ModelicaXML

A Modelica XML representation with Applications

Adrian Pop, Peter Fritzson
Programming Environments Laboratory
Linköping University

Outline

- Introduction
- Why XML?
- XML, DTD
- ModelicaXML
- ModelicaXML Applications
- Problems with XML
- Semantic Web Languages
- Conclusions and Future Work

Introduction

- Modelica has a fast growing code base
- Modelica adopters have to develop their *own* tools for tasks like:
  - analysis of models (checkers and validators)
  - pretty printing (un-parsing)
  - interchange with other modeling languages
  - query and transformation of models
  - impose code style guidelines
  - documentation
- All these utilities
  - need easy access to the structure of the language
  - should interoperate.

Why XML?

- Store the structure of the Modelica code using an *alternative representation*
- Perform the tasks on this alternative representation
- The alternative representation should
  - be easy accessible from any programming language
  - be easy to transform, query and manipulate
  - support validation
- XML has all these properties

Extensible Markup Language (XML)

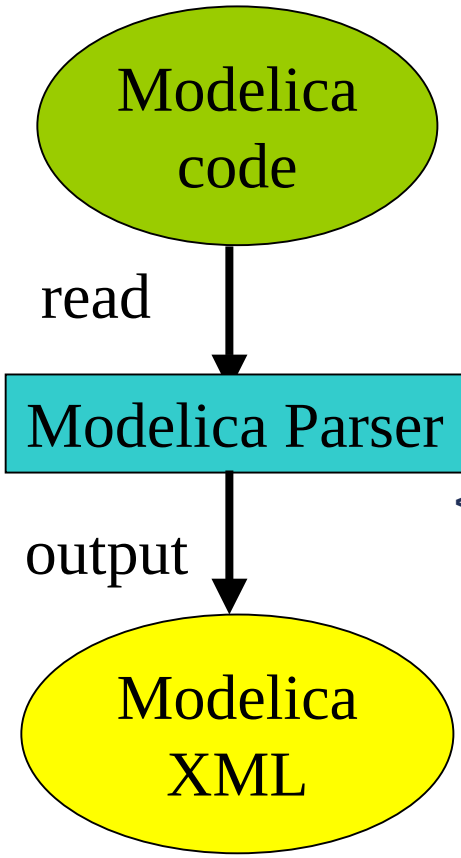
- World Wide Web Consortium (W3C) standard
- XML represents information as trees using tags

```
<?xml version="1.0"?>
<!DOCTYPE persons SYSTEM "persons.dtd">
<persons>
 <person job="programmer">
  <name>John Doe</name>
  <email>email@none.ro</email>
 </person>
 …
 <person job="manager">
   <comment>Classified</comment>
 </person>
</persons>
```

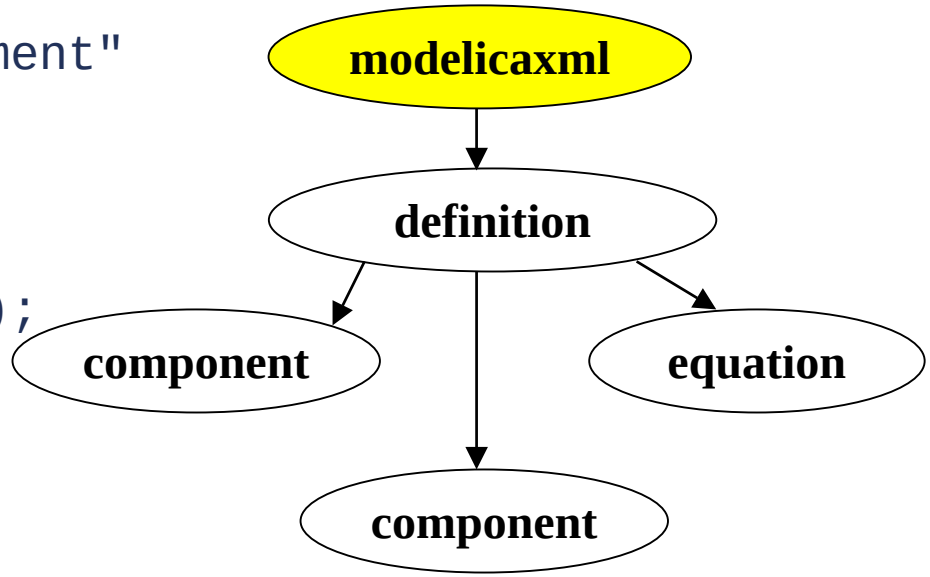
Document Type Definition (DTD)

- DTDs specify the allowed content of the XML elements
- Are used for XML document validation

```
<!ENTITY % person-job-attribute
    "job (programmer|manager) #REQUIRED">
<!ELEMENT persons (person*)>
<!ELEMEN person((name+, email*)|comment+)>
<!ATTLIST person
     project CDATA #IMPLIED
     &person-job-attribute;>
<!ELEMENT name(#PCDATA)>
<!ELEMENT email(#PCDATA)>
<!ELEMENT comment (#PCDATA)>
```

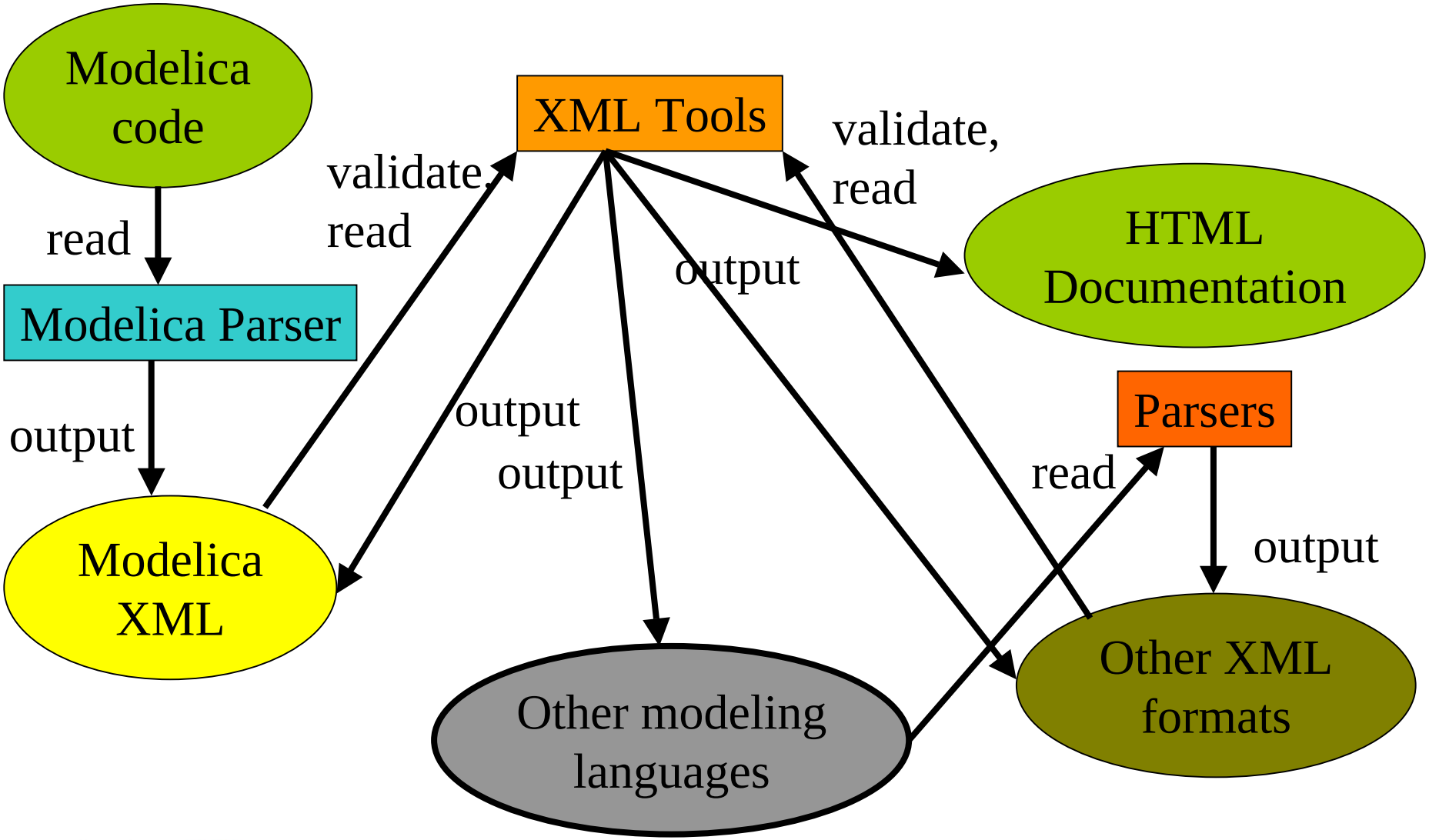



```
class Test "comment"
   Real x;
   Real xdot;
 equation
   xdot = der(x);
end Test;
```

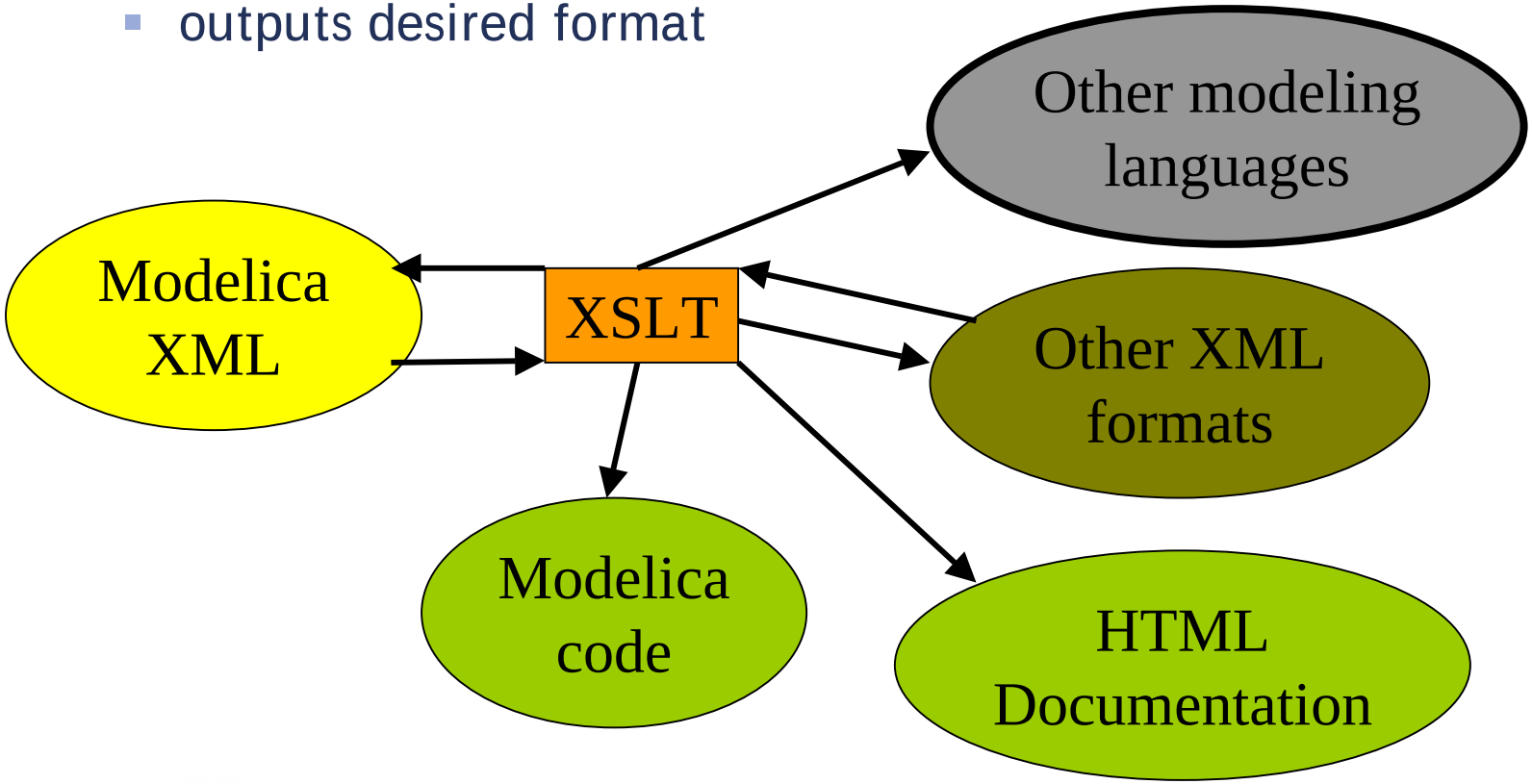



```
<modelicaxml>
  <definition ident= "Test"
              comment="comment">
    <component ident="x" type="Real"
               visibility="public" />
    <component ident="xdot" type="Real"
               visibility="public" />
    <equation>...</equation>
  </definition>
</modelicaxml>
```

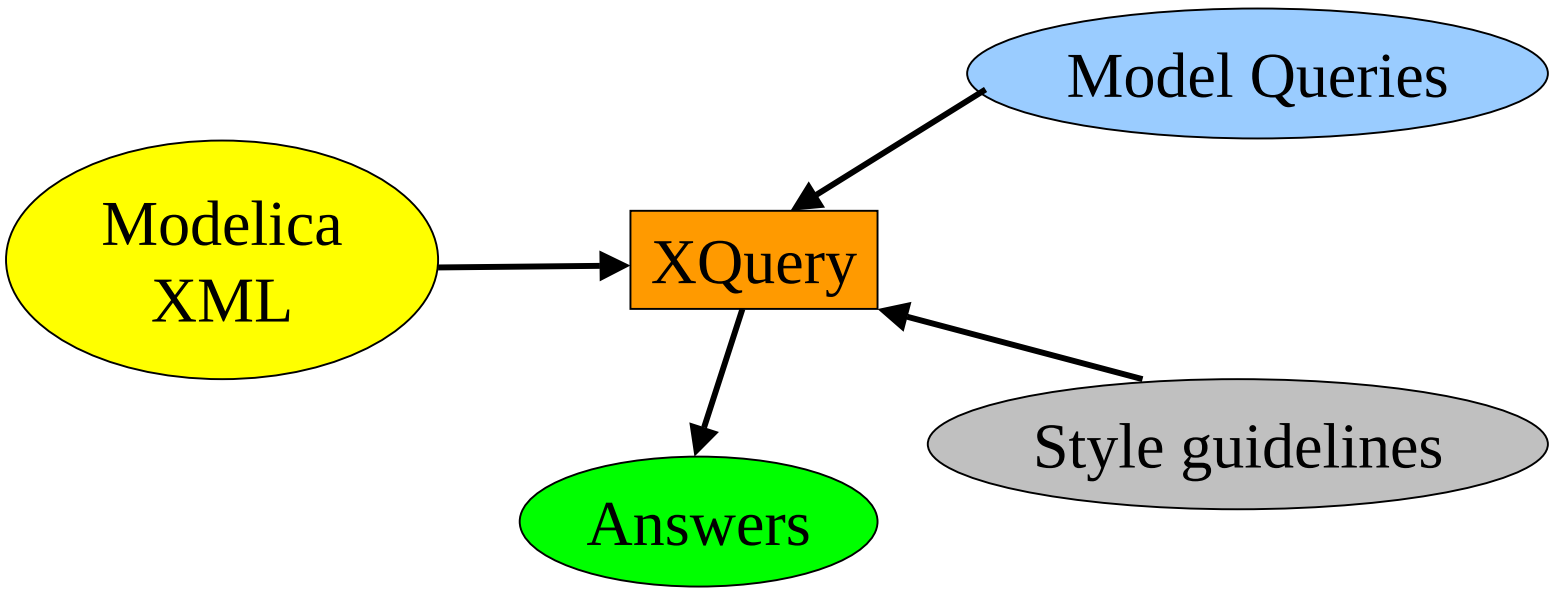
Interoperability and Transformation



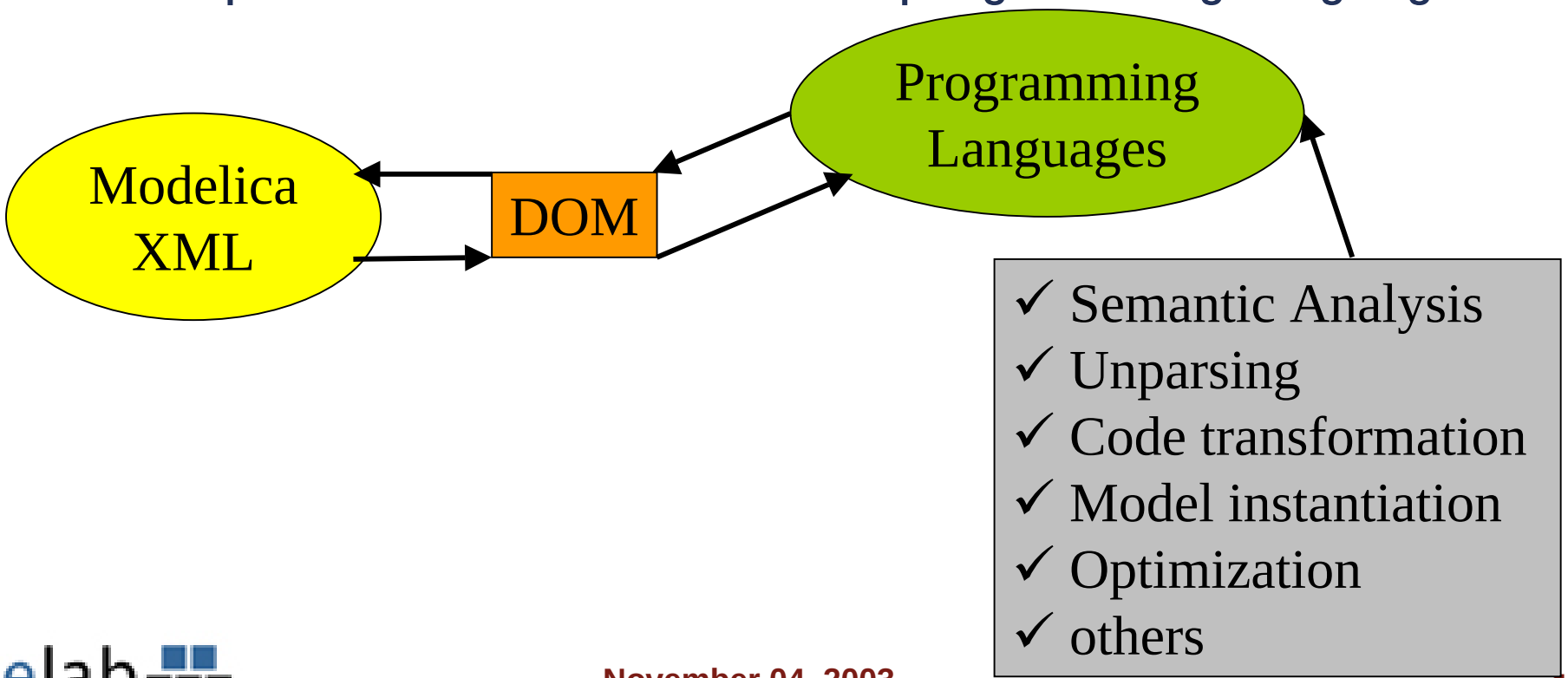
- The Stylesheet Language for Transformation (XSLT)
  - is a declarative language for *transforming* XML trees
  - selects parts of the XML tree using the XPath language
  - uses templates to transform the selected parts
  - outputs desired format



- The Query Language for XML (XQuery)
  - is a declarative language for *query* of XML trees
  - selects parts of the XML tree using the XPath language
  - uses SQL-like query language to further manipulate the results



- Document Object Model (DOM)
  - is a platform and language neutral interface for
    - access and update the content/structure/style of XML trees in XML documents
  - implementation in almost all programming languages



Problems with the XML Representation

- XML can only express *syntax*
- No easy way to automatically handle *semantics*
- Possible solutions
  - use more expressive markup languages to express Modelica semantics
  - use available tools for these languages

Semantic Web Languages

- Resource Description Framework (RDF)
  - represents graphs
  - describes classes and relations
  - out of the box tools for graph query
  - some type checking is available
- Web Ontology Language (OWL)
  - adds a Description Logics layer on top of RDF
  - out of the box tools for:
    - type checking
    - model consistency
    - making the implicit sub-typing and equivalence relations explicit (inference)

Conclusions and Future Work

- ModelicaXML
  - offers *easy access* to Modelica language structure
  - helps in providing *more non-simulation applications* for Modelica
  - is *not enough* for handling Modelica semantics

- Future Work
  - formal definition of all the intermediate steps from Modelica to flat Modelica (static semantics, interoperability)
    - tools will act on these level independent of each other
  - further investigation of the use of the Semantic Web Languages to express Modelica semantics is needed

Thank you!

Questions?

ModelicaXML and ModelicaOWL

- ModelicaXML
  - http://www.ida.liu.se/~adrpo/modelica/xml
- ModelicaOWL
  - http://www.ida.liu.se/~adrpo/modelica/owl