



## D5.2

### Initial report and updates on dissemination, exploitation and standardisation activities

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## Executive Summary

This deliverable provides an initial report as well as updates on the partners' dissemination and communication activities, stated in Annex 1. It includes a record of activities related to dissemination and exploitation that have been undertaken and those still planned as well as a report of completed and planned communication activities.

After a short introduction in Chapter 1, the initially planned dissemination and communication activities are described briefly in Chapter 2. Afterwards, all activities, from publications, workshops and presentations, as well as the project website, social media and print- and e-media are presented.

Chapter 3 is dedicated to the project exploitation. Partner inputs, describing their individual model and their initial hypotheses, have been captured in a so-called "Business Model Canvas" sheet. For confidentiality reasons, the updates on individual exploitation plans per partner are integrated in the 1<sup>st</sup> periodic report (at CO level) of Safe4RAIL.

In Chapter 4 the project standardisation activities are described and explained in detail.

Finally, Chapter 5 sums up the content of the deliverable and gives a general conclusion and future outlook. The deliverable will be finalized in "D5.3 Final report and updates on dissemination, exploitation and standardisation activities" at the project end.

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# Chapter 1 Introduction

Dissemination and exploitation activities are considered key enablers for the success of the Safe4RAIL project. The overall aim of dissemination and exploitation activities is to use research results in order to create value within all participating organisations, thus improving their competitive advantage. Wherever possible, research results will be used for the creation and support of new products, services or processes and will substantially contribute to the benefit of the targeted constituents.

Dissemination activities ensure the visibility and awareness of the project and support the widest adoption of its results among potential users. For the project Safe4RAIL the following user groups have been identified as stakeholders and beneficiaries of the project impacts: e.g. research, commercial, investment, social, environmental, policy making and setting standards. Raising awareness among stakeholders involves the setting up of basic instruments and awareness-raising presentations about the project and the impact it aims to tackle. Thus, the main activities will be the following:

- Setting up a **visual project identity** (common project design, templates for documents and presentations) as a cornerstone of every project engagement at European level.
- Creating and maintaining the **project website and designing project information materials** (such as a leaflet and an introductory off-the-shelf presentation and can be easily distributed at events and or B2B-meetings).
- Giving **presentations at conferences and workshops about the challenges and goals** of Safe4RAIL in order to raise awareness among the scientific and industrial stakeholders and to establish the basic brand name of Safe4RAIL.
- Organization of **two dedicated project dissemination events** targeted at railway stakeholders. These events are the perfect opportunity to present the project results and obtain feedback from a broader audience and to optimize project impacts.

# Chapter 2 Dissemination and Communication

The dissemination strategy aims to ensure visibility and awareness of the project results, which have been depicted in deliverable D5.1. Some indicators have also been selected in order to return a measure of the achieved goals and evaluate how effective the dissemination activities have been executed during the time to create public interest in the project and promote its results to the interested parties. This document reports on all the dissemination activities already executed during the first year (M01-M12) and discusses the achieved targets after monitoring of the activities. Furthermore, we report on the overall activities that have been executed during the whole duration of the project.

## 2.1 Dissemination Strategy

The Safe4RAIL dissemination strategy adopted for the entire project duration is based on the following pillars:

- Presentation of the research results within the scientific community (Section 2.2),
- Presentation of the project to the general public, Section 2.2.2:
  - Project website (Section 2.3.1)
  - Social media (Section 2.3.2)
  - Print- and e-media (Section 2.3.3)
- Presentation and demonstration at national and international exhibitions & fairs and dedicated events and industrial days (Section 2.4).

The dissemination plan of SAFE4RAIL is grouped in three project phases, as stated in Annex I. In the following, we will concentrate on the first two phases since these phases are covered by the first project year (M01-M12). The first two project phases of the dissemination plan are summarized in the table below.

Core Dissemination Activity	Target Group	Partners	Influence on achievement of expected impact
<b>Results of Phase I (M01 – M03) – State of the Art of the concerned technologies</b>			
Project website and information materials (leaflet)	General public	TEC	Disseminate information on the project and its impact to interested parties worldwide. Information to raise awareness on project targets and consortium.
Position papers on State-of-the-Art and research challenges of: - mixed-criticality networking - functional distribution architectures - distributed simulation and validation frameworks	Scientific audience and industry	SIE, TTT, IKL	Communicate results to scientific community and obtain feedback, based on the outputs at the first milestone of the project

Core Dissemination Activity	Target Group	Partners	Influence on achievement of expected impact
Incorporation of results into university courses (Lectures, Seminars, bachelor/master thesis)	Students	SIE, IFS	Convey results to students as part of university education (continues in Phases II and III)
<b>Results of Phase II (M04 – M12) – Identification of the appropriate technologies</b>			
Dedicated 1-day SAFE4RAIL dissemination event, presenting project results from Phase I and Phase II.	Shift2Rail members, railway stakeholders	All	Inform key stakeholders proactively about the project results, discuss with stakeholders in an open context about evaluation and directions, and assure project impact. It is planned to co-host the event in conjunction with the mid-term review meeting (M14).
Papers on initial concepts for - networking backbone for railway use cases. - functional distribution architectures - distributed simulation and validation framework for integrated TCMS architectures - safe electronic braking concept	Scientific and industry audience	SIE, TTT, IKL, IFS, IAV, ELE, NIER	Communicate results to scientific and industry community and obtain feedback, e.g. at nets4trains workshop, Join Rail Conference, WCRR 2018 and VDB-Verband der Bahntechnik. Arising interest among scientific groups, kicking-off discussions on performed work, future cooperation.
Presentation of ongoing activities on high-key industrial event, e.g. INNOTRANS, SafeTrans Industrial Day, safe.tech	Railway industry and operators, Cross-domain industry audience	NEW, TTT, IAV, TÜV	Communication with Railway industry and railway operators; Enable early adopters outside of Shift2Rail core members gaining insight information, raising awareness and initiating valuation and process preparation for the new technology; Arising interest among industrial groups within the railway, automotive and automation functional safety sector. Kicking off discussions about usage and cross sector evaluation of performed work.

Table 1: Dissemination Plan of Safe4RAIL – Phase I and II

## 2.2 Dissemination Activities Started in M01-M12

The project and its results have been disseminated by invited talks at conferences, by publications at scientific and industry oriented conferences and by organizing technical workshops within the project. All dissemination activities undertaken by the consortium have been made visible via the public project website (<https://safe4rail.eu/news/meetings>), including published scientific publications (<https://safe4rail.eu/news/publications>). The following section presents our dissemination activities in order to document the extent to which we have executed our above mentioned dissemination strategy.



## 2.2.1 Dissemination Activities

All scientific publications, presentations, conferences and workshops are listed in an action overview list and are updated by the partners on a regular basis. In total, there have been 17 dissemination activities within the first 12 month. Currently the Safe4RAIL partners participated in 5 events including presentations, conferences, exhibitions and workshops during the first project year. Furthermore, 6 press releases have been published and several website activities have been performed. In the following table, all the activities are listed, reporting the type of activity and the dissemination target, and all the details about the event.

No	Type of activities	Main leader	Title	Date			Place	Type of Audience <sup>1</sup>						Size of audience	Type and goal of the event	Countries addressed
				Day	Month	Year		A)	B)	C)	D)	E)	F)			
1	Website	TEC	Safe4RAILs Twitter Account	3	10	2016	Online	X	X	X	X	X	X	N/A	Social medium at: <a href="https://twitter.com/SAFE4RAIL">https://twitter.com/SAFE4RAIL</a>	International
2	Press release	TEC	Safe4RAIL Announcement Letter	7	10	2016	Online	X	X	X	X	X	X	N/A	Safe4RAILs announcement letter available on the SVN: <a href="https://safe4rail.technikon.com/05-Work-Packages/WP5/04-dissemination-material/SAFE4RAIL_Announcementletter.pdf">https://safe4rail.technikon.com/05-Work-Packages/WP5/04-dissemination-material/SAFE4RAIL_Announcementletter.pdf</a>	International
3	Website	TTT	Project Brief	10	10	2016	TTTech Website	X	X	X	X	X	X	N/A	Presentation of the SAFE4RAIL Project	International

<sup>1</sup> A) Scientific community & higher education, B) Industry, C) Civil Society, D) Policy Makers, E) Media), F) Others

No	Type of activities	Main leader	Title	Date			Place	Type of Audience <sup>1</sup>						Size of audience	Type and goal of the event	Countries addressed
				Day	Month	Year		A)	B)	C)	D)	E)	F)			
4	Press release	NEW	NewTec und SAFE4RAIL	25	10	2016	Online	X	X	X	X	X	X	N/A	Announcing cooperation in SAFE4RAIL	National
5	Website	NEW	Project Brief	25	10	2016	Online	X	X	X	X	X	X	N/A	Presentation of the SAFE4RAIL Project	National
6	Website	NEW	Project Brief	25	10	2016	NewTec Internal Website	X	X	X	X	X	X	N/A	Presentation of the SAFE4RAIL Project	National
7	Participation to other events	TTT	Lessons Learnt from Shift2Rail Open Calls 2016 successful participants	13	12	2016	Brno	X	X					75	Regional Infoday-Shift2RailOpenCalls 2017	International
8	Press release	TEC	Safe4RAIL Project Website Launch	16	12	2016	Online	X	X	X	X	X	X	N/A	Launch of official project website: <a href="https://safe4rail.eu/">https://safe4rail.eu/</a>	International
9	Participation to other events	IKL	Lessons Learnt from Shift2Rail Open Calls	17	1	2017	Brussels	X	X					N/A	<a href="https://shift2rail.org/news/shift2rail-information-day-open-calls-for-proposals-2017-update/">https://shift2rail.org/news/shift2rail-information-day-open-calls-for-proposals-2017-update/</a>	International

No	Type of activities	Main leader	Title	Date			Place	Type of Audience <sup>1</sup>						Size of audience	Type and goal of the event	Countries addressed	
				Day	Month	Year		A)	B)	C)	D)	E)	F)				
10	Participation to a Workshop	TTT	Safe4Rail: Integrated architecture and Safety for Railway applications	25	1	2017	Stockholm	X	X						50	5th International workshop on the "Integration of mixed-criticality subsystems on multi-core and manycore processors"	International
11	Flyer	TEC	Safe4RAIL Project Leaflet	10	2	2017	Online	X	X	X	X	X	X	N/A	The project leaflet provides an overview on Safe4RAILs mission as well as project goals and is available on the SVN: <a href="https://safe4rail.technikon.com/05-Work-Packages/WP5/04-dissemination-material/Leaflet/">https://safe4rail.technikon.com/05-Work-Packages/WP5/04-dissemination-material/Leaflet/</a>	International	
12	Other	TEC	Project Logo	10	2	2017	Online	X	X	X	X	X	X	N/A	Logo will be used for all SAFE4RAIL templates, deliverables, ppt, etc.	International	

No	Type of activities	Main leader	Title	Date			Place	Type of Audience <sup>1</sup>						Size of audience	Type and goal of the event	Countries addressed	
				Day	Month	Year		A)	B)	C)	D)	E)	F)				
13	Press release	IAV	Die Bahn lernt vom Auto - IAV-Know-how für Schienenfahrzeuge : EU-Projekt SAFE4RAIL stärkt unsere Kontakte in die Bahnbranche	31	3	2017	IAV office locations							X	6700	Article in an internal IAV employee newsletter (IAVintern).	International
14	Flyer	TEC	Project Newsletter (Issue 1)	30	5	2017	Online	X	X	X	X	X	X	N/A	The intention of this newsletter is to open a new communication channel in order to provide news on the project progress and to discuss ongoing topics relevant to Safe4RAIL. The Newsletter is available on the project website as well as on the SVN.	International	
15	Flyer	TEC	Project Poster	13	6	2017	Online	X	X	X	X	X	X	N/A	The project poster provides the same overview on Safe4RAILs mission and project goals as the project leaflet does and is available on the SVN.	International	
16	Website	TTT	Project Brief	1	8	2017	Mixed-criticality Forum website	X	X	X				N/A	Presentation of the SAFE4RAIL Project	International	

No	Type of activities	Main leader	Title	Date			Place	Type of Audience <sup>1</sup>						Size of audience	Type and goal of the event	Countries addressed
				Day	Month	Year		A)	B)	C)	D)	E)	F)			
17	Participation to a Conference	TTT	Next-Generation Integrated Modular Architectures: A Cookbook for Scalable and Reusable Ethernet-Based Embedded Platforms	26	9	2017	Ft Worth, TX, USA	X	X	X	X	X	X	N/A	SAE Aerotech 2017	International
18	Participation to a Conference	TTT	Secure deterministic L2/L3 Ethernet Networking for Integrated Architectures	26	9	2017	Ft Worth, TX, USA	X	X	X	X	X	X	N/A	SAE Aerotech 2017	International

Table 2: Dissemination Activities - year 1

Furthermore, the following table provides an overview of the planned dissemination activities for the second project year:

No	Type of activities	Main leader	Title	Date			Place	Type of Audience <sup>2</sup>						Size of audience	Type and goal of the event	Countries addressed
				Day	Month	Year		A)	B)	C)	D)	E)	F)			
19	Participation to a Conference	SIE	Execution Environment for Mixed-Criticality Train Applications based on an Integrated Architecture	16	10	2017	Palestine	X	X	X	X	X	X	N/A	ICPET 2017	International
20	Participation to a Conference	SIE	Evaluation of Time-Triggered Traffic In Vehicular Time-Sensitive Networks Using the Opnet Simulation Framework	27	11	2017	Torino	X	X	X	X	X	X	N/A	Vehicular Networking Conference 2017	International
21	Organisation of a Conference	TTT	Safe4RAIL Mid-Term Conference	25	1	2018	Prague	X	X	X	X	X	X	N/A	Publicly announce initial results of the project to interested parties (including but not limited to other JU projects)	International

<sup>2</sup> A) Scientific community & higher education, B) Industry, C) Civil Society, D) Policy Makers, E) Media), F) Others

No	Type of activities	Main leader	Title	Date			Place	Type of Audience <sup>2</sup>						Size of audience	Type and goal of the event	Countries addressed
				Day	Month	Year		A)	B)	C)	D)	E)	F)			
22	Participation to a Conference	TTT	Next-Gen Train Control / Management (TCMS) Architectures: "Drive-by-Data" System Integration Approach	31	1	2018	Toulouse	X	X	X				N/A	ERTS - European Congress on Embedded Real Time Software	International
23	Participation to a Conference	SIE	Distributed Co-simulation for Software-in-the-Loop Testing of Networked Embedded Systems	16	4	2018	Vienna	X	X	X	X	X	X	N/A	Transport Research Arena 2018 and How digitalisation is transforming transport & mobility systems	International
24	Participation to a Conference	SIE	Fault Injection Framework for Time Triggered Ethernet.	16	4	2018	Vienna	X	X	X	X	X	X	N/A	Transport Research Arena 2018 and How digitalisation is transforming transport & mobility systems	International
25	Participation to a Conference	TÜV	safe.tech	25	4	2018	Munich		x		x			150	<a href="https://www.tuev-sued.de/akademie-de/congress/automobil-bahn/safe.tech">https://www.tuev-sued.de/akademie-de/congress/automobil-bahn/safe.tech</a>	National
26	Participation to a Conference	IFS	Train-to-Ground communications of a Train Control and Monitoring Systems: a simulation platform modelling	16	4	2018	Vienna	X	X	X	X	X	X	N/A	Transport Research Arena 2018 and How digitalisation is transforming transport & mobility systems	International

No	Type of activities	Main leader	Title	Date			Place	Type of Audience <sup>2</sup>						Size of audience	Type and goal of the event	Countries addressed
				Day	Month	Year		A)	B)	C)	D)	E)	F)			
27	Participation to a Conference	TTT	Novel highly reliable safe architecture for robust integration of on-board train control applications	16	4	2018	Vienna	X	X	X	X	X	X	N/A	Transport Research Arena 2018 and How digitalisation is transforming transport & mobility systems	International
28	Exhibition	TTT	Visibility at Shift2Rail booth	16	4	2018	Vienna	X	X	X	X	X	X	N/A	Transport Research Arena 2018 and How digitalisation is transforming transport & mobility systems	International
29	Exhibition	NEW	InnoTrans	18	9	2018	Berlin	X	X	X	X	X	X	N/A	Presentation of NTTTrainSolutions, TRDP and SAFE4RAIL	International

Table 3: (Planned) Dissemination Activities - year 2



## 2.2.2 Scientific Publications

During period 1 of Safe4RAIL, the following scientific publications were published by the consortium. In the following table relevant information including the public access on said publications is provided. Further publications submitted to conference are pending evaluation.

- Hongjie Fang and Roman Obermaisser, *Execution Environment for Mixed-Criticality Train Applications based on an Integrated Architecture*, In Proc. of the IEEE International Conference on Promising Electronic Technologies (ICPET), Deir El-Balah, Palestine, 2017  
<https://networked-embedded.de/es/index.php/staff-details/fang.html>
- Mirko Jakovljevic, Alvaro Soares, *Open Ethernet-Based Embedded Platforms for Integrated Modular Architectures and Autonomous Systems*, AHS Forum 73, Forth Worth, Texas, USA, May 2017.  
<https://www.tttech.com/fileadmin/content/general/files/pdf/company/academic/publications/2017-AHS-Forum-73-Open-Ethernet-Based-Embedded-Platforms.pdf>
- Bernd Hirschler, Mirko Jakovljevic, *Secure deterministic L2/L3 Ethernet Networking for Integrated Architectures*, SAE Aerotech 2017, Forth Worth, Texas, USA, September 2017.  
<https://www.tttech.com/fileadmin/content/general/files/pdf/company/academic/publications/2017-SAE-Secure-deterministic-L2L3-Ethernet-Networking.pdf>
- Mirko Jakovljevic, Arjan Geven, Natasa Simanic-John, Derya Mete Saatci, *Next-Gen Train Control / Management (TCMS) Architectures: 'Drive-By-Data' System Integration Approach*, ERTS 2018, Toulouse, France, February 2018.  
<https://www.tttech.com/fileadmin/content/general/files/pdf/company/academic/publications/2018-ERTS2017-Next-Gen-Train-Control.pdf>

## 2.3 Communication Activities

The dissemination activities present the project's results to the general public, which rely on communication activities, respectively on the diffusion of news on the website, the usage of social media, newsletters, and other publications targeted at potentially interested people.

### 2.3.1 Safe4RAIL Project Website

The project website serves as the most versatile information and communication tool, as on one hand it provides information for a worldwide audience and on the other hand it enables a working platform for the project team. Therefore, it provides a user-friendly and informative environment.

The project website, launched in M03 of the project, available at <http://www.safe4rail.eu>, has been one of the most important dissemination channels, providing continuously updated information on the project, its activities and results. Furthermore, the website provides contact details and partners information as well.

Being based on the Content Management System (CMS) "Joomla!", the website has been flexible enough to act as information centre for all kind of audience and as a repository that can be accessed only by members.

The core functionality as well as the structure of the project website was already described in detail in D5.1.

To maximise the visibility of the project, all project partners are encouraged to promote the project and its news on their company websites and also link to the project website.

### 2.3.1.1 Web Performance

A statistical analysis of access (both unique visitors and overall visits) to the Safe4RAIL project website (graphical visualisation) has been created which can be found below. In order to obtain these figures, we used *Google Analytics* as statistical tools.

Since the Safe4RAIL website was developed during the first months of the project, the following figures give attention to M03-M12 of the first project year, starting from the 16<sup>th</sup> of December 2016 to the end of September 2017.

The two illustrations below (Figure 1 and Figure 2) provide an overview of the number of unique visitors and the total number of requests (visits). While the visitors are counted just for the first time of their website visit, visits are counted for each request of the website.

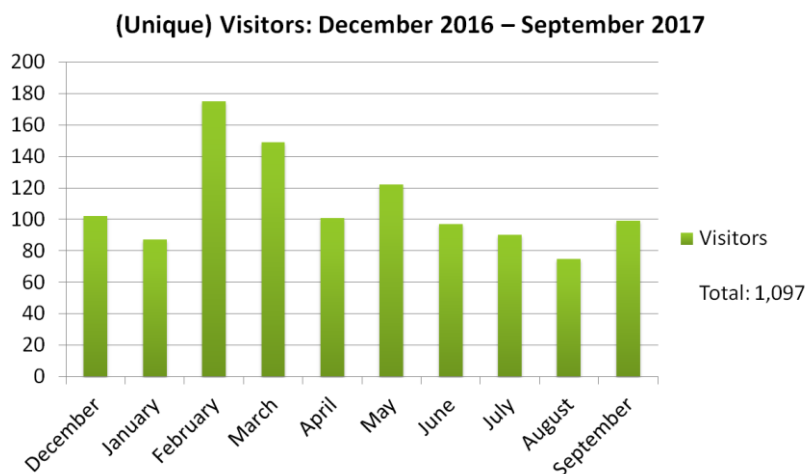


Figure 1: Safe4RAIL website statistic of unique visitors



Figure 2: Safe4RAIL website statistic of non-unique visits

During the first project year, the Safe4RAIL website has been visited 3,850 times in total by 1,097 unique visitors.

The following website statistic depicted in Figure 3 illustrates the geographical distribution of the visitor's location. More than four fifths of the visitors were from the Europe and almost one tenth is represented by Asia as well as America (Northern and South America and the Caribbean). The remaining percentage is spread over Africa and Oceania (Australia, New Zealand and New Guinea). This shows that during the first project period the major interest in this European research project lies of course within the Europe, but it must be also highlighted that the project raises interest in Asia and America.

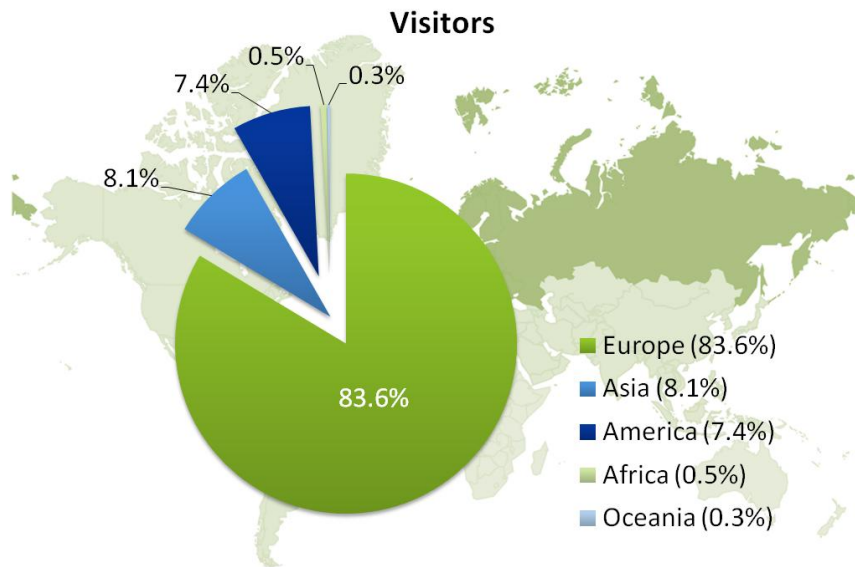


Figure 3: Safe4RAIL website statistic of the geographical distribution of visitor's location

With respect to the following statistic (Figure 4), it has to be pointed out that in the first project year of Safe4RAIL, the website has been able to attract a considerable amount of new visitors, representing almost two thirds of the overall visitors.

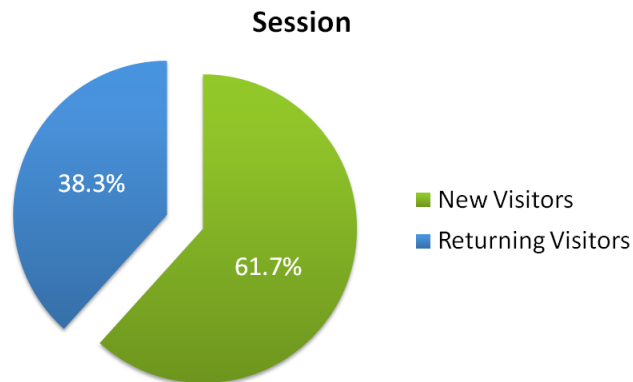


Figure 4: Safe4RAIL website statistic of the distribution of the type of the visitors

### 2.3.1.2 Analysis of the project website

As reported above, website statistics allow to easily evaluate the level of awareness of the project website by means of the number of visits and the number of unique visitors. Based on the number of visits and unique visitors in Section 2.3.1.1, an average rate of 3.51 pages per visitor with an average duration of stay of 3 minutes and 5 seconds is resulting. In conclusion, a visitor remains about 3 minutes on the Safe4RAIL website while reading more than 3 pages per visit.

### 2.3.2 Social Media

Making use of the advantages of social media helps spreading project information to a large audience. As a consequence, they are valuable means to disseminate project ideas and results.

*Twitter* is an online social networking service and micro-blogging service that enables its users to send and read text-based messages of up to 140 characters, known as "tweets". So far we have tweeted 9 entries in the first project year (M01-M12). We will continue with regularly tweets to inform the interested community about the latest project news and press releases and so increase the number of followers. Figure 5 depicts the actual Twitter webpage of Safe4RAIL, which is accessible via: <https://twitter.com/SAFE4RAIL>.

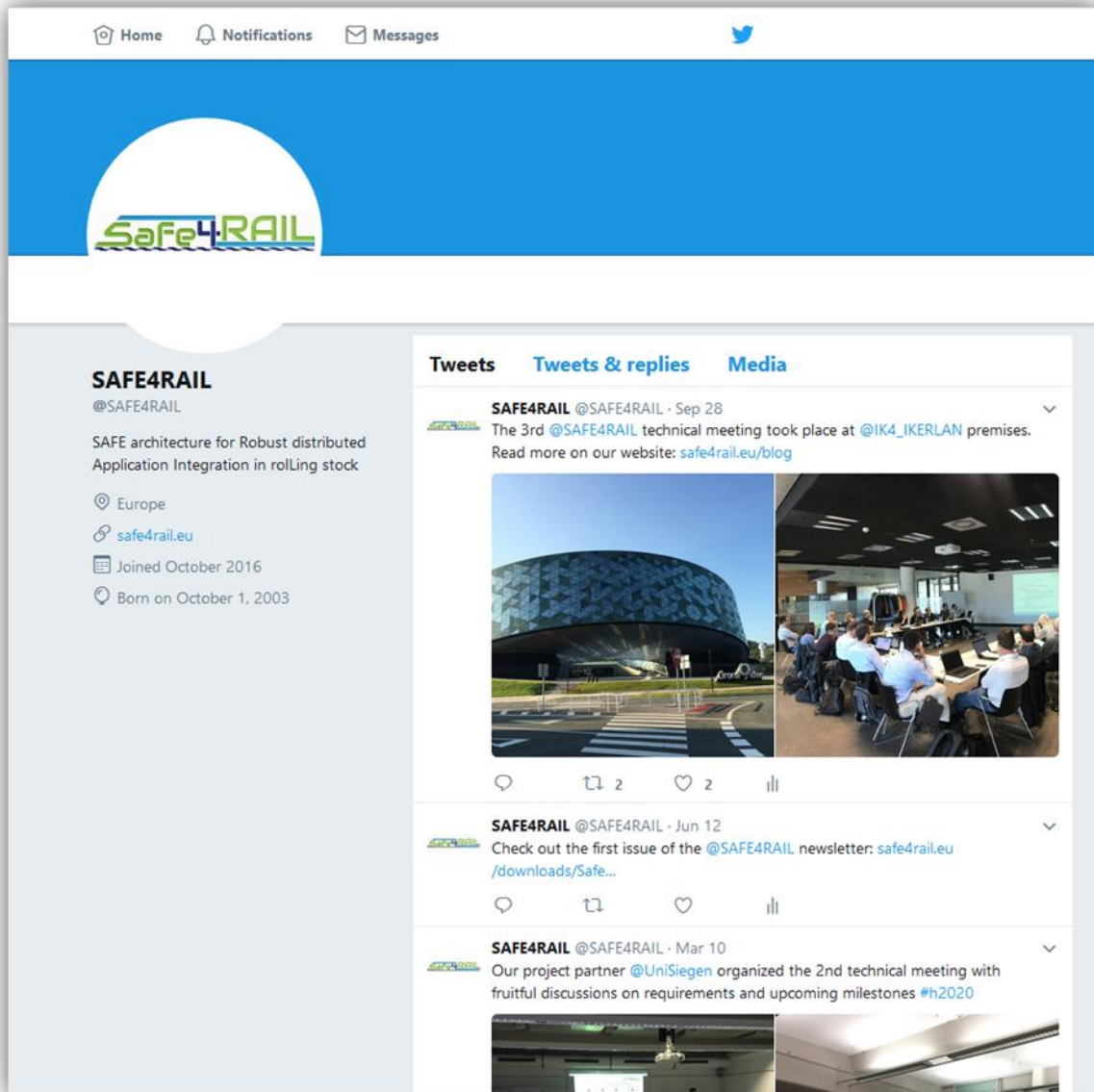


Figure 5: Safe4RAIL's Twitter webpage screenshot

### 2.3.3 Print- and E-Media

Dissemination media/materials, whether as printed or electronic version, contribute highly to the level of awareness of the project. Therefore, several media is used in Safe4RAIL, respectively project-specific leaflet, poster and newsletter were designed and published in order to bring the subject matter as well as results of Safe4RAIL to the public.

### 2.3.3.1 Project Leaflet

The official Safe4RAIL leaflet is a four page informative and graphically appealing A4 flyer, highlighting mission, motivation and objectives of Safe4RAIL (Figure 6). The purpose of the leaflet is to use it for distribution at conferences or certain other events in order to provide further visibility to the Safe4RAIL project.

An electronic version of the leaflet is available on the Safe4RAIL website: [https://safe4rail.eu/downloads/Safe4RAIL\\_Folder\\_Web.pdf](https://safe4rail.eu/downloads/Safe4RAIL_Folder_Web.pdf)



Figure 6: Safe4RAIL leaflet

### 2.3.3.2 Project Poster

Besides the official Safe4RAIL leaflet, a project poster depicted in Figure 7 was designed for raising attraction at fairs, conferences and other events, similar as the leaflet does. The poster was published on the project website and the electronic version is accessible by the following link: [https://safe4rail.eu/downloads/Safe4Rail\\_Poster.pdf](https://safe4rail.eu/downloads/Safe4Rail_Poster.pdf)

**MISSION**

Safe4RAIL (Safe architecture for Robust distributed Application Integration in roLling stock) targets to provide the baseline for a fundamentally simplified embedded computing and networked Train Control Monitoring System (TCMS) platform for modular integration and certification for distributed hard real-time controls, safety signals and functions up to the highest Safety Integrity Level (SIL). Safe4RAIL will reinforce European competitiveness by offering fundamentally simplified electronic and train control and monitoring architectures required for the optimization of railway systems. The outcomes refer to the reduction of the number of on-board computing devices, improved reliability, shortening the integration and (re)commissioning times and thus life-cycle cost reduction, as well as the ability to implement the SIL4 functions in TCMS.

**CONCEPT**

The project Safe4RAIL aims to create safety concepts for mixed-criticality Ethernet-based networking as well as a mixed-criticality application framework, including the brake-by-wire concept. The project will provide recommendations for standardization and certification of next generation TCMS embedded platform.

**OBJECTIVES**

In order to define the networking and application framework safety concepts, Safe4RAIL starts from cross-industry best practices, models of computation and embedded platform (computing, networking and software) technologies. These inputs lead to the development of proof-of-concepts that demonstrate the core components of the technology and ensures sustainable design of integrated modular architectures and next generation TCMS. The technology is demonstrated in the context of electronic train brake control based on a novel fully electronic architectural concept based on drive-by-wire technology. As a whole Safe4RAIL targets the following objectives:

- **Objective 1:** Configurable Mixed Criticality networking "Drive-By-Data" Concept
- **Objective 2:** Mixed Criticality Application Framework Concept
- **Objective 3:** Simulation and Testing Environment for distributed embedded railway systems
- **Objective 4:** Architecture and Safety concept for Brake-by-Wire (SIL4) utilizing the Networking- and Application Framework Concepts
- **Objective 5:** Modular Certification capability enabled by the distributed embedded railway platform and systems
- **Objective 6:** Contribution to safety- and technology standards for future European uptake

**Safe4RAIL**

**Safe architecture for Robust distributed Application Integration in roLling stock**

SIL4-capable mixed-criticality Deterministic Ethernet **Drive-by-Data** | SIL4-capable mixed-criticality Application Framework **Functional Distribution Architecture**

**Virtual Placement in the market** | **Brake-by-Wire**

Simulation and Testing Environment | SIL4-capable electronic Brake Control

Technology Identification and Assessment | Requirements Definition and Iteration | Architecture Safety Concept | Proof of Concept Implementations

**PROJECT PHASES**

**Phase 1 – State of the Art**  
The Safe4RAIL project starts with an exploratory inventory of technology and solutions from the aerospace, automotive and railway domains with regards to system-level, embedded platform with networking, computing, functional distribution, safety and security analyses.

**Phase 2 – Requirements and Technology Assessment**  
The traceability of requirements is a baseline essential for the knowledge transfer, future system development and system platform demonstration activities. The concepts and methodology for the design, configuration, integration, analysis, simulation and verification of subsystems are as essential as the set of principles, components, and networking capabilities enabling the definition of advanced integrated systems, so that they can be certified and commissioned by railway authorities.

**Phase 3 – Proof of Concepts and SIL4 Brake Use Case**  
The outcome of the activities will be validated by means of proof-of-concept demonstrators. The proof-of-concepts show the viability of the defined networks and embedded platforms for "drive-by-data" systems to host SIL4 functions and have all properties required for the TCMS system certification. The Brake-by-Wire activities and design concepts for electronics brake-by-wire system as an exemplary SIL4 can be placed and hosted on the same Safe4RAIL TCMS platform.

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Project start: 1<sup>st</sup> of October, 2016  
Project duration: 2 years

TTTech Ensuring Reliable Networks | IK4 Research Alliance | UNIVERSITÄT SIEGEN  
TECHNIKON | UniControls | Creating value With passion. NewTec  
TUV SUD | ELETSCH | automotive engineering iau  
IFSTAR | NIER INGENIERIA

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Figure 7: Safe4RAIL Poster

### 2.3.3.3 Project Newsletter

In M05 of the project, we launched the first newsletter issue for Safe4RAIL in order to address project related news (Figure 8). The three-page newsletter offers current information and disseminates important events. The release of the newsletter was announced via Safe4RAIL’s Twitter account to catch public awareness and it can be found on the project website: <https://safe4rail.eu/downloads/Safe4RAIL-Newsletter-Issue1.pdf>

It is planned to publish newsletters on a regular basis, in order to keep external partners and the public updated.

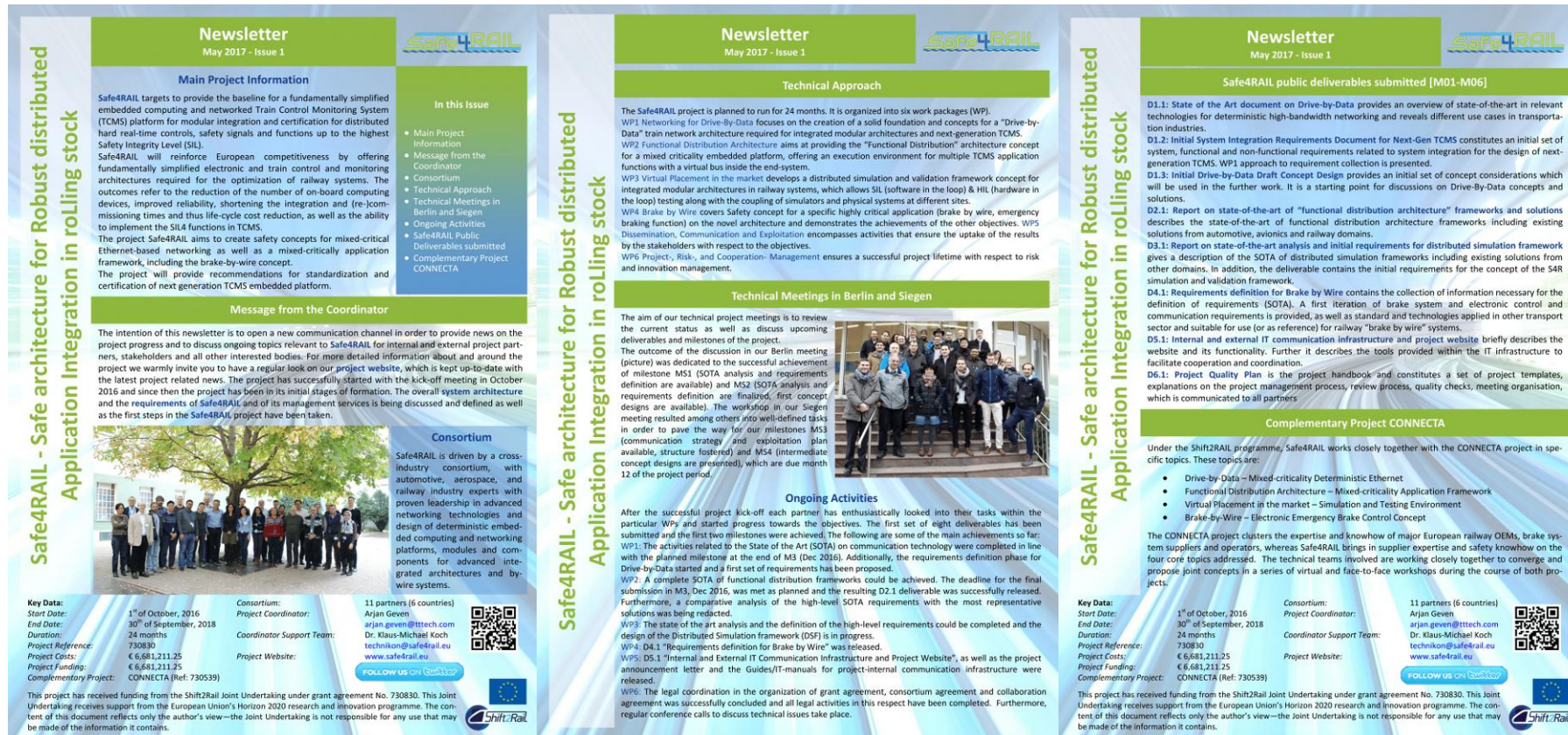


Figure 8: Safe4RAIL Newsletter - Issue 1 (May 2017)



## 2.4 Dissemination Events

Taking into account the strategy outlined in Task 5.1, in this task the most suitable dissemination events will be selected for participation and attendance. We will consider high quality scientific events but also professional events. Specific workshops will be organized within reference conferences (IEEE Vehicular technology Conference, JRC in the US, Nets4cars-Nets4trains-Nets4aircrafts annual workshop...), considering also the specific needs of the project. In order to maximize the impact of the project, this activity will target an identifiable presence at important international meetings and exhibitions (e.g., UIC workshops, World Congress on Railways Research, InnoTrans, etc.). The consortium plans to organize two dedicated 1-day SAFE4RAIL dissemination events, presenting project results.

We have also to take into account the dissemination suggestions within Shift2rail.

### List of possible international conferences and workshops

- IEEE VTC spring 2018 (some tracks could suit for dissemination for Task 3.4) and following similar events (fall event) - An edition each year
- IEEE vehicular networking Conference 2018 (and following events) - An edition each year
- Joint Rail Conference, Pittsburgh, Pennsylvania, April 18 - 21, 2018 (submission of abstract September, 13th, 2017) – An edition each year
- 12<sup>th</sup> WCRR, Tokyo, 28/10-1/11 2019 (call for papers no yet open)
- It could be interesting to enter in contact with the organisers of RailSIMtech to present some of the platforms to this business meeting for the rail industry with a full focus on simulators. Each year
- The Intelligent Rail Summit 2017 is focused on ATO and Cybersecurity – It could be possible to contact the organisers to plan some participation next year.
- IEEE ITS-T 2018 (Lisboa) – There will be a special session organized on Railway communications and testing
- RSSRail 2017 - International conference on reliability, safety and security of railway systems: modelling, analysis, verification and certification - Same event each year
- List of annual potential suitable conferences
- Annual IEEE Conference on Local Computer Networks
- International Conference on Communications (ICC)
- Principles Systems and Applications of IP Telecommunications
- International Telecommunication Networks and Applications Conference (ITNAC)
- International Conference on Network and Service Management
- International Conference on Information and Communications Technology Convergence
- IEEE Symposium on Communications and Vehicular Technology
- International Conference on Electronics, Information, and Communications (ICEIC)
- International Conference on Information Networking

- IEEE International Conference on Computer and Communications (ICCC 2017)
- IEEE International Conference on Electronics, Computing and Communication Technologies
- International Conference on Advanced Communication Technologies and Networking
- IFIP Networking 2018 Conference

**International journals that could be suitable for Safe4rail dissemination**

- IEEE Journal on Selected Areas in Communications - 2017 Special Issue on Network Softwarization & Enablers
- IEEE Transactions on Parallel and Distributed Systems
- IEEE Transactions on Industry Applications
- IEEE Transactions on Intelligent Transportation Systems
- IEEE Transactions on Mobile Computing
- IEEE Transactions on Vehicular technology
- IEEE Vehicular Technology Magazine (We can write un general paper on the aim of the project)
- Transportation Research Part C – emerging technologies - Journal – Elsevier, Open access
- Transportation Research Part B: Methodological - Journal – Elsevier – Open access

## Chapter 3 Exploitation

### 3.1 Introduction

The Safe4RAIL project gathers a highly competent group of partners who cover the whole value chain of product innovation. The common goal of the consortium is to create knowledge, to develop new solutions and to pave the way for commercially successful product innovation to impact the market. An exploitation plan is not just required to support the transfer from project to business level in the start-up phase, but is a vital aid to help the consortium to address potential business opportunities more effectively. The goals and ambitions of Safe4RAIL have already been stated within the proposal and confirmed at the project start.

The project exploitation strategy focuses on reaching the expected impact by the activities of the project consortium in the **medium** and **long term** and targets:

- *Medium-term*: Enlarged consensus around the project scientific and industrial excellence capitalising on reputation and networks of consortium partners; recalled attention of standards bodies to the benefits of next-generation TCMS architecture.
- *Long-term*: Uptake of next-generation TCMS architecture and respective SAFE4RAIL components and building blocks in the railway domain.

The exploitation is supported by the active dissemination activities that demonstrate the quality and applicability of project results. Broad presence and industrial uptake of the SAFE4RAIL results strengthens the market base for the industrial partners and is therefore an important factor in the exploitation of the project's results.

The partners in the project are committed to participate in the development of the common exploitation strategy and have provided information on their previous experience and their current business strategies and facilitate the exploitation activities planned. The plan is based on the high-level exploitation plans and the identified market and business opportunities, including a proposal for exploitation metrics of success.

The underlying exploitation plans are refined, detailed and further developed during the project duration. Due to the public nature of this deliverable and the confidential nature of the individual exploitation plans, the sketched exploitation plans are not included in the deliverable.

In conjunction to this common SAFE4RAIL exploitation strategy and in line with the Shift2Rail targets, partners are encouraged to achieve their individual exploitation plans in relation to the project outcomes.

### 3.2 Methodology

The initial exploitation planning approach targets the definition of essential elements of their business model. This can be interpreted as a blueprint for a strategy to be implemented through their organizational structures and processes using Safe4RAIL's results. What we have collected from partners at the current state of the project is a short description of their model and their initial hypotheses, which have been captured in what is called "The Business Model Canvas sheet" [1].

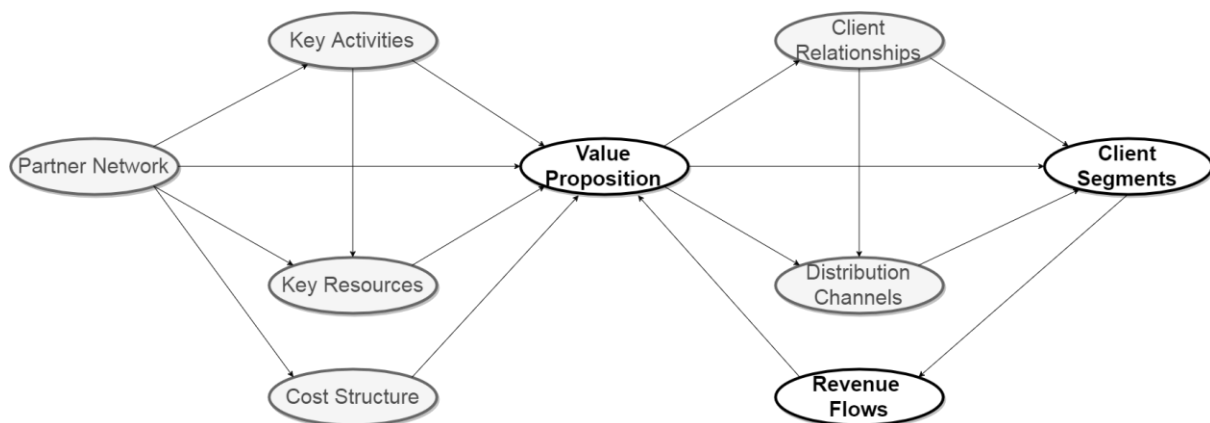


Figure 9: The relation between the nine elements in the Business Model Canvas (adopted from [1])

The nine elements and their relationship are depicted in Figure 9. Despite the model describes nine blocks of information that cover all areas of a business, the partners provide a brief description of three of these blocks that are relevant in particular for new technology development and improvement, which are the following:

- *Value Propositions*: products and services that can create value solving a problem or satisfying a need for each customer segment are described in this block.
- *Customer Segments*: this block attempts to define different groups of people or organization partners aim to reach and their different and common needs.
- *Revenue Streams*: represents the cash generated from each customer segment. Revenue model and pricing tactics should be provided in this block.

The Business Model Canvas is graphically depicted as e.g. in the graphic depicted below:



Figure 10: Business Model Canvas [2]

The individual approach to exploitation plans of partners involved in the project through the mentioned Business Model Canvas (BMC) sheet, with a short description of the blocks described above, are contained in the project's Periodic Report.

### 3.3 Metrics and KPIs for exploitation

Exploitation activities in the project are tracked according to specified Key Performance Indicators (KPIs) related to exploitation. In the first year of the project, the definition of these KPIs and realistic targets for a Research and Innovation Action is the most important activity. In the second year of the project, the metrics will be tracked in detail as part of the regular internal reporting activities.

Furthermore, an action and contingency plan for follow-up on these metrics is defined to handle potential deviations from the targets set.

#### 3.3.1 Exploitation KPIs and target values

The following KPIs are defined for the Safe4RAIL exploitation activities.

KPI	Description	Target
E1	Exchange with railway OEMs and suppliers	≥ 6
E2	Organisation/participation in exploitation-oriented events	≥ 3
E3	New patent application	≥ 1
E4	New start-up or spinoff company created	optional
E5	Total investments mobilised via debt financing and Venture Capital investments	optional
E6	New product developments around Safe4RAIL or integration in existing products / product developments	≥ 1 per industrial partner
E7	Contribution to standards or creation of new standards	≥ 1
E8	Personnel or in-house trainings on Safe4RAIL topics and/or outcomes	optional
E9	Integration of Safe4RAIL context in academic teaching and education activities	≥ 1 per academic partner
E10	Follow-up research project or activities formulated and submitted	≥ 1 (total)

Table 4: Exploitation KPIs

### 3.3.2 Action and contingency map upon KPI satisfaction or dissatisfaction






Categories		General Actions and Contingency
	Immediate action necessary	KPI is substantially below expected value. Actions taken need to include work on contingency measures, reassigning of responsibilities, adapting plans, and shifting of efforts in order to improve activities relevant to the KPI.
	Needs further attention	KPI is slightly below expectation or may deserve attention for other reasons, e.g. continuous performance drops. Proactive usage of this status is advised. The issue needs to be addressed in the monthly telephone conference and further measures for improvement need to be discussed project-wide. Actions to be taken are to be carried out by partner assigned within monthly telephone conference.
	Good progress	KPI on track with plan. Measures implemented so far need to be carried out in a similar way for the remainder of the project.
	Overachievement	KPI exceeds expectation. Potential adjustments of KPI plan necessary to account for undervaluation of exploitation efforts, or shift of efforts to tasks with lower performance.
	Not applicable, change of exploitation plan or measure	KPI cannot be evaluated at this point due to changes in exploitation plans and newly introduced measures. Actions to be carried out need to include adjustment for enabling future tracking of KPI.

Table 5: Action and contingency map

All mismatches will affect the planning for future reporting iterations. Substantial mismatches (“Immediate actions necessary”) will be discussed with the consortium. This may lead to the concentration on specific issues and as stated above, to the reassignments of efforts or responsibilities, or the revision of plans and strategies.

The individual business model canvas’ per partner can be found in the 1<sup>st</sup> periodic report.

## Chapter 4 Standardisation

### 4.1 Introduction

Harmonization and standardization are important ways to facilitate the adoption of technology, especially in niche markets where volumes are low and investment costs are high. This is exactly the case in the railway domain for safety-related embedded systems. Further factors are the ongoing harmonization of the national technical and safety regulations in the railway domain. Decisions from the past have resulted in non-interoperable, proprietary, country- and vendor-specific solutions. For new technologies, a different, European approach is followed in which interoperability and standardization are key requirements for any new technology in order to avoid future complexity. On the other hand, standardization itself does not come for free and requires all actors to work together to come to suitable standards that can be implemented in a cost-effective way.

In Safe4RAIL, standardization is one of the six key objectives, as announced in the Description of Action: “OBJ 6: Contribution to standards”, with two specific measures of success that are defined alongside the objective:

#### Measures of success to OBJ 6

- Recommendations and requirements are compliant to the basic safety and security requirements given by the established safety and security standards. A compliance argument is provided for all recommendations and requirements.
- Recommendations and requirements extend the established standards assuring safety and security. A safety & security argument for individual extensions and additions is provided.

This chapter highlights the activities planned and already undertaken with respect to standardization of the results in accordance with the objective of the project.

### 4.2 Standards addressed by Safe4RAIL

The relevant standards can be classified in two different areas that are of relevance to the project:

1. **Technical standards**, which can be split in generic and railway-specific technical standards.
  - a. Generic technical standards - this relates to e.g. Ethernet standards described in IEEE802.3, which may be extended based on new technological insights and where participants on Safe4RAIL are directly involved. These standards are typically optional for use in the railway domain, and can be selected or not depending on their technical merits and efficacy.
  - b. Railway-specific technical standards – this relates to domain-specific standards that are defined by and for the railway industry. An example of such a standard is the IEC61375 for electronic railway equipment for the Train Communication Network (TCN).
2. **Safety and Security standards** – this relates to railway safety standards which are normative standards that are actively enforced by authorities and must be adhered to. Standards are defined targeting the prevention of dangerous system failures and



safety of human life, both due to unintended failure (safety) and intended failure (security). As an example CENELEC EN 50126 targets the Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) of railway applications.

Both technical and safety/security related standards are important to the success of the Safe4RAIL project. However, they are important in different ways due to the way they affect the development of the rolling stock, on two different grounds:

*Normative vs. descriptive standards:* The technical standards are descriptive and target mainly the interoperability and serve as a means to reduce cost (either immediately or in the future). Safety and security standards are normative, non-negotiable and must be adhered to.

*Stakeholder dynamics:* The technical standards are largely shaped and defined by industrial parties and as such more susceptible to change in case of better technical alternatives. The major drivers for change are financial/effort-wise or feature-wise improvement of the capabilities offered by the technology, as well as interoperability reasons pushed for by specific stakeholders (e.g. operators). Safety norms are changed on the merits of safety and require proof to and approval of authorities. Subsequently, although all standards are slow, safety norms are particularly conservative and to react with certain delay on technological changes to ensure that unintended pitfalls are avoided at all times and safety is guaranteed.

### 4.3 Methodology

It is well-known that standardization is an activity that typically stretches over many years or even decades. At the same time, the project is working on results that will be suitable for standardization rather by the end of the project than by its beginning. As such, it is not feasible to expect conclusion of new standards with Safe4RAIL results directly in the context of the project.

The goal of the standardization activities described in this chapter is, due to these long lead-times, a different one, i.e.

- a) to ensure compatibility with existing safety and security standards without the need for changes to these standards.
- b) to integrate project technical results to the respective technical standards bodies on a per-partner basis
- c) to invite and discuss with members of standardization bodies regarding future standards update windows
- d) to present recommendations for updates to the relevant railway standards

#### Phases

The standardization methodology followed in Safe4RAIL is set up in three phases:

Phase 1 – Survey of relevant standards and standardization groups

Phase 2 – Detailed analysis of those standards with regards to compatibility and alignment with Safe4RAIL concepts

Phase 3 – Recommendation for changes towards these changes:

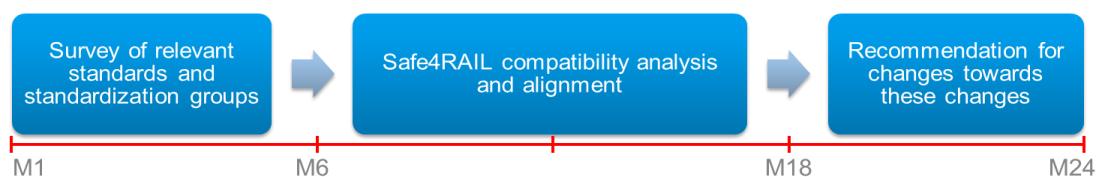


Figure 11: Phases of Standardization

#### 4.4 Survey of relevant standards and standardization groups

In the first phase, the survey of relevant standards and standardization groups have been performed which is documented in this deliverable. In the next phase, the compatibility analysis and alignment is performed. Since these activities are an integral part of the work in the technical work packages, the tables listed here merely provide an overview of the referenced standards and the reader is directed to the respective technical deliverable(s) in which standards are analysed in detail.

Safety Standard	Name	Partners directly involved	Related WP and/or Deliverable(s)
EN 50126	Railway Applications - The Specification And Demonstration Of Reliability, Availability, Maintainability And Safety (RAMS)	NEW, NIER, TTT	D1.1, D2.1
EN 50128	Railway Applications - Communication, Signalling And Processing Systems Software For Railway Control And Protection Systems	IAV, TTT, SIE, NEW, UNI	D1.1, D2.1, D2.2
EN 50129	Railway Applications - Communication, Signalling And Processing Systems - Safety Related Electronic Systems For Signalling	NEW, NIER	D1.1, D2.1
EN 50159	Railway Applications - Communication, Signalling And Processing Systems - Safety-Related Communication In Transmission Systems	NEW, UNI, TTT	D1.1, D2.1
EN 50657	Railway Applications - Rolling Stock Applications - Software On Board Of Rolling Stock, Excluding Railway Control And Protection Applications	NIER	

IEC 62443	Cybersecurity	IAV, TTT, SIE, NEW, UNI	D2.1, D2.2
ISO/IEC 15408	Common Criteria for Information Technology Security Evaluation	NEW, UNI	WP2 D2.1

Table 6: Safety and Security Standards

Technical Standard	Name	Partners involved	Related WP and/or Deliverable(s)
IEC 61375-2-3	Part 2-3: Communication Profile	UNI, NEW	WP1, D1.1
IEC 61375-2-5	Part 2-5: Ethernet Train Backbone	UNI	WP1, D1.1
IEC 61375-2-6	Train2Ground	UNI	WP3, D3.1, D3.3
IEC 61375-3-4	Part 3-4: ECN / Ethernet Consist network	UNI	WP1, D1.1
SAE 6802	TTEthernet	TTT	WP1, D1.1
IEEE 802.3	Ethernet	TTT	WP1, D1.1
IEEE 802.1	Local Area Networks	TTT	WP1, D1.1
ARINC 664 Part 7	Avionics Full Duplex Switched Ethernet (AFDX)	TTT	WP1, D1.1
TRDP	Train Real-time Data Protocol	NEW	WP1, WP2
DIN VDE V 0831-104	Electric signalling systems for railways - Part 104: IT Security Guideline based on IEC 62443	NEW, UNI	WP2 D2.1
VDE V 0831-102	Electric signalling systems for railways - Part 102: Protection profile for technical functions in railway signalling	NEW, UNI	WP2 D2.1

Table 7: Technical Standards

## Chapter 5 Conclusion

Dissemination, standardization and exploitation are three key areas of activity for the members of the consortium and for the success of the whole project.

As reported, a moderate quantity of dissemination activities has been performed during the first year of the project, corroborated by a good degree of quality. Dissemination, performed in most part by the commercial members, has also diffused the project's results in events targeting potential stakeholders or the general public.

As regard standardization, the activities have been targeting international standard bodies focusing on topics and techniques related to security in railway, aiming for a broader acceptance of the project's results.

The individual exploitation plans confirm the effectiveness of the research results produced within the project, and the possibility to produce value by taking advantage of the project's activities.

## List of Abbreviations

AFDX	Avionics Full Duplex Switched Ethernet
ASIC	Application-Specific Integrated Circuit
B2B	Business-To-Business
BMC	Business Model Canvas
CBTC	Communication-Based Train Control
CMS	Content Management Service
ECN	Ethernet Consist Network
ERTMS	European Rail Traffic Management System
ETBN	Ethernet Train Backbone Network
HIL	Hardware-in-the-Loop
ICT	Information- and Communication Technology
IoT	Internet-of-Things
KPI	Key Performance Indicator
LAN	Local Area Network
MCG	Mobile Communication Gateway
OEM	Original Equipment Manufacturer
PCB	Printed Circuit Board
PoC	Proof-of-Concept
RAMS	Reliability, Availability, Maintainability and Safety
RTOS	Real Time Operating System
SaaS	Software-as-a-Service
SIL	Software-in-the-Loop
SotA	State-of-the-Art

T2G	Train-to-Ground
TCMS	Train Control Monitoring System
TCN	Train Communication Network
TRDP	Train Real-Time Data Protocol
V&V	Verification and Validation
WiTEC	Women in Science, Engineering and Technology
WP	Work Package

Table 8: List of Abbreviations

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