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CRitical S**YST**em Engineering **A**cce**L**eration

Report on Standardisation Work - V1

D601.031

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CHANGE HISTORY

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CONTENT

1 Introduction

1.1 Role of deliverable

In order to make the CRYSTAL interoperability specification a sustainable result, it is important to gather experience and to start communication with existing bodies regarding interoperability standardization (or de-facto standardization). This deliverable documents and reports on activities and achievements with regard to the standardization of the Interoperability Specification. Furthermore the alignments with other projects are documented and evaluated.

1.2 Relationship to other CRYSTAL Documents

This document is highly related to this Interoperability Specification deliverables D601.021, D601.022 and D601.023

1.3 Structure of this document

Chapter 2 describes the overall strategy for standardization in CRYSTAL, while Chapter 3 describes the current status of the IOS with respect to standardization. Chapter 4 gives an overview over standardization-related events to which CRYSTAL contributed and Chapter 5 summarizes a proposal for an Innovation Action for supporting standardization which submitted by stakeholders of CRYSTAL and other related projects.

2 Overall Standardization Strategy

A major goal of CRYSTAL and ARTEMIS is to drive the standardization of the Interoperability Specification (IOS). Since the IOS is structured in different layers, where those layers have different maturity level, and a different usage scope (industrial or technology domain) it is reasonable to standardize the different parts of the IOS separately. This is also supported by the fact that the IOS is built on already existing and emerging standards where multiple standardization organizations are involved.

To realize this approach, the IOS group identifies which IOS parts are suitable units for standardization, and which standardization organizations fit for these parts. For the existing and emerging standards, where standardization already takes place, the project aims to have a prominent representation with the corresponding standardization organization on steering and working level. In addition, to support the project activities and increase the visibility within the standardization organization, ARTEMIS (or ECSEL) should have also a close collaboration with these organizations.

Summary of the overall standardization strategy in CRYSTAL:

- The IOS should be standardized according to its technology layers and scope
- Already started standardization activities should be supported by active participation on steering and working level
- Support by ARTEMIS/ECSEL to increase visibility in standardization organizations is highly appreciated
- Activities to standardize the IOS in different projects should be aligned whenever reasonable

3 Status of the IOS Standardization

As described in the Deliverable D601.021, the IOS is vertically organized in (a) interoperability for Lifecycle Management and (b) other interoperability topics (e.g., co-simulation). Since the version V1 of the Interoperability Specification concentrates on lifecycle management, we also focus on the corresponding standardization topics in this report.

3.1 Lifecycle Management

OSLC is a major part of the IOS specification for lifecycle management, and the standardization process of OSLC, where CRYSTAL is actively participating is already ongoing. The already available results include the following highlights:

- Multiple engineering domains and core specifications are available in revision 2.0
- Multiple tool vendors support OSLC interfaces out-of-the-box in the recent versions of their tools
- The OSLC organization has matured from a self-organized community to a Member Section (MS) with a clear, well defined governance model under the Open standard organization OASIS
- The CRYSTAL project is well connected with the OASIS-OSLC MS with representatives in the Steering Committee, contributors and observers of Working Groups.

This progress was possible due to a joined effort with other projects, organizations and tool users and providers sharing the same vision of Lifecycle Interoperability.

3.2 Other interoperability topics

The communication with other organizations managing other IOS candidates has been established. These organizations include:

- ProSTEP iViP
- ASAM
- OMG
- INCOSE

The investigation whether other standards from those organizations can be used as they are, can be combined with the Lifecycle Interoperability or require enhancement is still ongoing.

4 Participation to standardization-related events

To foster the collaboration with standardization bodies and related projects, CRYSTAL participated to several events in order to meet the relevant stake holders.

Event: ARTEMIS and Standardization Working Group Workshop

Date and location: 16th September 2013, Vienna

Role of CRYSTAL:

- Main organizer of this workshop
- Presenter

Comments: At this event CRYSTAL gave project presentation to representatives of ASAM, ProSTEP, OASIS and the ARTEMIS Standardization Working Group. A major topic of this meeting was the collaboration of recognized standardization bodies with CRYSTAL and other ARTEMIS projects

Event: ASAM International Conference:

Date and location: 4th December 2013, Dresden

Role of CRYSTAL: To raise awareness of the CRYSTAL project within the ASAM community the project was presented at the ASAM International Conference.

Comments: ASAM is an incorporated association under German law. Its members are primarily international car manufacturers, suppliers and engineering service providers from the automotive industry. The association coordinates the development of technical standards, which are developed by working groups composed of experts from its member companies. CRYSTAL will collaborate with ASAM to standardize the relevant parts of the interoperability specification.

Event: ARTEMIS and Standardization Working Group Workshop

Date and location:

- 17th January 2014, Brussels
- 5th February 2014, Brussels

Role of CRYSTAL: As the largest IOS-related project, CRYSTAL was a major contributor to the discussions

Comments: As a follow-up of the September workshop, the goal of this workshops was to refine the standardization concept of the interoperability specification, in particular to consolidate the results of other ARTEMIS IOS-related projects and to ensure their sustainability after the life-time of the project.

Event: ARTEMIS Spring Event

Date and location: 18th and 19th March, Amsterdam

Role of CRYSTAL: Participation in the ARETMIS Working Group Tool Platforms, Working Group Standardisation

Comments: CRYSTAL members where key participants of the ARTEMIS Working Group Tool Platforms, Working Group Standardisation. The major objective was to develop a plan and a process to enable the collaboration of IOS-related projects and to ensure the sustainability of a consolidated IOS also after the life time of the individual projects. These efforts resulted finally in a proposal for an Innovation Action in the H2020-ICT-2014-1 call.

Event: ProSTEP iViP

Date and location: 13th-14th May 2014, Berlin

Role of CRYSTAL:

- Booth presentation
- Workshop organizer

Comments: ProSTEP iViP is one of the most important standardization organizations in the field of product data management and virtual product creation. . Most of the major OEMs are members of the ProSTEP iViP association and the ProSTEP Symposium is a top-class event with excellent networking opportunities where the key decision makers meet. CRYSTAL organized a workshop at this event and was also present with a project booth on both days of the symposium.

Event: OASIS-OSLC monthly Steering Committee Meetings

Date: ongoing since foundation of the OASIS-OSLC Member Section and before at OSLC Community Steering Committee

Location: Web meetings and presence meeting at least once a year

Role of CRYSTAL: currently 3 representatives of CRYSTAL partners are appointed/elected as permanent OASIS-OSLC Steering Committee members

5 Proposal for innovation action CP-SETIS

In order to set up a sustainable organizational structure as a platform joining all stakeholders and to coordinate all IOS-related activities, especially the formal standardization and further extensions of the IOS, several CRYSTAL partners, including the coordinator, submitted together with stakeholders from other projects a proposal for an innovation action in the H2020-ICT-2014-1 call, called **CP-SETIS (Towards Cyber-Physical Systems Engineering Tools Interoperability Standards)**. The CP-SETIS proposal is coordinated by SafeTrans, and the initiative has been driven by MBAT and CRYSTAL partners. This chapter gives an overview of the proposed Innovation Action.

5.1 Background & Motivation

Besides CRYSTAL, past and on-going EU research projects have initiated a momentum around a common vision for the Establishment of Recognized International Open Standards of Lifecycle Tool & Data Integration Platforms for CPS Engineering.

Related EU research projects in the past include:

- **CESAR (59 partners)** - Cost-efficient methods and processes for safety relevant embedded systems, an Artemis project,
- **iFEST (21 partners)** - industrial Framework for Embedded Systems Tools, an Artemis project,
- **Sprint** – Simplifying the Design of Complex Engineering Systems, an FP7 ICT project

Related EU research projects which are currently running include besides CRYSTAL:

- **MBAT (39 partners)** – Combined Model-based Analysis and Testing of Embedded Systems, an Artemis project, and
- **EMC2 (98 partners)** - Embedded multi-core systems for mixed criticality applications in dynamic and changeable real-time environments, an Artemis project

However, the current situation with respect to IOS (pre-) standardization is characterized by a wide variety of activities, which are only partly coordinated:

- There is a wide variety of projects running, which build upon and extend the IOS (MBAT, EMC2, DANSE, D3COS, HOLIDES). These projects are run by different consortia and have different objectives. Many of them are already doing or at least aiming at pre-standardization activities for the IOS. Although there are some initiatives from these projects, to establish bilateral harmonization of IOS pre-standardization activities in areas of overlap, these initiatives only cover part of the IOS and only few projects.
- New projects emerge that aim at interoperability solutions for development tools, where the consortia are not always aware of the existing IOS and its applicability for their project objectives.
- First attempts of formally standardizing parts of the IOS (for Lifecycle Interoperability, OSLC based) within OASIS have been started, but cover only part of the IOS.
- The commitment of major stakeholders to IOS activities is strong at project level, but not always on an inter-project or even company-wide level.
- Different groups, organizations, clusters and networks (like for example the ARTEMIS Working Groups on Standardization and on Tool Platforms, the ARTEMIS Center of Innovation Excellence EICOSE) have a high interest in and support both, activities for Interoperability of Development Tools as well as Standardization Activities, but still more commitment is required from all key stakeholders involved in IOS Activities.

On an inter-project level, this lack of coordination leads to ungovernable structures, un-coordinated and therefore potentially diverging activities, thus jeopardizing the huge investment in and the innovation potential of the IOS by endangering the chance of establishing a major standard in Cyber-Physical Systems engineering.

5.2 Challenges, Goals and Objectives

The two main challenges to be addressed by the CP-SETIS Innovation Action can be summarized as follows:

- Challenge 1 (Organizational & Strategical): A common vision and mission, shared by all major stakeholders, for supporting lifecycle data and tool interoperability for CPS Engineering has to be established urgently and acted upon, aligning the as yet only partially coordinated European IOS-related activities and paving the way for establishing the IOS as a major standard in CPS Engineering.
- Challenge 2 (Technical): A clear bridge has to be defined between the on-going definition of the IOS and other wide spread Interoperability and Engineering Standards commonly used by European developing organizations (e.g., ASAM[1], FMI[2], AUTOSAR[3], STEP[4], OMG ReqIF[5], etc.) for supporting CPS Engineering activities.

In order to tackle these issues, CP-SETIS is articulated by the following goals and objectives:

- Goal 1: The alignment of all IOS-related forces within Europe to support a common IOS Standardization Strategy, aiming at a formal standardization process of the IOS.
- Goal 2: The definition and implementation of sustainable IOS Standardization Activities supporting both, formal standardization of ‘stable’ IOS versions as well as extensions of IOS, if possible within existing structures that survive the lifespan of single projects.

From these goals, the following objectives were derived:

- Objective 1: To build-up a consensus across key stakeholders (i.e., end-users organizations, tool providers, research organizations) and projects on a common IOS Standardization Strategy.
- Objective 2: To define a concrete model for sustainable IOS Standardization Activities (activities, processes, roles, responsibilities, interactions with projects, end-users, tool providers and relevant standardization bodies).
- Objective 3: To support implementation of sustainable IOS Standardization Activities within sustainable structures having a far longer lifespan than a single project (for example: existing ARTEMIS-IA structures10, i.e., the Tool Platform Working Group, the Standardization Working Group, the EICOSE Center of Innovation Excellence, etc.).
- Objective 4: To get commitment from key stakeholders for supporting common IOS Standardization Strategy and its implementation (firstly from key end-users and projects, ARTEMIS-IA, secondly from key tool & technology providers).
- Objective 5: To generalize findings of IOS Standardization Activities to update then ARTEMIS/PROSE Strategic Agenda for Standardization and to support further Standardization Activities within ARTEMIS/ECSEL.

5.3 Overall approach and methodology

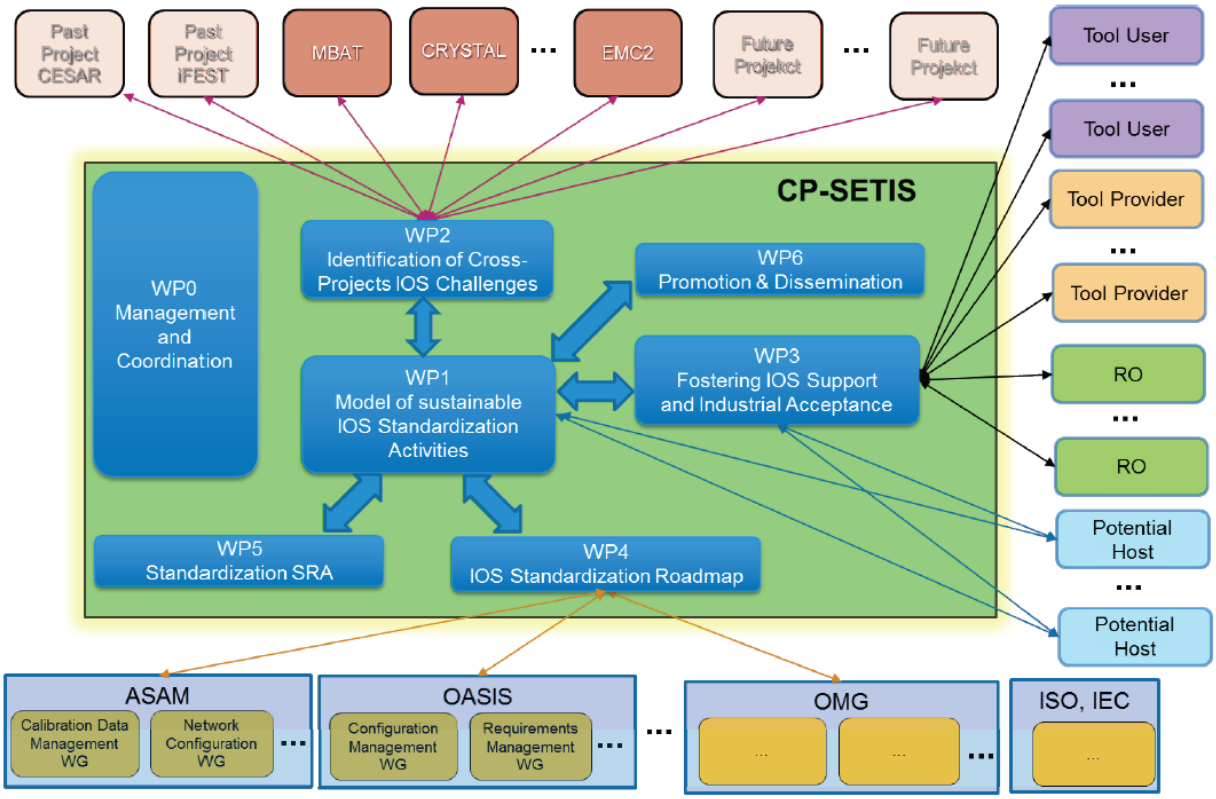
CP-SETIS is set in two phases: During the first year, a first phase for shaping and implementing a concrete model (in terms of activities, processes, roles, responsibilities, interactions with projects, end users, tool providers and relevant standardization bodies) for Sustainable IOS Standardization activities on the existing ARTEMIS-IA structures will be defined and harmonized between all stakeholders. In the second year, this concrete model will be deployed (‘implemented’), using existing sustainable structures, if possible,

[1] Association for Standardisation of Automation and Measuring Systems, http://asam.net
[2] Functional Mockup Interface for model exchange and tool coupling, https://www.fmi-standard.org
[3] AUTomotive Open System Architecture, http://autosar.org
[4] STEP – standing for "Standard for the Exchange of Product model data" is the informal name used for the ISO 10303 standard for the computer-interpretable representation and exchange of product manufacturing information.
[5] Requirements Interchange Format, http://www.omg.org/spec/ReqIF/

particularly taking into account ARTEMIS structures. In addition, the second year is used to expand the numbers of participants beyond our core/associate partners, to get a broad commitment from all stakeholders involved in sustainable IOS activities.

CP-SETIS consists of the following work packages:

- WP1 sets out to define a concrete model for sustainable IOS Standardization Activities and support its implementation (Objectives O2, O3)
- WP2 will be the link to the R&D projects. It will identify the key issues to be addressed for supporting IOS Sustainability (input to WP1) and serve as interface to IOS-related projects for providing them support and collect IOS Success Stories to be disseminated at a large scale for promoting our shared IOS Vision & Mission (WP6). WP2 will thus fulfil Objective O2.
- WP3 will be the link to the key stakeholders in the IOS. It will identify these key stakeholders and get their commitments regarding sustainable open interoperability specification (Objective O4). As such, it also will provide input to the model definition in WP1, as well as being the interface to these key stakeholders when assessing the potential hosts for the implementation of the model.
- WP4 serves as the interface to the Standardization Bodies. Its overall goal is to define a roadmap for establishing the IOS as a formal standard, thus contributing to Objective O1 and O5. The roadmap will contain identified IOS pre-standards and it is again an input to the model definition in WP1. It also serves as the basis for the concrete actions that have to be undergone for the standardization of the IOS by the main stakeholders, coordinated by the hosting structure(s) identified in WP1 as a host for the coordination model.
- As mentioned above, formal standardization of the IOS could serve as an excellent role model for further standardization activities within Europe. Thus, lessons learned from this undertaking should be collected and influence current Standardization Roadmaps. This is the objective of WP5, which will in particular create a CPS Standardization Strategic Research Agenda (SRA) based upon previous Standardization SRAs and incorporating the lessons learned from the definition and implementation of the IOS model for sustainable standardization activities. These activities will contribute to Objective O5. WP5 will support WP1 and WP4 and vice versa. The SRA will be printed finally by WP 6.
- WP6, finally, deals with communication, dissemination and exploitation of project results. It will elaborate a Communication, Dissemination and Exploitation Strategy and Policy and implement it, linking both, to standardization bodies such as ASAM, OASIS and others, to ensure proper communication between them and all partners and linking with the international scientific community.



CP-SETIS: Structure and Work Packages (A proposal for an Innovation Action which was submitted by several CRYSTAL partners together with stakeholders from other related research projects)