



FMI Processes

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FMI Cross Check Platform

History

- Modelisar started in April 2008
- FMI 1.0 released January 2010
- First tools on the market Q2 2010 → fast pace: then consolidate

Idea

- Provide a repository of FMUs generated by different tools and versions
- Encourage tool vendors to use these FMUs for testing
- Publish test results on website

FMI Cross Check Rules

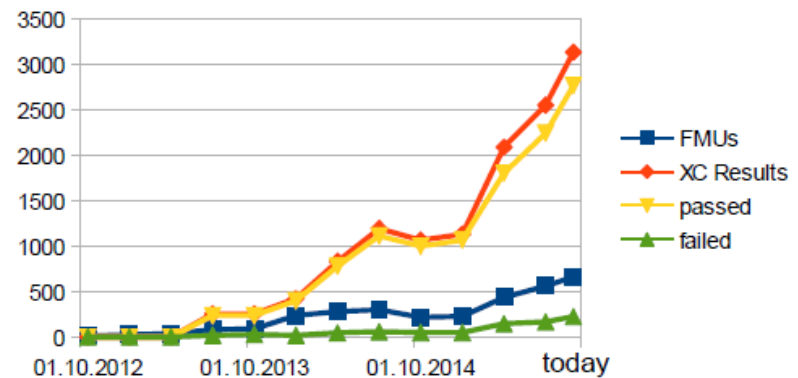
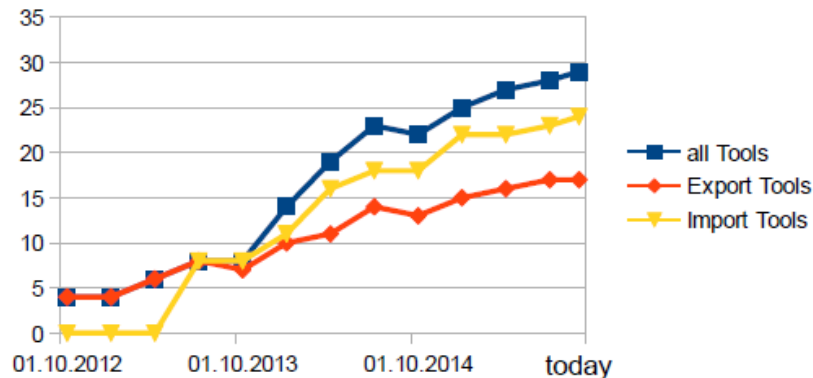
- First version in 2012
- Version 3.1 was approved by Steering Committee in August 2015

FMI Cross Check Platform

Now

- Multi-vendor driven quality assurance initiative
- Improve compatibility of tools and find standard improvements
- > 660 FMUs from 17 released (!) exporters
- > 3100 test results from 24 released (!) importers
- There is also a sandbox for testing development versions

Statistics



FMI Cross Check Platform

Public web-front end to query results

■ <https://www.fmi-standard.org/tools>

Start	Downloads	Tools	Related	Development	Literature	History	FAQ	Contact
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CrossCheck Results for:

Version: **FMI_2.0**

Variant: **% CoSimulation**

Platform: **win32**

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Legend FMI Support:

🟢 → 3 FMUs Imported successfully 🟡 → 1 FMU rejected 🔴 → 2 FMUs failed test

FMI_2.0 CoSimulation win32	Slaves ➡	ControlBuild	DS - FMU Export from Simulink	Dymola	FMI Toolbox for MATLAB/Simulink	FMUSDK	JModelica.org	MapleSim	Silver
⬇Masters		2015_FD01	2.1	2.1.1	2015FD01 2016	2.1	2.0.3 1.15	2015.1	7.01 3.2
Amesim	14	<div><div>1</div><div>1</div><div>1</div></div> <div>2015-03-27</div>		<div><div>6</div><div>0</div><div>0</div></div> <div>2015-03-27</div>		<div><div>4</div><div>0</div><div>0</div></div> <div>2015-03-27</div>		<div><div>3</div><div>0</div><div>0</div></div> <div>2015-03-27</div>	<div><div>3</div><div>0</div><div>0</div></div> <div>2015-03-27</div>
ControlBuild	2015_FD01	<div><div>3</div><div>0</div><div>0</div></div> <div>2015-03-17</div>							
dSPACE VEOS	Release_2015-A			<div><div>5</div><div>0</div><div>0</div></div> <div>2015-08-14</div>	<div><div>4</div><div>0</div><div>0</div></div> <div>2015-08-14</div>			<div><div>3</div><div>0</div><div>0</div></div> <div>2015-08-14</div>	
Dymola	2015FD01	<div><div>2</div><div>0</div><div>1</div></div> <div>2015-03-06</div>	<div><div>3</div><div>0</div><div>0</div></div> <div>2015-06-10</div>	<div><div>4</div><div>0</div><div>0</div></div> <div>2015-06-24</div>	<div><div>6</div><div>0</div><div>0</div></div> <div>2015-03-06</div>	<div><div>4</div><div>0</div><div>0</div></div> <div>2015-03-19</div>	<div><div>3</div><div>0</div><div>0</div></div> <div>2015-06-10</div>	<div><div>3</div><div>0</div><div>0</div></div> <div>2015-03-06</div>	<div><div>3</div><div>0</div><div>0</div></div> <div>2015-03-11</div>
	2016	<div><div>2</div><div>0</div><div>1</div></div> <div>2015-06-27</div>	<div><div>3</div><div>0</div><div>0</div></div> <div>2015-06-27</div>	<div><div>4</div><div>0</div><div>0</div></div> <div>2015-06-27</div>	<div><div>6</div><div>0</div><div>0</div></div> <div>2015-06-27</div>	<div><div>6</div><div>0</div><div>0</div></div> <div>2015-06-27</div>	<div><div>4</div><div>0</div><div>0</div></div> <div>2015-06-27</div>	<div><div>4</div><div>0</div><div>0</div></div> <div>2015-06-27</div>	<div><div>3</div><div>0</div><div>0</div></div> <div>2015-06-27</div>
FMI Blockset for Simulink	2014.1			<div><div>5</div><div>0</div><div>0</div></div> <div>2015-05-05</div>		<div><div>2</div><div>0</div><div>3</div></div> <div>2015-05-05</div>			<div><div>3</div><div>0</div><div>0</div></div> <div>2015-05-05</div>
FMI Toolbox for MATLAB/Simulink	2.0-Simulink			<div><div>6</div><div>0</div><div>0</div></div> <div>2015-04-01</div>		<div><div>4</div><div>0</div><div>0</div></div> <div>2015-04-01</div>		<div><div>3</div><div>0</div><div>0</div></div> <div>2015-04-01</div>	<div><div>3</div><div>0</div><div>0</div></div> <div>2015-04-01</div>
	2.1-Simulink				<div><div>5</div><div>0</div><div>0</div></div> <div>2015-07-17</div>				
JModelica.org	1.15	<div><div>4</div><div>0</div><div>0</div></div> <div>2015-07-08</div>	<div><div>2</div><div>0</div><div>0</div></div> <div>2015-07-08</div>	<div><div>6</div><div>0</div><div>0</div></div> <div>2015-07-08</div>		<div><div>4</div><div>0</div><div>0</div></div> <div>2015-07-08</div>	<div><div>4</div><div>0</div><div>0</div></div> <div>2015-07-08</div>	<div><div>3</div><div>0</div><div>0</div></div> <div>2015-07-08</div>	<div><div>3</div><div>0</div><div>0</div></div> <div>2015-07-08</div>
PyFMI	2.2	<div><div>4</div><div>0</div><div>0</div></div> <div>2015-07-08</div>	<div><div>3</div><div>0</div><div>0</div></div> <div>2015-07-08</div>	<div><div>3</div><div>0</div><div>1</div></div> <div>2015-07-08</div>	<div><div>6</div><div>0</div><div>0</div></div> <div>2015-07-08</div>	<div><div>4</div><div>0</div><div>0</div></div> <div>2015-07-08</div>	<div><div>4</div><div>0</div><div>0</div></div> <div>2015-07-08</div>	<div><div>3</div><div>0</div><div>0</div></div> <div>2015-07-08</div>	<div><div>2</div><div>0</div><div>0</div></div> <div>2015-07-08</div>
Silver	3.2	<div><div>2</div><div>0</div><div>1</div></div> <div>2015-03-05</div>		<div><div>6</div><div>0</div><div>0</div></div> <div>2015-03-12</div>		<div><div>4</div><div>0</div><div>0</div></div> <div>2015-03-18</div>		<div><div>3</div><div>0</div><div>0</div></div> <div>2015-03-18</div>	<div><div>3</div><div>0</div><div>0</div></div> <div>2015-03-05</div>

FMI Support in Tools

Compatibility Table

Generated on 2015-09-02 08:10 UTC

The following modeling and simulation environments support or plan to support FMI (alphabetical list):

Tools supporting FMI	FMI Version	Export	Import	Slave	Master	Notes
Adams	FMI_2.0	Planned	Planned	Available	Available	High end multibody dynamics simulation software from MSC Software
	FMI_1.0			Available	Available	
Amesim	FMI_2.0	Planned		Available	Available	Integrated simulation platform for the analysis of multi-domain mechatronics systems by Siemens PLM Software
	FMI_1.0	Available 10	Available 12	Available 20	Available 23	
ANSYS SCADE Display	FMI_1.0	Available		Available		SCADE Display facilitates embedded graphics, display and HMI development and certified code generation for safety-critical displays from ANSYS.
ANSYS SCADE Suite	FMI_1.0	Available		Available		SCADE Suite is a model-based development environment with certified code generation for safety critical embedded applications from ANSYS.
ANSYS Simplorer	FMI_1.0		Available 13		Planned	ANSYS Simplorer is a multi-domain, multi-technology simulation program from ANSYS.
ASim - AUTOSAR Simulation	FMI_1.0	Available		Available		AUTOSAR product from Dassault Systemes
@Source	FMI_1.0	Available				Simulink via @Source
AVL CRUISE	FMI_1.0	Planned	Available 11	Available	Available 15	Vehicle system analysis tool for the optimization of fuel efficiency, emission, performance and drivability, from office to HIL to testbed
Building Controls Virtual	FMI_1.0				Available	BCV/TB is a Software environment, based on Ptolemy II, for
Silver	FMI_2.0	Available 14	Available 16	Available 17	Available 22	Generation of virtual ECUs and virtual integration platform for Software in the Loop from QTronic.
	FMI_1.0	Available 6	Available 13	Available 6	Available 13	
SIMPACK	FMI_1.0	Planned	win32 13	win64 13	Available 11	High end multi-body simulation software from SIMPACK AG
SimulationX	FMI_2.0	Planned			Planned	Multi-domain simulation tool for design, analysis and virtual prototyping of complex systems by IIT.
	FMI_1.0	Available 10	Available 12	Available 10	Available 12	
SystemModeler	FMI_1.0	Available	Available	Planned	Planned	Modelica environment from Wolfram Research.
TLK FMI Suite	FMI_1.0		Available		Available	TLK FMI Suite provides LabVIEW and Simulink blocks for FMU simulation
TLK TISC Suite	FMI_1.0		Available		Available	Co-simulation environment from TLK-Thermo
TWT Co-Simulation Framework	FMI_1.0			Available	Available	Communication layer tool to flexibly plug together models for performing a co-simulation; front-end for set-up, monitoring and post-processing included
TWT FMU Trust Centre	FMI_1.0			Available		Cryptographic protection and signature of models including their safe FMU storage; secure authentication and authorization for protected (co-)simulation
VALDYN	FMI_2.0			Planned		Multi-body dynamic and kinematic simulation for valvetrain, powertrain and transmission systems from Ricardo Software.
	FMI_1.0			Available		
WAVE-RT	FMI_2.0			Planned		Real-time, crank-angle resolved engine simulation tool for testing new engine management systems in SIL, HIL, and rapid-prototyping from Ricardo Software.
	FMI_1.0			Available		
XFlow	FMI_1.0			Available		Computational Fluid Dynamics (CFD) code which uses a particle-based kinetic solver based on the Lattice-Boltzmann Method, thus avoids the meshing process and allows complex fluid-structure interaction including through FMI standard co-simulation.
xMOD	FMI_2.0		Available		Available	Heterogeneous model integration environment & virtual instrumentation and experimentation laboratory from IPFEN distributed by D2T.
	FMI_1.0		Available 15		Available 15	

🔍 number of tools and broken down by the FMI variants and directions.	FMI_1.0	22 (11)	12 (12)	32 (11)	41 (11)	We add green and orange available to compute these numbers (number proven with CrossCheck in parentheses).
	FMI_2.0	4 (0)	1 (0)	11 (0)	17 (1)	

FMI Compliance Checker

Idea and Implementation

- Have an FMU importing tool checking standard compliance of FMUs
- FMI MAP specified and the Modelica Association paid for the implementation of the FMI Compliance Checker

FMI Compliance Checker

- Version 1.0 was submitted to the Modelica Association in July 2012
- Current version: 2.0.2 supporting FMI 1.0 and FMI 2.0 for both Model Exchange and CoSimulation
- Tightly incorporated into **FMI Cross Checks**
- Ongoing maintenance is planned to fix issues and extend checks
- Issues & feature requests: <https://trac.fmi-standard.org/>

FMI Development Process

Motivation

- FMI 1.0 and even FMI 2.0 development was a small group effort
- Future versions need more predictability for release dates
- And invite larger number of participants

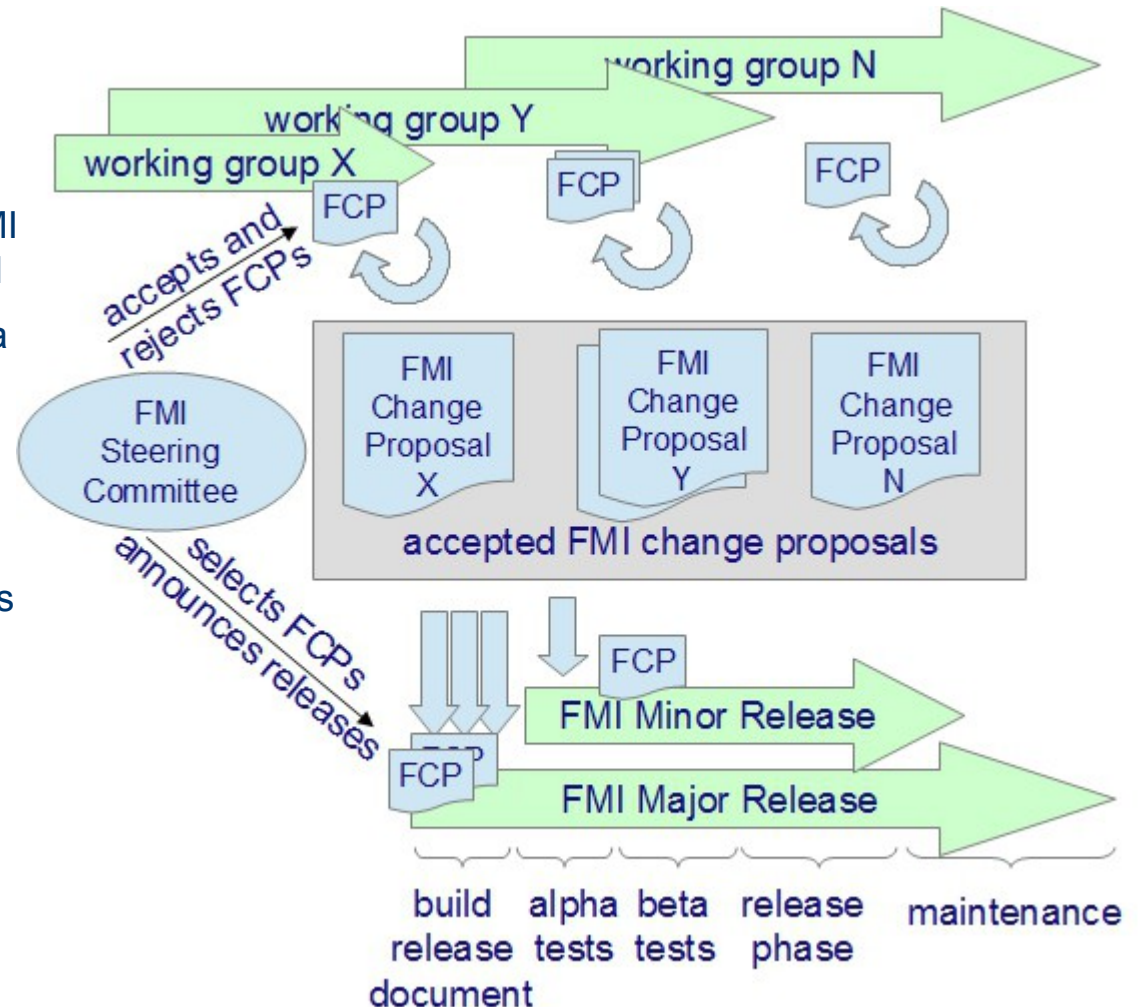
Status

- FMI Steering Committee approved version 1.0 July 2015
- The FMI Development Process now governs future FMI releases
- Documents can be downloaded here: <https://fmi-standard.org/development>

FMI Development Process

Key features

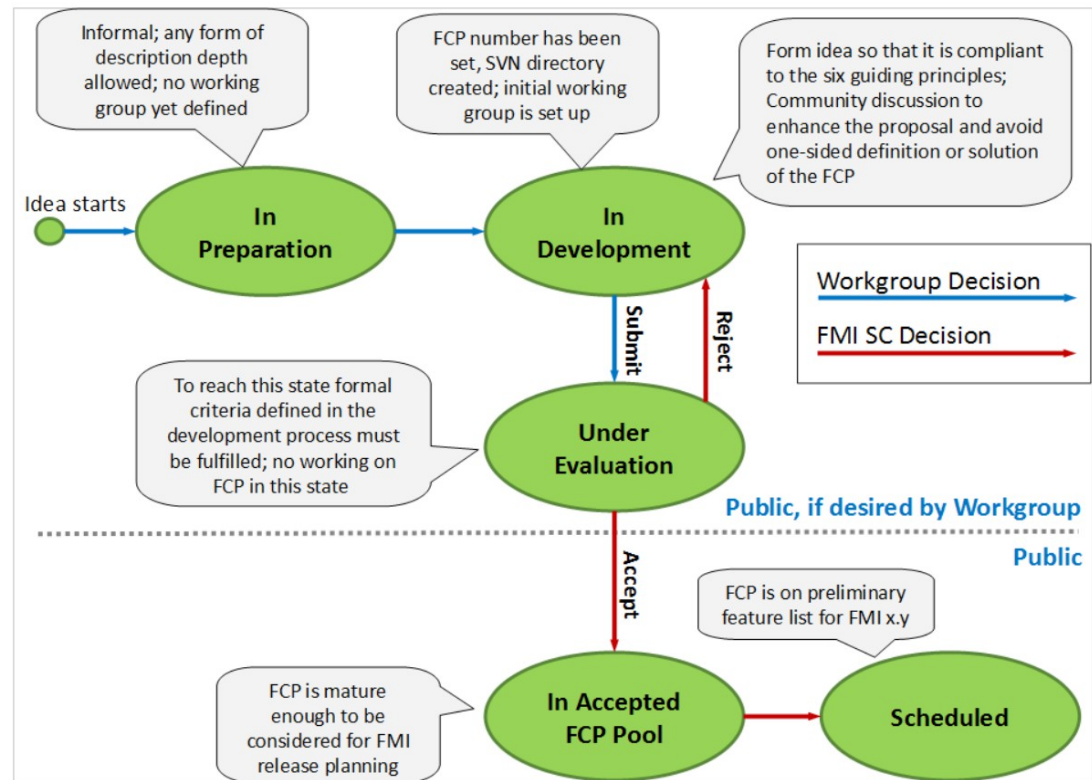
- Separation of:
 - creation and acceptance of FMI Change Proposals (FCPs) and
 - decision to include FCPs into a specific FMI Release
- Open working groups will create FCPs that need acceptance by FMI Steering Committee
- Storage of accepted FCPs shields the FMI release work from the uncertainty of creating new features
- An FMI Release “only” consolidates those FCPs in a consistent release document



FMI Development Process

FMI Change Proposals

- FCPs run through a multi-step process from idea to in-standard
- FCPs are created by a working group
- FCPs need to be accepted by the FMI Steering Committee and are stored in FCP Pool
- Even FCPs in pool might wait years for inclusion into an FMI Release



State machine describing FCP statuses and transitions

Summary

- Several quality improvement initiatives to improve both
 - Quality of the standard:
 - Add clarifications
 - Remove inconsistencies
 - Fix bugs
 - Quality of implementations
 - User experience: “Plug and Play”
- Many Todos, e.g. Reference FMUs
- Please get involved:
 - Add your FMUs to the FMI Cross Check platform
 - Add your Cross Check results as well
 - Add bugs reports and feature requests in the FMI trac
 - Add yourself to info mailing list
 - Participate in working groups
 - Ask your vendor to participate