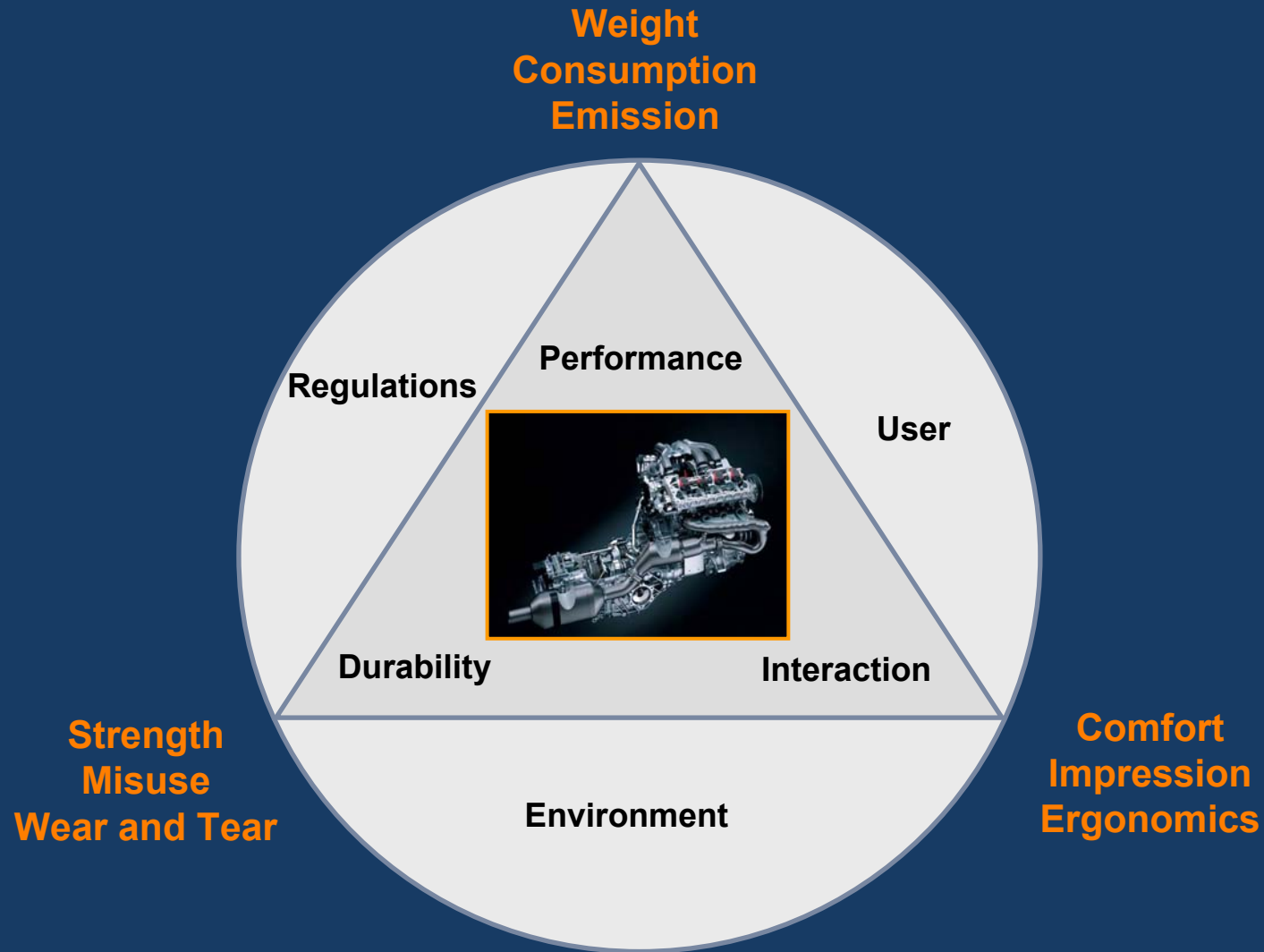


## Model based testing methods for engine and powertrain

Dr.-Ing. Christian Schyr  
Research Group Drive Technology  
Institute of Product Development  
University Karlsruhe

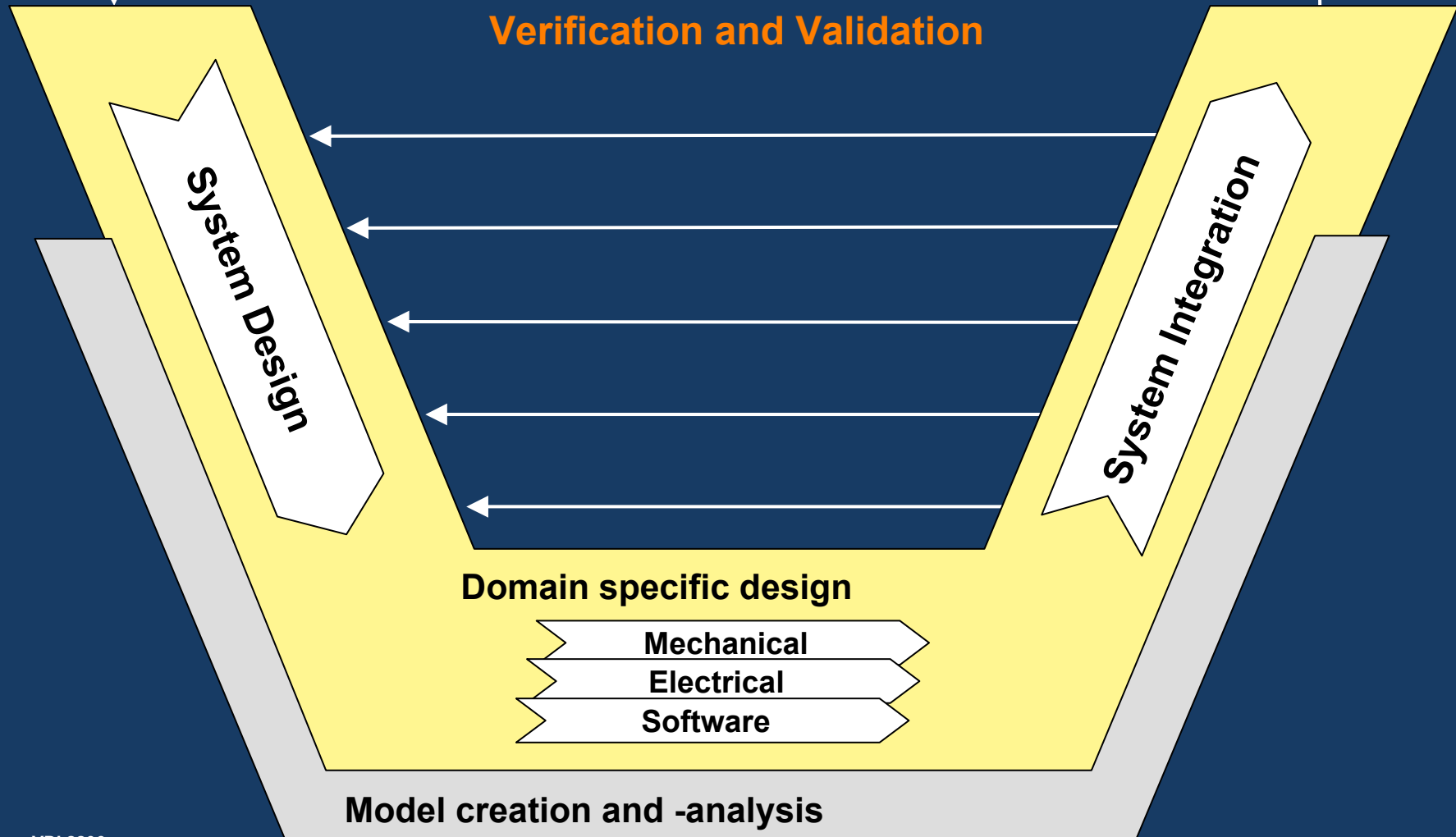
# Aspects of Powertrain Testing



# Powertrain Development Process

Requirements

Product

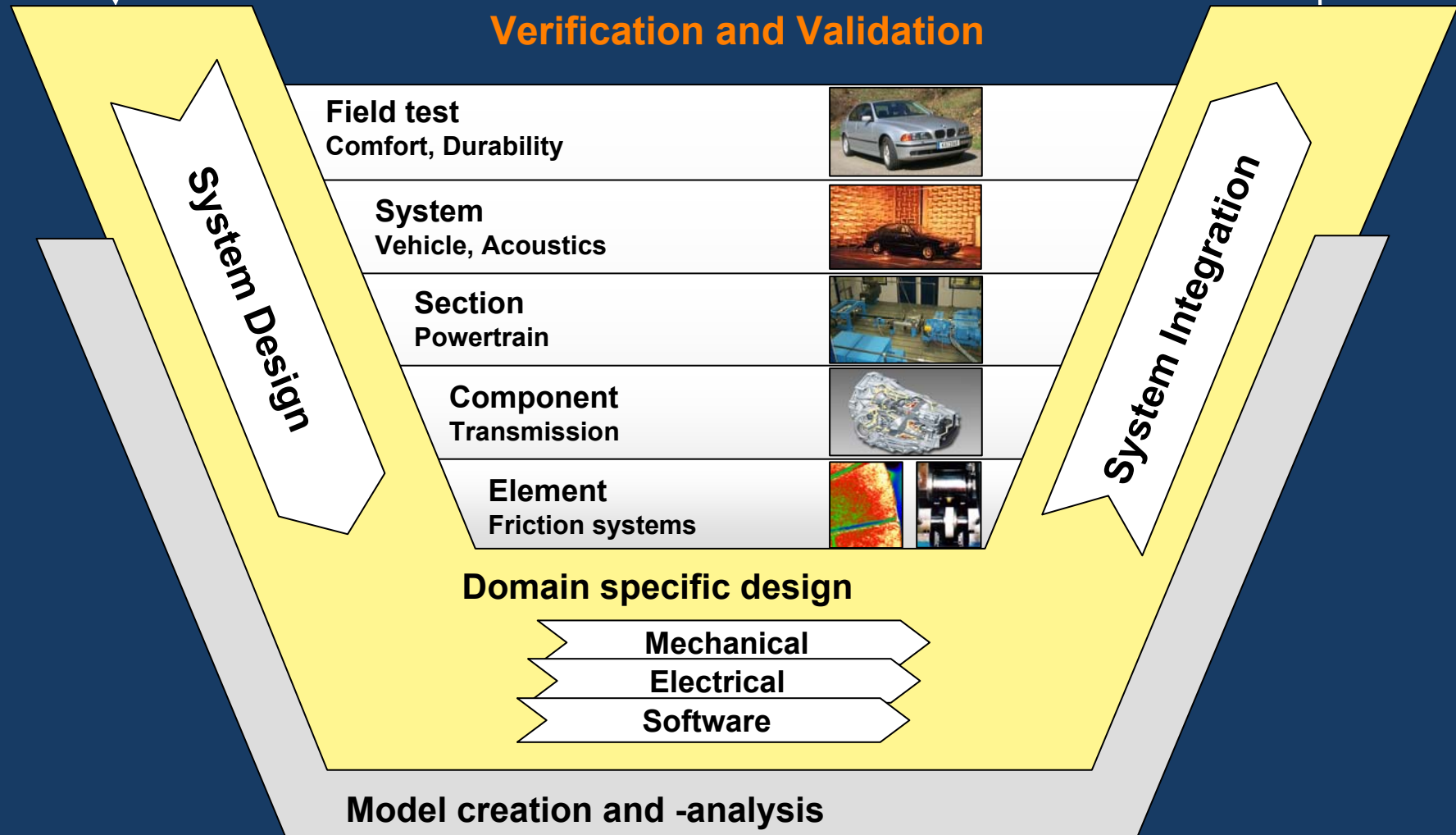


Source: VDI 2206

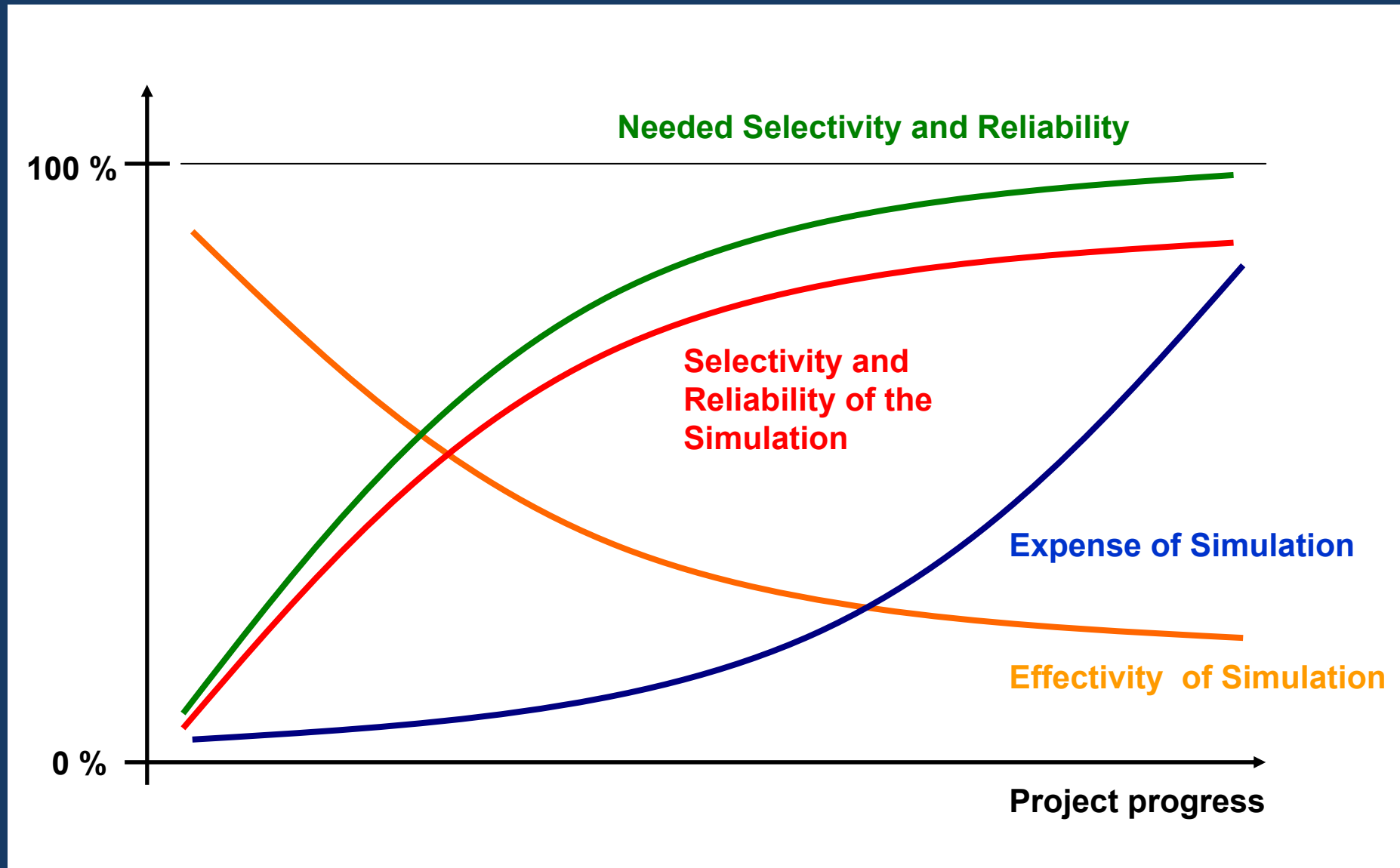
# Powertrain Development Process

Requirements

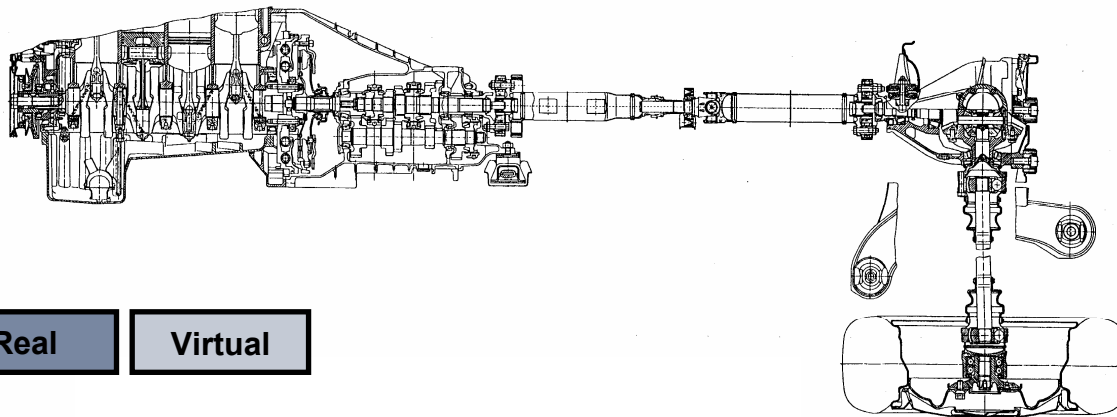
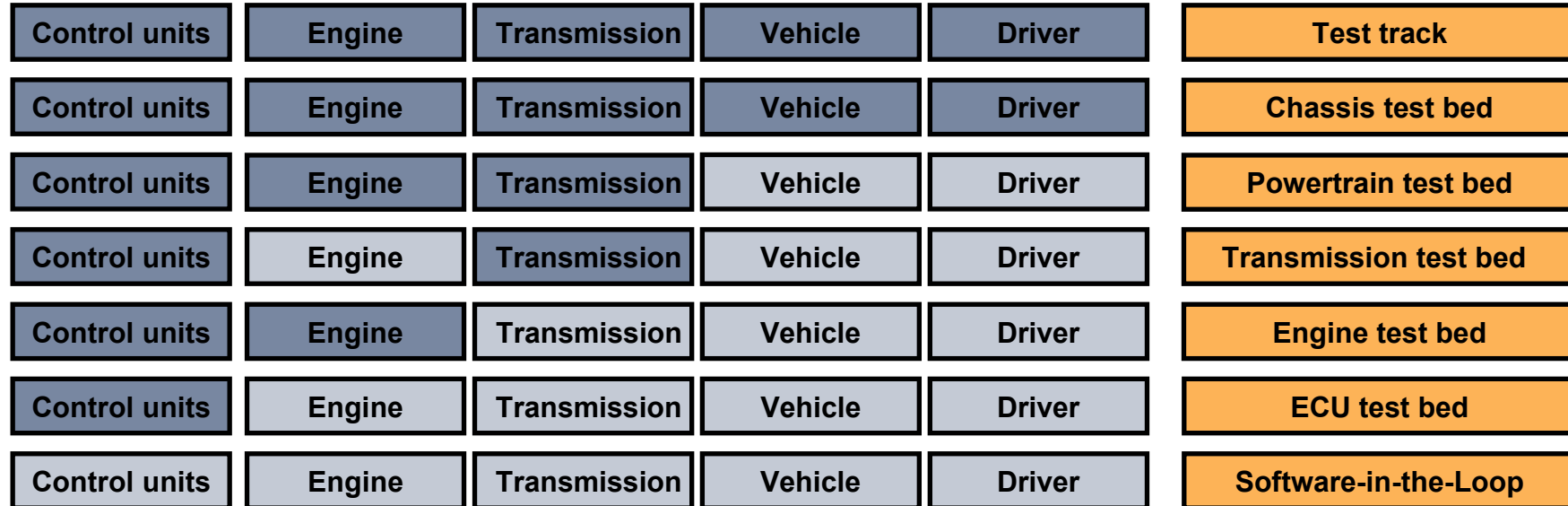
Product



# Simulation in the Development Process



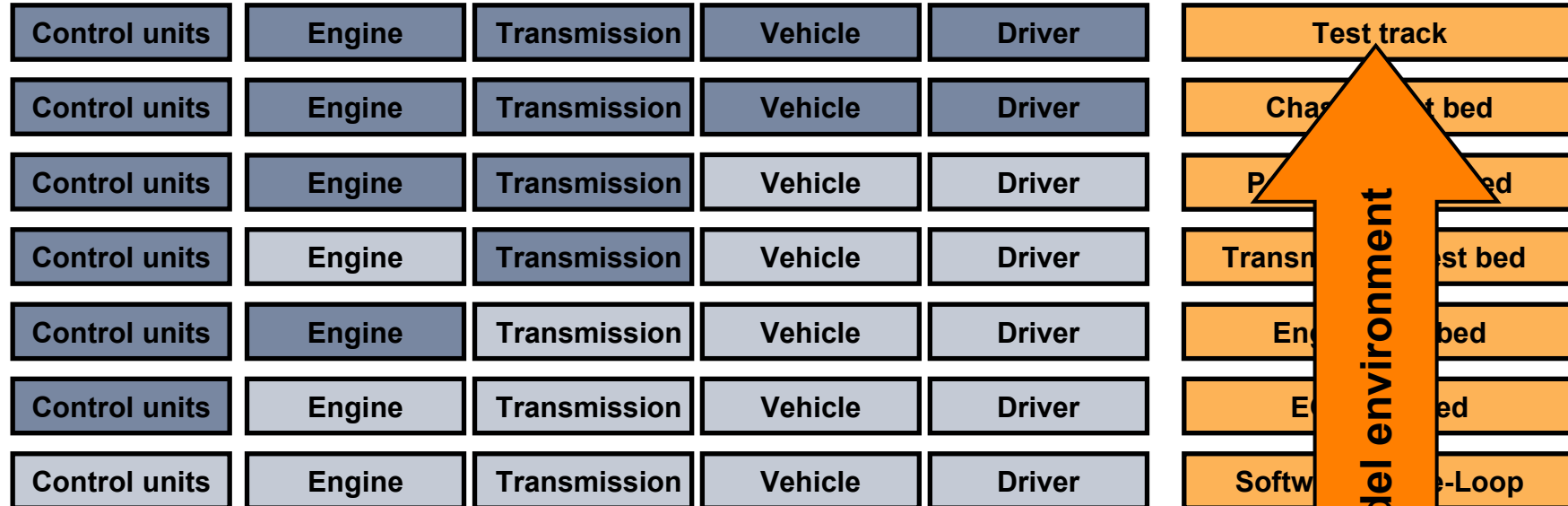
# Test beds in Powertrain Development



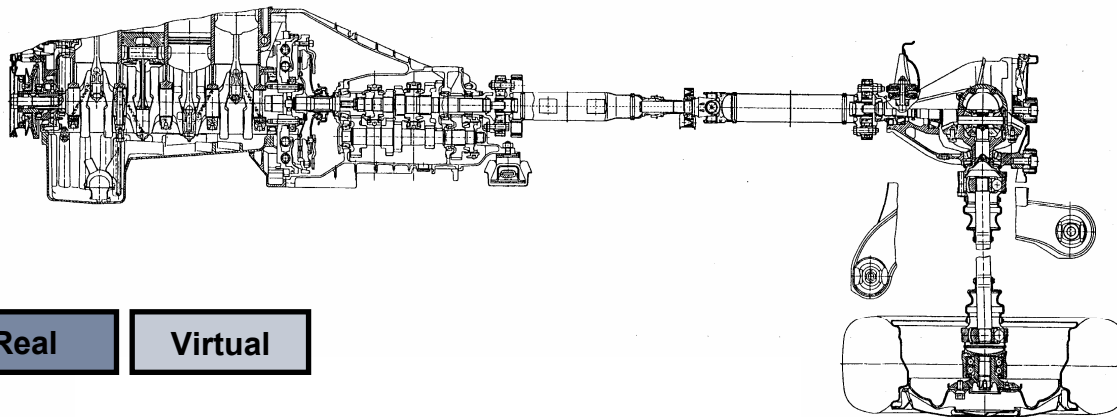
**Real**      **Virtual**

**Test bed configuration**

# Test beds in Powertrain Development

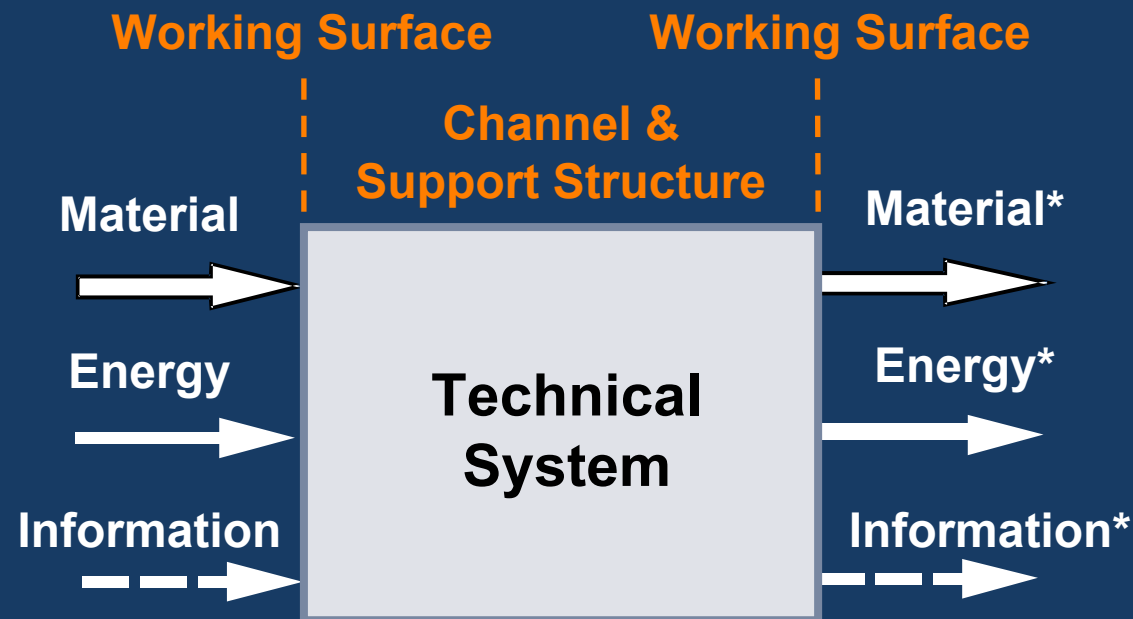


Test bed configuration



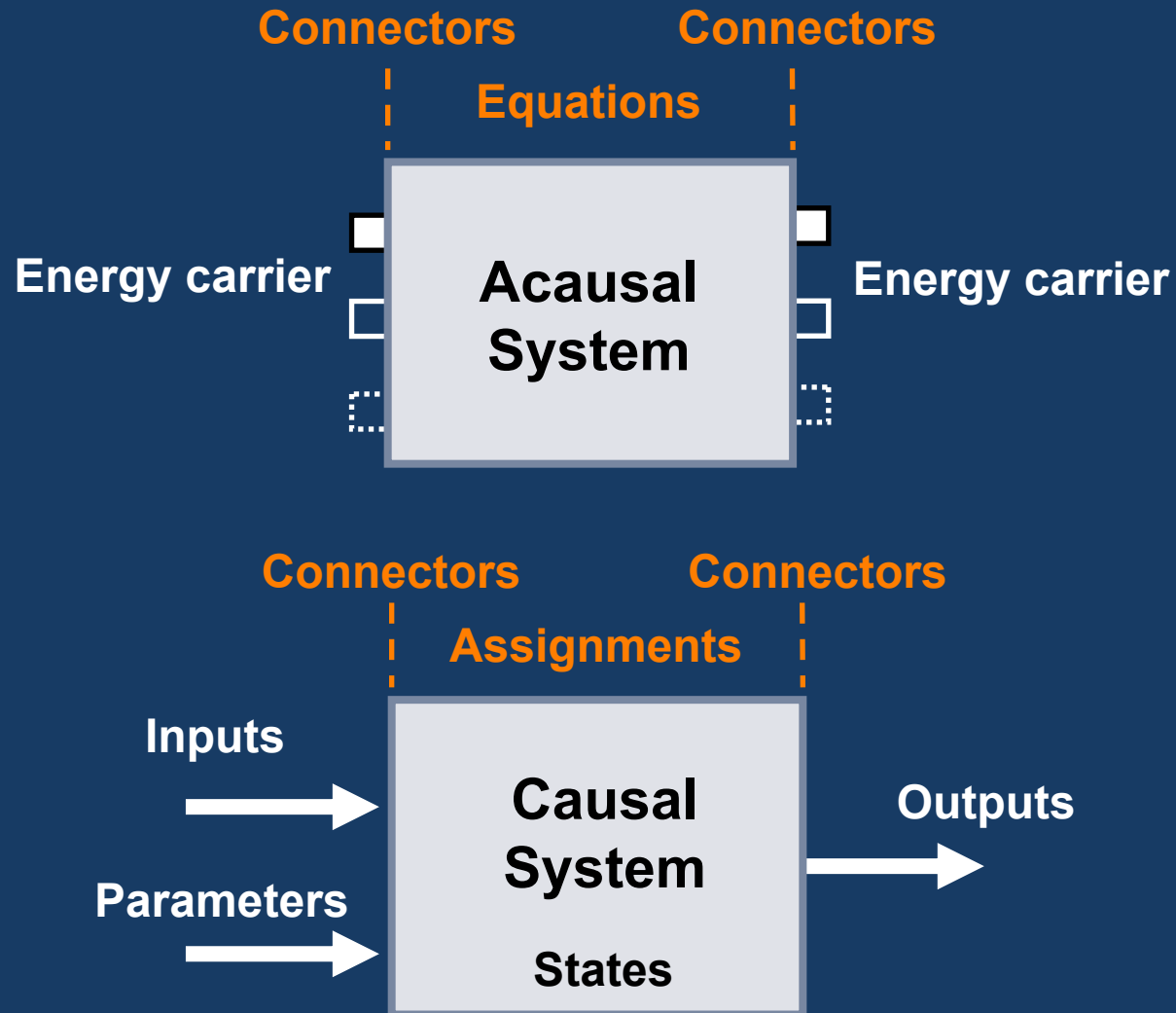
Real      Virtual

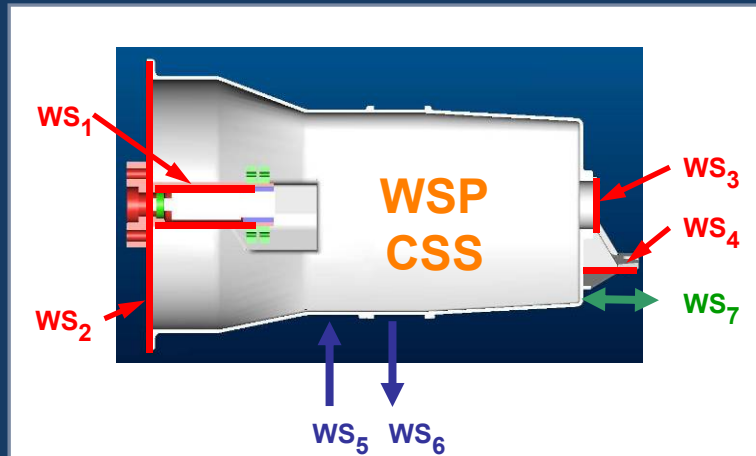
- **Working Surface Pairs (WSP)** are two generalized surfaces of a technical system which transmit material, energy and information.
- **Channel and Support Structures (CSS)** always connect two WSP and carry material, energy and information from one WSP to the other.



\*transformed

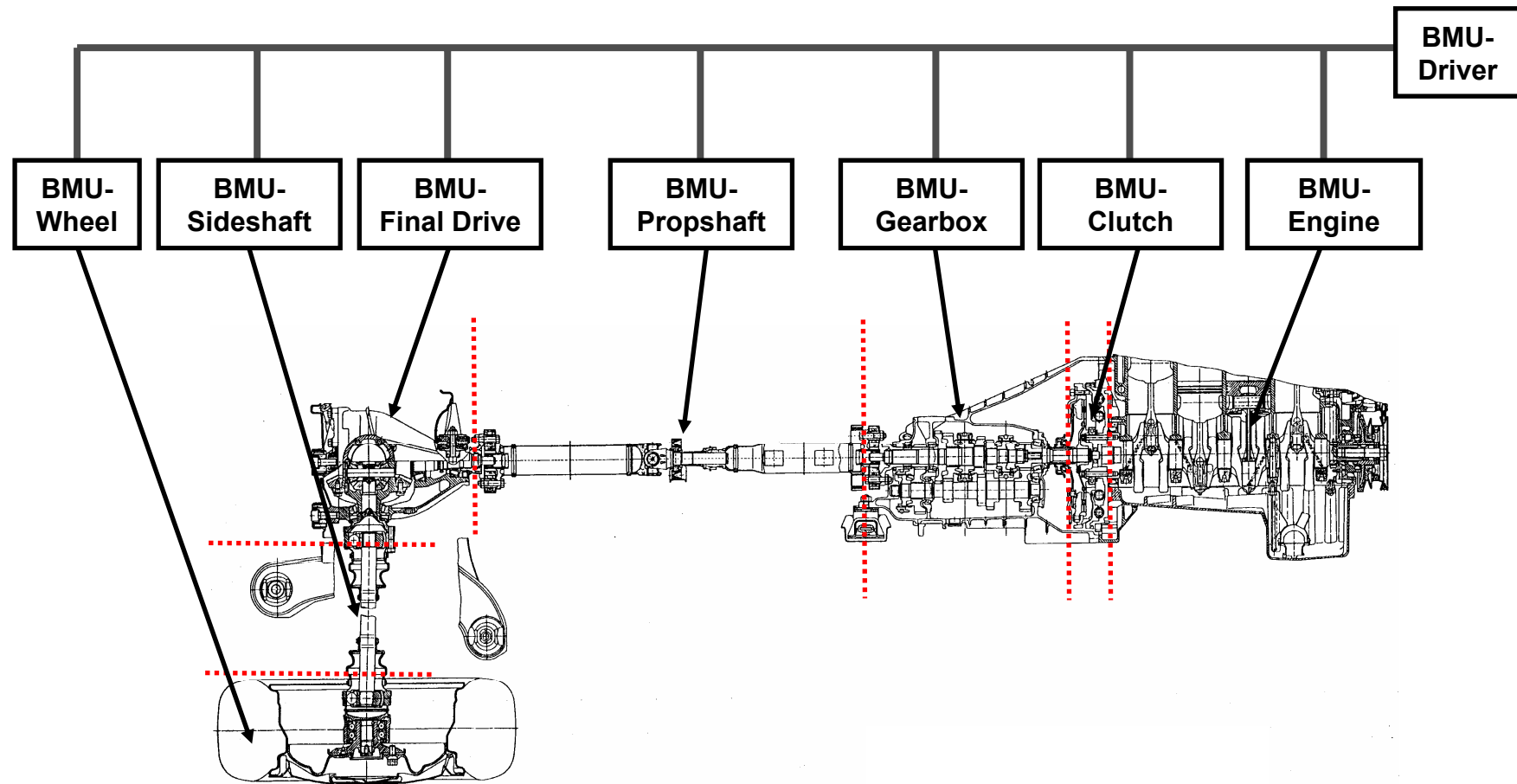
# Description of Physical Properties



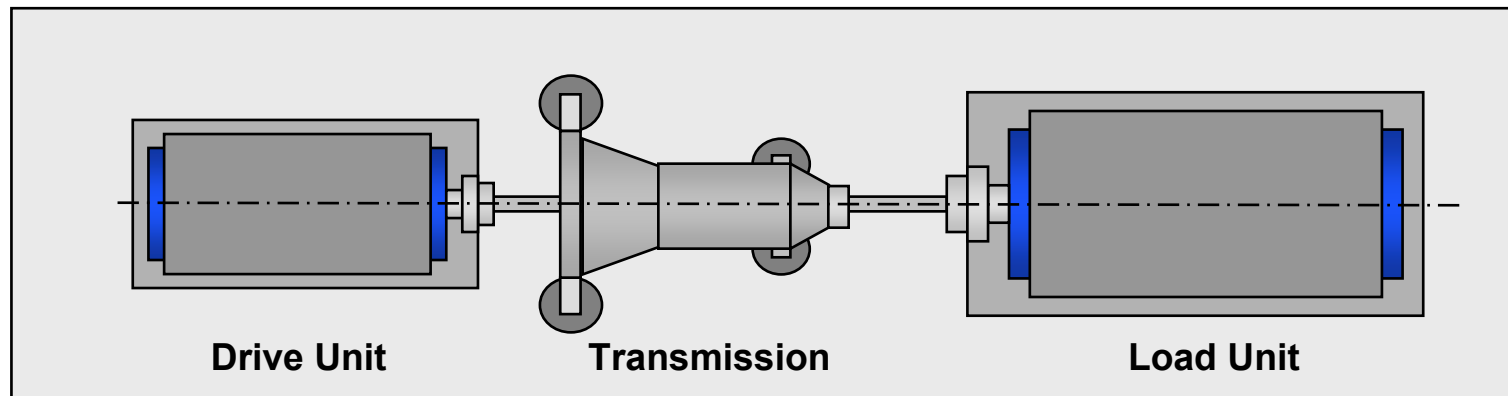


- Module **interface** with **WS**
- Module **description** with **WSP, CSS**
- **BMU-Modules** contain all relevant
  - functional,
  - physical,
  - information processing and
  - geometric propertiesaccording to the actual development stage

# Behavioural Mock-Up (BMU) Modules

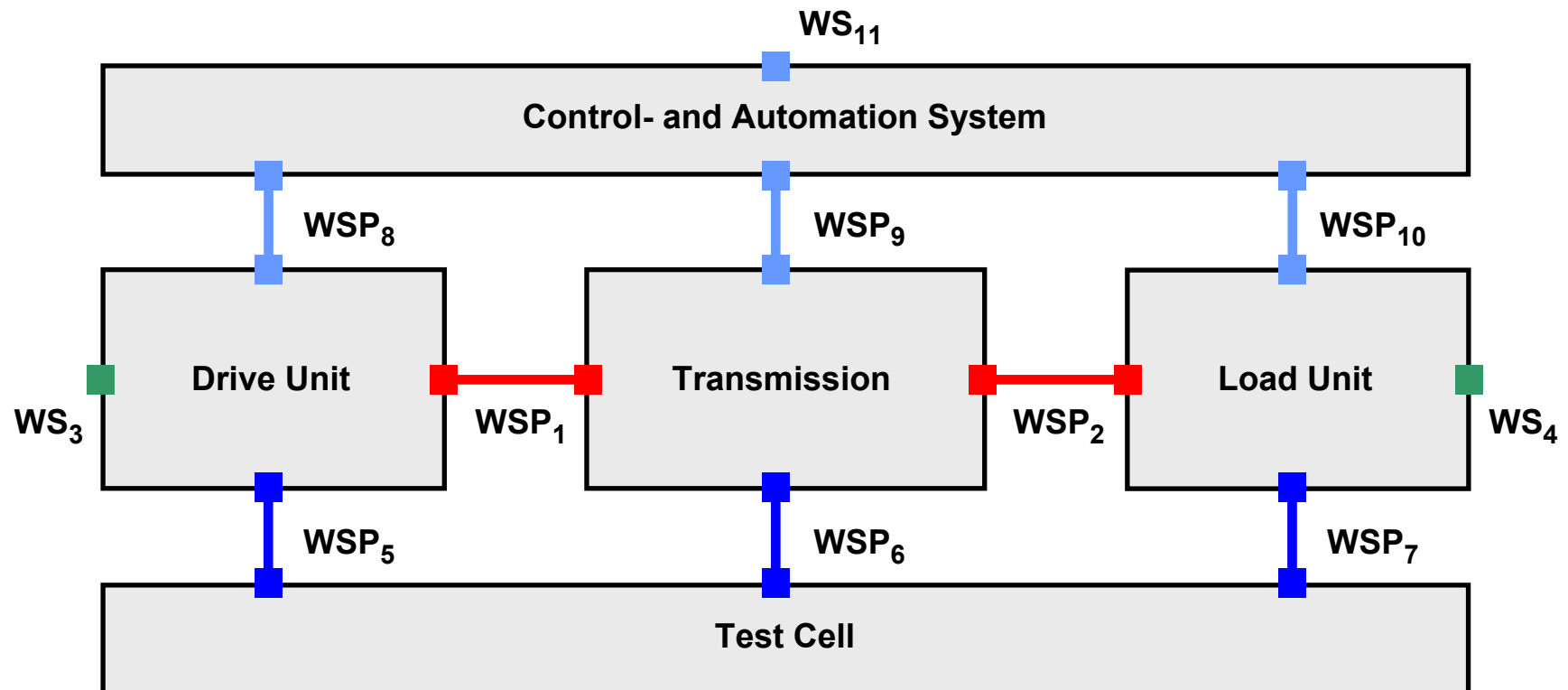


# Example: Transmission testing



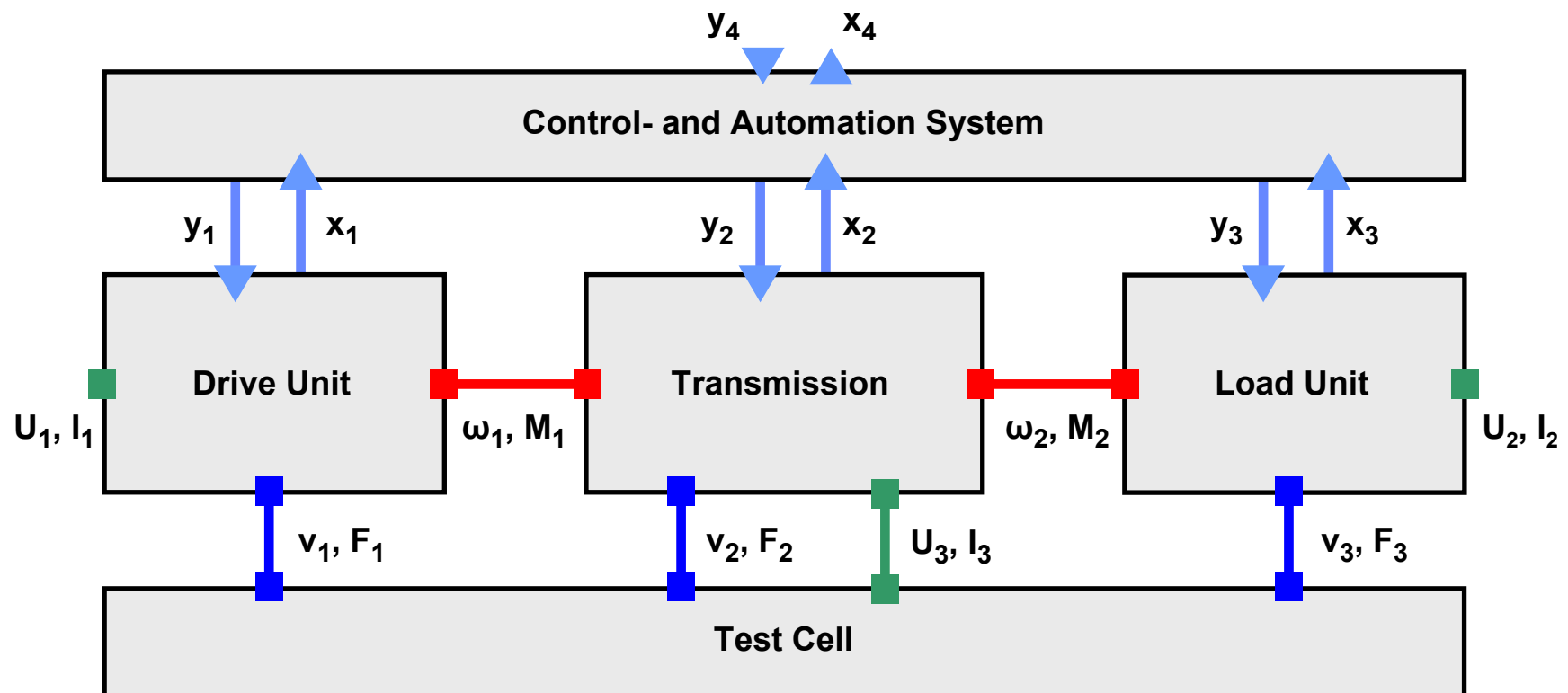
# Example: Transmission testing

## Notation: UML

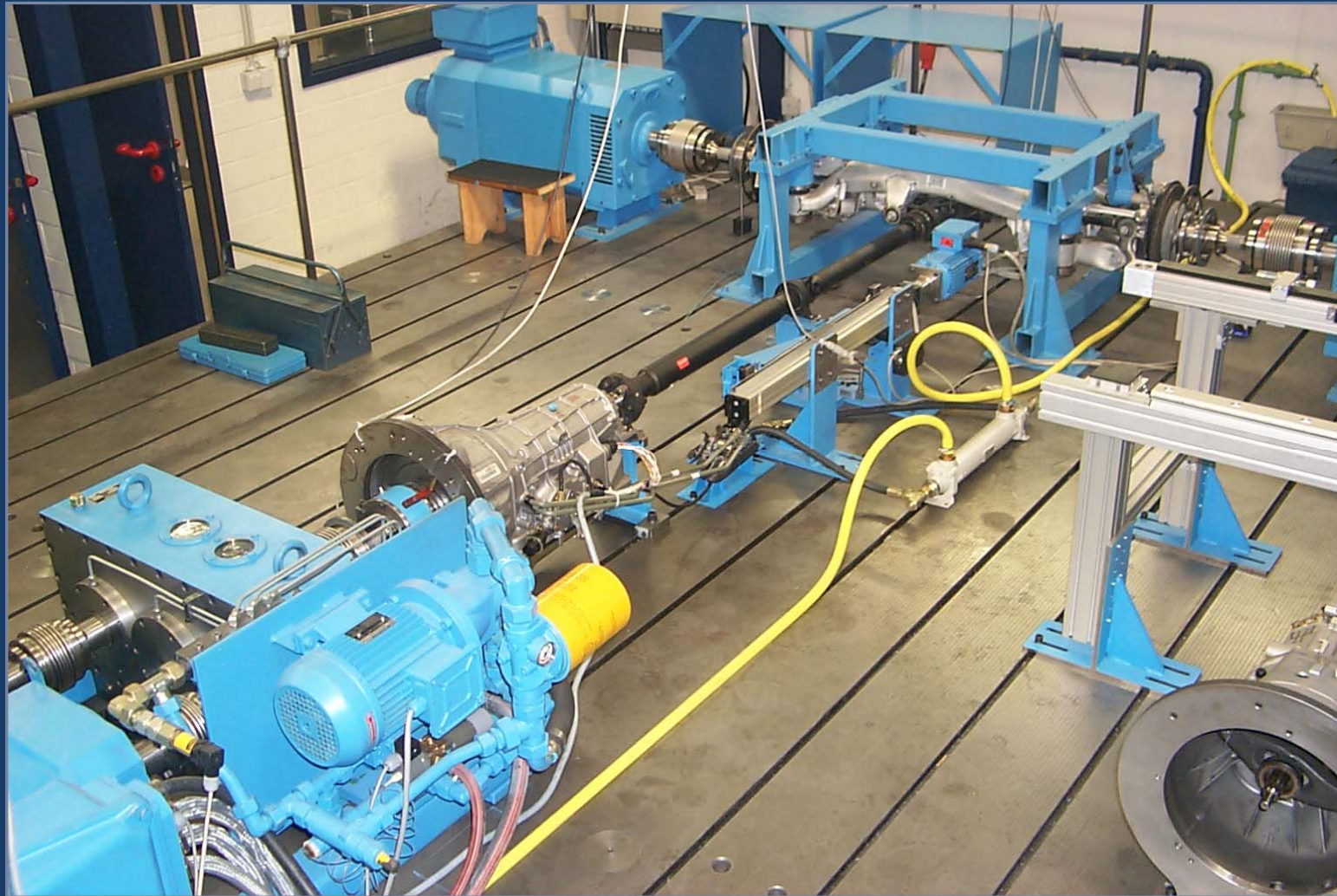


# Example: Transmission testing

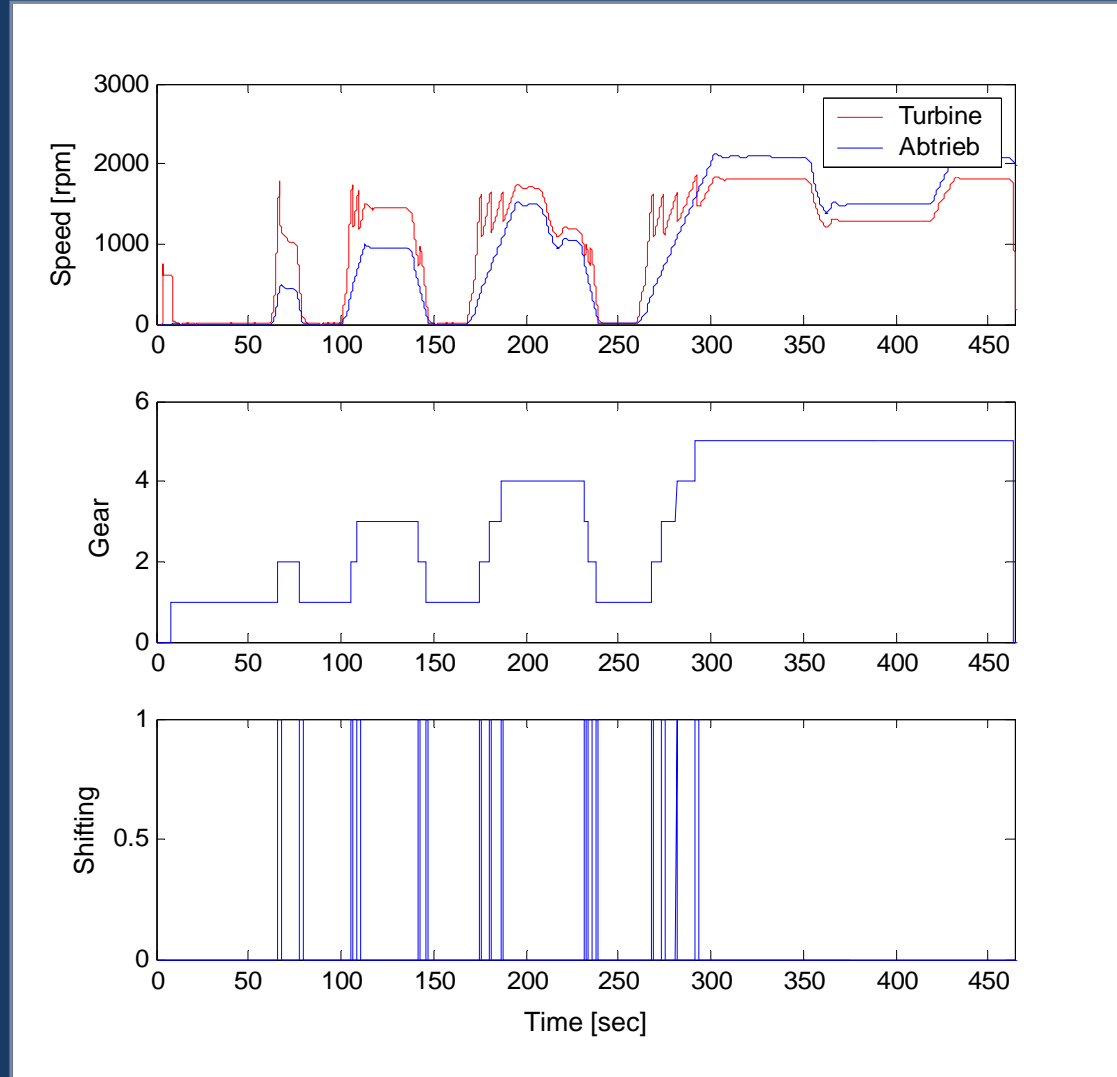
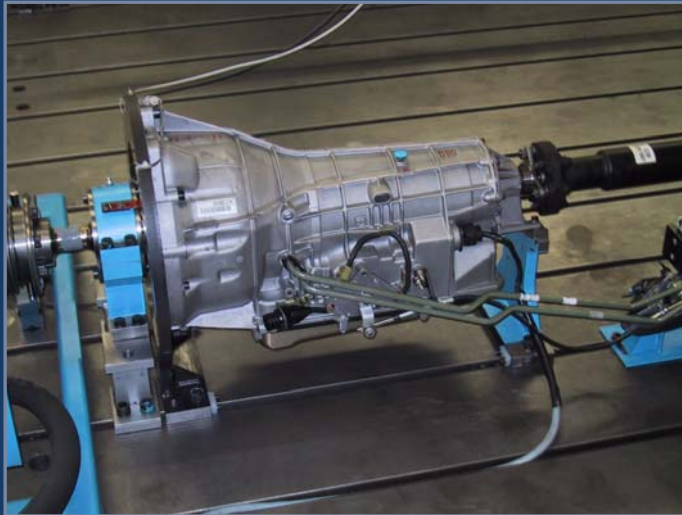
## Notation: Modelica



# Example: Transmission testing



# Example: Transmission testing



# Summary

Requirements

Product

