ITEA 2

INFORMATION TECHNOLOGY FOR EUROPEAN ADVANCEMENT

openETCS

WP4 – 1st Workshop on Safety Assessment
OpenETCS Safety Analysis

supported by:

Federal Ministry of Education and Research

Liberté • Égalité • Fraternité
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INVESTISSEMENTS D'AVENIR

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openETCS@ITEA2 Project

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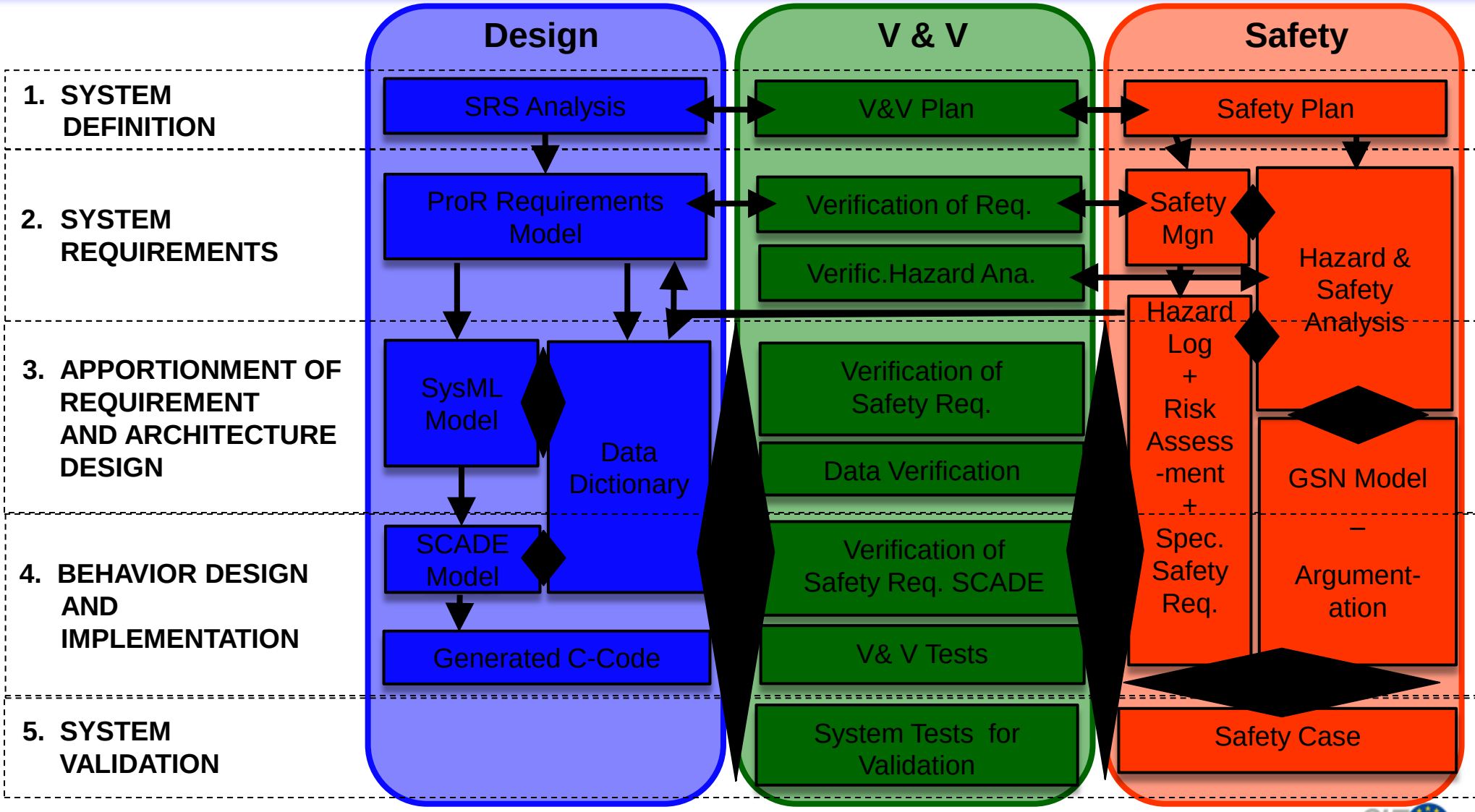
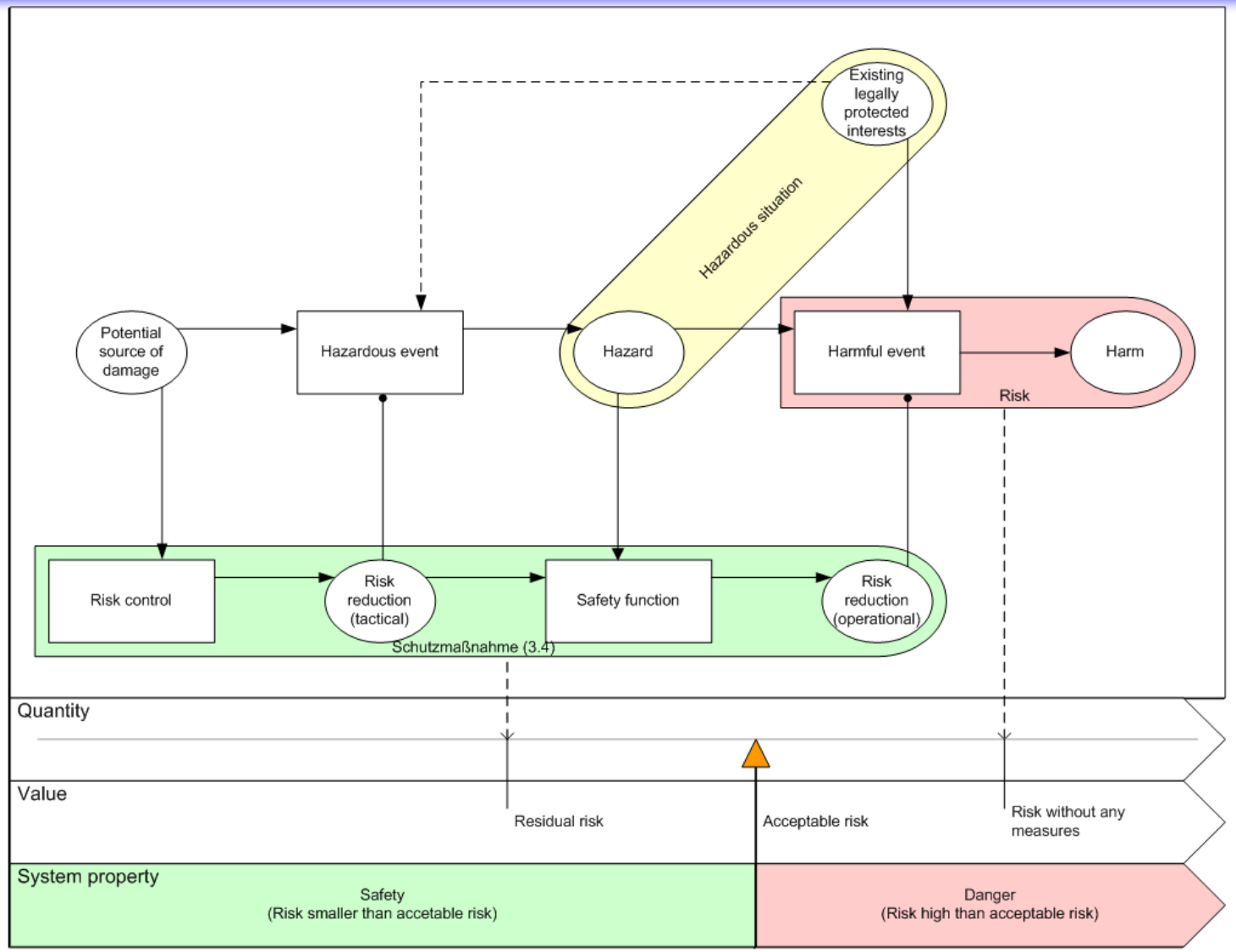
Safety Process Structure

Overview Artifacts



Safety

Risk-Genesis-Model



Exposure

Severity

Controllability

Safety Process

VnV Level 1 Safety activities – Hazard Identification

Objectives:

- Implement parts of the safety strategy on existing benchmark models
- Establish details for artifact relations and traceability

Main focus:

- Hazard identification
- Determination of resulting requirements

Safety Process

VnV Level 1 Safety – hazard identification

Identification is lead by the **Core Hazard**

Exceedance of the safe speed / distance as advised to ETCS

Maximum rate of occurrence for the core hazard (THR for ETCS) has been defined to

$$2.0 * 10^{-9}\ hour^{-1}\ train^{-1}$$

Based on

SUBSET 91	*Safety Requirements for the Technical Interoperability of ETCS in Levels 1 & 2 (Baseline 3)*
SUBSET 88	*ETCS Application Levels 1 & 2 - Safety Analysis (Baseline 2)*

Safety Process

VnV Level 1 Safety – Proof of Concept for MoRC

List of Hazardous Events

- 34 events assigned to the kernel resulting in the core hazard are listed in SUBSET 91 Annex A

Proof of Concept

(by Systerel, AEBT and All4Tec)

- Based on Hazard KERNEL-6
- Hazard Analysis for benchmark model on MoRC
- Derived Safety Criteria based on a FMEA for the subsystem

Event Id.	Event Description	Corresponding performance requirement in SUBSET-041
KERNEL-1	Balise linking consistency checking failure	In case the message is received but the linking is not consistent: 5.2.1.1: Delay between receiving of a balise message and applying the emergency brake
KERNEL-2	Balise group message consistency checking failure	5.2.1.1: Delay between receiving of a balise message and applying the emergency brake
KERNEL-3	Failure of radio message correctness check	
KERNEL-4	Radio sequencing checking failure	
KERNEL-5	Radio link supervision function failure	
KERNEL-6	Manage communication session failure	
KERNEL-7	Incorrect LRBG	
KERNEL-8	Emergency Message Acknowledgement Failure	
KERNEL-9	Speed calculation underestimates train speed	5.3.1.2: Accuracy of speed known onboard, in ceiling speed monitoring, release speed monitoring and in target speed monitoring in case the com-

Safety Process

VnV Level 1 Safety – Results

Specific for the Proof of Concept

- FMEA has been successfully done on the SysML model of MoRC
- 18 Safety Criteria have been defined
- Traceabilty has been established to SUBSET 26
- Results can be found at *https://github.com/openETCS/validation/blob/master/VnVUserStories/VnVUserStorySysterel/04-Results/a-SafetyAnalysis/safety_analyse_MoRC_4A.doc*

3.3. FMEA

#¤	Function¤	Failure·mode¤	Effect¤	Hazard¤	Detectability¤	SIL¤	Safety·Criteria¤	Comment¤
1¤	register·mobile·terminal¤	Absence¤	The·Mobile·Terminal·is·not·registered·to·the·radio·network.·Communication·with·trackside·equipment·is·not·possible.¤	yes¤	Detectable¤	SIL-4¤	REQ_FMEA_ID_001¶ The·Mobile·Terminal·shall·be·safely·registered·to·a·Radio·Network.¶ ¤	¤
2¤		Loss¤	The·Mobile·Terminal·is·not·registered·to·the·radio·network.·Communication·with·trackside·equipment·is·not·possible.¤	yes¤	Detectable¤	SIL-4¤	REQ_FMEA_ID_002¶ The·driver·shall·be·safely·informed·of·the·state·of·the·radio·communication·(resulting·of·the·different·steps:·registration·of·the·Mobile·Terminal·to·the·Radio·Network,·establishment·of·the·communication,·end·of·communication).¶ ¤	¤
3¤		Inadvertent¤	The·Mobile·Terminal·changes·form·a·radio·network·to·	yes¤	Detectable¤	SIL-4¤	REQ_FMEA_ID_003¶ If·a·communication·through·a·Radio·	¤

5. SAFETY CRITERIA

REQ_FMEA_ID_001

The Mobile Terminal shall be safely registered to a Radio Network.

REQ_FMEA_ID_002

The driver shall be safely informed of the state of the radio communication (resulting of the different steps: registration of the Mobile Terminal to the Radio Network, establishment of the communication, end of communication).

REQ_FMEA_ID_003

If a communication through a Radio Network is active, registration of the associated Mobile Terminal to another Radio Network mustn't be performed.

REQ_FMEA_ID_004

A safety protocol shall be used to performed communication between Mobile Terminal and Radio Network.

REQ_FMEA_ID_005

If a communication with trackside equipment is active, set-up of safe radio connection with another trackside equipment mustn't be performed. Exception in case of handover with RBC.

Questions or Discussion

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Task 4.4 Verification of the tools and processes

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