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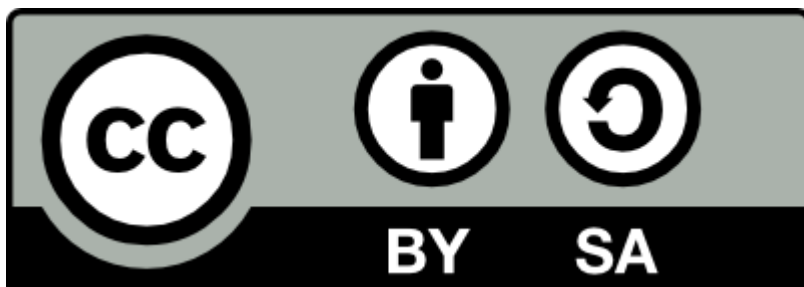
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Modelica Association Project Functional Mock-up Interface for embedded systems (MAP eFMI)

Annual report

Fiscal year 2024
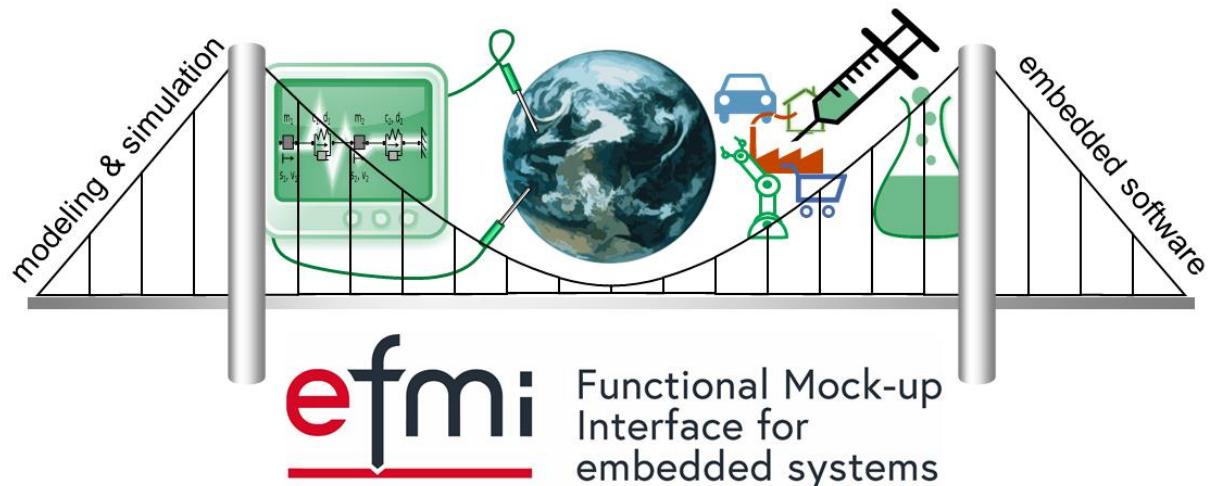
Preamble

The main purpose of the "Modelica Association Project Functional Mock-up Interface for embedded systems" (MAP eFMI) is the development, standardization and promotion of the *eFMI Standard*. The *eFMI Standard* is an open standard for step-wise development and validation of advanced control functions suited for safety-critical and real time targets. It enables the application of high-level abstraction and simulation models – like acausal physics models – in embedded software by providing a container architecture for the step-wise refinement of a first high-level algorithmic solution to an embedded implementation on a dedicated target environment. The eFMI container architecture and respective eFMI tooling capture all activities of such a credible model transformation process:

- behavior / reference results for testing (Behavioral Model containers)
- target-independent bounded algorithmic solution (Algorithm Code container) based on eFMI GALEC (guarded algorithmic language for embedded control)
- C implementations, tailored and optimized for the requirements of specific target environments (Production Code containers)
- binary distributions and their „build-recipes", ready for embedded system integration (Binary Code containers)

This report outlines the activities of MAP eFMI between June 2024 (including) and May 2025 (including).

Current members of the MAP

The project has 5 Steering Committee members and 10 Advisory Board members:

Project Leader	Christoff Bürger (Dassault Systèmes)
Deputy Project Leader	Hubertus Tummescheit (Modelon)
Steering Committee	Dassault Systèmes German Aerospace Center DLR Mercedes-Benz AG Modelon AB Robert Bosch GmbH
Advisory Board	Altair Engineering Inc. (part of Siemens AG) dSPACE GmbH e:fs TechHub GmbH (former: Elektronische Fahrwerksysteme GmbH) ETAS GmbH (part of Robert BOSCH GmbH) Institute of Vehicle Engineering CO LTD Keysight Technologies, Inc. (former ESI Group) Mitsubishi Electric Research Laboratories Open Source Modelica Consortium Siemens Digital Industries Software Synopsys, Inc. (former PikeTec GmbH)

Note, that dSPACE GmbH moved from Steering Committee membership to Advisory Board.

All members are also Modelica Association (MA) members; this is required by the project bylaws.

36 projectmen (individuals of member organizations) have access to the IT infrastructure and contribute to the MAP.

Meetings

11 Steering Committee meetings since June 2024.
Regular Steering Committee meetings every first Tuesday each month at 14:00 CET.

Time-limited, dedicated workgroup meetings (design and specification of *eFMI Standard*, `eFMI_TestCases` library and eFMU crosschecks etc.).

IT infrastructure and resources

All members signed the Modelica Association Contributor License Agreement (MA CLA); this is required by the project bylaws. All public repositories are protected by CLA assistant.

The IT infrastructure provided by MAP eFMI is (new marked in red):

efmi-info@googlegroups.com	Public e-mail list.
efmi-standard@googlegroups.com	Private e-mail list for members of the MAP.
https://efmi-standard.org/	Public website with introduction, officially released tools listing, standard releases (Beta 1 draft of eFMI Standard 1.0.0), and many resources like teaser videos and papers, example eFMUs, project organization documents like bylaws, membership application guidelines and forms etc.
https://github.com/EMPHYSIS/EMPHYSIS.github.io	Deprecated old public website of the EMPHYSIS project, now summarizing EMPHYSIS specific results only and otherwise pointing to the new MAP eFMI website.
https://github.com/EMPHYSIS/efmi-specification	Private GitHub repository with specification sources.
https://github.com/modelica/efmi-organization	Private repository with MAP eFMI organization-internal resources, e.g., organization documentation, meeting minutes and sources of bylaws and promotion material.
https://github.com/modelica/efmi-testcases	Public GitHub repository with official eFMI test cases (`eFMI_TestCases` Modelica library) for demonstrating and evaluating eFMI tooling (used by eFMI crosschecks).
https://github.com/modelica/efmi-containermanager	Public repository of the *eFMI Container Manager*, a tool for creating, checking, reading and modifying eFMUs and their individual containers.
https://github.com/modelica/efmi-compliancechecker	Public repository of the *eFMI Compliance Checker*, a tool for analyzing eFMUs for violations against the eFMI Standard.
https://github.com/EMPHYSIS/efmi-crosschecks	Private, NDA protected repository with crosscheck eFMUs generated from the official test cases.

Main activities from June 2024 – May 2025

- eFMI Standard 1.0.0 Beta 1 release (2024-07-02), focusing on and finalizing the eFMI Behavioral Model representation.
- Work on Beta 2 version of the eFMI Standard 1.0.0.
- Participation in the OpenSCALING research project, work packages 4 & 3, embedded PeN-ODE support with neural network tensor flows as multi-dimensional GALEC expressions well integrated with physics algorithms.
  - Paper under review for the 16th International Modelica & FMI Conference, 8-10th September 2025.
- Maintenance of eFMI website and promotional material at https://efmi-standard.org/resources/.

Planned activities for 2025

- Beta 2 release of eFMI Standard 1.0.0 for the 16th International Modelica & FMI Conference (finalizing Algorithm Code model representation/container and GALEC built-in functions).
- eFMI Tutorial and User Meeting at the 16th International Modelica & FMI Conference.
- Promotion of released commercial tools; support for industrial users.
- Promotion of eFMI technology to potential users and tool vendors.
- Support and collaboration with OpenSCALING research project.

Budget 2024

- 0 EUR: eFMI trademark and website-template are financed separately by the Modelica Association.

Budget proposal 2025+

- 7000 EUR: Discretionary Fund.

Date: 2024-06-04   Christoff Bürger (project leader)
                                             Hubertus Tummescheit (deputy project leader)