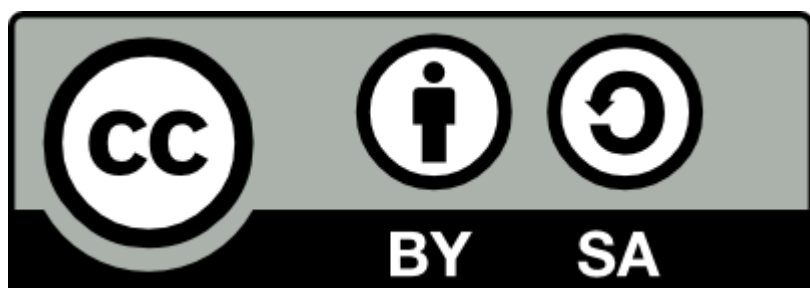




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Modelica Association Project Functional Mock-up Interface for embedded systems (MAP-eFMI)

Annual Report

Fiscal Year 2021

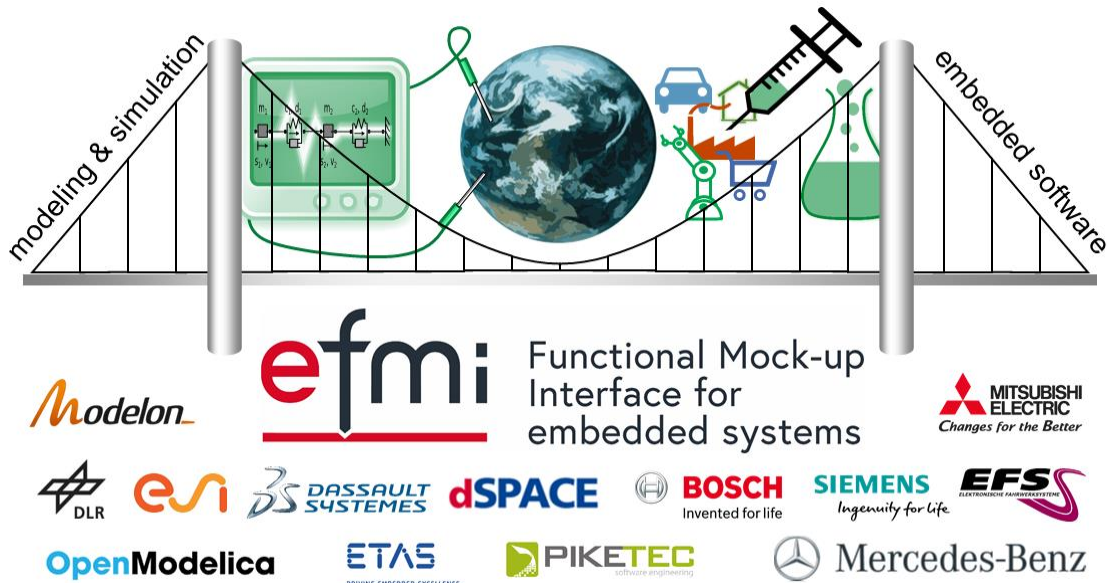
Preamble

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 a-causal 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 April 2021 and May 2022.

Current members of the MAP



Project Leader	Christoff Bürger (Dassault Systèmes)
Deputy Project Leader	Hubertus Tummescheit (Modelon AB)
Steering Committee	Dassault Systèmes, DLR-SR, dSPACE GmbH, ESI ITI GmbH, ETAS GmbH, Mercedes-Benz Group AG, Modelon AB, Robert Bosch GmbH

Advisory Board	Elektronische Fahrwerksysteme GmbH, Mitsubishi Electric Research Laboratories, Open Source Modelica Consortium, PikeTec GmbH, Siemens Digital Industries Software
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Most members come from the 2021 finished EMPHYSIS project. Two new joined:

- Mercedes-Benz Group AG (former EMPHYSIS OEM Board)
- Mitsubishi Electric Research Laboratories

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

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

IT infrastructure and resources

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

efmi-standard@googlegroups.com	Private e-mail list for members of the MAP.
https://github.com/EMPHYSIS/EMPHYSIS.github.io	Public webpage with introduction, Alpha 4 draft of eFMI Standard 1.0.0, introductory videos and papers, scientific publications etc.
https://github.com/modelica/efmi-standard.org	New webpage using new MA webpage-template (in development; private for now, will become public when HausE finished design).
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 for demonstrating and evaluating eFMI tooling (used by eFMI crosschecks).
https://github.com/modelica/efmi-containermanager	Public repository of the <i>eFMI Container Manager</i> , a tool for creating, checking, reading and modifying eFMUs and their individual containers.
https://github.com/modelica/efmi-compliancechecker	Public repository of the <i>eFMI Compliance Checker</i> , 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.

Meetings

14 Steering Committee meetings since April 2021 (when the project was founded).
Regular Steering Committee meetings every first Tuesday each month at 16:00 CET.

Many workgroup meetings (design/specification of eFMI Standard, eFMU crosschecks etc.).

8 meetings with recently started new third-party research project KI-EMBEDDED.

Main activities in April 2021 – May 2022

- MAP kickoff in April 2021.
- Setup infrastructure particularly GitHub repositories.
 - GitHub Wiki: Extensive documentation of project structure, members, repositories, bylaws, new member application guidelines etc.
 - GitHub Discussions.
- Public available eFMI Standard 1.0.0 Alpha 4.

- *Rigorous* crosschecks with 8 industrial leading and already in their field well-established tools now supporting eFMUs.
- Provided MA Backoffice & HausE content proposal for new MAP webpage based on the upcoming/in-development MA website-template designed by HausE.
- A lot of promotion and online available promotion material:
 - Scientific overview paper of eFMI Standard and EMPHYSIS results at 14th International Modelica Conference (title: “eFMI: An open standard for physical models in embedded software”).
 - Teaser videos, comparison with FMI, overview video presented on “FMI Industrial User Meeting” at 14th International Modelica Conference.
 - Presentation at prostep SSB & SSE group with classification in prostep V-Model and prostep whitepaper on “Virtual Electronic Control Units”.
 - Presentation at “International Council on Systems Engineering” (INCOSE).
 - ITEA3 Award of Excellence (highest rated project so far) and ITEA Magazine article.
 - Upcoming article in Elektronik magazine, special issue for “Embedded World 2022” fair.
- Official release dates for first commercial/industrial tools:
 - Dassault Systèmes: Dymola 2022x (Limited Availability, October 2021), Dymola 2023 (General Availability, May 2022).
 - dSPACE GmbH: TargetLink 2022 B (October/November 2022).
 - PikeTec GmbH: TPT 19 (October/November 2022).
 - Dassault Systèmes: CATIA ESP (3DEXPERIENCE 2022x FD03, June 2022).

Planned activities for 2022

- Webpage transition.
- Beta and final release of eFMI Standard 1.0.0, coordinated with first industrial/commercial tool releases such that users have offers for a complete eFMI toolchain.
- Promotion of eFMI technology to tool vendors and users.
- Promotion of first official industrial tool releases; support for industrial users.
- Support and collaboration with KI-EMBEDDED research project.

Budget 2021

- 0 EUR: eFMI logo and trademark (as part of the MA initiative to redesign and register MA and MAP logos and trademarks) organized by MA Backoffice.

Budget proposal 2022+

- 7000 EUR: Discretionary Fund.
- 5000 EUR: eFMI website based on new MA website-template developed by HausE.
- 459 EUR: XML Spy Professional license.

Date: 2022-06-23

Christoff Bürger (project leader)
Hubertus Tummescheit (deputy project leader)