



# **TrainSim: A Digital-Twin Eco System for the Development and Test of Railway Vehicles**

NI Connect Austin 2024

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# Siemens Mobility

We offer **Rolling Stock**:

from Urban to Interurban

from Light Rail to Highspeed

from Locomotive to Train

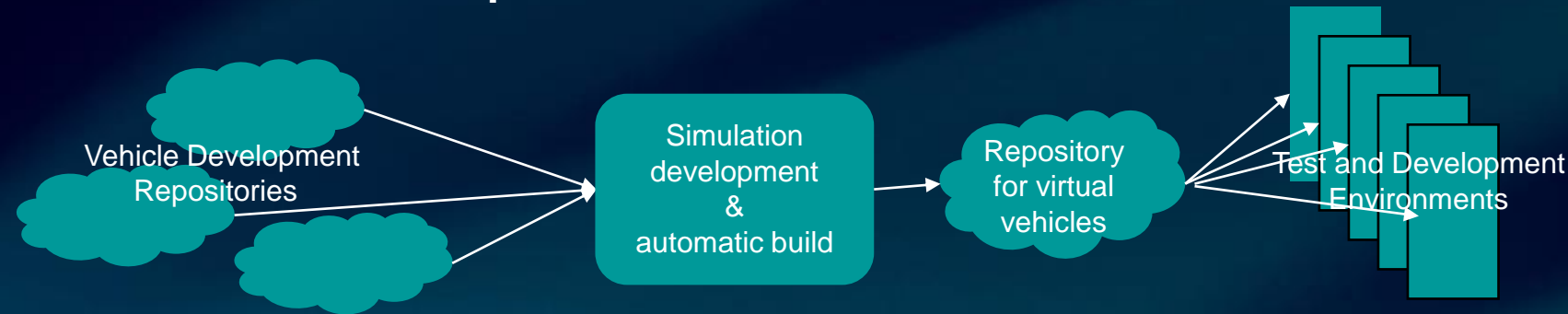


# TrainSim: Virtual Vehicle Twin

**We supply digital twins of our vehicles  
for our whole company,  
for our suppliers and  
for our customers;  
from the first ideas, up until  
the decommissioning of the vehicles.**

# TrainSim Concept

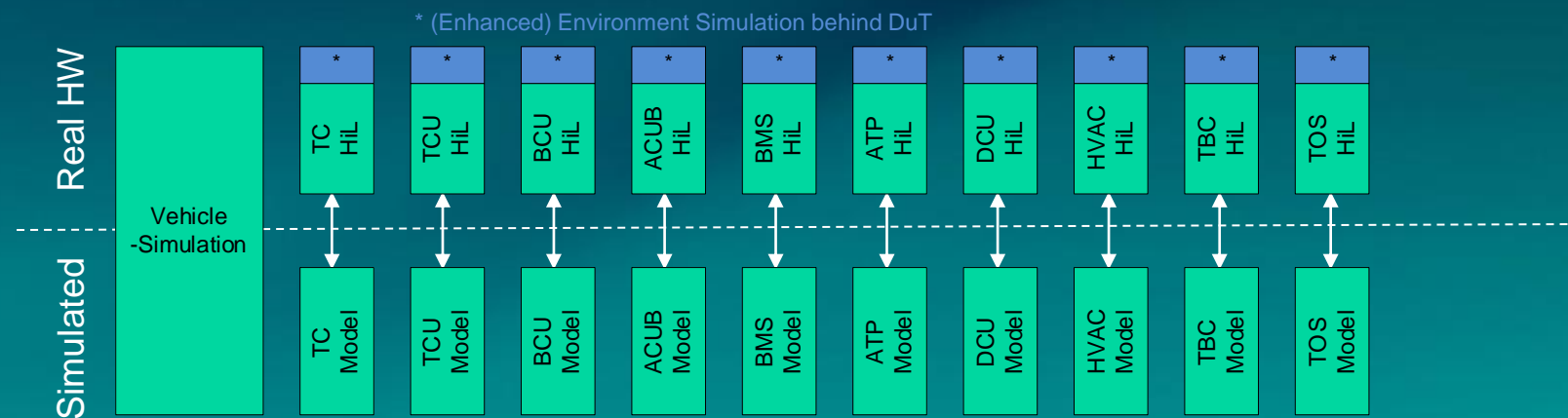
## Vehicle Simulation Concept



We build virtual vehicles from the current state of vehicle development using their development repositories.

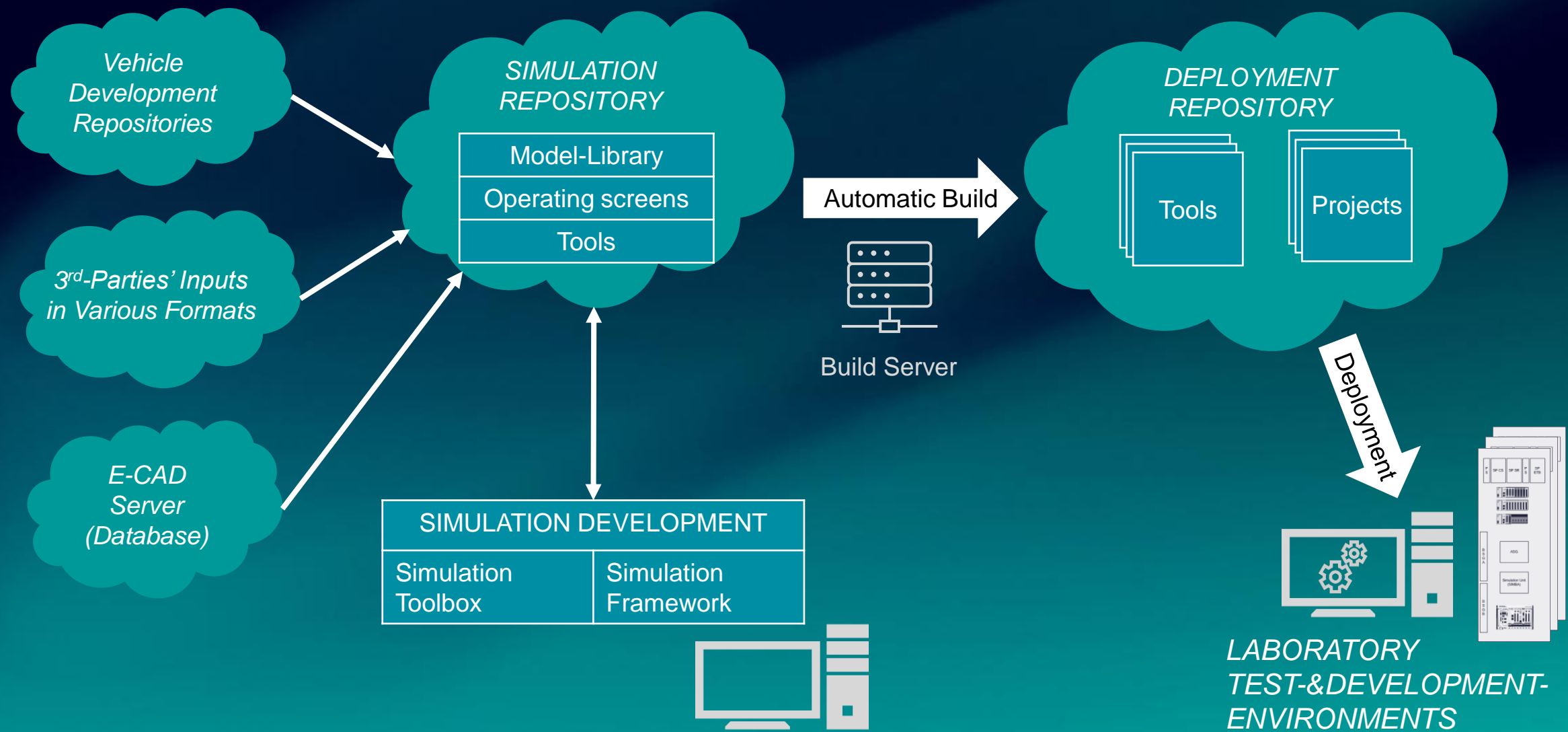
This allows the developers to develop into the current state and testers to test the current state.

## TrainSim Concept




Any subcomponent of the vehicle can be interchanged between the device in hardware (HiL) or as a Model. This can be done for every instance. Mixed setups are possible.

# TrainSim Simulation Workflow



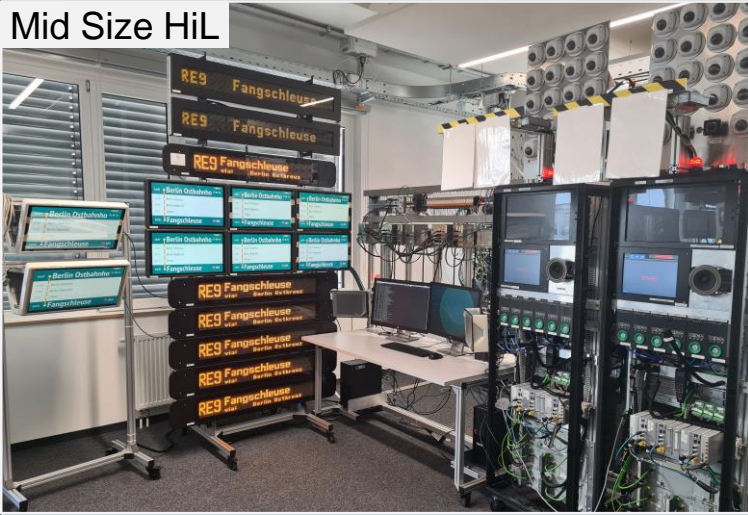
# TrainSim is a scalable simulation environment

Small HiL




Vehicle -Simulation	TC HiL	TCU HiL	BCU HiL	ACUB HiL	BMS HiL	ATP HiL	DCU HiL	HVAC HiL	TBC HiL	TOS HiL
	TC Model	TCU Model	BCU Model	ACUB Model	BMS Model	ATP Model	DCU Model	HVAC Model	TBC Model	TOS Model

Mid Size HiL



Vehicle -Simulation	TC HiL	TCU HiL	BCU HiL	ACUB HiL	BMS HiL	ATP HiL	DCU HiL	HVAC HiL	TBC HiL	TOS HiL
	TC Model	TCU Model	BCU Model	ACUB Model	BMS Model	ATP Model	DCU Model	HVAC Model	TBC Model	TOS Model

Large Size HiL

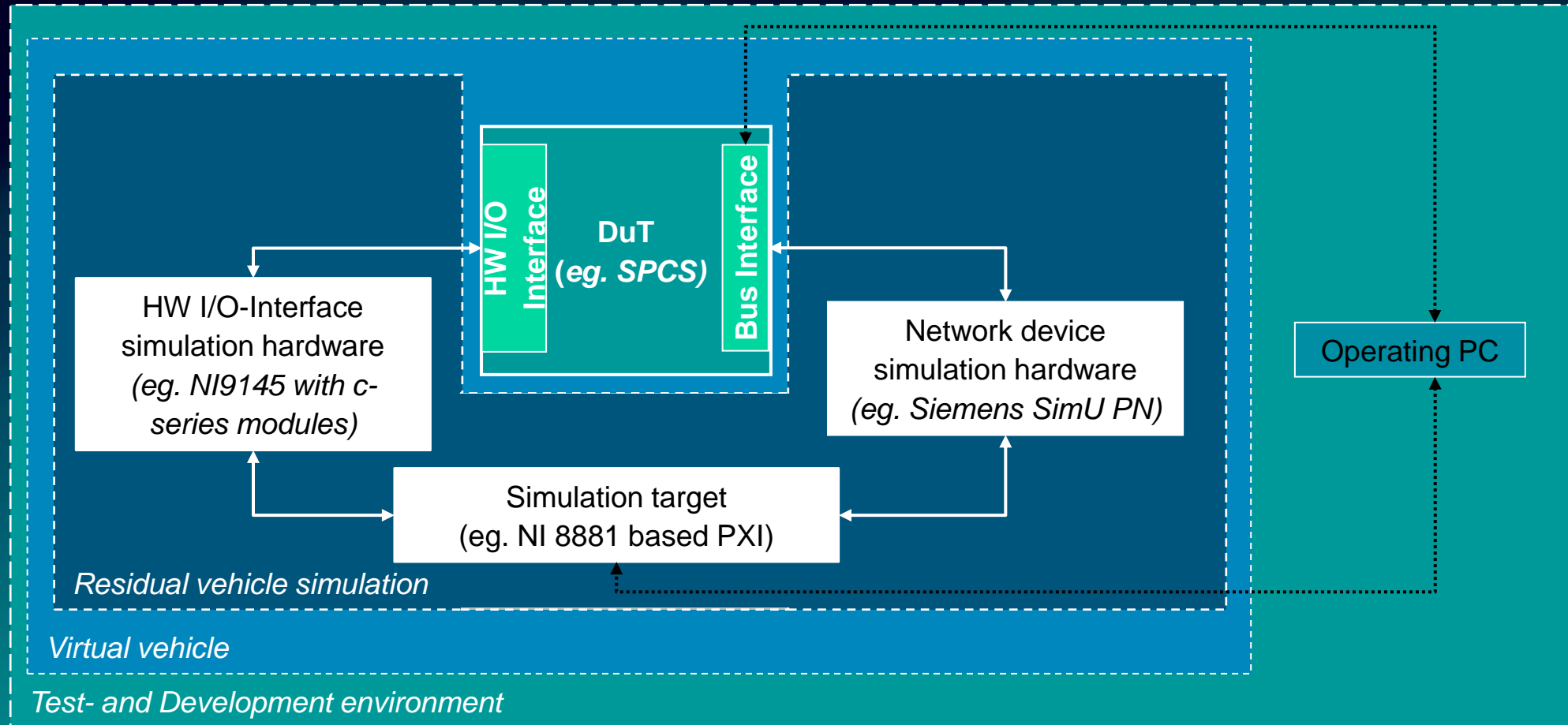


Vehicle -Simulation	TC HiL	TCU HiL	BCU HiL	ACUB HiL	BMS HiL	ATP HiL	DCU HiL	HVAC HiL	TBC HiL	TOS HiL
	TC Model	TCU Model	BCU Model	ACUB Model	BMS Model	ATP Model	DCU Model	HVAC Model	TBC Model	TOS Model



# TrainSim

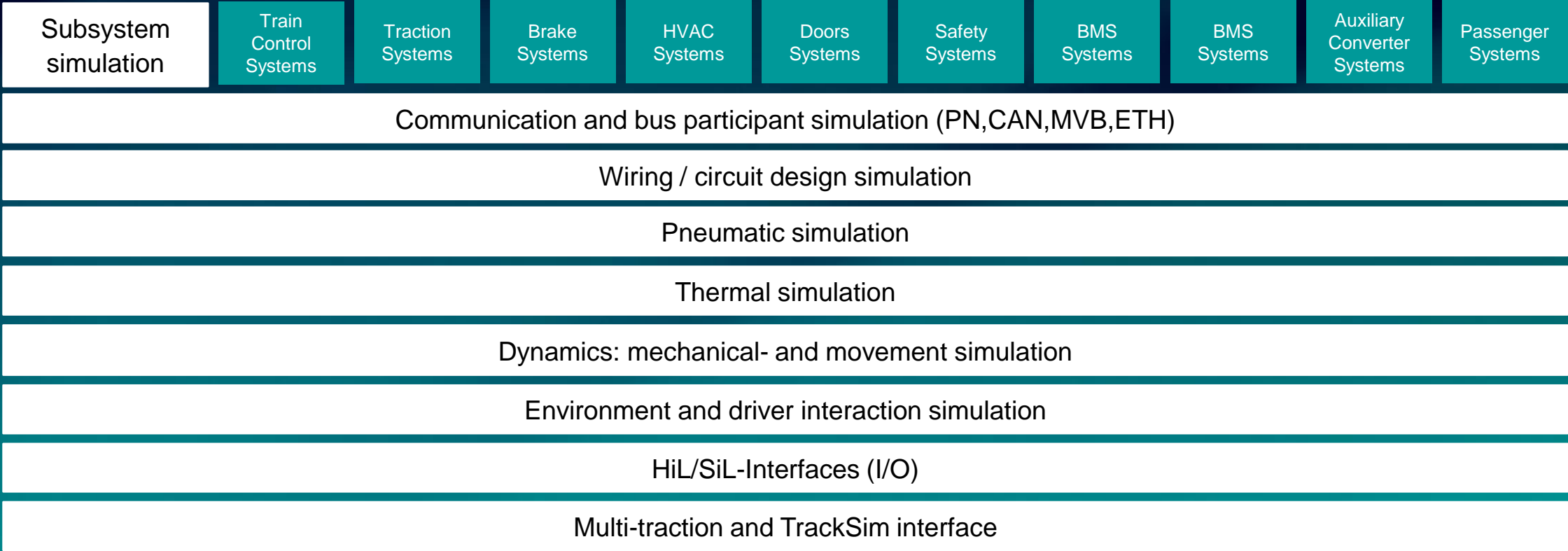
## HiL basics



- The Device under Test (DuT) is not instrumentalised.
- The real software is used.
- A real environment is simulated on all interfaces



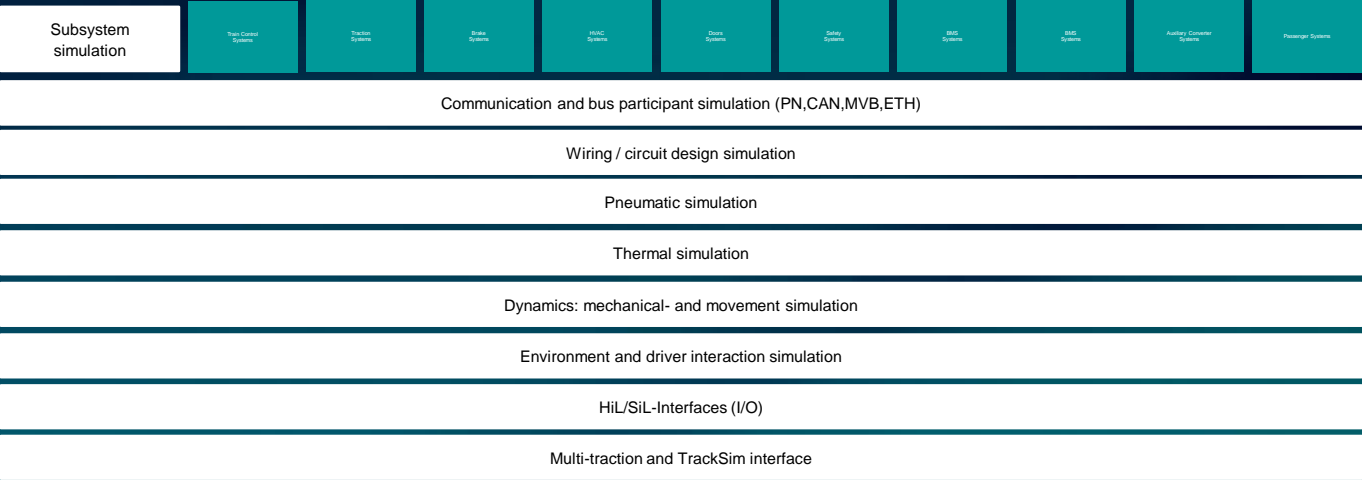
# Vehicle Simulation components



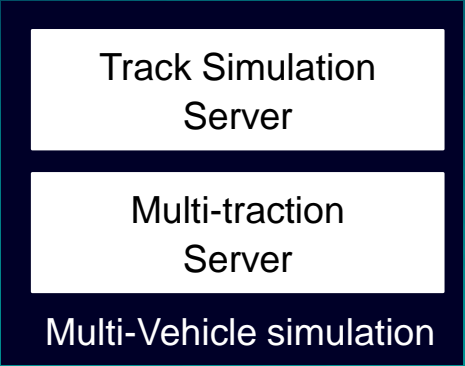
# Vehicle Simulation in an environment




TrainSim



Vehicle environment simulation





# **TrackSim: Server-based track and infrastructure simulation for TrainSim**

# Main TrackSim Features

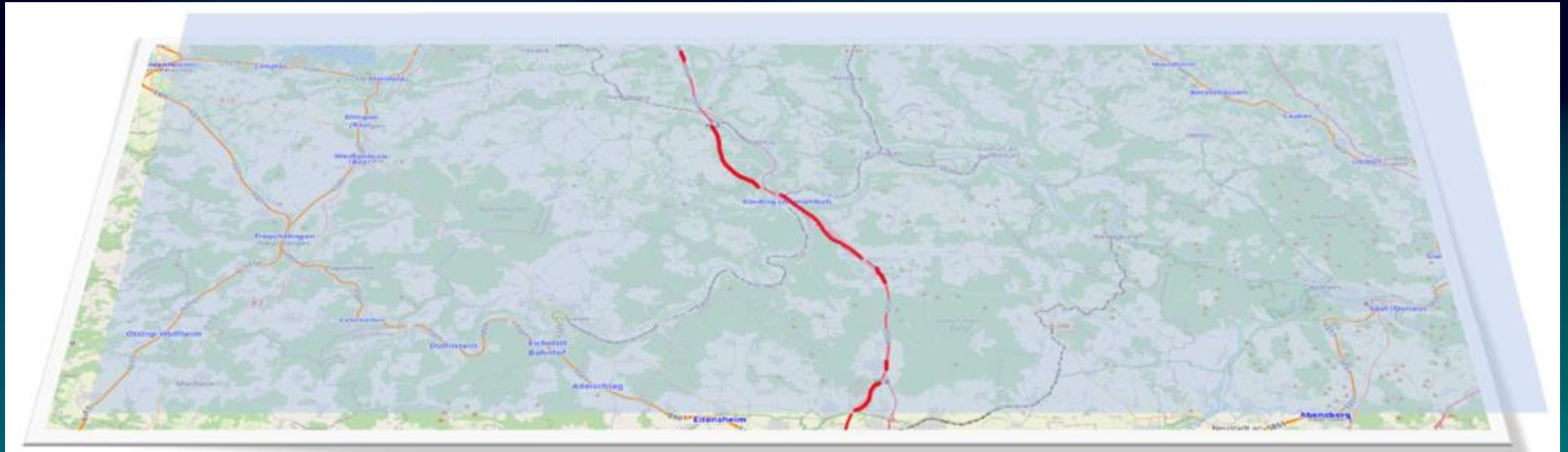
**Architecture which fits in to concept: infrastructure / multi-vehicle / vehicle / sub-vehicle object**

**Consistent single and multi-vehicle data from and to Track Simulation**

**Layer based additional position related information from Track Simulation (Infrastructure Information)**

**→ Mass virtual operation with Virtual Vehicles**




## Example: Infrastructure Layer



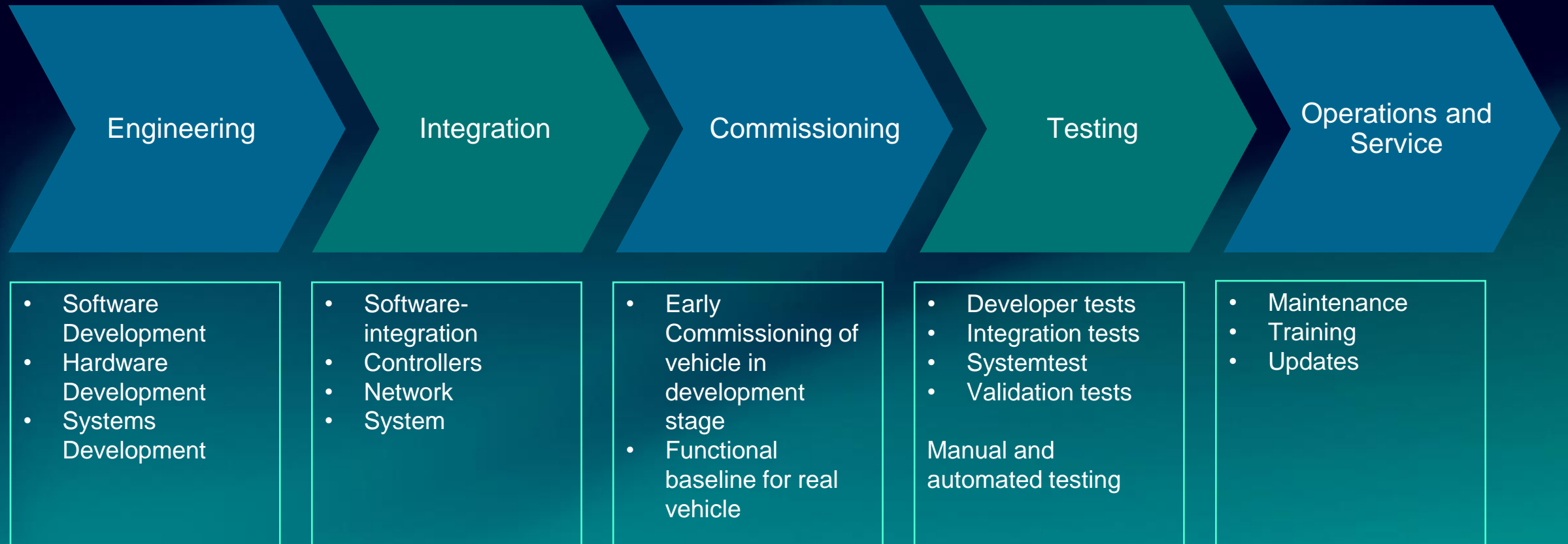
Infrastructure Layers:

Objects (coordinate, horizon, group, value)

eg: tunnel, pzb-magnet, line-voltage, ...

	route
	Layer „tunnel“ = true
	Layer „tunnel“ = false

# Scope of TrainSim



# | Contact

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