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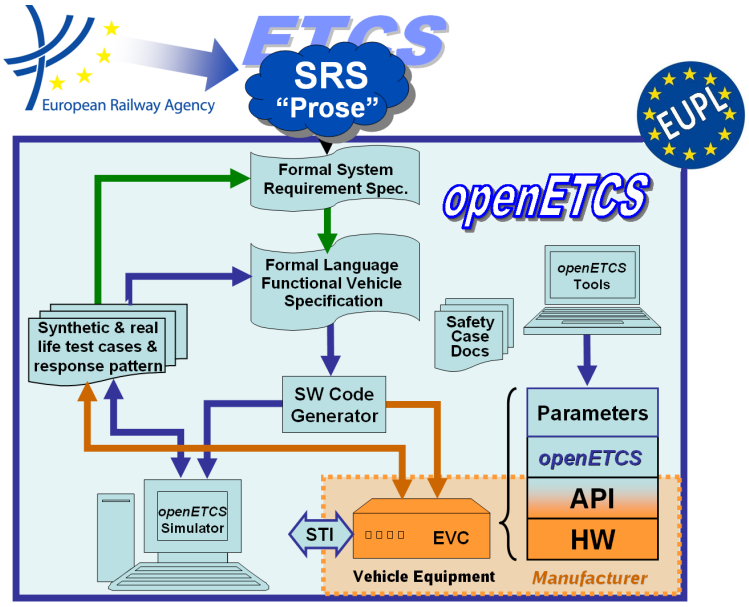
Work-Package 7: “Secondary tools - Transformation”

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

List of criteria on supporting tools and methods and results on the benchmark

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

October 2013



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Work-Package 7: “Secondary tools - Transformation” **OETCS/WP7/O7.2.1 – 00/05**
October 2013

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

List of criteria on supporting tools and methods and results on the benchmark

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.

This document focusses on means and tools for model transformation and code generation.

Table of Contents

Figures and Tables

Figures

Tables

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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 [1], and the results of T7.1 on the primary toolchain [2], 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 model transformation and code generation.

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
- Rodin and Pluggins
- Acceleo
- ATL
- QVTO and SmartQVT
- Xtend

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.

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.

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 Means and tools for model transformation and code generation

This section defines the criteria for the means and tools dedicated to model and code transformation. These activities are shared by the work packages WP3 and WP4.

2.4.1 Activities

These transformations concern the design models (from a model to an another, or to executable code) but also validation activities (for model-based testing techniques for example).

Besides dedicated verification activities shall be necessary to check these transformation (conformance, coverage, traceability,...)

Which transformations are covered by the mean or tool ?

	Author	Assessor 1	Assessor 2	Total
Model transformation for design				
Model transformation for VnV				
Code Generation				

2.4.2 Input Artifacts

Which artifacts are used as input of the mean or tool ?

	Author	Assessor 1	Assessor 2	Total
Informal description				
SysML model				
Scade model				
EFS model				
Classical B modes				
C Code				
Others (give details)				

2.4.3 Output Artifacts

Which artifacts are used as output of the mean or tool ?

	Author	Assessor 1	Assessor 2	Total
Informal description				
SysML model				
Scade model				
EFS model				
Classical B modes				
C Code				
Others (give details)				

2.4.4 Process

How process the tool, with which characteristics (please provides comments) ?

	Author	Assessor 1	Assessor 2	Total
Informal				
Model To Text (M2T)				
Model To Model (M2M)				
EMF models compliant				
others				

2.5 Other comments

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

3 Conclusion

The process of evaluation of secondary tools has evolved during the task: means and tools have been presented to all the partners but partly evaluated. Partners decided to based the evaluation and selection on the needs which are raised during the development of the toolchain or its use in the OpenETCS project.

In Appendix there are some results of the evaluation.

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.

Appendix A: Scade

No results of evaluation.

Appendix B: Rodin

No results of evaluation.

Appendix C: Acceleo

C.1 Instructions

Author Stefan Rieger (TWT)

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.

C.2 Presentation

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

Name Acceleo

Web site http://www.eclipse.org/acceleo/

Licence Eclipse

Abstract

Short abstract on the approach and tool (10 lines max) Acceleo is an implementation of the Object Management Group (OMG) MOF Model to Text Language (MTL) standard. Based on a special template language model to text transformations can be defined. It is fully integrated with Eclipse and also part of Polarsys.

Publications

Short list of publications on the approach (5 max) Most imformation is available on the homepage http://www.eclipse.org/acceleo/

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)	3			
Portability to operating systems (D2.6-02-075)	3			
Cooperation of tools (D2.6-02-076)	3			
Robustness (D2.6-02-078)	3*			
Modularity (D2.6-02-078.1)	3			
Documentation management (D2.6-02-078.02)	0**			
Distributed software development (D2.6-02-078.03)	0**			
Simultaneous multi-users (D2.6-02-078.04)	0**			
Issue tracking (D2.6-02-078.05)	0**			
Differences between models (D2.6-02-078.06)	0**			
Version management (D2.6-02-078.07)	0**			
Concurrent version development (D2.6-02-078.08)	0**			
Model-based version control (D2.6-02-078.09)	0**			
Role traceability (D2.6-02-078.10)	0**			
Safety version traceability (D2.6-02-078.11)	0**			
Model traceability (D2.6-02-079)	0**			
Tool chain integration	3			
Scalability	***			
User Friendliness	3			

Author:

* *Sub-criteria of robustness in D2.6 do not make sense here, e.g., version management is not a sub-criterion to robustness.*

** *Out of scope of this tool. The requirements address an tool chain, so other tools should be used to cover these aspects.*

*** *Scalability is difficult to judge and has not been evaluated.*

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)	3			
Proof of correctness (D.2.6-01-42.03)	0			
Existing industrial usage	*			
Model verification	0			
Test generation	0			
Simulation, execution, debugging	0			
Formal proof	0			

Author: The above table is not entirely clear to me. I filled the items 4-7 according to applicability of the tool.

** Not checked in this context.*

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

Author: The possible answers below are not aligned with the above question and thus make no sense. This is an open source tool that is not / will not be pre-qualified by the tool community (as is, e.g., gcc). As the tool is open source a qualification should be possible but may involve considerable effort.

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	3			
Scade method	2*			
EFS language	2**			
B Method	0			
C language	3			

Author:

* *As Scade System is based on EMF and Papyrus an integration should be possible*

** *If based on EMF integration is possible*

SysML

How the means or tools can complete SysML ?

Author: Full integration with Eclipse and SysML is available.

Scade, EFS, Classical B

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

Author: An integration with EMF-based tools should be possible.

C language

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

Author: C-Code (as code in any language) can be generated but generation templates need to be defined.

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: This section in my opinion is redundant for Acceleo, see my answers above (the answers for Eclipse and Papyrus are the same as for SysML).

	Author	Assessor 1	Assessor 2	Total
Eclipse	3			
Papyrus	3			
Scade	2			
EFS tools	2			
B tools	0			

Eclipse

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

Author: See comments regarding SysML above.

Papyrus

How the means or tools can complete Papyrus ?

Author: See comments regarding SysML above.

Scade, EFS, Classical B

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

Author: See comments regarding cade, EFS, Classical B above.

C.4 Means and tools for model transformation and code generation

This section defines the criteria for the means and tools dedicated to model and code transformation. These activities are shared by the work packages WP3 and WP4.

C.4.1 Activities

These transformations concern the design models (from a model to an another, or to executable code) but also validation activities (for model-based testing techniques for example).

Besides dedicated verification activities shall be necessary to check these transformation (conformance, coverage, traceability,...)

Which transformations are covered by the mean or tool ?

	Author	Assessor 1	Assessor 2	Total
Model transformation for design	3			
Model transformation for VnV	3			
Code Generation	3			

C.4.2 Input Artifacts

Which artifacts are used as input of the mean or tool ?

	Author	Assessor 1	Assessor 2	Total
Informal description				
SysML model	3			
Scade model	2*			
EFS model	2*			
Classical B modes	0			
C Code	0			
Others (give details)	0			

Author: * *EMF-based parts/tools*

C.4.3 Output Artifacts

Which artifacts are used as output of the mean or tool ?

	Author	Assessor 1	Assessor 2	Total
Informal description	0			
SysML model	1*			
Scade model	0			
EFS model	0			
Classical B modes	0			
C Code	3			
Others (give details)	3**			

Author:

* *Model-to-model transformation is possible if the generated model can be imported as text. However SysML → SysML does not make much sense in my opinion.*

** *Code in any language or text-based files/models can be generated.*

C.4.4 Process

How process the tool, with which characteristics (please provides comments) ?

	Author	Assessor 1	Assessor 2	Total
Informal	0			
Model To Text (M2T)	3			
Model To Model (M2M)	2*			
EMF models compliant	3			
others	3*			

Author:

* *Code in any language or text-based files/models can be generated.*

C.5 Other comments

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

Appendix D: ATL

No results of evaluation.

Appendix E: QVTO and SmartQVT

No results of evaluation.

Appendix F: XTend

No results of evaluation.

Appendix: References

[1] Sylvain Baro and Jan Welte. Requirements for openETCS. Technical Report D2.6, OpenETCS, 2013.

[2] Marielle Petit-Doche and WP7 Participants. D7.1: Report on the final choice of the primary toolchain. Primary Toolchain OETCS/WP7/D7.1, openETCS, July 2013.