Rationale of the project ...

Requirements (Word, DOORS, ...)

Simulation Model Interface is addressed by FMI

System modeling
Co-simulation configuration (ICOS, SystemDesk, XML, ...)

Software-in-the-loop (SiL)
Software validation

Model-in-the-loop (MiL)
System simulation

Hardware-in-the-loop (HiL)
Hardware validation

Problem:
Efficient integration of RT-Systems?

- Standardized
- Methodology
- Distributed
Differentiation to FMI and added value:

- **Distributed Co-Simulation** by integrating tools
- **Interactive Co-Simulation** without model export
- **Integration** of (multiple) **testbeds and simulations**
ACI Specification as Innovation

ACI integrates real-time systems and simulation environments

ACI ... Advanced Co-Simulation Interface

ACU ... Advanced Co-Simulation Unit
ACI Architecture

Model or Function
Subject to integration with other models or RT systems

ACI protocol or ACI logic: Defines the sequence and contents of ACI messages to be exchanged between ACUs in order to carry out specified ACI functions. May be monolithic within model or RT system.

ACI driver: Standardize mapping from ACI protocol to transport protocol. Contains no execution logic.

Media driver: Proprietary or self-written libraries, executables, scripts, etc., directly controls the communication media.

Key
* Subject to standardization
~ Specification but no standardization
State Machine – supporting FMI 1.0 & 2.0

Source: FMI 2.0 Specification
The Status Quo ...

**Data Exchange**

- ACU Master distributes single configurations.
- ACU constructs PDU to ACUs according to collected information from master.

**Communication Protocol**

- **PDU as specified:**
  - Structure or Protocol data unit:
    - Header
    - Payload
- **Initialization:**
  - Initialize ACU
- **Serialization – concept:**
  - Bit sequence order e.g. MSB
  - Example:
    - Bit sequence: 0 1 2 3 4 5
      - Byte sequence: 0 1 2 3 4 5

**ACI Specification**

- **ACI SPECIFICATION**
  - **DOCUMENT TYPE:** DEPLOYABLE
  - **DEPLOYABLE:** OAK1
  - **OBSERVATION:** COMPLETED
  - **DATE:** 06/05/2013
  - **VERSION:** DEVELOPER REVIEW

**First Demonstrators**

- **Model or function** Subject to integration with other models or HIL systems
- **Key**
  - Subject to standardization
  - Specification but no standardization

- **ACI control API** Convenience layer API, reference implementation will be available, not subject to standardization
- **ACI communication API** exchange of n*n ACI messages
- **ACI protocol** (logic)
  - Data exchange
  - Information exchange
  - Control exchange

- **ACI protocol or ACI logic** Defines the sequence and contents of ACI messages to be exchanged between ACUs in order to carry out specified ACI functions. May be resolved within model or HIL system.

- **ACI Driver** Standardize mapping from ACI protocol to transport protocol. Contains no execution logic.

- **Media Driver** Proprietary or self-written libraries, executable, scripts, etc., directly controls the communication media.
... a follow-up initiative called ACOSAR

 ITEA3 Project ACOSAR
 - Advanced Co-simulation Open System ARchitecture
 - Setting a global standard for integration of RT systems

 Motivation
 - Fast integration of RT Systems
 - Tool neutral standard for distributed co-simulation

 9 Automotive Use-Cases
 - Test system integration
 - Distributed development
You are welcome to join the ACOSAR initiative!
Open Questions?
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