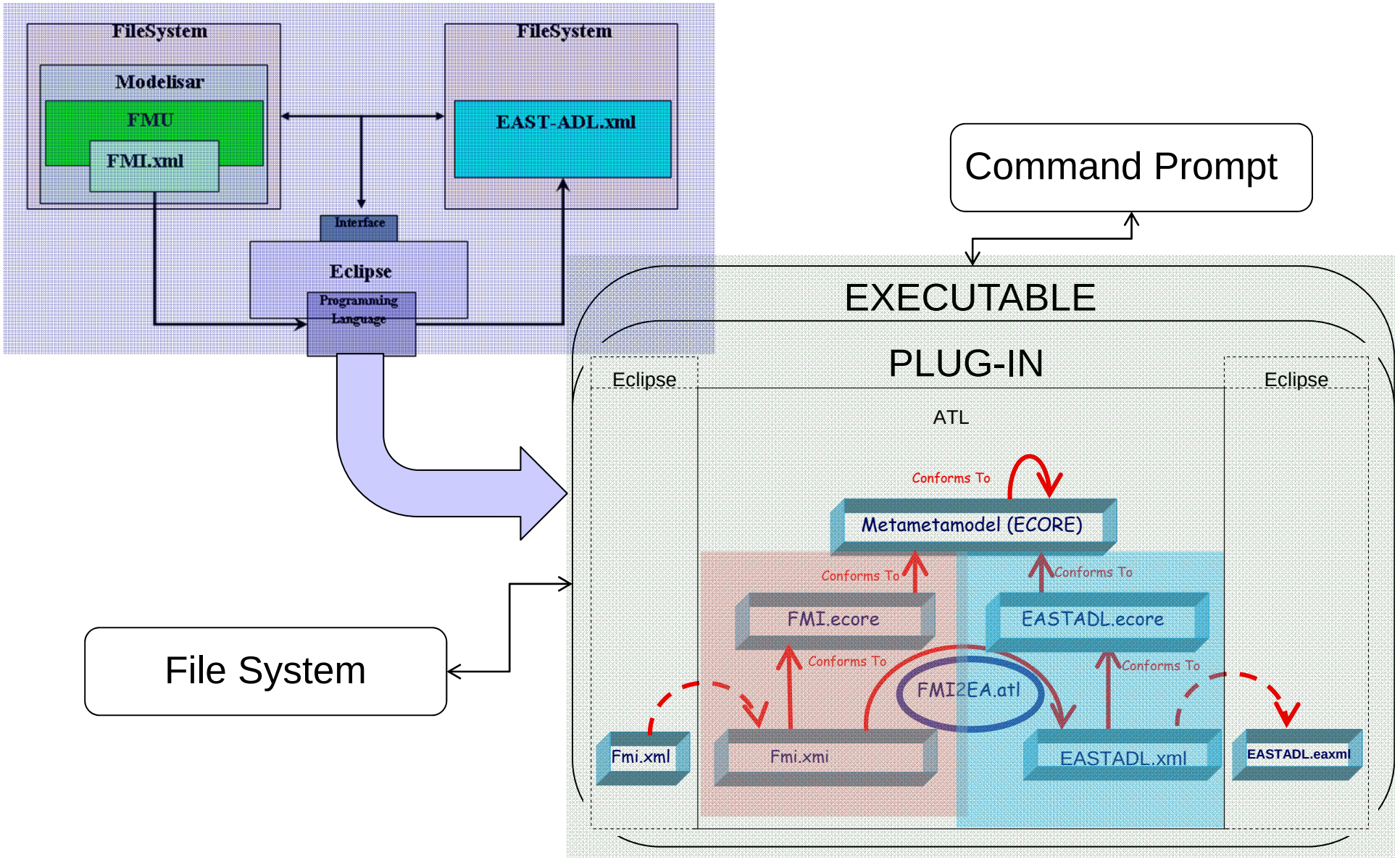

Address C:\Documents and Settings\ytp0142\Desktop\FMI
Name Size Type Date Modified
Example File Folder 2010-09-27 10:22
C:\Documents and Settings\ytp0142\Desktop\FMI\Example
File Edit View Favorites Tools Help
Back Search Folders
Address C:\Documents and Settings\ytp0142\Desktop\FMI\Example
Go
Name Size Type Date Modified
binaries File Folder 2010-09-27 10:21
modelDescription.xml 157 KB XML Document 2010-05-20 13:48
2 objects 156 KB Den här datorn

Background

- The interface definition of an FMU can be used for defining EAST-ADL models
  - Imported FMI is used to define ports and datatypes of EAST-ADL Function

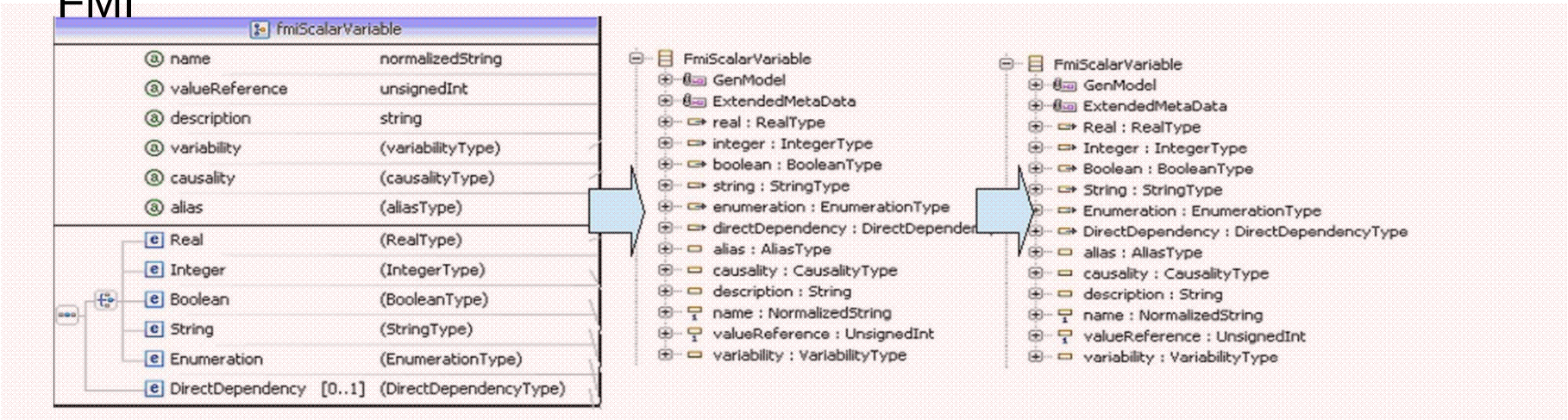
Tool FMI2EA converts from FMI definition in FMI XML file to an AnalysisFunction in an EAXML file.

Tool Oveview

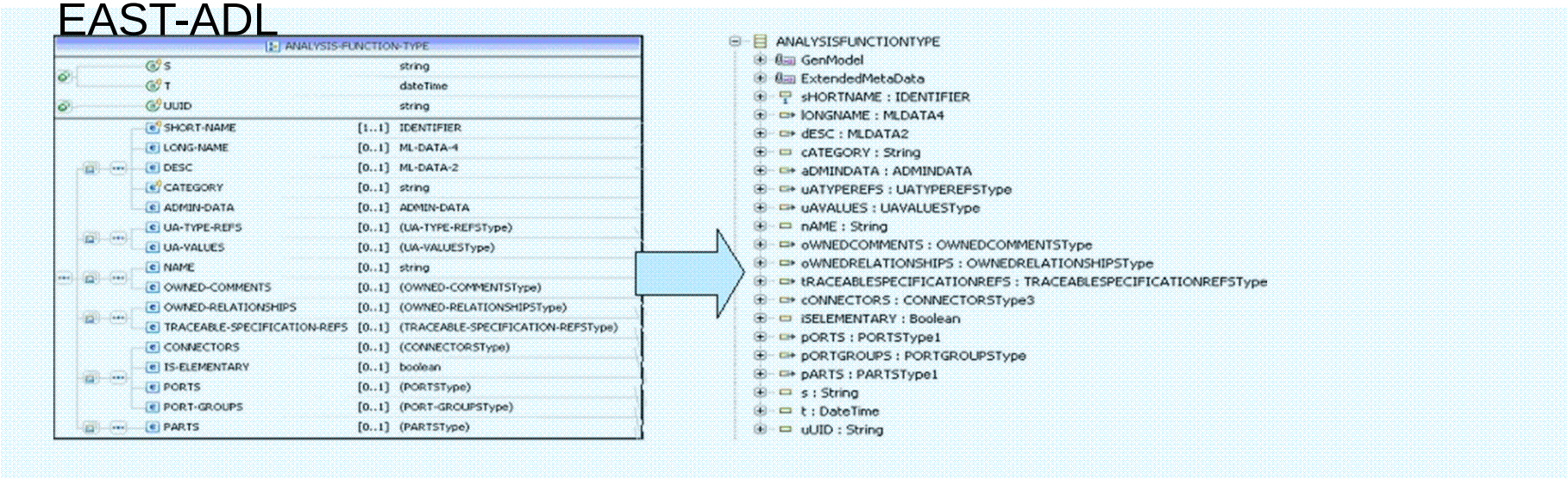


Implementation Details/ XSD→EcoreMM

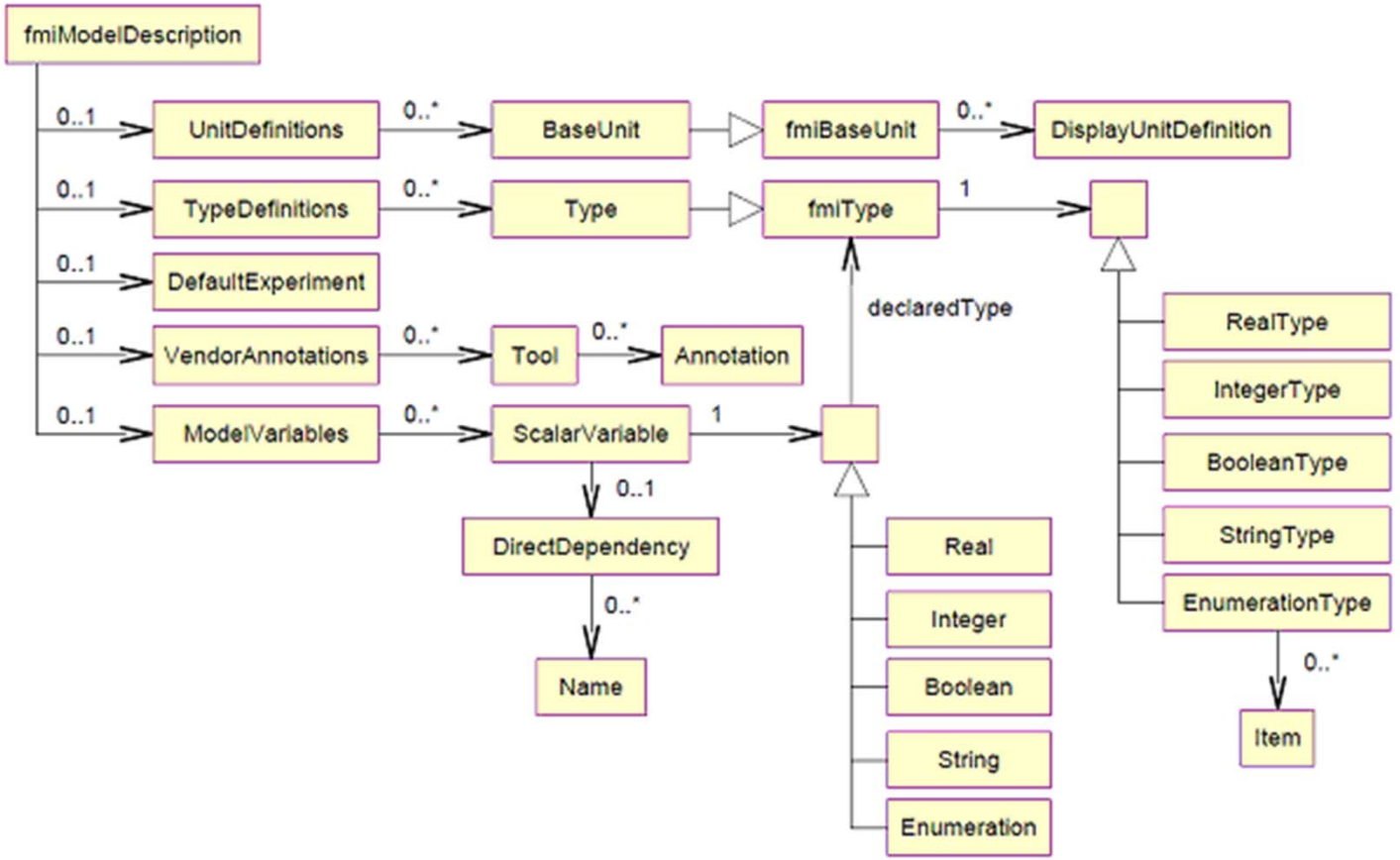
FMI



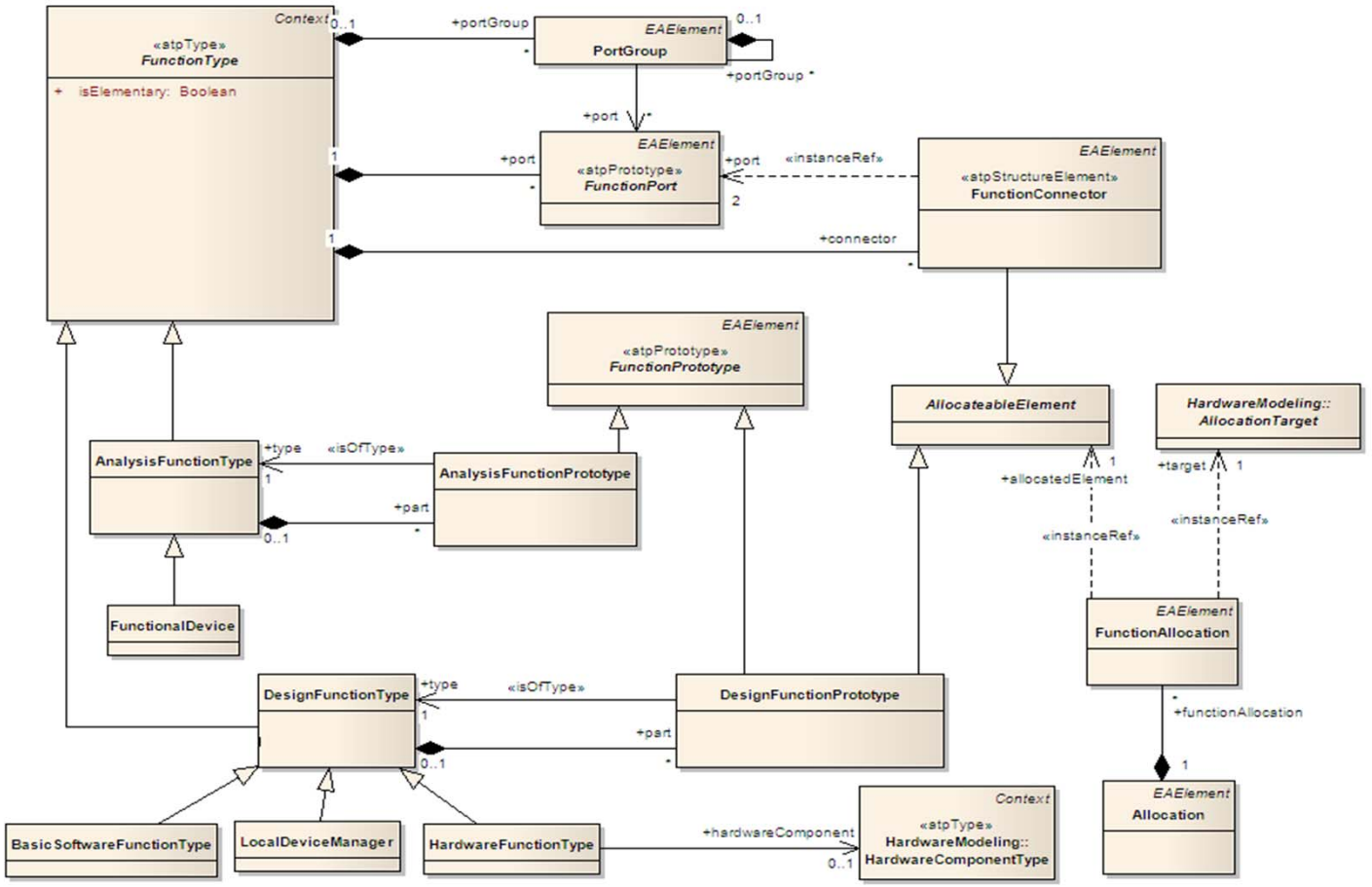
EAST-ADL



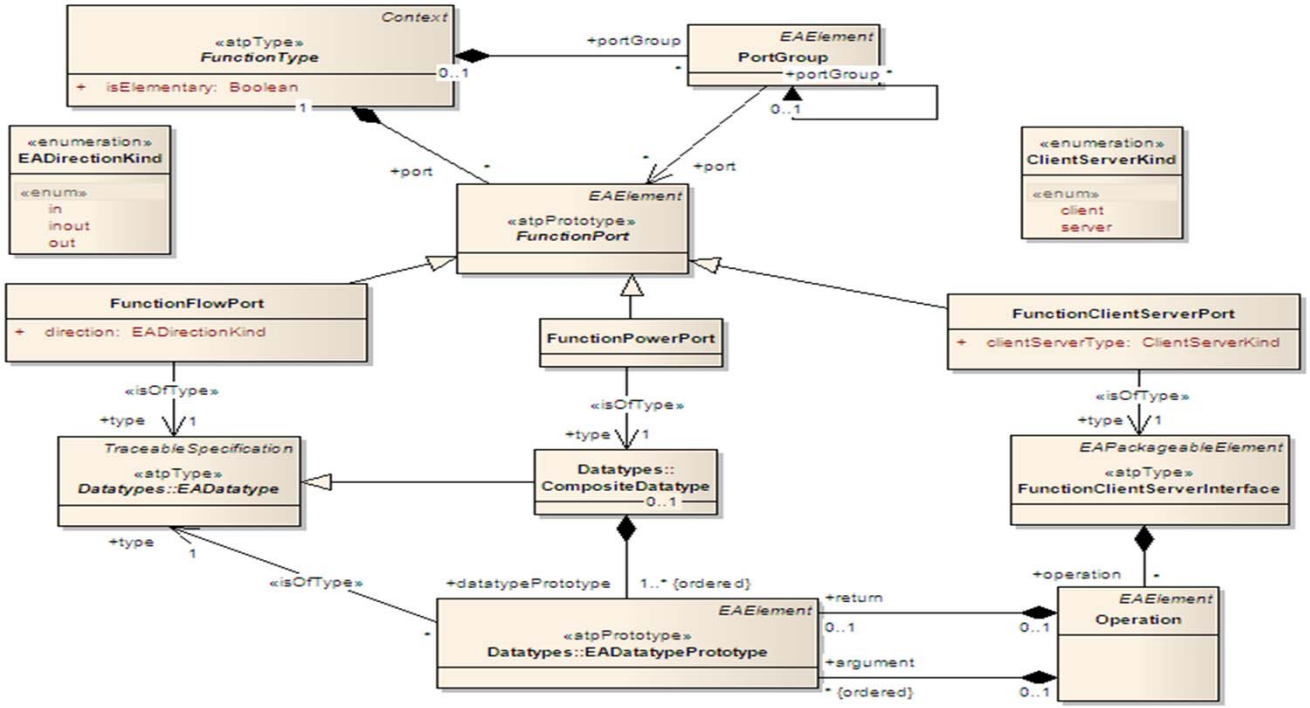
Implementation Details/ Mapping Rules



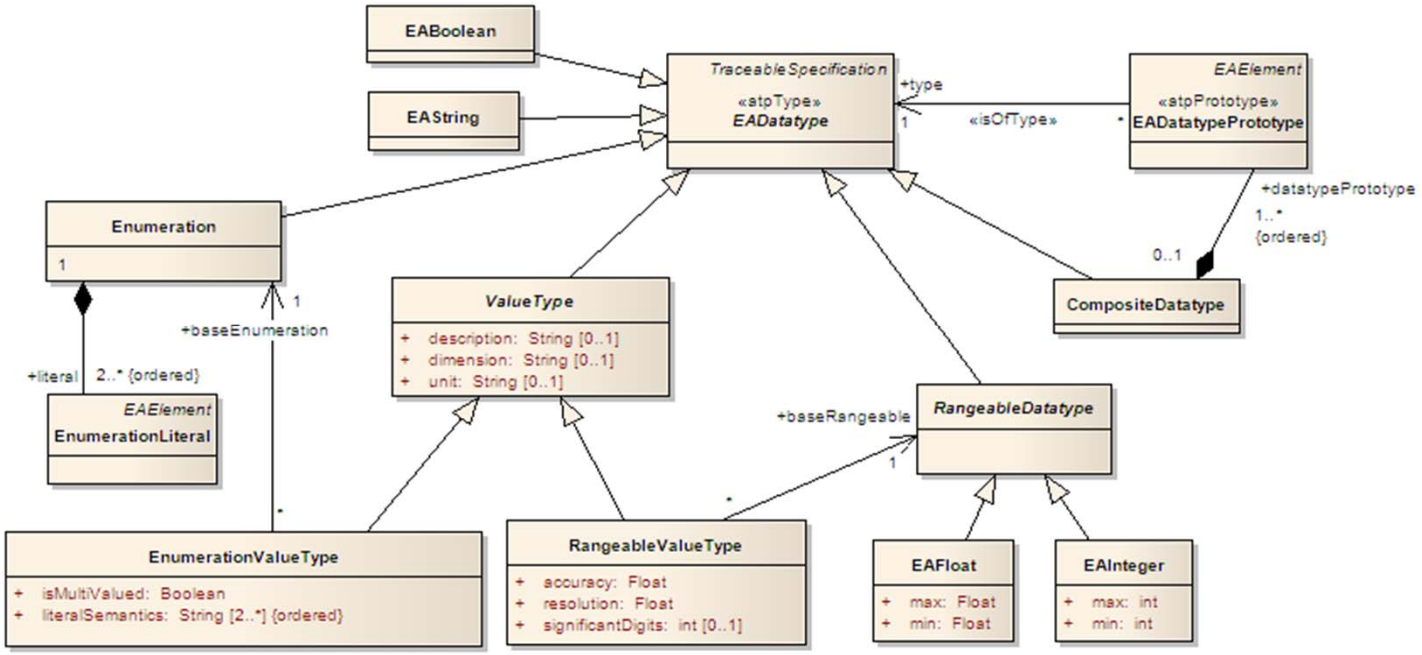
Implementation Details/ Mapping Rules



Implementation Details/ Mapping Rules



Implementation Details/ Mapping Rules



Example

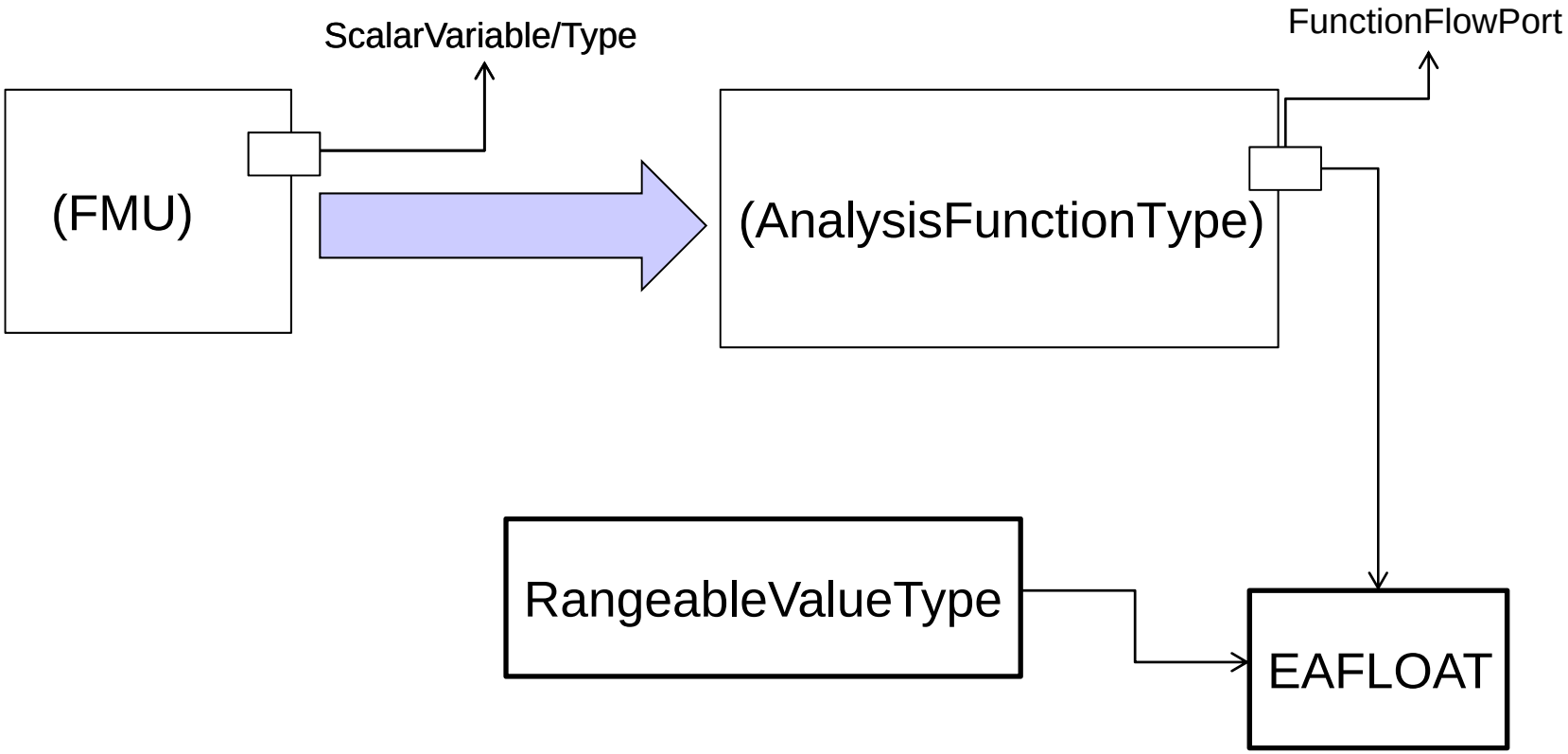
FmiModelExample.xml

```
1  <fmiModelDescription
2    modelName="Example"
3    <TypeDefinitions>
4      <Type
5          name="ExampleType">
6          <RealType
7              min="0"
8              max="10"
9              quantity = "ElectricPotential"
10             unit="V"
11         >
12         </RealType>
13         </Type>
14     </Type>
15   </TypeDefinitions>
16
17   <ModelVariables>
18     <ScalarVariable
19       name="ExampleScalarVariable"
20       description="VoltageMeasurementSignal"
21       causality="output">
22       <Real
23       min = "-5"
24       unit = "V"
25       declaredType = "ExampleType"
26       />
27     </ScalarVariable>
28   </ModelVariables>
29 </fmiModelDescription>
```

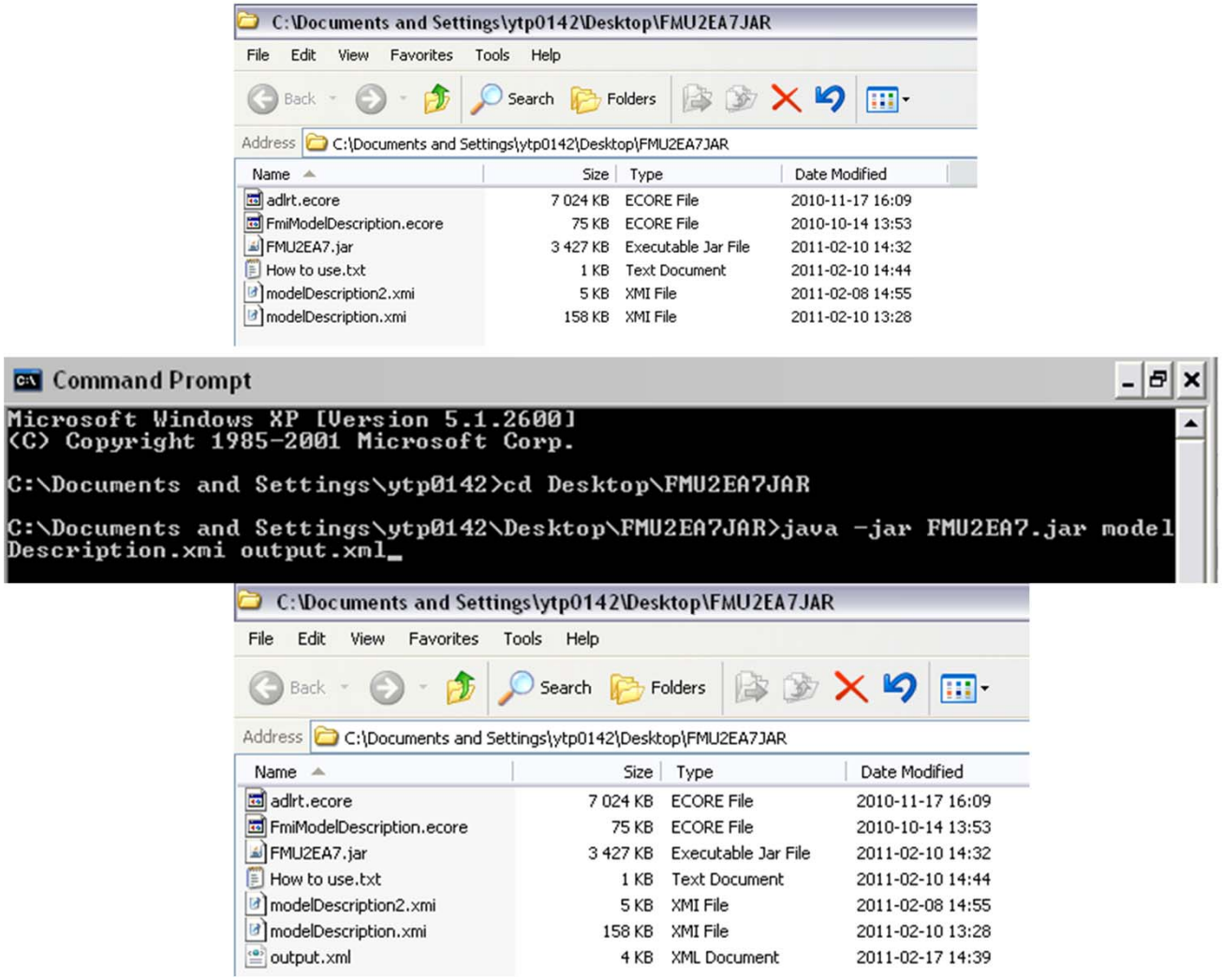
Example

```
<eAXML>
    <tOPLEVELPACKAGES>
      <eAPACKAGE>
        <eLEMENTS>
          <aNALYSISFUNCTIONTYPE sHORTNAME="Example" nAME="Example">
            <pORTS>
              <fUNCTIONFLOWPORT sHORTNAME="ExampleScalarVariable" nAME="ExampleScalarVariable" dIRECTION="OUT">
                <tYPETREF value="ElectricPotential" dEST="EA-FLOAT"/>
              </fUNCTIONFLOWPORT>
            </pORTS>
          </aNALYSISFUNCTIONTYPE>
          <EAFLOAT sHORTNAME="ElectricPotential" nAME="ElectricPotential" mAX="10.0" mIN="-5.0"/>
          <RANGEABLEVALUETYPE sHORTNAME="ElectricPotential" nAME="ElectricPotential">
            <bASERANGEABLEREF value="ElectricPotential" dEST="EA-FLOAT"/>
          </RANGEABLEVALUETYPE>
        </eLEMENTS>
      </eAPACKAGE>
    </tOPLEVELPACKAGES>
</eAXML>
```

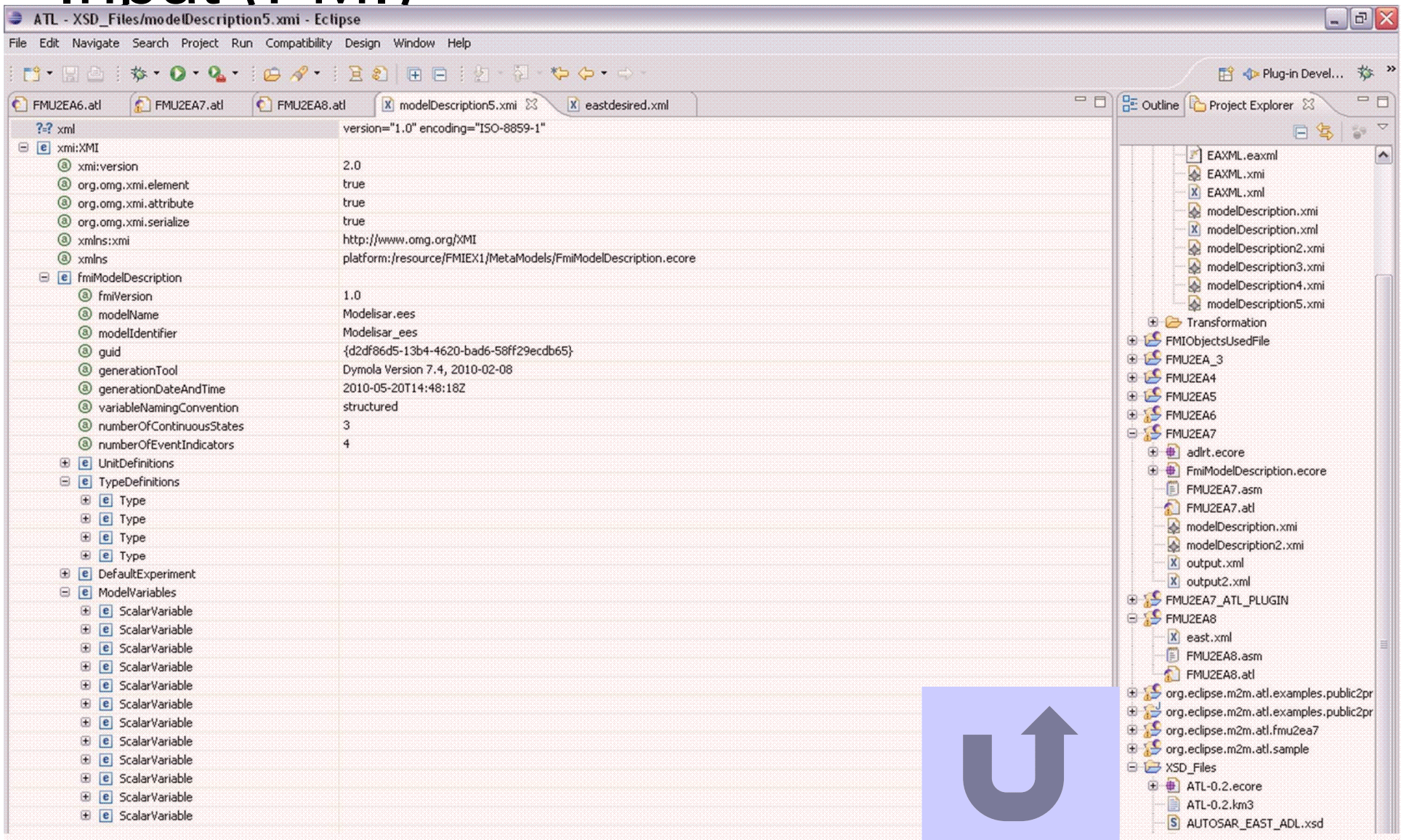
Example


ScalarVariable/Type
FunctionFlowPort
(FMU)
(AnalysisFunctionType)
RangeableValueType
EAFLOAT

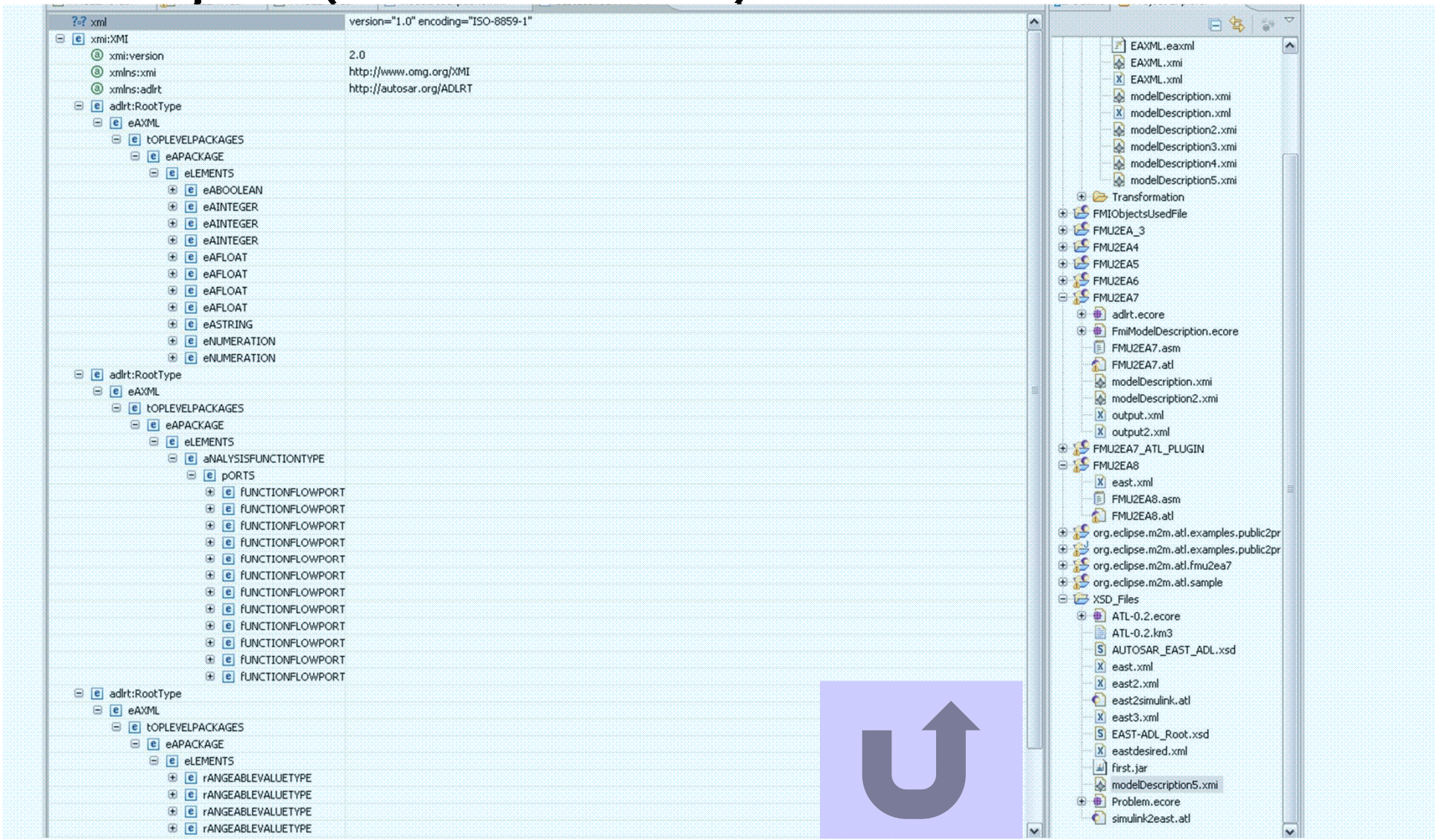
Tool User Interface



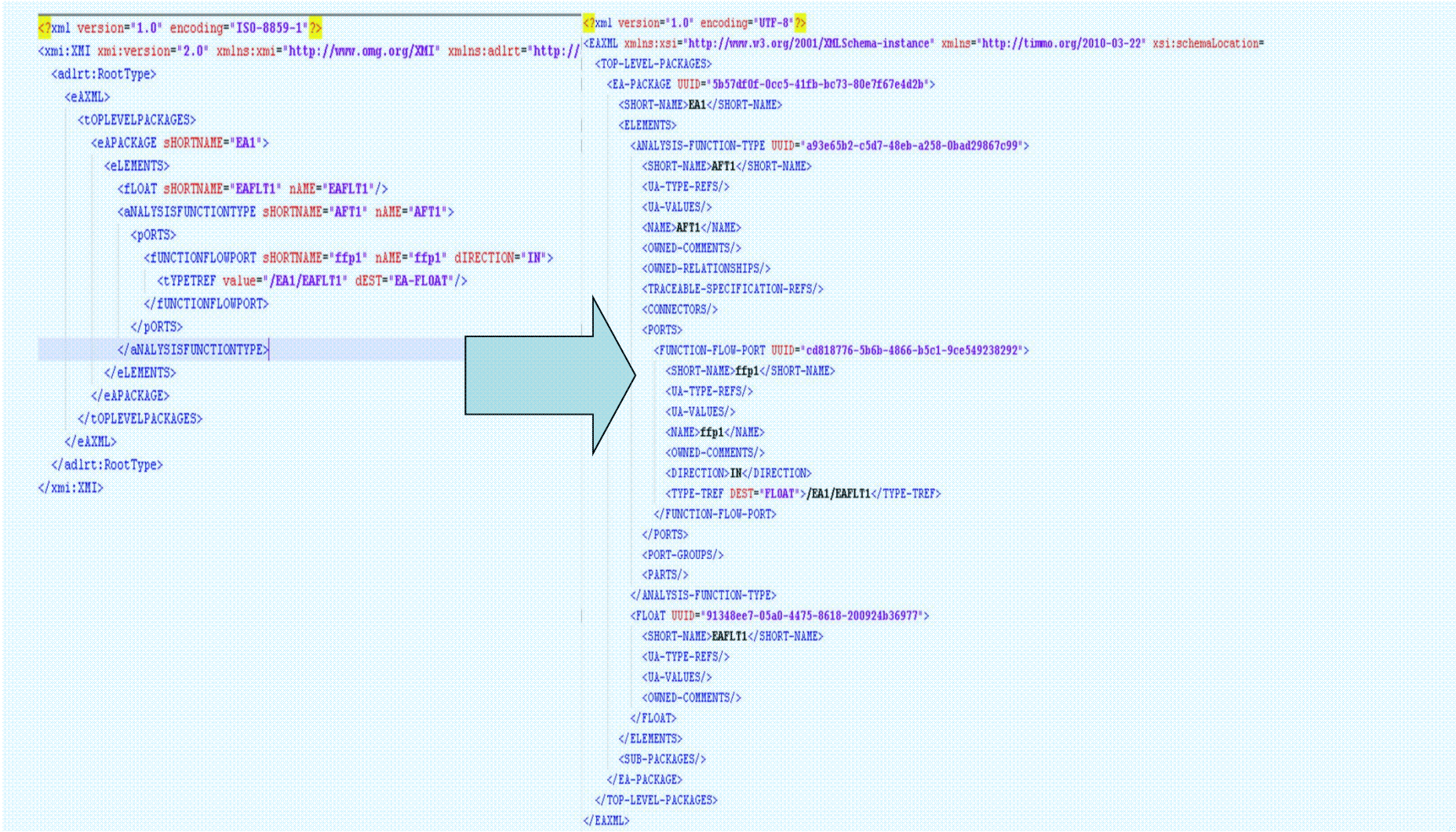
Input (FMI)


ATL - XSD_Files/modelDescription5.xmi - Eclipse
File Edit Navigate Search Project Run Compatibility Design Window Help
FMU2EA6.atl
FMU2EA7.atl
FMU2EA8.atl
modelDescription5.xmi
eastdesired.xml
xml
version="1.0" encoding="ISO-8859-1"
xmi:XMI
xmi:version 2.0
org.omg.xmi.element true
org.omg.xmi.attribute true
org.omg.xmi.serialize true
xmlns:xmi http://www.omg.org/XMI
xmlns platform:/resource/FMIEX1/MetaModels/FmiModelDescription.ecore
fmiModelDescription
fmiVersion 1.0
modelName Modelisar.ees
modelIdentifier Modelisar_ees
guid {d2df86d5-13b4-4620-bad6-58ff29ecdb65}
generationTool Dymola Version 7.4, 2010-02-08
generationDateAndTime 2010-05-20T14:48:18Z
variableNamingConvention structured
numberOfContinuousStates 3
numberOfEventIndicators 4
UnitDefinitions
TypeDefinitions
Type
Type
Type
Type
DefaultExperiment
ModelVariables
ScalarVariable
Outline
Project Explorer
EAXML.eaxml
EAXML.xmi
EAXML.xml
modelDescription.xmi
modelDescription.xml
modelDescription2.xmi
modelDescription3.xmi
modelDescription4.xmi
modelDescription5.xmi
Transformation
FMIObjectsUsedFile
FMU2EA_3
FMU2EA4
FMU2EA5
FMU2EA6
FMU2EA7
adlrt.ecore
FmiModelDescription.ecore
FMU2EA7.asm
FMU2EA7.atl
modelDescription.xmi
modelDescription2.xmi
output.xml
output2.xml
FMU2EA7_ATL_PLUGIN
FMU2EA8
east.xml
FMU2EA8.asm
FMU2EA8.atl
org.eclipse.m2m.atl.examples.public2pr
org.eclipse.m2m.atl.examples.public2pr
org.eclipse.m2m.atl.fmu2ea7
org.eclipse.m2m.atl.sample
XSD_Files
ATL-0.2.ecore
ATL-0.2.km3
AUTOSAR_EAST_ADL.xsd

Output (EAST-ADL)



EAST-ADL.XML→EAST-ADL.EAXML



```
<?xml version="1.0" encoding="ISO-8859-1"?>
<xmi:XMI xmi:version="2.0" xmlns:xmi="http://www.omg.org/XMI" xmlns:adlrt="http://
  <adlrt:RootType>
    <eAXML>
      <tOPLEVELPACKAGES>
        <eAPACKAGE sHORTNAME="EA1">
          <eLEMENTS>
            <fLOAT sHORTNAME="EAFLT1" nAME="EAFLT1"/>
            <aNALYSISFUNCTIONTYPE sHORTNAME="AFT1" nAME="AFT1">
              <pORTS>
                <fUNCTIONFLOWPORT sHORTNAME="ffp1" nAME="ffp1" dIRECTION="IN">
                  <tYPETREF value="/EA1/EAFLT1" dEST="EA-FLOAT"/>
                </fUNCTIONFLOWPORT>
              </pORTS>
            </aNALYSISFUNCTIONTYPE>
          </eLEMENTS>
        </eAPACKAGE>
      </tOPLEVELPACKAGES>
    </eAXML>
  </adlrt:RootType>
</xmi:XMI>
```

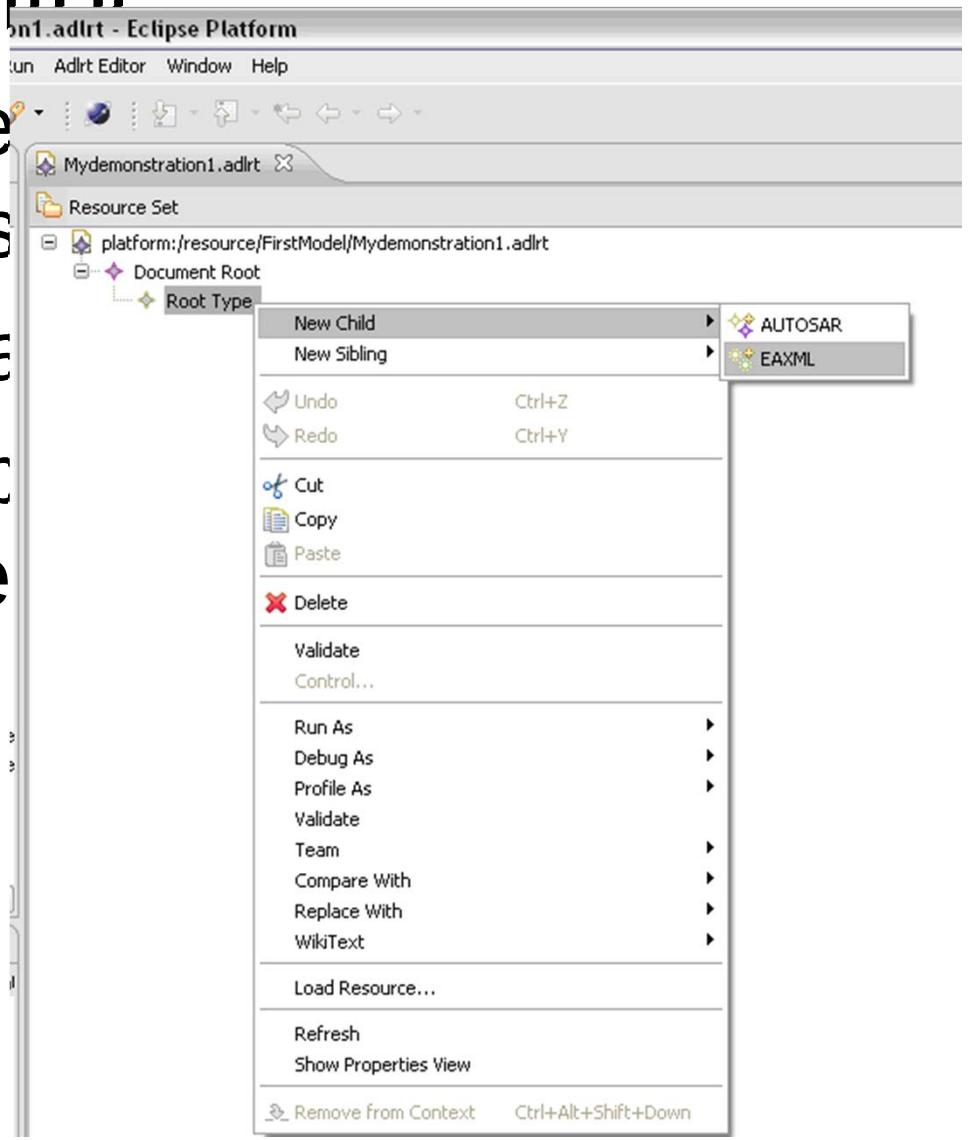
```
<?xml version="1.0" encoding="UTF-8"?>
<EAXML xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://timmo.org/2010-03-22" xsi:schemaLocation=
  <TOP-LEVEL-PACKAGES>
    <EA-PACKAGE UUID="5b57df0f-0cc5-41fb-bc73-80e7f67e4d2b">
      <SHORT-NAME>EA1</SHORT-NAME>
      <ELEMENTS>
        <ANALYSIS-FUNCTION-TYPE UUID="a93e65b2-c5d7-48eb-a258-0bad29867c99">
          <SHORT-NAME>AFT1</SHORT-NAME>
          <UA-TYPE-REFS/>
          <UA-VALUES/>
          <NAME>AFT1</NAME>
          <OWNED-COMMENTS/>
          <OWNED-RELATIONSHIPS/>
          <TRACEABLE-SPECIFICATION-REFS/>
          <CONNECTORS/>
          <PORTS>
            <FUNCTION-FLOW-PORT UUID="cd818776-5b6b-4866-b5c1-9ce549238292">
              <SHORT-NAME>ffp1</SHORT-NAME>
              <UA-TYPE-REFS/>
              <UA-VALUES/>
              <NAME>ffp1</NAME>
              <OWNED-COMMENTS/>
              <DIRECTION>IN</DIRECTION>
              <TYPE-TREF DEST="FLOAT">/EA1/EAFLT1</TYPE-TREF>
            </FUNCTION-FLOW-PORT>
          </PORTS>
          <PORT-GROUPS/>
          <PARTS/>
        </ANALYSIS-FUNCTION-TYPE>
        <FLOAT UUID="91348ee7-05a0-4475-8618-200924b36977">
          <SHORT-NAME>EAFLT1</SHORT-NAME>
          <UA-TYPE-REFS/>
          <UA-VALUES/>
          <OWNED-COMMENTS/>
        </FLOAT>
      </ELEMENTS>
      <SUB-PACKAGES/>
    </EA-PACKAGE>
  </TOP-LEVEL-PACKAGES>
</EAXML>
```

EAST-ADL Editor

- Building knowledge on Eclipse Modelling Tools
- Gaining Feedback for Maenad
- Obtaining an open source XML based EAST-ADL tree editor

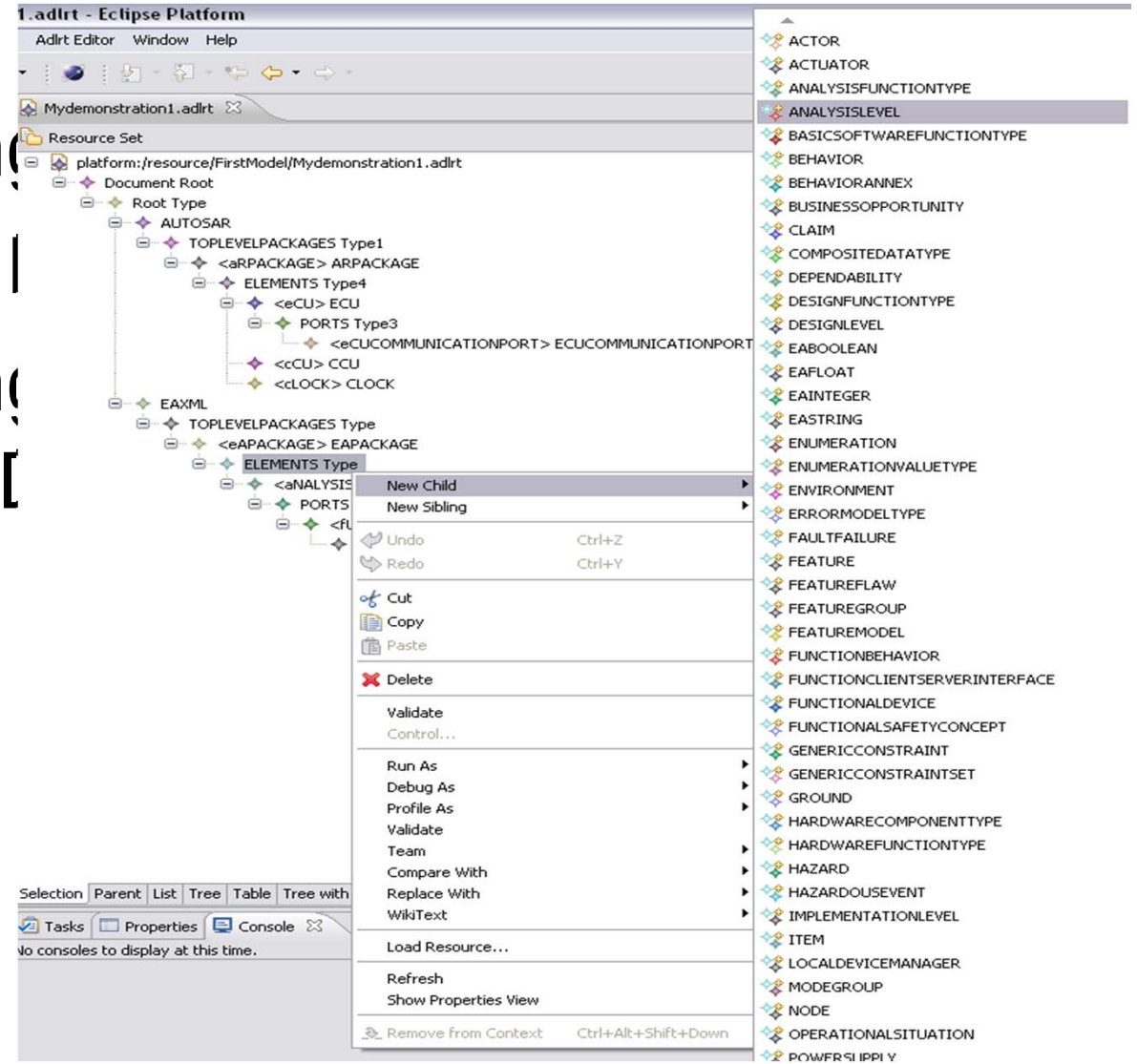
EAST-ADL Editor

- Building knowle
  Modelling Tools
- Gaining Feedba
- Obtaining an op
  EAST-ADL tree



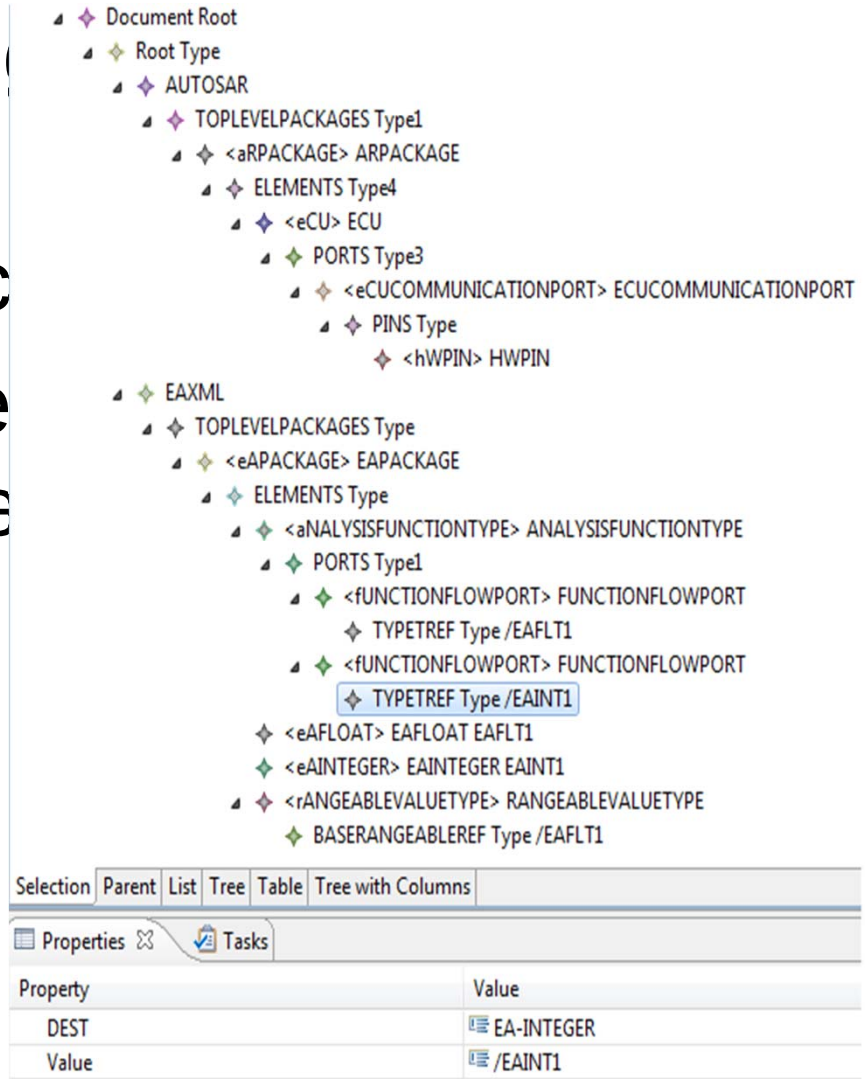
EAST-ADL Editor

- Building
  Modellin
- Gaining
- Obtainin
  EAST-AD



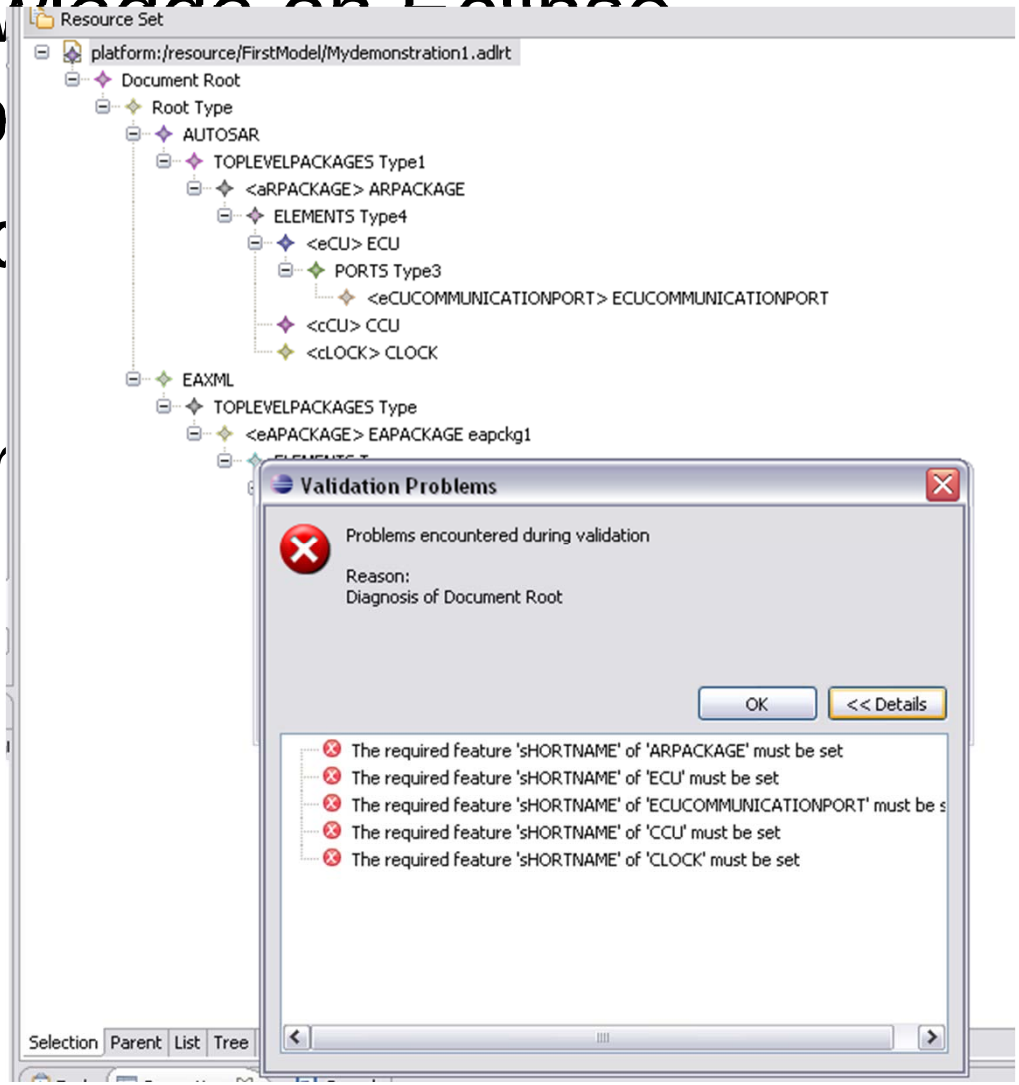
EAST-ADL Editor

- Building knowled
  Modelling Tools
- Gaining Feedbac
- Obtaining an ope
  EAST-ADL tree e



EAST-ADL Editor

- Building knowledge on Eclipse Modelling To
- Gaining Feed
- Obtaining an EAST-ADL tr



EAST-ADL Editor/ EditorOutput.XML→DesiredOutput.XML

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<adlrt:Root xmlns:adlrt="http://autosar.org/ADLRT">
  <adlrt:EAXML>
    <adlrt:TOP-LEVEL-PACKAGES>
      <adlrt:EA-PACKAGE>
        <adlrt:SHORT-NAME>EA1</adlrt:SHORT-NAME>
        <adlrt:ELEMENTS>
          <adlrt:ANALYSIS-FUNCTION-TYPE>
            <adlrt:SHORT-NAME>AFT1</adlrt:SHORT-NAME>
            <adlrt:NAME>AFT1</adlrt:NAME>
            <adlrt:PORTS>
              <adlrt:FUNCTION-FLOW-PORT>
                <adlrt:SHORT-NAME>ffp1</adlrt:SHORT-NAME>
                <adlrt:NAME>ffp1</adlrt:NAME>
                <adlrt:TYPE-TREF DEST="EA-FLOAT">/EA1/EAFLT1</adlrt:TYPE-TREF>
              </adlrt:FUNCTION-FLOW-PORT>
            </adlrt:PORTS>
          </adlrt:ANALYSIS-FUNCTION-TYPE>
          <adlrt:EA-FLOAT>
            <adlrt:SHORT-NAME>EAFLT1</adlrt:SHORT-NAME>
          </adlrt:EA-FLOAT>
        </adlrt:ELEMENTS>
      </adlrt:EA-PACKAGE>
    </adlrt:TOP-LEVEL-PACKAGES>
  </adlrt:EAXML>
</adlrt:Root>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<EAXML xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http:
  <TOP-LEVEL-PACKAGES>
    <EA-PACKAGE>
      <SHORT-NAME>EA1</SHORT-NAME>
      <ELEMENTS>
        <ANALYSIS-FUNCTION-TYPE>
          <SHORT-NAME>AFT1</SHORT-NAME>
          <NAME>AFT1</NAME>
          <PORTS>
            <FUNCTION-FLOW-PORT>
              <SHORT-NAME>ffp1</SHORT-NAME>
              <NAME>ffp1</NAME>
              <TYPE-TREF DEST="EA-FLOAT">/EA1/EAFLT1</TYPE-TREF>
            </FUNCTION-FLOW-PORT>
          </PORTS>
        </ANALYSIS-FUNCTION-TYPE>
        <EA-FLOAT>
          <SHORT-NAME>EAFLT1</SHORT-NAME>
        </EA-FLOAT>
      </ELEMENTS>
    </EA-PACKAGE>
  </TOP-LEVEL-PACKAGES>
</EAXML>
```

Summary

- FMU interface (FMI) and EAST-ADL Function has high correspondance
- Although ATL has some disadvanteges, it is well appropriate for M2M transformation projects
- Eclipse and its supporting tools are very powerful
- FMU2EA tool can be handy especially for reusability of already available FMU models.