

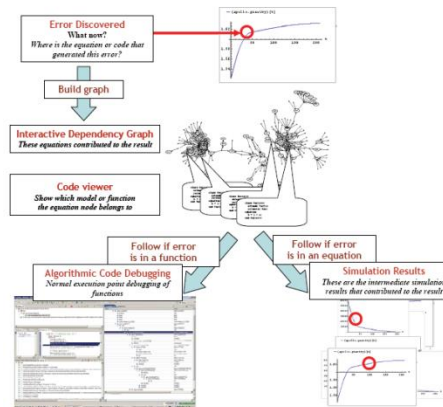
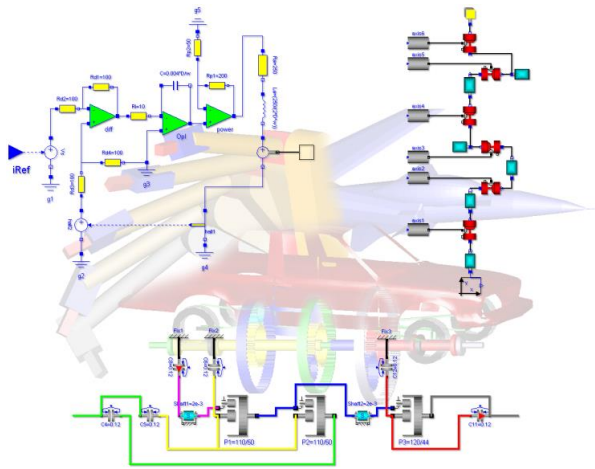
Technical Overview of OpenModelica and its Development Environment

Adrian Pop

2016-02-01

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www.OpenModelica.org



$$\tau_2 = \frac{1}{k_2} \tau_1$$

$$e = \theta_{ref} - \theta_{out}$$

$$u = K \left(e + \frac{1}{T_I} \int_0^t e dt \right)$$

$$v = u \quad u_R = R i \quad u_{out} = k_1 \omega_{out}$$

$$J_1 \frac{d^2 \theta_1}{dt^2} = \tau_{out} + \tau_1$$

$$J_2 \frac{d^2 \theta_2}{dt^2} = \tau_2 + \tau_3$$

$$J_3 \frac{d^2 \theta_3}{dt^2} = -\tau_4 - \tau_{load}$$

$$v = u$$

$$\theta_2 = k_2 \theta_1$$

$$u_L = L \frac{di}{dt}$$

$$u = K \left(e + \frac{1}{T_I} \int_0^t e dt \right)$$

$$e = \theta_{ref} - \theta_{out}$$

$$v = u_R - u_L - u_{out} = 0$$

$$u_{out} = k_1 \omega_{out} \quad i = \frac{1}{k_1} \tau_{out} \quad \tau_2 = \frac{1}{k_2} \tau_1$$

$$\frac{J_1 - J_2 k_2^2}{k_2} \frac{d^2 \theta_1}{dt^2} = \tau_{out} - k_2 \tau_3$$

- **OpenModelica**
 - What is OpenModelica?
 - The past
- **OpenModelica Technical Overview**
 - OMC, OMShell, OMNotebook,
 - OMEdit, ModelicaML
- **OpenModelica Development Environment**
 - MetaModelica (RML/OMC)
 - The Eclipse Environment (MDT)
- **OpenModelica Latest Developments (2015-2016)**

OpenModelica is ... its developers, testers, bug reporters, contributors

Thank you!

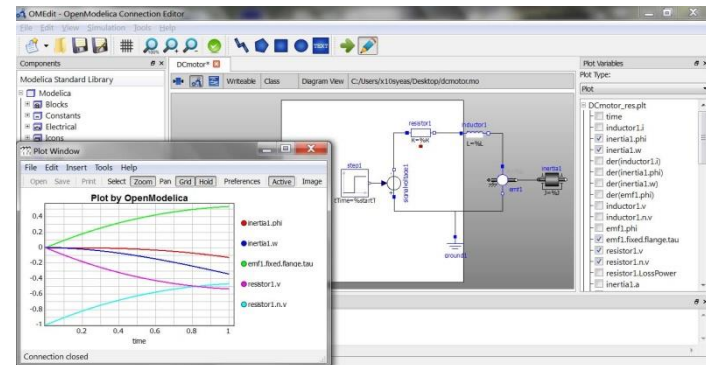
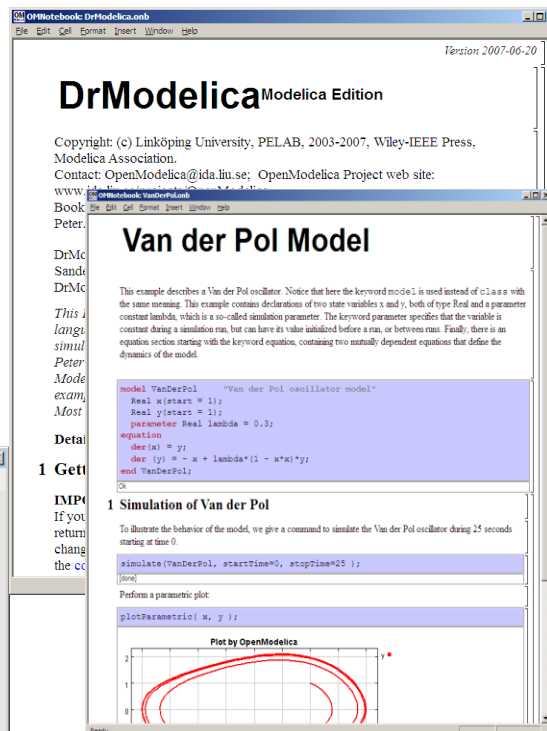
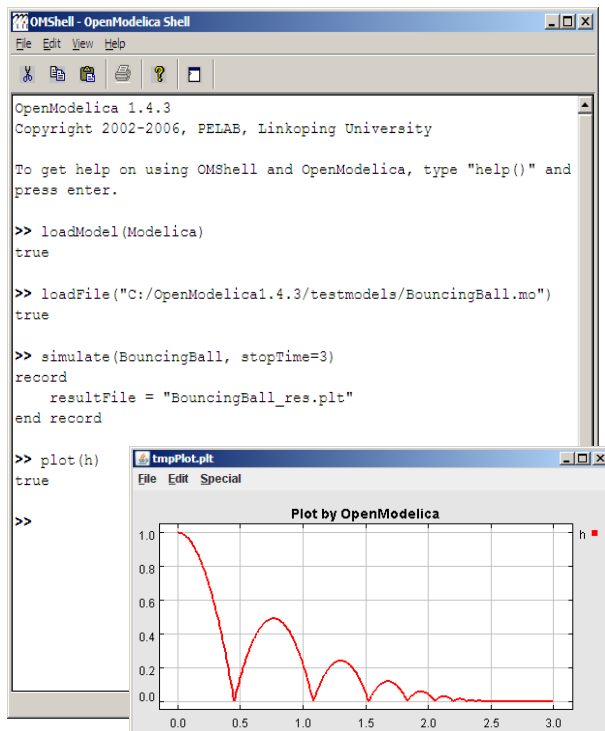
asodja, sjoelund.se, sebco011, lochel, wbraun, niklwors, hubert.thieriot, petar, perost, Frenkel TUD, Unknown, syeas460, adeas31, ppriv, ricli576, haklu, dietmarw, levsas, mahge930, x05andfe, mohsen, nutaro, x02lucpo, florosx, x06hener, x07simbj, stebr461, x08joekl, x08kimja, Dongliang Li, jhare950, x97darka, krsta, edgarlopez, hanke, henjo, wuzhu.chen, fbergero, harka011, tmtuomas, bjozac, AlexeyLebedev, x06klasj, ankar, kajny, vasaie_p, niemisto, donida, hkiel, darbr, otto@mathcore.com, Kaie Kubjas, x06krino, afshe, x06mikbl, leonardo.laguna, petfr, dhedberg, g-karbe, x06henma, abhinck, azazi, x02danhe, rruusu, x98petro, mater, g-bjoza, x02kajny, g-pavgr, x05andre, vaden, jansilar, ericmeyers, x05simel, andsa, leist, choeger, Ariel.Liebman, frisk, vaurich, mwalthner, mtiller, ptauber, casella, vitalij, hkiel, jank, adrho, rfranke, mflehmg

Developers (96)

Martin
Per
Adeel
Jens
Willi
Lennart
Alexey
Mahder
Olena
Mohsen
Kristian
Hubert
Niklas
Kaie
Kiel
Peter *
Leonardo
Filippo
Xenofon
Frederico
Edgar
Kaj
Levon
Stefan
Rickard
Bjorn
David
Otto
Eric
...
Adrian

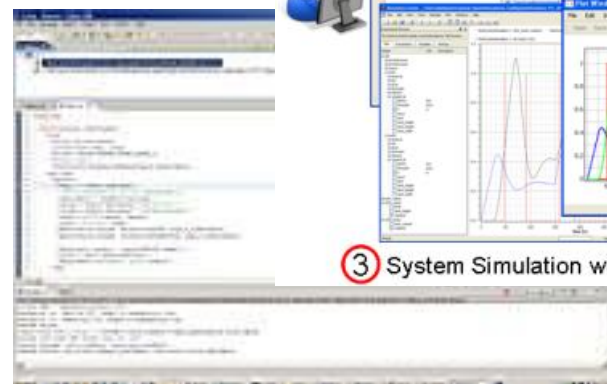
What is OpenModelica? (I)

- Advanced Interactive Modelica compiler (OMC)
 - Supports MSL v. 3.2.1/3.2.2/MSL trunk
- Basic and advanced environments for creating models
 - OMShell - an interactive command handler
 - OMNotebook - a literate programming notebook
 - OMEdit - OpenModelica Connection Editor
 - OMPlot - OpenModelica Plotting
 - OMOptim - OpenModelica Optimization Editor
 - OMPython - OpenModelica Python Environment
 - MDT - an advanced textual environment in Eclipse



What Is OpenModelica? (II)

- Advanced Eclipse-based Development Environment
- Modelica Development Tooling (MDT) - started in 2005
 - Code Assistance, Debugging, Outline & a lot more
 - *Used heavily for OpenModelica development*
 - Used in many OpenModelica Development Courses
- ModelicaML UML/SysML integration



① System Modeling with ModelicaML

② Modelica Code Generation

③ System Simulation with Modelica Tools



What is OpenModelica? (III)

- Open-source community services
 - Website and Support Forum
 - Source versioning (github.com)
 - Trac with bug database
 - Development courses
 - Mailing lists

Welcome to OpenModelica

<https://openmodelica.org>

OpenModelica

HOME DOWNLOAD TOOLS & APPS USERS DEVELOPERS FORUM EVENTS RESEARCH

Top information

- OMEdit: Enhanced OpenModelica Connection Editor.
- OMPYthon: The new OpenModelica Python Interface.

Modelica/OpenModelica Videos

- Overview of Modelica, an OpenModelica video.
- Modelica Cyber Physical Systems video.

Registration

Here is an overview presentation about Modelica and OpenModelica.

Introduction

OPENMODELICA is an open-source Modelica-based modeling and simulation environment intended for industrial and academic usage. Its long-term development is supported by a non-profit organization – the Open Source Modelica Consortium (OSMC).

The goal with the OpenModelica effort is to create a comprehensive Open Source Modelica modeling, compilation and simulation environment based on free software distributed in binary and source code form for research, teaching, and industrial usage. We invite researchers and students, or any interested developer to participate in the project and cooperate around OpenModelica, tools, and applications.

Donate

Please consider supporting our efforts.

Amount: SEK

Donate

Latest news

- CFP OpenModelica Workshop February 2014
- October 09: OpenModelica 1.9.0 released
- September 27: OpenModelica 1.9.0 RC1 released
- February 1: OpenModelica 1.9.0 Beta4 released
- October 19: OpenModelica 1.9.0 Beta2 released
- Oct 16 : CFP OpenModelica/MODPROD Workshops February 2013
- August 31: OpenModelica 1.9.0 Beta released
- April 4: OpenModelica 1.8.1 released

OpenModelica

https://github.com/OpenModelica

Search GitHub

Repositories People 21 Teams 5 Settings

Filters Find a repository... + New repository

OpenModelica

OpenModelica is an open-source Modelica-based modeling and simulation environment intended for industrial and academic usage.

Updated an hour ago

OMCompiler

The OpenModelica Compiler is the core of the OpenModelica project, which is an open-source Modelica-based modeling and simulation environment intended for industrial and academic usage.

Updated an hour ago

OMLibraries

Updated 14 hours ago

People 21

Invite someone

OpenModelica

https://trac.openmodelica.org/OpenModelica/wiki

OpenModelica

WIKI Timeline Roadmap Browse Source View Tickets New Ticket Search Start Page Index History

OpenModelica Project

OpenModelica is an open-source Modelica-based modeling and simulation environment intended for industrial and academic usage. Its long-term development is supported by a non-profit organization – the Open Source Modelica Consortium (OSMC).

This Trac installation is intended to help with the OpenModelica Project management, development, bug fixing, etc.

Documentation

Automatically generated documentation of OpenModelica and Modelica.

Writing efficient MetaModelica code

Details on how to write efficient MetaModelica code for the bootstrapped compiler is here.

Modelica Compliant Libraries

We have made a list with compatibility issues between tools. To write compliant library follow this document.

Contribute

You can report a bug by adding a new ticket. Please have a look at all the open tickets first.

Testing

We run builds and tests using Hudson. Check the latest build and test status. Check the status of the (in development) compliance suite of the Modelica specification. Check the latest MSL 3.2.1 coverage. Check the latest ModelicaTest 3.2.1 coverage. Check the historical MSL coverage or trend of all tested libraries. Check the directory of all tested libraries.

MSL 3.2.1 Coverage

ModelicaTest 3.2.1 Coverage

Legend

- Target: 274
- Compile: 269
- Simulate: 248

Legend

- Target: 431
- Compile: 414
- Simulate: 305

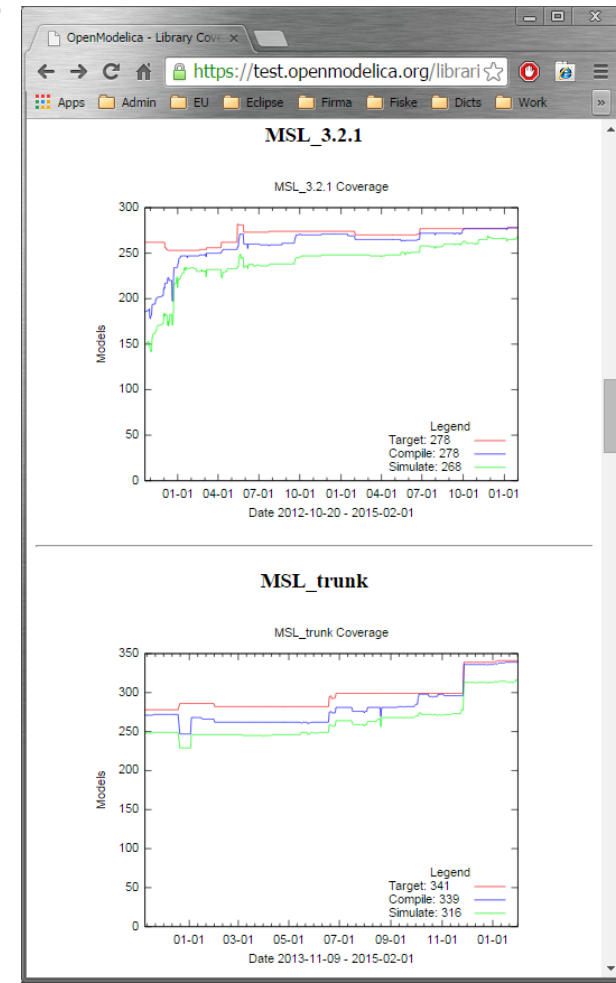
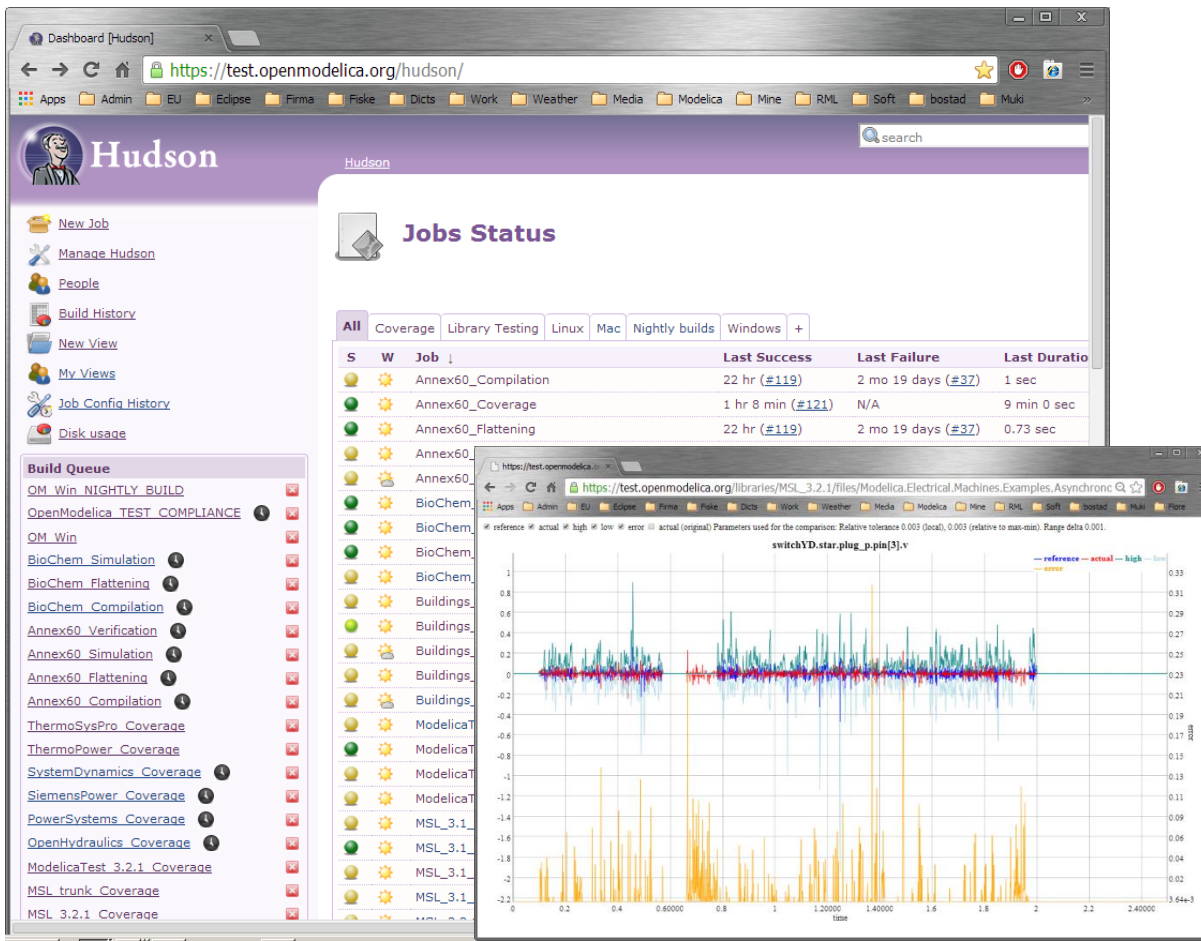
Date 2012-10-20 - 2014-01-31

Date 2012-10-20 - 2014-01-31

What is OpenModelica? (IV)

Open-source community services

- Extensive testing (unit & library coverage: MSL 3.2.1, ModelicaTest 3.2.1, PetriNet, Buildings, PowerSystems, OpenHydraulics, ThermoPower, and ThermoSysPro) with interactive result comparison
- ~2800 tests ran on each commit via Hudson (4 test servers currently)
 - Linux (GCC & CLANG), Windows (MinGW GCC), Mac OS (GCC)
- Automatic nightly builds for Window & Linux & Mac OS



What is OpenModelica? (V)

- **An incubator platform for research**
 - 9 PhDs since 2004 (Debugging, Parallelization, PDEs Extensions)
 - 36 Master's theses since 2004
 - Both the students and the project benefit
- **Master theses at PELAB 2006-2016**
 - Refactoring/Parsing and Language extensions
 - UML/SysML view of Modelica code
 - 2D and 3D visualization tools
 - Static and runtime debugging tools
 - Advanced code generation and parallelization of simulation code
 - Bootstrapping and Java Interface
 - Function pointers
 - NVIDIA for Cuda and OpenCL parallel simulation
 - OMEdit - Modelica Connection Editor
 - OMWeb - server based Modelica simulation for teaching
 - OMCcc parser
 - PDE-solver using ParModelica
- **External Master theses**
 - Model based diagnostics at ISY (Dep. Of Electrical Engineering)
 - Monte-Carlo simulation of Satellite Separation Systems at SAAB
 - Interactive Simulations (EADS)
 - Additional Solvers + Event handling (FH-Bielefeld)
 - EADS - ModelicaML
- **A Base for commercial and open source products**
 - MathCore AB, Bosch Rexroth, InterCAX (MagicDraw SysML), VTT, Equa, Evonik, ABB

OpenModelica Roadmap - Past

1997 - started as a master thesis

2003 - first usable internal version

2004 - first external version: OpenModelica 1.1

2005 - more development: OpenModelica 1.3.1

2006 - major milestone

- Translated the whole compiler to MetaModelica
- Integrated Development Environment for the compiler
- OpenModelica website started
- Moved the code repository to Subversion management
- Extended the OpenModelica environment with new tools
- 4 versions released during the year
- External people start using OpenModelica
 - ~ 200 downloads/month
 - first development course at INRIA

OpenModelica Roadmap - Past

2007 - continued development and community involvement

- Improvement in website, support and documentation
- Answered ~1000 questions on the forum
- Portability is highly improved, ported to 4 platforms
 - Linux, Mac, Solaris, Windows (version 1.4.3)
- Improvement of the compiler development tools in Eclipse
- OpenModelica Community starts to react
 - contribute code & report bugs & request enhancements & participate in answering questions in the OpenModelica forum
 - participate at courses and workshops
- New server acquired for better community services
- Increased usage: ~600 downloads/month
- Open Modelica Consortium created in December 4
 - 4 months of work
 - 9 organizations as members already (3 Universities, 6 Companies)
 - discussions are ongoing with other 6 companies

2008 - Further work on the compiler

- Release 1.4.4 and 1.4.5
 - Linux, Mac, Solaris, Windows
- New Solver Interface
- Refactoring
- Dynamic loading of functions
- Merging of MathCore front-end code
- 744 commits in Subversion
- Other things I don't remember

OpenModelica Roadmap - Past

2009

- Work mainly happened in OSMC (partially on a non-public branch)
- **Front-end**
 - Refactoring (OSMC)
 - Enumerations (OSMC)
 - Java Interface and Bootstrapping (Martin Sjölund)
 - MultiBody flattening (OSMC)
 - Constraint connection graph breaking (VTT + OSMC)
 - Support for Modelica 3.x and 3.x annotations (OSMC)
- **Back-end**
 - Tearing in the back-end (Jens Frenkel)
 - Template Code Generation and CSharp backend (Pavol Privitzer, Charles University Prague)
 - Interactive Simulations (EADS)
 - C++ Code generation (Bosch Rexroth)
 - Java Interface and Bootstrapping (Martin Sjölund)
 - Additional Solvers + Events (Willi Braun, FH-Bielefeld)
- **General**
 - New ModelicaML + SysML prototype (EADS)
 - 1144 commits in subversion (Since 2009 to February 8, 2010)
 - Bug fixes (OSMC)
 - Release 1.5.0 and 1.5.0-RC_X (Linux, Mac, Solaris, Windows)
- **More things I don't remember**

OpenModelica Roadmap - Past

2010 - 2011

- Support for Modelica Standard Library 3.1 (Media & Fluid in works)
- **Front-end**
 - MultiBody flattening (OSMC)
 - Support for Modelica 3.x and 3.x annotations (OSMC)
 - Performance Enhancements
 - Stream connectors
 - Media & Fluid work is on the way
- **Back-end**
 - Back-end redesign (Jens, Willi, Martin, Per, Adrian, Kristian, Filippo)
 - Tearing in the back-end (Jens Frenkel)
 - Template Code Generation and CSharp backend (Pavol Privitzer, Charles University Prague)
 - Interactive Simulations (EADS)
 - C++ Code generation (Bosch Rexroth)
 - Additional Solvers + Events + Linearization (Willi Braun, FH-Bielefeld)
- **General**
 - OMEdit - new connection editor
 - Bootstrapping OMC (90% finished)
 - 2550 commits in subversion from 2010 to Feb. 7, 2011 (double than 2009-2010)
 - Bug fixes ~300+ (OSMC)
 - Release 1.6.0 (Linux, Mac, Windows)
 - Downloads Windows (~16434) , Linux (~8301), Mac (~2816)
- **More things I don't remember**

OpenModelica Roadmap - Past

2012 - 2013

- Support for Modelica Standard Library 3.2.1 including Media & Fluid
- **Front-end**
 - Performance Enhancements
 - Media & Fluid work
 - Operator overloading
 - New instantiation module started
- **Back-end**
 - Modular back-end with more optimization modules (Jens, Willi, Martin)
 - New simulation runtime redesign (Willi, Lennart, Jens, Martin, Adrian)
 - C++ Code generation (Bosch Rexroth)
 - FMI export & import
 - Initialization, Jacobians (Lennart Lochel, Willi Braun, FH-Bielefeld)
 - Support for parallelization (Martin)
 - Parallel extensions in functions
- **General**
 - Uncertainties support (OpenTURNS connection & Data reconciliation)
 - MDT GDB debugging based on GDB and the bootstrapped compiler
 - OMEdit - improvements
 - Bootstrapping OMC (100% finished) using Boehm GC
 - 3909 commits in subversion from 2012 to Feb. 4, 2013
 - 2000 forum posts (questions and answers)
 - Bug fixes ~247+ (OSMC)
 - Release 1.9.0 (Linux, Mac, Windows)
 - Downloads Windows (~45307) , Linux (~15543), Mac (~5367)
- **More things I don't remember**

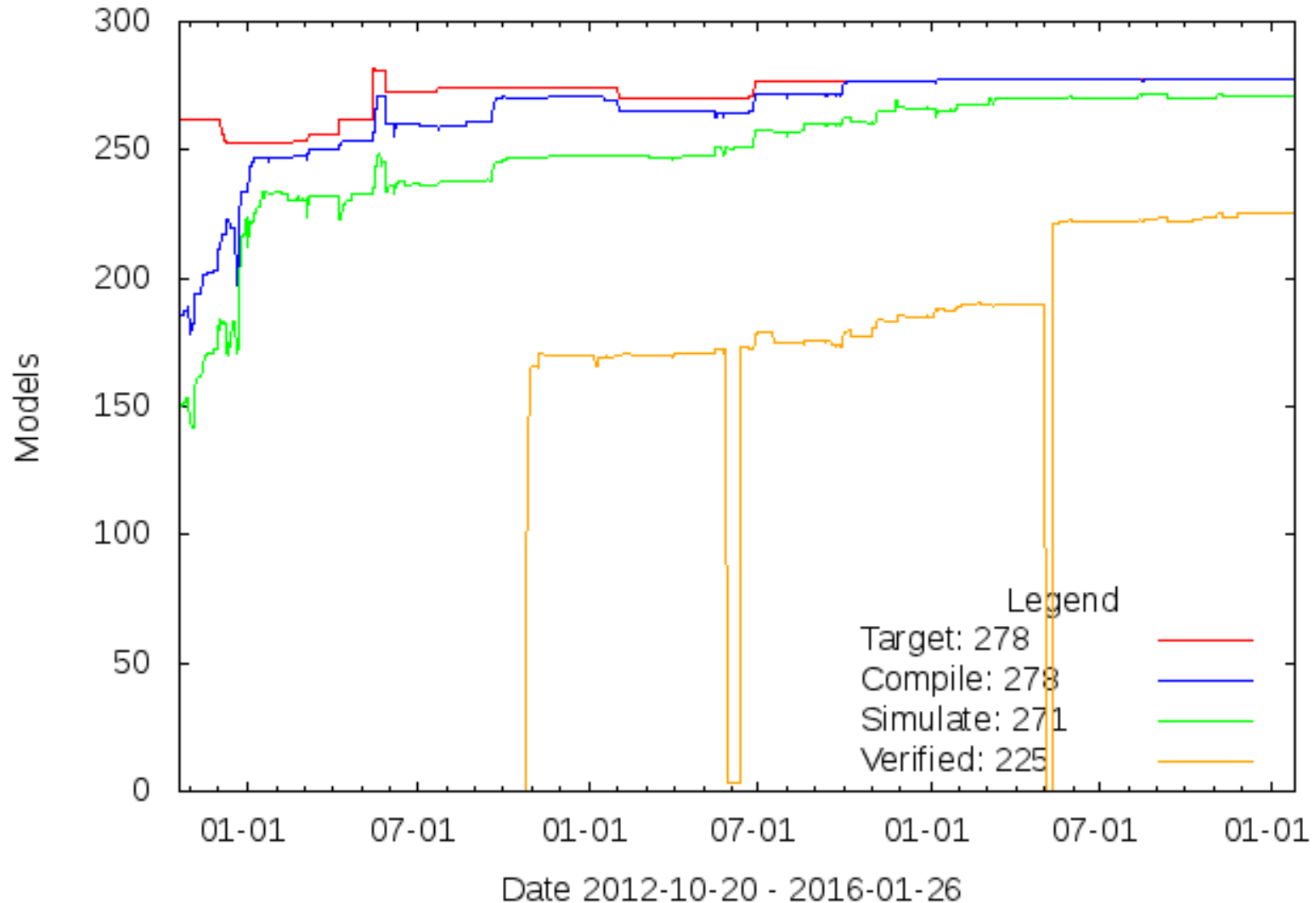
OpenModelica Roadmap - Past

- **2014 - 2015 - Most focus on libraries support & performance**
 - MSL 3.2.1 (100% build/98% simulate), ModelicaTest 3.2.1, PetriNet, Buildings, PowerSystems, OpenHydraulics, ThermoPower, and ThermoSysPro
 - Switch to bootstrapped compiler
- **Front-end, Back-end, Simulation Runtime, Graphical Clients**
 - Development switched to bootstrapped compiler since November 2014
 - Partially new graph-based front-end with better support for libraries
 - Improved back-end: initialization, system solving, parallelization, cse optimization, dynamic optimization
 - Faster and much more user friendly OpenModelica Connection editor
- **General**
 - 4960 commits in subversion from Feb. 2014 to Feb., 2015
 - Bug fixes
 - Release 1.9.2 (Linux, Mac, Windows)

OpenModelica Testing (I)

- 2016-02-01 g675b7d6 - total 278 - build 278 (100%) - sim 271 (98%)

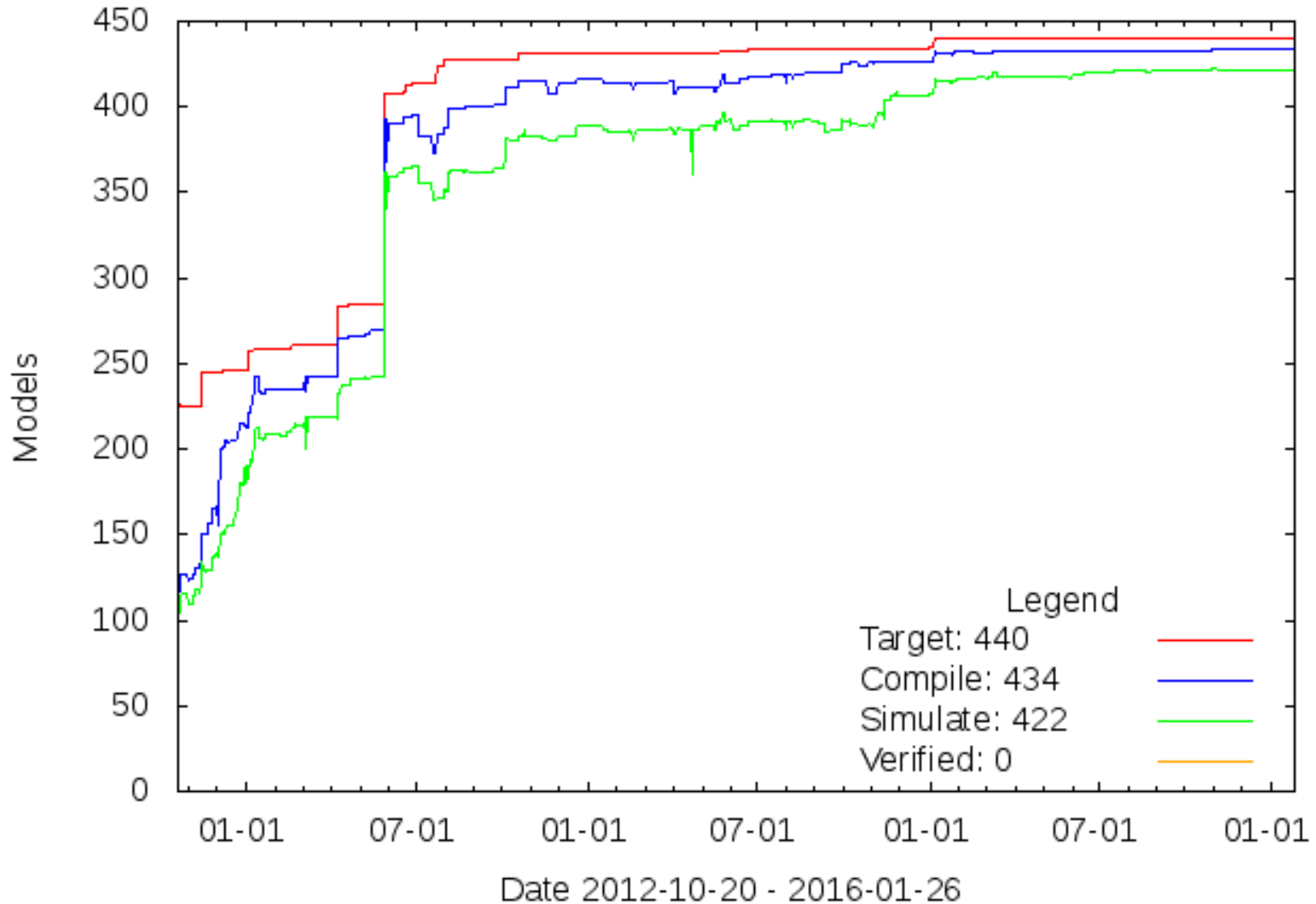
MSL_3.2.1 Coverage



OpenModelica Testing (II)

- 2016-02-01 g675b7d6 - total 440 - build 434(99%) - sim 422 (96%)

ModelicaTest_3.2.1 Coverage



- Moved the source code to github May 2015
 - Mature code base: <https://github.com/OpenModelica>
 - ~8000K lines of code and tests
-
- From Feb 2015 - Feb 2016
 - 55 contributors - up by 17 contributors (44%)
 - 5745 commits - up by 1631 commits (40%)

OpenModelica Statistics (II)

Contributors

Traffic

Commits

Code frequency

Punch card

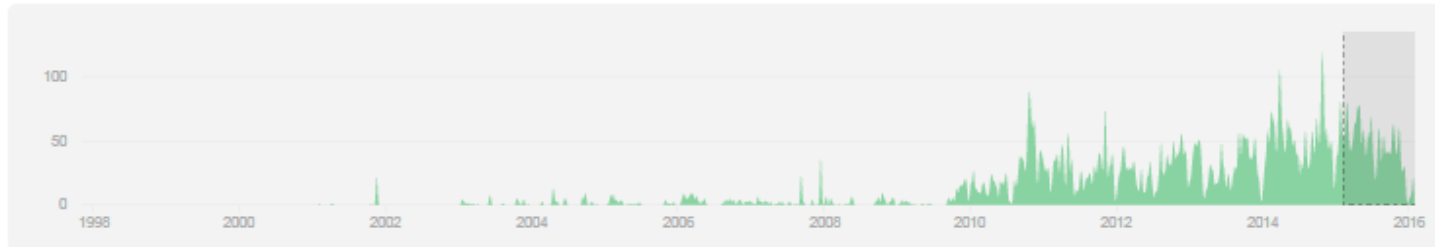
Network

Members

Feb 7, 2015 – Feb 1, 2016

Contributions: Commits

Contributions to master, excluding merge commits



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 - MetaModelica (RML/OMC)
 - The Eclipse Environment
- **OpenModelica Latest Developments (2015-2016)**

```
OMShell - OpenModelica Shell
File Edit View Help
[Icons]
OpenModelica 1.4.3
Copyright 2002-2006, PELAB, Linköping University

To get help on using OMShell and OpenModelica, type "help()" and
press enter.

>> loadModel(Modelica)
true

>> loadFile("C:/OpenModelica1.4.3/testmodels/BouncingBall.mo")
true

>> simulate(BouncingBall, stopTime=3)
record
  resultFile = "BouncingBall_res.plt"
end record

>> plot(h)
true

>>
```

Time (t)	Value (h)
0.0	1.0
0.5	0.0
0.8	0.5
1.1	0.0
1.4	0.25
1.7	0.0
2.0	0.1
2.3	0.0
2.6	0.05
3.0	0.0

OMNotebook: DrModelica.onb
Version 2007-06-20

DrModelica Modelica Edition

Copyright: (c) Linköping University, PELAB, 2003-2007, Wiley-IEEE Press,
Modelica Assoc. www.ida.liu.se/
Book web page
Peter.Fritzson@liu.se

DrModelica Author: Peter Fritzson
DrModelica Editor: Peter Fritzson

This DrModelica language as we know it is based on the book "Modelica (2003) examples and exercises" by Peter Fritzson.

Detailed Copy

1 Getting Started

IMPORTANT
If you end a cell with a colon, you will get a command prompt returned in an output window. To change the directory, use the `cd()` command.

1 Simulation of Van der Pol

To illustrate the behavior of the model, we give a command to simulate the Van der Pol oscillator during 25 seconds starting at time 0.

```
simulate(VanDerPol, startTime=0, stopTime=25 );
[done]
```

Perform a parametric plot:

```
plotParametric( x, y );
```

x	y
1.0	1.0
0.0	0.0
2.0	2.0
0.0	2.0
2.0	0.0
0.0	0.0

OMEdit - OpenModelica Connection Editor

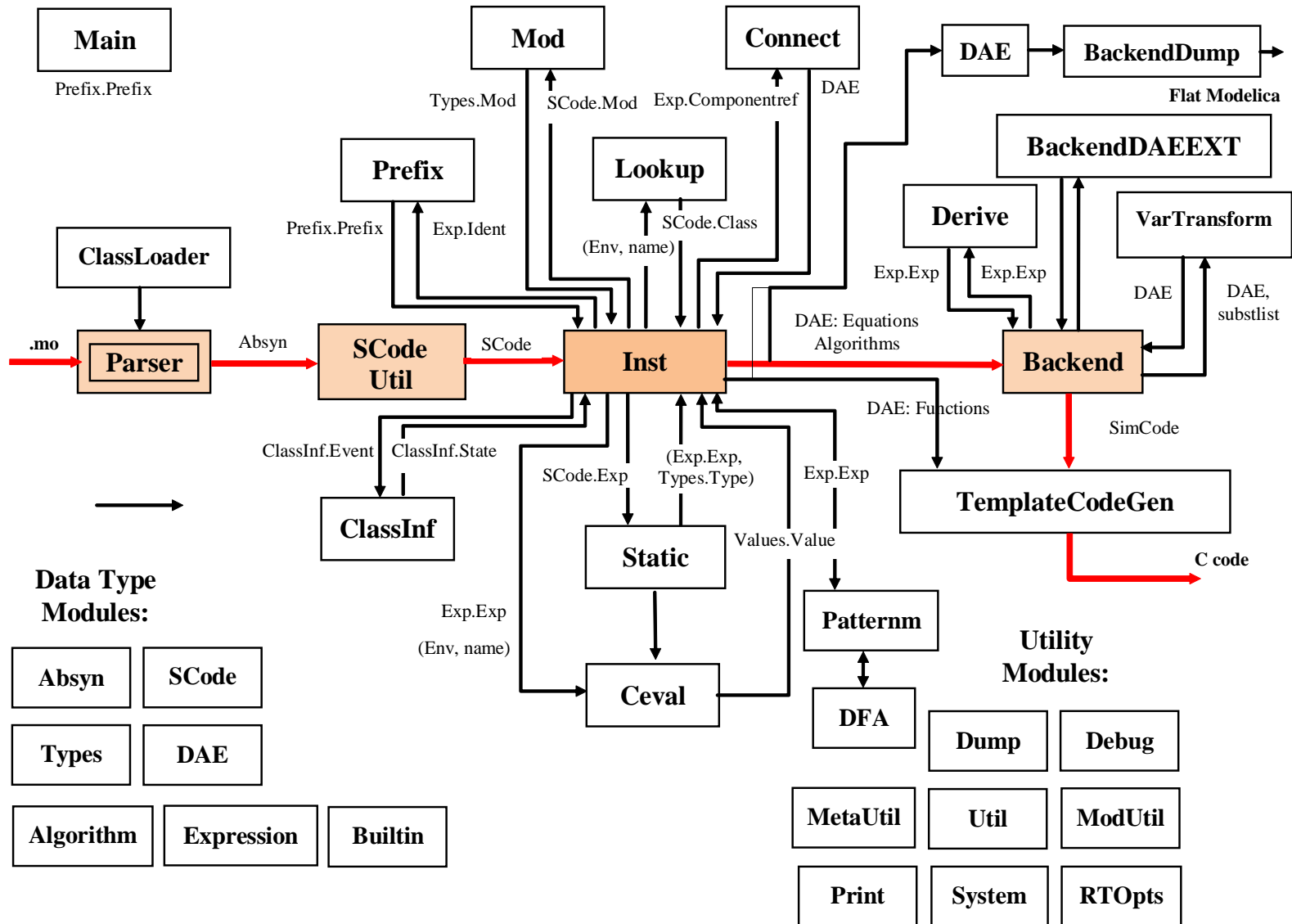
The screenshot displays the OMEdit - OpenModelica Connection Editor interface. The window title is "OMEdit - OpenModelica Connection Editor". The menu bar includes File, Edit, View, Simulation, FMI, Export, Tools, and Help. The toolbar contains various icons for file operations, simulation, and editing.

The Libraries Browser on the left shows a tree structure of libraries. The "Modelica" library is expanded, showing sub-libraries like "UsersGuide", "Blocks", "ComplexBlocks", "StateGraph", "Electrical", "Magnetic", "Mechanics", and "MultiBody". The "MultiBody" library is further expanded, showing "UsersGuide", "World", "Examples", and "Elementary". The "Elementary" sub-library is selected, and the "DoublePendulum" component is highlighted.

The main workspace displays a diagram of a double pendulum system. The system consists of a "world" frame with a vertical axis and a horizontal axis. A "damper" component is connected to the world frame. The damper is represented by a box with a red square and the text "d=0.1". The damper is connected to a revolute joint labeled "revolute1". This joint is connected to a blue rectangular body labeled "boxBody1" with position coordinates $r = (0.5, 0, 0)$. This body is connected to another revolute joint labeled "revolute2". This joint is connected to a second blue rectangular body labeled "boxBody2" with position coordinates $r = (0.5, 0, 0)$. The status bar at the bottom shows the coordinates X: -49.98, Y: 70.64, and tabs for Welcome, Modeling, and Plotting.

The OMC Compiler

- Implemented mainly in MetaModelica and C/C++
- The compiler has 258 packages



Modelica -> AST -> SCode -> DAE -> C Code

```
// Parse the file and get an AST back
```

```
ast = Parse.parse(modelicaFile);
```

```
// Translate to simplified C code
```

```
scode = SCode.absyn2SCode(ast);
```

```
// flatten the simplified code
```

```
(cache, dae1) = Inst.instantiate(Env.emptyCache, scode);
```

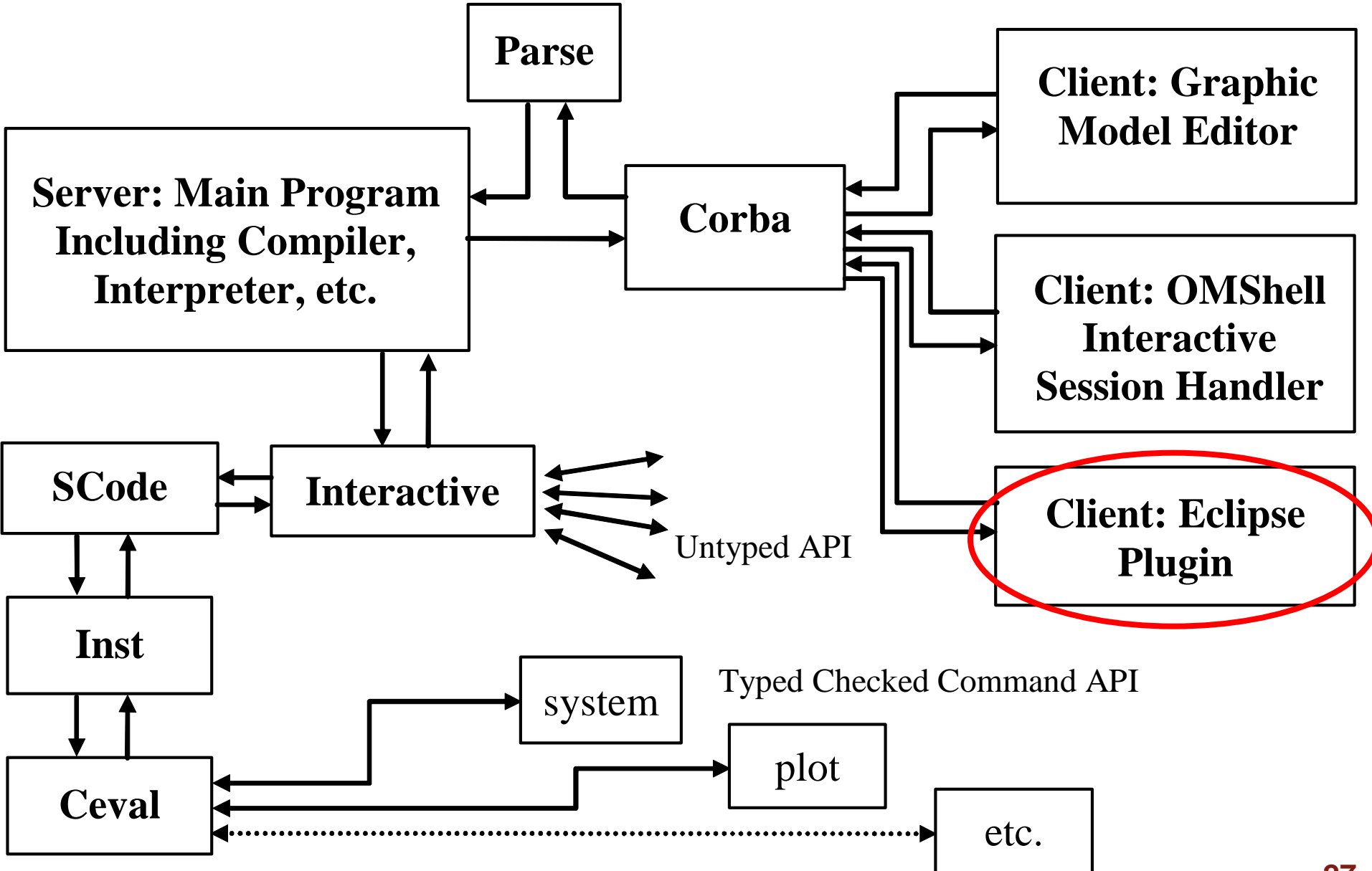
```
// Call the function that optimizes the DAE
```

```
optimizeDae(scode, ast, dae, dae, lastClassName);
```

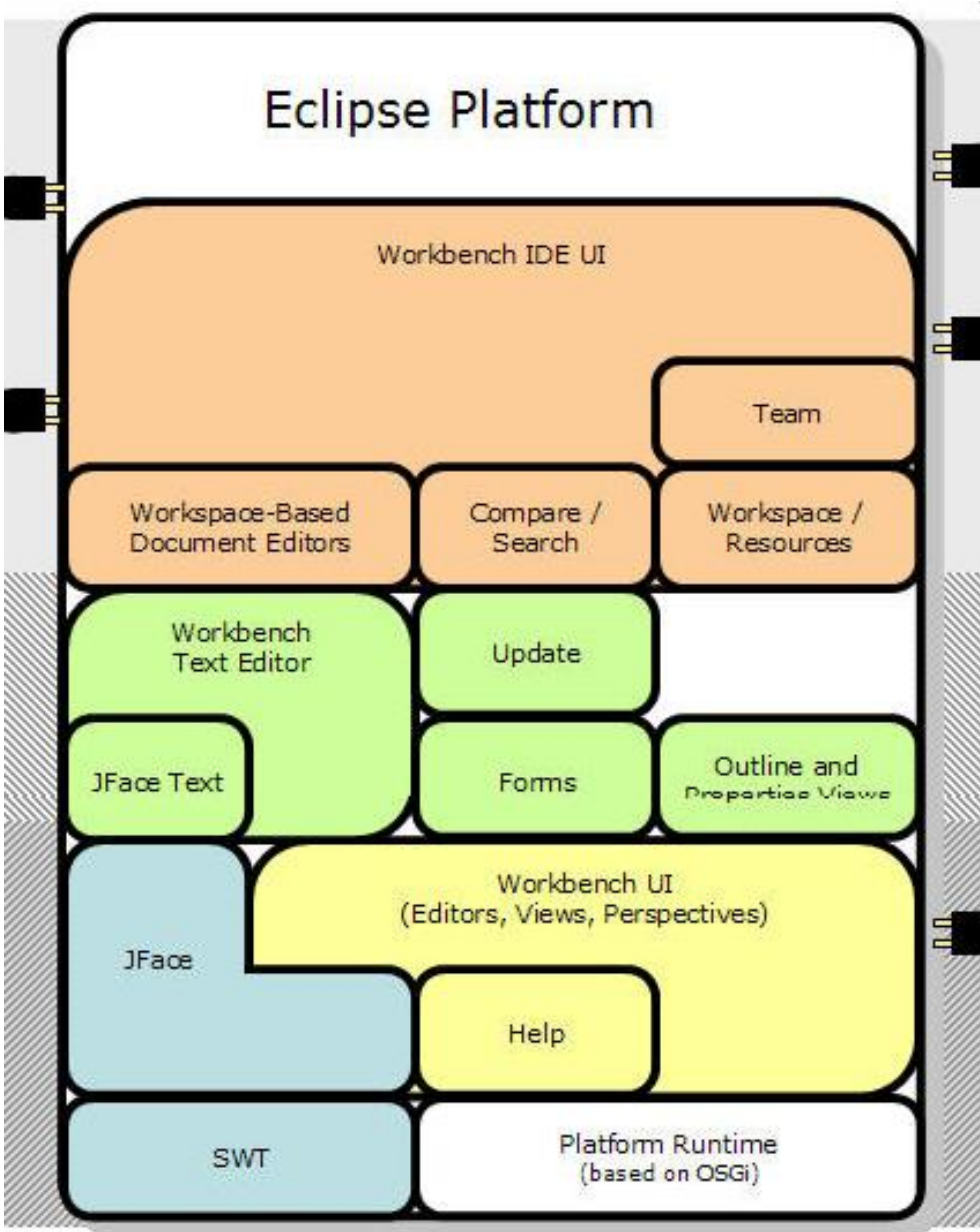

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- **OMC**
 - Implemented mainly in MetaModelica and C/C++
- **Modelica**
 - classes, models, records, functions, packages
 - behavior is defined by equations or/and functions
 - equations
 - differential algebraic equations and conditional equations
- **MetaModelica extensions**
 - local equations
 - pattern equations
 - match expressions
 - high-level data structures: lists, tuples, option and uniontypes

OpenModelica Context



The MDT Eclipse Environment (I)



Modelica Browser

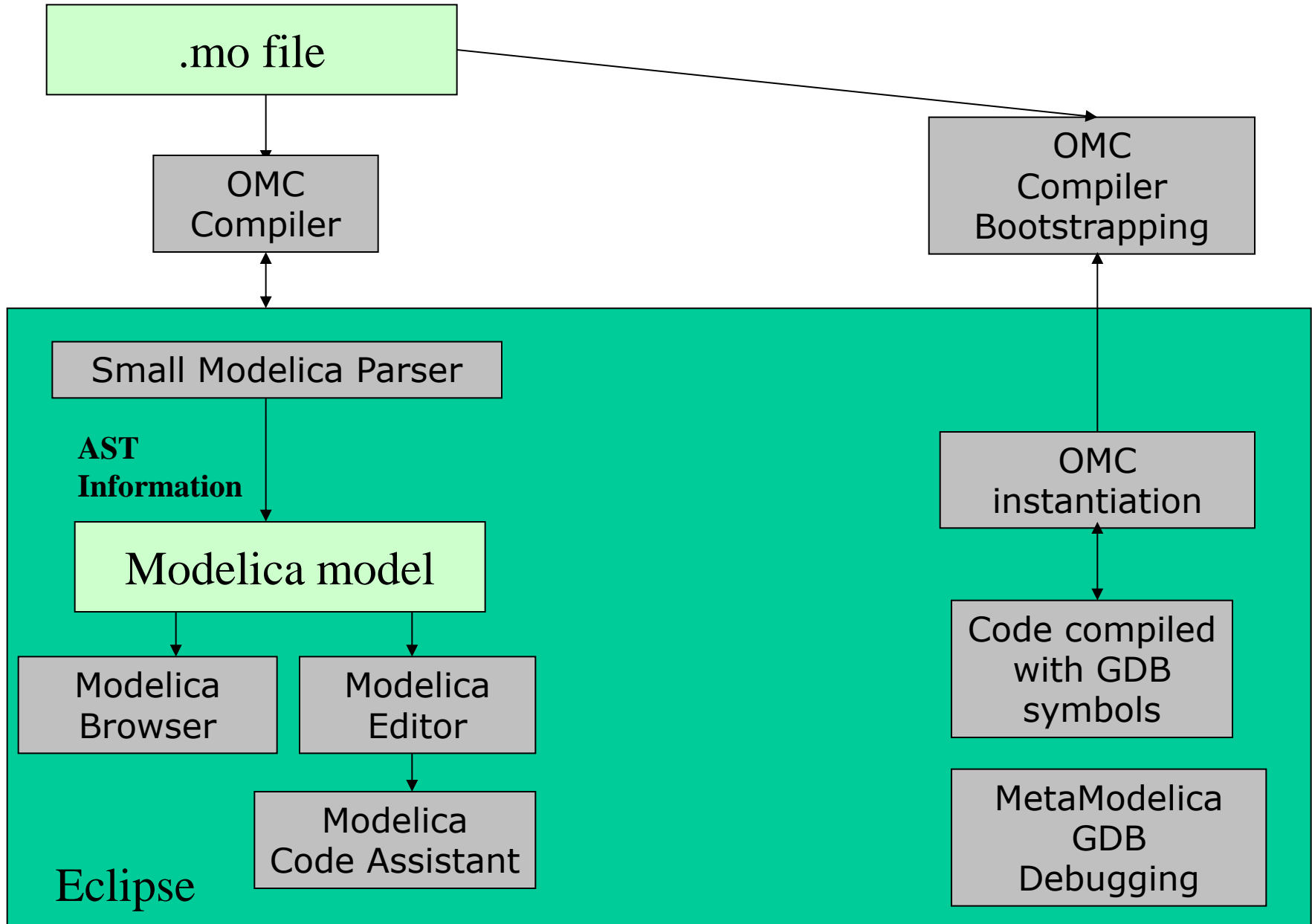
Modelica Editor

Modelica Code Assistant

MetaModelica Debugging

Modelica Perspective

The MDT Eclipse Environment (II)



Creating Modelica projects (I)

The image shows the Eclipse IDE interface with the 'File' menu open and 'Project...' selected. A 'New Project' wizard dialog is open, showing a list of wizards. The 'Modelica Project' wizard is selected. A 'New Modelica Project' dialog is also open, showing the project name 'demo' and 'Next >' buttons. Red arrows indicate the flow from the menu to the wizard list, then to the selected wizard, and finally to the 'Next >' button in the wizard dialog.

File Edit Refactor Navigate Search Project Run Window Help

New Alt+Shift+N ▶ Project...
Open File...
Close Ctrl+F4
Close All Ctrl+Shift+F4
Save Ctrl+S
Save As...
Save All Ctrl+Shift+S
Revert
Move...
Rename... F2
Refresh F5
Convert Line Delimiters To
Print... Ctrl+P
Switch Workspace...
Import

New Project
Select a wizard
Create a new Modelica project.

Wizards:

- Plug-in Project
- C
- C++
- CVS
- Eclipse Modeling Framework
- EJB
- Functional Programming
- J2EE
- Java
- Modelica
- Modelica Project**
- Plug-in Development
- Simple
- Web
- Examples

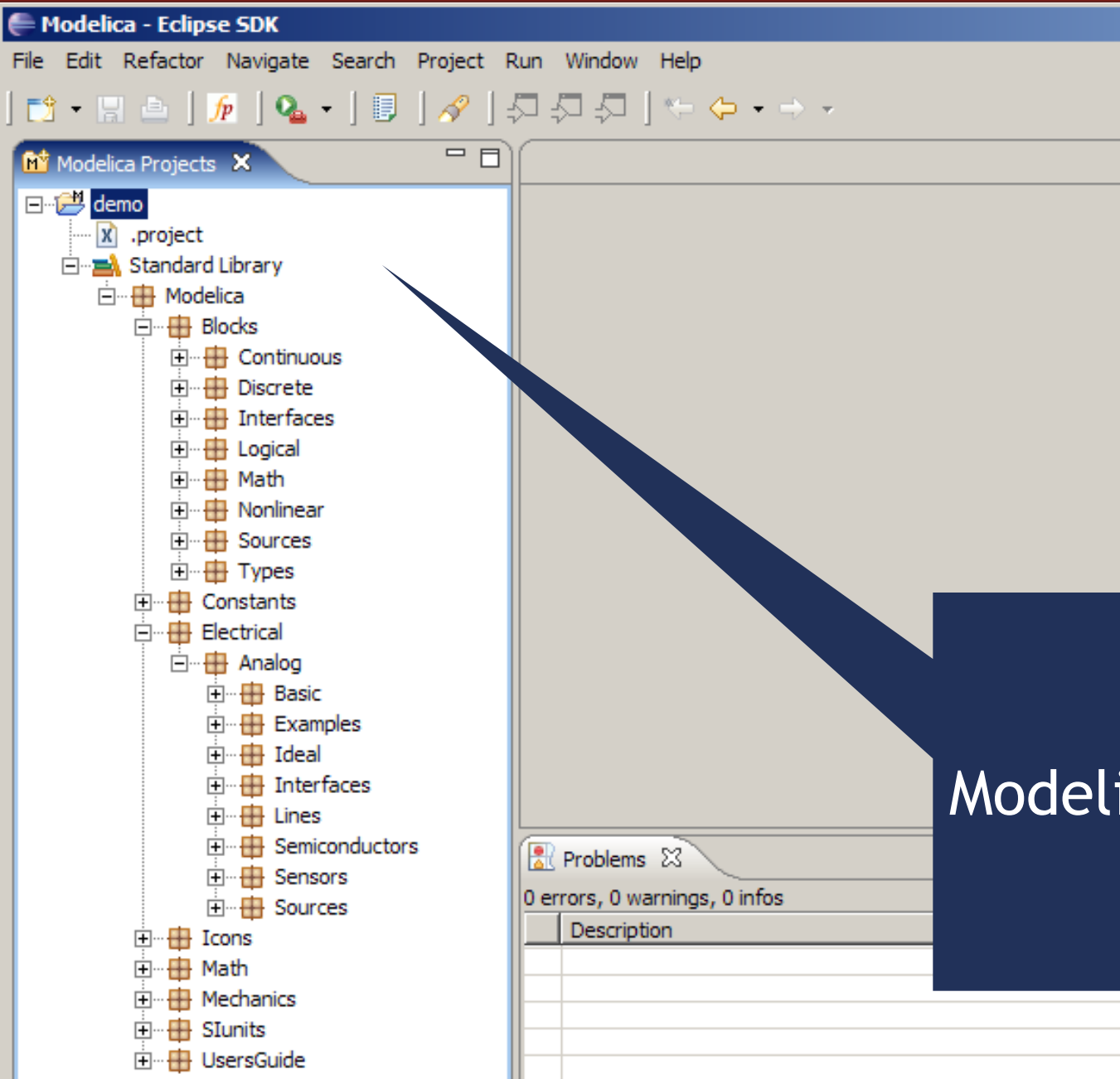
New Modelica Project
Create a Modelica project
Create a Modelica project in the workspace.

Project name: demo

< Back Next >
< Back Next > Finish Cancel

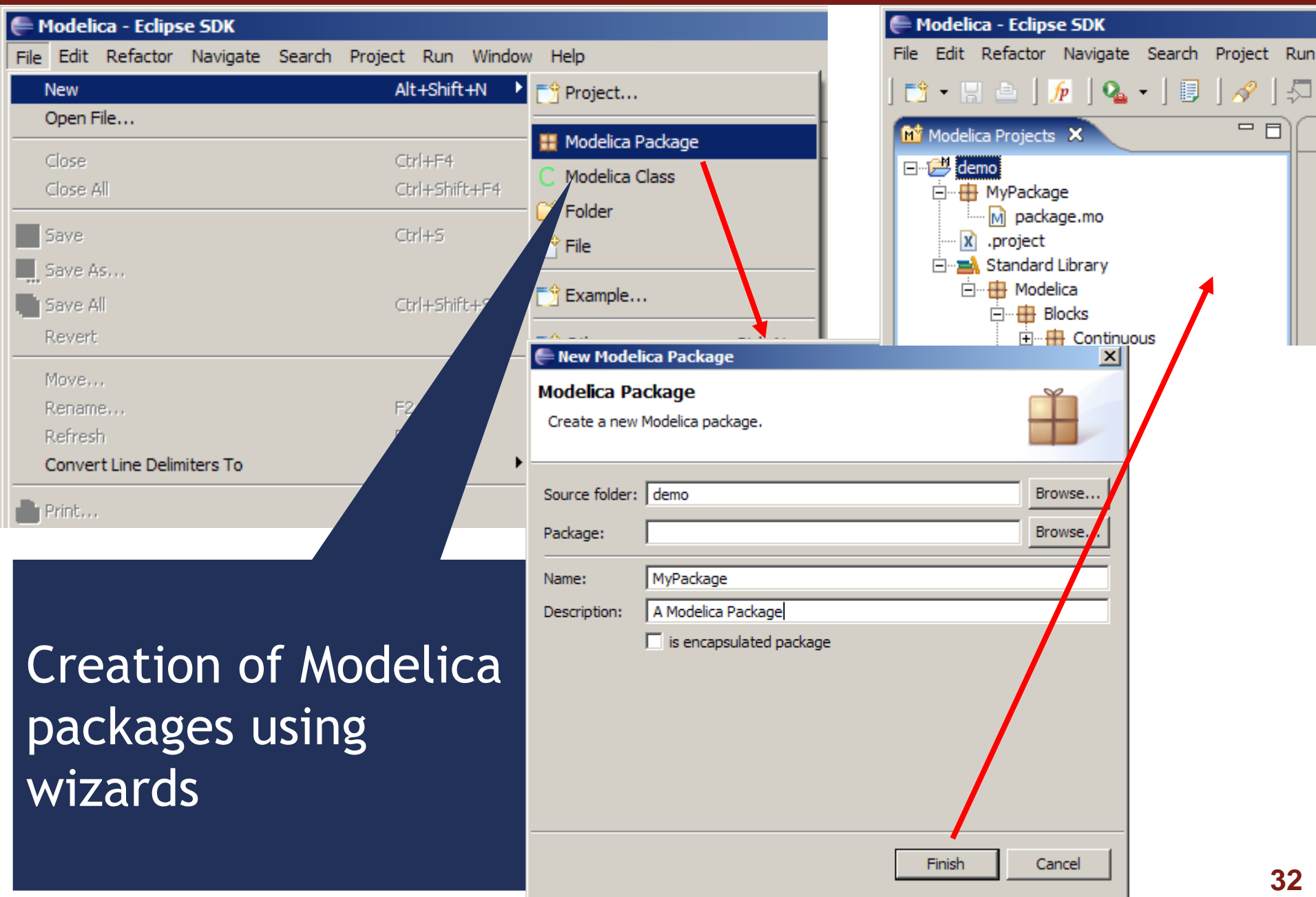
Creation of Modelica projects using wizards

Creating Modelica projects (II)



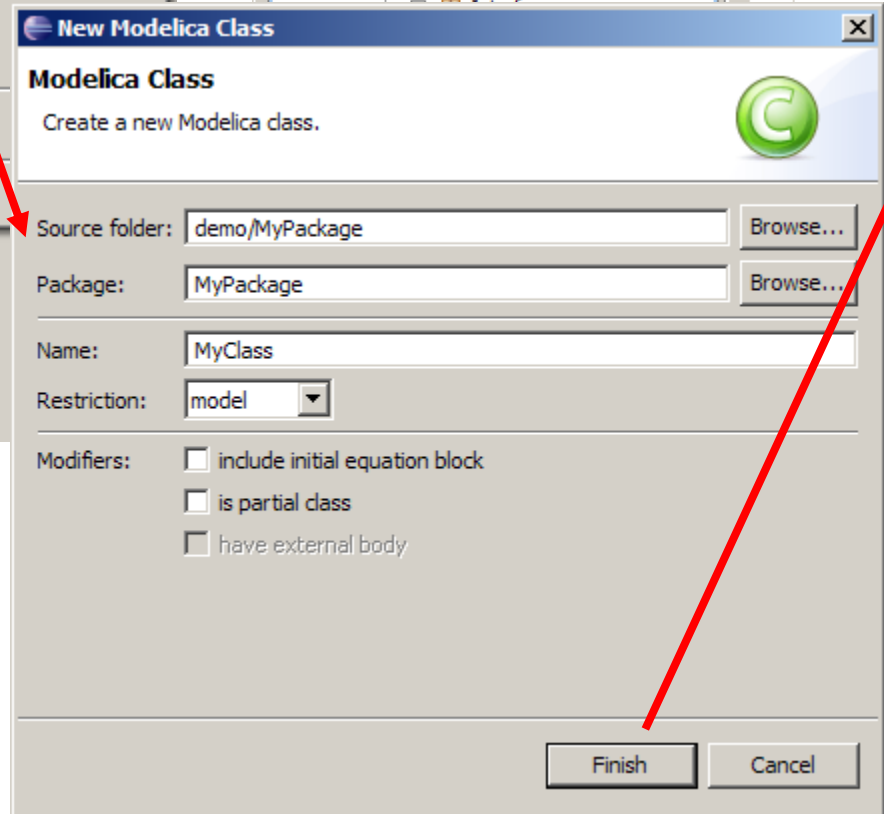
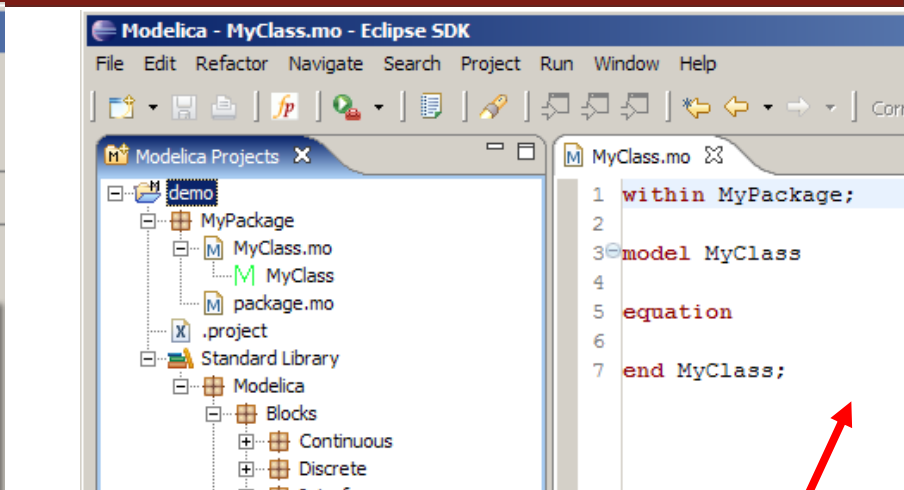
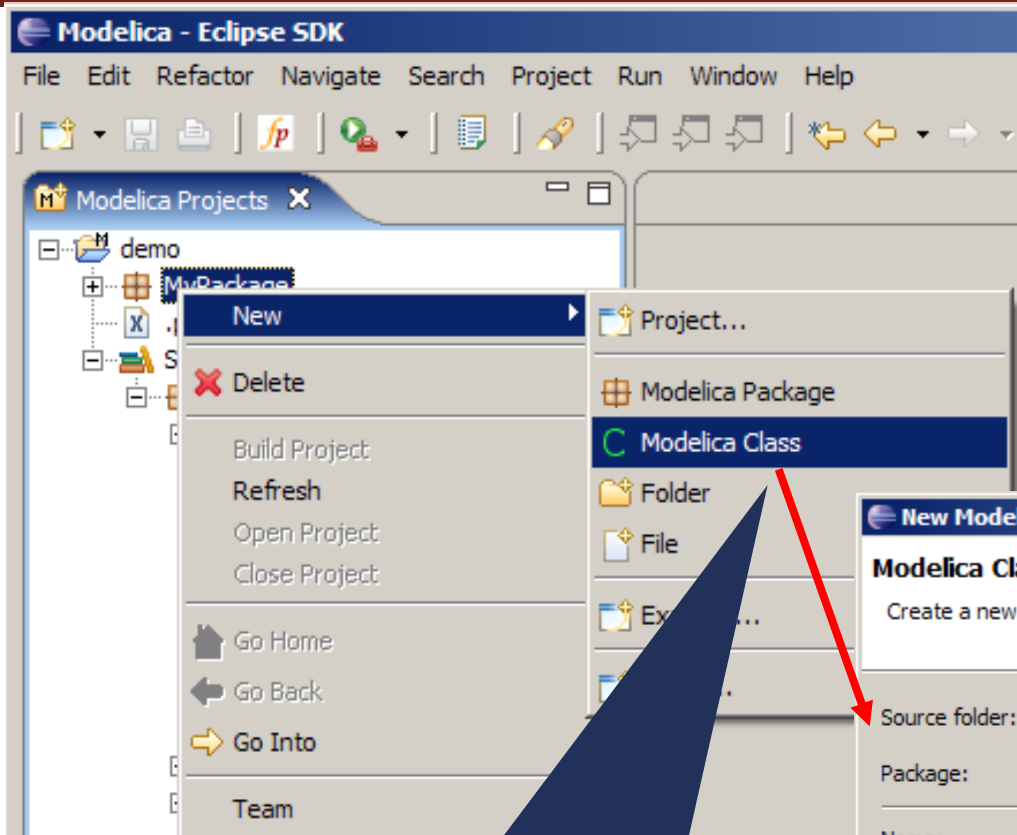
Modelica project

Creating Modelica packages



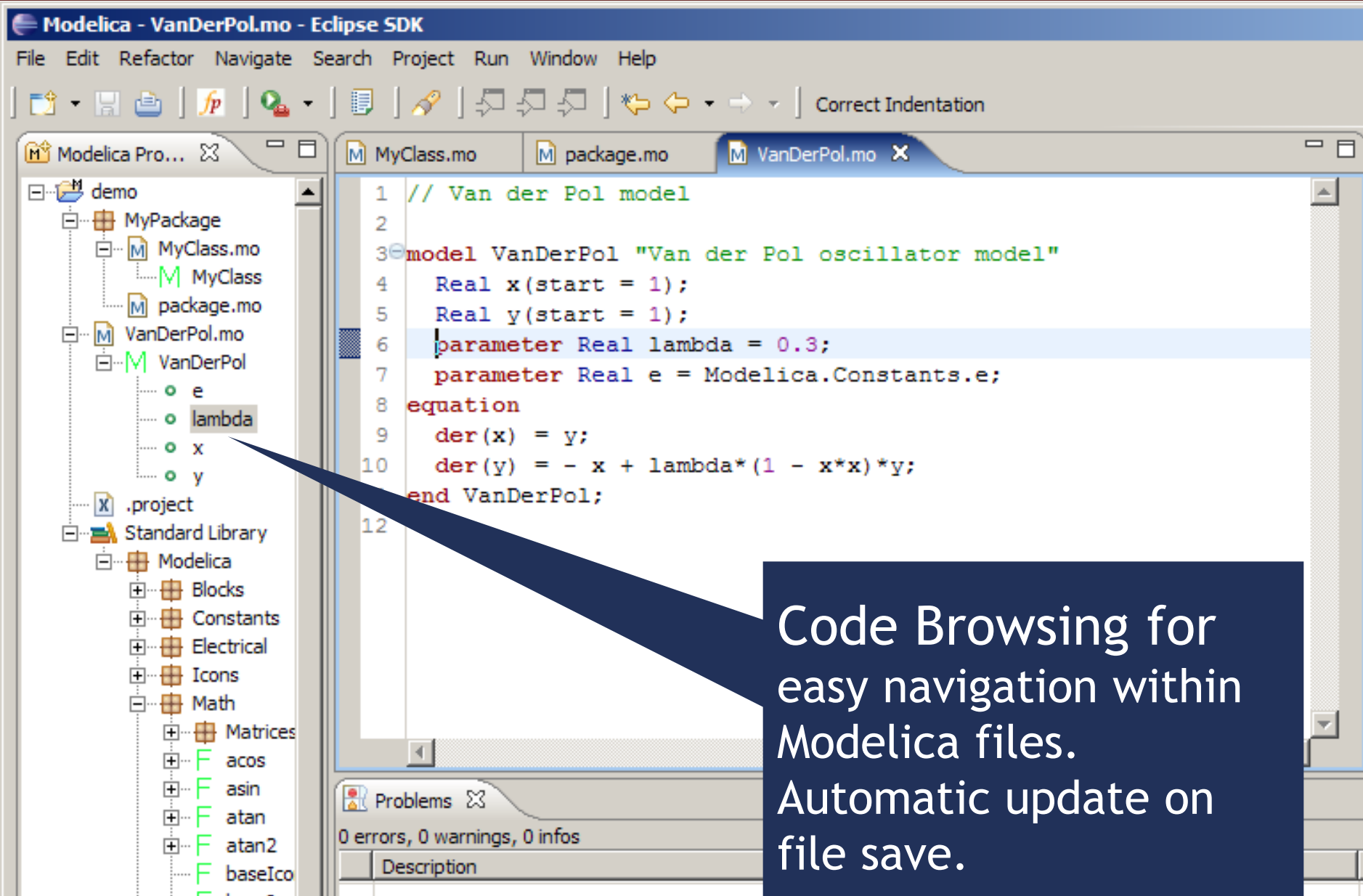
Creation of Modelica packages using wizards

Creating Modelica classes



Creation of Modelica classes, models, etc, using wizards

Code browsing



The screenshot shows the Eclipse IDE interface with the following components:

- Menu Bar:** File, Edit, Refactor, Navigate, Search, Project, Run, Window, Help.
- Toolbar:** Includes icons for file operations and a 'Correct Indentation' button.
- Project Explorer (Left):** Shows a project named 'demo' with a package 'MyPackage' containing files 'MyClass.mo', 'package.mo', and 'VanDerPol.mo'. The 'VanDerPol' model is expanded, showing parameters 'e', 'lambda', 'x', and 'y'. The 'lambda' parameter is selected, and a callout points to its value in the code.
- Editor (Center):** Displays the code for 'VanDerPol.mo'. The code is as follows:

```
1 // Van der Pol model
2
3 model VanDerPol "Van der Pol oscillator model"
4   Real x(start = 1);
5   Real y(start = 1);
6   parameter Real lambda = 0.3;
7   parameter Real e = Modelica.Constants.e;
8 equation
9   der(x) = y;
10  der(y) = - x + lambda*(1 - x*x)*y;
11 end VanDerPol;
12
```

Line 6 is highlighted, and a callout points to the value '0.3'.
- Problems View (Bottom):** Shows '0 errors, 0 warnings, 0 infos'.

Code Browsing for easy navigation within Modelica files. Automatic update on file save.

Error detection (I)

The screenshot shows the Eclipse IDE with the following components:

- Project Explorer:** Shows a project named 'demo' containing a package 'MyPackage' with files 'MyClass.mo', 'package.mo', and 'VanDerPol.mo'. The 'VanDerPol' model is expanded, showing parameters 'e', 'x', and 'y'.
- Code Editor:** Displays the content of 'VanDerPol.mo'. The code is as follows:

```
1 // Van der Pol model
2
3 model VanDerPol "Van der Pol oscillator model"
4   Real x(start = 1);
5   Real y(start = 1);
6   parameter Real lambda = 0.3;
7   parameter Real e = Modelica.Constants.e;
8 equation
9   der(x) = y;
10  der(y) = - x + lambda*(1 - x*x)*y;
11 end VanDerPol;
12
```
- Problems Window:** Shows 1 error, 0 warnings, and 0 infos. The error details are:

Description	Resource	In Folder	Location
unexpected token: lambda, parsing resumed at token ';' on line 6, column 29	VanDerPol.mo	demo	line 6

Parse error
detection on
file save

Error detection (II)

The screenshot shows the Eclipse IDE interface for the Modelica project. The left sidebar displays the project structure, including folders like 'Compiler', 'absyn_builder', 'doc', 'modpar', 'omc_debug', 'omc_release', 'report', 'rml2mmo', 'rml2sig', 'runtime', 'scripts', 'test_codegen', 'tools', 'VC7', 'winruntime', and files like 'Absyn.mo', 'Algorithm.mo', 'Builtin.mo', 'Ceval.mo', 'ClassLoader.mo', 'Codegen.mo', 'Connect.mo', 'Corba.mo', 'DAE.mo', 'DAEEXT.mo', 'DAELow.mo', 'Debug.mo', and 'Derive.mo'. The main editor window shows the source code for 'Absyn.mo' with the following content:

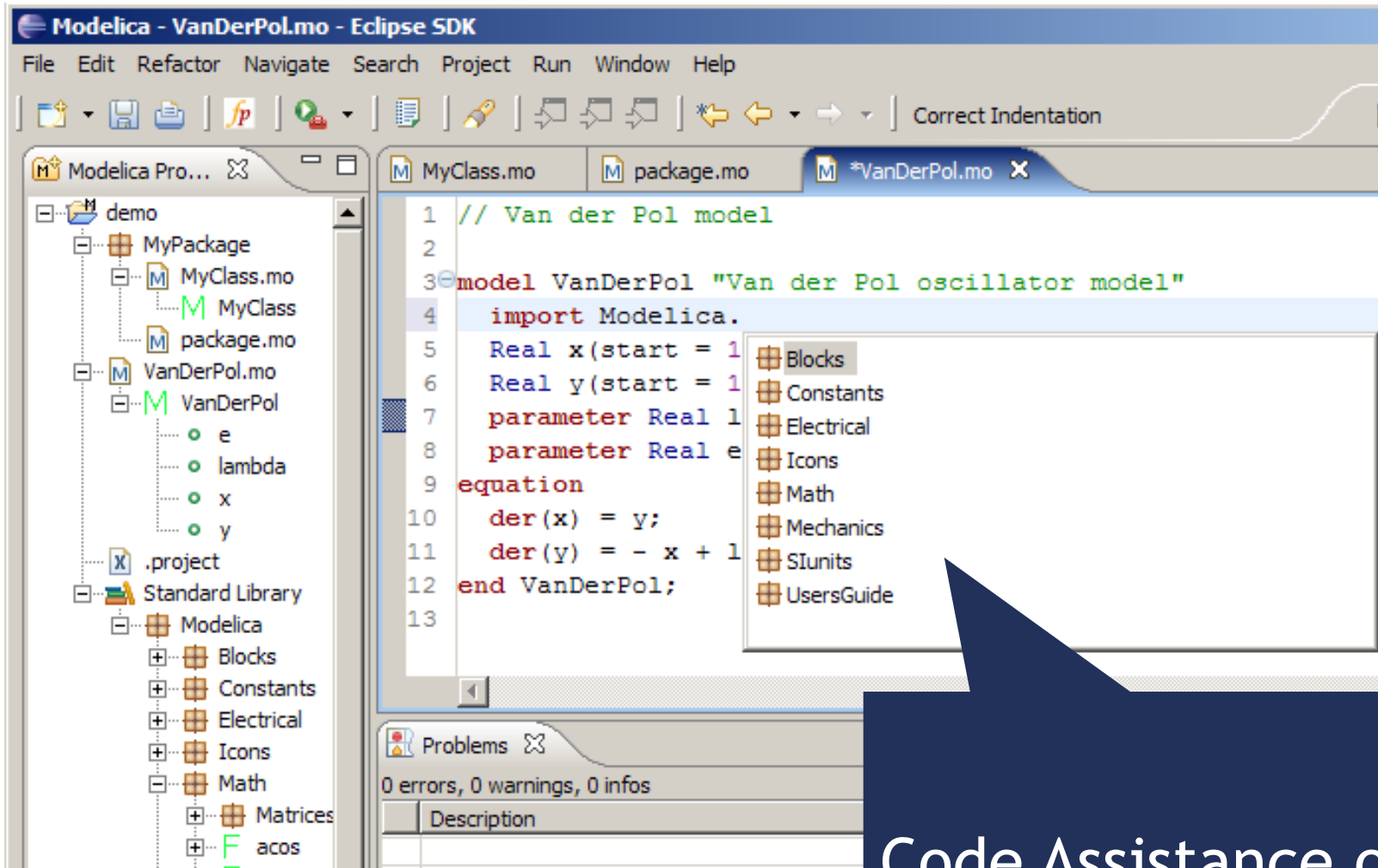
```
69 public
70 uniontype Program "- Programs, the top level construct
71 A program is simply a list of class definitions declared at top
72 level in the source file, combined with a within statement that
73 indicates the hieractical position of the program.
74 "
75 record PROGRAM
76 list<Class> classes "classes ; List of classes" ;
77 Withi within_ "within ; Within statement" ;
78 end PROGRAM;
```

The 'Problems' view at the bottom shows the following error message:

```
<terminated> OMDev-MINGW-OpenModelicaBuilder [Program] c:\OMDev\tools\msys\bin\make.exe
cp -p ../Static.mo Static.mo
cp -p ../SimCodegen.mo SimCodegen.mo
cp -p ../Values.mo Values.mo
cp -p ../System.mo System.mo
/c/OMDev//tools/rml/bin/rmlc -v -Wc,-O3 -c Absyn.mo
"/c/OMDev//tools/rml/bin/rml" -Eplain Absyn.mo
Absyn.mo:77.5-77.9 Error: unbound type constructor Withi
Error: StaticElaborationError
make[2]: Leaving directory `/c/bin/mingw/home/...
make[1]: Leaving directory `/c/bin/cy...
make[2]: *** [Absyn.h] Error 1
make[1]: *** [omc_release] Error 2
make: *** [omc] Error 2
```

A blue callout box with a white arrow points to the error message, containing the text: "Semantic error detection on compilation".

Code assistance (I)



The screenshot shows the Eclipse IDE with the Modelica project 'demo' open. The file 'VanDerPol.mo' is selected in the Package Explorer on the left. The main editor displays the following code:

```
1 // Van der Pol model
2
3 model VanDerPol "Van der Pol oscillator model"
4   import Modelica.
5   Real x(start = 1
6   Real y(start = 1
7   parameter Real l
8   parameter Real e
9   equation
10  der(x) = y;
11  der(y) = - x + l
12 end VanDerPol;
13
```

A code assistance popup is visible over the 'import Modelica.' line, showing a list of available packages:

- Blocks
- Constants
- Electrical
- Icons
- Math
- Mechanics
- SIunits
- UsersGuide

The Problems window at the bottom shows 0 errors, 0 warnings, and 0 infos.

Code Assistance on imports

Code assistance (II)

The screenshot shows the Eclipse IDE with the following components:

- Project Explorer:** Shows a project named 'demo' containing a package 'MyPackage' with files 'MyClass.mo', 'MyClass', and 'package.mo'. It also contains a file 'VanDerPol.mo' with a class 'VanDerPol' and parameters 'e', 'lambda', 'x', and 'y'. A 'Standard Library' is also visible with categories like 'Modelica', 'Blocks', 'Constants', 'Electrical', 'Icons', 'Math', 'Matrices', and functions like 'acos' and 'asin'.
- Editor:** Displays the code for 'VanDerPol.mo'. The code is as follows:

```
1 // Van der Pol model
2
3 model VanDerPol "Van der Pol oscillator model"
4   import Modelica.Math;
5   Real x(start = 1);
6   Real y(start = 1);
7   parameter Real lambda = 0.3;
8   parameter Real e = Modelica.Constants.
9 equation
10  der(x) = y;
11  der(y) = - x + lambda*(1 - x*x)*y;
12 end VanDerPol;
13
```

Line 8 is selected, and a list of completion suggestions is shown on the right, including 'c', 'D2R', 'e', 'eps', 'epsilon_0', 'G', 'g_n', 'h', and 'inf'. The suggestion 'e' is highlighted.
- Problems View:** Shows '0 errors, 0 warnings, 0 infos'.
- Table:** A table with columns 'Description', 'Resource', 'In Folder', and 'Location' is partially visible at the bottom.

Code Assistance on assignments

Code assistance (III)

The screenshot shows the Eclipse IDE with the following components:

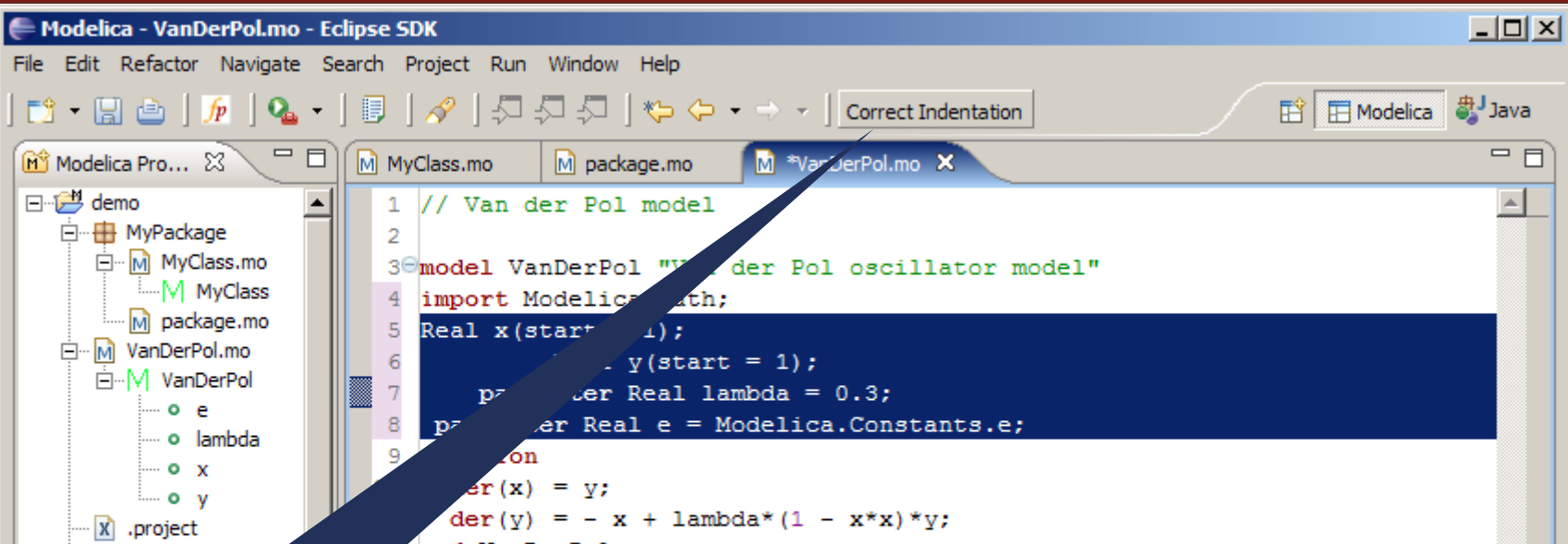
- Project Explorer:** Shows a project named 'demo' with a package 'MyPackage' containing 'MyClass.mo', 'MyClass', and 'package.mo'. A 'VanDerPol.mo' file is also present, containing a 'VanDerPol' model with parameters 'e', 'lambda', 'x', and 'y'.
- Editor:** Displays the code for 'VanDerPol.mo'. The code is as follows:

```
1 // Van der Pol model
2
3 model VanDerPol "Van der Pol oscillator model"
4   import Modelica.Math;
5   Real x(start = 1);
6   Real y(start = 1);
7   parameter Real lambda = 0.3;
8   parameter Real e = Modelica.Constants.e;
9   equation
10    der(x) = y;
11    y = Modelica.Math.sin(
12    der(y) = - x + lambda*(1 - x*x)*y;
13  end VanDerPol;
14
```

Line 11 is highlighted, and a tooltip shows 'Real sin(SI.Angle u)'. A blue arrow points from this tooltip to a dark blue box at the bottom right.
- Problems View:** Shows '0 errors, 0 warnings, 0 infos'.
- Table:** A table with columns 'Description', 'Resource', 'In Folder', and 'Location' is partially visible at the bottom.

Code Assistance on
function calls

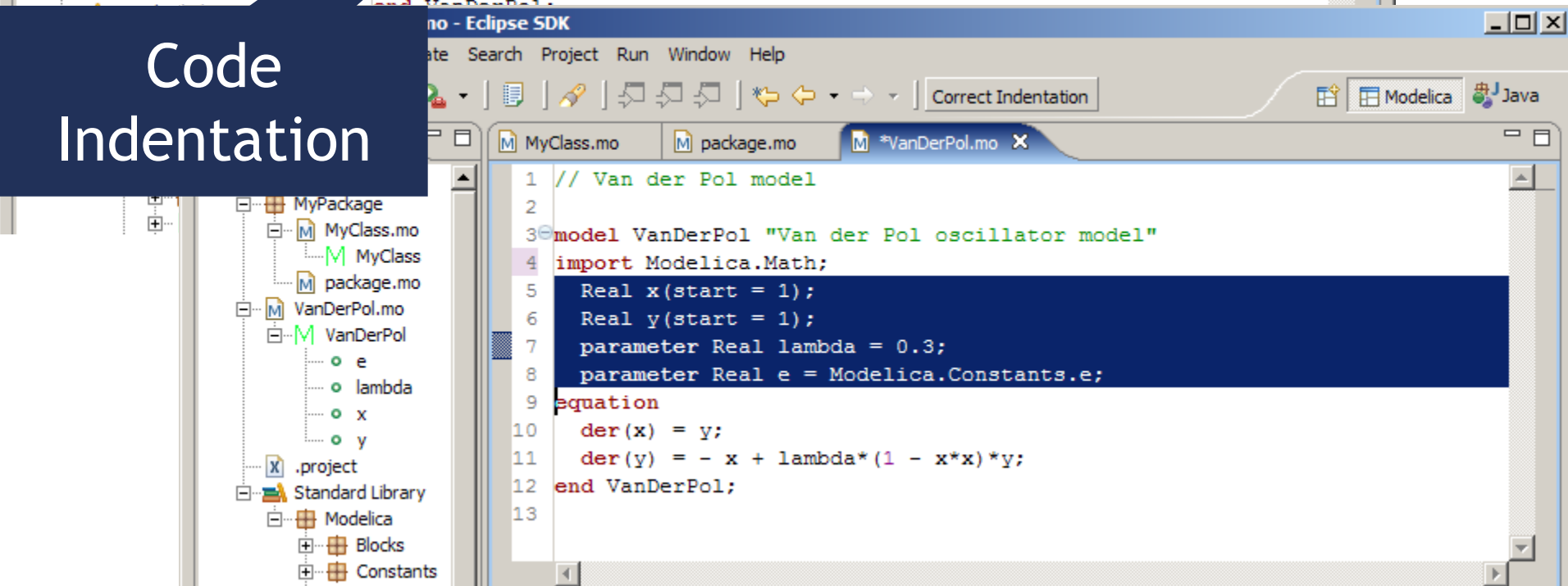
Code indentation



Modelica - VanDerPol.mo - Eclipse SDK

```
1 // Van der Pol model
2
3 model VanDerPol "Van der Pol oscillator model"
4 import Modelica.Math;
5 Real x(start = 1);
6 Real y(start = 1);
7 parameter Real lambda = 0.3;
8 parameter Real e = Modelica.Constants.e;
9
10 equation
11   der(x) = y;
12   der(y) = - x + lambda*(1 - x*x)*y;
13 end VanDerPol;
```

Code
Indentation



Modelica - VanDerPol.mo - Eclipse SDK

```
1 // Van der Pol model
2
3 model VanDerPol "Van der Pol oscillator model"
4 import Modelica.Math;
5   Real x(start = 1);
6   Real y(start = 1);
7   parameter Real lambda = 0.3;
8   parameter Real e = Modelica.Constants.e;
9
10 equation
11   der(x) = y;
12   der(y) = - x + lambda*(1 - x*x)*y;
13 end VanDerPol;
```


Code Outline and Hovering Info

The screenshot displays the Eclipse IDE interface for the Modelica compiler project. The top menu bar includes File, Edit, Navigate, Search, Project, Run, Field Assist, Window, and Help. The toolbar contains various icons for file operations and development tools. The Project Explorer on the left shows a tree view of the project structure, with 'Absyn.mo' selected. The Outline view below it provides a hierarchical view of the code structure. The main code editor shows the source code for 'Absyn.mo', with a tooltip hovering over a function definition. The tooltip text reads: 'function getCrefFromExp "function: getCrefFromExp Returns a flattened list of the component references in an expression" input Exp inExp; then output list<ComponentRef> outComponentRefLst; algorithm outComponentRefLst:=matchcontinue inExp local ComponentRef cx;'. The Problems view at the bottom shows 113 errors, 0 warnings, and 0 infos, with a list of error descriptions.

Code Outline for easy navigation within Modelica files

Identifier Info on Hovering

64M of 254M

Ctrl Contrib (Bottom)

Eclipse Debugging Environment

- Type information for all variables
- Browsing of complex data structures
- GDB based

The screenshot displays the Eclipse IDE interface for debugging OpenModelica. The main window is titled "Debug - OpenModelica/Compiler/Main.mo - Eclipse SDK". The interface is divided into several panels:

- Debug Panel:** Shows the execution flow with a tree view of the main thread (stepping) and a stack trace including `Main.translateFile` and `Main.main`.
- Variables Panel:** Displays a table of variables and their values. The table has columns for Name, Value, and Declared Type.
- Console Panel:** Shows the output of the program, including the path `C:\bin\cygwin\home\adrho\dev\OpenModelica\bu`.
- Outline Panel:** Shows the project structure with a tree view of files and folders.
- Source Editor:** Displays the source code of the `Bla.mo` file, showing a `model Bla` block with an `Integer z[10];` declaration and an `equation` block.

Name	Value	Declared Type
p	Absyn.Program	Absyn.Program
[record]	Absyn.PROGRAM[2]	((Absyn.Class list, Absyn.Within) :
classes	LIST	Absyn.Class list
[0]	Absyn.CLASS[7]	((string, bool, bool, bool, Absyn.R
name	"Bla"	string
partial_	false	bool
final_	false	bool
encapsulated_	false	bool
restriction	1:enum:Absyn.R_MODEL	Absyn.Restriction
body	Absyn.PARTS[2]	((Absyn.ClassPart list, string optio
classParts	LIST	Absyn.ClassPart list
[0]	Absyn.PUBLIC[1]	((Absyn.ElementItem list) => (Abs
contents	LIST	Absyn.ElementItem list
[0]	Absyn.ELEMENTITEM[1]	((Absyn.Element) => (Absyn.Elen
comment	NONE[0]	string option
info	Absyn.INFO[6]	((string, bool, int, int, int, int) =>
within_	Absyn.TOP[0]	Absyn.Within
f	string	string
->	"Bla.mo"	string

```
model Bla
  Integer z[10];
end Bla;
```

```
local String s;
equation
  isModelicaFile(f);
  p = Parser.parse(f);
  Debug.fprint("dump", "\n----- Parsed progr
  Debug.fcall("dumpgraphviz", DumpGraphviz.dump, p);
  Debug.fcall("dump", Dump.dump, p);
```

OMEdit Debugging Environment

The screenshot displays the OMEdit - Transformational Debugger interface. The main window shows the source code for a debugging session, with the following code visible:

```
enthalpy computation";
parameter
SI.SpecificHeatCapacity
cp=4186 "Cp of the fluid";
SI.MassFlowRate w_pump
"Mass flow rate from the
pump";
SI.Pressure p1 "Pump
discharge pressure";
SI.Pressure p2 "Storage
tank inlet pressure";
SI.Pressure dp_pump
"Pump dp";
SI.Pressure dp_valve
"Valve dp";
Real sqrt_dp
"Regularized sqrt(dp)";
SI.SpecificEnthalpy h0
"Pump inlet specific
enthalpy";
SI.SpecificEnthalpy h1
"Pump discharge specific
enthalpy";
SI.Power W;
SI.Length y(start=40,
fixed=true) "Reservoir
level";
Real eta(final
unit="1") = (p1 -
patm)*w_pump/rho/W "Pump
efficiency";
SI.Temperature T1 "Pump
discharge temperature";
SI.Time tau=1 "Time
constant of temperature
sensor";
equation
dp_pump = p1 - patm
dp";
```

The interface includes several panels:

- Variables Browser:** Lists variables with their comments, line numbers, and locations. For example, T0 is defined at line 118 as "Tempera...g fluid".
- Equations Browser:** Lists equations with their indices, types, and equations. For example, equation 1 is an initial condition: "(assignment) ...*(T0 - Tref)".
- Source Browser:** Shows the source code being debugged, with the current line highlighted.
- Defined In Equations / Used In Equations:** Tables showing the relationship between variables and equations.
- Equation Operations:** Shows the operations performed on equations, such as solving for h0.

Tutorial 1 - tomorrow at ModProd 2016!

- OpenModelica
 - What is OpenModelica?
 - The past
- OpenModelica Technical Overview
 - OMC, OMShell, OMNotebook,
 - OMEdit, ModelicaML
- OpenModelica Development Environment
 - MetaModelica
 - The Eclipse Environment
- OpenModelica Latest Developments (2015-2016)

Latest Developments (2015-2016)

- **2015 - 2016 - Most focus on libraries support & performance**
 - MSL 3.2.1 (100% build/99% simulate), ModelicaTest 3.2.1, PetriNet, Buildings, PowerSystems, OpenHydraulics, ThermoPower, and ThermoSysPro, Modelica_Synchronous
 - Switched to bootstrapped compiler
 - Moved the source code to <https://github.com/OpenModelica>
- **Front-end, Back-end, Simulation Runtime, Graphical Clients**
 - Development switched to bootstrapped compiler
 - Support for synchronous language features and state machines
 - Better support for libraries in the front-end and back-end
 - Improved back-end: initialization, system solving, parallelization, cse optimization, dynamic optimization
 - Performance and scalability improvements
 - Faster and much more user friendly OpenModelica Connection Editor
 - Improved FMI support for Model Exchange and Co-Simulation
- **General**
 - Feb 2015 - Feb 2016
 - 55 contributors - up by 17 contributors (44%)
 - 5745 commits - up by 1631 commits (40%)
 - Bug fixes
 - Release 1.9.3 (Linux, Mac, Windows)

Latest Developments (2015-2016)

- **Front-end issues still in works**
 - support for querying the instance of a flattened model needed for OMEdit handling of model structure
 - support for choicesAllMatching annotation (subtyping relationship of models/comps) needed for OMEdit handling of replaceable components/models
 - scalability & performance
basically do things once and not several times
separate lookup, modifier application, typing, array expansion, equation & connection handling, etc.
- **General**
 - 64 bit Windows versions

Thank You!

Questions?

asodja, sjoelund.se, sebco011, lochel, wbraun, niklwors, hubert.thieriot, petar, perost, Frenkel TUD, Unknown, syeas460, adeas31, ppriv, ricli576, haklu, dietmarw, levs, mahge930, x05andfe, mohsen, nutaro, x02lucpo, florox, x06hener, x07simbj, stebr461, x08joekl, x08kimja, Dongliang Li, jhare950, x97davka, krsta, edgarlopez, hanke, henjo, wuzhu.chen, fbergero, harka011, tmtuomas, bjozac, AlexeyLebedev, x06klasj, ankar, kajny, vasaie_p, niemisto, donida, hkiel, darbr, otto@mathcore.com, Kaie Kubjas, x06krino, afshe, x06mikbl, leonardo.laguna, petfr, dhedberg, g-karbe, x06henma, abhinck, azazi, x02danhe, rruusu, x98petro, mater, g-bjoza, x02kajny, g-pavgr, x05andre, vaden, jansilar, ericmeyers, x05simel, andsa, leist, choeger, Ariel.Liebman, frisk, vaurich, mwalther, mtiller, ptauber, casella, vitalij, hkiel, jank, adrpo, rfranke, mflehmg

OpenModelica Project

<http://www.OpenModelica.org>

Modelica.Fluid.Examples.BranchingDynamicPipes

Modelica.Fluid.Examples.BranchingDynamicPipes.graphml - yEd

File Edit View Layout Tools Grouping Windows Help

Overview

Modelica.Fluid...ipes.graphml * x

Neighborhood

Structure View

Search Text

Graph

- 1701
- CL: AbsolutePressure
- CL: AbsolutePressure
- CL: Acceleration
- CL: Air
- CL: AmountOfSubstance
- CL: Angle
- CL: Area
- CL: AxisCenter
- CL: AxisLeft
- CL: BaseClasses
- CL: BaseClasses
- CL: BaseProps_Tpoly

