Strategic Agenda on Standardization
For
Cyberphysical Systems

Amsterdam, CP-SETIS Final Event, 2017-05-09

Erwin Schoitsch (AIT Austrian Institute of Technology)
Background: ARTEMIS/ProSE Strategic Agenda for Standardization

ARTEMIS Goal: Not just another funding scheme – but building together an open sustainable innovation ecosystem!

Not isolated projects but groups of projects building on each other towards a common goal – IOS is one example.

ARTEMIS conceptual model of an innovation eco-system – 7 pillars

ARTEMIS Standardization WG:
- 2007/08 First Strategic Standardization Agenda, to support the ARTEMIS SRA
- Since 2008: Standardization mandatory part in all ARTEMIS proposals, EC concern
- Support Action ProSE: 2008 – 2010
- ProSE Strategic Standardization Agenda paving the way forward!
Background: ARTEMIS/ProSE
Strategic Standardization Agendas

2007/08

ICT 2010, Brussels

„Landscape“ of Standards 2009

Available at
https://cp-setis.eu/documents/

Erwin Schoitsch (AIT)
CP-SETIS Final Event
Amsterdam, 2017–05–09

Funded by the European Union
And now:

New Strategic Agenda on Standardization for CPS

Authors:
Erwin Schoitsch
Jürgen Niehaus


Available at
https://cp-setis.eu/documents/
Version 2010 provides:

- **Collection of standards and standardization organizations** in all major areas of embedded systems (now: CPS) *(Facts)*
- How to identify gaps in the existing standards landscape
- **The way forward: Process** guidelines and criteria for prioritization of standardization activities – to focus on the most promising topics and approaches
- Table of ProSE criteria for standardization candidate assessment
- Four stakeholder groups identified, different approaches recommended

ProSE (FP7 Support Action, contract n° 224213)
Promoting Standardization for Embedded Systems
Update of the ARTEMIS Strategic Standardization Agenda: What's new?

Two tasks to fulfill:

1. **Inclusion of the CP-SETIS Findings concerning IOS (Interoperability Specifications) Framework:**
   - presented in the first sessions
   - Coherent setting of Standards and Specifications for Tool Operability covering the full set of requirements identified, sustainable maintenance process and evolution process, way to identify and implement such structures (ICF Forum as an example), influence on existing established standards with respect to requirements for tools and tool chains (as initiated in IEC 61508 and ISO 26262 for single tools only).

2. **Update of the overview on maintained standards, on new standardization areas, evolving technologies, and of new standardization groups tackling CPS and SoS (Systems of Systems):**
   - What’s new in established standards implemented through their maintenance process? (e.g. security-awareness in functional safety standards, guidance on new software paradigms)
   - New standardization areas because of evolving technologies (e.g. Cloud, IoT, open adaptive systems/SoS)
   - New standardization Groups e.g. IEC TC65 Ad-hoc Groups, ISO and others: discussing Smart Manufacturing, Smart Grids, Robotics (new paradigms like autonomy, perception, decision making, and V&V of these properties), Human Factors and Functional Safety
Update: What’s new?
Cloud and IoT

BRANDNEW:

AIOTI: Alliance for Internet of Things Innovation
→ now AISBL Association, becoming a cPPP?

• IoT becomes a more and more intriguing issue.
• IoT landscape even more fragmented than Embedded Systems 10 years ago
• The recently founded AIOTI have worked in 11 (now 13) Working Groups on Recommendations for an IoT Research Program for the European Commission, a first IoT Calls were issued last year.

Sources:

IERC (European Research Cluster on the Internet of Things) 2015,
AIOTI Alliance for the Internet of Things Initiative Reports, Nov. 2016
**AIOTI**
Alliance for Internet of Things Innovation

**Basis:** Current Workinggroups = current topics of interest

WG reports of all WG’s (Except WG 10) completed

<table>
<thead>
<tr>
<th>WG 01</th>
<th>IoT European Research Cluster</th>
<th>Smart Living Environment for Ageing Well</th>
<th>Smart Farming and Food Security</th>
<th>Smart Cities</th>
<th>Smart Mobility</th>
<th>Smart Water Management</th>
<th>Smart Manufacturing</th>
<th>Smart Energy</th>
<th>Smart Buildings and Architecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>WG 02</td>
<td>Innovation Ecosystems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WG 03</td>
<td>IoT Standardisation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WG 04</td>
<td>IoT Policy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SME Interests</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Update: What’s new?
Cloud and IoT

BRANDNEW:

AIOTI: Alliance for Internet of Things Innovation
WG 3 on “Standardization” has issued three documents:
- IoT LSP Standard Framework Concepts (LSP means “Large Scale Pilots”, an EC Large Projects’ Initiative)
- IoT High Level Architecture
- Semantic Interoperability (need for appropriate tools and semantic interoperability addressed)

IERC and AIOTI – close cooperation with international standardization organizations, including ETSI, ITU-T, CEN/ISO, CENELEC/IEC, IETF, IEEE, W3C, OASIS, oneM2M and OGC.

→ in line with proposed ARTEMIS-IA – AIOTI Cooperation, new task for ARTEMIS-IA Standardization WG as mentioned before today; maybe another possibility to apply the IOS – ICF ideas in an fast evolving field
ISO IoT Standardization Work

- ISO/IEC CD 20924 - Information technology -- Internet of Things (IoT) -- Definition and vocabulary
- ISO/IEC WD 30141 Internet of Things Reference Architecture (IoT RA)
- ISO/IEC FDIS 29341-30-2 Information technology -- UPnP Device Architecture -- Part 30-2: IoT management and control device control protocol -- IoT management and control device
- ISO/IEC FDIS 29341-30-1 Information technology -- UPnP Device Architecture -- Part 30-1: IoT management and control device control protocol -- IoT management and control architecture overview
- ISO/IEC FDIS 29341-30-10: IoT management and control device control protocol -- Data store service
- ISO/IEC FDIS 29341-30-11: IoT management and control device control protocol -- IoT management and control data model service
- ISO/IEC FDIS 29341-30-12: IoT management and control device control protocol -- IoT management and control transport generic service
- ISO/IEC 29161 Information technology -- Data structure -- Unique identification for the Internet of Things
- ISO/IEC AWI 18574 – 18577: Internet of Things (IoT) in the supply chain
IoT – Internet of Things

How to bring IoT requirements to communication standards?

- Pre-standardization Groups: IRTF-ISOC, ITU-T-Focus Group, IEEE-SA Industry Connection Program, ETSI – ISG → No separate AIOTI Standards, utilizing existing organizations/groups → Multi-Standard-type Approach?!

Some results:

- FI-WARE now includes “Generic Enablers” for Future-Internet/IoT (OASIS eXtensible Access Control Markup Language XACML provided to the IoT domain)

- Cybersecurity, privacy, identification, traceability, anonymization, semantic interoperability, interoperability/coexistence testing, performance characterization and scalability, auto-configuration, discovery, self-configuration, service robustness and resilience → IERC central reference for EC IoT pre-standardization

- M2M Service Layer in IoT (integrated horizontal approach instead of vertical-only approach) (transport and application layer) ETSI-M2M

- Cross-Vertical M2M Layer Standardization (integrate different verticals) ETSI-M2M
“NEW” Topic, promoters try to differentiate/separate:

• Many competing standardization activities, e.g.
  – ISO/IEC JTC1, WG 10, Internet of Things; SWG 5
  – ISO/IEC JTC1, WG 7, Sensor networks
  – ISO, IEC: Many IoT relevant related standards in the communication area – **new**: ISO/IEC JTC1 SC41 – Internet of Things and related Technologies
  – IEEE: many IoT related standards and standards projects
  – Particular protocols, e.g. the open AllJoyn protocol, now supported by the AllSeen Alliance (Qualcomm, Cisco, Linux, MicroSoft, …)
  – Open Interconnect Consortium (Intel, Atmel, Dell, Samsung, WindRiver, …)
  – Thread protocol (Google)
  – Particular protocols for e.g. home devices etc.
BRANDNEW: Standards for the Cloud

- The Joint Technical Committee of ISO and IEC, JTC1, Subcommittee 30 (“Distributed Application Platforms and Services”) has started foundational work on Cloud Computing Standards. These standards
  – ISO IEC 17788 – Cloud computing – overview and vocabulary
  – ISO/IEC 17789 - Cloud computing - Reference architecture
- are recommended and supported by ITU-T, the International Telecommunication Union.
- In the mean-time, related standards like ISO/IEC 19831:2015 have been published (“Cloud Infrastructure Management Interface (CIMI) Model and RESTful HTTP-based protocol”).
Update: What’s new?
Cloud and IoT

➢ BRANDNEW:
Standards for the Cloud

• Joint Technical Committee of ISO and IEC, JTC1, Subcommittee 30 (“Distributed Application Platforms and Services”): New standardization projects are another window of opportunity for research project partners, particularly when not just file services but more complex digital industrial services should be addressed in future:
  • Service level agreements,
  • Interoperability and portability,
  • Data and their flow across devices and cloud services,
  • Security issues

• Besides ISO/IEC, a number of standards and specifications from IETF, W3C and OASIS are relevant in the area of Cloud and Web Services.

• For common security requirements standardized protocols and specifications can be used, like for example SSL/TLS (RFC 5246), IPsec (RFC 4301), XML Signature and XML Encryption, SAML, XACML and others.
There is a standard evolving towards open, adaptive systems!

- Open systems dependability is the ability of a system
  - operated for an extended period of time in a real-world environment to accommodate change in its objectives and environment,
  - to ensure that accountability in regard to the system is continually achieved, and
  - to provide the expected services to users without interruption. It systematizes and puts emphasis on post failure management.
- Is about adaptive systems as well!
- Standard provides four process views to achieve these goals:
  - Change Accommodation process view,
  - Accountability Achievement process view,
  - Failure Response process view and
  - Consensus Building process view.
- This International Standard requires a dependability case assuring these process views, and five assurance metacases:
  - Internal Consistency and External Consistency,
  - Validity, Adequacy and Confidence assurance metacases.
SoA Standardization
(Collaborative Automation, Local Clouds)

Service Oriented Architecture: Service Interoperability
• Factory description system
• Deployment system
• Configuration system
• Event handler system
• Historian system
• Meta service registry system
• User registry system
• Quality of Service system

→ Refer to ARROWHEAD, EMC², …

→ Concerns many Engineering Standards!
Service Oriented Architecture based framework for integrating multi-vendor applications

Included in the Arrowhead Framework

- Authorisation System
- Service Registry
- Orchestration System
- Service providing system
- Service consuming system

www.arrowhead.eu

Erwin Schoitsch (AIT)
CP-SETIS Final Event
Amsterdam, 2017-05-09

Funded by the European Union
Clause 7.4.4 in IEC 61508-3: some general requirements for off-line support tools are:

- shall all be selected as a coherent part of the software development activities,
- shall be selected to be integrated to minimize the possibility of introducing human errors,
- selection and use shall be justified.

Support tools in classes T2 and T3 shall have

- a specification or product manual that defines the behaviour of the tool together with instructions and constraints on its use.
- to be assessed with the aim to determine the level of reliance that shall be placed on the tool, on potential failure mechanisms that may affect the executable software (T3 only).

Examples of how to achieve this:

- perform software HAZOP, restrict tool functionality, check tool output
- use diverse tools for the same purpose.

Tool Chain issues insufficiently covered by Functional Safety Standards (SAFECOMP Paper 2012 by partner KTH) → NEW: Task group in MT 61508-3

(similar: ISO 26262, Part 8, but tool chains still not addressed)
The CP–SETIS – IOS Approach

What is different, what is applicable?

Findings of CP-SETIS:
- IOS cannot be a single standard, specification or guideline
- IOS is rather a set of standards, guidelines and specifications
- It consists of items of different maturity level
- IOS defines a process of tracking, adoption and enhancement for standardization/specification candidates

The proposed approach:
- Creation of the ICF (Interoperability Coordination Forum) (= stakeholders)
- Finding a suitable Sustainable Hosting Structure

NEW: Can the „Multi-Standard“ Concept be generalized to resolve complex standardization issues where groups of consistent standards would be required?
Update: What’s new?

Multi-Standard Approach

<general applicability?>

Horizontal: Specification becomes part of the Multi-Standard

Selected ProSE criteria can be used

Proposal
- any Stakeholder can propose new candidates.

Selection
- Expert team evaluates and selects proposals to be tracked

Evaluation
- Evaluation of the proposed parts in industrial scenarios

Candidate
- Stakeholders vote to accept new part based on evaluation results

Adopted

Vertical: Specification becomes part of a formal standard (using the ‘ProSE way of Standardization’) like OSLC, FMI,...
Example: oneM2M, IoT

Formed in 2012: 8 of the world’s leading information and communications technology (ICT) standards development organizations (e.g. ETSI, more than 200 member companies). oneM2M

• provides a necessary framework for interoperability between the many M2M and IoT technologies being introduced.
• is developing globally agreed, access-independent, end-to-end specifications for an M2M and IoT communications and management system that can be easily embedded within various hardware and software
• Interoperability between IoT devices of
  • AllSeen Alliance’s AllJoyn
  • Open Connectivity Foundation’s IoTivity
  • Open Mobile Alliance’s Lightweight Machine-to-Machine

IoT Co-operations:
• Pre-standardization Groups: IRTF-ISOC, ITU-T-Focus Group, IEEE-SA Industry Connection Program, ETSI – ISG, AIOTI
• ISO/IEC JTC1 SC41
• CEN/CENELEC, OASIS, W3C, OGC
Safety & Security Standards Framework
(Example by Bertrand Rique)
Multi-concern Issues: How to align all this?

BRANDNEW: IEC TC65 Ad Hoc Groups – Safety, Reliability, Cybersecurity, Smart Manufacturing, Human Factors, …. (Examples)


- IEC TC65 AHG2: “Reliability of Automation Devices and Systems”, looking at the demand of reliability design, test, verification and operational life of (safety related) automation devices and systems as handled by IEC TC65.

- IEC TC65 AHG3: “Smart Manufacturing Framework and System Architecture” (Kick-off April 2016); this group will address the issues of highly interconnected industrial automation systems for smart manufacturing in a multi-concern manner.

- IEC SC65E (Devices and integration in enterprise systems) AHG1 (started 2016) “Smart manufacturing information models”. This subcommittee SC65E looks at enterprise management systems from top level down to devices. Main concern: interoperability of models and data exchanged, how managed by smart items in enterprise context (safety, security and dependability will play an important role)

- IEC SC65A WG 17: Human factors – Functional Safety (IEC TR 62879)
Partners and Associated Partners

Coordinator:

Partners:

Associated Partners:

Additional Associated Partners welcome!
THANK YOU FOR YOUR KIND ATTENTION!