4th Annual OpenModelica Workshop
Feb 6, 2012

Workshop Opening

OpenModelica – Status and Directions

Peter Fritzson
To All Participants!

Very Welcome to this Fourth Annual OpenModelica Workshop!
Goals for the OpenModelica Effort

- Comprehensive **modeling, simulation and systems engineering** environment for research, teaching, and industrial usage
- **Open-source** for both **academic** and **industrial** usage
- Invitation for **open-source cooperation** around OpenModelica, tools, and applications
OpenModelica Web Page

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.

Latest news

Jan 30: OpenModelica 1.8.1 beta released
January 22: Registration Open - MODPROD/2012 and OpenModelica 2012 workshops on Model-based development
Nov 25: OpenModelica 1.8.0 released
Nov 22: Preliminary Program For OpenModelica Annual Workshop
OpenModelica Developers Week - 7-11 November 2011
Oct 13: CFP OpenModelica/MODPROD Workshops February 2012
October 11: OpenModelica 1.8.0 Beta2 release
September 24: OpenModelica 1.8.0 Beta Release
June 21: Next Modelica design meeting in Linköping, 31th August - 2nd September
May 20: OMWeb Teacher and Student Clients Running Now

Register yourself to get information about new releases.
Participate in the OpenModelica interest mailing list.
Help us: get the latest source code or nightly-build and report bugs.
To learn about Modelica, read a book or a tutorial about Modelica.
To do system modeling with integrated UMLModelica, use ModelicaML.
**Current OpenModelica**  [www.openmodelica.org](http://www.openmodelica.org)

- **Advanced Interactive Modelica compiler (OMC)**
  - Supports most of the Modelica Language
- **Basic environment for creating models**
  - **OMShell** – an interactive command handler
  - **OMNotebook** – a literate programming notebook
  - **MDT** – an advanced textual environment in Eclipse
- **ModelicaML** – UML Profile
- **MetaModelica** – model transforms
- **ParModelica** – parallel programming
Expanded Vision for OpenModelica Effort: Integrated Model-driven Development
Based on OpenModelica, e.g. in OPENPROD project

Business Process Control → Requirements Capture → Model-Driven Design (PIM) → Compilation & Code Gen (PSM)

Process models → Requirements models → Product models → Platform models

Unified Modeling: Meta-modeling & Modelica & UML & OWL

Vision of unified modeling framework for model-driven product development from platform independent models (PIM) to platform specific models (PSM)
Main Events 2011

Outlook for 2012
Main Events 2011 and January 2012

• OSMC expanded from 32 to 38 organizational members
• OpenModelica 1.7 release (April 2010)
  • Faster and more stable simulation through improved event handling
  • New optimization subsystem OMOptim
  • Improvements in OMEdit including support for icon editing
  • Faster simulation storage, including binary .mat files and alias variables
• OpenModelica 1.8 release (Nov 2011)
  • Support for FMI Export and Import
  • Flattening of the whole MSL 3.1 Media library, and about half of the Fluid library.
  • Improved index reduction with dynamic state selection
  • Beta release of new efficient debugger for algorithmic Modelica/MetaModelica
• OpenModelica 1.8.1 beta release (Jan 2012)
  • Operator Overloading support
  • Dramatically improved flattening speed for some models
  • Improved simulation run-time
  • ModelicaML with Modelica library import (MSL) and value-bindings
OpenModelica – Outlook for 2012

• Whole 2012. Continued high priority on better support for the Modelica standard libraries.
• Spring 2012. Support for larger models and improved simulation efficiency.
• February 2012. Shifting to bootstrapped OpenModelica compiler for development.
• February-March 2012. Parallel Modelica simulation, OpenMP, and ParModelica for GPU simulation prototypes
• March-April 2012. Most of Fluid library flattening and simulating
• March 2012. improved support for MultiBody simulation.
• April-June 2012. Most of Media and Fluid libraries simulating
• May-June 2012. Integrated Modelica debugger.
• May-June 2012. Python API
• Fall 2012. Support for Modelica 3.3
OpenModelica Compiler Bootstrapping

• Bootstrapping = OMC Compiler Compiles itself

• Advantages
  • Faster compilation for the developers
  • Complete Modelica language for easier programming
  • Better error messages and maintainability
  • Makes a faster Modelica debugger possible
  • Makes performance analysis possible
  • some Modelica 4 like features

• Status
  • Dec 2010, OMC first compiled itself
  • During 2011, used for development with the new debugger
  • Feb-Mar 2012. Planned completion of automatic memory reclamation
Improved OpenModelica Connection Editor
OMEdit

- Supports MSL 3.1
- Easy to use
- Stable
- Implemented in C++ Qt library
New Efficient OpenModelica MDT Debugger for Algorithmic MetaModelica/Modelica (Eclipse-based)

Here Using Japanese Characters
OpenModelica Optimization Subsystem
OMOptim

- Parameter optimization
- Currently using genetic optimization algorithms in OMOptim 0.9.
Prototypes of Parallel Execution with OpenModelica

• **ParModelica** – Parallel Algoritmic Modelica Code Execution on GPU
  • Speedup factor 114 of matrix multiplication on NVIDIA Fermi GPU

• **OPENMP** support in OpenModelica, parallelization of partitioned models
  • Speedup factor 4 of trivial model on 4-core machine
The Open Source Modelica Consortium
Purpose of the Consortium

• The Open Source Modelica Consortium, created the 4th of December 2007 in Linköping, Sweden, in the following called OSMC, is a non-profit, non-governmental organization with the aim of developing and promoting the development and usage of the OpenModelica open source implementation of the Modelica computer language (also named Modelica modeling language) and OpenModelica associated open-source tools and libraries, collectively named the OpenModelica Environment, in the following referred to as OpenModelica.

• OpenModelica is available for commercial and non-commercial usage under the conditions of the OSMC Public License. It is the aim of OSMC, within the limitations of its available resources, to provide support and maintenance of OpenModelica, to support its publication on the web, and to coordinate contributions to OpenModelica.
Open Source Modelica Consortium
Originally Created Dec 4, 2007

7 Founding Organizational Members
• Bosch-Rexroth AG, Germany
• Equa Simulation AB, Sweden
• TLK Thermo, Germany
• VTT, Finland
• Linköping University, Sweden
• Hamburg University of Technology/TuTech, Institute of Thermo-Fluid Dynamics, Germany
• Technical University of Braunschweig, the Institut of Thermodynamik, Germany
OSMC – Open Source Modelica Consortium
40 organizational members February 2012

Founded Dec 4, 2007

Open-source community services
• Website and Support Forum
• Version-controlled source base
• Bug database
• Development courses
• www.openmodelica.org

Code Statistics
## OSMC 40 Organizational Members, Feb 2012
(initially 7 members, 2007)

<table>
<thead>
<tr>
<th>Companies and Institutes (22 members)</th>
<th>Universities (18 members)</th>
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<tbody>
<tr>
<td>• ABB Corporate Research, Sweden</td>
<td>• Linköping University, Sweden</td>
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<tr>
<td>• Bosch Rexroth AG, Germany</td>
<td>• TU Berlin, Institute of UEBB, Germany</td>
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<tr>
<td>• Siemens PLM, California, USA</td>
<td>• FH Bielefeld, Bielefeld, Germany</td>
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<tr>
<td>• Siemens Turbo Machinery AB, Sweden</td>
<td>• TU Braunschweig, Institute of Thermodynamics, Germany</td>
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<tr>
<td>• CDAC Centre for Advanced Computing, Kerala, India</td>
<td>• TU Dortmund, Proc. Dynamics, Germany</td>
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<td>• Creative Connections, Prague, Czech Republic</td>
<td>• Technical University Dresden, Germany</td>
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<td>• DHI, Aarhus, Denmark</td>
<td>• Université Laval, modelEAU, Canada</td>
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<tr>
<td>• Evonik, Dehli, India</td>
<td>• Georgia Institute of Technology, USA</td>
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<tr>
<td>• Equa Simulation AB, Sweden</td>
<td>• Ghent University, Belgium</td>
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<tr>
<td>• Fraunhofer FIRST, Berlin, Germany</td>
<td>• Griffith University, Australia</td>
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<tr>
<td>• Frontway AB, Sweden</td>
<td>• Hamburg Univ. Technology/TuTech, Institute of Thermo-Fluid, Germany</td>
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<tr>
<td>• IFP, Paris, France</td>
<td>• University of Ljubljana, Slovenia</td>
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<td>• InterCAX, Atlanta, USA</td>
<td>• University of Maryland, Inst. Systems Engineering, USA</td>
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<tr>
<td>• ISID Dentsu, Tokyo, Japan</td>
<td>• University of Maryland, CEEE, USA</td>
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<tr>
<td>• MathCore Engineering/ Wolfram, Sweden</td>
<td>• Politecnico di Milano, Italy</td>
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<tr>
<td>• Maplesoft, Canada</td>
<td>• Ecoles des Mines, ParisTech, CEP, France</td>
</tr>
<tr>
<td>• TLK Thermo, Germany</td>
<td>• Mälardalen University, Sweden</td>
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<tr>
<td>• Sozhou Tongyuan Software and Control, China</td>
<td>• Telemark University College, Norway</td>
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<td>• VI-grade, Italy</td>
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<td>• VTI, Linköping, Sweden</td>
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<td>• VTT, Finland</td>
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<td>• XRG Simulation, Germany</td>
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Open Source Modelica Consortium
Individual Members

(58 individual members, 6 February 2012)

Open Source Modelica Consortium – OSMC
Board of Directors

- **Oliver Lenord**, OSMC Chairman; Manager, Siemens PLM, USA
- **Per Sahlin**, OSMC Vice Chairman; CEO, Equa Simulation AB
- **Peter Fritzson**, OSMC Director; Prof, Linköping University, Sweden
- **Juha Kortelainen**, Manager, VTT, Finland
- **Gerhard Schmitz**, Prof, Univ. Hamburg, Germany
- **Alf Isaksson**, Manager, ABB Corp. Research, Sweden
- **Francesco Casella**, Prof, Politecnico di Milano, Italy
- **Jan Brugård**, CEO, MathCore Engineering AB, Sweden
- **Kilian Link**, Manager, Siemens, Germany (and Sweden)
- **Lars Mikelsons**, Manager, Bosch-Rexroth, Germany (expected member from Feb 6, 2012.)
# OSMC Board – 5 Meetings Jan 1 2011 – Dec 31 2011

<table>
<thead>
<tr>
<th>Meeting dates</th>
<th>Board Work</th>
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<tbody>
<tr>
<td>110315</td>
<td>Planning and prioritizing the OSMC work</td>
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<tr>
<td>110518</td>
<td>Admitting new members</td>
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<tr>
<td>110629</td>
<td>Planning the workshop</td>
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<tr>
<td>110920</td>
<td>Budget</td>
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<td>111115</td>
<td>etc.</td>
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</table>
OPENPROD – OpenModelica related Project

• Duration: June 2009 – Sept 2012 (3.3 years)
• Budget: approx 11 Meuro, 94 Manyears
• 28 partners
• Very important for OpenModelica development
• Successful review Sept 2011 after 2 years
• Final review fall 2012 including most application demos
• (New project MODRio approved, starting fall 2012)

Main workpackages

• Integrated hardware software modeling by Modelica - UML - SysML integration.
• Model compiler enhancements.
• Compilation of Modelica to parallel multi-core platforms.
• Tool interoperability.
• Application demonstrators.
Some Swedish OpenModelica-Related Projects

- **HIPo** – High Speed Simulation for Product Design and Operation (2010 – 2013)
  - Model partitioning using TLM techniques
  - TLM-Partitioning for hi-speed on multi-core
- **EDOp** – Efficient Traceable Model-Based Dynamic Optimization (2011-2013)
  - Dynamic and parameter optimization
  - High-speed optimization on multi-core
- **RTSIM** – Real-Time Simulation (2011-2013)
  - India CDAC – Sweden PELAB Cooperation
  - Real-time code generation and control
Special Thanks

- The developers (Especially Adrian) who worked very hard during 2011. Adrian Pop, Martin Sjölund, Per Östlund, Jens Frenkel, Willi Braun, Lennart Ochel, Alexey Lebedev, and many others.

- The 38 OpenModelica consortium organizational members for support, especially Bosch-Rexroth, with OSMC Chairman Oliver Lenord (now at Siemens PLM); ABB, Siemens, etc...

- Master students and PhD students who made important contributions.
Conclusions and Summary 2011

- OSMC expanded from 32 to 38 organizational members.
- April 2011, OpenModelica 1.7 release. Improved OMC compiler. OMOptim subsystem.
- 2012. Good prospects for the future – towards a standard high quality open source Modelica implementation in Modelica, increased tool support for integrated systems engineering.

Questions?

www.openmodelica.org