



# Roll2Rail



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No: 636032



# Roll2Rail – WP2:Wireless TCMS

ICT on TRAINS – Birmingham

8<sup>th</sup>-9<sup>th</sup> of September 2015

Eneko Echeverria (CAF) / Eulalia Peris (UNIFE)



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## **Eneko Echeverria**

Project Coordinator

CAF Construcciones y Auxiliar de Ferrocarriles

Eneko Echeverria graduated in Telecommunications Engineering in 2005 and immediately after, he joined the research division at CAF.

Although he worked for 3 years for CAF Power and Automation in the electronic department, in 2010 he was back in CAF's research department to start his role as Validation and Verification Manager within new generation of electronic platforms with safety implications.

He is the TCMS WP leader of Roll2Rail.





## **Eulalia Peris**

Technical Affairs Manager

UNIFE: The European Rail Industry

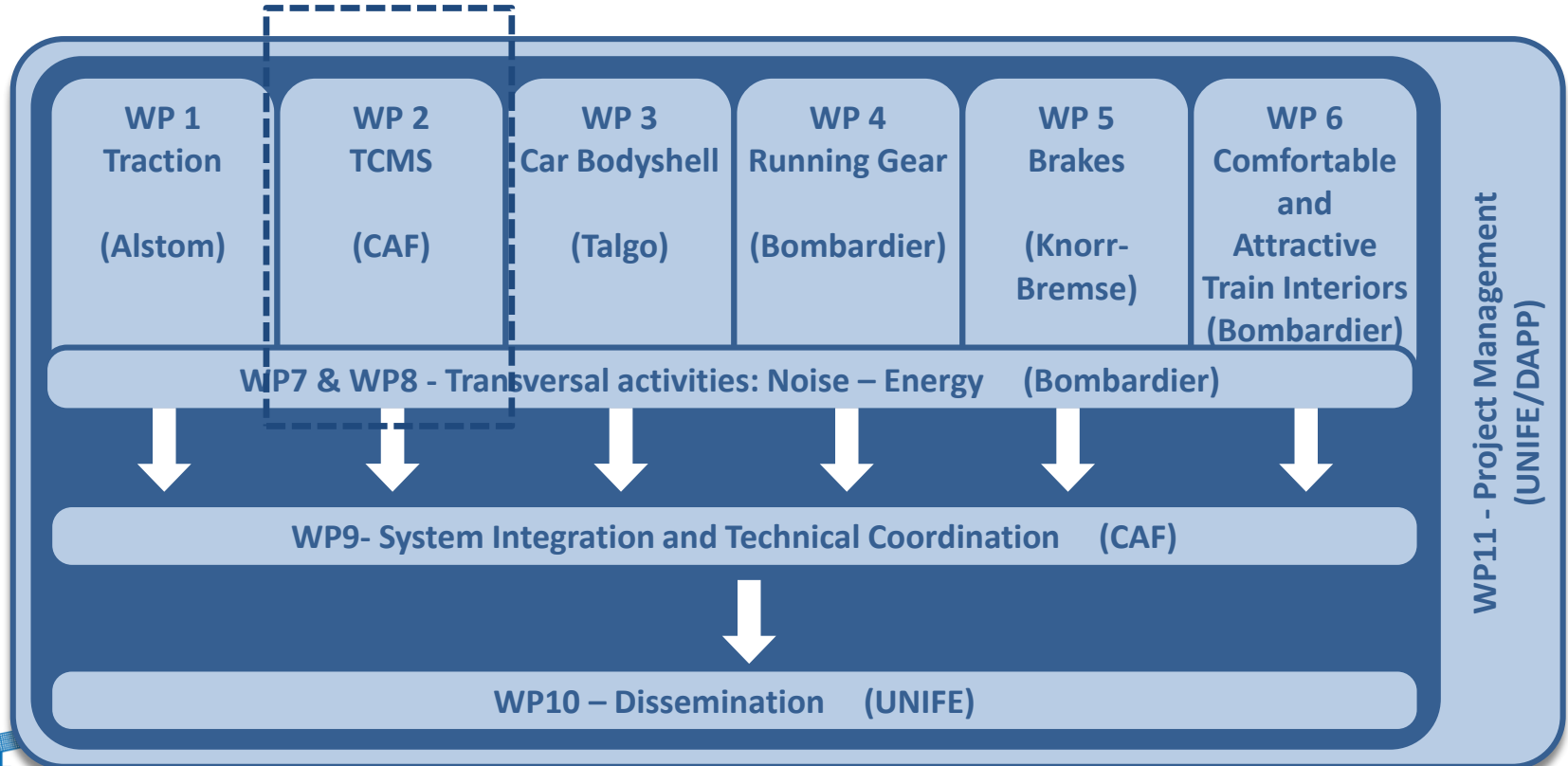
Eulalia Peris graduated in Sound and Image Engineering in 2006 and obtained a PhD in Environmental Acoustics in 2013. She joined UNIFE in January 2015 as a Technical Affairs Manager and is currently the coordinator of two EU funded projects : Roll2Rail and REFRESCO



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# Roll2Rail

*New Dependable Rolling Stock for a more Sustainable, Intelligent and Comfortable Rail Transport in Europe*

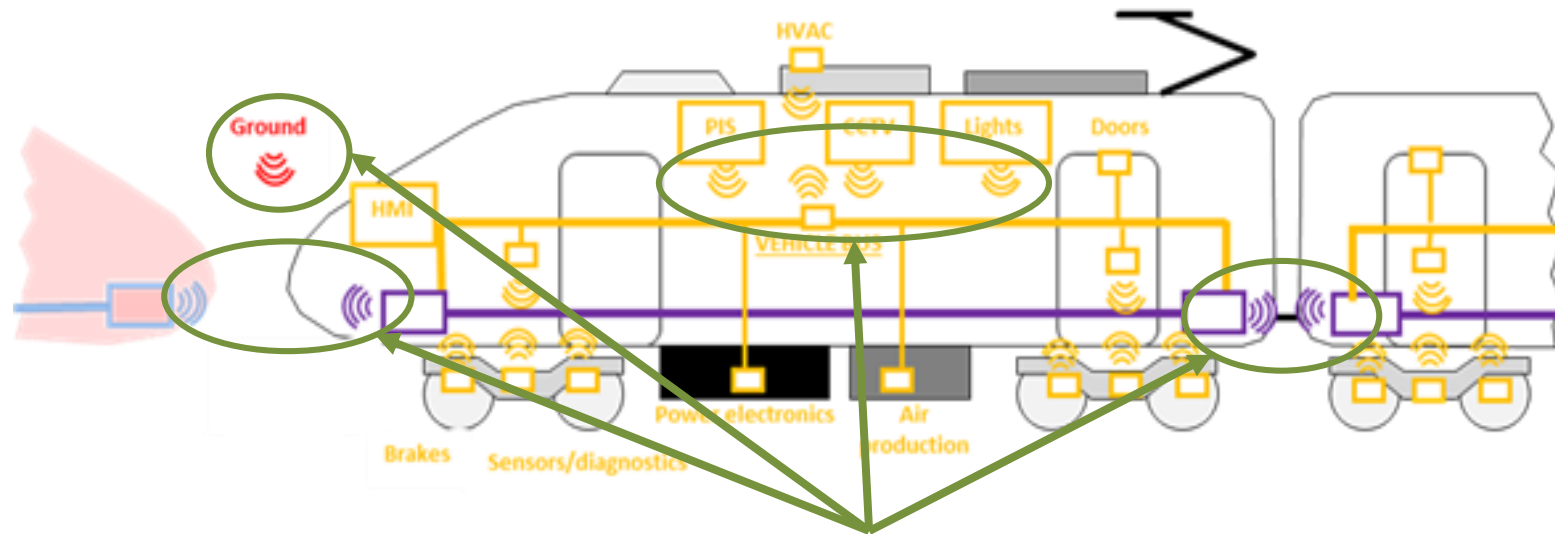


# WP2 WIRELESS TCMS: Partners



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# Introduction / Scope



## Scope

- a) Train to Ground Communication
- b) Train to Train Communication or Inter-Consist
- c) Intra-consist Communication

- TCMS functions
- Infotainment
- CCTV applications
- Eliminating on board communication cables
- Simplifying the train coupling procedure



# Objectives

- To implement a radio communications technology assessment for railways that increases reliability and reduces life cycle costs.
- To develop of standard high level resilient architectures and physical interfaces for the train wireless communication systems, to drive their deployment in real products in the future





# Structure

*T2.1 - Specification of the Wireless TCMS*

*T2.2 - Characterization of the Railway Environment for Radio Transmission*

*T2.3 - State of the Art in Radio Technologies for Data Transmission*

*T2.4 - RAMS and Security Analysis*

*T2.5 - Architecture for the Train and Consist Wireless Networks*

*T2.6 - Architecture and Interface Definition for the Train to Ground Communication*

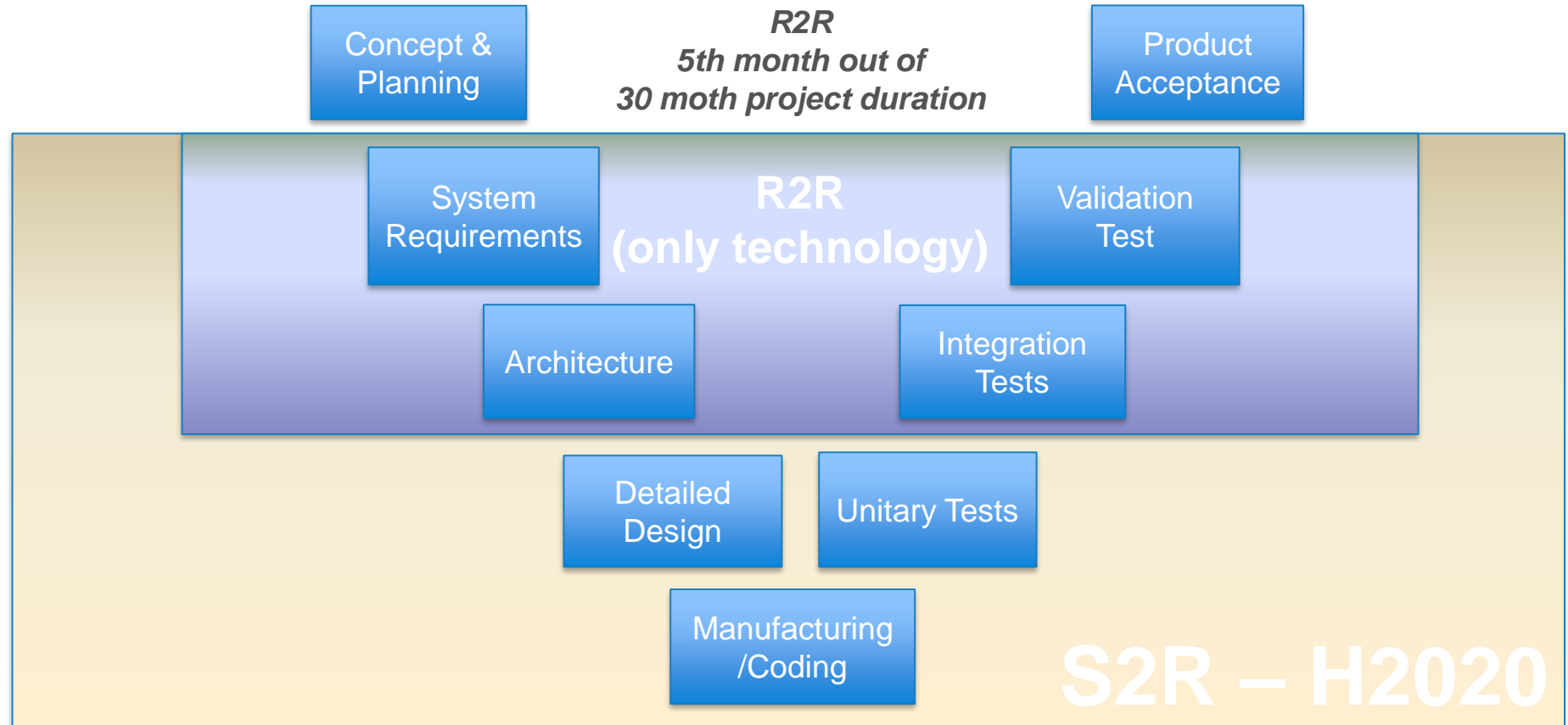
*T2.7 – Pre-selection of Suitable Radio Technologies*

*T2.8 - Validation of Technologies in Laboratories*



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# Project Management Model



# 2.1 Requirements Specification

## Functional Breakdown Structure

EUROPEAN STANDARD **EN 15380-4**

NORME EUROPÉENNE

EUROPÄISCHE NORM

January 2013

ICS 01.110; 45.060.01

English Version

**Railway applications - Classification system for railway vehicles -  
Part 4: Function groups**

Applications ferroviaires - Système de classification pour  
véhicules ferroviaires - Partie 4: Groupes des fonctions

Bahnanwendungen - Kennzeichnungssystematik für  
Schienenfahrzeuge - Teil 4: Funktionsgruppen

This European Standard was approved by CEN on 3 November 2012.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



## Use Cases Definition

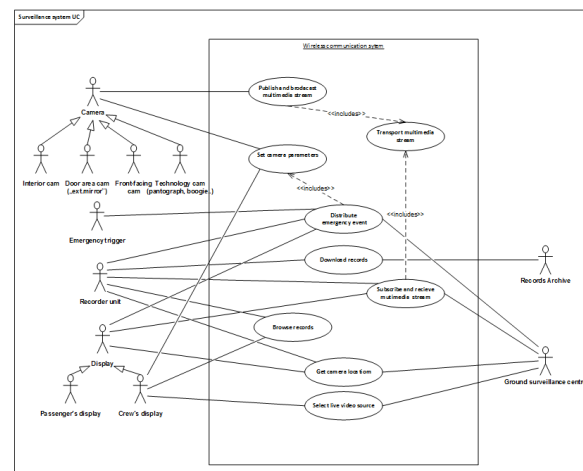


Figure 1 – Use Case Train On-Board Video Surveillance System¶

Source: R2R-T2.1-T-UNC-030-01

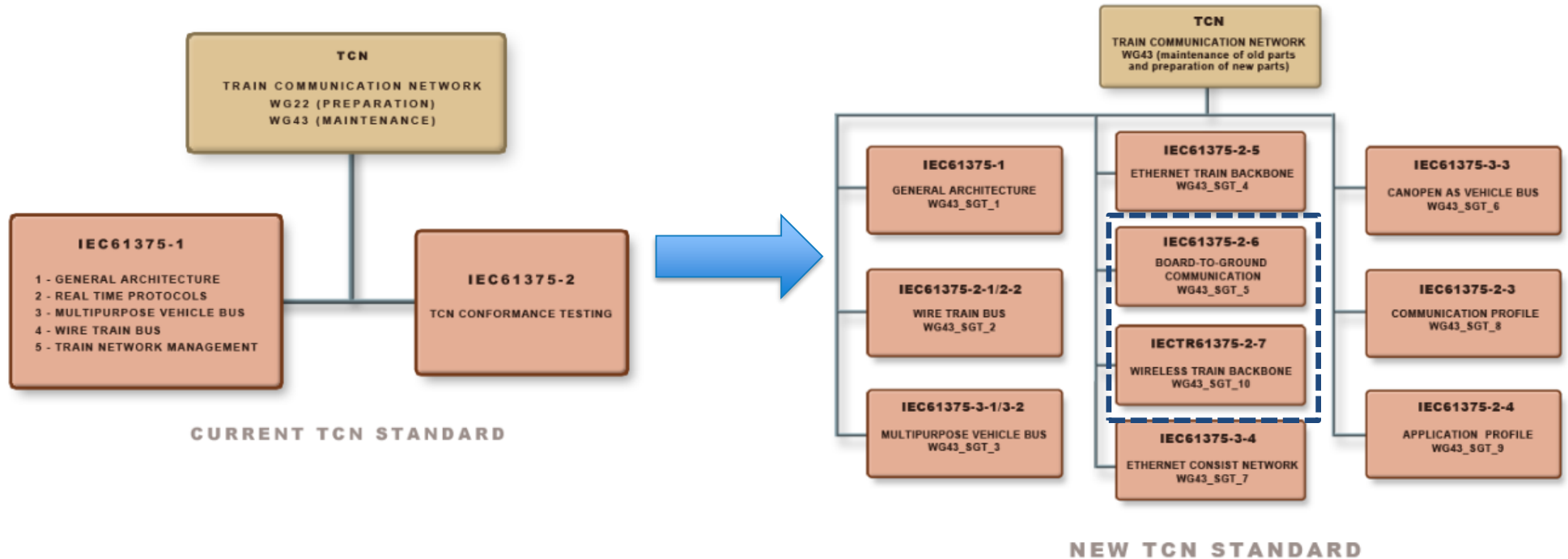


**Requirements  
Boundaries**

**Roll2Rail**



# Incoming TCN Standard



Source: <http://www.tcnopen.eu/description.aspx>



# T2.2 Environmental Characterisation and Modelling



## 1. Identify Scenarios:

Communications boundaries for data rate/latency will be considered and critical/non-critical data will be identified in collaboration with T2.1



## 2. Measurements:

Measurement scenarios will be selected:



Measurements (channel characterisation) on selected scenarios will be executed.

## 3. Modelling:

Models for scenarios will be proposed (they will be used in T2.7).



Source: R2R-T2.1-I-TRI-037-01



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# T2.3 State of the Art

**State of the art in radio technologies for data transmission in real time:**

- Railway
- Aeronautics
- Industry
- Automotive

**Collaborate in decision of selecting suitable radio technology for :**

- T2G
- Train to Train/ Inter-Consist Communication
- Intra-Consist Communication

*Public Deliverable  
Available soon !!!!  
By end of October 2015*





# T2.4 RAMS and Security Analysis

## Description:

TCMS with wireless should increase reliability as well as keeping the current levels of safety. Wireless technologies have to be as safe and secure as the cabling ones.

## Safety →

Analysis on safety parameters: SIL / THR / PST / SFF / HFT

## Security →

Analysis on how possible cyber-attacks would affect operational train control functions.

### Reference standards:

#### Reliability

- Reliability Block Diagrams:
  - IEC61078
- Fault Tree Analysis
  - IEC61025

#### Safety

- General Concepts:
  - EN50126
  - EN50128
  - EN50129
  - IEC61508
- Communication Oriented:
  - EN50159 [4]
- PHA:
  - EN50126 [1].
- FMEA:
  - MIL-STD-1629A [9].





# T2.5 Preliminary Architecture for the Train and Consist Wireless Networks

## Description:

This task will define suitable architectures of the wireless networks for train-to-train and inter-consist communications as well as for selected applications.

- Train Command and Monitoring
- Safety Function & Redundancy
- Infotainment & CCTV



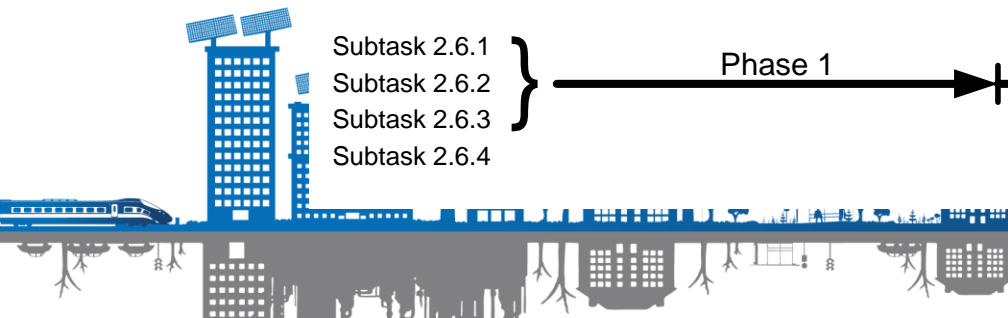
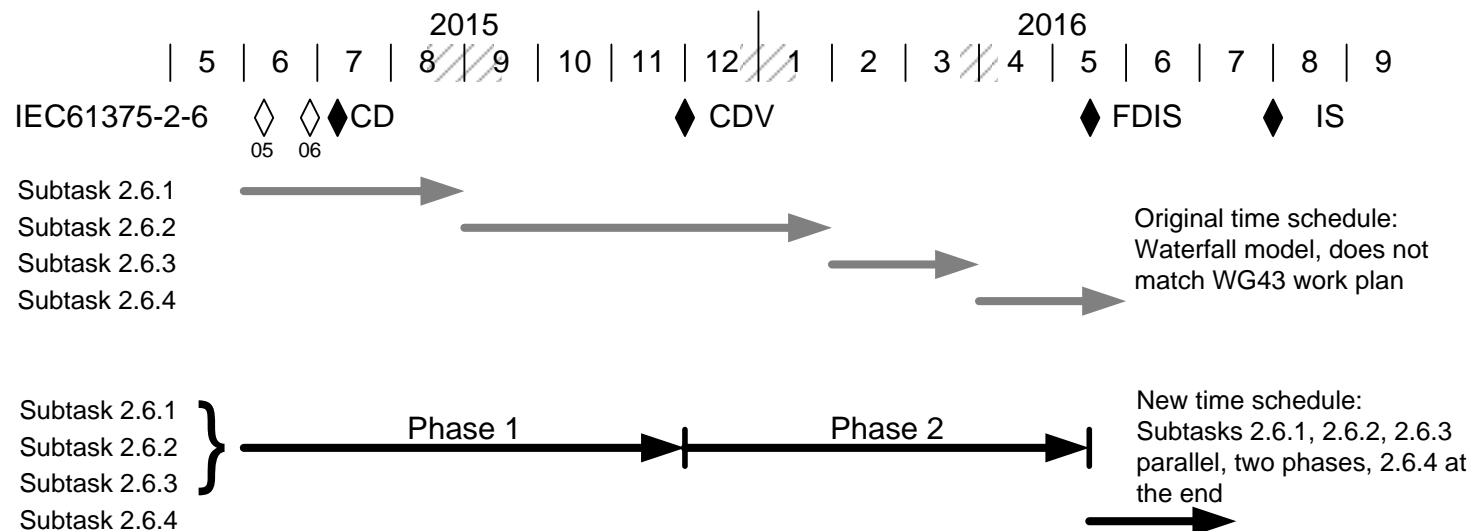


# T2.6 Architecture and Interface Definition

## SIEMENS for Train-to-Ground Communication

### Complete IEC 61375-2-6 IEC TC9 WG43:

- Subtask 2.6.1 – Architecture Definition: Clauses 4, 5, 6 and 7 of v04 of standard will be analysed and completed.
- Subtask 2.6.2 – Functional Interface Definition: clause 8 of v04 of standard will be further developed.
- Subtask 2.6.3 – Addressing: clause 8 of v04 of standard will be reviewed
- Subtask 2.6.4 – Applications and Services: this will be treated in a 2nd phase because it is interesting to give ideas, but they will be out of the scope of previous standard.



# T2.7 Simulation of Pre-selected Suitable Radio Technologies

## Description:

The pre-selection of suitable radio technologies for TCMS will be made regarding to the RAMS and security study and in collaboration with the architecture definition task.

## Simulations →

Radio technologies and proposed architectures will be simulated to evaluate their performance under conditions modelled in T2.2.

## Technology Definition →

Transmission physics, frequencies, basic protocols, existing COTS hardware, potential limitations.



# T2.8 Validation of Suitable Radio Technologies



## Description:

The proposed radio technologies will be validated in the laboratory.

- Control command
- Safety functions
- Infotainment and CCTV

→ **Scenarios & Test Protocol Definition**

→ **Implementation of Test Scenarios**

→ **Test Execution and Assessment**



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# Deliverables

Code	Title	Release Date	Dissemination Level
D2.1	Specification of the Wireless TCMS	M18	Public
D2.2	Characterisation of the Railway Environment for Radio Transmission	M13	Public
D2.3	State of the Art in Radio Technologies for Data Transmission	M6	Public
D2.4	RAMS and Security Analysis Report	M18	Confidential
D2.5	Architecture for the Train and Consist Wireless Networks	M18	Public
D2.6	Architecture and Interface Definition for the Train to Ground Communication	M12	Public
D2.7	Pre-Selection of Suitable Radio Technologies	M22	Public
D2.8	Validation Report	M26	Confidential



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# THANK YOU FOR YOUR ATTENTION

## For further information:

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