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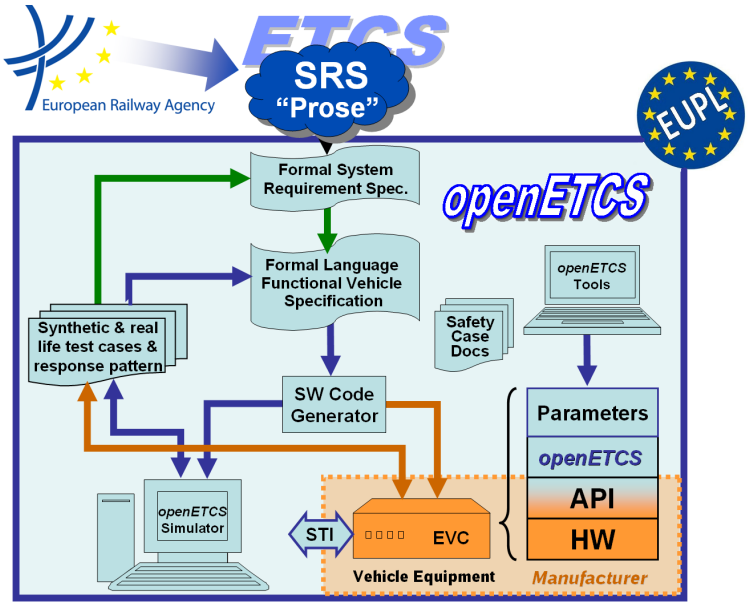
Work-Package 7: “Secondary tools - Verification and Validation ”

Evaluation of supporting tools and methods against the WP2 requirements and task 1

Means and tools for Verification and Validation

Marielle Petit-Doche, all participants of the benchmark and all participants of VnV and Safety process

October 2013



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October 2013

Evaluation of supporting tools and methods against the WP2 requirements and task 1

Means and tools for Verification and Validation

Marielle Petit-Doche

Systerel

all participants of the benchmark

WP7 partners

all participants of VnV and Safety process

WP4 partners

Evaluation

Prepared for openETCS@ITEA2 Project

Abstract: This document gives elements to evaluate the tools and methods to complete the primary toolchain and to support verification and validation activities, safety activities, moodel transformation and data management for the whole project. Evaluation on the means and tools of benchmark is also described.

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1 Introduction

The aim of this document is to report the results of the evaluation of means and tools for the secondary means and tools, i.e. the means and tools which complete the primary tool chain dedicated to formal model and software design.

This evaluation task is part of work package WP7, task 2 "Secondary tools analyses and recommendations". According to the results of WP2, especially the OpenETCS process and the requirements on language and tools [**?**], and the results of T7.1 on the primary toolchain [**?**], the aim of this task is to determine the best candidates to complete and support the primary toolchain for the following activities:

- verification and validation (WP4)
- safety activities support (WP4)
- data, function and requirement management (SSRS, WP3 and WP4)
- model transformation and code generation (WP3 and WP4)

This document is dedicated to tools and means for verification and validation.

1.1 Organisation of the document

The chapter 2 provides a template to describe the means and tools and a list of criteria according WP2 requirements on language, models and tools, and T7.1 primary tool chain decision. The objectives of this description and criteria are to allow to determine the best means of description and associated tool for a given activities.

The chapter 3 resumes the results of the evaluation at the end of the benchmark activities.

In Appendix, a chapter is dedicated to each models produced during the benchmark activities :

- Scade Suite
- System C
- UPPAAL
- Rodin and Pluggins
- Tools around Classical B (ProB, SMT solver,...)
- CPN tools
- Matelo
- RT-Tester

- Fiacre and Tina
- Frama-C
- Diversity

2 Template

2.1 Instructions

Author Author of the approaches description %%Name - Company%%

Assessor 1 First assessor of the approaches %%Name - Company%%

Assessor 2 Second assessor of the approaches %%Name - Company%%

In the sequel, main text is under the responsibilities of the author.

Author: Author can add comments using this format at any place.

Assessor 1: First assessor can add comments using this format at any place.

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When a note is required, please follow this list (inspired from Technology Readiness Level, see `http://en.wikipedia.org/wiki/Technology_readiness_level`) :

0 not recommended / rejected / no integration possible or valuable / not adapted for this topic / not available for this topic

1 weakly recommended / adapted after major improvements / weakly rejected / concept of integration roughly defined / adapted after major improvements / available after major developments

2 recommended / adapted (with light improvements if necessary) weakly accepted / integration prototyped or defined in details / adapted after small improvements / available after small developments or tests

3 highly recommended / well adapted / strongly accepted / integration done and tested / well adapted to the purpose / available and suitable for the purpose All the notes can be commented under each table.

***** difficult to evaluate with a note (please add a comment under the table)

All the notes can be commented under each table.

This section defines the criteria for the means and tools dedicated to verification and validation activities, in the WP4 workpackage.

Criteria of this section are defined according [**?**].

2.2 Presentation

This section gives a quick presentation of the approach and the tool.

Name %%Name of the approach and the tool%%

Web site %%if available, how to find information%%

Licence %%Kind of licence%%

Abstract

Short abstract on the approach and tool (10 lines max)

Publications

Short list of publications on the approach (5 max)

2.3 Common criteria on secondary means and tools

This section discusses the common criteria of the means and tools according to the project requirements on tools and the results of T7.1.

2.3.1 Project and WP2 requirements

The objectives of this list of criteria is to check if the proposed means and tools meet the main criteria of the project: open-source approaches, usability, modularity, coverage of the objectives,...

According WP2 requirements, give a note for characteristics of the use of the tool (from 0 to 3) :

	Author	Assessor 1	Assessor 2	Total
Open Source (D2.6-02-074)				
Portability to operating systems (D2.6-02-075)				
Cooperation of tools (D2.6-02-076)				
Robustness (D2.6-02-078)				
Modularity (D2.6-02-078.1)				
Documentation management (D2.6-02-078.02)				
Distributed software development (D2.6-02-078.03)				
Simultaneous multi-users (D2.6-02-078.04)				
Issue tracking (D2.6-02-078.05)				
Differences between models (D2.6-02-078.06)				
Version management (D2.6-02-078.07)				
Concurrent version development (D2.6-02-078.08)				
Model-based version control (D2.6-02-078.09)				
Role traceability (D2.6-02-078.10)				
Safety version traceability (D2.6-02-078.11)				
Model traceability (D2.6-02-079)				
Tool chain integration				
Scalability				
User Friendliness				

2.3.2 Qualification

This section discusses how the tool can be classified according EN50128 requirements (D2.6-02-085). Some qualification shall be mandatory if the tool is involved to design a SIL4 software.

	Author	Assessor 1	Assessor 2	Total
Tool manual (D.2.6-01-42.02)				
Proof of correctness (D.2.6-01-42.03)				
Existing industrial usage				
Model verification				
Test generation				
Simulation, execution, debugging				
Formal proof				

Which level of tool qualification has been reached or will be reached within the next year ?

Score :

3 already qualified for this level

2 qualification possible to this level, but some elements shall be provided

0 qualification not recommended for this level

	Author	Assessor 1	Assessor 2	Total
class T1				
class T2				
class T3				

Other elements for tool certification

2.3.3 Complementarity with primary toolchain

The objectives of this list of criteria is to check if the proposed means and tools can be easily integrated to the primary toolchain.

2.3.3.1 Language

According to the decisions and the propositions of T7.1, how the mean and approach can be adapted to or can complete the chosen language and methods:

	Author	Assessor 1	Assessor 2	Total
SysML				
Scade method				
EFS language				
B Method				
C language				

SysML

How the means or tools can complete SysML ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling language ?

C language

How the means or tools can complete or be adapted to SIL4 software in C language ?

2.3.3.2 Tools and platforms

According to the decisions and the propositions of T7.1, how the mean and approach can be integrated to or can complete the chosen tools and platforms:

	Author	Assessor 1	Assessor 2	Total
Eclipse				
Papyrus				
Scade				
EFS tools				
B tools				

Eclipse

How the means or tools can be integrated to the Eclipse platform ?

Papyrus

How the means or tools can complete Papyrus ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling tools ?

2.4 VnV Activities

The VnV activities are described in details in the verification and Validation Plan [**?**].

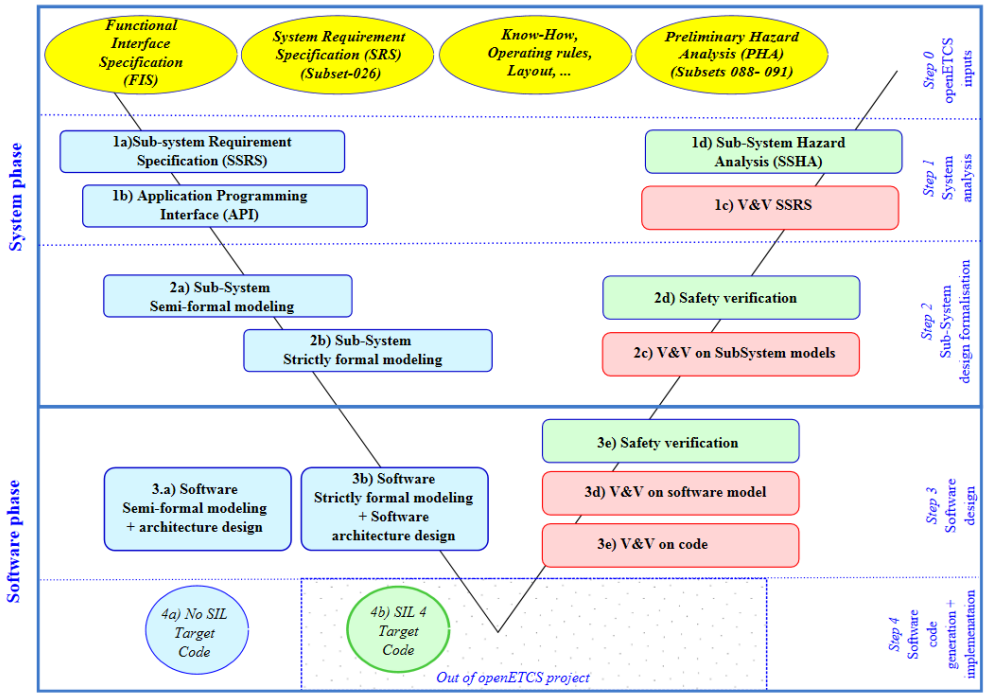

Figure 1. openETCS Process (rough view)

According figure 1, for which activities is the mean or tool suitable (see also [**?**] section 5.1.2 for more details)[1] ?

[1] DAS2V : Design Artifact Subject to Verification and Validation, see [**?**]

	Author	Assessor 1	Assessor 2	Total
1c SSRS Verification				
1c SSRS Validation				
2c SFM Verification				
2c SFM Validation				
3d SW-SFM Verification				
3d SW-SFM Validation				
3d SW-FFM Verification				
3d SW-FFM Validation				
3e Code Verification				
3e Code Validation				
DAS2V Verification				
DAS2V Validation				
Automatic model transformation verification				
Automatic code generation verification				

2.5 Properties

Which kind of properties or elements are verified or validated by the mean or tool (see also [**?**] section 4) ?

	Author	Assessor 1	Assessor 2	Total
Functionalities of the system and sub-system				
System and sub-system architecture				
External and internal interfaces of sub-system				
Software components				
Performance constraints				
Safety objectives				
Functional properties				
Safety properties				

2.6 Verification methods and tools

Which kind of methods is proposed (see also [**?**] section 5.3) ?

	Author	Assessor 1	Assessor 2	Total
Reviews				
Inspections				
Software Architecture Analysis Method				
Architecture Tradeoff Analysis Method				
Model-Based System Integration Testing				
Model-Based Testing of Generated High-Level Code				
Abstract Interpretation				
Deductive Verification				
Model Checking				
Correct by Construction Formal Methods				
Verification with Formal Methods				
Simulation-based				

2.7 Validation means and tools

The following list of criteria focuss on means and tools to support validation activities, according WP2 requirements :

	Author	Assessor 1	Assessor 2	Total
Simulation-based				
Step-by-step simulation (D2.6-01-036)				
Environment emulation (D2.6-01-037 and D2.6-02-080)				
Time-based test case (D2.6-02-081)				
Test cases writing (D2.6-01-038)				
Test cases execution (D2.6-01-038)				
Test cases storage (D2.6-01-038)				
Version management of test cases (D2.6-02-082)				
Test generation from independant test model (D2.6-02-083)				
Test sequences writing (D2.6-02-084)				
Test sequences execution (D2.6-02-084)				
Test sequences storage (D2.6-02-084)				

2.8 VnV artifacts

Concerning the artifacts used or produced by the mean or tool, please to detail:

Input

Which is the list of the input artifacts for the mean or tools ?

Output

Which is the list of the output artifacts for the mean or tools ?

Syntax

Which are the reference documents which give a description of the artifacts syntax ?

Semantic

Which are the reference documents which give a description of the artifacts semantic ?

Integration

How these artifacts can be integrated with the elements of the toolchain (language, mangement,...) ?

2.9 Detailled Criterias for VnV

Please fill only the section concerning the proposed mean or tool, other section can be skipped (see issue `https://github.com/openETCS/toolchain/issues/180` for details and discussions)

2.9.1 System Modelling simulation

	Author	Assessor 1	Assessor 2	Total
User Scenario Modelling				
Test Case Modelling				
Test Sequence Modelling				

2.9.2 System Model Verification

	Author	Assessor 1	Assessor 2	Total
Input/ Output checking				
System Behavior Simulation (Mathematical)				
System Behavior Simulation (Animated)				

2.9.3 Software Model Verification

	Author	Assessor 1	Assessor 2	Total
Static Model Verification				
Property Proofing				
Dynamic Testing				
Automatic Test Generation				
Input/ Output checking				
Software Behaviour Simulation (Mathematical)				
Software Behaviour Simulation (Animated)				

2.9.4 Source Code

	Author	Assessor 1	Assessor 2	Total
Traceability to Model				

2.9.5 Code Verification

	Author	Assessor 1	Assessor 2	Total
Formal Proof				
Programming by contract				
Static Analysis				
Dynamic Analysis				
Dynamic Testing				
Automatic Test Generation				
Performance Testing				
Interface Testing				

2.9.6 Validation System/Software/Code/ Validation

	Author	Assessor 1	Assessor 2	Total
Test Coverage				
Use Case Validation of Model				
Functional or Black-box Testing				
User Scenario Testing				
Traceability				
Schedulability Analyzer / UseCase Check all				
Schedulability Analyzer / UseCase Check single mode				

2.10 Other comments

Comment. This section is available for the author or the assessors to complete the description and criteria.

3 Conclusion

Comment. MPD : Todo

The sequel is let as an example is this early version.

Criteria to discuss here are those which concerns all the secondary tools as open-source issues, compatibility with primary tool-chain, compatibility with eclipse,...

This conclusion give a sum up of the evaluation results for each approach. The detailed results of each approach are given in the appendix.

Minus mark "-" means this criteria as not been evaluated for this approach.

Star mark "*" means this criteria has been difficult to evaluate for this approach.

The highest score is **9** and means that the criteria is fully respected, the lowest score is 0.

3.1 Main usage of the approach

Comment. MPD : Todo

The sequel is let as an example in this early version.

Score and results shall be corrected latter.

This section discusses the main usage of the approach.

According to the figure **??**, for which phases do you recommend the approach (give a note from 0 to 3) :

	GOPRR	ERTMSFormalSpecs	SysML with Papyrus	SysML with EA	SCADE	EventB	Classical B	System C	Petri Nets	GNATprove
Verification	5	1	7	**9**	3	**9**	3	2	**6(9)**	2 (3)
Validation	**9**	**9**	6	7	**9**	**9**	5	5	**6(9)**	3 (4)
Safety analysis	**9**	0	6	7	**9**	6	**9**	**9**	**6(9)**	**6(9)**
Data, function or requirement management	**9**	0	3	3	**9**	3	**9**	6	2 (3)	**6(9)**
Model or code transformation	**9**	0	3	3	**9**	3	**9**	6	2 (3)	**6(9)**

Appendix A: Scade

A.1 Instructions

Author Author of the approaches description %%Name - Company%%

Assessor 1 First assessor of the approaches %%Name - Company%%

Assessor 2 Second assessor of the approaches %%Name - Company%%

In the sequel, main text is under the responsibilities of the author.

Author: Author can add comments using this format at any place.

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***** difficult to evaluate with a note (please add a comment under the table)

All the notes can be commented under each table.

This section defines the criteria for the means and tools dedicated to verification and validation activities, in the WP4 workpackage.

Criteria of this section are defined according [**?**].

A.2 Presentation

This section gives a quick presentation of the approach and the tool.

Name %%Name of the approach and the tool%%

Web site %%if available, how to find information%%

Licence %%Kind of licence%%

Abstract

Short abstract on the approach and tool (10 lines max)

Publications

Short list of publications on the approach (5 max)

A.3 Common criteria on secondary means and tools

This section discusses the common criteria of the means and tools according to the project requirements on tools and the results of T7.1.

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The objectives of this list of criteria is to check if the proposed means and tools meet the main criteria of the project: open-source approaches, usability, modularity, coverage of the objectives,...

According WP2 requirements, give a note for characteristics of the use of the tool (from 0 to 3) :

	Author	Assessor 1	Assessor 2	Total
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Portability to operating systems (D2.6-02-075)				
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Modularity (D2.6-02-078.1)				
Documentation management (D2.6-02-078.02)				
Distributed software development (D2.6-02-078.03)				
Simultaneous multi-users (D2.6-02-078.04)				
Issue tracking (D2.6-02-078.05)				
Differences between models (D2.6-02-078.06)				
Version management (D2.6-02-078.07)				
Concurrent version development (D2.6-02-078.08)				
Model-based version control (D2.6-02-078.09)				
Role traceability (D2.6-02-078.10)				
Safety version traceability (D2.6-02-078.11)				
Model traceability (D2.6-02-079)				
Tool chain integration				
Scalability				
User Friendliness				

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This section discusses how the tool can be classified according EN50128 requirements (D2.6-02-085). Some qualification shall be mandatory if the tool is involved to design a SIL4 software.

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Tool manual (D.2.6-01-42.02)				
Proof of correctness (D.2.6-01-42.03)				
Existing industrial usage				
Model verification				
Test generation				
Simulation, execution, debugging				
Formal proof				

Which level of tool qualification has been reached or will be reached within the next year ?

Score :

3 already qualified for this level

2 qualification possible to this level, but some elements shall be provided

0 qualification not recommended for this level

	Author	Assessor 1	Assessor 2	Total
class T1				
class T2				
class T3				

Other elements for tool certification

A.3.3 Complementarity with primary toolchain

The objectives of this list of criteria is to check if the proposed means and tools can be easily integrated to the primary toolchain.

A.3.3.1 Language

According to the decisions and the propositions of T7.1, how the mean and approach can be adapted to or can complete the chosen language and methods:

	Author	Assessor 1	Assessor 2	Total
SysML				
Scade method				
EFS language				
B Method				
C language				

SysML

How the means or tools can complete SysML ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling language ?

C language

How the means or tools can complete or be adapted to SIL4 software in C language ?

A.3.3.2 Tools and platforms

According to the decisions and the propositions of T7.1, how the mean and approach can be integrated to or can complete the chosen tools and platforms:

	Author	Assessor 1	Assessor 2	Total
Eclipse				
Papyrus				
Scade				
EFS tools				
B tools				

Eclipse

How the means or tools can be integrated to the Eclipse platform ?

Papyrus

How the means or tools can complete Papyrus ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling tools ?

A.4 VnV Activities

The VnV activities are described in details in the verification and Validation Plan [**?**].

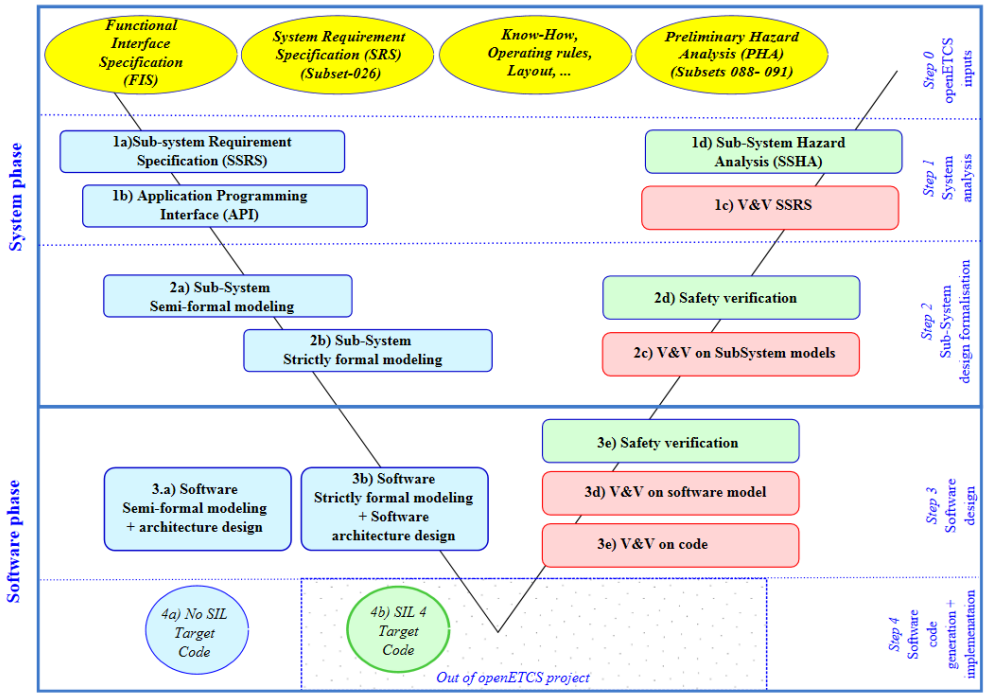

Figure A1. openETCS Process (rough view)

According figure 1, for which activities is the mean or tool suitable (see also [**?**] section 5.1.2 for more details)[2] ?

[2]DAS2V : Design Artifact Subject to Verification and Validation, see [**?**]

	Author	Assessor 1	Assessor 2	Total
1c SSRS Verification				
1c SSRS Validation				
2c SFM Verification				
2c SFM Validation				
3d SW-SFM Verification				
3d SW-SFM Validation				
3d SW-FFM Verification				
3d SW-FFM Validation				
3e Code Verification				
3e Code Validation				
DAS2V Verification				
DAS2V Validation				
Automatic model transformation verification				
Automatic code generation verification				

A.5 Properties

Which kind of properties or elements are verified or validated by the mean or tool (see also [**?**] section 4) ?

	Author	Assessor 1	Assessor 2	Total
Functionalities of the system and sub-system				
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Performance constraints				
Safety objectives				
Functional properties				
Safety properties				

A.6 Verification methods and tools

Which kind of methods is proposed (see also [**?**] section 5.3) ?

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Inspections				
Software Architecture Analysis Method				
Architecture Tradeoff Analysis Method				
Model-Based System Integration Testing				
Model-Based Testing of Generated High-Level Code				
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Model Checking				
Correct by Construction Formal Methods				
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Test cases writing (D2.6-01-038)				
Test cases execution (D2.6-01-038)				
Test cases storage (D2.6-01-038)				
Version management of test cases (D2.6-02-082)				
Test generation from independant test model (D2.6-02-083)				
Test sequences writing (D2.6-02-084)				
Test sequences execution (D2.6-02-084)				
Test sequences storage (D2.6-02-084)				

A.8 VnV artifacts

Concerning the artifacts used or produced by the mean or tool, please to detail:

Input

Which is the list of the input artifacts for the mean or tools ?

Output

Which is the list of the output artifacts for the mean or tools ?

Syntax

Which are the reference documents which give a description of the artifacts syntax ?

Semantic

Which are the reference documents which give a description of the artifacts semantic ?

Integration

How these artifacts can be integrated with the elements of the toolchain (language, mangement,...) ?

A.9 Detailled Criterias for VnV

Please fill only the section concerning the proposed mean or tool, other section can be skipped (see issue `https://github.com/openETCS/toolchain/issues/180` for details and discussions)

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	Author	Assessor 1	Assessor 2	Total
User Scenario Modelling				
Test Case Modelling				
Test Sequence Modelling				

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	Author	Assessor 1	Assessor 2	Total
Input/ Output checking				
System Behavior Simulation (Mathematical)				
System Behavior Simulation (Animated)				

A.9.3 Software Model Verification

	Author	Assessor 1	Assessor 2	Total
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Property Proofing				
Dynamic Testing				
Automatic Test Generation				
Input/ Output checking				
Software Behaviour Simulation (Mathematical)				
Software Behaviour Simulation (Animated)				

A.9.4 Source Code

	Author	Assessor 1	Assessor 2	Total
Traceability to Model				

A.9.5 Code Verification

	Author	Assessor 1	Assessor 2	Total
Formal Proof				
Programming by contract				
Static Analysis				
Dynamic Analysis				
Dynamic Testing				
Automatic Test Generation				
Performance Testing				
Interface Testing				

A.9.6 Validation System/Software/Code/ Validation

	Author	Assessor 1	Assessor 2	Total
Test Coverage				
Use Case Validation of Model				
Functional or Black-box Testing				
User Scenario Testing				
Traceability				
Schedulability Analyzer / UseCase Check all				
Schedulability Analyzer / UseCase Check single mode				

A.10 Other comments

Comment. This section is available for the author or the assessors to complete the description and criteria.

Appendix B: SystemC

B.1 Instructions

Author Author of the approaches description %%Name - Company%%

Assessor 1 First assessor of the approaches %%Name - Company%%

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B.2 Presentation

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Abstract

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Publications

Short list of publications on the approach (5 max)

B.3 Common criteria on secondary means and tools

This section discusses the common criteria of the means and tools according to the project requirements on tools and the results of T7.1.

B.3.1 Project and WP2 requirements

The objectives of this list of criteria is to check if the proposed means and tools meet the main criteria of the project: open-source approaches, usability, modularity, coverage of the objectives,...

According WP2 requirements, give a note for characteristics of the use of the tool (from 0 to 3) :

	Author	Assessor 1	Assessor 2	Total
Open Source (D2.6-02-074)				
Portability to operating systems (D2.6-02-075)				
Cooperation of tools (D2.6-02-076)				
Robustness (D2.6-02-078)				
Modularity (D2.6-02-078.1)				
Documentation management (D2.6-02-078.02)				
Distributed software development (D2.6-02-078.03)				
Simultaneous multi-users (D2.6-02-078.04)				
Issue tracking (D2.6-02-078.05)				
Differences between models (D2.6-02-078.06)				
Version management (D2.6-02-078.07)				
Concurrent version development (D2.6-02-078.08)				
Model-based version control (D2.6-02-078.09)				
Role traceability (D2.6-02-078.10)				
Safety version traceability (D2.6-02-078.11)				
Model traceability (D2.6-02-079)				
Tool chain integration				
Scalability				
User Friendliness				

B.3.2 Qualification

This section discusses how the tool can be classified according EN50128 requirements (D2.6-02-085). Some qualification shall be mandatory if the tool is involved to design a SIL4 software.

	Author	Assessor 1	Assessor 2	Total
Tool manual (D.2.6-01-42.02)				
Proof of correctness (D.2.6-01-42.03)				
Existing industrial usage				
Model verification				
Test generation				
Simulation, execution, debugging				
Formal proof				

Which level of tool qualification has been reached or will be reached within the next year ?

Score :

3 already qualified for this level

2 qualification possible to this level, but some elements shall be provided

0 qualification not recommended for this level

	Author	Assessor 1	Assessor 2	Total
class T1				
class T2				
class T3				

Other elements for tool certification

B.3.3 Complementarity with primary toolchain

The objectives of this list of criteria is to check if the proposed means and tools can be easily integrated to the primary toolchain.

B.3.3.1 Language

According to the decisions and the propositions of T7.1, how the mean and approach can be adapted to or can complete the chosen language and methods:

	Author	Assessor 1	Assessor 2	Total
SysML				
Scade method				
EFS language				
B Method				
C language				

SysML

How the means or tools can complete SysML ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling language ?

C language

How the means or tools can complete or be adapted to SIL4 software in C language ?

B.3.3.2 Tools and platforms

According to the decisions and the propositions of T7.1, how the mean and approach can be integrated to or can complete the chosen tools and platforms:

	Author	Assessor 1	Assessor 2	Total
Eclipse				
Papyrus				
Scade				
EFS tools				
B tools				

Eclipse

How the means or tools can be integrated to the Eclipse platform ?

Papyrus

How the means or tools can complete Papyrus ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling tools ?

B.4 VnV Activities

The VnV activities are described in details in the verification and Validation Plan [**?**].

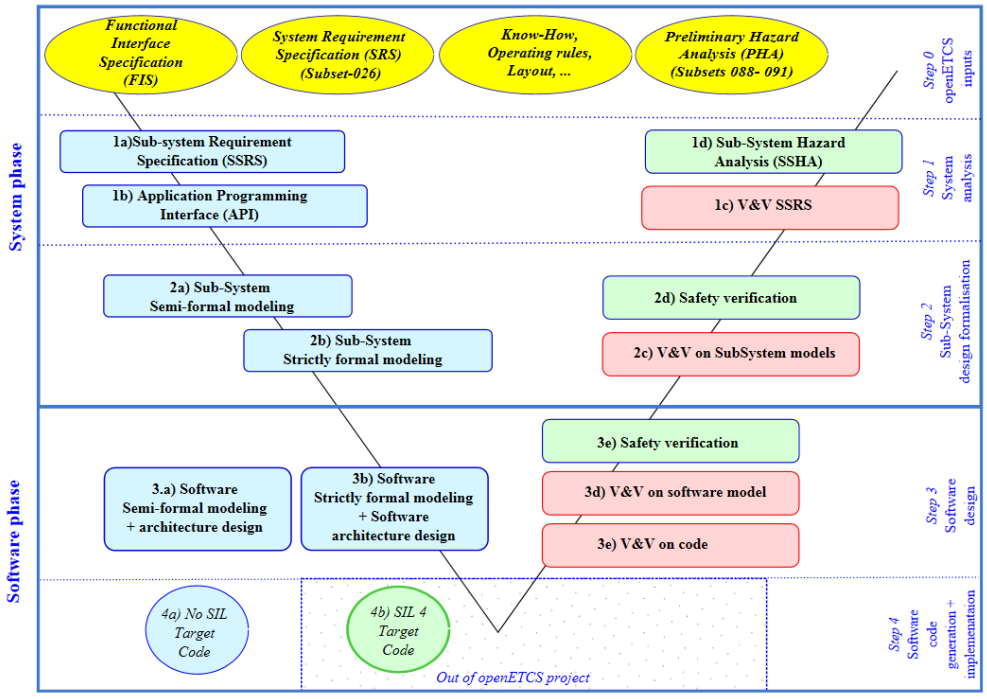

Figure B1. openETCS Process (rough view)

According figure 1, for which activities is the mean or tool suitable (see also [**?**] section 5.1.2 for more details)[3] ?

[3]DAS2V : Design Artifact Subject to Verification and Validation, see [**?**]

	Author	Assessor 1	Assessor 2	Total
1c SSRS Verification				
1c SSRS Validation				
2c SFM Verification				
2c SFM Validation				
3d SW-SFM Verification				
3d SW-SFM Validation				
3d SW-FFM Verification				
3d SW-FFM Validation				
3e Code Verification				
3e Code Validation				
DAS2V Verification				
DAS2V Validation				
Automatic model transformation verification				
Automatic code generation verification				

B.5 Properties

Which kind of properties or elements are verified or validated by the mean or tool (see also [**?**] section 4) ?

	Author	Assessor 1	Assessor 2	Total
Functionalities of the system and sub-system				
System and sub-system architecture				
External and internal interfaces of sub-system				
Software components				
Performance constraints				
Safety objectives				
Functional properties				
Safety properties				

B.6 Verification methods and tools

Which kind of methods is proposed (see also [**?**] section 5.3) ?

	Author	Assessor 1	Assessor 2	Total
Reviews				
Inspections				
Software Architecture Analysis Method				
Architecture Tradeoff Analysis Method				
Model-Based System Integration Testing				
Model-Based Testing of Generated High-Level Code				
Abstract Interpretation				
Deductive Verification				
Model Checking				
Correct by Construction Formal Methods				
Verification with Formal Methods				
Simulation-based				

B.7 Validation means and tools

The following list of criteria focuss on means and tools to support validation activities, according WP2 requirements :

	Author	Assessor 1	Assessor 2	Total
Simulation-based				
Step-by-step simulation (D2.6-01-036)				
Environment emulation (D2.6-01-037 and D2.6-02-080)				
Time-based test case (D2.6-02-081)				
Test cases writing (D2.6-01-038)				
Test cases execution (D2.6-01-038)				
Test cases storage (D2.6-01-038)				
Version management of test cases (D2.6-02-082)				
Test generation from independant test model (D2.6-02-083)				
Test sequences writing (D2.6-02-084)				
Test sequences execution (D2.6-02-084)				
Test sequences storage (D2.6-02-084)				

B.8 VnV artifacts

Concerning the artifacts used or produced by the mean or tool, please to detail:

Input

Which is the list of the input artifacts for the mean or tools ?

Output

Which is the list of the output artifacts for the mean or tools ?

Syntax

Which are the reference documents which give a description of the artifacts syntax ?

Semantic

Which are the reference documents which give a description of the artifacts semantic ?

Integration

How these artifacts can be integrated with the elements of the toolchain (language, mangement,...) ?

B.9 Detailled Criterias for VnV

Please fill only the section concerning the proposed mean or tool, other section can be skipped (see issue `https://github.com/openETCS/toolchain/issues/180` for details and discussions)

B.9.1 System Modelling simulation

	Author	Assessor 1	Assessor 2	Total
User Scenario Modelling				
Test Case Modelling				
Test Sequence Modelling				

B.9.2 System Model Verification

	Author	Assessor 1	Assessor 2	Total
Input/ Output checking				
System Behavior Simulation (Mathematical)				
System Behavior Simulation (Animated)				

B.9.3 Software Model Verification

	Author	Assessor 1	Assessor 2	Total
Static Model Verification				
Property Proofing				
Dynamic Testing				
Automatic Test Generation				
Input/ Output checking				
Software Behaviour Simulation (Mathematical)				
Software Behaviour Simulation (Animated)				

B.9.4 Source Code

	Author	Assessor 1	Assessor 2	Total
Traceability to Model				

B.9.5 Code Verification

	Author	Assessor 1	Assessor 2	Total
Formal Proof				
Programming by contract				
Static Analysis				
Dynamic Analysis				
Dynamic Testing				
Automatic Test Generation				
Performance Testing				
Interface Testing				

B.9.6 Validation System/Software/Code/ Validation

	Author	Assessor 1	Assessor 2	Total
Test Coverage				
Use Case Validation of Model				
Functional or Black-box Testing				
User Scenario Testing				
Traceability				
Schedulability Analyzer / UseCase Check all				
Schedulability Analyzer / UseCase Check single mode				

B.10 Other comments

Comment. This section is available for the author or the assessors to complete the description and criteria.

Appendix C: UPPAAL

C.1 Instructions

Author Author of the approaches description %%Name - Company%%

Assessor 1 First assessor of the approaches %%Name - Company%%

Assessor 2 Second assessor of the approaches %%Name - Company%%

In the sequel, main text is under the responsibilities of the author.

Author: Author can add comments using this format at any place.

Assessor 1: First assessor can add comments using this format at any place.

Assessor 2: Second assessor can add comments using this format at any place.

When a note is required, please follow this list (inspired from Technology Readiness Level, see `http://en.wikipedia.org/wiki/Technology_readiness_level`) :

0 not recommended / rejected / no integration possible or valuable / not adapted for this topic / not available for this topic

1 weakly recommended / adapted after major improvements / weakly rejected / concept of integration roughly defined / adapted after major improvements / available after major developments

2 recommended / adapted (with light improvements if necessary) weakly accepted / integration prototyped or defined in details / adapted after small improvements / available after small developments or tests

3 highly recommended / well adapted / strongly accepted / integration done and tested / well adapted to the purpose / available and suitable for the purpose All the notes can be commented under each table.

***** difficult to evaluate with a note (please add a comment under the table)

All the notes can be commented under each table.

This section defines the criteria for the means and tools dedicated to verification and validation activities, in the WP4 workpackage.

Criteria of this section are defined according [**?**].

C.2 Presentation

This section gives a quick presentation of the approach and the tool.

Name %%Name of the approach and the tool%%

Web site %%if available, how to find information%%

Licence %%Kind of licence%%

Abstract

Short abstract on the approach and tool (10 lines max)

Publications

Short list of publications on the approach (5 max)

C.3 Common criteria on secondary means and tools

This section discusses the common criteria of the means and tools according to the project requirements on tools and the results of T7.1.

C.3.1 Project and WP2 requirements

The objectives of this list of criteria is to check if the proposed means and tools meet the main criteria of the project: open-source approaches, usability, modularity, coverage of the objectives,...

According WP2 requirements, give a note for characteristics of the use of the tool (from 0 to 3) :

	Author	Assessor 1	Assessor 2	Total
Open Source (D2.6-02-074)				
Portability to operating systems (D2.6-02-075)				
Cooperation of tools (D2.6-02-076)				
Robustness (D2.6-02-078)				
Modularity (D2.6-02-078.1)				
Documentation management (D2.6-02-078.02)				
Distributed software development (D2.6-02-078.03)				
Simultaneous multi-users (D2.6-02-078.04)				
Issue tracking (D2.6-02-078.05)				
Differences between models (D2.6-02-078.06)				
Version management (D2.6-02-078.07)				
Concurrent version development (D2.6-02-078.08)				
Model-based version control (D2.6-02-078.09)				
Role traceability (D2.6-02-078.10)				
Safety version traceability (D2.6-02-078.11)				
Model traceability (D2.6-02-079)				
Tool chain integration				
Scalability				
User Friendliness				

C.3.2 Qualification

This section discusses how the tool can be classified according EN50128 requirements (D2.6-02-085). Some qualification shall be mandatory if the tool is involved to design a SIL4 software.

	Author	Assessor 1	Assessor 2	Total
Tool manual (D.2.6-01-42.02)				
Proof of correctness (D.2.6-01-42.03)				
Existing industrial usage				
Model verification				
Test generation				
Simulation, execution, debugging				
Formal proof				

Which level of tool qualification has been reached or will be reached within the next year ?

Score :

3 already qualified for this level

2 qualification possible to this level, but some elements shall be provided

0 qualification not recommended for this level

	Author	Assessor 1	Assessor 2	Total
class T1				
class T2				
class T3				

Other elements for tool certification

C.3.3 Complementarity with primary toolchain

The objectives of this list of criteria is to check if the proposed means and tools can be easily integrated to the primary toolchain.

C.3.3.1 Language

According to the decisions and the propositions of T7.1, how the mean and approach can be adapted to or can complete the chosen language and methods:

	Author	Assessor 1	Assessor 2	Total
SysML				
Scade method				
EFS language				
B Method				
C language				

SysML

How the means or tools can complete SysML ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling language ?

C language

How the means or tools can complete or be adapted to SIL4 software in C language ?

C.3.3.2 Tools and platforms

According to the decisions and the propositions of T7.1, how the mean and approach can be integrated to or can complete the chosen tools and platforms:

	Author	Assessor 1	Assessor 2	Total
Eclipse				
Papyrus				
Scade				
EFS tools				
B tools				

Eclipse

How the means or tools can be integrated to the Eclipse platform ?

Papyrus

How the means or tools can complete Papyrus ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling tools ?

C.4 VnV Activities

The VnV activities are described in details in the verification and Validation Plan [**?**].

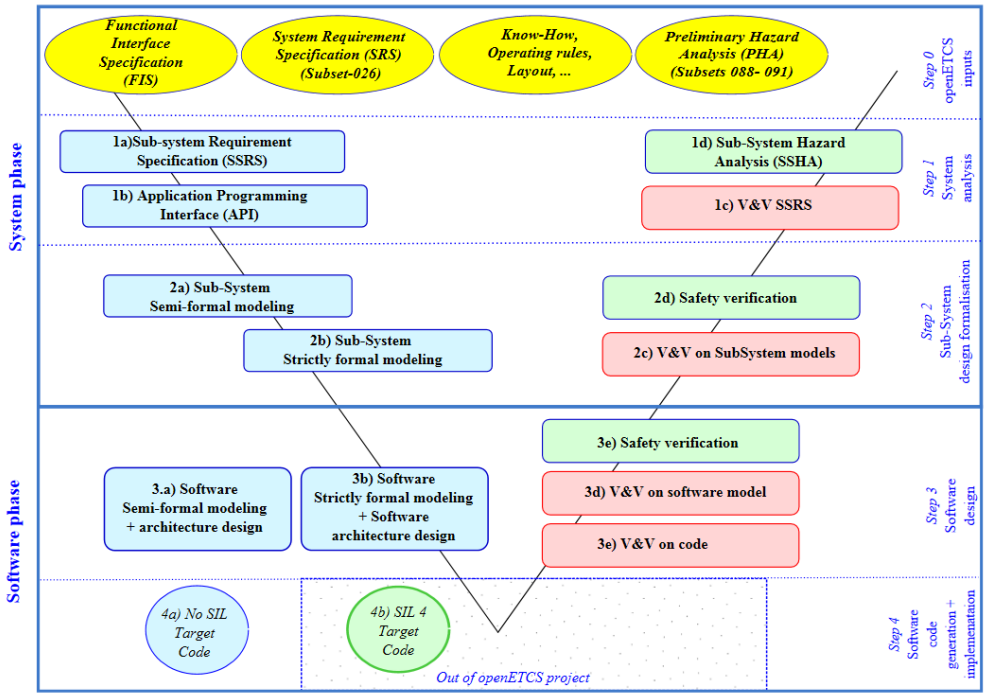

Figure C1. openETCS Process (rough view)

According figure 1, for which activities is the mean or tool suitable (see also [**?**] section 5.1.2 for more details)[4] ?

[4]DAS2V : Design Artifact Subject to Verification and Validation, see [**?**]

	Author	Assessor 1	Assessor 2	Total
1c SSRS Verification				
1c SSRS Validation				
2c SFM Verification				
2c SFM Validation				
3d SW-SFM Verification				
3d SW-SFM Validation				
3d SW-FFM Verification				
3d SW-FFM Validation				
3e Code Verification				
3e Code Validation				
DAS2V Verification				
DAS2V Validation				
Automatic model transformation verification				
Automatic code generation verification				

C.5 Properties

Which kind of properties or elements are verified or validated by the mean or tool (see also [**?**] section 4) ?

	Author	Assessor 1	Assessor 2	Total
Functionalities of the system and sub-system				
System and sub-system architecture				
External and internal interfaces of sub-system				
Software components				
Performance constraints				
Safety objectives				
Functional properties				
Safety properties				

C.6 Verification methods and tools

Which kind of methods is proposed (see also [**?**] section 5.3) ?

	Author	Assessor 1	Assessor 2	Total
Reviews				
Inspections				
Software Architecture Analysis Method				
Architecture Tradeoff Analysis Method				
Model-Based System Integration Testing				
Model-Based Testing of Generated High-Level Code				
Abstract Interpretation				
Deductive Verification				
Model Checking				
Correct by Construction Formal Methods				
Verification with Formal Methods				
Simulation-based				

C.7 Validation means and tools

The following list of criteria focuss on means and tools to support validation activities, according WP2 requirements :

	Author	Assessor 1	Assessor 2	Total
Simulation-based				
Step-by-step simulation (D2.6-01-036)				
Environment emulation (D2.6-01-037 and D2.6-02-080)				
Time-based test case (D2.6-02-081)				
Test cases writing (D2.6-01-038)				
Test cases execution (D2.6-01-038)				
Test cases storage (D2.6-01-038)				
Version management of test cases (D2.6-02-082)				
Test generation from independant test model (D2.6-02-083)				
Test sequences writing (D2.6-02-084)				
Test sequences execution (D2.6-02-084)				
Test sequences storage (D2.6-02-084)				

C.8 VnV artifacts

Concerning the artifacts used or produced by the mean or tool, please to detail:

Input

Which is the list of the input artifacts for the mean or tools ?

Output

Which is the list of the output artifacts for the mean or tools ?

Syntax

Which are the reference documents which give a description of the artifacts syntax ?

Semantic

Which are the reference documents which give a description of the artifacts semantic ?

Integration

How these artifacts can be integrated with the elements of the toolchain (language, mangement,...) ?

C.9 Detailled Criterias for VnV

Please fill only the section concerning the proposed mean or tool, other section can be skipped (see issue `https://github.com/openETCS/toolchain/issues/180` for details and discussions)

C.9.1 System Modelling simulation

	Author	Assessor 1	Assessor 2	Total
User Scenario Modelling				
Test Case Modelling				
Test Sequence Modelling				

C.9.2 System Model Verification

	Author	Assessor 1	Assessor 2	Total
Input/ Output checking				
System Behavior Simulation (Mathematical)				
System Behavior Simulation (Animated)				

C.9.3 Software Model Verification

	Author	Assessor 1	Assessor 2	Total
Static Model Verification				
Property Proofing				
Dynamic Testing				
Automatic Test Generation				
Input/ Output checking				
Software Behaviour Simulation (Mathematical)				
Software Behaviour Simulation (Animated)				

C.9.4 Source Code

	Author	Assessor 1	Assessor 2	Total
Traceability to Model				

C.9.5 Code Verification

	Author	Assessor 1	Assessor 2	Total
Formal Proof				
Programming by contract				
Static Analysis				
Dynamic Analysis				
Dynamic Testing				
Automatic Test Generation				
Performance Testing				
Interface Testing				

C.9.6 Validation System/Software/Code/ Validation

	Author	Assessor 1	Assessor 2	Total
Test Coverage				
Use Case Validation of Model				
Functional or Black-box Testing				
User Scenario Testing				
Traceability				
Schedulability Analyzer / UseCase Check all				
Schedulability Analyzer / UseCase Check single mode				

C.10 Other comments

Comment. This section is available for the author or the assessors to complete the description and criteria.

Appendix D: Rodin

D.1 Instructions

Author Author of the approaches description %%Name - Company%%

Assessor 1 First assessor of the approaches %%Name - Company%%

Assessor 2 Second assessor of the approaches %%Name - Company%%

In the sequel, main text is under the responsibilities of the author.

Author: Author can add comments using this format at any place.

Assessor 1: First assessor can add comments using this format at any place.

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***** difficult to evaluate with a note (please add a comment under the table)

All the notes can be commented under each table.

This section defines the criteria for the means and tools dedicated to verification and validation activities, in the WP4 workpackage.

Criteria of this section are defined according [**?**].

D.2 Presentation

This section gives a quick presentation of the approach and the tool.

Name %%Name of the approach and the tool%%

Web site %%if available, how to find information%%

Licence %%Kind of licence%%

Abstract

Short abstract on the approach and tool (10 lines max)

Publications

Short list of publications on the approach (5 max)

D.3 Common criteria on secondary means and tools

This section discusses the common criteria of the means and tools according to the project requirements on tools and the results of T7.1.

D.3.1 Project and WP2 requirements

The objectives of this list of criteria is to check if the proposed means and tools meet the main criteria of the project: open-source approaches, usability, modularity, coverage of the objectives,...

According WP2 requirements, give a note for characteristics of the use of the tool (from 0 to 3) :

	Author	Assessor 1	Assessor 2	Total
Open Source (D2.6-02-074)				
Portability to operating systems (D2.6-02-075)				
Cooperation of tools (D2.6-02-076)				
Robustness (D2.6-02-078)				
Modularity (D2.6-02-078.1)				
Documentation management (D2.6-02-078.02)				
Distributed software development (D2.6-02-078.03)				
Simultaneous multi-users (D2.6-02-078.04)				
Issue tracking (D2.6-02-078.05)				
Differences between models (D2.6-02-078.06)				
Version management (D2.6-02-078.07)				
Concurrent version development (D2.6-02-078.08)				
Model-based version control (D2.6-02-078.09)				
Role traceability (D2.6-02-078.10)				
Safety version traceability (D2.6-02-078.11)				
Model traceability (D2.6-02-079)				
Tool chain integration				
Scalability				
User Friendliness				

D.3.2 Qualification

This section discusses how the tool can be classified according EN50128 requirements (D2.6-02-085). Some qualification shall be mandatory if the tool is involved to design a SIL4 software.

	Author	Assessor 1	Assessor 2	Total
Tool manual (D.2.6-01-42.02)				
Proof of correctness (D.2.6-01-42.03)				
Existing industrial usage				
Model verification				
Test generation				
Simulation, execution, debugging				
Formal proof				

Which level of tool qualification has been reached or will be reached within the next year ?

Score :

3 already qualified for this level

2 qualification possible to this level, but some elements shall be provided

0 qualification not recommended for this level

	Author	Assessor 1	Assessor 2	Total
class T1				
class T2				
class T3				

Other elements for tool certification

D.3.3 Complementarity with primary toolchain

The objectives of this list of criteria is to check if the proposed means and tools can be easily integrated to the primary toolchain.

D.3.3.1 Language

According to the decisions and the propositions of T7.1, how the mean and approach can be adapted to or can complete the chosen language and methods:

	Author	Assessor 1	Assessor 2	Total
SysML				
Scade method				
EFS language				
B Method				
C language				

SysML

How the means or tools can complete SysML ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling language ?

C language

How the means or tools can complete or be adapted to SIL4 software in C language ?

D.3.3.2 Tools and platforms

According to the decisions and the propositions of T7.1, how the mean and approach can be integrated to or can complete the chosen tools and platforms:

	Author	Assessor 1	Assessor 2	Total
Eclipse				
Papyrus				
Scade				
EFS tools				
B tools				

Eclipse

How the means or tools can be integrated to the Eclipse platform ?

Papyrus

How the means or tools can complete Papyrus ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling tools ?

D.4 VnV Activities

The VnV activities are described in details in the verification and Validation Plan [**?**].

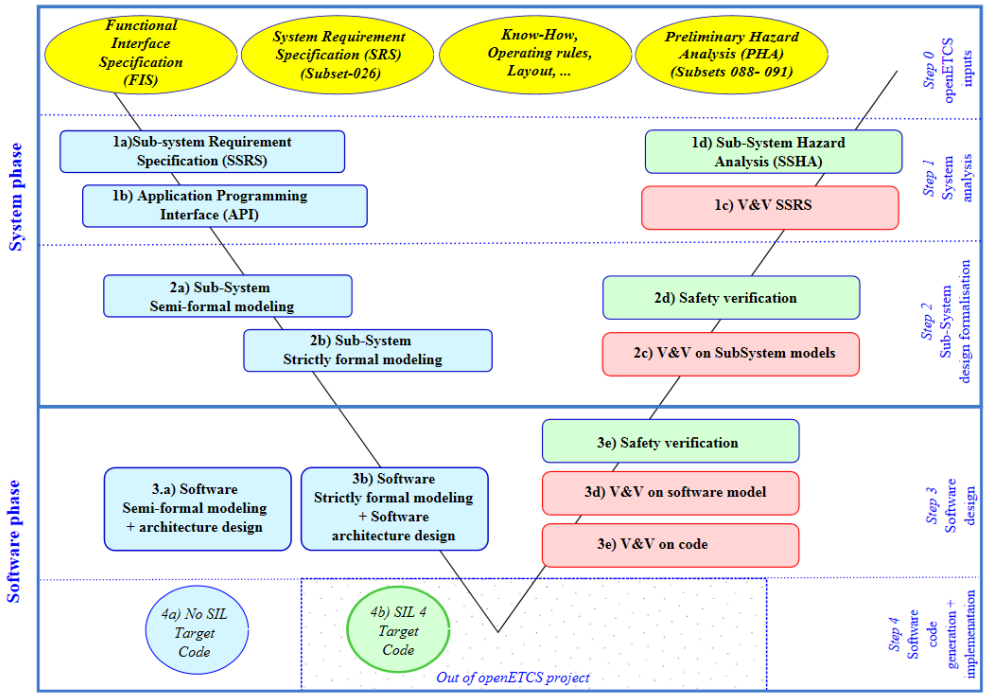

Figure D1. openETCS Process (rough view)

According figure 1, for which activities is the mean or tool suitable (see also [**?**] section 5.1.2 for more details)[5] ?

[5]DAS2V : Design Artifact Subject to Verification and Validation, see [**?**]

	Author	Assessor 1	Assessor 2	Total
1c SSRS Verification				
1c SSRS Validation				
2c SFM Verification				
2c SFM Validation				
3d SW-SFM Verification				
3d SW-SFM Validation				
3d SW-FFM Verification				
3d SW-FFM Validation				
3e Code Verification				
3e Code Validation				
DAS2V Verification				
DAS2V Validation				
Automatic model transformation verification				
Automatic code generation verification				

D.5 Properties

Which kind of properties or elements are verified or validated by the mean or tool (see also [**?**] section 4) ?

	Author	Assessor 1	Assessor 2	Total
Functionalities of the system and sub-system				
System and sub-system architecture				
External and internal interfaces of sub-system				
Software components				
Performance constraints				
Safety objectives				
Functional properties				
Safety properties				

D.6 Verification methods and tools

Which kind of methods is proposed (see also [**?**] section 5.3) ?

	Author	Assessor 1	Assessor 2	Total
Reviews				
Inspections				
Software Architecture Analysis Method				
Architecture Tradeoff Analysis Method				
Model-Based System Integration Testing				
Model-Based Testing of Generated High-Level Code				
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Model Checking				
Correct by Construction Formal Methods				
Verification with Formal Methods				
Simulation-based				

D.7 Validation means and tools

The following list of criteria focuss on means and tools to support validation activities, according WP2 requirements :

	Author	Assessor 1	Assessor 2	Total
Simulation-based				
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Test cases writing (D2.6-01-038)				
Test cases execution (D2.6-01-038)				
Test cases storage (D2.6-01-038)				
Version management of test cases (D2.6-02-082)				
Test generation from independant test model (D2.6-02-083)				
Test sequences writing (D2.6-02-084)				
Test sequences execution (D2.6-02-084)				
Test sequences storage (D2.6-02-084)				

D.8 VnV artifacts

Concerning the artifacts used or produced by the mean or tool, please to detail:

Input

Which is the list of the input artifacts for the mean or tools ?

Output

Which is the list of the output artifacts for the mean or tools ?

Syntax

Which are the reference documents which give a description of the artifacts syntax ?

Semantic

Which are the reference documents which give a description of the artifacts semantic ?

Integration

How these artifacts can be integrated with the elements of the toolchain (language, mangement,...) ?

D.9 Detailled Criterias for VnV

Please fill only the section concerning the proposed mean or tool, other section can be skipped (see issue `https://github.com/openETCS/toolchain/issues/180` for details and discussions)

D.9.1 System Modelling simulation

	Author	Assessor 1	Assessor 2	Total
User Scenario Modelling				
Test Case Modelling				
Test Sequence Modelling				

D.9.2 System Model Verification

	Author	Assessor 1	Assessor 2	Total
Input/ Output checking				
System Behavior Simulation (Mathematical)				
System Behavior Simulation (Animated)				

D.9.3 Software Model Verification

	Author	Assessor 1	Assessor 2	Total
Static Model Verification				
Property Proofing				
Dynamic Testing				
Automatic Test Generation				
Input/ Output checking				
Software Behaviour Simulation (Mathematical)				
Software Behaviour Simulation (Animated)				

D.9.4 Source Code

	Author	Assessor 1	Assessor 2	Total
Traceability to Model				

D.9.5 Code Verification

	Author	Assessor 1	Assessor 2	Total
Formal Proof				
Programming by contract				
Static Analysis				
Dynamic Analysis				
Dynamic Testing				
Automatic Test Generation				
Performance Testing				
Interface Testing				

D.9.6 Validation System/Software/Code/ Validation

	Author	Assessor 1	Assessor 2	Total
Test Coverage				
Use Case Validation of Model				
Functional or Black-box Testing				
User Scenario Testing				
Traceability				
Schedulability Analyzer / UseCase Check all				
Schedulability Analyzer / UseCase Check single mode				

D.10 Other comments

Comment. This section is available for the author or the assessors to complete the description and criteria.

Appendix E: Tools for classical B

E.1 Instructions

Author Author of the approaches description %%Name - Company%%

Assessor 1 First assessor of the approaches %%Name - Company%%

Assessor 2 Second assessor of the approaches %%Name - Company%%

In the sequel, main text is under the responsibilities of the author.

Author: Author can add comments using this format at any place.

Assessor 1: First assessor can add comments using this format at any place.

Assessor 2: Second assessor can add comments using this format at any place.

When a note is required, please follow this list (inspired from Technology Readiness Level, see `http://en.wikipedia.org/wiki/Technology_readiness_level`) :

0 not recommended / rejected / no integration possible or valuable / not adapted for this topic / not available for this topic

1 weakly recommended / adapted after major improvements / weakly rejected / concept of integration roughly defined / adapted after major improvements / available after major developments

2 recommended / adapted (with light improvements if necessary) weakly accepted / integration prototyped or defined in details / adapted after small improvements / available after small developments or tests

3 highly recommended / well adapted / strongly accepted / integration done and tested / well adapted to the purpose / available and suitable for the purpose All the notes can be commented under each table.

***** difficult to evaluate with a note (please add a comment under the table)

All the notes can be commented under each table.

This section defines the criteria for the means and tools dedicated to verification and validation activities, in the WP4 workpackage.

Criteria of this section are defined according [**?**].

E.2 Presentation

This section gives a quick presentation of the approach and the tool.

Name %%Name of the approach and the tool%%

Web site %%if available, how to find information%%

Licence %%Kind of licence%%

Abstract

Short abstract on the approach and tool (10 lines max)

Publications

Short list of publications on the approach (5 max)

E.3 Common criteria on secondary means and tools

This section discusses the common criteria of the means and tools according to the project requirements on tools and the results of T7.1.

E.3.1 Project and WP2 requirements

The objectives of this list of criteria is to check if the proposed means and tools meet the main criteria of the project: open-source approaches, usability, modularity, coverage of the objectives,...

According WP2 requirements, give a note for characteristics of the use of the tool (from 0 to 3) :

	Author	Assessor 1	Assessor 2	Total
Open Source (D2.6-02-074)				
Portability to operating systems (D2.6-02-075)				
Cooperation of tools (D2.6-02-076)				
Robustness (D2.6-02-078)				
Modularity (D2.6-02-078.1)				
Documentation management (D2.6-02-078.02)				
Distributed software development (D2.6-02-078.03)				
Simultaneous multi-users (D2.6-02-078.04)				
Issue tracking (D2.6-02-078.05)				
Differences between models (D2.6-02-078.06)				
Version management (D2.6-02-078.07)				
Concurrent version development (D2.6-02-078.08)				
Model-based version control (D2.6-02-078.09)				
Role traceability (D2.6-02-078.10)				
Safety version traceability (D2.6-02-078.11)				
Model traceability (D2.6-02-079)				
Tool chain integration				
Scalability				
User Friendliness				

E.3.2 Qualification

This section discusses how the tool can be classified according EN50128 requirements (D2.6-02-085). Some qualification shall be mandatory if the tool is involved to design a SIL4 software.

	Author	Assessor 1	Assessor 2	Total
Tool manual (D.2.6-01-42.02)				
Proof of correctness (D.2.6-01-42.03)				
Existing industrial usage				
Model verification				
Test generation				
Simulation, execution, debugging				
Formal proof				

Which level of tool qualification has been reached or will be reached within the next year ?

Score :

3 already qualified for this level

2 qualification possible to this level, but some elements shall be provided

0 qualification not recommended for this level

	Author	Assessor 1	Assessor 2	Total
class T1				
class T2				
class T3				

Other elements for tool certification

E.3.3 Complementarity with primary toolchain

The objectives of this list of criteria is to check if the proposed means and tools can be easily integrated to the primary toolchain.

E.3.3.1 Language

According to the decisions and the propositions of T7.1, how the mean and approach can be adapted to or can complete the chosen language and methods:

	Author	Assessor 1	Assessor 2	Total
SysML				
Scade method				
EFS language				
B Method				
C language				

SysML

How the means or tools can complete SysML ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling language ?

C language

How the means or tools can complete or be adapted to SIL4 software in C language ?

E.3.3.2 Tools and platforms

According to the decisions and the propositions of T7.1, how the mean and approach can be integrated to or can complete the chosen tools and platforms:

	Author	Assessor 1	Assessor 2	Total
Eclipse				
Papyrus				
Scade				
EFS tools				
B tools				

Eclipse

How the means or tools can be integrated to the Eclipse platform ?

Papyrus

How the means or tools can complete Papyrus ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling tools ?

E.4 VnV Activities

The VnV activities are described in details in the verification and Validation Plan [**?**].

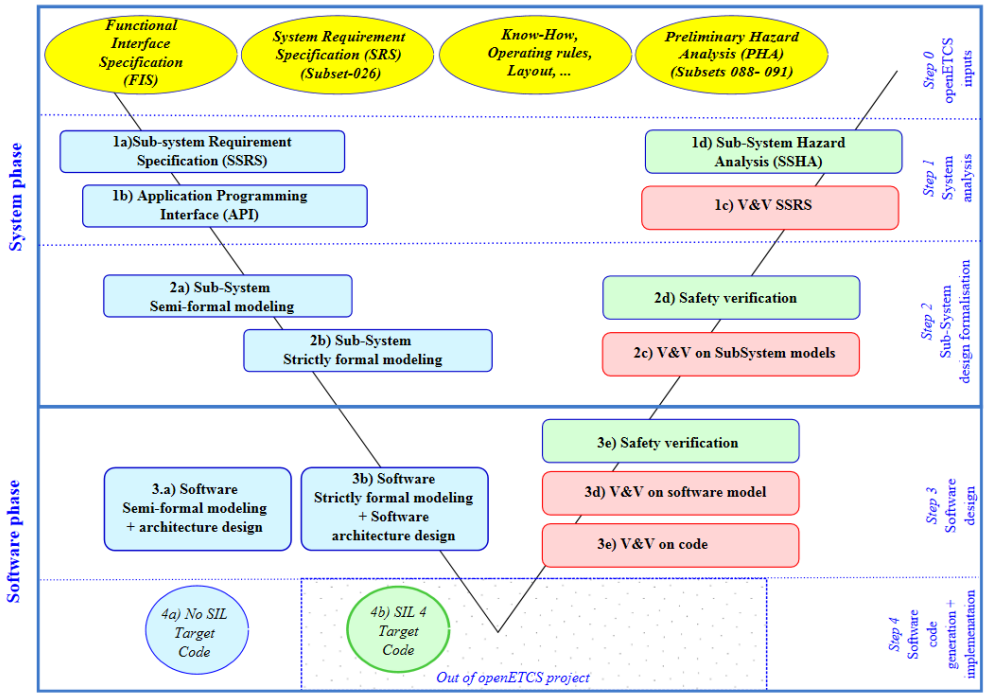

Figure E1. openETCS Process (rough view)

According figure 1, for which activities is the mean or tool suitable (see also [**?**] section 5.1.2 for more details)[6] ?

[6]DAS2V : Design Artifact Subject to Verification and Validation, see [**?**]

	Author	Assessor 1	Assessor 2	Total
1c SSRS Verification				
1c SSRS Validation				
2c SFM Verification				
2c SFM Validation				
3d SW-SFM Verification				
3d SW-SFM Validation				
3d SW-FFM Verification				
3d SW-FFM Validation				
3e Code Verification				
3e Code Validation				
DAS2V Verification				
DAS2V Validation				
Automatic model transformation verification				
Automatic code generation verification				

E.5 Properties

Which kind of properties or elements are verified or validated by the mean or tool (see also [**?**] section 4) ?

	Author	Assessor 1	Assessor 2	Total
Functionalities of the system and sub-system				
System and sub-system architecture				
External and internal interfaces of sub-system				
Software components				
Performance constraints				
Safety objectives				
Functional properties				
Safety properties				

E.6 Verification methods and tools

Which kind of methods is proposed (see also [**?**] section 5.3) ?

	Author	Assessor 1	Assessor 2	Total
Reviews				
Inspections				
Software Architecture Analysis Method				
Architecture Tradeoff Analysis Method				
Model-Based System Integration Testing				
Model-Based Testing of Generated High-Level Code				
Abstract Interpretation				
Deductive Verification				
Model Checking				
Correct by Construction Formal Methods				
Verification with Formal Methods				
Simulation-based				

E.7 Validation means and tools

The following list of criteria focuss on means and tools to support validation activities, according WP2 requirements :

	Author	Assessor 1	Assessor 2	Total
Simulation-based				
Step-by-step simulation (D2.6-01-036)				
Environment emulation (D2.6-01-037 and D2.6-02-080)				
Time-based test case (D2.6-02-081)				
Test cases writing (D2.6-01-038)				
Test cases execution (D2.6-01-038)				
Test cases storage (D2.6-01-038)				
Version management of test cases (D2.6-02-082)				
Test generation from independant test model (D2.6-02-083)				
Test sequences writing (D2.6-02-084)				
Test sequences execution (D2.6-02-084)				
Test sequences storage (D2.6-02-084)				

E.8 VnV artifacts

Concerning the artifacts used or produced by the mean or tool, please to detail:

Input

Which is the list of the input artifacts for the mean or tools ?

Output

Which is the list of the output artifacts for the mean or tools ?

Syntax

Which are the reference documents which give a description of the artifacts syntax ?

Semantic

Which are the reference documents which give a description of the artifacts semantic ?

Integration

How these artifacts can be integrated with the elements of the toolchain (language, mangement,...) ?

E.9 Detailled Criterias for VnV

Please fill only the section concerning the proposed mean or tool, other section can be skipped (see issue `https://github.com/openETCS/toolchain/issues/180` for details and discussions)

E.9.1 System Modelling simulation

	Author	Assessor 1	Assessor 2	Total
User Scenario Modelling				
Test Case Modelling				
Test Sequence Modelling				

E.9.2 System Model Verification

	Author	Assessor 1	Assessor 2	Total
Input/ Output checking				
System Behavior Simulation (Mathematical)				
System Behavior Simulation (Animated)				

E.9.3 Software Model Verification

	Author	Assessor 1	Assessor 2	Total
Static Model Verification				
Property Proofing				
Dynamic Testing				
Automatic Test Generation				
Input/ Output checking				
Software Behaviour Simulation (Mathematical)				
Software Behaviour Simulation (Animated)				

E.9.4 Source Code

	Author	Assessor 1	Assessor 2	Total
Traceability to Model				

E.9.5 Code Verification

	Author	Assessor 1	Assessor 2	Total
Formal Proof				
Programming by contract				
Static Analysis				
Dynamic Analysis				
Dynamic Testing				
Automatic Test Generation				
Performance Testing				
Interface Testing				

E.9.6 Validation System/Software/Code/ Validation

	Author	Assessor 1	Assessor 2	Total
Test Coverage				
Use Case Validation of Model				
Functional or Black-box Testing				
User Scenario Testing				
Traceability				
Schedulability Analyzer / UseCase Check all				
Schedulability Analyzer / UseCase Check single mode				

E.10 Other comments

Comment. This section is available for the author or the assessors to complete the description and criteria.

Appendix F: CPN tools

F.1 Instructions

Author Author of the approaches description %%Name - Company%%

Assessor 1 First assessor of the approaches %%Name - Company%%

Assessor 2 Second assessor of the approaches %%Name - Company%%

In the sequel, main text is under the responsibilities of the author.

Author: Author can add comments using this format at any place.

Assessor 1: First assessor can add comments using this format at any place.

Assessor 2: Second assessor can add comments using this format at any place.

When a note is required, please follow this list (inspired from Technology Readiness Level, see `http://en.wikipedia.org/wiki/Technology_readiness_level`) :

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1 weakly recommended / adapted after major improvements / weakly rejected / concept of integration roughly defined / adapted after major improvements / available after major developments

2 recommended / adapted (with light improvements if necessary) weakly accepted / integration prototyped or defined in details / adapted after small improvements / available after small developments or tests

3 highly recommended / well adapted / strongly accepted / integration done and tested / well adapted to the purpose / available and suitable for the purpose All the notes can be commented under each table.

***** difficult to evaluate with a note (please add a comment under the table)

All the notes can be commented under each table.

This section defines the criteria for the means and tools dedicated to verification and validation activities, in the WP4 workpackage.

Criteria of this section are defined according [**?**].

F.2 Presentation

This section gives a quick presentation of the approach and the tool.

Name %%Name of the approach and the tool%%

Web site %%if available, how to find information%%

Licence %%Kind of licence%%

Abstract

Short abstract on the approach and tool (10 lines max)

Publications

Short list of publications on the approach (5 max)

F.3 Common criteria on secondary means and tools

This section discusses the common criteria of the means and tools according to the project requirements on tools and the results of T7.1.

F.3.1 Project and WP2 requirements

The objectives of this list of criteria is to check if the proposed means and tools meet the main criteria of the project: open-source approaches, usability, modularity, coverage of the objectives,...

According WP2 requirements, give a note for characteristics of the use of the tool (from 0 to 3) :

	Author	Assessor 1	Assessor 2	Total
Open Source (D2.6-02-074)				
Portability to operating systems (D2.6-02-075)				
Cooperation of tools (D2.6-02-076)				
Robustness (D2.6-02-078)				
Modularity (D2.6-02-078.1)				
Documentation management (D2.6-02-078.02)				
Distributed software development (D2.6-02-078.03)				
Simultaneous multi-users (D2.6-02-078.04)				
Issue tracking (D2.6-02-078.05)				
Differences between models (D2.6-02-078.06)				
Version management (D2.6-02-078.07)				
Concurrent version development (D2.6-02-078.08)				
Model-based version control (D2.6-02-078.09)				
Role traceability (D2.6-02-078.10)				
Safety version traceability (D2.6-02-078.11)				
Model traceability (D2.6-02-079)				
Tool chain integration				
Scalability				
User Friendliness				

F.3.2 Qualification

This section discusses how the tool can be classified according EN50128 requirements (D2.6-02-085). Some qualification shall be mandatory if the tool is involved to design a SIL4 software.

	Author	Assessor 1	Assessor 2	Total
Tool manual (D.2.6-01-42.02)				
Proof of correctness (D.2.6-01-42.03)				
Existing industrial usage				
Model verification				
Test generation				
Simulation, execution, debugging				
Formal proof				

Which level of tool qualification has been reached or will be reached within the next year ?

Score :

3 already qualified for this level

2 qualification possible to this level, but some elements shall be provided

0 qualification not recommended for this level

	Author	Assessor 1	Assessor 2	Total
class T1				
class T2				
class T3				

Other elements for tool certification

F.3.3 Complementarity with primary toolchain

The objectives of this list of criteria is to check if the proposed means and tools can be easily integrated to the primary toolchain.

F.3.3.1 Language

According to the decisions and the propositions of T7.1, how the mean and approach can be adapted to or can complete the chosen language and methods:

	Author	Assessor 1	Assessor 2	Total
SysML				
Scade method				
EFS language				
B Method				
C language				

SysML

How the means or tools can complete SysML ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling language ?

C language

How the means or tools can complete or be adapted to SIL4 software in C language ?

F.3.3.2 Tools and platforms

According to the decisions and the propositions of T7.1, how the mean and approach can be integrated to or can complete the chosen tools and platforms:

	Author	Assessor 1	Assessor 2	Total
Eclipse				
Papyrus				
Scade				
EFS tools				
B tools				

Eclipse

How the means or tools can be integrated to the Eclipse platform ?

Papyrus

How the means or tools can complete Papyrus ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling tools ?

F.4 VnV Activities

The VnV activities are described in details in the verification and Validation Plan [**?**].

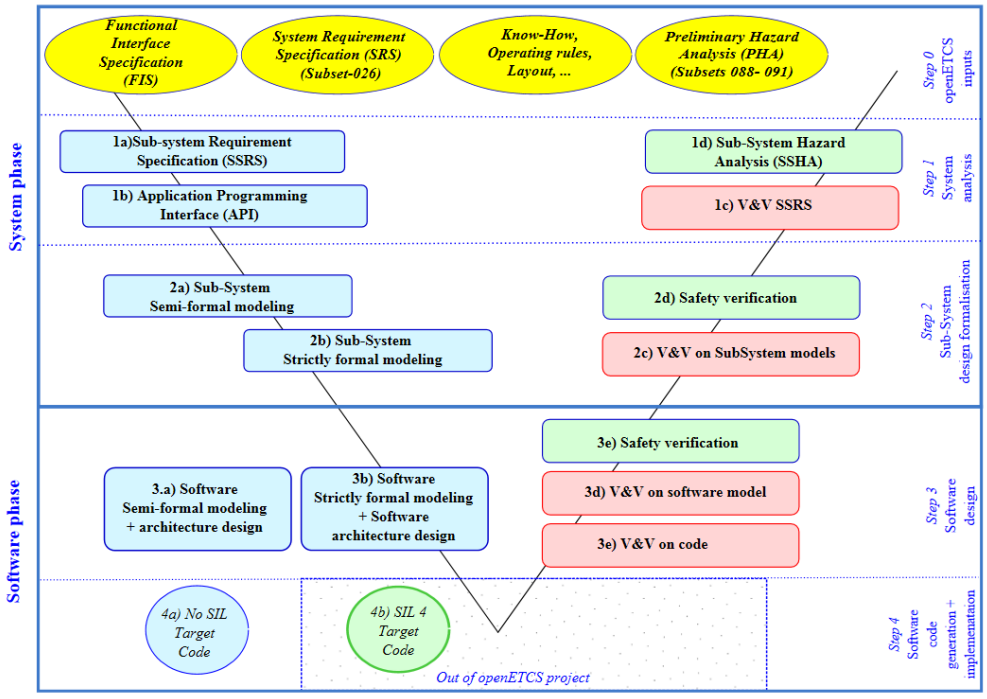

Figure F1. openETCS Process (rough view)

According figure 1, for which activities is the mean or tool suitable (see also [**?**] section 5.1.2 for more details)[7] ?

[7] DAS2V : Design Artifact Subject to Verification and Validation, see [**?**]

	Author	Assessor 1	Assessor 2	Total
1c SSRS Verification				
1c SSRS Validation				
2c SFM Verification				
2c SFM Validation				
3d SW-SFM Verification				
3d SW-SFM Validation				
3d SW-FFM Verification				
3d SW-FFM Validation				
3e Code Verification				
3e Code Validation				
DAS2V Verification				
DAS2V Validation				
Automatic model transformation verification				
Automatic code generation verification				

F.5 Properties

Which kind of properties or elements are verified or validated by the mean or tool (see also [**?**] section 4) ?

	Author	Assessor 1	Assessor 2	Total
Functionalities of the system and sub-system				
System and sub-system architecture				
External and internal interfaces of sub-system				
Software components				
Performance constraints				
Safety objectives				
Functional properties				
Safety properties				

F.6 Verification methods and tools

Which kind of methods is proposed (see also [**?**] section 5.3) ?

	Author	Assessor 1	Assessor 2	Total
Reviews				
Inspections				
Software Architecture Analysis Method				
Architecture Tradeoff Analysis Method				
Model-Based System Integration Testing				
Model-Based Testing of Generated High-Level Code				
Abstract Interpretation				
Deductive Verification				
Model Checking				
Correct by Construction Formal Methods				
Verification with Formal Methods				
Simulation-based				

F.7 Validation means and tools

The following list of criteria focuss on means and tools to support validation activities, according WP2 requirements :

	Author	Assessor 1	Assessor 2	Total
Simulation-based				
Step-by-step simulation (D2.6-01-036)				
Environment emulation (D2.6-01-037 and D2.6-02-080)				
Time-based test case (D2.6-02-081)				
Test cases writing (D2.6-01-038)				
Test cases execution (D2.6-01-038)				
Test cases storage (D2.6-01-038)				
Version management of test cases (D2.6-02-082)				
Test generation from independant test model (D2.6-02-083)				
Test sequences writing (D2.6-02-084)				
Test sequences execution (D2.6-02-084)				
Test sequences storage (D2.6-02-084)				

F.8 VnV artifacts

Concerning the artifacts used or produced by the mean or tool, please to detail:

Input

Which is the list of the input artifacts for the mean or tools ?

Output

Which is the list of the output artifacts for the mean or tools ?

Syntax

Which are the reference documents which give a description of the artifacts syntax ?

Semantic

Which are the reference documents which give a description of the artifacts semantic ?

Integration

How these artifacts can be integrated with the elements of the toolchain (language, mangement,...) ?

F.9 Detailled Criterias for VnV

Please fill only the section concerning the proposed mean or tool, other section can be skipped (see issue `https://github.com/openETCS/toolchain/issues/180` for details and discussions)

F.9.1 System Modelling simulation

	Author	Assessor 1	Assessor 2	Total
User Scenario Modelling				
Test Case Modelling				
Test Sequence Modelling				

F.9.2 System Model Verification

	Author	Assessor 1	Assessor 2	Total
Input/ Output checking				
System Behavior Simulation (Mathematical)				
System Behavior Simulation (Animated)				

F.9.3 Software Model Verification

	Author	Assessor 1	Assessor 2	Total
Static Model Verification				
Property Proofing				
Dynamic Testing				
Automatic Test Generation				
Input/ Output checking				
Software Behaviour Simulation (Mathematical)				
Software Behaviour Simulation (Animated)				

F.9.4 Source Code

	Author	Assessor 1	Assessor 2	Total
Traceability to Model				

F.9.5 Code Verification

	Author	Assessor 1	Assessor 2	Total
Formal Proof				
Programming by contract				
Static Analysis				
Dynamic Analysis				
Dynamic Testing				
Automatic Test Generation				
Performance Testing				
Interface Testing				

F.9.6 Validation System/Software/Code/ Validation

	Author	Assessor 1	Assessor 2	Total
Test Coverage				
Use Case Validation of Model				
Functional or Black-box Testing				
User Scenario Testing				
Traceability				
Schedulability Analyzer / UseCase Check all				
Schedulability Analyzer / UseCase Check single mode				

F.10 Other comments

Comment. This section is available for the author or the assessors to complete the description and criteria.

Appendix G: Matelo

G.1 Instructions

Author Author of the approaches description %%Name - Company%%

Assessor 1 First assessor of the approaches %%Name - Company%%

Assessor 2 Second assessor of the approaches %%Name - Company%%

In the sequel, main text is under the responsibilities of the author.

Author: Author can add comments using this format at any place.

Assessor 1: First assessor can add comments using this format at any place.

Assessor 2: Second assessor can add comments using this format at any place.

When a note is required, please follow this list (inspired from Technology Readiness Level, see `http://en.wikipedia.org/wiki/Technology_readiness_level`) :

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1 weakly recommended / adapted after major improvements / weakly rejected / concept of integration roughly defined / adapted after major improvements / available after major developments

2 recommended / adapted (with light improvements if necessary) weakly accepted / integration prototyped or defined in details / adapted after small improvements / available after small developments or tests

3 highly recommended / well adapted / strongly accepted / integration done and tested / well adapted to the purpose / available and suitable for the purpose All the notes can be commented under each table.

***** difficult to evaluate with a note (please add a comment under the table)

All the notes can be commented under each table.

This section defines the criteria for the means and tools dedicated to verification and validation activities, in the WP4 workpackage.

Criteria of this section are defined according [**?**].

G.2 Presentation

This section gives a quick presentation of the approach and the tool.

Name %%Name of the approach and the tool%%

Web site %%if available, how to find information%%

Licence %%Kind of licence%%

Abstract

Short abstract on the approach and tool (10 lines max)

Publications

Short list of publications on the approach (5 max)

G.3 Common criteria on secondary means and tools

This section discusses the common criteria of the means and tools according to the project requirements on tools and the results of T7.1.

G.3.1 Project and WP2 requirements

The objectives of this list of criteria is to check if the proposed means and tools meet the main criteria of the project: open-source approaches, usability, modularity, coverage of the objectives,...

According WP2 requirements, give a note for characteristics of the use of the tool (from 0 to 3) :

	Author	Assessor 1	Assessor 2	Total
Open Source (D2.6-02-074)				
Portability to operating systems (D2.6-02-075)				
Cooperation of tools (D2.6-02-076)				
Robustness (D2.6-02-078)				
Modularity (D2.6-02-078.1)				
Documentation management (D2.6-02-078.02)				
Distributed software development (D2.6-02-078.03)				
Simultaneous multi-users (D2.6-02-078.04)				
Issue tracking (D2.6-02-078.05)				
Differences between models (D2.6-02-078.06)				
Version management (D2.6-02-078.07)				
Concurrent version development (D2.6-02-078.08)				
Model-based version control (D2.6-02-078.09)				
Role traceability (D2.6-02-078.10)				
Safety version traceability (D2.6-02-078.11)				
Model traceability (D2.6-02-079)				
Tool chain integration				
Scalability				
User Friendliness				

G.3.2 Qualification

This section discusses how the tool can be classified according EN50128 requirements (D2.6-02-085). Some qualification shall be mandatory if the tool is involved to design a SIL4 software.

	Author	Assessor 1	Assessor 2	Total
Tool manual (D.2.6-01-42.02)				
Proof of correctness (D.2.6-01-42.03)				
Existing industrial usage				
Model verification				
Test generation				
Simulation, execution, debugging				
Formal proof				

Which level of tool qualification has been reached or will be reached within the next year ?

Score :

3 already qualified for this level

2 qualification possible to this level, but some elements shall be provided

0 qualification not recommended for this level

	Author	Assessor 1	Assessor 2	Total
class T1				
class T2				
class T3				

Other elements for tool certification

G.3.3 Complementarity with primary toolchain

The objectives of this list of criteria is to check if the proposed means and tools can be easily integrated to the primary toolchain.

G.3.3.1 Language

According to the decisions and the propositions of T7.1, how the mean and approach can be adapted to or can complete the chosen language and methods:

	Author	Assessor 1	Assessor 2	Total
SysML				
Scade method				
EFS language				
B Method				
C language				

SysML

How the means or tools can complete SysML ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling language ?

C language

How the means or tools can complete or be adapted to SIL4 software in C language ?

G.3.3.2 Tools and platforms

According to the decisions and the propositions of T7.1, how the mean and approach can be integrated to or can complete the chosen tools and platforms:

	Author	Assessor 1	Assessor 2	Total
Eclipse				
Papyrus				
Scade				
EFS tools				
B tools				

Eclipse

How the means or tools can be integrated to the Eclipse platform ?

Papyrus

How the means or tools can complete Papyrus ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling tools ?

G.4 VnV Activities

The VnV activities are described in details in the verification and Validation Plan [**?**].

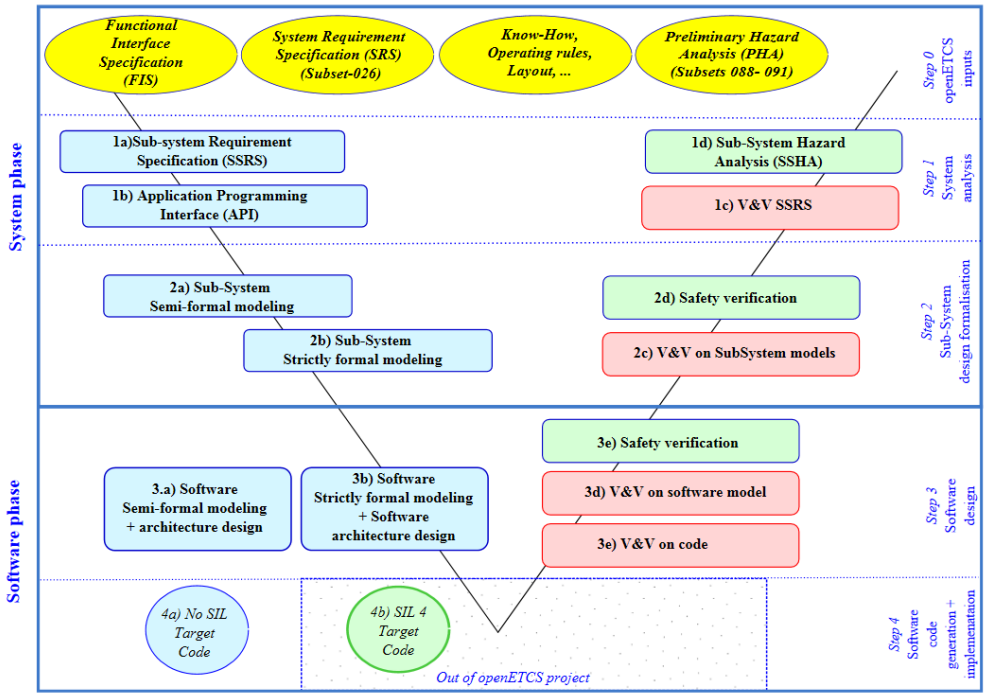

Figure G1. openETCS Process (rough view)

According figure 1, for which activities is the mean or tool suitable (see also [**?**] section 5.1.2 for more details)[8] ?

[8]DAS2V : Design Artifact Subject to Verification and Validation, see [**?**]

	Author	Assessor 1	Assessor 2	Total
1c SSRS Verification				
1c SSRS Validation				
2c SFM Verification				
2c SFM Validation				
3d SW-SFM Verification				
3d SW-SFM Validation				
3d SW-FFM Verification				
3d SW-FFM Validation				
3e Code Verification				
3e Code Validation				
DAS2V Verification				
DAS2V Validation				
Automatic model transformation verification				
Automatic code generation verification				

G.5 Properties

Which kind of properties or elements are verified or validated by the mean or tool (see also [**?**] section 4) ?

	Author	Assessor 1	Assessor 2	Total
Functionalities of the system and sub-system				
System and sub-system architecture				
External and internal interfaces of sub-system				
Software components				
Performance constraints				
Safety objectives				
Functional properties				
Safety properties				

G.6 Verification methods and tools

Which kind of methods is proposed (see also [**?**] section 5.3) ?

	Author	Assessor 1	Assessor 2	Total
Reviews				
Inspections				
Software Architecture Analysis Method				
Architecture Tradeoff Analysis Method				
Model-Based System Integration Testing				
Model-Based Testing of Generated High-Level Code				
Abstract Interpretation				
Deductive Verification				
Model Checking				
Correct by Construction Formal Methods				
Verification with Formal Methods				
Simulation-based				

G.7 Validation means and tools

The following list of criteria focuss on means and tools to support validation activities, according WP2 requirements :

	Author	Assessor 1	Assessor 2	Total
Simulation-based				
Step-by-step simulation (D2.6-01-036)				
Environment emulation (D2.6-01-037 and D2.6-02-080)				
Time-based test case (D2.6-02-081)				
Test cases writing (D2.6-01-038)				
Test cases execution (D2.6-01-038)				
Test cases storage (D2.6-01-038)				
Version management of test cases (D2.6-02-082)				
Test generation from independant test model (D2.6-02-083)				
Test sequences writing (D2.6-02-084)				
Test sequences execution (D2.6-02-084)				
Test sequences storage (D2.6-02-084)				

G.8 VnV artifacts

Concerning the artifacts used or produced by the mean or tool, please to detail:

Input

Which is the list of the input artifacts for the mean or tools ?

Output

Which is the list of the output artifacts for the mean or tools ?

Syntax

Which are the reference documents which give a description of the artifacts syntax ?

Semantic

Which are the reference documents which give a description of the artifacts semantic ?

Integration

How these artifacts can be integrated with the elements of the toolchain (language, mangement,...) ?

G.9 Detailled Criterias for VnV

Please fill only the section concerning the proposed mean or tool, other section can be skipped (see issue `https://github.com/openETCS/toolchain/issues/180` for details and discussions)

G.9.1 System Modelling simulation

	Author	Assessor 1	Assessor 2	Total
User Scenario Modelling				
Test Case Modelling				
Test Sequence Modelling				

G.9.2 System Model Verification

	Author	Assessor 1	Assessor 2	Total
Input/ Output checking				
System Behavior Simulation (Mathematical)				
System Behavior Simulation (Animated)				

G.9.3 Software Model Verification

	Author	Assessor 1	Assessor 2	Total
Static Model Verification				
Property Proofing				
Dynamic Testing				
Automatic Test Generation				
Input/ Output checking				
Software Behaviour Simulation (Mathematical)				
Software Behaviour Simulation (Animated)				

G.9.4 Source Code

	Author	Assessor 1	Assessor 2	Total
Traceability to Model				

G.9.5 Code Verification

	Author	Assessor 1	Assessor 2	Total
Formal Proof				
Programming by contract				
Static Analysis				
Dynamic Analysis				
Dynamic Testing				
Automatic Test Generation				
Performance Testing				
Interface Testing				

G.9.6 Validation System/Software/Code/ Validation

	Author	Assessor 1	Assessor 2	Total
Test Coverage				
Use Case Validation of Model				
Functional or Black-box Testing				
User Scenario Testing				
Traceability				
Schedulability Analyzer / UseCase Check all				
Schedulability Analyzer / UseCase Check single mode				

G.10 Other comments

Comment. This section is available for the author or the assessors to complete the description and criteria.

Appendix H: RT-Tester

H.1 Instructions

Author Author of the approaches description %%Name - Company%%

Assessor 1 First assessor of the approaches %%Name - Company%%

Assessor 2 Second assessor of the approaches %%Name - Company%%

In the sequel, main text is under the responsibilities of the author.

Author: Author can add comments using this format at any place.

Assessor 1: First assessor can add comments using this format at any place.

Assessor 2: Second assessor can add comments using this format at any place.

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1 weakly recommended / adapted after major improvements / weakly rejected / concept of integration roughly defined / adapted after major improvements / available after major developments

2 recommended / adapted (with light improvements if necessary) weakly accepted / integration prototyped or defined in details / adapted after small improvements / available after small developments or tests

3 highly recommended / well adapted / strongly accepted / integration done and tested / well adapted to the purpose / available and suitable for the purpose All the notes can be commented under each table.

***** difficult to evaluate with a note (please add a comment under the table)

All the notes can be commented under each table.

This section defines the criteria for the means and tools dedicated to verification and validation activities, in the WP4 workpackage.

Criteria of this section are defined according [**?**].

H.2 Presentation

This section gives a quick presentation of the approach and the tool.

Name %%Name of the approach and the tool%%

Web site %%if available, how to find information%%

Licence %%Kind of licence%%

Abstract

Short abstract on the approach and tool (10 lines max)

Publications

Short list of publications on the approach (5 max)

H.3 Common criteria on secondary means and tools

This section discusses the common criteria of the means and tools according to the project requirements on tools and the results of T7.1.

H.3.1 Project and WP2 requirements

The objectives of this list of criteria is to check if the proposed means and tools meet the main criteria of the project: open-source approaches, usability, modularity, coverage of the objectives,...

According WP2 requirements, give a note for characteristics of the use of the tool (from 0 to 3) :

	Author	Assessor 1	Assessor 2	Total
Open Source (D2.6-02-074)				
Portability to operating systems (D2.6-02-075)				
Cooperation of tools (D2.6-02-076)				
Robustness (D2.6-02-078)				
Modularity (D2.6-02-078.1)				
Documentation management (D2.6-02-078.02)				
Distributed software development (D2.6-02-078.03)				
Simultaneous multi-users (D2.6-02-078.04)				
Issue tracking (D2.6-02-078.05)				
Differences between models (D2.6-02-078.06)				
Version management (D2.6-02-078.07)				
Concurrent version development (D2.6-02-078.08)				
Model-based version control (D2.6-02-078.09)				
Role traceability (D2.6-02-078.10)				
Safety version traceability (D2.6-02-078.11)				
Model traceability (D2.6-02-079)				
Tool chain integration				
Scalability				
User Friendliness				

H.3.2 Qualification

This section discusses how the tool can be classified according EN50128 requirements (D2.6-02-085). Some qualification shall be mandatory if the tool is involved to design a SIL4 software.

	Author	Assessor 1	Assessor 2	Total
Tool manual (D.2.6-01-42.02)				
Proof of correctness (D.2.6-01-42.03)				
Existing industrial usage				
Model verification				
Test generation				
Simulation, execution, debugging				
Formal proof				

Which level of tool qualification has been reached or will be reached within the next year ?

Score :

3 already qualified for this level

2 qualification possible to this level, but some elements shall be provided

0 qualification not recommended for this level

	Author	Assessor 1	Assessor 2	Total
class T1				
class T2				
class T3				

Other elements for tool certification

H.3.3 Complementarity with primary toolchain

The objectives of this list of criteria is to check if the proposed means and tools can be easily integrated to the primary toolchain.

H.3.3.1 Language

According to the decisions and the propositions of T7.1, how the mean and approach can be adapted to or can complete the chosen language and methods:

	Author	Assessor 1	Assessor 2	Total
SysML				
Scade method				
EFS language				
B Method				
C language				

SysML

How the means or tools can complete SysML ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling language ?

C language

How the means or tools can complete or be adapted to SIL4 software in C language ?

H.3.3.2 Tools and platforms

According to the decisions and the propositions of T7.1, how the mean and approach can be integrated to or can complete the chosen tools and platforms:

	Author	Assessor 1	Assessor 2	Total
Eclipse				
Papyrus				
Scade				
EFS tools				
B tools				

Eclipse

How the means or tools can be integrated to the Eclipse platform ?

Papyrus

How the means or tools can complete Papyrus ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling tools ?

H.4 VnV Activities

The VnV activities are described in details in the verification and Validation Plan [**?**].

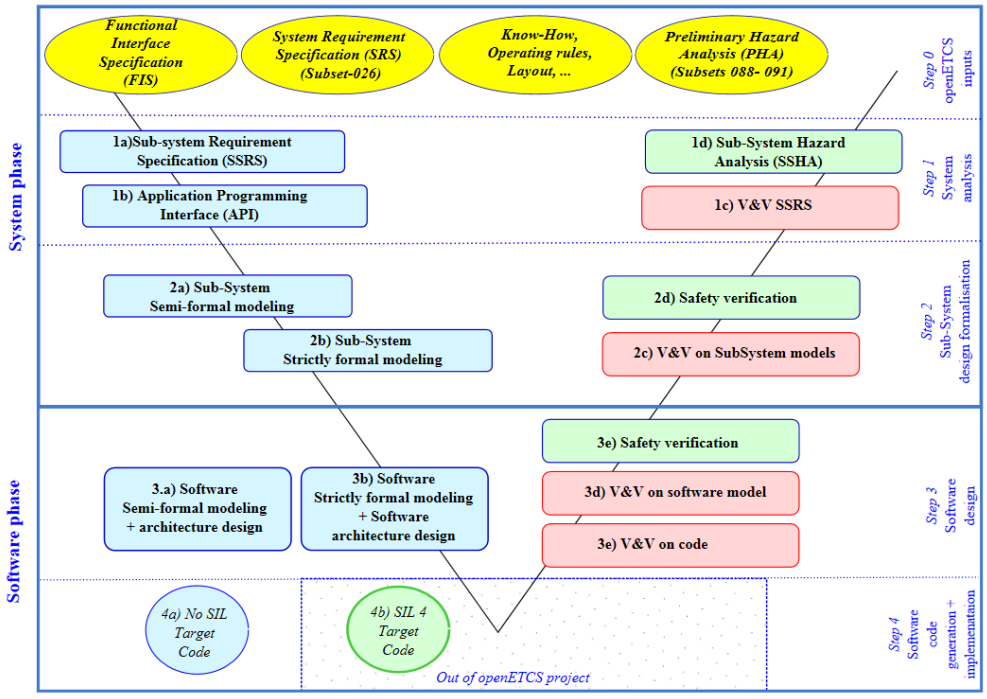

Figure H1. openETCS Process (rough view)

According figure 1, for which activities is the mean or tool suitable (see also [**?**] section 5.1.2 for more details)[9] ?

[9]DAS2V : Design Artifact Subject to Verification and Validation, see [**?**]

	Author	Assessor 1	Assessor 2	Total
1c SSRS Verification				
1c SSRS Validation				
2c SFM Verification				
2c SFM Validation				
3d SW-SFM Verification				
3d SW-SFM Validation				
3d SW-FFM Verification				
3d SW-FFM Validation				
3e Code Verification				
3e Code Validation				
DAS2V Verification				
DAS2V Validation				
Automatic model transformation verification				
Automatic code generation verification				

H.5 Properties

Which kind of properties or elements are verified or validated by the mean or tool (see also [**?**] section 4) ?

	Author	Assessor 1	Assessor 2	Total
Functionalities of the system and sub-system				
System and sub-system architecture				
External and internal interfaces of sub-system				
Software components				
Performance constraints				
Safety objectives				
Functional properties				
Safety properties				

H.6 Verification methods and tools

Which kind of methods is proposed (see also [**?**] section 5.3) ?

	Author	Assessor 1	Assessor 2	Total
Reviews				
Inspections				
Software Architecture Analysis Method				
Architecture Tradeoff Analysis Method				
Model-Based System Integration Testing				
Model-Based Testing of Generated High-Level Code				
Abstract Interpretation				
Deductive Verification				
Model Checking				
Correct by Construction Formal Methods				
Verification with Formal Methods				
Simulation-based				

H.7 Validation means and tools

The following list of criteria focuss on means and tools to support validation activities, according WP2 requirements :

	Author	Assessor 1	Assessor 2	Total
Simulation-based				
Step-by-step simulation (D2.6-01-036)				
Environment emulation (D2.6-01-037 and D2.6-02-080)				
Time-based test case (D2.6-02-081)				
Test cases writing (D2.6-01-038)				
Test cases execution (D2.6-01-038)				
Test cases storage (D2.6-01-038)				
Version management of test cases (D2.6-02-082)				
Test generation from independant test model (D2.6-02-083)				
Test sequences writing (D2.6-02-084)				
Test sequences execution (D2.6-02-084)				
Test sequences storage (D2.6-02-084)				

H.8 VnV artifacts

Concerning the artifacts used or produced by the mean or tool, please to detail:

Input

Which is the list of the input artifacts for the mean or tools ?

Output

Which is the list of the output artifacts for the mean or tools ?

Syntax

Which are the reference documents which give a description of the artifacts syntax ?

Semantic

Which are the reference documents which give a description of the artifacts semantic ?

Integration

How these artifacts can be integrated with the elements of the toolchain (language, mangement,...) ?

H.9 Detailled Criterias for VnV

Please fill only the section concerning the proposed mean or tool, other section can be skipped (see issue `https://github.com/openETCS/toolchain/issues/180` for details and discussions)

H.9.1 System Modelling simulation

	Author	Assessor 1	Assessor 2	Total
User Scenario Modelling				
Test Case Modelling				
Test Sequence Modelling				

H.9.2 System Model Verification

	Author	Assessor 1	Assessor 2	Total
Input/ Output checking				
System Behavior Simulation (Mathematical)				
System Behavior Simulation (Animated)				

H.9.3 Software Model Verification

	Author	Assessor 1	Assessor 2	Total
Static Model Verification				
Property Proofing				
Dynamic Testing				
Automatic Test Generation				
Input/ Output checking				
Software Behaviour Simulation (Mathematical)				
Software Behaviour Simulation (Animated)				

H.9.4 Source Code

	Author	Assessor 1	Assessor 2	Total
Traceability to Model				

H.9.5 Code Verification

	Author	Assessor 1	Assessor 2	Total
Formal Proof				
Programming by contract				
Static Analysis				
Dynamic Analysis				
Dynamic Testing				
Automatic Test Generation				
Performance Testing				
Interface Testing				

H.9.6 Validation System/Software/Code/ Validation

	Author	Assessor 1	Assessor 2	Total
Test Coverage				
Use Case Validation of Model				
Functional or Black-box Testing				
User Scenario Testing				
Traceability				
Schedulability Analyzer / UseCase Check all				
Schedulability Analyzer / UseCase Check single mode				

H.10 Other comments

Comment. This section is available for the author or the assessors to complete the description and criteria.

Appendix I: Fiacre and Tina

I.1 Instructions

Author Author of the approaches description %%Name - Company%%

Assessor 1 First assessor of the approaches %%Name - Company%%

Assessor 2 Second assessor of the approaches %%Name - Company%%

In the sequel, main text is under the responsibilities of the author.

Author: Author can add comments using this format at any place.

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***** difficult to evaluate with a note (please add a comment under the table)

All the notes can be commented under each table.

This section defines the criteria for the means and tools dedicated to verification and validation activities, in the WP4 workpackage.

Criteria of this section are defined according [**?**].

I.2 Presentation

This section gives a quick presentation of the approach and the tool.

Name %%Name of the approach and the tool%%

Web site %%if available, how to find information%%

Licence %%Kind of licence%%

Abstract

Short abstract on the approach and tool (10 lines max)

Publications

Short list of publications on the approach (5 max)

I.3 Common criteria on secondary means and tools

This section discusses the common criteria of the means and tools according to the project requirements on tools and the results of T7.1.

I.3.1 Project and WP2 requirements

The objectives of this list of criteria is to check if the proposed means and tools meet the main criteria of the project: open-source approaches, usability, modularity, coverage of the objectives,...

According WP2 requirements, give a note for characteristics of the use of the tool (from 0 to 3) :

	Author	Assessor 1	Assessor 2	Total
Open Source (D2.6-02-074)				
Portability to operating systems (D2.6-02-075)				
Cooperation of tools (D2.6-02-076)				
Robustness (D2.6-02-078)				
Modularity (D2.6-02-078.1)				
Documentation management (D2.6-02-078.02)				
Distributed software development (D2.6-02-078.03)				
Simultaneous multi-users (D2.6-02-078.04)				
Issue tracking (D2.6-02-078.05)				
Differences between models (D2.6-02-078.06)				
Version management (D2.6-02-078.07)				
Concurrent version development (D2.6-02-078.08)				
Model-based version control (D2.6-02-078.09)				
Role traceability (D2.6-02-078.10)				
Safety version traceability (D2.6-02-078.11)				
Model traceability (D2.6-02-079)				
Tool chain integration				
Scalability				
User Friendliness				

I.3.2 Qualification

This section discusses how the tool can be classified according EN50128 requirements (D2.6-02-085). Some qualification shall be mandatory if the tool is involved to design a SIL4 software.

	Author	Assessor 1	Assessor 2	Total
Tool manual (D.2.6-01-42.02)				
Proof of correctness (D.2.6-01-42.03)				
Existing industrial usage				
Model verification				
Test generation				
Simulation, execution, debugging				
Formal proof				

Which level of tool qualification has been reached or will be reached within the next year ?

Score :

3 already qualified for this level

2 qualification possible to this level, but some elements shall be provided

0 qualification not recommended for this level

	Author	Assessor 1	Assessor 2	Total
class T1				
class T2				
class T3				

Other elements for tool certification

I.3.3 Complementarity with primary toolchain

The objectives of this list of criteria is to check if the proposed means and tools can be easily integrated to the primary toolchain.

I.3.3.1 Language

According to the decisions and the propositions of T7.1, how the mean and approach can be adapted to or can complete the chosen language and methods:

	Author	Assessor 1	Assessor 2	Total
SysML				
Scade method				
EFS language				
B Method				
C language				

SysML

How the means or tools can complete SysML ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling language ?

C language

How the means or tools can complete or be adapted to SIL4 software in C language ?

I.3.3.2 Tools and platforms

According to the decisions and the propositions of T7.1, how the mean and approach can be integrated to or can complete the chosen tools and platforms:

	Author	Assessor 1	Assessor 2	Total
Eclipse				
Papyrus				
Scade				
EFS tools				
B tools				

Eclipse

How the means or tools can be integrated to the Eclipse platform ?

Papyrus

How the means or tools can complete Papyrus ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling tools ?

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The VnV activities are described in details in the verification and Validation Plan [**?**].

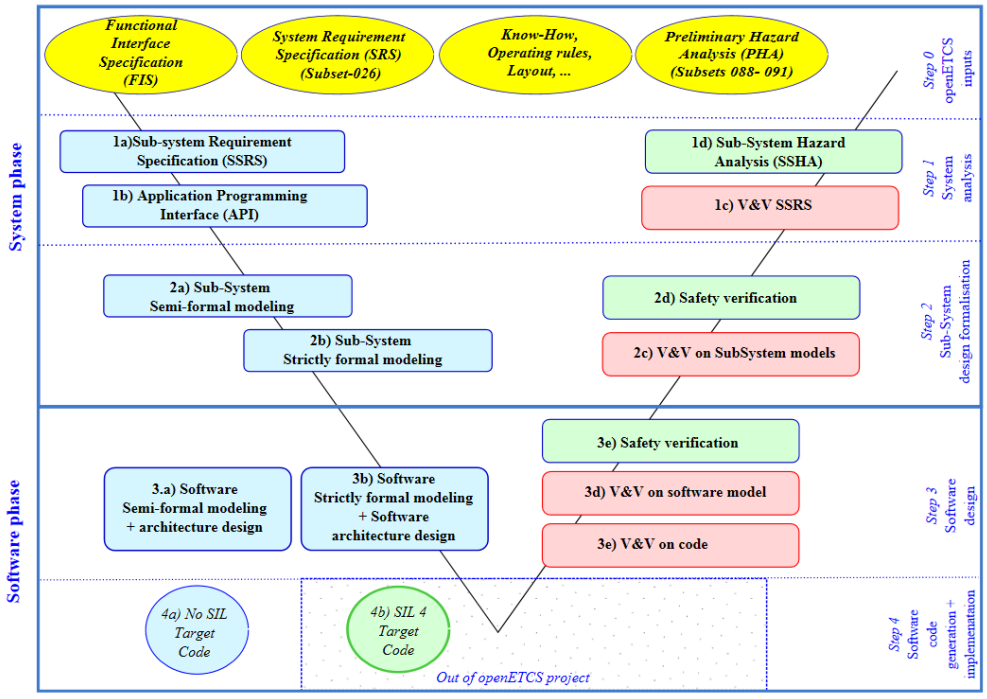

Figure I1. openETCS Process (rough view)

According figure 1, for which activities is the mean or tool suitable (see also [**?**] section 5.1.2 for more details)[10] ?

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3d SW-FFM Verification				
3d SW-FFM Validation				
3e Code Verification				
3e Code Validation				
DAS2V Verification				
DAS2V Validation				
Automatic model transformation verification				
Automatic code generation verification				

I.5 Properties

Which kind of properties or elements are verified or validated by the mean or tool (see also [**?**] section 4) ?

	Author	Assessor 1	Assessor 2	Total
Functionalities of the system and sub-system				
System and sub-system architecture				
External and internal interfaces of sub-system				
Software components				
Performance constraints				
Safety objectives				
Functional properties				
Safety properties				

I.6 Verification methods and tools

Which kind of methods is proposed (see also [**?**] section 5.3) ?

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Model-Based Testing of Generated High-Level Code				
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Model Checking				
Correct by Construction Formal Methods				
Verification with Formal Methods				
Simulation-based				

I.7 Validation means and tools

The following list of criteria focuss on means and tools to support validation activities, according WP2 requirements :

	Author	Assessor 1	Assessor 2	Total
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Test cases execution (D2.6-01-038)				
Test cases storage (D2.6-01-038)				
Version management of test cases (D2.6-02-082)				
Test generation from independant test model (D2.6-02-083)				
Test sequences writing (D2.6-02-084)				
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I.8 VnV artifacts

Concerning the artifacts used or produced by the mean or tool, please to detail:

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Which are the reference documents which give a description of the artifacts semantic ?

Integration

How these artifacts can be integrated with the elements of the toolchain (language, mangement,...) ?

I.9 Detailled Criterias for VnV

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	Author	Assessor 1	Assessor 2	Total
User Scenario Modelling				
Test Case Modelling				
Test Sequence Modelling				

I.9.2 System Model Verification

	Author	Assessor 1	Assessor 2	Total
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System Behavior Simulation (Mathematical)				
System Behavior Simulation (Animated)				

I.9.3 Software Model Verification

	Author	Assessor 1	Assessor 2	Total
Static Model Verification				
Property Proofing				
Dynamic Testing				
Automatic Test Generation				
Input/ Output checking				
Software Behaviour Simulation (Mathematical)				
Software Behaviour Simulation (Animated)				

I.9.4 Source Code

	Author	Assessor 1	Assessor 2	Total
Traceability to Model				

I.9.5 Code Verification

	Author	Assessor 1	Assessor 2	Total
Formal Proof				
Programming by contract				
Static Analysis				
Dynamic Analysis				
Dynamic Testing				
Automatic Test Generation				
Performance Testing				
Interface Testing				

I.9.6 Validation System/Software/Code/ Validation

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Use Case Validation of Model				
Functional or Black-box Testing				
User Scenario Testing				
Traceability				
Schedulability Analyzer / UseCase Check all				
Schedulability Analyzer / UseCase Check single mode				

I.10 Other comments

Comment. This section is available for the author or the assessors to complete the description and criteria.

Appendix J: Frama-C

J.1 Instructions

Author Author of the approaches description %%Name - Company%%

Assessor 1 First assessor of the approaches %%Name - Company%%

Assessor 2 Second assessor of the approaches %%Name - Company%%

In the sequel, main text is under the responsibilities of the author.

Author: Author can add comments using this format at any place.

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Criteria of this section are defined according [**?**].

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This section gives a quick presentation of the approach and the tool.

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Web site %%if available, how to find information%%

Licence %%Kind of licence%%

Abstract

Short abstract on the approach and tool (10 lines max)

Publications

Short list of publications on the approach (5 max)

J.3 Common criteria on secondary means and tools

This section discusses the common criteria of the means and tools according to the project requirements on tools and the results of T7.1.

J.3.1 Project and WP2 requirements

The objectives of this list of criteria is to check if the proposed means and tools meet the main criteria of the project: open-source approaches, usability, modularity, coverage of the objectives,...

According WP2 requirements, give a note for characteristics of the use of the tool (from 0 to 3) :

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Modularity (D2.6-02-078.1)				
Documentation management (D2.6-02-078.02)				
Distributed software development (D2.6-02-078.03)				
Simultaneous multi-users (D2.6-02-078.04)				
Issue tracking (D2.6-02-078.05)				
Differences between models (D2.6-02-078.06)				
Version management (D2.6-02-078.07)				
Concurrent version development (D2.6-02-078.08)				
Model-based version control (D2.6-02-078.09)				
Role traceability (D2.6-02-078.10)				
Safety version traceability (D2.6-02-078.11)				
Model traceability (D2.6-02-079)				
Tool chain integration				
Scalability				
User Friendliness				

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This section discusses how the tool can be classified according EN50128 requirements (D2.6-02-085). Some qualification shall be mandatory if the tool is involved to design a SIL4 software.

	Author	Assessor 1	Assessor 2	Total
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Proof of correctness (D.2.6-01-42.03)				
Existing industrial usage				
Model verification				
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Which level of tool qualification has been reached or will be reached within the next year ?

Score :

3 already qualified for this level

2 qualification possible to this level, but some elements shall be provided

0 qualification not recommended for this level

	Author	Assessor 1	Assessor 2	Total
class T1				
class T2				
class T3				

Other elements for tool certification

J.3.3 Complementarity with primary toolchain

The objectives of this list of criteria is to check if the proposed means and tools can be easily integrated to the primary toolchain.

J.3.3.1 Language

According to the decisions and the propositions of T7.1, how the mean and approach can be adapted to or can complete the chosen language and methods:

	Author	Assessor 1	Assessor 2	Total
SysML				
Scade method				
EFS language				
B Method				
C language				

SysML

How the means or tools can complete SysML ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling language ?

C language

How the means or tools can complete or be adapted to SIL4 software in C language ?

J.3.3.2 Tools and platforms

According to the decisions and the propositions of T7.1, how the mean and approach can be integrated to or can complete the chosen tools and platforms:

	Author	Assessor 1	Assessor 2	Total
Eclipse				
Papyrus				
Scade				
EFS tools				
B tools				

Eclipse

How the means or tools can be integrated to the Eclipse platform ?

Papyrus

How the means or tools can complete Papyrus ?

Scade, EFS, Classical B

How the means or tools can complete the current proposals for formal modeling tools ?

J.4 VnV Activities

The VnV activities are described in details in the verification and Validation Plan [**?**].

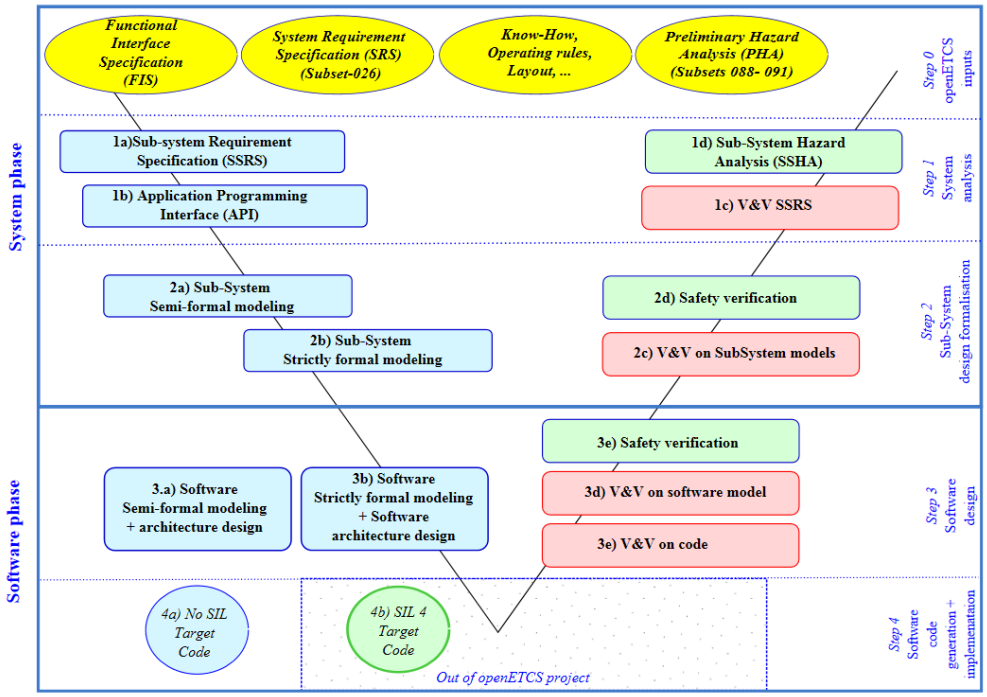

Figure J1. openETCS Process (rough view)

According figure 1, for which activities is the mean or tool suitable (see also [**?**] section 5.1.2 for more details)[11] ?

[11] DAS2V : Design Artifact Subject to Verification and Validation, see [**?**]

	Author	Assessor 1	Assessor 2	Total
1c SSRS Verification				
1c SSRS Validation				
2c SFM Verification				
2c SFM Validation				
3d SW-SFM Verification				
3d SW-SFM Validation				
3d SW-FFM Verification				
3d SW-FFM Validation				
3e Code Verification				
3e Code Validation				
DAS2V Verification				
DAS2V Validation				
Automatic model transformation verification				
Automatic code generation verification				

J.5 Properties

Which kind of properties or elements are verified or validated by the mean or tool (see also [**?**] section 4) ?

	Author	Assessor 1	Assessor 2	Total
Functionalities of the system and sub-system				
System and sub-system architecture				
External and internal interfaces of sub-system				
Software components				
Performance constraints				
Safety objectives				
Functional properties				
Safety properties				

J.6 Verification methods and tools

Which kind of methods is proposed (see also [**?**] section 5.3) ?

	Author	Assessor 1	Assessor 2	Total
Reviews				
Inspections				
Software Architecture Analysis Method				
Architecture Tradeoff Analysis Method				
Model-Based System Integration Testing				
Model-Based Testing of Generated High-Level Code				
Abstract Interpretation				
Deductive Verification				
Model Checking				
Correct by Construction Formal Methods				
Verification with Formal Methods				
Simulation-based				

J.7 Validation means and tools

The following list of criteria focuss on means and tools to support validation activities, according WP2 requirements :

	Author	Assessor 1	Assessor 2	Total
Simulation-based				
Step-by-step simulation (D2.6-01-036)				
Environment emulation (D2.6-01-037 and D2.6-02-080)				
Time-based test case (D2.6-02-081)				
Test cases writing (D2.6-01-038)				
Test cases execution (D2.6-01-038)				
Test cases storage (D2.6-01-038)				
Version management of test cases (D2.6-02-082)				
Test generation from independant test model (D2.6-02-083)				
Test sequences writing (D2.6-02-084)				
Test sequences execution (D2.6-02-084)				
Test sequences storage (D2.6-02-084)				

J.8 VnV artifacts

Concerning the artifacts used or produced by the mean or tool, please to detail:

Input

Which is the list of the input artifacts for the mean or tools ?

Output

Which is the list of the output artifacts for the mean or tools ?

Syntax

Which are the reference documents which give a description of the artifacts syntax ?

Semantic

Which are the reference documents which give a description of the artifacts semantic ?

Integration

How these artifacts can be integrated with the elements of the toolchain (language, mangement,...) ?

J.9 Detailled Criterias for VnV

Please fill only the section concerning the proposed mean or tool, other section can be skipped (see issue `https://github.com/openETCS/toolchain/issues/180` for details and discussions)

J.9.1 System Modelling simulation

	Author	Assessor 1	Assessor 2	Total
User Scenario Modelling				
Test Case Modelling				
Test Sequence Modelling				

J.9.2 System Model Verification

	Author	Assessor 1	Assessor 2	Total
Input/ Output checking				
System Behavior Simulation (Mathematical)				
System Behavior Simulation (Animated)				

J.9.3 Software Model Verification

	Author	Assessor 1	Assessor 2	Total
Static Model Verification				
Property Proofing				
Dynamic Testing				
Automatic Test Generation				
Input/ Output checking				
Software Behaviour Simulation (Mathematical)				
Software Behaviour Simulation (Animated)				

J.9.4 Source Code

	Author	Assessor 1	Assessor 2	Total
Traceability to Model				

J.9.5 Code Verification

	Author	Assessor 1	Assessor 2	Total
Formal Proof				
Programming by contract				
Static Analysis				
Dynamic Analysis				
Dynamic Testing				
Automatic Test Generation				
Performance Testing				
Interface Testing				

J.9.6 Validation System/Software/Code/ Validation

	Author	Assessor 1	Assessor 2	Total
Test Coverage				
Use Case Validation of Model				
Functional or Black-box Testing				
User Scenario Testing				
Traceability				
Schedulability Analyzer / UseCase Check all				
Schedulability Analyzer / UseCase Check single mode				

J.10 Other comments

Comment. This section is available for the author or the assessors to complete the description and criteria.

Appendix K: Diversity

K.1 Instructions

Author Author of the approaches description %%Name - Company%%

Assessor 1 First assessor of the approaches %%Name - Company%%

Assessor 2 Second assessor of the approaches %%Name - Company%%

In the sequel, main text is under the responsibilities of the author.

Author: Author can add comments using this format at any place.

Assessor 1: First assessor can add comments using this format at any place.

Assessor 2: Second assessor can add comments using this format at any place.

When a note is required, please follow this list (inspired from Technology Readiness Level, see `http://en.wikipedia.org/wiki/Technology_readiness_level`) :

0 not recommended / rejected / no integration possible or valuable / not adapted for this topic / not available for this topic

1 weakly recommended / adapted after major improvements / weakly rejected / concept of integration roughly defined / adapted after major improvements / available after major developments

2 recommended / adapted (with light improvements if necessary) weakly accepted / integration prototyped or defined in details / adapted after small improvements / available after small developments or tests

3 highly recommended / well adapted / strongly accepted / integration done and tested / well adapted to the purpose / available and suitable for the purpose All the notes can be commented under each table.

***** difficult to evaluate with a note (please add a comment under the table)

All the notes can be commented under each table.

This section defines the criteria for the means and tools dedicated to verification and validation activities, in the WP4 workpackage.

Criteria of this section are defined according [**?**].

K.2 Presentation

This section gives a quick presentation of the approach and the tool.

Name %%Name of the approach and the tool%%

Web site %%if available, how to find information%%

Licence %%Kind of licence%%

Abstract

Short abstract on the approach and tool (10 lines max)

Publications

Short list of publications on the approach (5 max)

K.3 Common criteria on secondary means and tools

This section discusses the common criteria of the means and tools according to the project requirements on tools and the results of T7.1.

K.3.1 Project and WP2 requirements

The objectives of this list of criteria is to check if the proposed means and tools meet the main criteria of the project: open-source approaches, usability, modularity, coverage of the objectives,...

According WP2 requirements, give a note for characteristics of the use of the tool (from 0 to 3) :

	Author	Assessor 1	Assessor 2	Total
Open Source (D2.6-02-074)				
Portability to operating systems (D2.6-02-075)				
Cooperation of tools (D2.6-02-076)				
Robustness (D2.6-02-078)				
Modularity (D2.6-02-078.1)				
Documentation management (D2.6-02-078.02)				
Distributed software development (D2.6-02-078.03)				
Simultaneous multi-users (D2.6-02-078.04)				
Issue tracking (D2.6-02-078.05)				
Differences between models (D2.6-02-078.06)				
Version management (D2.6-02-078.07)				
Concurrent version development (D2.6-02-078.08)				
Model-based version control (D2.6-02-078.09)				
Role traceability (D2.6-02-078.10)				
Safety version traceability (D2.6-02-078.11)				
Model traceability (D2.6-02-079)				
Tool chain integration				
Scalability				
User Friendliness				

K.3.2 Qualification

This section discusses how the tool can be classified according EN50128 requirements (D2.6-02-085). Some qualification shall be mandatory if the tool is involved to design a SIL4 software.

	Author	Assessor 1	Assessor 2	Total
Tool manual (D.2.6-01-42.02)				
Proof of correctness (D.2.6-01-42.03)				
Existing industrial usage				
Model verification				
Test generation				
Simulation, execution, debugging				
Formal proof				

Which level of tool qualification has been reached or will be reached within the next year ?

Score :

3 already qualified for this level

2 qualification possible to this level, but some elements shall be provided

0 qualification not recommended for this level

	Author	Assessor 1	Assessor 2	Total
class T1				
class T2				
class T3				

Other elements for tool certification

K.3.3 Complementarity with primary toolchain

The objectives of this list of criteria is to check if the proposed means and tools can be easily integrated to the primary toolchain.

K.3.3.1 Language

According to the decisions and the propositions of T7.1, how the mean and approach can be adapted to or can complete the chosen language and methods:

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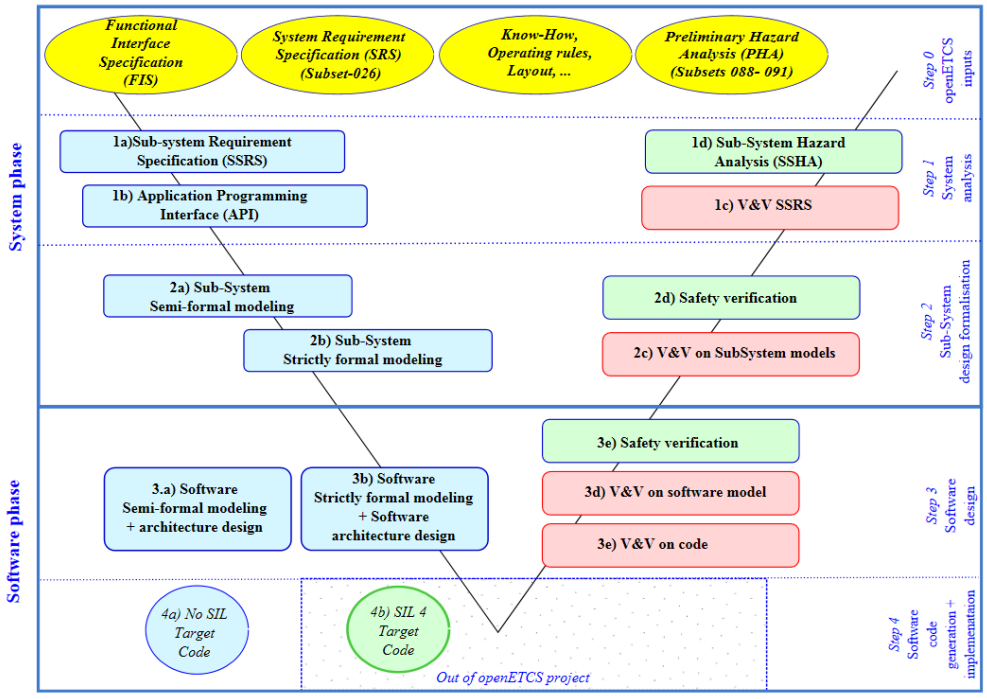

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Property Proofing				
Dynamic Testing				
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Software Behaviour Simulation (Mathematical)				
Software Behaviour Simulation (Animated)				

K.9.4 Source Code

	Author	Assessor 1	Assessor 2	Total
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K.9.5 Code Verification

	Author	Assessor 1	Assessor 2	Total
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Dynamic Analysis				
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K.9.6 Validation System/Software/Code/ Validation

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User Scenario Testing				
Traceability				
Schedulability Analyzer / UseCase Check all				
Schedulability Analyzer / UseCase Check single mode				

K.10 Other comments

Comment. This section is available for the author or the assessors to complete the description and criteria.