Modelica Association
News Update & System Structure and Parameterization

INCOSE IW 2020 SMS WG-meeting

modelica
Association

Modelica Association Standards News

- System Structure and Parameterization, SSP 1.0: released March 2019
- DCP, Distributed Co-simulation Protocol, DCP 1.0: release March 2019
- FMI 3.0: approaching beta-status, first public release in 2020
- eFMI: currently under development in EU-project Emphysis
    - FMI for inclusion of advanced models into embedded control systems.

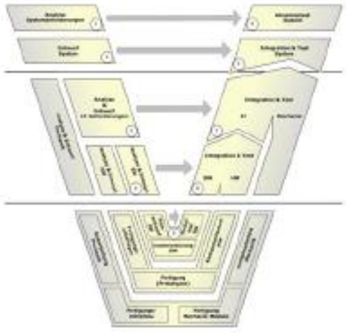
dcp Distributed Co-Simulation Protocol

fmi Functional Mock-Up Interface

ssp System Structure & Parameterization

Main Purposes of SSP –Based on FMI standard

- Define a standardized format for the connection structure of a network of components (FMUs in particular).
- Define a standardized way to store and apply parameters to these components.
- The developed standard / APIs should be usable in all stages of development process (architecture definition, integration, simulation, test in MiL, SiL, HiL).
- The work in this project shall be coordinated with other standards and organizations (FMI, ASAM, OMG).



ssp

System Structure
& Parameterization

List of features

- Hierarchical description of systems of connected components
- Components: FMUs and external SSPs/SSDs, extensible to models, …
- Parameter bindings both at component and system-level, including transformations and name/unit-mapping
- Signal dictionaries support cross-hierarchical data pools (e.g for busses)
- Packaging of SSDs, FMUs, Parameters, … into one bundle (SSP)
- Light-weight support for variant handling at SSP level (multiple SSDs sharing components, parameters, resources)
- Optional exchange of graphical information (similar display across tools)
- URI references to all resources: Integration with other systems via URIs

Modelica Association Standards: FMI

- The **Functional Mock-Up Interface (FMI)** standard is a *low-level* application programming interface (API) to support both model exchange and co-simulation of cyber-physical system models having inputs and outputs, using a combination of xml-files and compiled C-code packed in a zip-file. For example, the FMI-for-Co-Simulation has C-function calls to initialize a dynamic system, perform one simulation step to the next communication point, and inquire values .
  The **FMI compliance checker** is an open source tool, which can be used to check whether a model fulfils the requirements of the FMI standard.

Modelica Association Standards: SSP

- The **System Structure and Parameterization (SSP)** standard describes in a logical way how FMI-based or other kinds of model components are connected and how model parameterization data is stored and exchanged between them. Components can be present on different computers. SSP just defines how the components are connected and possibly (hierarchically) composed into composite components, independently of where they are located.
  SSP does not define how data is exchanged between components, and no communication protocol is defined.

Modelica Association Standards: DCP

- The **Distributed Co-Simulation Protocol (DCP)** standard is an application level communication protocol. It is designed to integrate models or real-time systems into simulation environments and also with real test hardware. It enables exchange of simulation related configuration information and data by use of an underlying communication system (such as UDP, TCP, or CAN). At the same time the DCP supports the integration of tools and real-time systems from different vendors. The DCP is intended to make simulation-based workflows more efficient, and to reduce the integration effort. The DCP is compatible to the FMI by design.

The Modelica language

- The **Modelica Language** standard defines an object-oriented equation-based language to describe cyber-physical systems on a *high level* with physical or signal connectors . Modelica models can be provided by different parties from different tools and can be connected and simulated/analyzed together. Modelica tools typically support export and import of Modelica models in FMI pre-compiled format or Modelica source format .
  The **Modelica Standard Library** is an open source Modelica library of about 1600 component models in various domains (electrical, magnetic, mechanics, fluid, thermal, control). Many more open source and commercial libraries are available as well.