ECSEL Research and Innovation actions (RIA)

AMASS

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

Integrated AMASS platform (b)
D2.7

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<tr>
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Executive Summary

The AMASS Open Tool Platform is the main result of the AMASS project. This platform corresponds to a collaborative tool environment supporting Cyber Physical Systems assurance and certification. The development of the AMASS Open Tool Platform follows an incremental approach by developing rapid and early prototypes in three iterations called Core, P1, and P2.

The current deliverable (D2.7) is the second one produced in the Task 2.4 AMASS Platform Validation. It concerns the validation of the prototype P1.

The functionalities of the AMASS platform are described in the AMASS deliverable D2.3 (AMASS Reference Architecture) [6]. The Prototype Core has been built upon three pre-existing toolsets from the OPENCOSS project [1], the CHESS project (Polarsys Platform) [12] and the SafeCer project [2] (which built on top of the Eclipse Process Framework project). This prototype P1 extends the prototype Core with specific blocks/functionalities/tools addressing the AMASS STOs: Architecture-Driven Assurance (STO1), Multi-Concern Assurance (STO2), Seamless Interoperability (STO3), and Cross/intra-Domain Reuse (STO4).

The prototype P1 has been released as an Eclipse bundle. Two manuals have been provided with the platform: Developer Guide that is dedicated to the AMASS Platform developers, and User Manual that targets AMASS Platform users.

This deliverable:

- recalls the architecture of the overall AMASS Platform and its building blocks,
- presents the validation activities that have been conducted on the prototype P1:
  - This validation has been based on an analysis of the requirements and corresponding functionalities, planned for prototype P1 and defined in D2.1 [7], and the usage scenarios defined in D2.3 [6]. These items have been refined into test cases that are compatible with the current developments of the AMASS platform. The previous validation results of prototype Core have been revised as well as the functionalities that were postponed for P1.
- summarizes the validation results:
  - Many test cases have been executed with the status Passed_But, which means that the functionalities should be enhanced. The verification of many functionalities has been postponed for the next iteration, because some of them were not completely available or no related use cases or guidelines have been identified.
- and gives recommendations for the next prototype iteration, such as traceability among requirements, use cases, developed functionalities, and methodological guidelines for a better validation process.
1. Introduction

1.1 Scope

AMASS will create and consolidate a de-facto European-wide assurance and certification open tool platform, ecosystem and self-sustainable community spanning the largest Cyber-Physical System vertical markets. The ultimate aim is to lower certification costs in face of rapidly changing product features and market needs. This will be achieved by establishing a novel holistic and reuse-oriented approach for:

- architecture-driven assurance fully compatible with standards such as AUTOSAR [25] and Integrated Modular Avionics (IMA) [26];
- multi-concern assurance, for example compliance demonstration, impact analyses, and compositional assurance of security and safety aspects;
- seamless interoperability between assurance/certification and engineering activities along with third-party activities (external assessments, supplier assurance);
- cross/intra-domain re-use of, for instance, semantic standards and product/process assurance.

The AMASS tangible expected results are:

a) The AMASS Reference Tool Architecture, which will extend the OPENCOSS [1] and SafeCer [2] conceptual, modelling and methodological frameworks for architecture-driven and multi-concern assurance, as well as for further cross-domain and intra-domain reuse capabilities and seamless interoperability mechanisms (e.g. based on Open Services for Lifecycle Collaboration (OSLC)\(^1\) specifications).

b) The AMASS Open Tool Platform, which will correspond to a collaborative tool environment supporting CPS assurance and certification. This platform represents a concrete implementation of the AMASS Reference Tool Architecture, with a capability for evolution and adaptation, which will be released as an open technological solution by the AMASS project. AMASS openness is based on both standard OSLC Application programming interfaces (APIs) [21] with external tools (e.g. engineering tools including V&V tools) and on open-source release of the AMASS building blocks.

c) The Open AMASS Community, which will manage the project outcomes for maintenance, evolution and industrialization. The Open Community will be supported by a governance board, and by rules, policies, and quality models. This includes support for AMASS base tools (tool infrastructure for database and access management, among others) and extension tools (enriching AMASS functionality). As Eclipse Foundation is part of the AMASS consortium, the PolarSys/Eclipse community [3] is a strong candidate to host AMASS.

To achieve these results, the AMASS Consortium has decided to follow an incremental approach by developing rapid and early prototypes in three iterations:

1. During the first prototyping iteration (prototype Core), the AMASS Platform Basic Building Blocks were aligned, merged and consolidated at Technology Readiness Level (TRL) 4 (technology validated in laboratory).
2. During the second prototyping iteration (prototype P1), the single AMASS-specific Building Blocks have been developed, integrated with previous prototype and benchmarked at TRL 4.
3. Finally, at the third prototyping iteration (Prototype P2), all AMASS building blocks are integrated in a comprehensive toolset operating at TRL 5 (technology validated in relevant environment).

\(^{1}\) https://open-services.net
1.2 Purpose of the deliverable

This deliverable is the second one from the Task 2.4 AMASS Platform Validation. The purpose of this deliverable is to serve as a complement to the prototype P1. It provides a summarised version of the implementation work that has been done related to the AMASS blocks implementation and their integration based on the reference architecture that was envisioned for the platform in deliverable D2.3 [6].

This document presents the platform architecture and its different blocks, and the methodology followed for its validation. It also presents the testing and validation activities of the AMASS platform that correspond to the scope of prototype P1, in order to check the global functionality of the platform according to the requirements defined in WP2, T2.1. For the validation activities, we have performed an analysis of the functionalities planned for building blocks constituting the prototype P1 defined in D2.1 [7] and collected usage scenarios defined in D2.3 [6] in order to refine these items into test cases that are compatible with the current developments of the AMASS platform. We have also analysed the functionalities specified for the basic building blocks of prototype Core that were postponed for the next iteration. Additional test cases have been defined for those functionalities that were implemented during the previous iteration but whose test results were not found satisfactory. The manual execution of the test cases enables us to provide direct feedback regarding implementation status and potential further enhancements for the next iteration.

The testing results together with the validation team feedback will allow WP1 and T1.5 to do an assessment of: 1) how the objectives of the case studies are met, 2) which applications perform best, and consequently, have the biggest market potential, and 3) which aspects can be improved.

1.3 Relations to others deliverables

D2.7 is related to others AMASS deliverables:

- D2.1 [7] (Business cases and high-level requirements) defines the business models of the AMASS solutions as well as the requirements to be met by the WP3, WP4, WP5, and WP6 technical AMASS work packages.
- D2.3 [6] (AMASS Reference Architecture (b)) describes the overall architecture of the AMASS platform including needs from the case studies that must be covered by the platform.
- D3.5 [8] (Prototype for Architecture-Driven Assurance (b)), D4.5 [9] (Prototype for multi-concern assurance (b)), D5.5 [10] (Prototype for seamless interoperability (b)) and D6.5 [11] (Implementation for Cross-Domain and Intra-Domain Reuse (b)) define the development of a tooling framework to support the AMASS platform second prototype. These deliverables describe the tools whose testing is reported in the current document.
- The AMASS Prototype P1 user manual2 [4] provides a guide on how to use the AMASS platform. It is the update of the previous prototype Core user manual that targets AMASS Platform users as the desirable audience.

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• The AMASS Prototype P1 developer guide\textsuperscript{3} provides a guide on how to set up the development environment and the tools integrated in the AMASS platform. The manual targets the AMASS Platform developers. It was created at the same time than the implementation in a collaborative way by the own developers and validated among them.

The D2.3 \textsuperscript{6} deliverable and the AMASS user manual \textsuperscript{4} have been the main reference documents from which new test cases have been derived, so that the features described there can be validated.

1.4 Structure of the document

The deliverable is structured as follows: Chapter 2 is a brief presentation of the AMASS platform and the tooling architecture and technologies used to implement them, and describes the testing and validation procedure. Chapter 3 to 6 contains the implementation status of the functionalities for the prototype P1, the test cases that have been defined to evaluate them and the results of execution of these test cases. Chapter 7 provides a synthesis of the validation results of the prototype P1 and some recommendations to be considered for the prototype P2. To sum up, some conclusions about validation on prototype P1 have been included in Chapter 8. Finally, Appendix A provides a detailed status of the implementation of prototype P1.

\textsuperscript{3} Developer guide available at: \url{https://services.medini.eu/svn/AMASS_collab/WP-transversal/ImplementationTeam/PrototypeP1/AMASSPrototypeP1_DeveloperGuide.doc}
2. AMASS Platform Architecture

2.1 Conceptual and Implementation Architecture

A general top-level architecture of the AMASS platform has been designed in the D2.3 deliverable [6]. As part of the overall platform, the AMASS prototype Core was the result of merging existing technologies from OPENCOSS [1] and SafeCer [2], and other related project such as CHESS [12]. The prototype P1 includes building blocks composed of tools to extend the functionalities provided by the basic building blocks of the prototype Core in order to address the following specific concerns: architecture-driven assurance, multi-concern assurance, seamless interoperability and cross/intra-domain reuse.

Figure 1 provides a high-level picture of the AMASS Reference Tool Architecture (ARTA) where the basic building blocks constituting the prototype Core are surrounded by a red dash-line and the building blocks implemented in prototype P1 are depicted in green boxes.

![AMASS Reference Tool Architecture](image)

Figure 1. Overall AMASS Platform Architecture

The AMASS platform is composed of a set of tools providing the functionalities described in the AMASS deliverable D2.3 [6] (AMASS Reference Architecture, first prototype). Figure 2 presents an overall picture of the layered structure of the AMASS implemented architecture. This architecture has been implemented in the scope of the T3.3, T4.3, T5.3 and T6.3 tasks.
2.2 AMASS Platform prototype P1

The prototype P1, which implements some specific STOx blocks, has been built upon the following baseline technologies and toolsets:

1. Tools from OPENC OSS project [1]
2. Papyrus tool and some of its features
3. Tools from the CHESS Project (Polarsys Platform) [12]
5. The Base Variability Resolution (BVR) tool [18]
6. Tools from the Capra project [24]
7. WEFACT tool [19]
8. Knowledge Manager (KM) toolset [22]
9. Open Service for Lifecycle Collaboration (OSLC) technology [21]

This prototype has been released as an Eclipse bundle, available at:

https://services.medini.eu/svn/AMASS_collab/WP-Transversal/ImplementationTeam/PrototypeP1/Tools/Client_Bundle/20171215_OpenCertCHESSClient_Win_x64.zip

Its source code is available at https://services.medini.eu/svn/AMASS_source/
2.3 Testing and Validation Methodology

Figure 3 presents the overall validation and testing methodology that has been defined in task T2.4. The methodology aims to validate that the AMASS prototype P1 platform satisfies its requirements and to check the system behaviour against the users’ needs and the case studies (see D2.1 [7] and D2.3 [6] deliverables). It also checks that those functionalities specified for the prototype Core which validation results were not found satisfactory during last validation iteration are now correctly integrated in the platform.

The test cases listed in this document are mainly based on the scenarios defined in the use cases of D2.3 deliverable. These test cases aim to provide concrete scenarios about how AMASS will be used and when such usage can be regarded as successful. The test cases have been also traced to the D2.1 requirements of the AMASS prototype P1 (and some of the prototype Core as well) to ensure their theoretical coverage.

We have also used the AMASS user manual and the methodological guides D3.7 [13], D4.7 [14], D5.7 [15], and D6.7 [16] provided for the technical WP3 to WP6 as a reference document to enhance some test cases input(s), steps, and expected result(s).

Similarly, as for the previous AMASS Platform validation, a test case specification consists of the following information:

- **Test Case ID**, which uniquely identifies the test case.
- **Scope**, which provides the context and summarizes the purpose of the test case.
- **Functionality ID**, which refers to the AMASS related requirements that must be validated.
- **Related use cases**, which refer to the use case scenarios that are concerned.
- **Input**, which specifies the necessary input data needed prior to execute the test case.
- **Steps are the execution steps to follow in order to run the test case.**
- **Expected results** specify the behaviour or computation results expected from the execution of the test case.
- **MoSCoW Priority**\(^4\) as defined for the AMASS requirements in D2.1 deliverable [7].

Dedicated partners have performed the installation of the platform and executed manually the test cases checking its implementation. The testing partners have indicated the material used to run the test cases: machine configuration, validation data, etc. We report the status of the execution of the test cases as:

- **PASSED**: functionality that works as required

\(^4\) Must have, Should have, Could have, and Won't have but would like
• PASSED_BUT: functionality that works but could be enhanced
• FAILED: functionality that does not work
• POSTPONED: functionality implemented but that has not been tested

For each “Passed but”, “Failed” or “Postponed” status, a rationale is given to detail the reason of such status. We generate a ticket within the AMASS Issue-Tracker system for such test cases to report the problem to the Implementation Team. The overall validation results are summarized in this document.
3. Testing and Validation for WP3-related Blocks

3.1 Functionalities

The functionalities concerning the System Component Specification and Architecture driven assurance blocks are defined in D2.1 deliverable [7]. Table 1 is an excerpt of the relevant functionalities planned for prototype P1 in addition to the functionalities postponed in prototype Core, their implementation status and the implementation responsible. Among the twelve planned functionalities, eight have been implemented, and four functionalities were pending and then postponed for the next version of the AMASS platform.

<table>
<thead>
<tr>
<th>ID</th>
<th>Functionality</th>
<th>Status</th>
<th>Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP3_VVA_004</td>
<td>Trace requirements validation checks</td>
<td>Pending</td>
<td>INT</td>
</tr>
<tr>
<td>WP3_SC_007</td>
<td>Fault injection (includes faulty behaviour of a component)</td>
<td>Implemented</td>
<td>INT</td>
</tr>
<tr>
<td>WP3_CAC_001</td>
<td>Validate composition of components by validating their contracts</td>
<td>Implemented</td>
<td>FBK</td>
</tr>
<tr>
<td>WP3_CAC_005</td>
<td>General management of contract-component assignments</td>
<td>Implemented</td>
<td>FBK</td>
</tr>
<tr>
<td>WP3_CAC_006</td>
<td>Refinement-based overview</td>
<td>Implemented</td>
<td>INT, FBK</td>
</tr>
<tr>
<td>WP3_CAC_007</td>
<td>Overview of check refinements results</td>
<td>Implemented</td>
<td>FBK</td>
</tr>
<tr>
<td>WP3_CAC_008</td>
<td>Contract-based validation and verification</td>
<td>Implemented</td>
<td>FBK</td>
</tr>
<tr>
<td>WP3_CAC_009</td>
<td>Improvement of Contract definition process</td>
<td>Implemented</td>
<td>FBK</td>
</tr>
<tr>
<td>WP3_CAC_011</td>
<td>Overview of contract-based validation for behavioural models</td>
<td>Pending</td>
<td>FBK</td>
</tr>
<tr>
<td>WP3_VVA_005</td>
<td>Verify (model checking) state machines</td>
<td>Pending</td>
<td>FBK, HON, UOM</td>
</tr>
<tr>
<td>WP3_VVA_010</td>
<td>Model-based safety analysis</td>
<td>Implemented</td>
<td>FBK</td>
</tr>
<tr>
<td>WP3_VVA_002</td>
<td>Trace model-to-model transformation</td>
<td>Pending</td>
<td>INT</td>
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</table>

3.2 Test Cases

In this section, we present the set of test cases defined to validate the implementation of the functionalities implemented for prototype P1. The test cases are based on the use case scenarios defined in the deliverable D2.3 [6] for the concerned functionalities when existing.

<table>
<thead>
<tr>
<th>ID</th>
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<tbody>
<tr>
<td>Scope</td>
<td>Support specification of variability at the component level.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP6_PPA_004</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Manage product variability”</td>
</tr>
<tr>
<td>Input</td>
<td>The component warehouse (Base Model) has been specified.</td>
</tr>
</tbody>
</table>
| Steps | 1. The user manages variability via the Variability, Resolution, and Realization editors.  
2. The user generates/exports the new component model, obtained as tailoring of the Base Model. |
| Expected results | New component model tailoring from the Base component model.             |
Table 3. Test Case WP3_TC_002 for WP3_SC_007

<table>
<thead>
<tr>
<th>ID</th>
<th>WP3_TC_002</th>
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<tbody>
<tr>
<td>Scope</td>
<td>Fault injection (includes faulty behaviour of a component).</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP3_SC_007</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Specify system architecture at different levels”</td>
</tr>
<tr>
<td>Input</td>
<td>A CHESS model with already defined nominal state machines (e.g., the Battery new project).</td>
</tr>
</tbody>
</table>
| Steps  | 1. Browse the model using the “Model Explorer” view and select the “System View” package.  
  2. Select the component with the state diagram to be enrich.  
  3. Right click on the selected component, then go to “New Diagram” – “State Machine Diagram”.  
  4. Select the newly created state machine and apply the stereotype “Error Model”.  
  5. Open the related State Machine Diagram in the editor.  
  6. Create the state machine with the correct stereotypes. |
| Expected results | The user is able to create fault injection state machines. |
| Priority | Must |

Table 4. Test Case WP3_TC_003a for WP3_CAC_001

<table>
<thead>
<tr>
<th>ID</th>
<th>WP3_TC_003a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Validate composition of components by validating their contracts.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP3_CAC_001</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Validate components composition through contracts-based design”</td>
</tr>
<tr>
<td>Input</td>
<td>A CHESS model with some components and contracts already defined (e.g. the WBS project).</td>
</tr>
</tbody>
</table>
| Steps  | 1. Browse the model using the “Model Explorer” view (e.g. for the WBS project, go inside the “PhysicalArchitecture” package under “modelSystemView” package).  
  2. Open the Block Definition Diagram inside the package.  
  3. Select a component (in the “Model Explorer” view) or the corresponding graphical representation (in the diagram editor). The properties available to check will be the assumptions and guarantees of contracts owned by the selected component and by its sub components. This operation includes recursively all the properties from the root to the leaves of the selected component.  
  4. Right click on the selected component, then go to “CHESS” – “Validation” – “Check Validation Property on selected component”. A popup appears.  
  5. Select the model of time of the system, “Hybrid” or “Discrete” (“Discrete” for the WBS project) and another popup appears.  
  6. Select the type of check to perform, i.e., consistency, possibility, or entailment. Then select the Component and Properties ID and press OK.  
  7. When the check is completed, the status of the check is shown in the “Trace” view. |
| Expected results | The user can validate the composition of the components through their contracts. |
| Priority | Should |
Table 5. Test Case WP3_TC_003b for WP3_CAC_001

<table>
<thead>
<tr>
<th>ID</th>
<th>WP3_TC_003b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Validate the feature for composition of components by validating their contracts.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP3_CAC_001</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Validate components composition through contracts-based design”</td>
</tr>
<tr>
<td>Input</td>
<td>A CHESS model including some components and their contracts.</td>
</tr>
</tbody>
</table>
| Steps  | 1. Select a component (in the “Model Explorer” view) or the corresponding graphical representation (in the diagram editor).  
2. Right click on the selected component, then go to “CHESS - Validation – Check Validation Property on Selected Component”  
3. A popup appears to set the parameters of the command.  
4. Select the property Type (consistency, possibility, and entailment).  
5. Select the component selected in step 1 or its sub components.  
6. Select the assumptions and guarantees of contracts.  
7. Click “ok” to perform the validation and show the result of the verification. |
| Expected results | A status of the check is shown in the “V&V Result» view. |
| Priority | Shall |

Table 6. Test Case WP3_TC_004a for WP3_CAC_005

<table>
<thead>
<tr>
<th>ID</th>
<th>WP3_TC_004a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>General management of contract-component assignments.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP3_CAC_005</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Browse components and associated contracts”</td>
</tr>
<tr>
<td>Input</td>
<td>A CHESS model with some components and contracts already defined (e.g. the WBS project).</td>
</tr>
</tbody>
</table>
| Steps  | 1. Browse the model using the “Model Explorer” view (e.g. for the WBS project, go inside the “PhysicalArchitecture” package under “modelSystemView” package).  
2. Open the Block Definition Diagram inside the package.  
3. Select the “Hierarchical Model View” view to check the status of the components currently defined in the system architecture, together with its associated contracts. |
| Expected results | The system should enable users to have an overview in terms of components and their associated contracts. |
| Priority | Should |

Table 7. Test Case WP3_TC_004b for WP3_CAC_005

<table>
<thead>
<tr>
<th>ID</th>
<th>WP3_TC_004b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>General management of contract-component assignments.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP3_CAC_005</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Browse components and associated contracts”</td>
</tr>
<tr>
<td>Input</td>
<td>System architecture (components with potential associated contracts).</td>
</tr>
</tbody>
</table>
| Steps  | 1. Go to Window – Show View – Hierarchical Model View  
Expected results | Contracts assigned for each component in the “System Architectures” Column of “Hierarchical Model View”. |
| Priority | Should |
Table 8. Test Case WP3_TC_005a for WP3_CAC_006

<table>
<thead>
<tr>
<th>ID</th>
<th>WP3_TC_005a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Refinement-based overview.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP3_CAC_006</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Browse Contracts refinement status”</td>
</tr>
<tr>
<td>Input</td>
<td>A CHESS model with some components and contracts with refinements already defined (e.g. the WBS project).</td>
</tr>
</tbody>
</table>
| Steps | 1. Browse the model using the “Model Explorer” view (e.g. for the WBS project, go inside the “PhysicalArchitecture” package under “modelSystemView” package).  
2. Open the Block Definition Diagram inside the package.  
3. Select the “Contract Refinement View” to check all the defined contracts and their refinements. |
| Expected results | The system should enable users to have a hierarchical view of the contracts and relative refinements along the system architecture. |
| Priority | Should |

Table 9. Test Case WP3_TC_005b for WP3_CAC_006

<table>
<thead>
<tr>
<th>ID</th>
<th>WP3_TC_005b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Refinement-based overview.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP3_CAC_006</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Browse Contracts refinement status”</td>
</tr>
<tr>
<td>Input</td>
<td>Components and their contracts</td>
</tr>
<tr>
<td>Steps</td>
<td>1. Go to Window – Show View – Contract Refinement View</td>
</tr>
<tr>
<td>Expected results</td>
<td>Contract refinement for each contract in the “Refined Contract” Column of the “Contract Refinement View”.</td>
</tr>
<tr>
<td>Priority</td>
<td>Should</td>
</tr>
</tbody>
</table>

Table 10. Test Case WP3_TC_006a for WP3_CAC_007

<table>
<thead>
<tr>
<th>ID</th>
<th>WP3_TC_006a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Overview of check refinements results.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP3_CAC_007</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Inspect contracts refinement result”</td>
</tr>
<tr>
<td>Input</td>
<td>A CHESS model with some components and contracts with refinements already defined (e.g. the WBS project).</td>
</tr>
</tbody>
</table>
| Steps | 1. Browse the model using the “Model Explorer” view (e.g., go inside the “PhysicalArchitecture” package under “modelSystemView” package).  
2. Open the Block Definition Diagram inside the package.  
3. Ensure that a contract refinement check has already been run or start a check (for instruction steps see use case “Verify contract refinement”).  
4. Open the “V&V Results” view and look for a function called “ocra_check_refinement”.  
5. Right click on the function and select “Show result”. The “Contract trace” view will open and show the results. |
| Expected results | The system should enable users to have an overview in terms of status of check refinement of all the defined contracts. |
| Priority | Should |
Table 11. Test Case WP3_TC_006b for WP3_CAC_007

<table>
<thead>
<tr>
<th>ID</th>
<th>WP3_TC_006b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Overview of check refinements results.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP3_CAC_007</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Inspect contracts refinement result”</td>
</tr>
<tr>
<td>Input</td>
<td>Component contracts</td>
</tr>
<tr>
<td>Steps</td>
<td>1. Select the “Contract Refinement View” to check the refining contracts for each contract.</td>
</tr>
<tr>
<td>Expected results</td>
<td>Number of sub-contracts for each refined contract.</td>
</tr>
<tr>
<td>Priority</td>
<td>Should</td>
</tr>
</tbody>
</table>

Table 12. Test Case WP3_TC_007a for WP3_CAC_008

<table>
<thead>
<tr>
<th>ID</th>
<th>WP3_TC_007a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Contract-based validation and verification.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP3_CAC_008</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Verify contract refinement”, “Perform contract-based fault tree generation”, and “Validate weak contracts”</td>
</tr>
<tr>
<td>Input</td>
<td>A CHESS model with some components and contracts with refinements already defined (e.g. the WBS project).</td>
</tr>
<tr>
<td>Steps</td>
<td>1. Browse the model using the “Model Explorer” view (e.g., go inside the “PhysicalArchitecture” package under “modelSystemView” package). 2. Open the Block Definition Diagram inside the package. 3. Select a component (in the “Model Explorer” view) or the corresponding graphical representation (in the diagram editor). The contract refinements considered will be the ones associated to the selected component and the ones associated to its sub components. This operation includes recursively all the contracts along the subcomponents, from the root to the leaves of the system. 4. Right click on the selected component, then go to “CHESS” – “Functional Verifications” – “Check Contract Refinement on selected component”. 5. When the analysis is completed, it is possible to see the status of each refinement in the “Contract trace” view. If the check fails, it is possible to see the counter example, i.e., the instances of values to assign to the ports that cause the failure of the contract refinement.</td>
</tr>
<tr>
<td>Expected results</td>
<td>The system must provide support for contract-based system validation and verification.</td>
</tr>
<tr>
<td>Priority</td>
<td>Must</td>
</tr>
</tbody>
</table>

Table 13. Test Case WP3_TC_007b for WP3_CAC_008

<table>
<thead>
<tr>
<th>ID</th>
<th>WP3_TC_007b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Contract-based validation and verification.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP3_CAC_008</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Verify contract refinement”</td>
</tr>
<tr>
<td>Input</td>
<td>Component contracts and their refinement. Configuration of external tool (OCRA tool) allowing contracts refinement.</td>
</tr>
<tr>
<td>Steps</td>
<td>1. Select a component (in the “Model Explorer” View) or the corresponding graphical representation (in the Diagram Editor). 2. Right click on the selected component, then go to CHESS-Functional Verification – Check Contract Refinement on Selected Component.</td>
</tr>
</tbody>
</table>
**Expected results**
A status of the check is shown in the “V&V Result” view.

**Priority**
Must

**Table 14. Test Case WP3_TC_007c for WP3_CAC_008**

<table>
<thead>
<tr>
<th>ID</th>
<th>WP3_TC_007c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Contract-based validation and verification.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP3_CAC_008</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Perform contract-based fault trees generation”</td>
</tr>
<tr>
<td>Input</td>
<td>Component contracts and their refinement. Configuration of external tool (OCRA tool) allowing contracts refinement.</td>
</tr>
</tbody>
</table>
| Steps  | 1. Select a component (in the “Model Explorer” View) or the corresponding graphical representation (in the Diagram Editor).  
2. Right click on the selected component, then go to CHESS-Safety Analysis – Contract-based Safety Analysis on selected component. |
| Expected results | A status of the check is shown in the “V&V result” view. |
| Priority | Must |

**Table 15. Test Case WP3_TC_007d for WP3_CAC_008**

<table>
<thead>
<tr>
<th>ID</th>
<th>WP3_TC_007d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Contract-based validation and verification.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP3_CAC_008</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Validate weak contracts”</td>
</tr>
<tr>
<td>Input</td>
<td>Component contracts and their refinement. Configuration of external tool (OCRA tool) allowing contracts refinement.</td>
</tr>
</tbody>
</table>
| Steps  | 1. Select a component (in the “Model Explorer” View) or the corresponding graphical representation (in the Diagram Editor).  
2. Right click on the selected component, then go to CHESS-Safety Analysis – Contract-based Safety Analysis on selected component. |
| Expected results | A status of the check is shown in the “V&V result” view. |
| Priority | Must |

**Table 16. Test Case WP3_TC_008a for WP3_CAC_009**

<table>
<thead>
<tr>
<th>ID</th>
<th>WP3_TC_008a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Improvement of Contract definition process.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP3_CAC_009</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Assign a contract to the component”, and “Structure properties into contracts (assumptions/guarantees)”</td>
</tr>
<tr>
<td>Input</td>
<td>A CHESS model with some components already defined.</td>
</tr>
</tbody>
</table>
| Steps  | 1. Select a component (in the “Model Explorer” view) or the corresponding graphical representation (in the Diagram Editor) and go to the “Properties” view.  
2. Go to the “ContractEditor” tab, type the contract name and click on “Add Contract”. A popup appears.  
3. Create a new contract and select the pencil icon. A popup appears.  
4. Select “No” to avoid the creation of empty formal properties.  
5. A new contract is created, along with a contract instance.  
6. Select the contract just created in the Contract List drop down menu.  
7. Type the Assume and Guarantee properties in the text boxes. Notice how grammar keywords are highlighted and flow ports are suggested as terms. |
Expected results | The user is able to add contracts in a simple way and the typing of formal properties is eased by the editor.
--- | ---
Priority | Should

**Table 17. Test Case WP3_TC_008b for WP3_CAC_009**

<table>
<thead>
<tr>
<th>ID</th>
<th>WP3_TC_008b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Improvement of Contract definition process.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP3_CAC_009</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Assign a contract to the component”, and “Structure properties into contracts”</td>
</tr>
<tr>
<td>Input</td>
<td>None</td>
</tr>
</tbody>
</table>
| Steps | 1. Browse the model using the “Project Explorer” view  
2. Select the diagram from the “Model Explorer” view  
3. Select Contract from the Palette and click on the diagram  
4. Give a proper name to the Contract  
5. Create a ContractProperty inside the Block/Component  
6. In the “Property” view – Contract Tab, type the just created ContractProperty with the Contract |
| Expected results | A component updated with a property that represents the contract assignment. |
| Priority | Should |

**Table 18. Test Case WP3_TC_009a for WP3_CAC_011**

<table>
<thead>
<tr>
<th>ID</th>
<th>WP3_TC_009a (pending)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Overview of contract-based validation for behavioural models.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP3_CAC_011</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Perform contract-based verification of behavioural models”</td>
</tr>
<tr>
<td>Input</td>
<td>A CHESS model with some components, contracts with refinements, and state machines already defined.</td>
</tr>
</tbody>
</table>
| Steps | 1. Browse the model using the “Model Explorer” view (e.g., go inside the “PhysicalArchitecture” package under “modelSystemView” package).  
2. Open the Block Definition Diagram inside the package.  
3. Select a component (in the “Model Explorer” view) or the corresponding graphical representation (in the Diagram Editor). The contracts and the state machines considered will be the ones associated to the selected component and the ones associated to its sub components. This operation includes recursively all the contracts and state machines along the subcomponents, from the root to the leaves of the system.  
4. Right click on the selected component, then go to “CHESS”–“Functional Verifications”–“Check Contract Implementation on selected component”. A popup appears.  
5. Select the model of time of the system, “Hybrid” or “Discrete”.  
6. Receive the results of the analysis. |
| Expected results | None defined |
| Priority | Could |

**Table 19. Test Case WP3_TC_009b for WP3_CAC_011**

<table>
<thead>
<tr>
<th>ID</th>
<th>WP3_TC_009b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Overview of contract-based validation for behavioural models.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP3_CAC_011</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Perform contract-based validation for behavioural models”</td>
</tr>
</tbody>
</table>
Input
Component contracts and their refinement. CHESS finite state machines.

Steps
1. Select a component (in the “Model Explorer” View) or the corresponding graphical representation (in the Diagram editor).
2. Right click on the selected component, then go to CHESS-Functional Verification – Model Checking on Selected Component.
3. A popup appears to set the parameters (Check Type, Algorithm Type and Property) of the command.

Expected results
A component updated with a property that represents the contract assignment

Table 20. Test Case WP3_TC_010 for WP3_VVA_005

<table>
<thead>
<tr>
<th>ID</th>
<th>WP3_TC_010 (pending)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Verify (model checking) state machines.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP3_VVA_005</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Perform contract-based verification of behavioural models”</td>
</tr>
<tr>
<td>Input</td>
<td>A model with some components and state machines already defined.</td>
</tr>
</tbody>
</table>

Steps
1. Browse the model using the “Model Explorer” view (e.g., go inside the “PhysicalArchitecture” package under “modelSystemView” package).
2. Open the Block Definition Diagram inside the package.
3. Select a component (in the “Model Explorer” view) or the corresponding graphical representation (in the Diagram editor). The components behaviour to check will be the behaviour of the selected component and the behaviour of its sub components. This operation includes recursively all the behaviours from the root to the leaves of the selected component.
4. Right click on the selected component, then go to “CHESS” – “Functional Verifications” – “Model Checking on selected component”. A popup appears.
5. Select the nuXmv parameters and press OK.
6. Receive the results of the analysis.

Expected results
None defined

Priority
Must

Table 21. Test Case WP3_TC_011 for WP3_VVA_010

<table>
<thead>
<tr>
<th>ID</th>
<th>WP3_TC_011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Model-based safety analysis.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP3_VVA_010</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Generate fault tree”</td>
</tr>
<tr>
<td>Input</td>
<td>A CHESS model with already defined nominal and ErrorModel state machines (e.g., the Battery_new project)</td>
</tr>
</tbody>
</table>

Steps
1. Browse the model using the “Model Explorer” view and select the “System View” package.
2. Select the root component of the CHESS system, or the corresponding graphical representation (in the Diagram editor).
3. From the “Properties” view, stereotype the component as CHGaResourcePlatform.
4. In the “Model Explorer” view, go to the “DependabilityAnalysisView” package under the “Analysis View” package.
5. Right click on the package, then go to “New Diagram” – “Class Diagram”.
6. Right click again on the package, then go to “New Child” – “Class”.
7. Select the class from the “Properties” view, stereotype the component as “GaAnalysisContext”.
8. In the “Properties” view, select the stereotype “GaAnalysisContext”.
9. Set the platform attribute to the CHGaResourcePlatform entity and the context attribute write the top-level condition to be used for the FTA.
11. Select one of the analysis contexts found in the model from the drop-down list and press “OK”.
12. The external tool runs and displays the fault tree.

Expected results
The system shall allow the user to generate and view fault trees.

Priority
Must

3.3 Test Results

Table 22 presents the results of the execution, the status and the validation responsible for the Test Cases in section 3.2. The instructions for installing the used testing environment are described in the AMASS Developer Guide [5]. The functionalities provided for System component specification and architecture-driven assurance in Prototype P1 are detailed in the AMASS User manual [4].

The test cases have been performed with the following machine configurations: Windows 10 Enterprise (64 bits) Operating system, Intel(R) Core(TM) i7-6700HQ and i7-5600U processors, CPU @ 2.60 GHz, 16 GB of RAM.

Nineteen test cases have been defined: seven test cases were successfully PASSED, eleven test cases were executed with the status PASSED_BUT, and one has not been executed since its implementation was not realized.

Table 22. Test results for the WP3 implemented functionalities

<table>
<thead>
<tr>
<th>Test Case ID</th>
<th>Execution Results</th>
<th>Status</th>
<th>Rationale</th>
<th>Test Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP3_TC_001</td>
<td>Postponed</td>
<td></td>
<td>This requirement will be implemented in WP6.</td>
<td></td>
</tr>
<tr>
<td>WP3_TC_002</td>
<td>The user is able</td>
<td>Passed</td>
<td>Passed for model with discrete time (e.g., CHESS project &quot;WBS_SM_Single_State&quot;). However, an Execution timeout is triggered for other example such as CHESS project WBS.</td>
<td>FBK</td>
</tr>
<tr>
<td>WP3_TC_003a</td>
<td>to create fault</td>
<td>Passed_But</td>
<td>An assumption is needed in the related use case “Validate components composition through</td>
<td>A4T</td>
</tr>
<tr>
<td></td>
<td>injection state</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>machines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 22. Test results for the WP3 implemented functionalities
<table>
<thead>
<tr>
<th>Task ID</th>
<th>Description</th>
<th>Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP3_TC_003b</td>
<td>The validation status in the “V&amp;V Results” view</td>
<td>Passed_ But</td>
<td>An assumption is needed in the related use case specification in D2.3 [6].</td>
</tr>
<tr>
<td>WP3_TC_004a</td>
<td>Contracts assigned for each component in the “System Architectures” Column of “Hierarchical Model” view</td>
<td>Passed_ But</td>
<td>How the “Number of Subcomponent and Contract” is computed for subcomponents and contracts together?</td>
</tr>
<tr>
<td>WP3_TC_004b</td>
<td>Contracts assigned for each component in the “System Architectures” Column of “Hierarchical model” view</td>
<td>Passed_ But</td>
<td>How the “Number of Subcomponent and Contract” is computed for subcomponents and contracts together?</td>
</tr>
<tr>
<td>WP3_TC_005a</td>
<td>Contract refinement for each contract in the “Refined Contract” Column of “Contract Refinement” view</td>
<td>Passed</td>
<td></td>
</tr>
<tr>
<td>WP3_TC_005b</td>
<td>Contract refinement for each contract in the “Refined Contract” Column of “Contract Refinement” view</td>
<td>Passed</td>
<td></td>
</tr>
<tr>
<td>WP3_TC_006a</td>
<td>Number of sub-contracts for each refined contract</td>
<td>Passed</td>
<td></td>
</tr>
<tr>
<td>WP3_TC_006b</td>
<td>Number of sub-contracts for each refined contract</td>
<td>Passed</td>
<td></td>
</tr>
<tr>
<td>WP3_TC_007a</td>
<td>A status of the check is shown in the “V&amp;V result” view</td>
<td>Passed_ But</td>
<td>An assumption is needed in the related use case specification in D2.3 [6].</td>
</tr>
<tr>
<td>WP3_TC_007b</td>
<td>A status of the check is shown in the “V&amp;V result” view</td>
<td>Passed_ But</td>
<td>An assumption is needed in the related use case specification in D2.3 [6].</td>
</tr>
<tr>
<td>WP3_TC_007c</td>
<td>A status of the check is shown in the “V&amp;V result” view</td>
<td>Passed_ But</td>
<td>An assumption is needed in the related use case specification in D2.3 [6].</td>
</tr>
<tr>
<td>WP3_TC_007d</td>
<td>A status of the check is shown in the “V&amp;V result” view</td>
<td>Passed_ But</td>
<td>An assumption is needed in the related use case specification in D2.3 [6].</td>
</tr>
<tr>
<td>WP3_TC_008a</td>
<td>A component updated with a property that</td>
<td>Passed</td>
<td></td>
</tr>
<tr>
<td>Component ID</td>
<td>Description</td>
<td>Status</td>
<td>Issue Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>--------</td>
<td>-------------------</td>
</tr>
<tr>
<td>WP3_TC_008b</td>
<td>A component updated with a property that represents the contract assignment</td>
<td>Passed</td>
<td></td>
</tr>
<tr>
<td>WP3_TC_009a</td>
<td>A status of the check is shown in the “V&amp;V result” view</td>
<td>Passed</td>
<td>But An assumption is needed in the related use case specification in D2.3 [6]</td>
</tr>
<tr>
<td>WP3_TC_009b</td>
<td>A status of the check is shown in the “V&amp;V result” view</td>
<td>Passed</td>
<td>But An assumption is needed in the related use case specification in D2.3 [6]</td>
</tr>
<tr>
<td>WP3_TC_011</td>
<td>A fault tree is generated</td>
<td>Passed</td>
<td>But The fault tree is not generated for all the projects. There seems to be an issue with the export functionality.</td>
</tr>
</tbody>
</table>

A4T

FBK
4. Testing and Validation for WP4-related Blocks

4.1 Functionalities

The functionalities concerning the Assurance Case Specification and Multi-concern assurance blocks are defined in the deliverable D2.1 [7]. Table 23 is an excerpt of these functionalities planned for prototype P1 plus the ones postponed in prototype Core, their implementation status and the partner responsible for their implementation. Among the thirteen collected functionalities, two functionalities have not been implemented and are postponed for the next version of the AMASS platform.

<table>
<thead>
<tr>
<th>ID</th>
<th>Functionality</th>
<th>Status</th>
<th>Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP4_ACS_001</td>
<td>Edit an assurance case in a scalable way</td>
<td>Implemented</td>
<td>TEC</td>
</tr>
<tr>
<td>WP4_ACS_002</td>
<td>Argumentation architecture: Edit a modular structure (argument architecture) associated with a system and/or component</td>
<td>Implemented</td>
<td>TEC</td>
</tr>
<tr>
<td>WP4_ACS_003</td>
<td>Drag and drop argumentation patterns</td>
<td>Implemented</td>
<td>TEC</td>
</tr>
<tr>
<td>WP4_ACS_004</td>
<td>Semi-automatic generation of process arguments</td>
<td>Pending</td>
<td>MDH</td>
</tr>
<tr>
<td>WP4_ACS_005</td>
<td>Provide support for language formalization inside argument claims</td>
<td>Implemented</td>
<td>TEC</td>
</tr>
<tr>
<td>WP4_ACS_010</td>
<td>Provide the capability of generating a compositional assurance case argument</td>
<td>Implemented</td>
<td>TEC</td>
</tr>
<tr>
<td>WP4_DAM_001</td>
<td>Capability to model relationships between concerns</td>
<td>Implemented</td>
<td>TEC</td>
</tr>
<tr>
<td>WP4_DAM_002</td>
<td>Capability to capture conflicts occurring during system development and the trade-off process</td>
<td>Implemented</td>
<td>TEC</td>
</tr>
<tr>
<td>WP4_ACS_007</td>
<td>Argumentation import/export</td>
<td>Implemented</td>
<td>AIT (TEC)</td>
</tr>
<tr>
<td>WP4_ACS_006</td>
<td>Provide guidelines for argumentation</td>
<td>Pending</td>
<td>AIT</td>
</tr>
<tr>
<td>WP4_SDCA_002</td>
<td>System dependability co-verification and co-validation</td>
<td>Implemented</td>
<td>AIT, ANSYS</td>
</tr>
<tr>
<td>WP4_SDCA_003</td>
<td>The system shall allow combinations of safety and security analysis</td>
<td>Implemented</td>
<td>AIT</td>
</tr>
<tr>
<td>WP4_CMA_003</td>
<td>Contract based multi-concern assurance</td>
<td>Implemented</td>
<td>INT</td>
</tr>
</tbody>
</table>

4.2 Test Cases

This section presents the set of test cases defined to validate the implementation of the Assurance Case Specification and Multi-concern assurance blocks of Prototype P1. The test cases are based on the use case scenarios defined in the D2.3 deliverable [6] for the concerned functionalities when existing.

<table>
<thead>
<tr>
<th>ID</th>
<th>WP4_TC_001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Edit an assurance case in a scalable way</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP4_ACS_001</td>
</tr>
<tr>
<td>Related use cases “Define and navigate an assurance case structure”</td>
<td></td>
</tr>
<tr>
<td>Input</td>
<td>A reference framework</td>
</tr>
<tr>
<td>Steps</td>
<td>1. Create an assurance project</td>
</tr>
</tbody>
</table>
2. Create a baseline from a big reference framework (ISO 26262)
3. Choose to create automatically the argumentation diagram
4. Browse the argument diagram elements
5. Create new elements, links
6. Update the elements
7. Delete some elements
8. Save the argumentation diagram
9. Create a diagram view
10. Drag and drop element from Outline menu to Diagram editor
11. Hide an element on the diagram
12. Delete an element on the diagram
13. Create a new diagram from the argumentation model

<table>
<thead>
<tr>
<th>Expected results</th>
<th>Modified assurance case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority</td>
<td>Must</td>
</tr>
</tbody>
</table>

**Table 25. Test Case WP4_TC_002 for WP4_ACS_010 functionality**

<table>
<thead>
<tr>
<th>ID</th>
<th>WP4_TC_002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Provide the capability of generating a compositional assurance case argument.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP4_ACS_010</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Define and navigate an assurance case structure”</td>
</tr>
<tr>
<td>Input</td>
<td>None</td>
</tr>
</tbody>
</table>
| Steps | For every argument module:  
1. Specify manually the claims set  
2. Provide stated and valid assumptions applied to the claims  
3. Specify contextual information to define or constraint the scope over which the arguments are assumed to be valid  
4. Map claims (away goals) to the external claims (public goals) that support to (in other argument modules) |
| Expected results | A compositionally defined assurance case |
| Priority | Must |

**Table 26. Test Case WP4_TC_003 for WP4_ACS_005 functionality**

<table>
<thead>
<tr>
<th>ID</th>
<th>WP4_TC_003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Provide support for language formalization inside argument claims.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP4_ACS_005</td>
</tr>
<tr>
<td>Related use cases</td>
<td>None</td>
</tr>
<tr>
<td>Input</td>
<td>An argumentation model</td>
</tr>
</tbody>
</table>
| Steps | 1. Create a vocabulary diagram  
2. Add categories and terms  
3. Open an argumentation diagram  
4. Edit the description of the elements using the defined terms  
5. Save the vocabulary on an xml file |
| Expected results | A vocabulary and an argumentation using it inside claims. |
| Priority | Must |

**Table 27. Test Case WP4_TC_004 for WP4_ACS_002 functionality**

<table>
<thead>
<tr>
<th>ID</th>
<th>WP4_TC_004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Argumentation architecture: edit a modular structure (argument architecture) associated with a system and/or component.</td>
</tr>
</tbody>
</table>
Functionality ID | WP4_ACS_002  
---|---
Related use cases | “Define and navigate an assurance case structure”  
Input | None  
Steps | In an argumentation diagram the user will:  
1. Define the appropriate granularity by using argument modules to encapsulate arguments.  
2. Inside each argument module, include appropriate arguments taking into account: hazard mitigation, requirements, and integration.  
3. Drag and drop argument module into the desired diagram of assurance case.  
Expected results | The modular assurance structure for a given project has been detailed.  
Priority | Must

Table 28. Test Case WP4_TC_005 for WP4_ACS_003 functionality

| ID | WP4_TC_005  
---|---
Scope | Argumentation architecture: edit a modular structure (argument architecture) associated with a system and/or component.  
Functionality ID | WP4_ACS_003  
Related use cases | “Reuse an argument pattern”  
Input | Assurance argumentation is under edition.  
Steps | 1. Library of patterns is available to be used in a specific assurance case model.  
2. Drag and drop argument pattern into the desired diagram of assurance case.  
4. Pattern parameters must be defined by the user.  
Expected results | Changes are registered  
Priority | Must

Table 29. Test Case WP4_TC_006 for WP4_ACS_002 functionality

| ID | WP4_TC_006  
---|---
Scope | Argumentation architecture: edit a modular structure (argument architecture) associated with a system and/or component.  
Functionality ID | WP4_ACS_002  
Related use cases | “Reuse an argument pattern”  
Input | A system architecture definition.  
Steps | 1. Select the component specification from the system component’s architecture specification to be connected.  
2. Select one of the architecture element (block, contract, ...).  
3. Open the assurance case structure view.  
4. Select one of the argument modules (claim, evidence, agreement)  
5. Connect the argument module with the system architecture by drag and drop in the “OpenCert” tab property of the architecture element.  
Expected results | System architecture and the assurance case specifications are correlated.  
Priority | Must

Table 30. Test Case WP4_TC_007 for WP4_DAM_001 and WP4_DAM_002 functionality

| ID | WP4_TC_007  
---|---
Scope | Capability to model relationships between concerns.  
Functionality ID | WP4_DAM_001, WP4_DAM_002  
Related use cases | “Specify impact of claims”  
Input | The current argumentation module has been created.  
The pieces of evidence addressed by the current project have been established.
Steps

For each of the claims referring to a specific concern
1. Analyse the impact of another claim
2. Specify the possible impact relationships described in D4.2 [17]:
   a) Dependency relationship,
   b) Conflicting relationship, or
   c) Supporting relationship

Expected results
The current Argumentation Module is under edition.

Priority
Must

Table 31. Test Case WP4_T0C_008 for WP4_DAM_001 functionality

<table>
<thead>
<tr>
<th>ID</th>
<th>WP4_T0C_008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Capability to model relationships between concerns</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP4_DAM_001</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Tag multi-concern to contracts”</td>
</tr>
<tr>
<td>Input</td>
<td>The contracts are already defined.</td>
</tr>
</tbody>
</table>
| Steps       | 1. The user selects an existing contract.
             | 2. The user associates selected contract to a property/concern. |
| Expected results | The contract has data associated referring the concern. |
| Priority    | Must |

Table 32. Test Case WP4_T0C_009 for WP4_ACS_007 functionality

<table>
<thead>
<tr>
<th>ID</th>
<th>WP4_T0C_009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Argumentation import/export.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP4_ACS_007</td>
</tr>
<tr>
<td>Related use cases</td>
<td>None</td>
</tr>
<tr>
<td>Input</td>
<td>Argumentation exported and imported</td>
</tr>
</tbody>
</table>
| Steps       | 1. The user edits an argumentation diagram.
             | 2. The user exports this argumentation model in a file.
             | 3. The user reuses this model to create a new argumentation diagram. |
| Expected results | Argumentation exported and imported. |
| Priority    | Must |

Table 33. Test Case WP4_T0C_010 for WP4_SDCA_002 functionality

<table>
<thead>
<tr>
<th>ID</th>
<th>WP4_T0C_010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>System dependability co-verification and co-validation.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP4_SDCA_002</td>
</tr>
<tr>
<td>Related use cases</td>
<td>None</td>
</tr>
<tr>
<td>Input</td>
<td>Dependability workflow engine (WEFACT) and Co-V&amp;V tools</td>
</tr>
</tbody>
</table>
| Steps       | 1. Define the requirements to be verified and validated
             | 2. Create a Co-V&V Process (e.g., Verification of safety and Security concepts)
             | 3. Link Requirement to Process
             | 4. Create Co-V&V Tools
             | 5. Link Tools to process
             | 6. Execute a process step
             | 7. Collect the Tools outputs in Co-V&V engine |
| Expected results | Outputs or Co-V&V tools, such as FMVEA tables or FT&AT. |
| Priority    | Must |
### Table 34. Test Case WP4_TC_011 for WP4_SDCA_003 functionality

<table>
<thead>
<tr>
<th>ID</th>
<th>WP4_TC_011</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope</strong></td>
<td>The system shall allow combinations of safety and security analysis.</td>
</tr>
<tr>
<td><strong>Functionality ID</strong></td>
<td>WP4_SDCA_003</td>
</tr>
<tr>
<td><strong>Related use cases</strong></td>
<td>“Define/Perform Safety/Security Analysis”</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td>System/component definition fully specified at the planned analysis level.</td>
</tr>
</tbody>
</table>
| **Steps** | 1. Identify assets to be protected  
2. Select appropriate method and tool  
3. Decide on which level to analyse the (Sub-)System/Component  
4. Identify for each item all conceivable failure and threat modes with all possible causes and vulnerabilities and assess possibility to detect the failures/attacks  
5. Identify mitigation measures already in place |
| **Expected results** | Safety and Security artefacts (FMVEA or FT&AT) generated by the tool for Safety/Security Analysis. |
| **Priority** | Must |

### Table 35. Test Case WP4_TC_012 for WP4_CMA_003 functionality

<table>
<thead>
<tr>
<th>ID</th>
<th>WP4_TC_012</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope</strong></td>
<td>The system must provide features that support contract based assurance with respect to multiple concerns; i.e. it must be possible to specify relations between safety contracts, security contracts and other-concerns-related contracts in order to take care of the influence of system modifications for mitigating the risks associated with one quality attribute on the contract belonging to another quality attribute.</td>
</tr>
<tr>
<td><strong>Functionality ID</strong></td>
<td>WP4_CMA_003</td>
</tr>
<tr>
<td><strong>Related use cases</strong></td>
<td>“Tag multi-concerns to contracts”</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td>CHESS project with the formal property already defined.</td>
</tr>
</tbody>
</table>
| **Steps** | 1. Select the formal property (in the “Model Explorer” view) or the corresponding graphical representation (in the Diagram editor).  
2. In the “Property” view – Profile Tab, FormalProperty – concern, select the concern (unspecified/safety/security/performance). |
| **Expected results** | The concern is specified for the formal property |
| **Priority** | Must |

### 4.3 Test Results

Table 36 presents, for each test case defined for the implemented Assurance Case Specification and Multi-concern assurance functionalities, the results of the execution, the status, a rationale when the execution failed and finally the AMASS project partner who is responsible for the validation of the test case. The functionalities are detailed in the AMASS User manual [4].

The test cases have been performed with the following machine configurations: Windows 10 Enterprise (64 bits) operating system, Intel(R) Core(TM) i7-6700HQ and i7-5600U processors, CPU @ 2.60 GHz, 16 GB of RAM. The instructions to install the used testing environment are described in the AMASS Developer Guide [5].

Between the twelve test cases that have been defined, eight test cases were successfully PASSED, three test cases were executed with the status PASSED_BUT, and one test case FAILED.
## Table 36. Test results for the WP4 implemented functionalities

<table>
<thead>
<tr>
<th>Test Case ID</th>
<th>Execution Results</th>
<th>Status</th>
<th>Rationale</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP4_TC_001</td>
<td>An argumentation model</td>
<td>Passed_But</td>
<td>Step 11: “Delete from diagram” menu option is always greyed.</td>
<td>CEA</td>
</tr>
<tr>
<td>WP4_TC_002</td>
<td>A compositionally defined assurance case</td>
<td>Passed</td>
<td></td>
<td>CEA</td>
</tr>
<tr>
<td>WP4_TC_003</td>
<td>A vocabulary and an argumentation using it inside claims</td>
<td>Failed</td>
<td>We created a vocabulary, both on a file or in the remote repository. However, we did not succeed in associating the vocabulary to the assurance case. When we use CTRL-SPACE during claim editing, nothing happens.</td>
<td>CEA</td>
</tr>
<tr>
<td>WP4_TC_004</td>
<td>A modular assurance structure</td>
<td>Passed</td>
<td></td>
<td>CEA</td>
</tr>
<tr>
<td>WP4_TC_005</td>
<td>An assurance argumentation</td>
<td>Passed</td>
<td></td>
<td>CEA</td>
</tr>
<tr>
<td>WP4_TC_006</td>
<td>A system architecture definition</td>
<td>Passed</td>
<td></td>
<td>CEA</td>
</tr>
<tr>
<td>WP4_TC_007</td>
<td>An argumentation module</td>
<td>Passed</td>
<td></td>
<td>CEA</td>
</tr>
<tr>
<td>WP4_TC_008</td>
<td>Contracts with associated concern</td>
<td>Passed</td>
<td></td>
<td>CEA</td>
</tr>
<tr>
<td>WP4_TC_009</td>
<td>Argumentation exported and imported</td>
<td>Passed</td>
<td></td>
<td>CEA</td>
</tr>
<tr>
<td>WP4_TC_010</td>
<td>Outputs or Co-V&amp;V tools, such as FMVEA tables or FT&amp;AT</td>
<td>Passed_But</td>
<td>WEFACT tool is installed perfectly thanks to WEFACT Handbook. The test steps are executed but a Co-V&amp;V tool is not available for the full test.</td>
<td>A4T</td>
</tr>
<tr>
<td>WP4_TC_011</td>
<td>Safety and Security artefacts (FMVEA or FT&amp;AT) generated by the tool for Safety/Security Analysis</td>
<td>Passed_But</td>
<td>WEFACT tool is installed and linked to Safety and Security tools for separated Safety and Security analysis, but the combined safety and security analysis is not ready for the full test.</td>
<td>A4T</td>
</tr>
<tr>
<td>WP4_TC_012</td>
<td>The concern is specified for the formal property</td>
<td>Passed</td>
<td></td>
<td>FBK</td>
</tr>
</tbody>
</table>
5. Testing and Validation for WP5-related Blocks

5.1 Functionalities

The functionalities concerning Evidence Management and Seamless interoperability blocks are defined in the D2.1 deliverable [7]. Table 37 is an excerpt of these functionalities, their implementation status and the AMASS project partner who is responsible for the validation of the test case. Three functionalities among the ten identified for this Prototype iteration have not been implemented and postponed for the next version of the AMASS platform.

Table 37. Evidence Management and seamless interoperability functionalities

<table>
<thead>
<tr>
<th>ID</th>
<th>Functionality</th>
<th>Status</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP5_EM_006</td>
<td>Evidence information export</td>
<td>Implemented</td>
<td>TEC, UC3, TRC</td>
</tr>
<tr>
<td>WP5_EM_008</td>
<td>Visualization of chains of evidence</td>
<td>Pending</td>
<td>AMT, INT</td>
</tr>
<tr>
<td>WP5_EM_009</td>
<td>Suggestion of evidence traces</td>
<td>Pending</td>
<td>UC3, TRC</td>
</tr>
<tr>
<td>WP5_EM_012</td>
<td>Evidence trace verification</td>
<td>Pending</td>
<td>UC3, TRC</td>
</tr>
<tr>
<td>WP5_EM_015</td>
<td>Resource part selection</td>
<td>Implemented</td>
<td>AMT</td>
</tr>
<tr>
<td>WP5_TI_018</td>
<td>Extended standard-based interoperability</td>
<td>Implemented</td>
<td>UC3, TRC, FBK, HON</td>
</tr>
<tr>
<td>WP5_TI_017</td>
<td>Standards-based interoperability</td>
<td>Implemented</td>
<td>UC3, TRC, FBK, HON</td>
</tr>
<tr>
<td>WP5_TI_003</td>
<td>Tool chain deployment support</td>
<td>Implemented</td>
<td>UC3, TRC, FBK, HON</td>
</tr>
<tr>
<td>WP5_TI_005</td>
<td>System specification tools interoperability</td>
<td>Implemented</td>
<td>UC3, TRC, FBK</td>
</tr>
<tr>
<td>WP5_TI_006</td>
<td>V&amp;V tools interoperability</td>
<td>Implemented</td>
<td>UC3, TRC, FBK, HON, UOM</td>
</tr>
</tbody>
</table>

5.2 Test Cases

Table 38 in this section defines the test cases to validate the implementation of the Evidence Management and Seamless interoperability basic building blocks of the Prototype Core. The test cases are based on the use case scenarios defined in the D2.3 deliverable [6] for the concerned functionalities when existing.

Table 38. Test Case WP5_TC_001 for WP5_EM_006 functionality

<table>
<thead>
<tr>
<th>ID</th>
<th>WP5_TC_001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Evidence information export</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP5_EM_006</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Link Artefact with External Tool”</td>
</tr>
<tr>
<td>Input</td>
<td>Assurance Project. An Artefact has been created.</td>
</tr>
<tr>
<td>Steps</td>
<td>1. Select an Artefact</td>
</tr>
<tr>
<td></td>
<td>2. Add a Resource to the Artefact</td>
</tr>
<tr>
<td>Expected results</td>
<td>Exported data to the external tool.</td>
</tr>
<tr>
<td>Priority</td>
<td>Must</td>
</tr>
</tbody>
</table>
Table 39. Test Case WP5_TC_002 for WP5_TI_006 functionality

<table>
<thead>
<tr>
<th>ID</th>
<th>WP5_TC_002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>V&amp;V tools interoperability</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP5_TI_006</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Specify Tool Connection Information”</td>
</tr>
<tr>
<td>Input</td>
<td>System / component model with formal properties and contracts</td>
</tr>
<tr>
<td>Steps</td>
<td>1. Setup external V&amp;V tools</td>
</tr>
<tr>
<td></td>
<td>2. Check contract refinement using external V&amp;V tool</td>
</tr>
<tr>
<td></td>
<td>3. Check contract implementation using external V&amp;V tool</td>
</tr>
<tr>
<td></td>
<td>4. Verify V&amp;V tool results</td>
</tr>
<tr>
<td>Expected results</td>
<td>External V&amp;V tools produce adequate (expected) results</td>
</tr>
<tr>
<td>Priority</td>
<td>Should</td>
</tr>
</tbody>
</table>

Table 40. Test Case WP5_TC_003 for WP5_TI_003 functionality

<table>
<thead>
<tr>
<th>ID</th>
<th>WP5_TC_003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Toolchain deployment</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP5_TI_003</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Characterise Toolchain”</td>
</tr>
<tr>
<td>Input</td>
<td>External tools</td>
</tr>
<tr>
<td>Steps</td>
<td>1. Configure at least two tools that will be part of a toolchain</td>
</tr>
<tr>
<td></td>
<td>2. Configure at least one interaction between those tools</td>
</tr>
<tr>
<td></td>
<td>3. Connect both tools</td>
</tr>
<tr>
<td></td>
<td>4. Verify the connection and validate the expected result</td>
</tr>
<tr>
<td>Expected results</td>
<td>Tool chains can be “characterized” aka configured.</td>
</tr>
<tr>
<td>Priority</td>
<td>Can</td>
</tr>
</tbody>
</table>

Table 41. Test Case WP5_TC_004 for WP5_EM_015 functionality

<table>
<thead>
<tr>
<th>ID</th>
<th>WP5_TC_004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Resource part selection</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP5_EM_015</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Link Artefact with External Tool”</td>
</tr>
<tr>
<td>Input</td>
<td>An Artefact has been created</td>
</tr>
<tr>
<td>Steps</td>
<td>1. The Assurance Manager selects an Artefact</td>
</tr>
<tr>
<td></td>
<td>2. The Assurance Manager adds a Resource to the Artefact</td>
</tr>
<tr>
<td></td>
<td>3. The Assurance Manager specifies the information about an External Tool in the Resource</td>
</tr>
<tr>
<td></td>
<td>4. The Assurance Manager selects a part of the Resource</td>
</tr>
<tr>
<td></td>
<td>5. The AMASS Platform retrieves data from the external tool</td>
</tr>
<tr>
<td></td>
<td>6. The AMASS Platform exports data to the external tool</td>
</tr>
<tr>
<td>Expected results</td>
<td>The link with the external tool is stored in the AMASS Platform.</td>
</tr>
<tr>
<td>Priority</td>
<td>Should</td>
</tr>
</tbody>
</table>

Table 42. Test Case WP5_TC_005 for WP5_TI_017 and WP5_TI_018 functionalities

<table>
<thead>
<tr>
<th>ID</th>
<th>WP5_TC_005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Extended standard-based interoperability</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP5_TI_017, WP5_TI_018</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Characterise Toolchain”</td>
</tr>
<tr>
<td>Input</td>
<td>Tool information is available in the AMASS Tool Platform.</td>
</tr>
<tr>
<td>Steps</td>
<td>1. The Assurance Manager selects the tools that will be part of the toolchain.</td>
</tr>
</tbody>
</table>
2. The Assurance Manager specifies the interactions between the tools.
3. The Assurance Manager specifies the necessary information to enable the toolchain.
4. The Assurance Manager is informed about the success of toolchain connection.
5. The Assurance Manager will be notified of the specified interactions between tools that are not supported.

**Expected results**
The toolchain information is available in the AMASS Tool Platform.

**Priority**
Must

### Table 43. Test Case WP5_TC_006 for WP5_TI_005 functionality

<table>
<thead>
<tr>
<th>ID</th>
<th>WP5_TC_006</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope</strong></td>
<td>System specification tools interoperability</td>
</tr>
<tr>
<td><strong>Functionality ID</strong></td>
<td>WP5_TI_005</td>
</tr>
<tr>
<td><strong>Related use cases</strong></td>
<td>“Specify Tool Connection Information”</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td>None</td>
</tr>
</tbody>
</table>
| **Steps** | 1. The Assurance Manager creates a new tool connection.  
2. The Assurance Manager specifies the required information to the tool connection.  
3. The Assurance Manager is provided information about the success of the tool connection.  
4. The required tool connection information can vary among tools, and it can include user, password, and a URL.  
Alternatives can be offered for connection with a tool, e.g. ad-hoc connection or OSLC-based. |
| **Expected results** | The tool connection information is available in the AMASS Tool Platform. |
| **Priority** | Should |

### 5.3 Test Results

Table 44 presents, for each test case defined for the implemented Evidence Management and Seamless interoperability functionalities, the results of the execution, the status, a rationale when the execution failed and the AMASS project partner who is responsible for the validation of the test case. The installation instructions for the tools used for the validation are provided in the AMASS Developer Guide [5]. The AMASS user manual [4] was used to understand how the selected functionalities were working.

The test case WP5_TC_001 has been performed with the following machine configuration: Windows 10 Enterprise (64 bits) operating system, Intel(R) Core(TM) i7-6700HQ processor, CPU @ 2.60 GHz, 16 GB of RAM. The test cases WP5_TC_002 and WP5_TC_003 have been performed on Windows 7 Professional (64 bit) with Intel Xeon @ 2.8 GHZ CPU(W3530) with 12GB of RAM.

Between the six test cases that have been defined, one test case was successfully PASSED and five test cases FAILED.

### Table 44. Test results for the WP5 implemented functionalities

<table>
<thead>
<tr>
<th>Test Case ID</th>
<th>Execution Results</th>
<th>Status</th>
<th>Rationale</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP5_TC_001</td>
<td>Exported data to the external tool</td>
<td>Passed</td>
<td></td>
<td>A4T</td>
</tr>
<tr>
<td>WP5_TC_002</td>
<td></td>
<td>Failed</td>
<td>Incomplete test procedure. V&amp;V tool setup partially passed, however, setup of system model with contracts and</td>
<td>AMT</td>
</tr>
<tr>
<td>Test Case</td>
<td>Status</td>
<td>Reason</td>
<td>Responsible Party</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
<td>------------------------------------------------------------------------</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td>WP5_TC_003</td>
<td>Failed</td>
<td>Missing tool features. This test failed due to missing tool functionality. External tools can be used in various places but there is neither a feature to “characterize” (model) them nor any mean to model toolchains.</td>
<td>AMT</td>
<td></td>
</tr>
<tr>
<td>WP5_TC_004</td>
<td>Failed</td>
<td>Nothing is said in the manual concerning how to specify a part of a resource. The implementation progress notes that Capra could provide support for it but no detail is given.</td>
<td>CEA</td>
<td></td>
</tr>
<tr>
<td>WP5_TC_005</td>
<td>Failed</td>
<td>The only use case associated to this requirement is “Characterize toolchain”. Nothing is said in the manual concerning the definition of toolchains.</td>
<td>CEA</td>
<td></td>
</tr>
<tr>
<td>WP5_TC_006</td>
<td>Failed</td>
<td>The requirement “WP5_TI_005” is too vague. It should better characterize the tools addressed. Neither the implementation progress nor the D5.5 [10], explain how this requirement is solved. We have considered that it is related to the use of OSLC-KM to access Papyrus models. We have tried to test it (import Papyrus model as evidence) but the corresponding web-services do not respond.</td>
<td>CEA</td>
<td></td>
</tr>
</tbody>
</table>
6. Testing and Validation for WP6-related Blocks

6.1 Functionalities

Table 45 is an excerpt of some functionalities defined in the D2.1 deliverable [7] for Compliance management and Cross and intra-domain reuse. It presents their implementation status and the AMASS project partner who is responsible for their validation. Among the planned functionalities for prototype P1, thirteen functionalities have been implemented and two functionalities are still pending at the time of the validation.

Table 45. Compliance Management and cross and intra-domain reuse functionalities

<table>
<thead>
<tr>
<th>ID</th>
<th>Functionality</th>
<th>Status</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP6_CM_002</td>
<td>Tailoring of Standards models to specific projects</td>
<td>Implemented</td>
<td>MDH + TEC</td>
</tr>
<tr>
<td>WP6_CM_005</td>
<td>Compliance Monitoring</td>
<td>Implemented</td>
<td>MDH + TEC</td>
</tr>
<tr>
<td>WP6_CM_008</td>
<td>Process Compliance (informal) management</td>
<td>Implemented</td>
<td>TEC</td>
</tr>
<tr>
<td>WP6_CM_006</td>
<td>Compliance status to externals.</td>
<td>Pending</td>
<td>MDH + TEC</td>
</tr>
<tr>
<td>WP6_CM_001</td>
<td>Retrieving, digitalizing and storing of a set of industrial standards (including the parts, objectives, practices, goals/requirements, criticality levels from the standards).</td>
<td>Implemented</td>
<td>TEC</td>
</tr>
<tr>
<td>WP6_RA_001</td>
<td>Intra-Domain, Intra standard, Reuse Assistance</td>
<td>Implemented</td>
<td>TEC</td>
</tr>
<tr>
<td>WP6_RA_002</td>
<td>Intra-Domain, Cross standards, Reuse Assistance</td>
<td>Implemented</td>
<td>TEC</td>
</tr>
<tr>
<td>WP6_RA_003</td>
<td>Intra-Domain, Cross versions, Reuse Assistance</td>
<td>Implemented</td>
<td>TEC</td>
</tr>
<tr>
<td>WP6_RA_004</td>
<td>Cross-Domain Reuse Assistance</td>
<td>Implemented</td>
<td>TEC</td>
</tr>
<tr>
<td>WP6_RA_005</td>
<td>Intra-Domain, Intra standard, Different Stakeholders, Reuse/Integration Assistance</td>
<td>Pending</td>
<td>TEC</td>
</tr>
<tr>
<td>WP6_RA_006</td>
<td>Reuse of pre-developed components and their accompanying artefact.</td>
<td>Implemented</td>
<td>TRC</td>
</tr>
<tr>
<td>WP6_PPA_001</td>
<td>The AMASS tools must support variability management at process level</td>
<td>Implemented</td>
<td>MDH</td>
</tr>
<tr>
<td>WP6_PPA_002</td>
<td>Semi-automatic generation of product arguments</td>
<td>Implemented</td>
<td>MDH</td>
</tr>
<tr>
<td>WP6_PPA_003</td>
<td>Semi-automatic generation of process arguments</td>
<td>Implemented</td>
<td>MDH</td>
</tr>
<tr>
<td>WP6_PPA_004</td>
<td>The AMASS tools must support management of variability at the component level</td>
<td>Implemented</td>
<td>MDH</td>
</tr>
</tbody>
</table>

6.2 Test Cases

Table 46 and Table 47 in this section define the test cases to validate the implementation of the Compliance management and Cross and intra-domain reuse functionalities. The test cases have been defined based on the use case scenarios defined in the D2.3 deliverable [6] for the concerned functionalities when existing.

Table 46. Test Case WP6_TC_001 for WP6_CM_001 functionality

<table>
<thead>
<tr>
<th>ID</th>
<th>WP6_TC_001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Retrieve, digitalize and store a set of norms, recommendations, standards, or quality models.</td>
</tr>
</tbody>
</table>
### Functionality ID

**WP6_CM_001**

### Related use cases

“Capture information from standards”

### Input

Standard information

### Steps

1. Create a new standard model.
2. Specify the characteristics that define the standard in the properties view.
3. Structure/Categorize the standard by parts, objectives, activities, practices, goals and requirements.
4. Describe the parts, objectives, activities, practices, goals and requirements contained in the standard in the properties view.

### Expected results

Standard model

### Priority

Must

---

**Table 47.** Test Case WP6_TC_002 for WP6_RA_006 functionality

<table>
<thead>
<tr>
<th>ID</th>
<th>WP6_TC_002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Reuse of pre-developed components and their accompanying artefact.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP6_RA_006</td>
</tr>
<tr>
<td>Related use cases</td>
<td>None</td>
</tr>
<tr>
<td>Input</td>
<td>Pre-developed components and their accompanying artefact.</td>
</tr>
<tr>
<td>Steps</td>
<td>None</td>
</tr>
<tr>
<td>Expected results</td>
<td>Import of pre-developed components and their accompanying artefact.</td>
</tr>
<tr>
<td>Priority</td>
<td>Must</td>
</tr>
</tbody>
</table>

---

**Table 48.** Test Case WP6_TC_003 for WP6_RA_001, WP6_RA_005 functionalities

<table>
<thead>
<tr>
<th>ID</th>
<th>WP6_TC_003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Intra-Domain, Intra standard, Reuse Assistance</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP6_RA_001, WP6_RA_005</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Assist for Cross-System Assurance Assets Reuse”</td>
</tr>
</tbody>
</table>
| Input | • A source assurance project which includes assurance assets (evidence, process, argumentation, compliance models).
• A target assurance project. |
| Steps | 1. The actor opens the newly created assurance project (target project), starts the reuse assistant, and selects the reusable assurance project (source project).
2. A number of assurance models from the source project are available for navigation, including evidence, process, argumentation and baseline (compliance information) models and can be individually selected.
3. Once selected a specific model in the source project, the actor can call the impact analysis functionality to select model elements and visualise the dependent (impacted) model elements.
4. Additional selection criteria can be applied such as e.g. subset of assurance assets associated to a given criticality level.
5. Once selected all the desired model elements to be reused from the various models, the actor can store the subset before executing the reuse operation. |
| Expected results | AMASS models updated according to the reuse scope, including evidence models, argumentation models, process models and compliance information. |
| Priority | Must |
Table 49. Test Case WP6_TC_004 for WP6_CM_002 functionality

<table>
<thead>
<tr>
<th>ID</th>
<th>WP6_TC_004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Create, modify and drop assurance information.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP6_CM_002</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Manage Assurance Project”</td>
</tr>
<tr>
<td>Input</td>
<td>Library and configuration models exported from EPF.</td>
</tr>
<tr>
<td>Steps</td>
<td>1. Import process related information from EPF.</td>
</tr>
<tr>
<td>Expected results</td>
<td>Process and Artefact (Evidence) models.</td>
</tr>
<tr>
<td>Priority</td>
<td>Must</td>
</tr>
</tbody>
</table>

Table 50. Test Case WP6_TC_005 for WP6_CM_002, WP6_CM_008 functionalities

<table>
<thead>
<tr>
<th>ID</th>
<th>WP6_TC_005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Create, modify and drop assurance information.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP6_CM_002, WP6_CM_008</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Manage Assurance Project”</td>
</tr>
<tr>
<td>Input</td>
<td>A model containing information of the standard available in the platform</td>
</tr>
<tr>
<td>Steps</td>
<td>1. Create a new assurance project</td>
</tr>
<tr>
<td></td>
<td>2. Specify the baseline in association with a standard which will be followed in the project</td>
</tr>
<tr>
<td></td>
<td>3. Specify the compliance maps/links through the project lifecycle.</td>
</tr>
<tr>
<td>Expected results</td>
<td>Assurance Project</td>
</tr>
<tr>
<td>Priority</td>
<td>Must</td>
</tr>
</tbody>
</table>

Table 51. Test Case WP6_TC_006 for WP6_CM_005 functionality

<table>
<thead>
<tr>
<th>ID</th>
<th>WP6_TC_006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Information about the assurance activities.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP6_CM_005</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Monitor Assurance Project Status”</td>
</tr>
<tr>
<td>Input</td>
<td>Assurance project in the platform.</td>
</tr>
<tr>
<td>Steps</td>
<td>1. Select an assurance project</td>
</tr>
<tr>
<td></td>
<td>2. Define a filter to find specific compliance information</td>
</tr>
<tr>
<td>Expected results</td>
<td>Compliance information</td>
</tr>
<tr>
<td>Priority</td>
<td>Must</td>
</tr>
</tbody>
</table>

Table 52. Test Case WP6_TC_007 for WP6_RA_002, WP6_RA_003, WP6_RA_004 functionality

<table>
<thead>
<tr>
<th>ID</th>
<th>WP6_TC_007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Intra-Domain, Intra/Cross standards, Cross versions, Reuse Assistance</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP6_RA_002, WP6_RA_003, WP6_RA_004</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Assist for Cross-Standards Assurance Assets Reuse”</td>
</tr>
<tr>
<td>Input</td>
<td>• A source assurance project which includes assurance assets (evidence, process, argumentation, compliance models)</td>
</tr>
<tr>
<td></td>
<td>• It exists an equivalence map model between the source and target standards</td>
</tr>
<tr>
<td></td>
<td>• A target assurance project based in a standard model with equivalence maps with the standards model in which is based the source assurance project.</td>
</tr>
<tr>
<td>Steps</td>
<td>1. The actor opens the newly created assurance project (target project), starts the reuse assistant, and selects the reusable assurance project (source project).</td>
</tr>
</tbody>
</table>
2. Assurance models from the target project can already exist or may be created automatically. In the latter case, the model elements will follow the same structure and naming as the standards (baseline in this case) model.

3. A number of assurance models from the target project are available for navigation, including evidence, process, argumentation and baseline (compliance information) models and can be individually selected.

4. Once a source model element is selected, the actor can discover reuse opportunities by using equivalence maps (extended use case).

5. Once selected all the desired model elements to be reused from the various models, the actor can store the subset before executing the reuse operation. Storing the subset of assets permits to check the actions that need to be performed before executing them. This is important for example if it is necessary to have an internal approval or if the user wants to check the impact of the operation before executing it.

Expected results
AMASS models updated according to the reuse scope, including evidence models, argumentation models, process models and compliance information

Priority
Must

Table 53. Test Case WP6_TC_008 for WP6_RA_002, WP6_RA_003, WP6_RA_004 functionalities

<table>
<thead>
<tr>
<th>ID</th>
<th>WP6_TC_008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Intra-Domain, Intra/Cross standards, Cross versions, Reuse Assistance.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP6_RA_002, WP6_RA_003, WP6_RA_004</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Discover Reuse Opportunities by using Standards Equivalences”</td>
</tr>
<tr>
<td>Input</td>
<td>An equivalence map model between the source and target standards.</td>
</tr>
</tbody>
</table>
| Steps | 1. Select target model elements.  
  2. Visualise the equivalent model elements in the source assurance projects.  
  3. Look at the reuse post-conditions identified in the equivalence map model.  
  4. Decide if the reusable element will be selected for reuse. |
| Expected results | Identification of model elements with associated equivalence standard model elements. |
| Priority | Must |

Table 54. Test Case WP6_TC_009 for WP6_RA_001, WP6_RA_002, WP6_RA_003, WP6_RA_004, WP6_RA_005 functionalities

<table>
<thead>
<tr>
<th>ID</th>
<th>WP6_TC_009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Intra/Cross-Domain, Intra/Cross standard, Cross versions, Different Stakeholders, Reuse/Integration Assistance</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP6_RA_001, WP6_RA_002, WP6_RA_003, WP6_RA_004, WP6_RA_005</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Reuse Selected Assurance Assets”</td>
</tr>
<tr>
<td>Input</td>
<td>A subset of assurance assets has been selected.</td>
</tr>
</tbody>
</table>
| Steps | 1. Visualise the subset of selected assurance assets  
  2. Perform reuse operation  
  3. Visualise results of the reuse operation |
| Expected results | Copy operation in the AMASS repository. |
| Priority | Must |

Table 55. Test Case WP6_TC_010 for WP6_PPA_001 functionality

<table>
<thead>
<tr>
<th>ID</th>
<th>WP6_TC_010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>AMASS tools must support variability management at process level.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP6_PPA_001</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Manage process variability”</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Input</td>
<td>A Process library (Base Model)</td>
</tr>
</tbody>
</table>
| Steps             | 1. The user imports the Base Model into a project.  
|                   | 2. The user manages variability via the Variability, Resolution, an Realization editors.  
|                   | 3. The user generates/exports the new process model, obtained as tailoring of the Base Model. |
| Expected results  | A new Base Model. |
| Priority          | Must |

Table 56. Test Case WP6_TC_011 for WP6_PPA_002 functionality

<table>
<thead>
<tr>
<th>ID</th>
<th>WP6_TC_011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Semi-automatic generation of product arguments.</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP6_PPA_002</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Semi-automatic generation of product arguments”</td>
</tr>
<tr>
<td>Input</td>
<td>Strong and weak component contracts shall be already defined and associated with claims, context statements and evidence artefacts. The weak contracts shall be either selected for usage in the given context, or all weak contract assumptions shall be validated. The contract refinement analysis shall be already performed, either for the selected contracts, or for all the weak contracts.</td>
</tr>
</tbody>
</table>
| Steps       | 1. The user selects the “Generate argumentation fragments” functionality.  
|             | 2. The user selects either new or existing assurance project as the destination for the argument-fragments.  
|             | 3. The ARTA validates the system model and extract the information needed for the argument-fragment generation for each component.  
|             | 4. The ARTA generates the corresponding argument-fragments, and notifies the user of their location. |
| Expected results | An argument model with the argument fragments included. |
| Priority    | Should |

Table 57. Test Case WP6_TC_012 for WP6_PPA_003 functionality

<table>
<thead>
<tr>
<th>ID</th>
<th>WP6_TC_012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Semi-automatic generation of process arguments</td>
</tr>
<tr>
<td>Functionality ID</td>
<td>WP6_PPA_003</td>
</tr>
<tr>
<td>Related use cases</td>
<td>“Automatic generation of process arguments”</td>
</tr>
<tr>
<td>Input</td>
<td>A process model</td>
</tr>
</tbody>
</table>
| Steps       | 1. The user selects the “Generate argumentation fragments” functionality.  
|             | 2. The user selects either new or existing assurance project as the destination for the argument-fragments.  
|             | 3. The information needed for the argument-fragment generation is extracted from the process model.  
|             | 4. The corresponding argument-fragments are generated; the location is notified to the user. |
| Expected results | An argument model with the argument fragments included. |
| Priority    | Should |

Table 58. Test Case WP6_TC_013 for WP6_PPA_004 functionality

<table>
<thead>
<tr>
<th>ID</th>
<th>WP6_TC_013</th>
</tr>
</thead>
</table>
### Scope
The AMASS tools must support management of variability at the component level.

### Functionality ID
WP6_PPA_004

### Related use cases
“Manage product variability”

### Input
A component warehouse (Base Model)

### Steps
1. The user manages variability via the variability, resolution, realization editors.
2. The user generates/export the new component model, obtained as tailoring of the Base Model.

### Expected results
A new component model.

### Priority
Shall

## 6.3 Test Results

Table 59 presents, for each test case defined for WP6 related functionalities, the results of the execution, the status, a rationale when the execution was not fully satisfying the expected results, and the AMASS project partner who is responsible for the validation of the test case.

The installation instructions for the validation environment and the description of the selected functionalities are respectively found in the AMASS Developer Guide [5] and the AMASS User Manual [4]. As testing data, we use a database backup containing examples of assurance project and evidence model. We also used some files exported from EPF tool for the process model.

The test cases have been performed with the following machine configuration: Windows 7 Enterprise (64 bits) operating system, Intel Core i7-56000U processor, CPU @ 2.60 GHz, 16 GB of RAM.

Between the thirteen test cases that have been defined, three test cases were successfully PASSED, one test case was executed with the status PASSED_BUT, and one test case FAILED.

### Table 59. Test results for the WP6 implemented functionalities

<table>
<thead>
<tr>
<th>Test Case ID</th>
<th>Execution Results</th>
<th>Status</th>
<th>Rationale</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP6_TC_001</td>
<td>A standard’s model with its characteristics</td>
<td>Passed_But</td>
<td>The argumentation model is not generated from the baseline, but together with the baseline from a new assurance project creation. When a different baseline is created, we are not able to generate the corresponding argumentation model.</td>
<td>CEA, AMT</td>
</tr>
<tr>
<td>WP6_TC_002</td>
<td>Import of pre-developed components and their accompanying artefact</td>
<td>Failed</td>
<td>No description of an usage scenario defined in D2.3 deliverable [6][6].</td>
<td>VIF</td>
</tr>
<tr>
<td>WP6_TC_003</td>
<td>Postponed</td>
<td></td>
<td>Consistent requirement information, (owner, allocated prototype, implementation status)</td>
<td></td>
</tr>
</tbody>
</table>

5 The EPF files used are located in the SVN repository: [https://services-medini.kpit.com/svn/AMASS_collab/WP-transversal/ImplementationTeam/PrototypeCore/Vaditation_Data/EPF/Exported XML](https://services-medini.kpit.com/svn/AMASS_collab/WP-transversal/ImplementationTeam/PrototypeCore/Vaditation_Data/EPF/Exported XML)
| WP6_TC_004 | Process and artefact models imported from EPF. | Passed | CEA |
| WP6_TC_005 | An Assurance Project with compliance links done. Summary can be checked through the mapping table. | Passed | CEA |
| WP6_TC_006 | The Compliance information related to a specific element type (activity, requirement, etc.). | Passed | CEA |
| WP6_TC_007 | | Postponed | Consistent requirement information, (owner, allocated prototype, implementation status) were not available at the time of the validation |
| WP6_TC_008 | | Postponed | Consistent requirement information, (owner, allocated prototype, implementation status) were not available at the time of the validation |
| WP6_TC_009 | | Postponed | Consistent requirement information, (owner, allocated prototype, implementation status) were not available at the time of the validation |
| WP6_TC_010 | | Postponed | Consistent requirement information, (owner, allocated prototype, implementation status) were not available at the time of the validation |
| WP6_TC_011 | | Postponed | Consistent requirement information, (owner, allocated prototype, implementation status) were not available at the time of the validation |
| WP6_TC_012 | | Postponed | Consistent requirement information, (owner, allocated prototype, implementation status) were not available at the time of the validation |
| WP6_TC_013 | Postponed | Consistent requirement information, (owner, allocated prototype, implementation status) were not available at the time of the validation |
7. Prototype P1 Validation Synthesis

7.1 Analysis of Test Results

Table 60 summarizes the implementation status of the planned functionalities at the time of the release of the prototype P1. In total, 50 functionalities have been planned for the prototype P1: 11 functionalities have been postponed, while 39 functionalities have successfully been implemented.

Table 60. Prototype P1 Implementation Status

<table>
<thead>
<tr>
<th>Functionalities</th>
<th>WP3 related functionalities</th>
<th>WP4 related functionalities</th>
<th>WP5 related functionalities</th>
<th>WP6 related functionalities</th>
<th>AMASS prototype P1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implemented</td>
<td>8</td>
<td>11</td>
<td>7</td>
<td>13</td>
<td>39</td>
</tr>
<tr>
<td>Pending</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>13</td>
<td>10</td>
<td>15</td>
<td>50</td>
</tr>
</tbody>
</table>

We have defined 50 test cases to test and validate the (39) implemented functionalities: Nineteen test cases have been successfully PASSED. Fifteen test cases result with the status PASSED_BUT, seven test cases FAILED to provide the expected results. Finally, night test cases have been postponed for being tested during next validation.

For each test case with the status FAILED or PASSED_BUT, we have created a ticket corresponding to each problem identified in the software or user guide in the AMASS wiki to report them to the implementation responsible. It results in 13 opened tickets. In priority, we must address the problems described in these tickets with respect to new developments and implement the pending functionalities before tackling the prototype P2 functionalities implementation. The future D2.8 deliverable about the final validation of AMASS Platform will review these tickets statuses and how they have been taken into account.

Table 61. Results of the test cases for prototype P1 implemented functionalities

<table>
<thead>
<tr>
<th>Test Results Status</th>
<th>WP3 related functionalities</th>
<th>WP4 related functionalities</th>
<th>WP5 related functionalities</th>
<th>WP6 related functionalities</th>
<th>AMASS prototype P1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passed</td>
<td>7</td>
<td>8</td>
<td>1</td>
<td>3</td>
<td>19</td>
</tr>
<tr>
<td>Passed but</td>
<td>11</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Failed</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Postponed</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>12</td>
<td>6</td>
<td>13</td>
<td>50</td>
</tr>
</tbody>
</table>

7.2 Recommendations

Although the recommendations elicited during the prototype Core validation have been followed, there is still some room for improvements. Some required functionalities have not been tested because of some issues that the validation team faced:

- Some usage scenarios are defined vaguely and are found difficult to interpret.
- There is missing information about the related use case(s) or required guideline(s) for some requirements.
- Some requirements are cross-tools and or cross-WP, sometimes leading to duplication among them.
• The set of inputs needed for performing some use cases are incompletely defined.
• The status of some requirements was not up to date at the time of the validation.

To avoid such issues for prototype P2 validation, we recall some recommendations already elicited during last validation:

• The requirements, use case scenarios, guidelines and user manual must be updated to create a better alignment between these documents. Ideally, we need a homogeneous (in the different WP3-6) description allowing to follow the links between the requirements that were planned, those that have been implemented, how prototype functionalities solve these requirements, which are the relevant use cases, and how these use cases are realized in terms of actions described in the user manual.

• To enhance further the validation results, the test cases definition by the validation team must be carried out in closer collaboration with the implementation team prior to their execution, to early identify any comprehension discrepancies of the implemented functionalities. We propose defining a test cases review and validation phase before their execution.

Furthermore, the requirements information, (i.e. owner, prototype number on which it should be made available, implementation status, modification date, etc.), must be updated, and that in a coherent manner within all the WPs. For example, it was missing the information whether an already implemented and satisfactory tested requirement for prototype Core has been enhanced for some reason for prototype P1, so that the validation team can confirm that the test status of the concerned requirement is still valid.
8. Conclusion

This report reflects the results of testing and validation on the AMASS prototype P1. The validation has been based on an analysis of the planned requirements and corresponding functionalities planned for the AMASS platform. These items have been refined into test cases that are compatible with the current developments of the AMASS platform. The previous validation results of prototype Core have been revised as well as the functionalities that were postponed for P1. Some issues were detected and reported as well as recommendations given for improvement.

Three main topics will be tackled in the prototype P2 validation phase:

1. Perform testing and validation of pending (not implemented) and postponed (not tested) functionalities with respect to old developments prior to tackling the new developments.
2. Validate the new implemented tool parts.
3. Validate that the AMASS platform is integrated in a comprehensive toolset operating at TRL 5.
**Abbreviations and Definitions**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMASS</td>
<td>Architecture-driven, Multi-concern and Seamless Assurance and Certification of Cyber-Physical Systems</td>
</tr>
<tr>
<td>API</td>
<td>Application Programming Interface</td>
</tr>
<tr>
<td>ARTA</td>
<td>AMASS Reference Tool Architecture</td>
</tr>
<tr>
<td>AUTOSAR</td>
<td>AUTomotive Open System ARchitecture</td>
</tr>
<tr>
<td>BVR</td>
<td>Base Variability Resolution</td>
</tr>
<tr>
<td>CDO</td>
<td>Connected Data Objects</td>
</tr>
<tr>
<td>CPS</td>
<td>Cyber Physical Systems</td>
</tr>
<tr>
<td>CPU</td>
<td>Central Processing Unit</td>
</tr>
<tr>
<td>EPF</td>
<td>Eclipse Process Framework</td>
</tr>
<tr>
<td>FMVEA</td>
<td>Failure Modes, Vulnerabilities and Effect Analysis</td>
</tr>
<tr>
<td>FT&amp;AT</td>
<td>Fault Tree &amp; Attack Tree</td>
</tr>
<tr>
<td>FTA</td>
<td>Fault tree analysis</td>
</tr>
<tr>
<td>GB</td>
<td>Gigabyte</td>
</tr>
<tr>
<td>HMI</td>
<td>Human Machine Interface</td>
</tr>
<tr>
<td>IMA</td>
<td>Integrated Modular Avionics</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
</tr>
<tr>
<td>KM</td>
<td>Knowledge Management</td>
</tr>
<tr>
<td>NuSMV</td>
<td>New Symbolic Model Verifier (a symbolic model checker tool for finite state systems)</td>
</tr>
<tr>
<td>OCRA</td>
<td>Othello Contracts Refinement Analysis</td>
</tr>
<tr>
<td>OPENC OSS</td>
<td>Open Platform for Evolutionary Certification Of Safety-critical Systems</td>
</tr>
<tr>
<td>OSLC</td>
<td>Open Services for Lifecycle Collaboration</td>
</tr>
<tr>
<td>RAM</td>
<td>Random-access memory</td>
</tr>
<tr>
<td>STO</td>
<td>Scientific and Technical Objective</td>
</tr>
<tr>
<td>URL</td>
<td>Uniform Resource Locator</td>
</tr>
<tr>
<td>TRL</td>
<td>Technology Readiness Level</td>
</tr>
<tr>
<td>V&amp;V</td>
<td>Verification &amp; Validation</td>
</tr>
<tr>
<td>WBS</td>
<td>Work Break Down Structure</td>
</tr>
<tr>
<td>WP</td>
<td>Workpackage</td>
</tr>
<tr>
<td>XML</td>
<td>eXtensible Markup Language</td>
</tr>
</tbody>
</table>
References

[7] AMASS D2.1 Business cases and high-level requirements. 28 February 2017.
[23] Papyrus Eclipse project: https://eclipse.org/papyrus/

6 The current User Manual is a draft document; the final version of the manual will be integrated in D2.5 - AMASS User guidance and methodological framework (m31).
7 The current Developer Guide is a draft document; the final version of the manual will be integrated in D2.5 - AMASS User guidance and methodological framework (m31).
Appendix A: Validation status of the AMASS Prototype P1

Table 62 summarizes the validation status of the prototype P1 implementation. Each functionality of the prototype P1 is traced to the test cases that evaluated them, if existing. The colour code indicates the status of associated test cases to the functionalities:

- Green indicates all test cases have the status PASSED, so the functionality is correctly implemented.
- Red indicates that the test cases FAILED, hence the functionality was not correctly implemented.
- Orange indicates that the test cases PASSED BUT we identified some needed improvements to fully meet the expected results for the functionality.
- Yellow indicates that the validation have been postponed for the next prototype P2 validation, either because the requirements were not implemented yet, or some information were missing to perform the validation.

Table 62. Prototype P1 Functionalities Status

<table>
<thead>
<tr>
<th>Functionality</th>
<th>Test Cases Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System component specification and architecture driven assurance</strong></td>
<td></td>
</tr>
<tr>
<td>WP3_VVA_004 Trace requirements validation checks</td>
<td></td>
</tr>
<tr>
<td>WP3_SC_007 Fault injection (includes faulty behaviour of a component)</td>
<td></td>
</tr>
<tr>
<td>WP6_PPA_004 The AMASS tools must support specification of variability at the component level</td>
<td></td>
</tr>
<tr>
<td>WP3_CAC_001 Validate composition of components by validating their contracts</td>
<td></td>
</tr>
<tr>
<td>WP3_CAC_005 General management of contract-component assignments</td>
<td></td>
</tr>
<tr>
<td>WP3_CAC_006 Refinement-based overview</td>
<td></td>
</tr>
<tr>
<td>WP3_CAC_007 Overview of check refinements results</td>
<td></td>
</tr>
<tr>
<td>WP3_CAC_008 Contract-based validation and verification</td>
<td></td>
</tr>
<tr>
<td>WP3_CAC_009 Improvement of Contract definition process</td>
<td></td>
</tr>
<tr>
<td>WP3_CAC_011 Overview of contract-based validation for behavioural models</td>
<td></td>
</tr>
<tr>
<td>WP3_VVA_005 Verify (model checking) state machines</td>
<td></td>
</tr>
<tr>
<td>WP3_VVA_010 Model-based safety analysis</td>
<td></td>
</tr>
<tr>
<td>WP3_VVA_002 Trace model-to-model transformation</td>
<td></td>
</tr>
<tr>
<td><strong>Assurance Case Specification and multi-concern assurance</strong></td>
<td></td>
</tr>
<tr>
<td>WP4_ACS_001 Edit an assurance case in a scalable way</td>
<td></td>
</tr>
<tr>
<td>WP4_ACS_002 Argumentation architecture: Edit a modular structure (argument architecture) associated with a system and/or component</td>
<td></td>
</tr>
<tr>
<td>WP4_ACS_003 Drag and drop argumentation patterns</td>
<td></td>
</tr>
<tr>
<td>WP4_ACS_004 Semi-automatic generation of process arguments</td>
<td></td>
</tr>
<tr>
<td>WP4_ACS_005 Provide support for language formalization inside argument claims</td>
<td></td>
</tr>
<tr>
<td>WP4_ACS_010 Provide the capability of generating a compositional assurance case argument</td>
<td></td>
</tr>
<tr>
<td>WP4_DAM_001 Capability to model relationships between concerns</td>
<td></td>
</tr>
<tr>
<td>WP4_DAM_002 Capability to capture conflicts occurring during system development and the trade-off process</td>
<td></td>
</tr>
<tr>
<td>WP4_ACS_007 Argumentation import/export</td>
<td></td>
</tr>
<tr>
<td>WP4_ACS_006 Provide guidelines for argumentation</td>
<td></td>
</tr>
<tr>
<td>WP4_SDCA_002 System dependability co-verification and co-validation</td>
<td></td>
</tr>
<tr>
<td>WP4_SDCA_003 The system shall allow combinations of safety and security analysis</td>
<td></td>
</tr>
<tr>
<td>WP4_CMA_003 Contract based multi-concern assurance</td>
<td></td>
</tr>
<tr>
<td><strong>Evidence Management and seamless interoperability</strong></td>
<td></td>
</tr>
<tr>
<td>WPS_EM_006 Evidence information export</td>
<td></td>
</tr>
<tr>
<td>WPS_EM_008 Visualization of chains of evidence</td>
<td></td>
</tr>
<tr>
<td>WPS_EM_009 Suggestion of evidence traces</td>
<td></td>
</tr>
<tr>
<td>WPS_EM_012 Evidence trace verification</td>
<td></td>
</tr>
<tr>
<td>WPS_EM_015 Resource part selection</td>
<td></td>
</tr>
<tr>
<td>WP5_TI_018</td>
<td>Extended standard-based interoperability</td>
</tr>
<tr>
<td>WP5_TI_017</td>
<td>Standards-based interoperability</td>
</tr>
<tr>
<td>WP5_TI_003</td>
<td>Tool chain deployment support</td>
</tr>
<tr>
<td>WP5_TI_005</td>
<td>System specification tools interoperability</td>
</tr>
<tr>
<td>WP5_TI_006</td>
<td>V&amp;V tools interoperability</td>
</tr>
</tbody>
</table>

**Compliance management and cross/intra-domain reuse**

| WP6_CM_006 | Compliance status to externals |
| WP6_CM_001 | Retrieving, digitalizing and storing of a set of industrial standards (including the parts, objectives, practices, goals/requirements, criticality levels from the standards) |
| WP6_RA_006 | Reuse of pre-developed components and their accompanying artefact |
| WP6_CM_004 | Triggering compliance Checking |
| WP6_CM_009 | Process Compliance (formal) management |
| WP6_SEM_001 | Semantics-based mapping of standards |
| WP6_PPA_005 | The AMASS tools must support variability management at the assurance case level |
| WP6_CM_002 | Tailoring of Standards models to specific projects |
| WP6_CM_005 | Compliance Monitoring |
| WP6_CM_008 | Process Compliance (informal) management |
| WP6_RA_001 | Intra-Domain, Intra standard, Reuse Assistance |
| WP6_RA_002 | Intra-Domain, Cross standards, Reuse Assistance |
| WP6_RA_003 | Intra-Domain, Cross versions, Reuse Assistance |
| WP6_RA_004 | Cross-Domain Reuse Assistance |
| WP6_RA_005 | Intra-Domain, Intra standard, Different Stakeholders, Reuse/Integration Assistance |
| WP6_RA_006 | Reuse of pre-developed components and their accompanying artefact. |
| WP6_PPA_001 | The AMASS tools must support variability management at process level |
| WP6_PPA_002 | Semi-automatic generation of product arguments |
| WP6_PPA_003 | Semi-automatic generation of process arguments |
| WP6_PPA_004 | The AMASS tools must support management of variability at the component level |