

Flagship Project 1:

Mobility Management in a multimodal environment & digital enablers

# Digital Twin Overview

## Modularized Digital Twins for Rail



WP 28 & 29: 2022-2026: A. Heckmann<sup>1</sup> et al.

<sup>1</sup>German Aerospace Center (DLR), Institute of Vehicle Concepts



# Modularized Digital Twins for Rail

## The Project Background

- [Europe's Rail](#) is a joint undertaking, i.e. a public-private partnership for rail research & innovation
  - Established in 2021 under Horizon Europe, 8 Flagship Projects ≈ 600 Mio€ total budget

### Founding Members



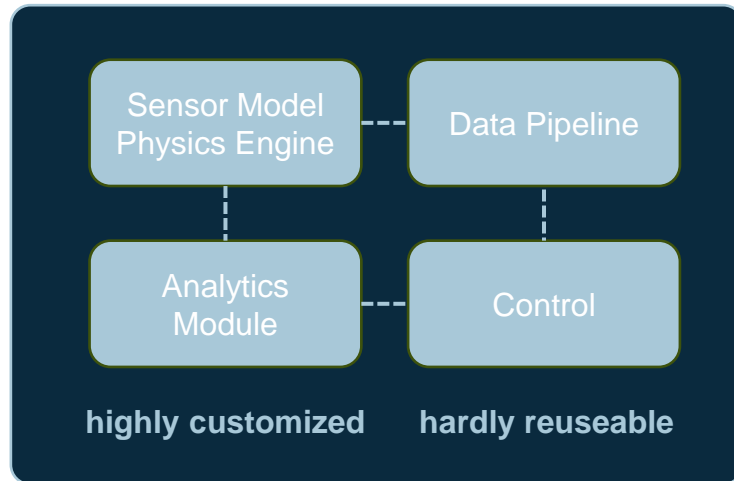
Co-funded by  
the European Union

Funded by the European Union. Views and opinion expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the Europe's Rail Joint Undertaking. Neither the European Union nor the granting authority can be held responsible for them. The project 'FP1-MOTIONAL' is supported by the Europe's Rail Joint Undertaking and its members.

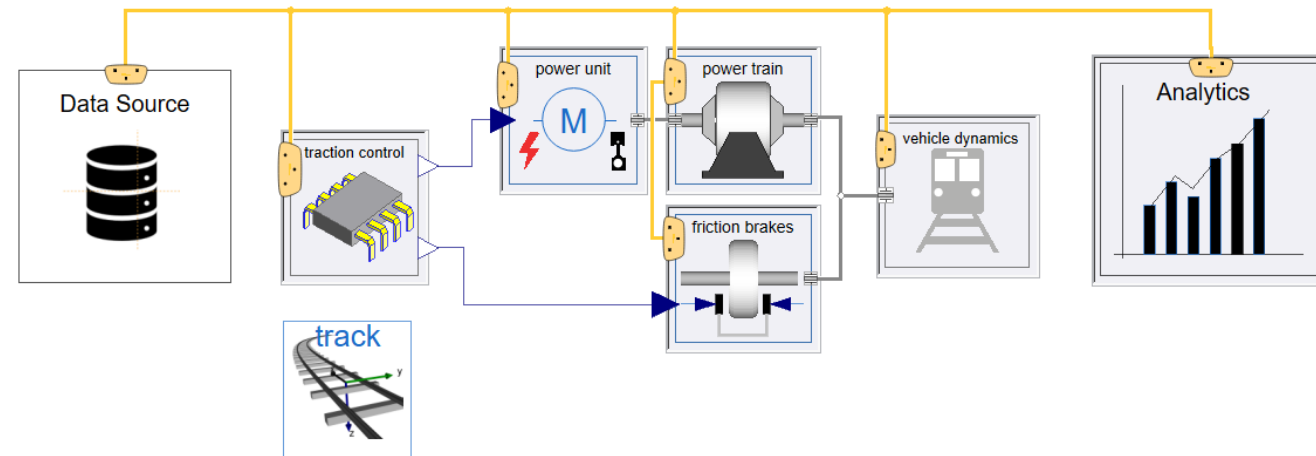
# Modularized Digital Twins for Rail

## Digital Twin Components as Tradeable Assets

### Monolithic



### Modular



interoperable exchangeable

DT components are **modular, interoperable IP assets** — securely exchangeable via Federated Dataspace to protect IP, generate revenue, and unlock ecosystem-wide benefits.



Unlock Efficiencies



Reduce Duplication



Accelerate Innovation



Support Scalability

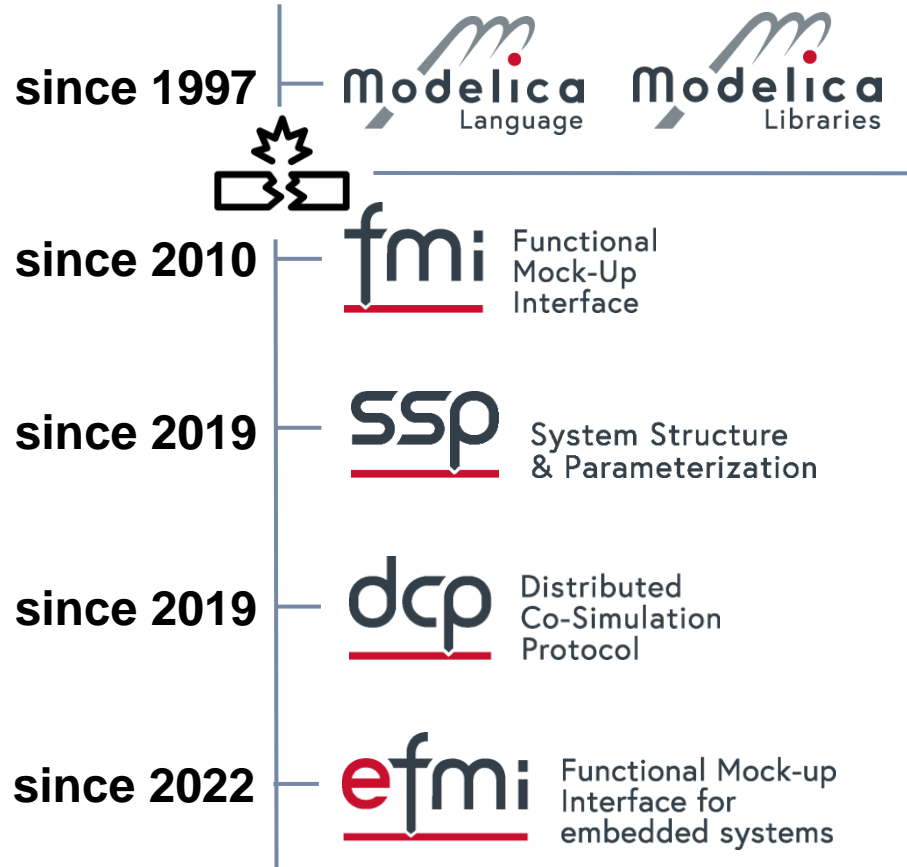


Cross-Domain Collaboration



Protect IP & Revenue

# Modularized Digital Twins for Rail Technologies



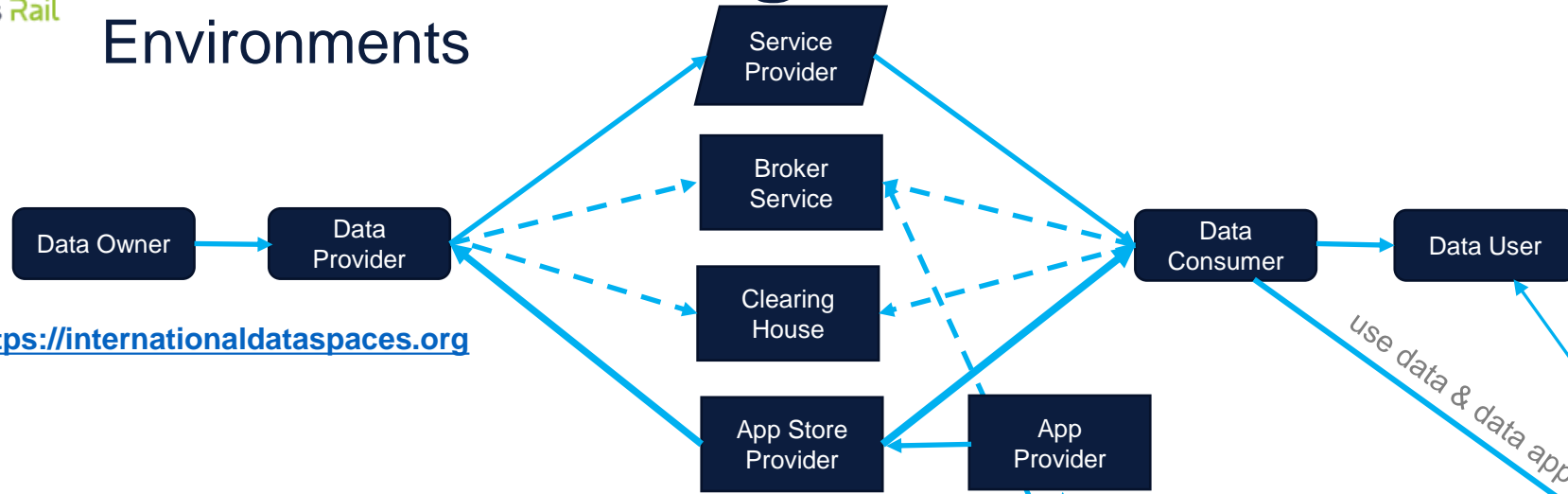
High level standard und libraries for multi-domain models described by differential, algebraic, discrete equataions (> 10 tools)

Low level standard for exchange of dynamic models (> ^200 Tools) DLL / C-call interface, packed with resources in zip-file: IP-Protection

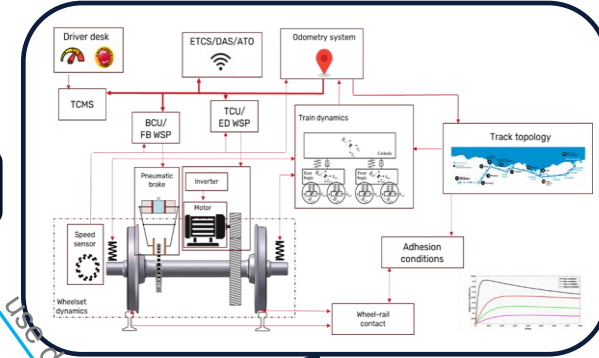
## Advantages

- **Mature Technology**
- **No vendor lock-in**
- **Free choice of runtime environment**
- **Resuage of existing models**
- **Support of IP Protection**

## Environments

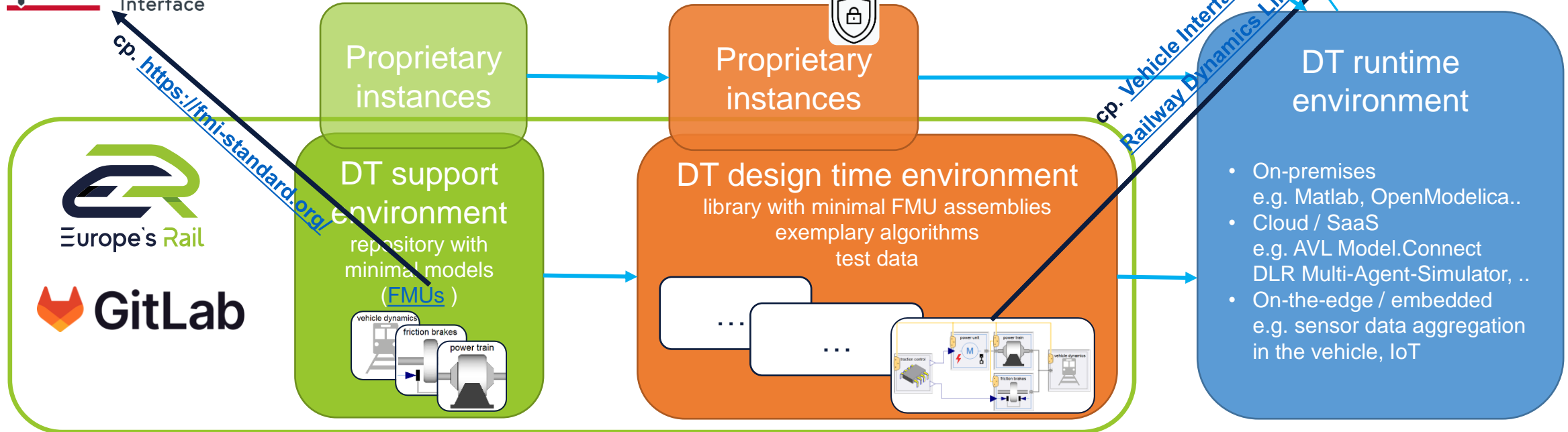


cp. <https://internationaldataspaces.org>



fmi Functional Mock-Up Interface

cp. <https://fmi-standard.org/>



cp. Vehicle Interface Library 2006  
Railway Dynamics Library 2019

- On-premises e.g. Matlab, OpenModelica..
- Cloud / SaaS e.g. AVL Model.Connect DLR Multi-Agent-Simulator, ..
- On-the-edge / embedded e.g. sensor data aggregation in the vehicle, IoT

# Modularized Digital Twins for Rail

## Example: Eurobalise Error Check

