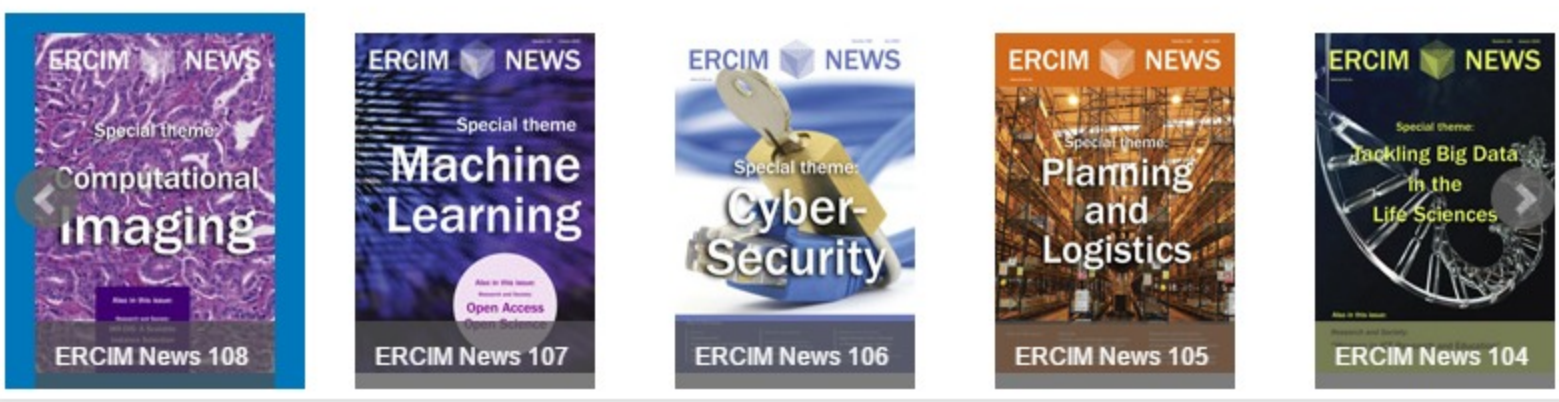

Development Tool Interoperability Specifications and Standardization

Research And Innovation Hits: 201

by Erwin Schoitsch (AIT), Jürgen Niehaus (SafeTRANS)

Standardisation plays an important role in large industry-driven European research projects that aim to put research results into practice, and are run by EC PPP (Public-Private Partnership) organisations such as ECSEL JU (Electronic Components and Systems for European Leadership, Joint Undertaking) and its predecessor ARTEMIS. In recent years, several projects in the area of safety critical embedded systems have addressed interoperability specifications (IOS) for development tools to reduce costs and errors in critical CPS development and to allow easier integration of tools of different suppliers. CP-SETIS, a Horizon 2020 project, will harmonise these efforts and create a sustainable structure to further develop and maintain the landscape of standards, specifications and guidelines which comprise the IOS.

Cyber-physical systems are everywhere, and the comfort, health, services, safety and security of individuals are becoming increasingly dependent on them. A huge variety of engineering tools are required to address a range of demanding challenges during the development of these systems. To facilitate development and satisfy requirements for fully-fledged traceability throughout the development lifecycle of safety-critical CPS these tools need to be smoothly integrated into engineering environments, allowing fast and efficient development of CPS and smooth cooperation of stakeholders. Organisations that develop CPS are stuck between two extremes: Either to develop their own hard-to-maintain in-house engineering environments, or to be locked-in with proprietary solutions. Therefore past and ongoing ARTEMIS/ECSEL R&D projects, including iFEST, CESAR, MBAT, nSafeCer, HOLIDES, ARROWHEAD, EMC² and CRYSTAL, have proposed open standards for data and tool interoperability, the IOS (Interoperability Specification). Major functional safety standards like IEC 61508 or ISO 26262 have provided some requirements and guidance for tools, but have not tackled the issue of tool chains and tool interoperability.
CP-SETIS is a 24-month Horizon2020 Innovation and Support Action which aims to leverage on these initiatives by proposing and implementing sustainable cooperation and governance structures to:

- facilitate long-term cooperation between all stakeholders – CPS development organisations, end users, tool vendors, research organisations, standardisation bodies, R&D projects, etc.,
- support extensions, advancements and formal standardisation of the IOS in a sustainable manner beyond the duration of research projects.

Interoperability Specification – IOS
The Interoperability Specification covers many aspects and all phases of the development process. It is not feasible to put all these concerns within a single standard. On the other hand, there already exist a number of standards that cover interoperability and/or data exchange aspects between engineering tools. It would be unwise not to take advantage of them. The IOS therefore consists of different parts, each of which:

- deals with a specific aspect of CPS development ('engineering concern'), for example lifecycle data integration and data exchange or heterogeneous co-simulation, and
- is based upon existing standards and possible extensions of them.

For lifecycle data integration and data exchange, the underlying existing standard is OSLC (Open Services for Lifecycle Collaboration, see http://open-services.net/), for heterogeneous co-simulation FMI (Functional Mock-Up Interface, http://www.fmi-standard.org) is under consideration. It is noteworthy that IOS includes only those parts of existing standards relevant for the respective engineering concern, but also additional specifications, either as extensions of existing standards or as an independent specification to cover a particular engineering concern. The IOS also includes 'bridges', which describe the relationships between the different engineering concerns and the corresponding interoperability specifications/standards.

IOS Coordination Forum – ICF
CP-SETIS develops a model for a sustainable organisational structure called ICF, as a cooperation platform for IOS stakeholders. Specifically, ICF will:

- collect and make available the current baseline of the IOS, together with information about the concrete technical specifications, maturity level, status of formal standardisation, current versions, and update this information according to results from projects, standardisation activities etc.,
- give organisational support to stakeholders to coordinate their activities to further develop the IOS – e.g., by incubating new R&D projects,
- give organisational support to synchronise activities for formal standardisation of parts of the IOS,
- support the building of an IOS community (contacts to experts, organising workshops, coordinating meetings, etc.).

ICF will also allow stakeholders to

- find allies and cooperation partners, e.g., to extend and shape those parts of the IOS that are relevant to a particular group, including pushing of formal standardisation,
- be able to guarantee sustainability and accessibility for their IOS related project results,
- use ICF as an independent, neutral forum,
- gather IOS related information.

ICF implementation
ICF should be a lightweight structure. In particular, it was clear from the beginning, that ICF would not be a new legal body, but rather a structure within an existing organisation. CP-SETIS contacted various existing organisations to evaluate and find a potential host for ICF:

- ARTEMIS-IA (ARTEMIS Industrial Association, a private partner of the ECSEL JU),
- OASIS (Advancing Open Standards for the Information Society, an international non-profit oriented consortium)
- ETSI (European Telecommunications Standards Institute).

AIT, like other partners, is member of all of these organisations. A selection process was performed based on clear criteria. Details and procedures have now to be confirmed before finalisation of the selection process.

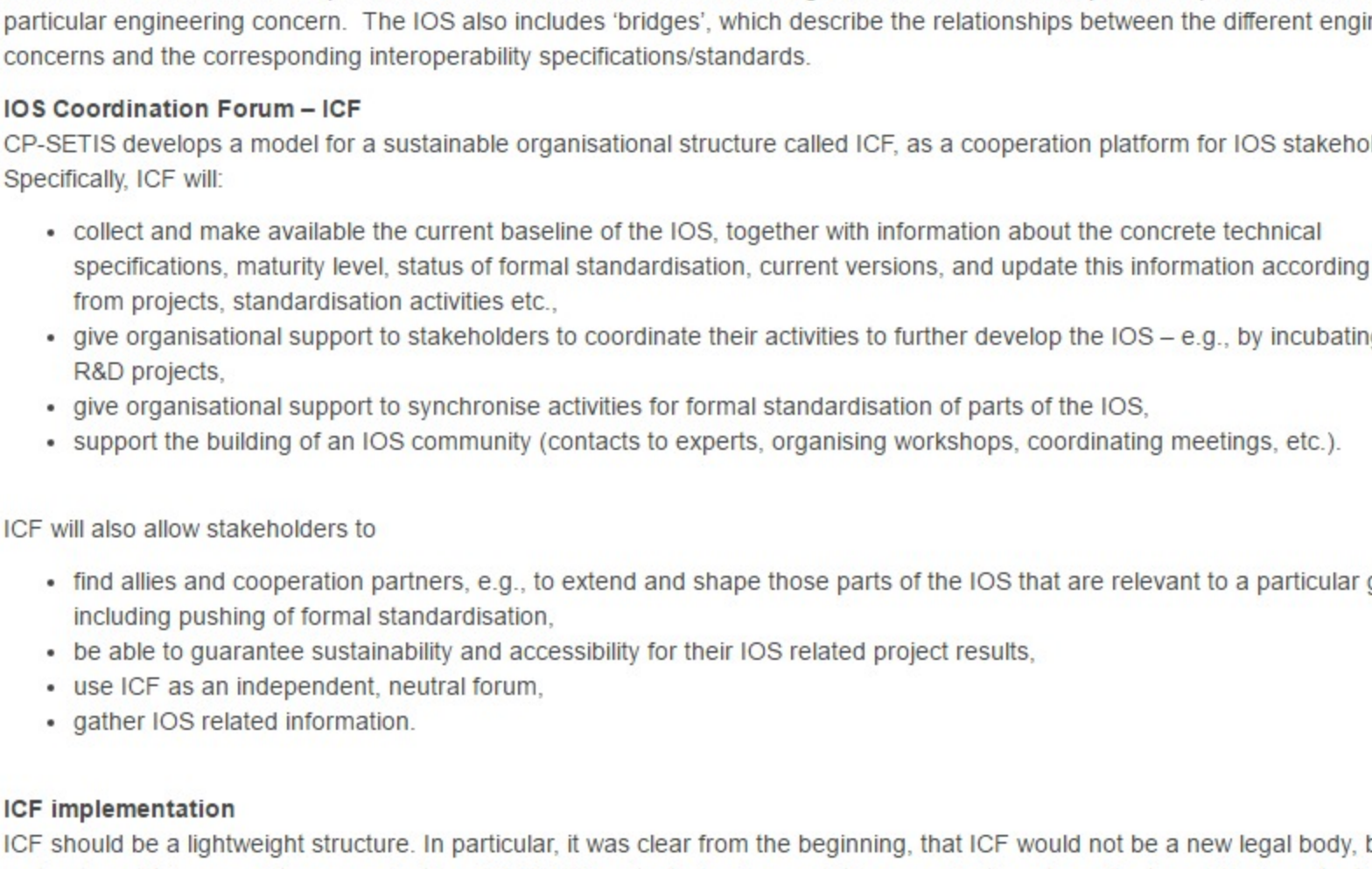

Figure 1: Model of the IOS Interoperability Specifications' Landscape (positioning of the IOS parts within this landscape is an example only, and does not necessarily reflect the current maturity of these parts)

The CP-SETIS/ARTEMIS Strategic Agenda for Standardization
The ARTEMIS-IA Standardisation Working Group has published two Strategic Agendas in the past, supported by the FP7 European research project ProSE ('Promoting Standardisation for Embedded Systems') under contract nr. 224213 (see ERCIM News Oct. 2008, p. 44-45). CP-SETIS is substantially updating this Strategic Agenda, in particular, the way in which standardisation activities for a multi-standard like IOS can effectively be supported. Furthermore, recent developments and evolving new paradigms (e.g., cloud computing, agile software paradigms, contract-based development, run-time qualification/certification, open adaptive systems, IoT, multi-concern assurance) will be considered as standardisation issues.

At the HiPEAC 2017 Conference in Stockholm, a CP-SETIS Workshop will be organised on 23 January. We will discuss IOS achievements, the new Strategic Standardisation Agenda, and collect additional input from participants (https://www.hipeac.net/2017/stockholm/schedule/#wshop).

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Links:
http://www.cp-setis.eu
https://www.hipeac.net/2017/stockholm/

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