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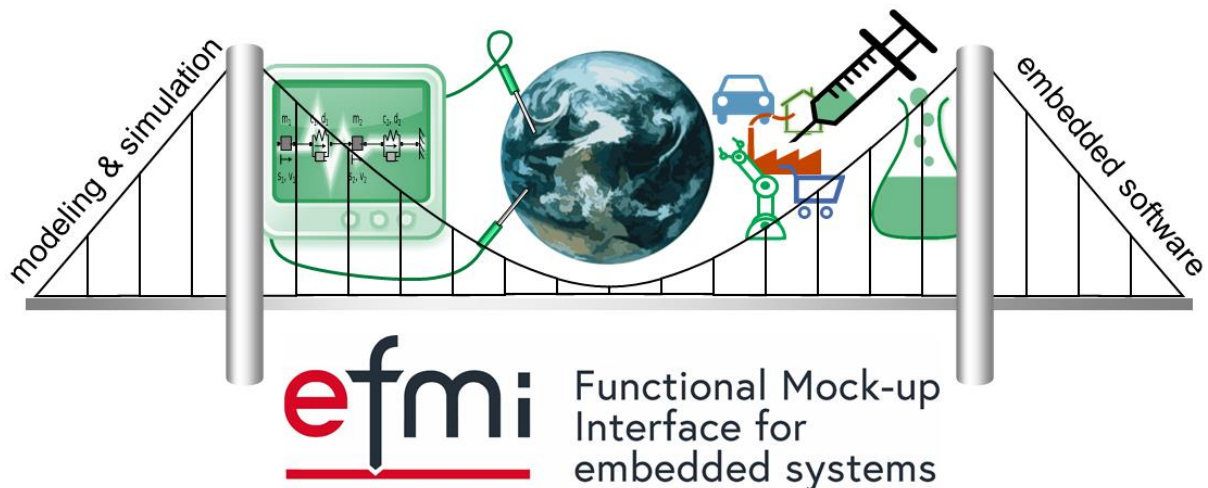
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# Modelica Association Project Functional Mock-up Interface for embedded systems (MAP eFMI)

## Annual Report

*Fiscal Year 2022*



### Preamble

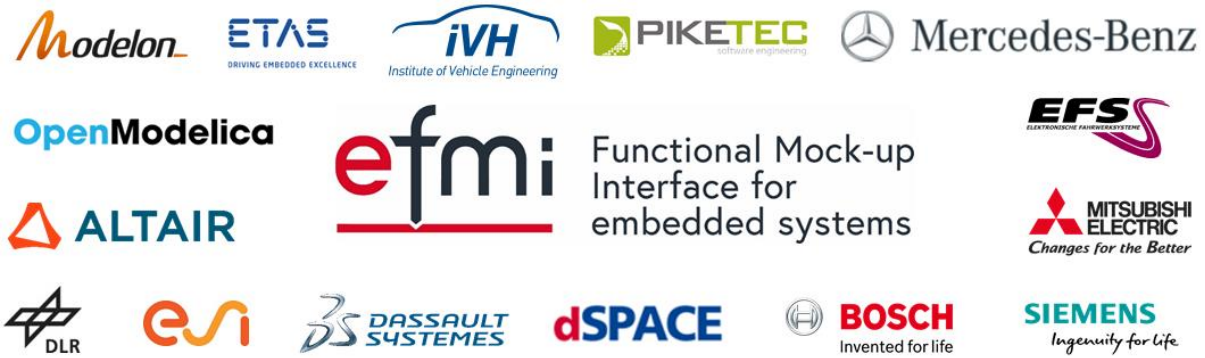
The main purpose of the “Modelica Association Project Functional Mock-up Interface for embedded systems” (MAP eFMI) is the development, standardization and promotion of the *eFMI Standard*. The *eFMI Standard* is an open standard for step-wise development and validation of advanced control functions 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 April 2022 and May 2023.

### 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, Mercedes-Benz Group AG, Modelon AB, Robert Bosch GmbH
Advisory Board	Altair Engineering Inc., Elektronische Fahrwerksysteme GmbH, ETAS GmbH, Institute of Vehicle Engineering CO LTD, Mitsubishi Electric Research Laboratories, Open Source Modelica Consortium, PikeTec GmbH, Siemens Digital Industries Software



Two new members joined:

- Altair Engineering Inc. (<https://www.altair.com/>)
- Institute of Vehicle Engineering CO LTD (<http://www.ivh.co.kr/>)

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

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

38 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 the project bylaws. All public repositories are protected by CLA assistant.

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

<a href="mailto:efmi-info@googlegroups.com">efmi-info@googlegroups.com</a>	Public e-mail list.
<a href="mailto:efmi-standard@googlegroups.com">efmi-standard@googlegroups.com</a>	Private e-mail list for members of the MAP.
<a href="https://efmi-standard.org/">https://efmi-standard.org/</a>	Public website with introduction, officially released tools listing, standard releases (Alpha 4 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.
<a href="https://github.com/EMPHYSIS/EMPHYSIS.github.io">https://github.com/EMPHYSIS/EMPHYSIS.github.io</a>	Deprecated old public website of the EMPHYSIS project, now summarizing EMPHYSIS specific results only and otherwise pointing to the new MAP eFMI website.
<a href="https://github.com/EMPHYSIS/efmi-specification">https://github.com/EMPHYSIS/efmi-specification</a>	Private GitHub repository with specification sources.
<a href="https://github.com/modelica/efmi-organization">https://github.com/modelica/efmi-organization</a>	Private repository with MAP eFMI organization-internal resources, e.g., organization documentation, meeting minutes and sources of bylaws and promotion material.
<a href="https://github.com/modelica/efmi-testcases">https://github.com/modelica/efmi-testcases</a>	Public GitHub repository with official eFMI test cases for demonstrating and evaluating eFMI tooling (used by eFMI crosschecks).
<a href="https://github.com/modelica/efmi-containermanager">https://github.com/modelica/efmi-containermanager</a>	Public repository of the <i>eFMI Container Manager</i> , a tool for creating, checking, reading and modifying eFMUs and their individual containers.
<a href="https://github.com/modelica/efmi-compliancechecker">https://github.com/modelica/efmi-compliancechecker</a>	Public repository of the <i>eFMI Compliance Checker</i> , a tool for analyzing eFMUs for violations against the eFMI Standard.
<a href="https://github.com/EMPHYSIS/efmi-crosschecks">https://github.com/EMPHYSIS/efmi-crosschecks</a>	Private, NDA protected repository with crosscheck eFMUs generated from the official test cases.

## Meetings

11 Steering Committee meetings since April 2022.

Regular Steering Committee meetings every first Tuesday each month at 15:00 CET.

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

Many application and organization meetings for upcoming ITEA research project OpenSCALING (labeled green by ITEA; supposed to start in 2024).

Several meetings with third-party research project KI-EMBEDDED.

## Main activities in April 2022 – May 2023

- New public mailing list [efmi-info@googlegroups.com](mailto:efmi-info@googlegroups.com).
- Public release of new website <https://efmi-standard.org/>.
- A lot of promotion and online available promotion material (see *Resources* subpage of new website, <https://efmi-standard.org/resources/>):
  - ITEA Magazine Issue 41 (March 2022) article (<https://itea4.org/magazine/41/march-2022/by-and-for-end-users.html>).
  - Elektronik magazine, special issue for “Embedded World 2022” fair (<https://www.elektroniknet.de/embedded/software/modelltransformation-und-automatische-codegenerierung.196801.html>).
- *Rigorous* crosschecks with 7 industrial leading and already in their field well-established tools now supporting eFMUs.
- Official releases of first commercial tools, extensively tested in the MAP eFMI crosschecks repository, and providing offers for a complete eFMI toolchain:
  - Dassault Systèmes: Dymola 2022x, 2023, 2023x, 2023x Refresh 1
  - dSPACE GmbH: TargetLink 22.1
  - PikeTec GmbH: TPT 19.
  - Dassault Systèmes: CATIA ESP on 3DEXPERIENCE® 2023
  - Dassault Systèmes: AUTOSAR Builder 23x
- *eFMI Container Manager 1.0.1* release.
- *eFMI crosscheck test cases 1.0.1* release.

## Planned activities for 2023

- Beta and final release of eFMI Standard 1.0.0.
- eFMI tutorial at the upcoming 15<sup>th</sup> International Modelica Conference (October 2023).
- Promotion of eFMI technology to tool vendors and users.
- Promotion of first official commercial tool releases; support for industrial users.
- Support for upcoming ITEA OpenSCALING research project.
- Support and collaboration with KI-EMBEDDED research project.

## Budget 2022

- 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.
- 0 EUR: eFMI website based on new MA website-template.

## Budget proposal 2023+

- 7000 EUR: Discretionary Fund.
- 459 EUR: XML Spy Professional license.
- 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.

Date: 2023-05-10

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