AMASS
Architecture-driven, Multi-concern and Seamless Assurance and Certification of Cyber-Physical Systems

WP5: Seamless Interoperability

First EAB Workshop
Trento, September 11, 2017

Jose Luis de la Vara
WP5 Leader
uc3m
Seamless Interoperability Objectives

To develop a fully-fledged open tool platform that will allow developers and other assurance stakeholders to guarantee seamless interoperability of the platform with other tools used in the development of CPSs.

→ Develop an open and generically applicable approach to ensure the interoperability between the tools used in the modelling, analysis, and development of CPS.

Main specific objectives:

1. To define the baseline for an intelligent, automated, and highly customizable tool infrastructure for seamless interoperability and its management

2. To provide an extensible tool architecture that supports the intended use cases

3. To investigate suitable generic approaches for tool integration

4. To define metamodel(s) as a foundation for tool integration

5. To provide and demonstrate the seamless tool integration by the provision of a tool chain with selected tools
Seamless Interoperability Work Areas

• Tool Integration Management
  – Need for better intertwining assurance and engineering activities, and thus for integrating their tool support
  – Focus on OSLC

• Collaborative Work Management
  – Different stakeholders (and roles) are involved in CPS assurance & certification and need to collaborate
  – The stakeholders need to share information

• Tool Quality Assessment and Characterisation
  – CPS development and V&V tools can also pose safety risks
  – The tools must be characterized, tool output quality must be assessed, and tool selection impact must be analysed
# Seamless Interoperability Baseline

<table>
<thead>
<tr>
<th>State of the Art</th>
<th>State of the Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Authentication</strong></td>
<td>Single sign-in</td>
</tr>
<tr>
<td><strong>Collaboration</strong></td>
<td>Live collaboration on same set of data</td>
</tr>
<tr>
<td><strong>Change management</strong></td>
<td>Complete history of changes with manually created baselines</td>
</tr>
<tr>
<td><strong>Installation</strong></td>
<td>No installation required</td>
</tr>
<tr>
<td><strong>Data changes</strong></td>
<td>Push notifications across tool borders</td>
</tr>
<tr>
<td><strong>Data exchange</strong></td>
<td>Single source of truth</td>
</tr>
<tr>
<td><strong>Tool integration</strong></td>
<td>Standardized data bus (Tasktop Sync, ModelBus, OSLC)</td>
</tr>
</tbody>
</table>
## Seamless Interoperability Baseline

<table>
<thead>
<tr>
<th>ID</th>
<th>User Story</th>
</tr>
</thead>
<tbody>
<tr>
<td>US_04</td>
<td>As a tool user I want to <strong>access the tools data concurrently</strong> with other users so that the integrity of the data is guaranteed and that I am aware of the concurrence modifications rules and effects.</td>
</tr>
<tr>
<td>US_05</td>
<td>As a tool manager I want to <strong>grant access to users</strong> according to (a) tool functionality, (b) type of information (e.g., specific project, date range) so that users get access according to their profiles.</td>
</tr>
<tr>
<td>US_06</td>
<td>As a tool manager I want <strong>data to be readily available in non-proprietary formats</strong>.</td>
</tr>
<tr>
<td>US_07</td>
<td>As a tool user I want to <strong>create and enter data only once</strong>.</td>
</tr>
<tr>
<td>US_10</td>
<td>As a tool auditor I want <strong>automatic collection of lifecycle and status data in a transparent way</strong> as part of workflow.</td>
</tr>
<tr>
<td>US_11</td>
<td>As a tool user I want data to <strong>move through process with minimal manual intervention</strong>.</td>
</tr>
</tbody>
</table>
Seamless Interoperability Technologies

Tool integration

XQA

KNOWLEDGE BASE
- Ontology (Terms, XBS, Clusters, Patterns)
- Interoperability Platform – OSLC KM
- Quality Metrics
- Rules Based System
- Libraries Model

knowledge MANAGER

OSLC KM

DOORS DB

INTEGRITY DB

XML FILE

PTC Integrity

RAT

Native

DOORS

INTEGRITY

XML FILE

File
Seamless Interoperability Technologies

Tool integration

Property Manager
- Formalize requirements

V & V Manager
- Formal Contracts
  - text
  - ReqIF
  - LTL
- Verifiable design
  - C/C++
  - SMV

Automation servers
- Performance Monitoring
- Automation Plan
- Automation Request
- DiVinE
- NuSMV
- Testing
- Automation Result
- Verification Results

OSLC
Tool integration: OSLC-KM

- Specific resource shape for knowledge management and definition
- Objective: Data and services
  - oslc_km:Artifact
  - oslc_km:MetaProperty
  - oslc_km:RSHP
  - oslc_km:Concept
- Possibility of automatic generation of connectors
- Work with over 10 external tools
  - KM, RQA, RAT, Jazz, Papyrus, Rhapsody, MagicDraw, OpenModelica, Protégé, Simulink, ASCE, MS Word, MS Excel...
Collaborative work
Seamless Interoperability Technologies

Collaborative model creation
Collaborative work: automatic translations

Seamless Interoperability Technologies
Seamless Interoperability Technologies

Traceability with Capra
Seamless Interoperability Technologies

OSLC-based traceability

## Seamless Interoperability Implementation

<table>
<thead>
<tr>
<th>Evidence storage</th>
<th>Artefact &amp; lifecycle CRUD</th>
<th>Artefact information check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence traceability</td>
<td>Artefact relationships CRUD</td>
<td>-</td>
</tr>
<tr>
<td>Evidence evaluation</td>
<td>Artefact evaluation CRUD</td>
<td>Evaluations &amp; completeness check</td>
</tr>
<tr>
<td>Evidence change impact analysis</td>
<td>Impact trigger &amp; propagation</td>
<td>Impact check</td>
</tr>
<tr>
<td>Integration with external tools</td>
<td>SVN</td>
<td>SVN, API</td>
</tr>
</tbody>
</table>

---

[Image of Eclipse integration with external tools such as SVN and API]
Seamless Interoperability Main Achievements

• During the first project year, Seamless Interoperability has dealt with:
  – Three main aspects: tool integration, collaborative work, and tool quality characterisation & assessment
  – Three basic building blocks: data management, access management, and evidence management

• The work has allowed us to:
  – Set a common conceptual basis for seamless interoperability, including metamodels and expected advanced features
  – Envision and start designing and implementing specific solutions, by exploiting existing technologies (e.g. OSLC and web collaboration)
  – Release the first prototype, based on OpenCert
Seamless Interoperability Next Steps

• Tool integration
  – AMASS OSLC-based approaches
  – Demonstration on selected tool chains

• Collaborative work
  – Exploitation of web-based technologies
  – Demonstration with collaborative assurance info editing

• Enhancement of WP5 basic building blocks
  – CAPRA as traceability tool
  – Access management with CDO security mechanisms
  – Extension of CDO-based data management

Questions? Thanks!