ITEA 2

INFORMATION TECHNOLOGY FOR EUROPEAN ADVANCEMENT

openETCS

openETCS: Modelling and Formalisation for Safety and Interoperability

supported by:

Federal Ministry of Education and Research

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INVESTISSEMENTS D'AVENIR

Région de Bruxelles-Capitale

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN

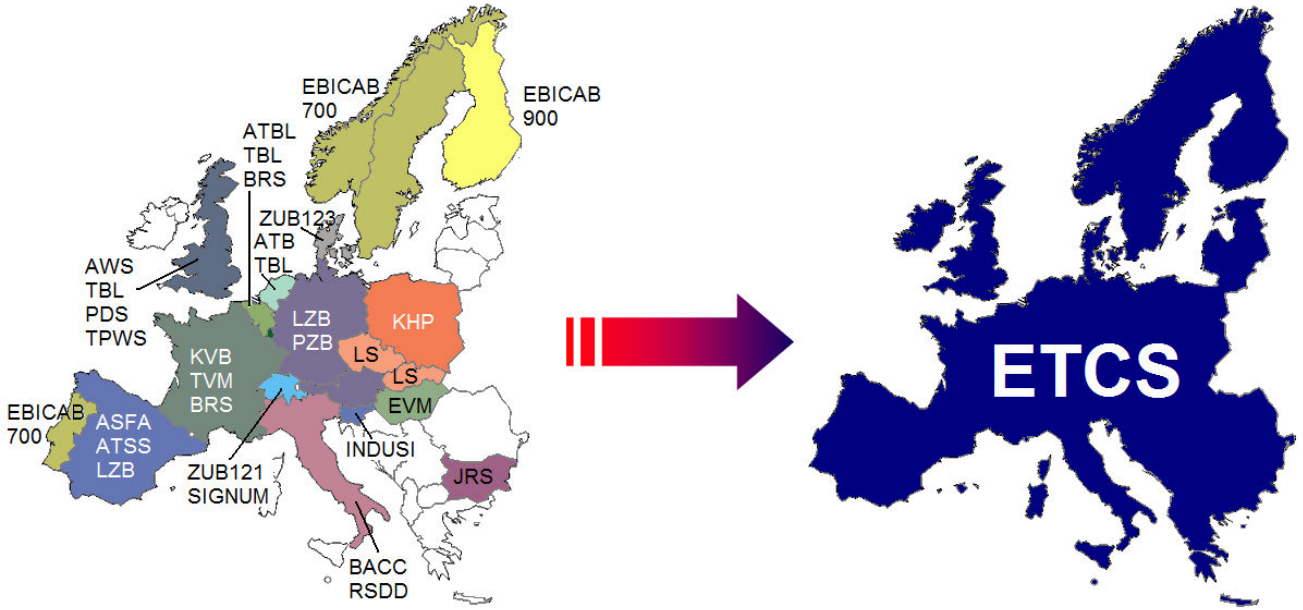
openETCS@ITEA2 Project

Dr. Stefan Rieger

Berlin, 24/09/2014

The Vision

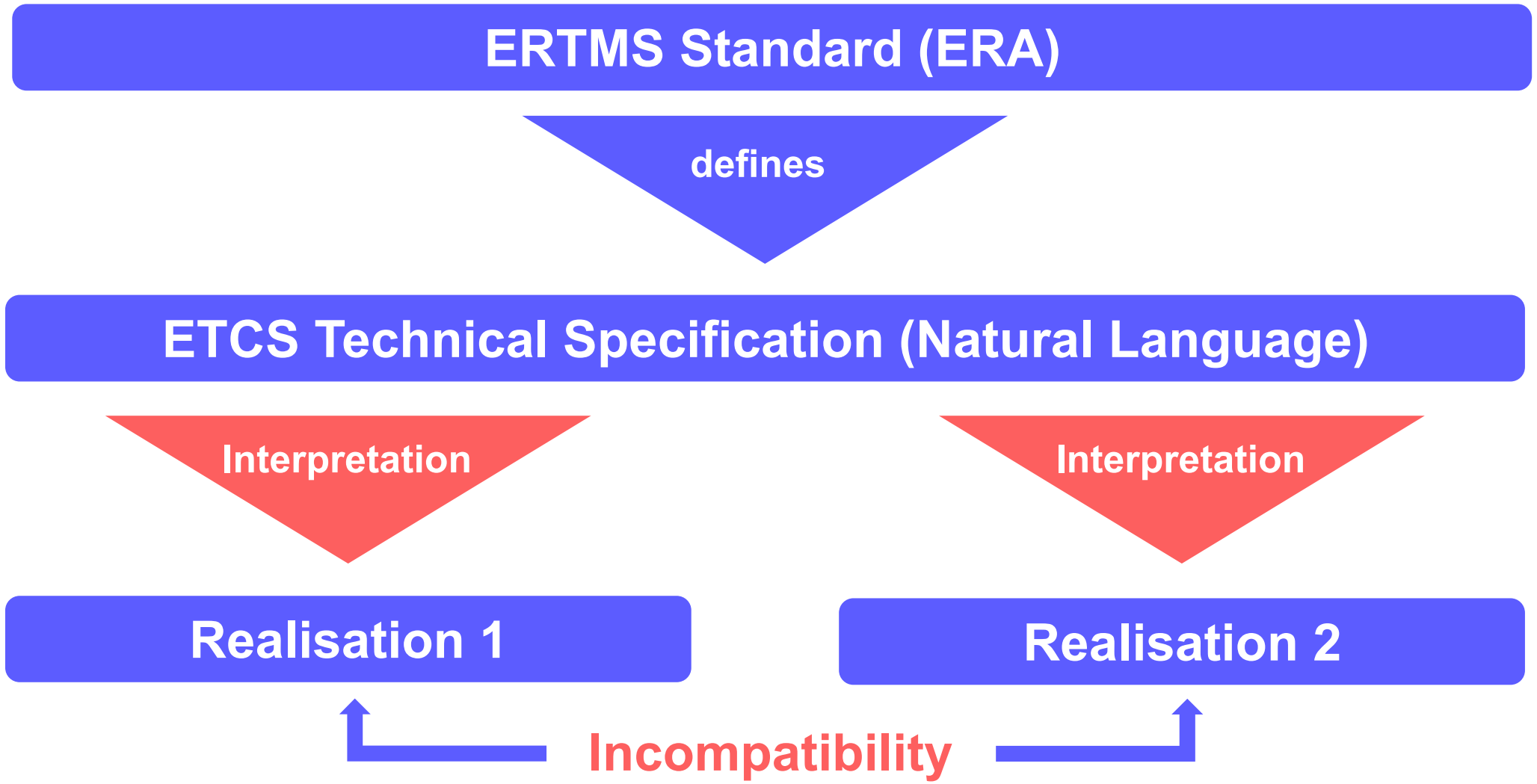
Goal of ETCS: Interoperability



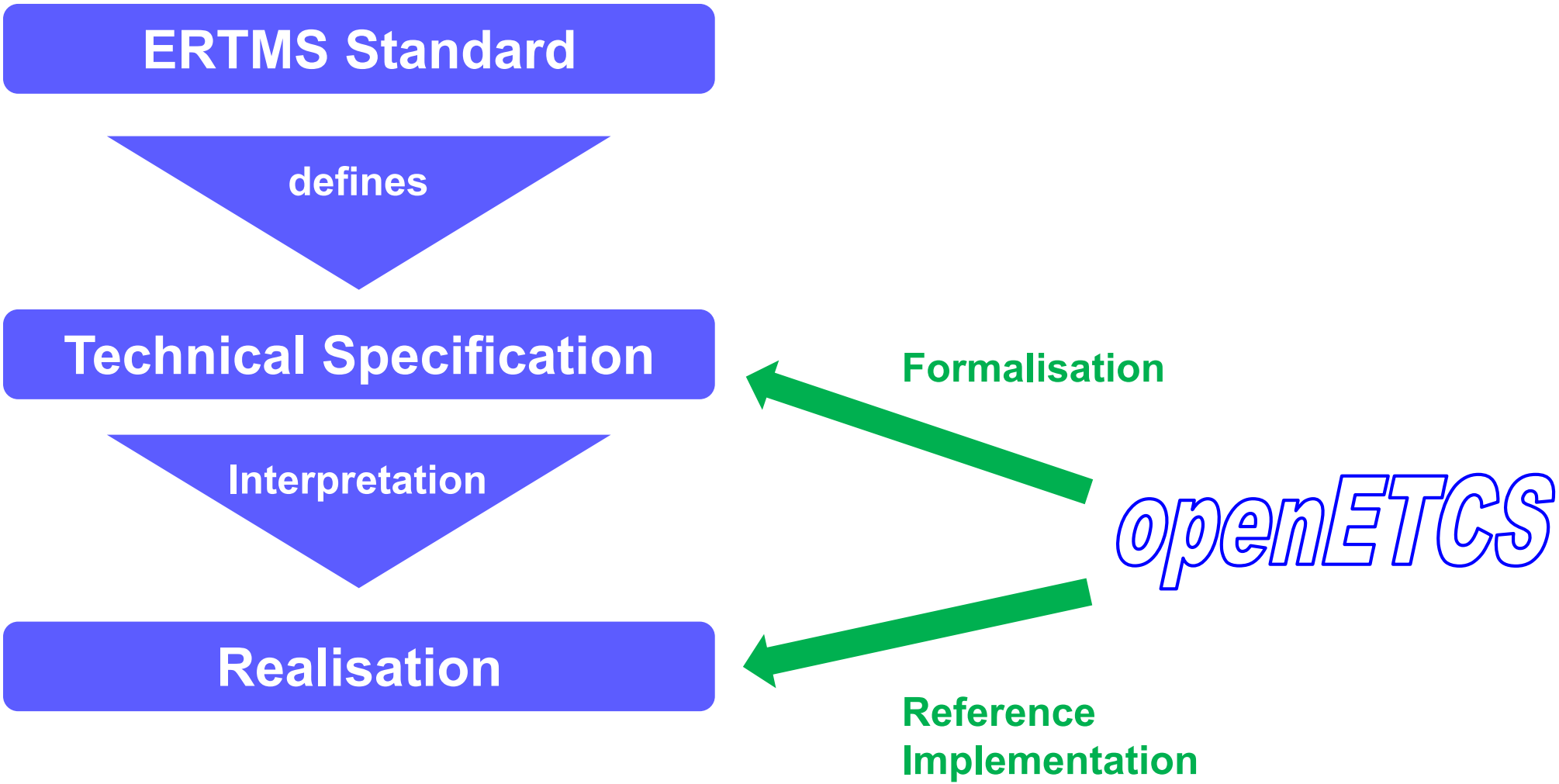
Vision of ETCS:

- Unification of the European rail network
- Vehicles equipped with ETCS can operate throughout Europe

The Reality


ERTMS Standard (ERA)
defines
ETCS Technical Specification (Natural Language)
Interpretation
Interpretation
Realisation 1
Realisation 2
Incompatibility

How do we achieve real interoperability?



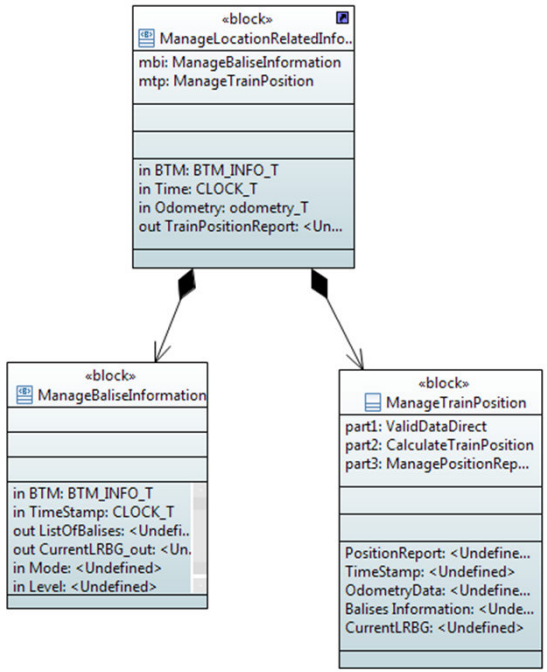
The openETCS Approach

ETCS Specification (natural language)

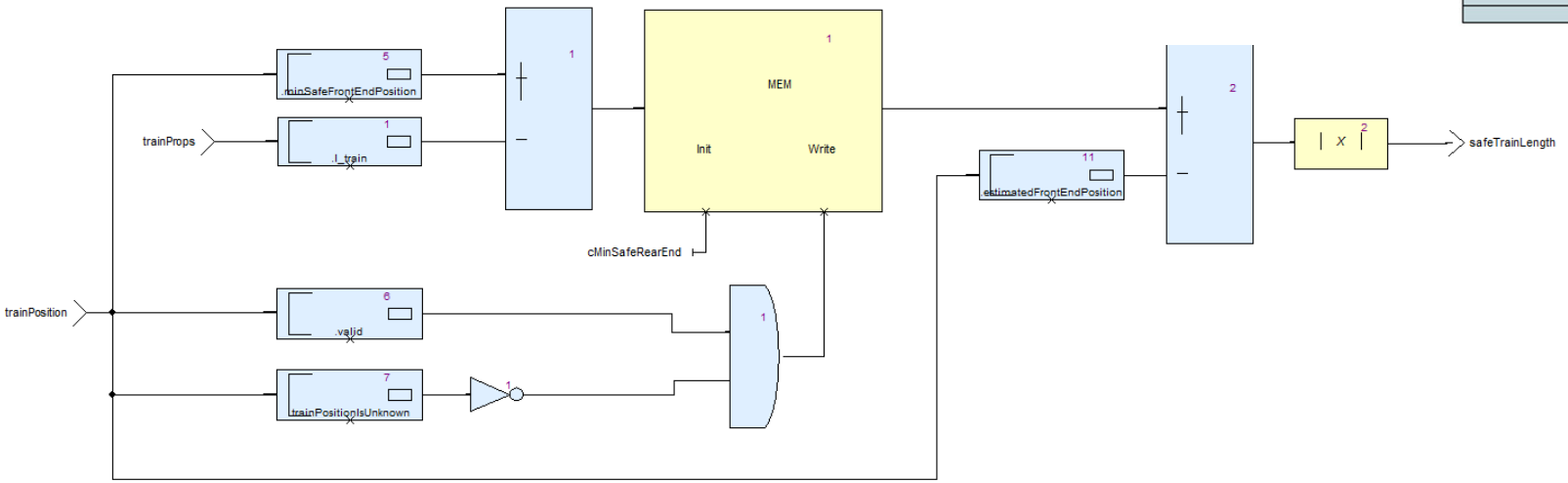
Formalisation

(Semi-)Formal Model

Architecture (SysML)



Behaviour (Scade)

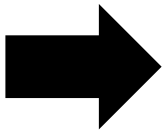


From Model to Code

(Semi-)formal Model

Architectural Model

Behavioural Model



Code Generation

Reference Unit

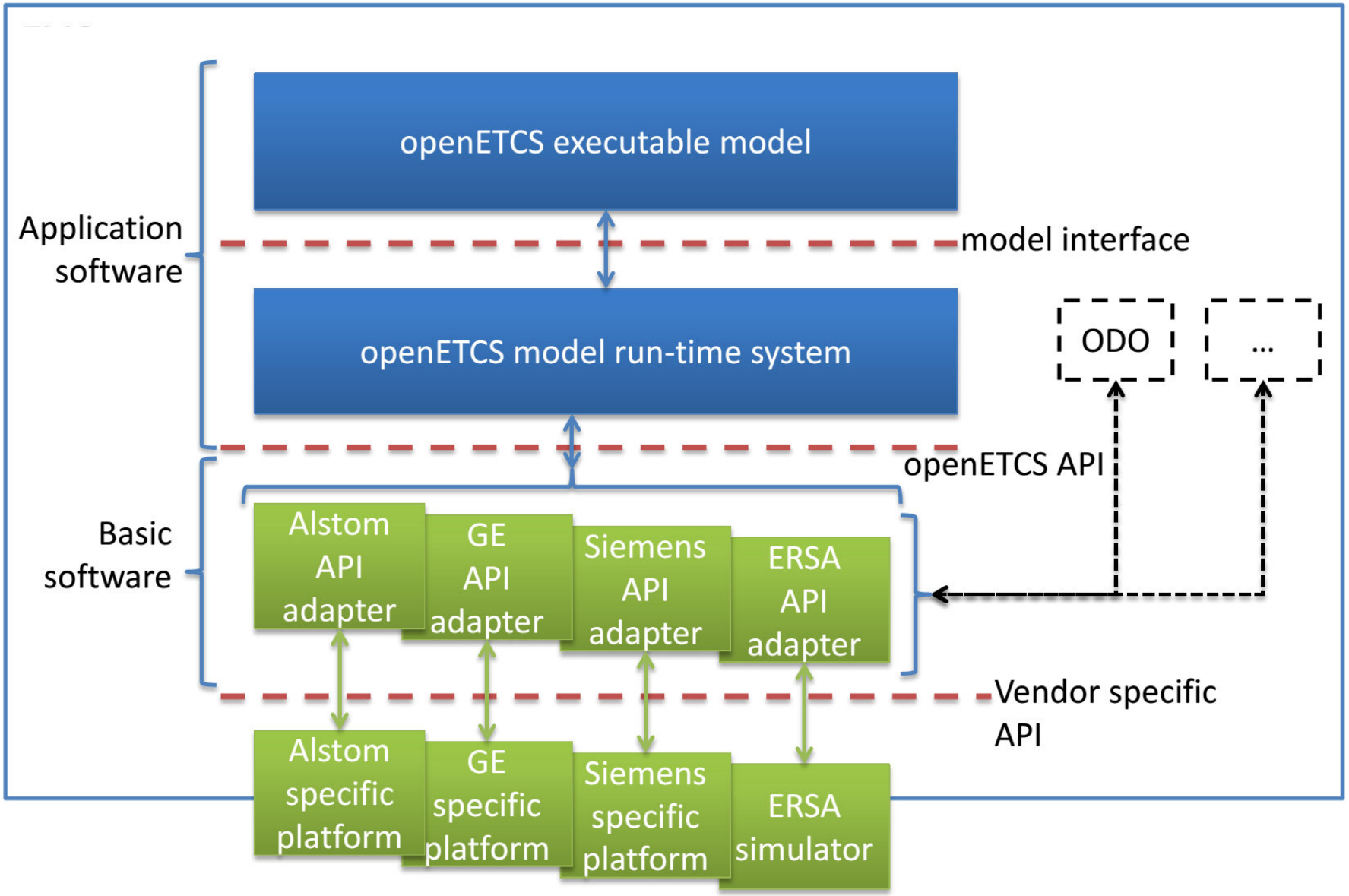
openETCS Software

openETCS API
(provided by Alstom)

Hardware

Verification & Validation

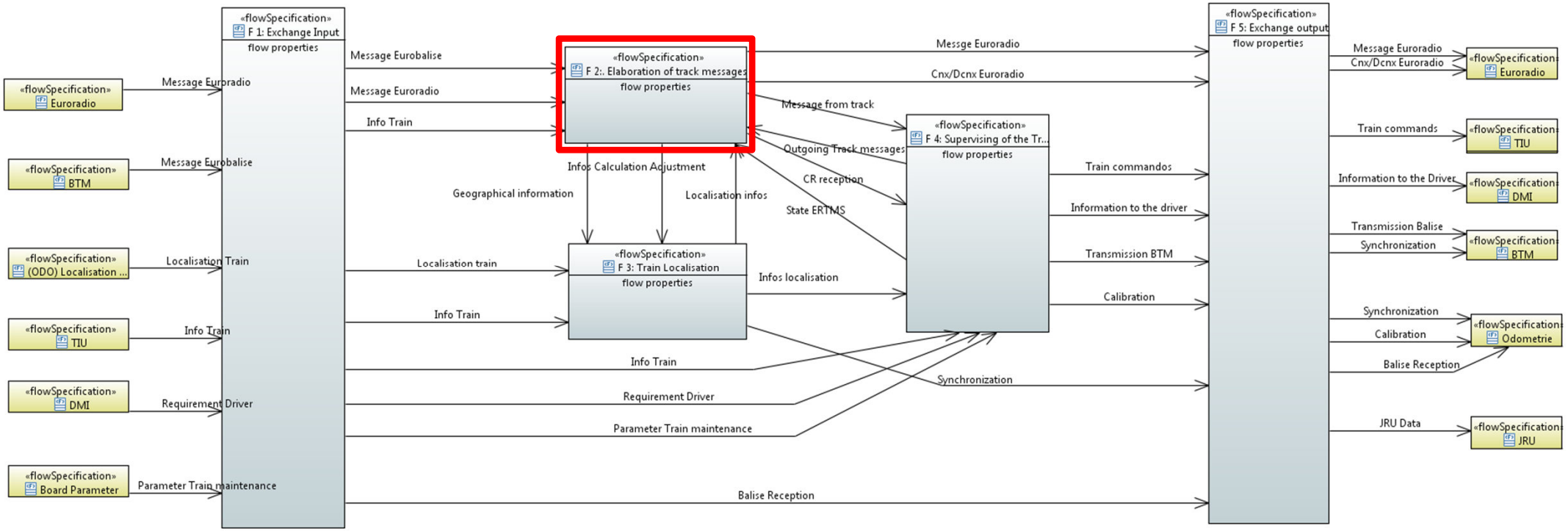
EVC


openETCS executable model
Application software
model interface
openETCS model run-time system
ODO
...
openETCS API
Basic software
Alstom API adapter
GE API adapter
Siemens API adapter
ERSA API adapter
Vendor specific API
Alstom specific platform
GE specific platform
Siemens specific platform
ERSA simulator

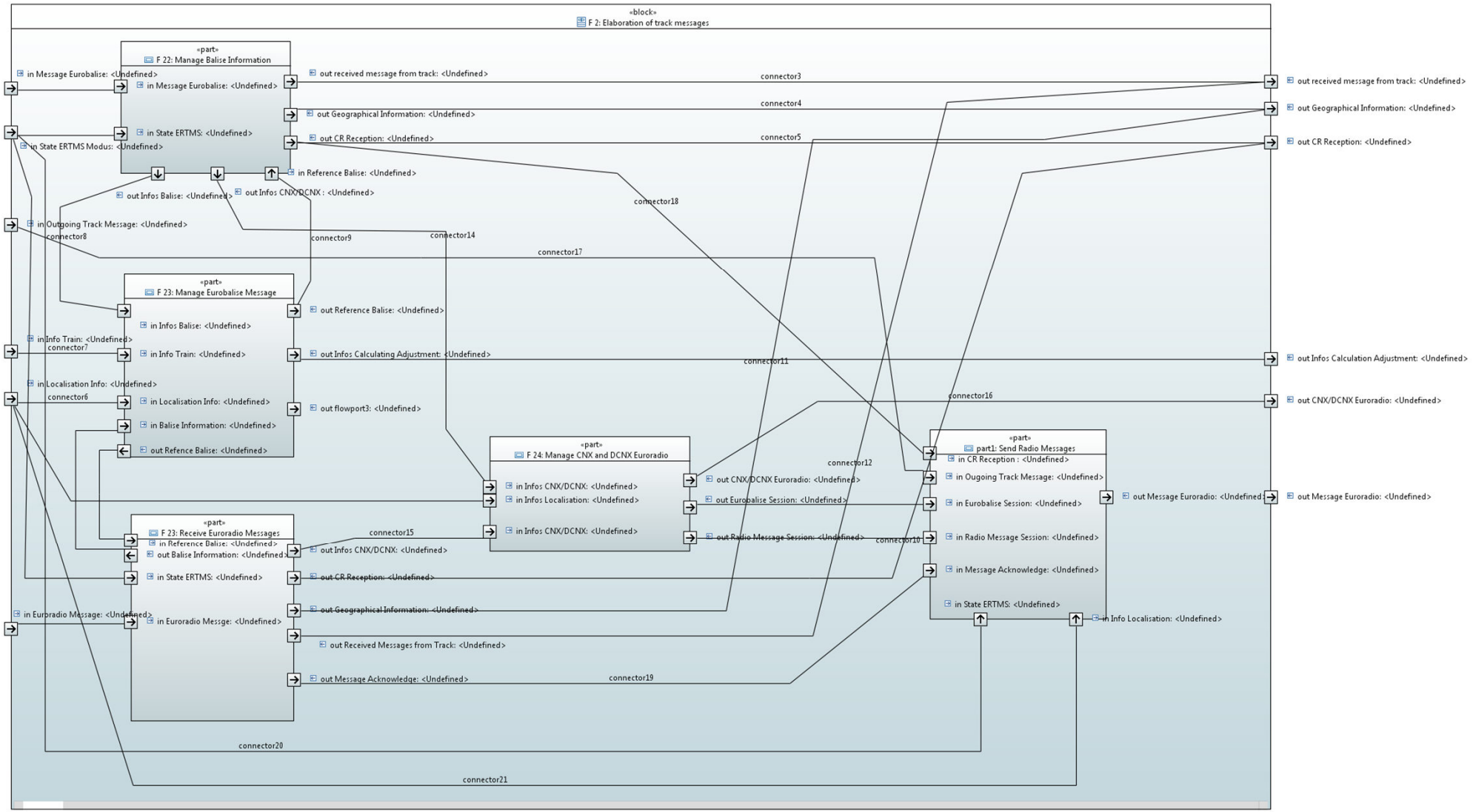
Architectural Model

Facts

- SysML (using open source tool Papyrus)
- Functional architecture, no behaviour
- Import into SCADE



Architectural Model – Hierarchical Structure

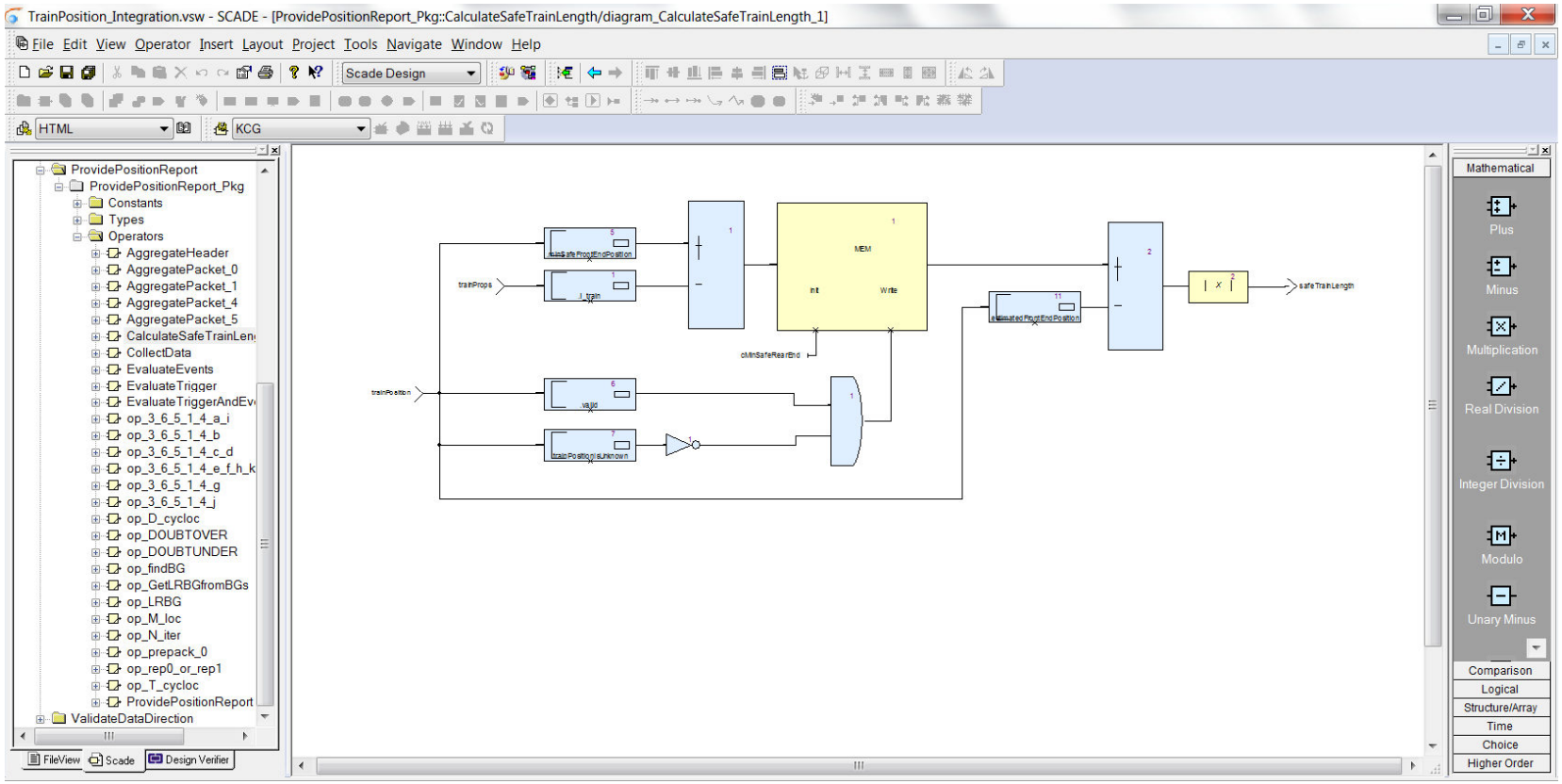


Behavioural Model

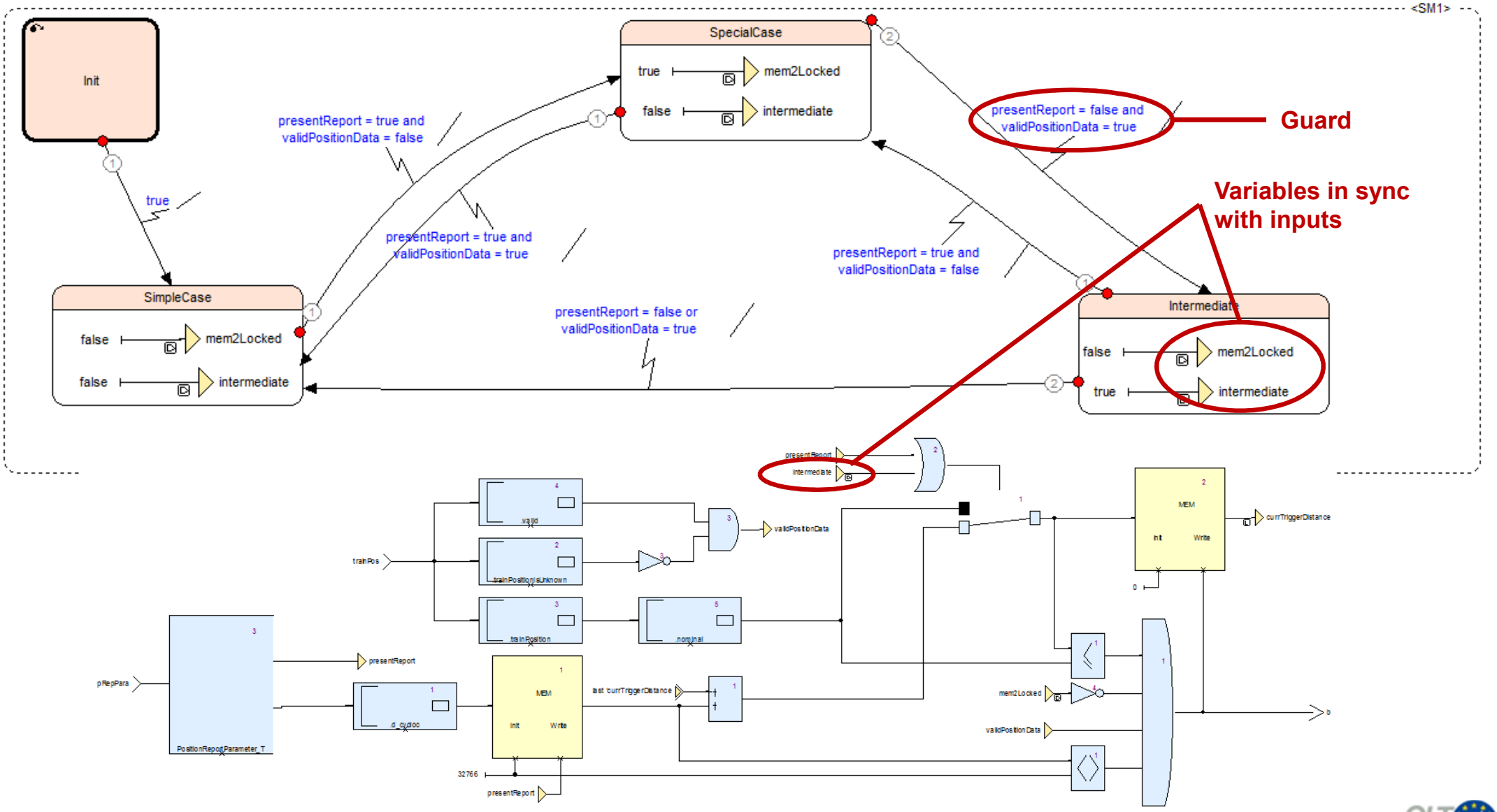
Facts

- **SCADE (state-of-the-art commercial tool, closed source)**
- **Powerful code generator (SIL4 certified)**
- **Hierarchical structure**

migration strategy in development



Data-Flow & State Machines in SCADE



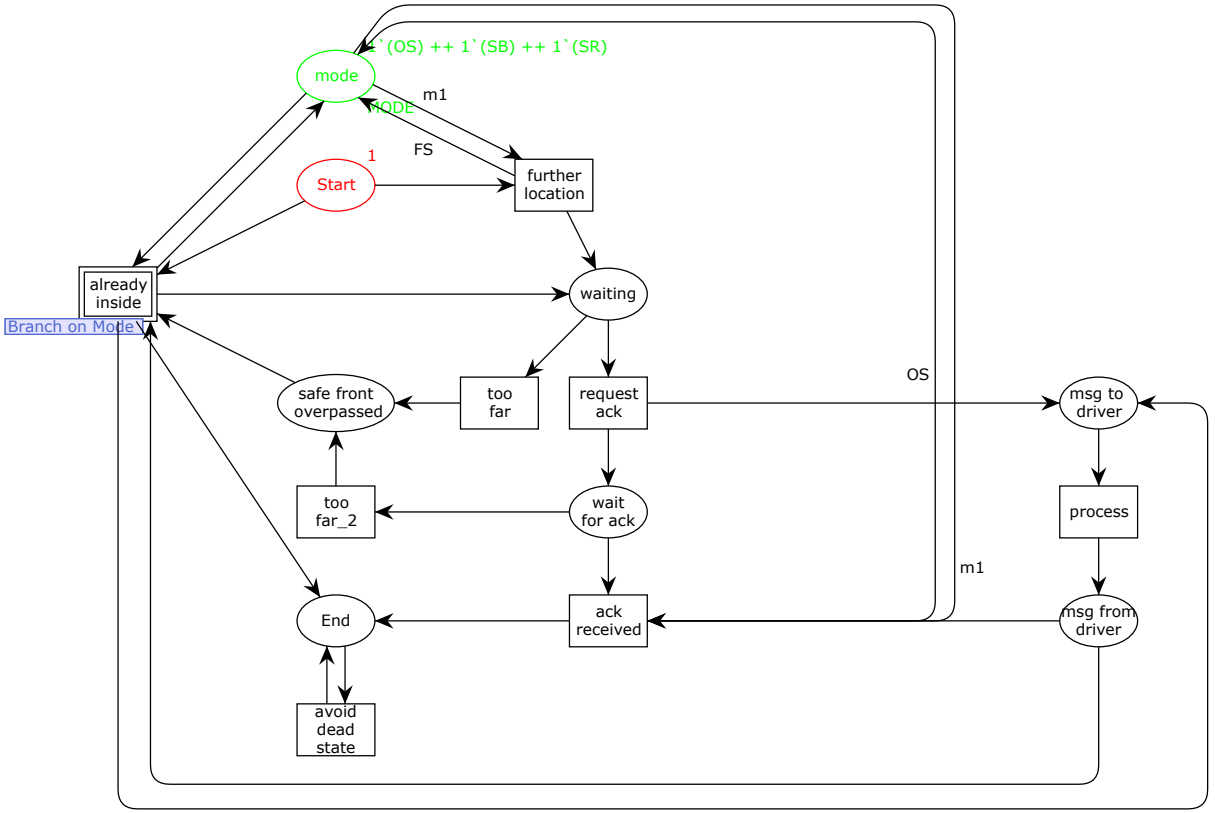
Verification and Validation

Prime concern safety

- CENELEC EN 50128
- Qualification aspects

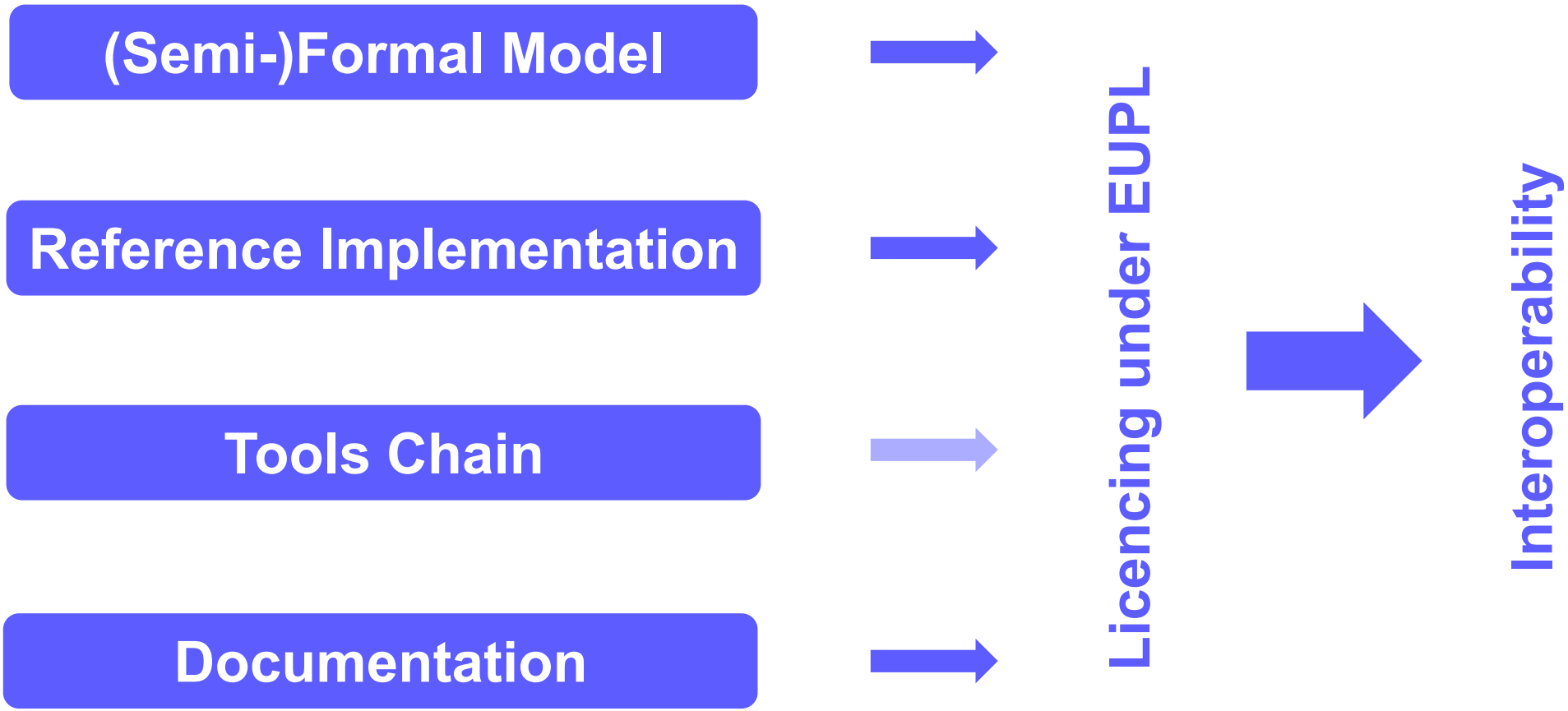
V&V

- Model-based testing
- Demonstrator
- Formal methods
- Validation of specification
- Model-based safety analysis
- … (and more)



Example: Part of the test model to validate the ETCS specification developed by TWT

„Open Proof“


(Semi-)Formal Model
Reference Implementation
Tools Chain
Documentation
Licencing under EUPL
Interoperability

openETCS @ INNOTRANS

Booths of partners:

ERSA	Hall 11.2, Booth 110
Fraunhofer FOKUS	Hall 23B, Booth 206
Systerel	Hall 11.2, Booth 110