

# EUR-INTERLOCKING

## Standards for functions and interfaces as the basis for CBTC in Europe

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Euro-Interlocking, Zurich

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Union Internationale des Chemins de fer  
Internationaler Eisenbahnverband - International Union of  
Railways

# EUR-INTERLOCKING

## Summary of this presentation

### Euro-Interlocking:

- **Link to CBTC**
- **Objectives and aims of Euro-Interlocking**
- **Project participants**
- **Project organisation**
- **Standards:**
  - **Non-functional requirements**
  - **Functional requirements**
  - **Interface specifications**
  - **Applications**

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# EUR<sup>○</sup>-INTERLOCKING

## Interfaces in CBTC

- Migration to CBTC systems on mainline railways requires **interfaces** between:
  - CBTC components and
  - conventional signalling components such as interlocking systems
- Interface standards require a common approach for the expression of **functional requirements**
- Standards for **functions** and **interfaces** are main objectives of the Euro-Interlocking project

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## CBTC in Europe: ERTMS / ETCS

- **Main driver: Cross-border interoperability for trains**
- **ERTMS: European Rail Traffic Management Systems**
- **ETCS: European Train Control System (a subproject)**
- **ETCS Level 2 allows elimination of lineside signals**
  - **First lines now in revenue service**
- **ETCS Level 3 allows moving blocks**
  - **Still under development, but will use much from Level 2**

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## Primary project objectives

- **Significant reduction of life-cycle costs**
- **Improved reliability and availability**
- **Comply fully with the European standards EN 50126 to 50129**
- **Higher traffic density and more efficient traffic management in connection with ERTMS/ETCS**

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## Specific project aims

- **Standardised (generic) requirements for interlocking systems to meet current and future needs of participating railways**
- **Standardisation of interfaces (such as to adjacent interlockings, remote control, ERTMS/ETCS and track elements)**
- **Better reliability and availability through standards that promote industry innovation**
- **Cross-acceptance of systems throughout Europe**
- **Realisation of initial projects implementing the Euro-Interlocking Standards based on first calls for tenders in 2002-2004**



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# EUR-INTERLOCKING

## 17 participating European railways

**BS, Denmark**

**BV, Sweden**

**BLS, Switzerland**

**CD, Czech Republic**

**CFR, Romania**

**DB AG, Germany**

**JBV, Norway**

**MAV, Hungary**

**NS/ProRail,  
Netherlands**

**REFER, Portugal**

**RFF, France**

**RHK, Finland**

**Network Rail,  
United Kingdom**

**RFI/FS SpA,  
Italy**

**SBB/CFF, Switzerland**

**ÖBB, Austria**

**SNCB/NMBS,  
Belgium**

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## 12 participating suppliers



**AEA Technology Rail**  
**Alcatel**  
**Alstom Transport**  
**Ansaldo**  
**AZD Praha**  
**Bombardier Transportation**  
**I-Logix**  
**Invensys/Westinghouse/Dimetronic**  
**OSC-Offis**  
**Siemens Verkehrstechnik**  
**Telelogic**  
**Vossloh System-Technik**

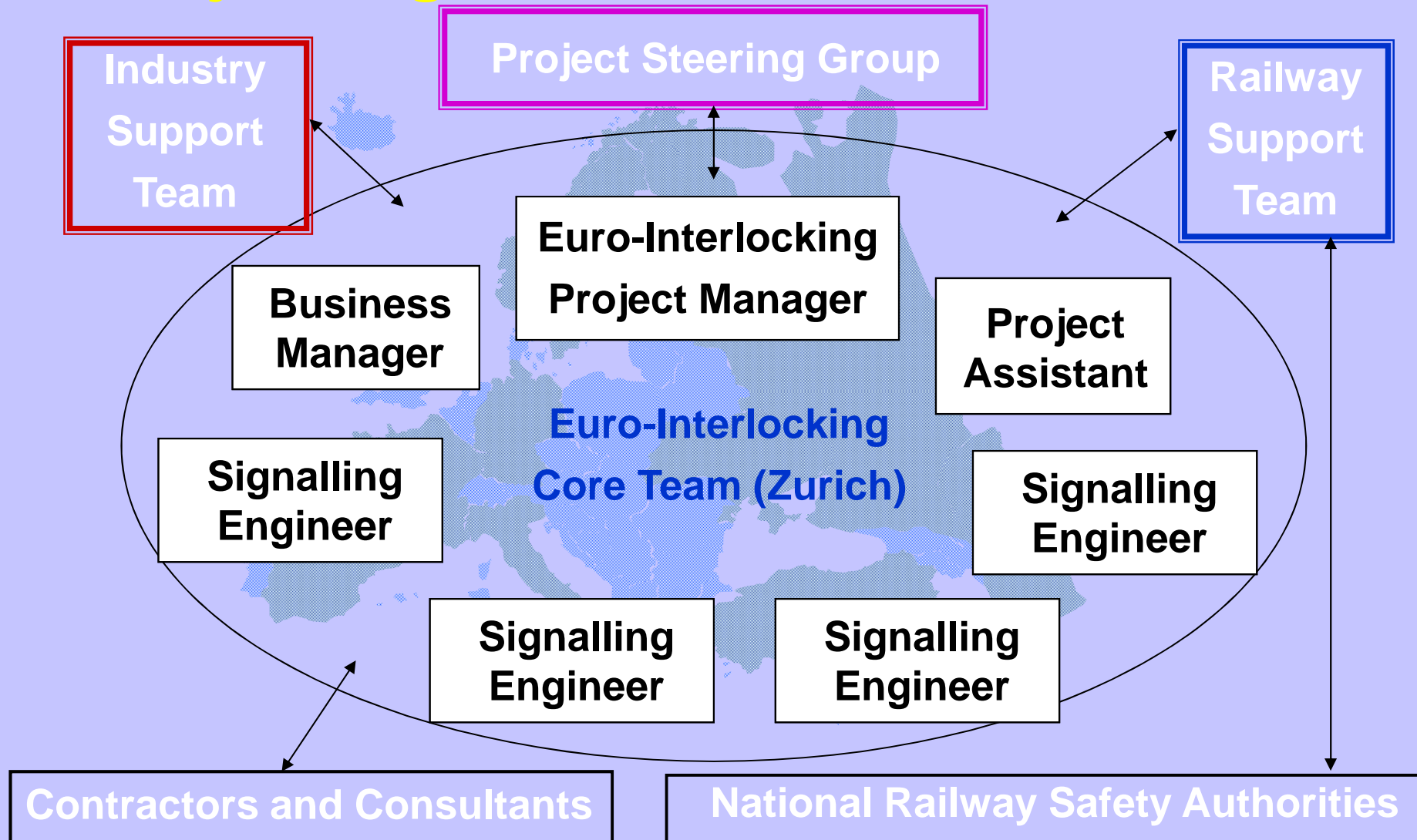
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# EUR-INTERLOCKING

## Project organisation



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# EUR<sup>U</sup>-INTERLOCKING

## Approved standards (1): Non-functional requirements

Participating railways and suppliers have approved the following standards for interlocking systems:

- **RAMS (reliability, availability, maintainability, safety)**
- **Related non-functional requirements for interlockings: design and architecture, documentation, physical construction, power supply, installation/test/commissioning, performance, modification, lifetime.**

# EUR-INTERLOCKING

## Approved standards (1): Non-functional requirements

Participating railways and suppliers have approved the following standards for interlocking systems:

- RAMS (**reliability**, availability, maintainability, safety)
- Related non-functional requirements for interlockings: design and architecture, documentation, physical construction, power supply, installation/test/commissioning, **performance**, modification, lifetime.

\* **Approval expected May 15, 2003**



# EUR<sup>U</sup>-INTERLOCKING

## Approved standards (2): Support, environment, cross-acceptance

### Requirements for:

- diagnostic system,
- juridical recorder (black box)
- environmental conditions
- electromagnetic compatibility (EMC)
- international cross-acceptance within Europe

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## Euro-Interlocking Formal Functional Requirements Approach (EIFFRA) (1)

- **Textual requirements**
  - in DOORS (a requirements management tool)
  - based on SELRED (**S**tructured **E**nglish **L**anguage for **RE**quirements **D**evelopment)
- **Formal modelling of requirements**
  - in UML (Unified Modelling Language) or
  - in Statemate based on state-event diagrams

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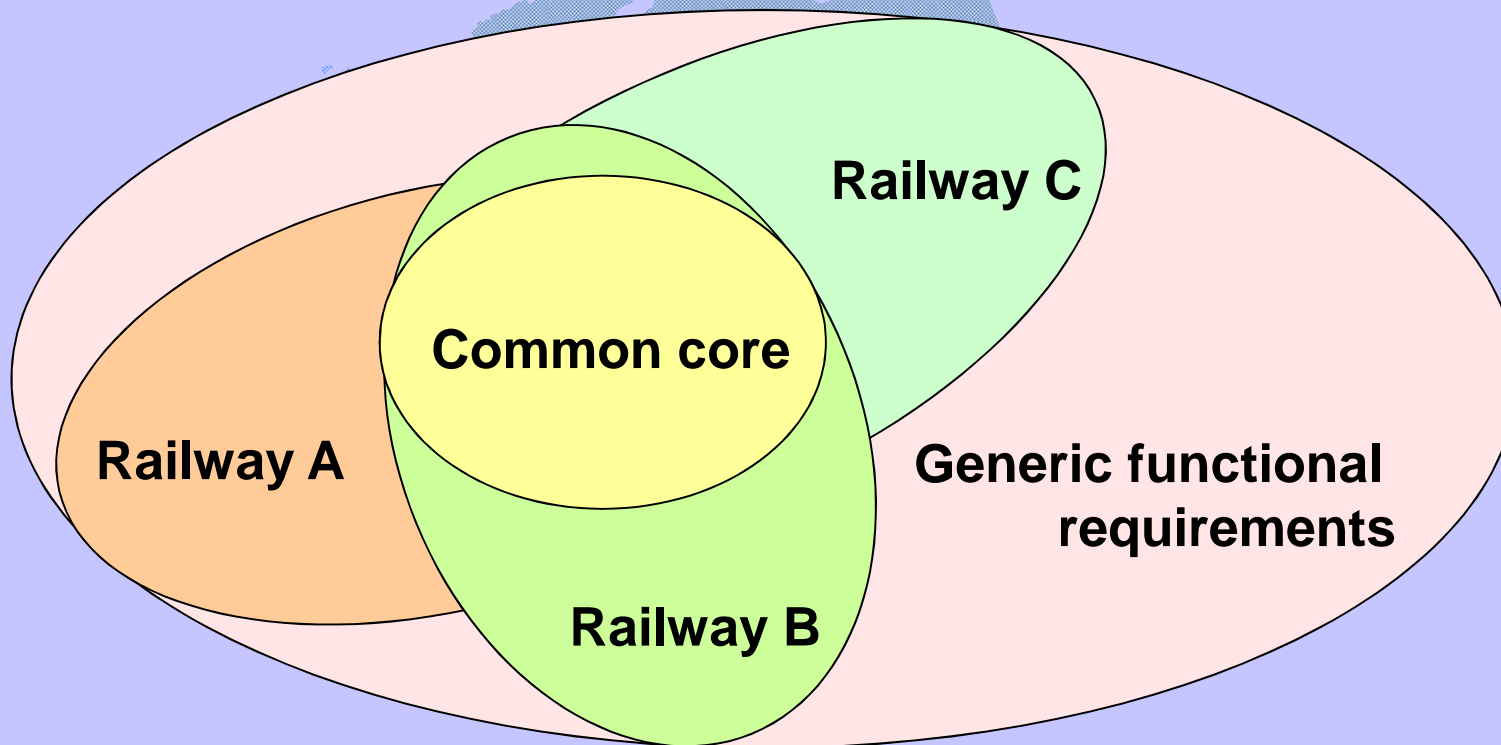
## Euro-Interlocking Formal Functional Requirements Approach (EIFFRA) (2)

- **Formal language for requirements description**
  - Primarily for safety requirements
  - UML's object constraint language (OCL)
- **Simulation of requirements**
- **Completed: Functional requirements of a “mini-interlocking” for two railways using the EIFFRA approach**

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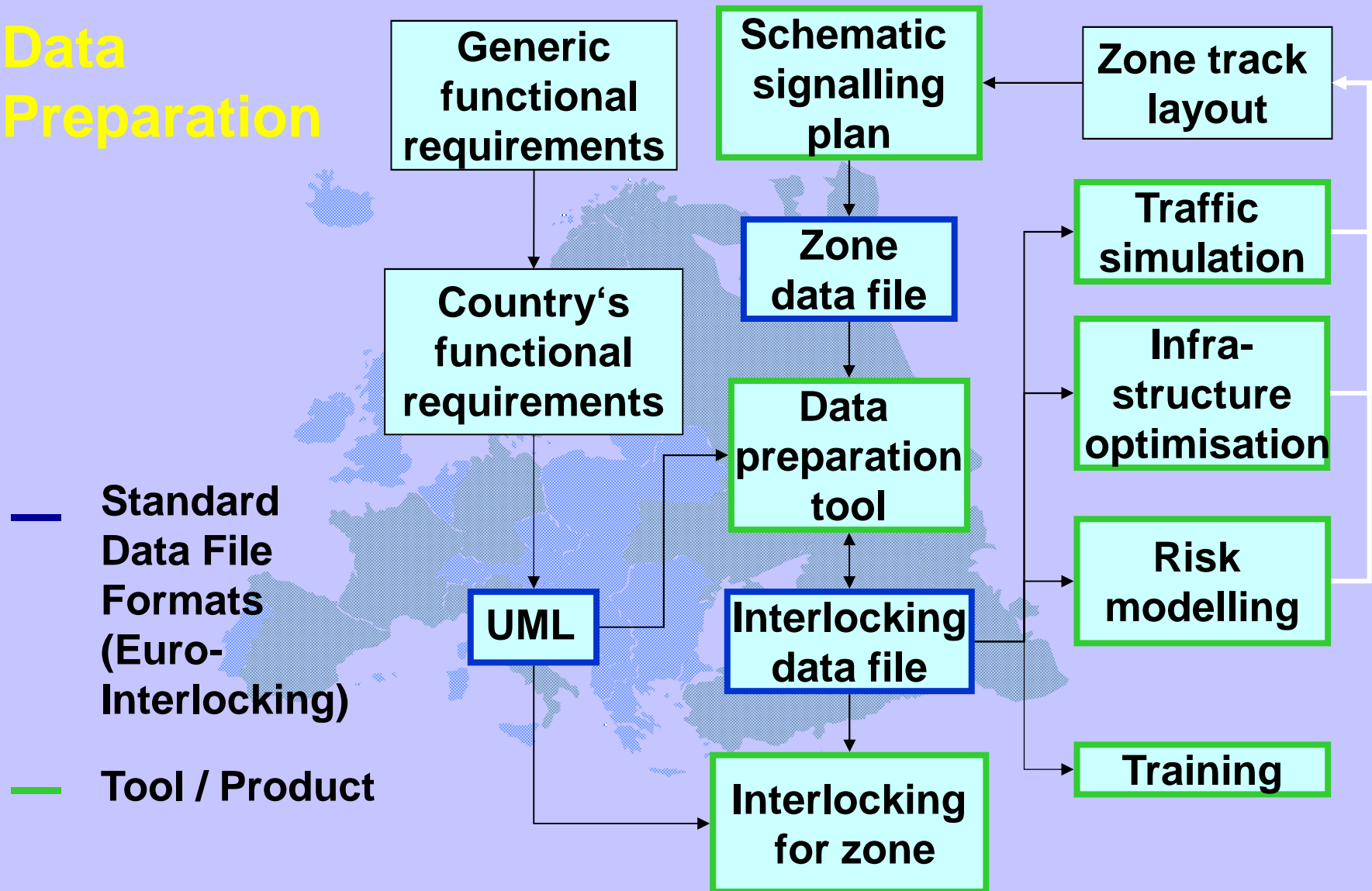
**Functional requirements:  
Main project task in 2003-04**

**Development of national functional requirements  
based on the EIFFRA approach**



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## Data Preparation



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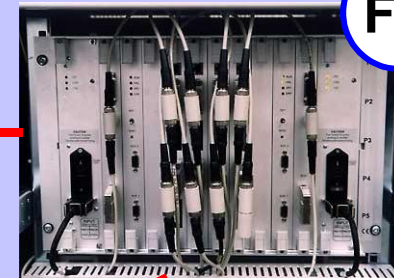
## Standardised interfaces for signalling

Traffic control system  
(human-machine interface,  
remote control)



FR

ETCS radio  
block centre



FR

FIS

FIS

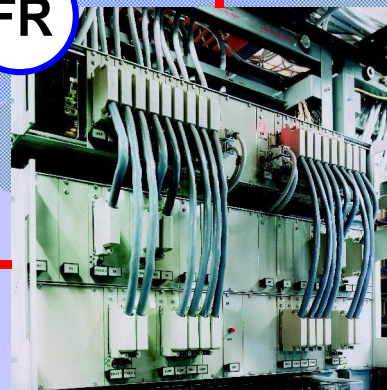
FIS

FR



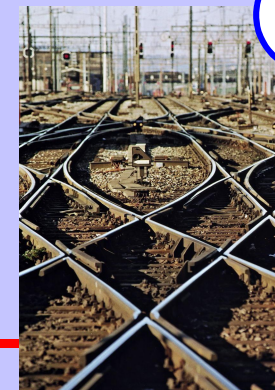
FIS

FR



FIS

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Track elements (e.g.  
signals, turnouts,  
track circuits)

Adjacent interlocking

Interlocking system



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## Interfaces: completed and current work

- **Several suppliers' interface specifications available to the project**
- **Business case for signalling interface standardisation**
- **FIS for interface between traffic control system (TCS) and interlocking, draft version**
- **Survey of existing functionality among interlockings, ETCS radio block centres, and TCSs**
- **Non-functional interface requirements (data transport layers) for signalling interfaces**

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## Interface standards development

**Non-functional** interface standard (data transport layers)

- Requirements by Euro-Interlocking (approval expected 15 May)
- Specification by Unisig (ERTMS/ETCS supplier consortium) in 2003

**Functional** interface specifications (FIS) for the given signalling interfaces (2003-2004)

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## Standardisation in European signalling interfaces: the benefits (1)

### Project benefits for **railways**:

- Procure and combine signalling system products from various suppliers
- Implement an optimal combination of supplier products
- Combine different generations of products
- Implement new signalling systems for specific zones faster

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## Standardisation in European signalling interfaces: the benefits (2)

Benefits for **railways**, **suppliers** and **European Union**:

- Use of standardised, possibly off-the-shelf products
- Less work on safety cases, product testing and product acceptance
- Shorter time to market for interlocking system products
- Significant reduction of project risks and delays caused by “hand-knitted” interfaces
- International cross-acceptance of products
- Simpler migration to ERTMS/ETCS systems

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## Standardisation in European signalling interfaces: the benefits (3)

### Achievement of the primary objectives of Euro-Interlocking:

- Significant reduction of life-cycle costs
- Improved reliability and availability
- Comply fully with the European standards EN 50126 to 50129
- Higher traffic density and more efficient traffic management in connection with ERTMS/ETCS (CBTC on Europe's mainline railways)

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## Applications of the standards

Euro-Interlocking is not just creating standards, but also promoting their implementation:

- **Non-functional requirements standards** are major bases for procurement in Denmark, France, Finland, the Netherlands and Switzerland.
- **Data preparation standards** (data exchange file format): basis for procurement in Switzerland and Finland.
- **Definition and structuring of functional requirements** based on EIFFRA in Denmark, France, Finland and the Netherlands.

# EUR-INTERLOCKING

**For more information**

**Read our accompanying paper,  
“Standards for functions and interfaces  
as a basis for CBTC in Europe”**

**See our web site at:  
[www.euro-interlocking.org](http://www.euro-interlocking.org)**



# EUR<sup>U</sup>-INTERLOCKING

A question for you

What are the opportunities for **transatlantic** and **worldwide** synergy in the area of interface standards for the migration to CBTC systems?

Thanks for your attention