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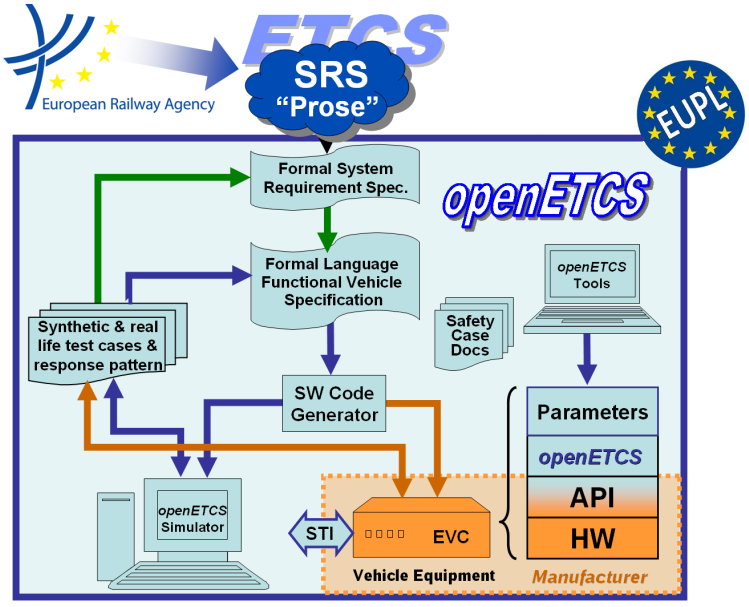
Work-Package 3: “Tool chain”

Tool chain Design Specification

Description of the OpenETCS tool chain implementation

Cecile Braunstein and Jan Peleska

August 2013



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Work-Package 3: “Tool chain” **OETCS/WP7/O7.3.2**
August 2013

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Description of the OpenETCS tool chain implementation

Document approbation

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Final Report

Prepared for openETCS@ITEA2 Project

Abstract: This document defines the tool chain architecture. It gives an overview of what has benn implemented and what is at the moment running .

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Figures and Tables

Figures

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Document Information

Document information	
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List of Terms

Notation	Description
API	Application programming inerface.
EMF	Eclipse Modeling Framework.
EVC	European Vital Computer.
OBU	On Board Unit.
SRS	System Requirement Specification.

1 Introduction and Motivation

Chap resp. Cecile

1.1 Motivation

One of the goals of the openETCS project is to "Provide a tool chain and process/methodologies for developing an on-board software that can fulfill the CENELEC requirements for SIL4 software".

The tool chain consists of activities to support producing certifiable software such as:

- Software planning
- Requirements tracing
- Tool confidences
- Documentation/report production
- Testing
- Verification and validation

The tool chain also takes care of providing the following functioning infrastructure to allow robust distributed development within the defined life cycle.

- a continuous automated build system,
- mechanisms to upgrade tools in the platform,
- mechanisms to add tools to the chain at a later stage (without breaking compatibility),
- modification and change control manager,
- tool chain documentation system.

1.2 Scope of the document

1.3 Reference documents

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

[2] Cécile Braunstein, Jan Peleska, Izaskun de la Torre, and Stefan Rieger. D7.3 toolchain qualification process description. Delivrable D7.3, openETCS.

[3] Cécile Braunstein and Moritz Dorka. Traceability architecture in openetcs. Delivrable O7.3.5, openETCS.

[4] Marielle Petit-Doche and Matthias Güdemann. openETCS process. Definition D2.3, openETCS, February 2013.

[5] 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.

[6] Oscar Slotosch, Martin Wildmoser, Jan Philipps, Reinhard Jeschull, and Rafael Zalman. ISO 26262-tool chain analysis reduces tool qualification costs. *Automotive 2012*, 2012.

[7] Anthony I. Wasserman. Tool integration in software engineering environments. In Fred Long, editor, *Software Engineering Environments*, volume 467 of *Lecture Notes in Computer Science*, page 137–149. Springer Berlin Heidelberg, 1990.

2 OpenETCS Tool chain Presentation

Chap resp.
Cécile/Izaskun

2.1 The OpenETCS tool chain

2.1.1 Definition

The tool chain provides the tool support and the development process to provide a formalized specification of SRS and an executable code of the OBU.

The tool chain is composed by two kind of tools :

1. *Development tools*: those used along the phases of the software development process (Requirement engineering, modeling ...).
2. *Management tools*: those used transversely during the complete development process (version management, requirements traceability ...).

These tools are called vertical and horizontal tools in [7]. Figure 1 shows the idea of the complete tool chain integration.

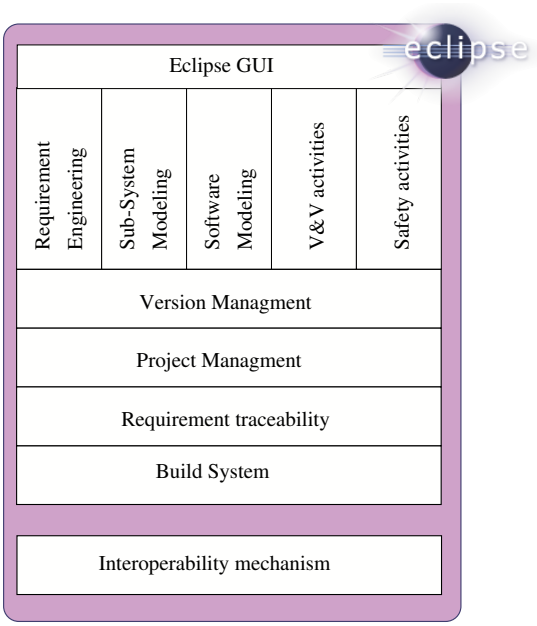

Figure 1. The OpenETCS tool chain

In the next chapters we will give more details on the data integration between the development tools by defining the inputs and outputs artifact of each tools. This document describes the interface between the tool chain activities. The interoperability mechanism will be defined in a separate document. However, the first version of the tool chain will implement a file-based data exchange.

It has been decided (see [5]) that the tool platform hosting the tool chain is Eclipse with the Eclipse modeling framework (EMF). This implies that the tool chain will be a set of Eclipse plug-ins. It also implies that we can rely on already available plug-in and features for the versioning, the project management or the build system. The use of EMF will also assist the software development, by providing a meta model and an API for manipulating EMF components.

2.1.2 The SysML Model

A SysML model of the tool shown figure 2 . It allows us to have a formal representation of the tool chain and help to model precisely the different interaction between the development tools as well as the management tools. The SysML model may be also seen as a guideline for integrated new tool: each new tool should be fully described and comply to the defined interfaces. Moreover following the idea of Slotosch [6] the model will be the basis to the qualification analysis [2].

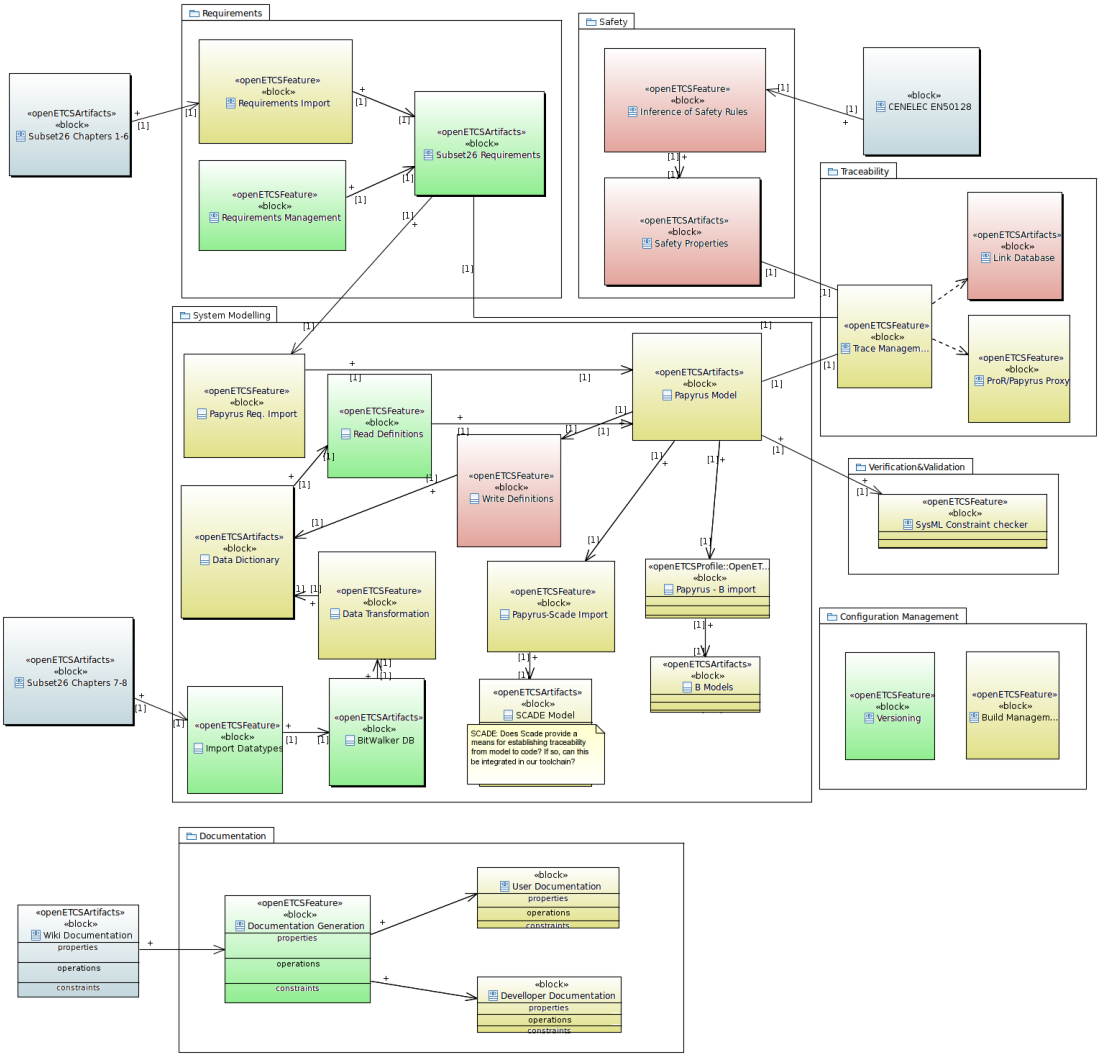

Figure 2. OpenETCS tool chain Status Overview

Check if the overview is up-to-date and complient with the real implementation

The requirements of WP2 [1] as well as our intern requirements (Appendixes A and B) will be included in the SysML model. Each tools and their connections should then also comply to the requirements list.

2.1.3 The OpenETCS lifecycle

Insert the tool chain lifecycle definition from WP1

2.2 OpenETCS EVC lifecycle

The openETCS lifecycle has been defined in [4] as presented figure 3.

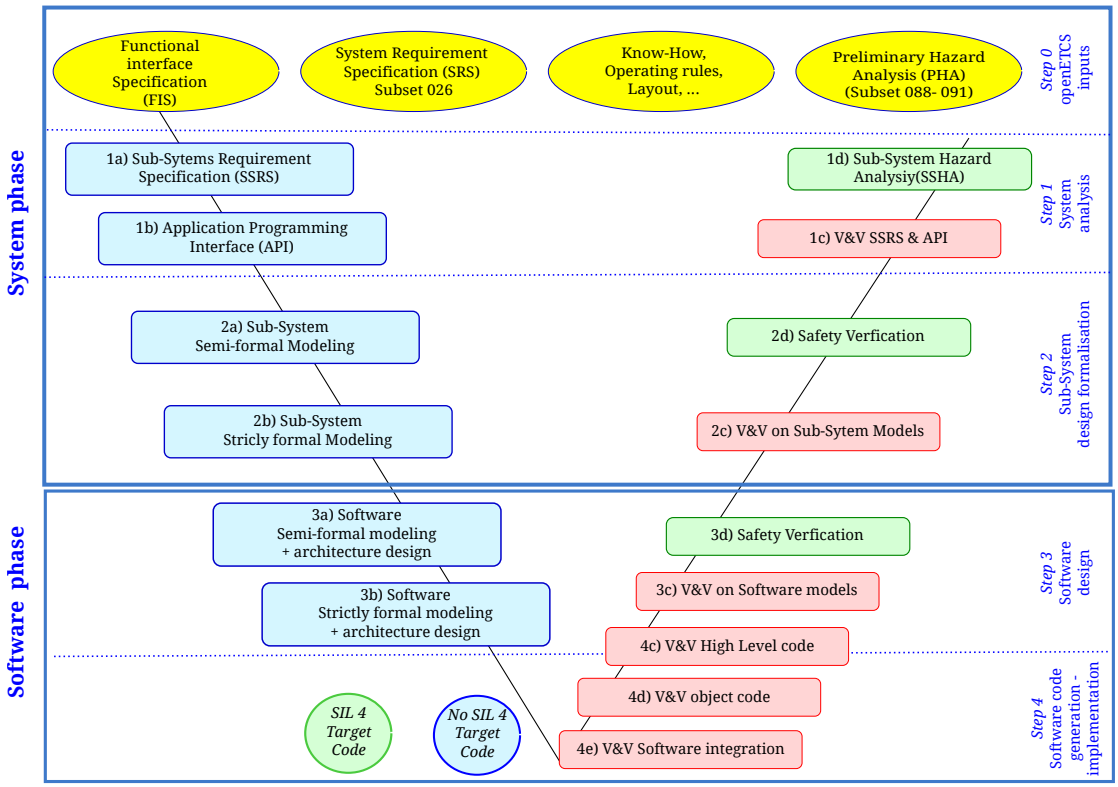

Figure 3. openETCS Process (rough view)

The lifecycle defined all the different steps needed to produce a EVC certifiable SIL4. However in order to define a tool chain we need to define the lifecycle by means of activities (Fig. 4). Each activities may be achieved by one or more tools in the tool chain.

The next chapters will define the limits of each activities, we will show what should be consumed and produced by each activities.

add description of each activities

2.3 Management tools

add the list of the management tools and a description

- Version Management
  Version management of the artifacts and the openETCS glue code

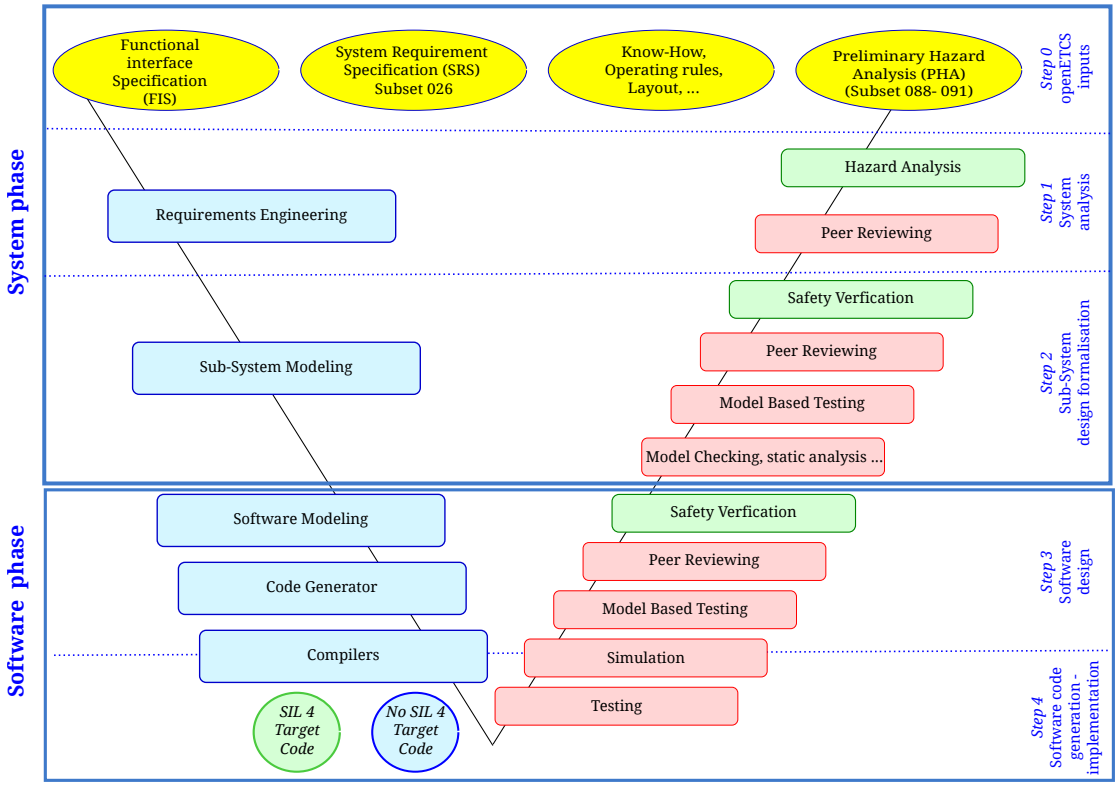

Figure 4. openETCS Process Tool chain activities

- Tool version Management
  Keep track of the compatible and status version of each tools.
- Collaborative work
- Project Management
- Build system
- Non regression test
- Configuration Manger to manage modification and change in tools

3 Activities covered by the OpenETCS tool chain

Chap resp. ??

3.1 Traceability

The traceability architecture is described in detail in the document [3]

3.1.1 From Word document to ReqIF

Chap resp. Moritz

3.1.2 ProR and papyrus Proxy

Chap ??

3.1.3 Data Dictionary

Chap ??

3.2 Modeling

3.2.1 Papyrus

Chap ??

3.2.2 SysML2Scade

Chap ??

3.2.3 SysML2B

Chap ??

3.2.4 SysML constraints checkers

Chap ??

3.3 Documentation

Chap ??

3.4 VnV Activities

Chap ??

4 Tests

Chap resp. ??

4.0.1 Requirement lists

Chap ??

4.0.2 Test Specification

Chap ??

5 Integration in the tool platform

Chap resp. ??

Fill for each plugin

Feature/plug-in Name
Version
Activities covered
Documentation link
Tutorial links
Short Description
Unit tests references
Covered Requirements

7.7 Tools chain	
7.7.1 Usage	
R-WP2/D2.6-X-36	The tools chain shall be composed as far as possible of Open Source components licensed under a license compatible with the EUPL license.
R-WP2/D2.6-X-36.1	Closed source components may be used, but only if their use is not mandatory in the process, or if an open source counterpart is provided.
R-WP2/D2.6-X-36.2	If a closed source component is used, it has to be displayed how an open source component has to be designed to replace the closed component later.
R-WP2/D2.6-X-37	The tools chain shall be portable to common operating systems.
R-WP2/D2.6-X-37.1	The tool chain shall run stable on all main operating systems.
R-WP2/D2.6-X-37.2	The tool chain shall run with a good performance on all main operating systems.
R-WP2/D2.6-X-38	The tools used in the tool chain shall be able to cooperate, i.e. the outputs of one tool will be suitable to be used as the inputs of another tool.
R-WP2/D2.6-X-38.1	All possible input and output formats of a tool have to be documented.
R-WP2/D2.6-X-38.2	Open data formats shall be used for the tool cooperation.
R-WP2/D2.6-01-032	If tools are required for configuration management, they will be considered as part of the tool chain.
R-WP2/D2.6-X-40	The tools chain shall allow to generate executable code from the model(s).
7.7.2 Information management	
R-WP2/D2.6-X-41	The tools chain shall be sufficiently robust to allow large software management (at least covering the onboard part of the SUBSET-026).
R-WP2/D2.6-X-41.1	It shall allow modularity at any level (proof, models, software).
R-WP2/D2.6-X-41.2	It shall allow the management of documentation.
R-WP2/D2.6-X-41.3	It shall allow distributed software development.
R-WP2/D2.6-X-41.4	It shall allow simultaneous multi user usage.
R-WP2/D2.6-X-41.5	It shall include an issue-tracking system, in order to allow change management and errors/bugs management.
R-WP2/D2.6-X-41.6	It shall allow to document/track the differences between the models and the ERTMS reference.
R-WP2/D2.6-X-41.7	It shall support management of subsequent Subset-026 versions, as well as differences tracking between Subset-026 versions.
R-WP2/D2.6-X-41.8	It shall allow concurrent version development, or be compatible with tools allowing concurrent version development.
R-WP2/D2.6-X-41.9	The version management tools shall use model-based version control instead of text-based version control, when appropriate.
R-WP2/D2.6-X-41.10	In particular it shall allow to track the roles and responsibilities of each participant on a configuration item, at each step of the project lifecycle.
R-WP2/D2.6-X-41.11	In particular, version management shall allow to track version of the safety properties together with the models.
R-WP2/D2.6-01-035	The tool chain shall allow traceability between:
R-WP2/D2.6-01-035.01	the documentation/requirements and the models,

R-WP2/D2.6-01-035.02	the documentation/requirements and the tests,
R-WP2/D2.6-01-035.03	the models and the tests,
R-WP2/D2.6-01-035.04	the documentation/requirements and the models,
R-WP2/D2.6-01-035.05	the documentation/requirements and the safety properties/requirements,
R-WP2/D2.6-01-035.06	the models and the safety properties/requirements,
R-WP2/D2.6-01-035.07	the tests and the safety properties/requirements.
R-WP2/D2.6-X-43	The tools chain shall be compliant to EN 50128 for the corresponding tool
7.7.3 Testing	
R-WP2/D2.6-01-036	The SFM shall be executable in debug mode (step-by-step), allowing inspection of states, variables and I/O.
R-WP2/D2.6-01-037	The environment shall be emulated by high level construction of the inputs. Justification. “High level” means that it will not be necessary to define bitwise the inputs at each cycle. On the contrary, some automation will be available to define the behavior of the inputs.
R-WP2/D2.6-01-038	The tool chain shall allow to write, execute and store test cases and use cases for the SFM.
R-WP2/D2.6-X-47	Version management will allow to map test cases version to the SFM, the FFM and source code versions.
R-WP2/D2.6-X-48	The tool chain shall allow to generate test cases for the SFM, the FFM and source code from a test model.
R-WP2/D2.6-X-49	The tool chain shall allow to write, execute and store test sequences combining multiple test cases for the SFM, the FFM and source code.
7.7.4 Conformance to standards	
R-WP2/D2.6-X-50	Each tool in the tool chain shall be classified among T1, T2 and T3 depending on its usage in the process.
R-WP2/D2.6-01-042	The tool chain shall conform to EN 50128 requirements, for the corresponding SIL and tool class 6 .
R-WP2/D2.6-01-042.01	For T2 and T3 tools 7 , the choice of tools shall be justified, and the justification shall include how the tools failures are covered, avoided or taken into account (ref. to EN 50128 6.7.4.2).
R-WP2/D2.6-01-042.02	All T2 and T3 tools must be provided with their user manuals.
R-WP2/D2.6-01-042.03	For all T3 tool, the proof of correctness or the measure taken to guarantee the correctness of the output w.r.t. their specification and the inputs shall be provided
R-WP2/D2.6-01-042.03.01	. . . for data transformation,
R-WP2/D2.6-01-042.03.02	. . . for software transformation (e.g. translation, compilation. . .).

Appendix B: WP7-specific requirements

R-WP7/T7.3-X-1 The tool chain shall include support for the following graphical user interface facilities:

R-WP7/T7.3-X-1.1 model syntax highlighting and auto-completion, for the parts of the model that are text-based

R-WP7/T7.3-X-1.2 graphical representation of Subset-026 braking curves

R-WP7/T7.3-X-1.3 tree-based display of model elements

R-WP7/T7.3-X-1.4 model animation and debugging

R-WP7/T7.3-X-1.5 perspective management: offer in a single graphical user interface several interconnected views for SRS, model and tests.

R-WP7/T7.3-X-2 The tool chain shall provide the following reporting facilities:

R-WP7/T7.3-X-2.1 detailed implementation metrics

R-WP7/T7.3-X-2.2 detailed traceability reports

R-WP7/T7.3-X-2.3 detailed model errors and warnings list

to be continued