MOTION AND MOBILITY

Benefits of using standards for model exchange

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Agenda

1. Introduction
2. Model exchange inside the company
3. Model exchange among companies
4. Summary

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Introduction

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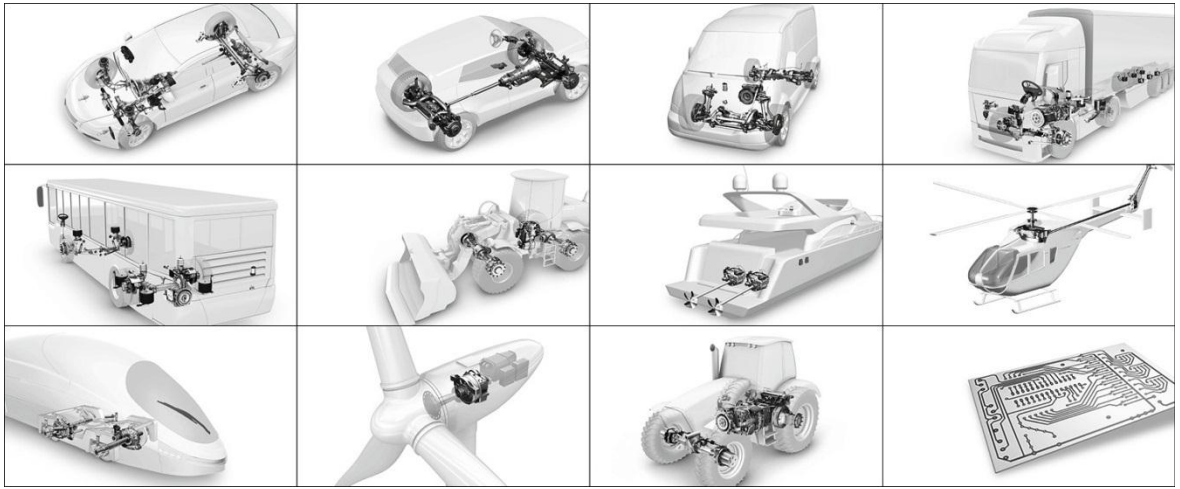
- ZF is a global leader in driveline and chassis technology with 121 production companies in 26 countries
- ZF is one of the ten largest automotive suppliers worldwide
- Product range comprises transmissions and steering systems as well as chassis components and complete axle systems and modules



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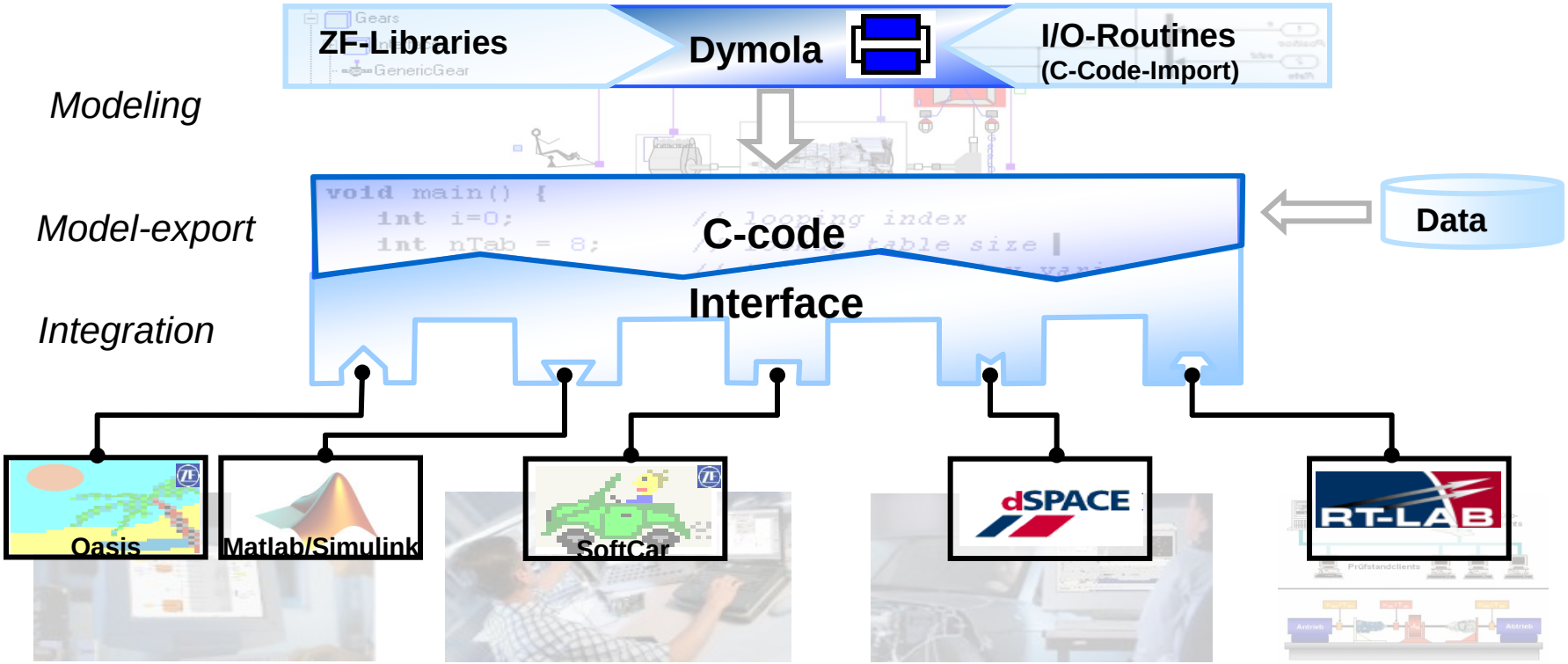
Workflow Modelica-Models



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Model exchange at ZF

- Standardized model export at ZF
- Integration mostly done in Simulink
- Established processes which are both efficient and robust

Problems

- High adaptional effort when changing release set of different tools
- Model export instead of model exchange
- Models not shareable between different tools
- Multiple development of models
  → more effort, error-prone and less accurate

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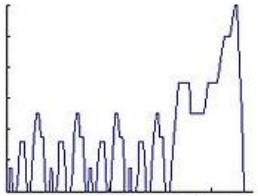
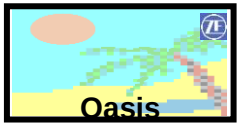
UseCase: Drive Cycle Simulation





Vehicle → Environment → Driver → Strategy

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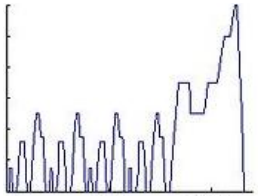

Oasis

Vehicle → Environment → Driver → Strategy

Dynasim

Vehicle → Environment → Driver → Strategy

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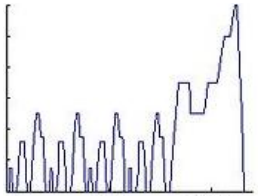
UseCase: Drive Cycle Simulation



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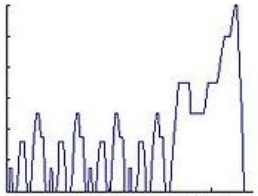

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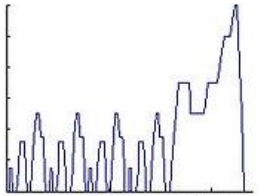

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MATLAB & SIMULINK

Vehicle → Environment → Driver → Strategy

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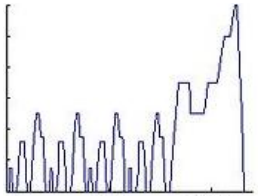

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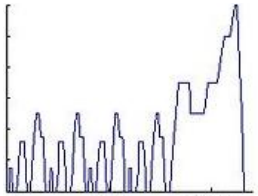

Oasis

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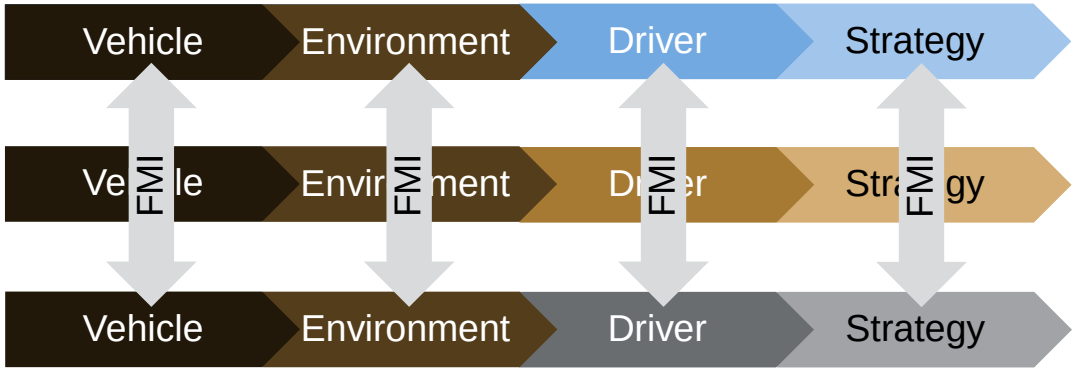
MATLAB & SIMULINK



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Benefits using FMI

- FMI is standardized approach
  → Less customizing of model export
- FMI is tool-independent
  → Model exchange among different tools
- Re-Use of models
  → Less effort and better quality

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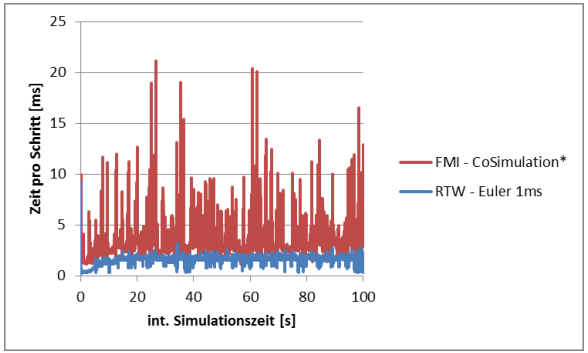
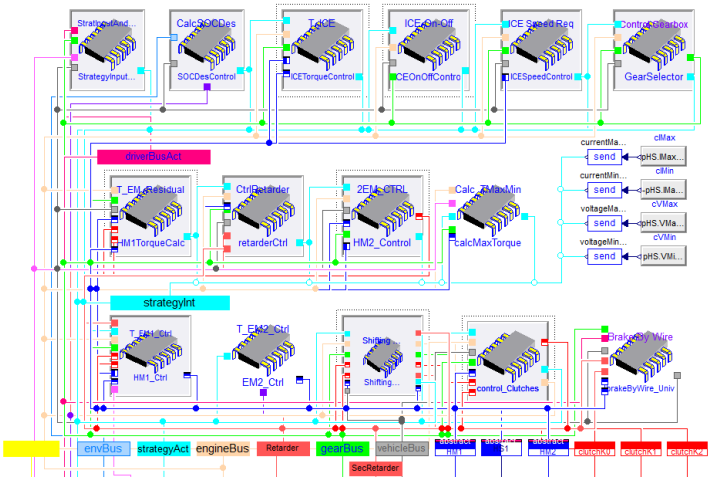
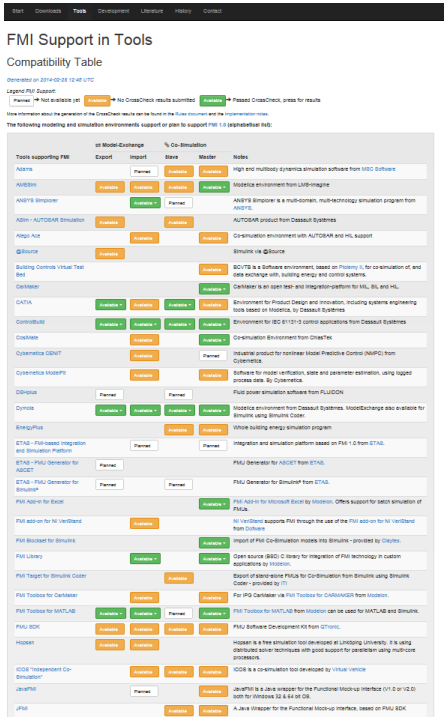
Challenges

- Processes must be efficient and robust (usability, performance and errorhandling)
- Integrated approach along all integration plattforms
- Consistent parametrization of FMUs
- Handling of complex interfaces







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Model exchange among companies

- Increased variety of modeling tools and integration approaches
- Integration tool defined by customer
- Interfaces often specified by customer

Problems

- Handling of variety on tools, releases and platforms
- Share of object-files require used tools and licenses
- One-directional process – no model exchange
- Numerical issues due to co-simulation of physically coupled models

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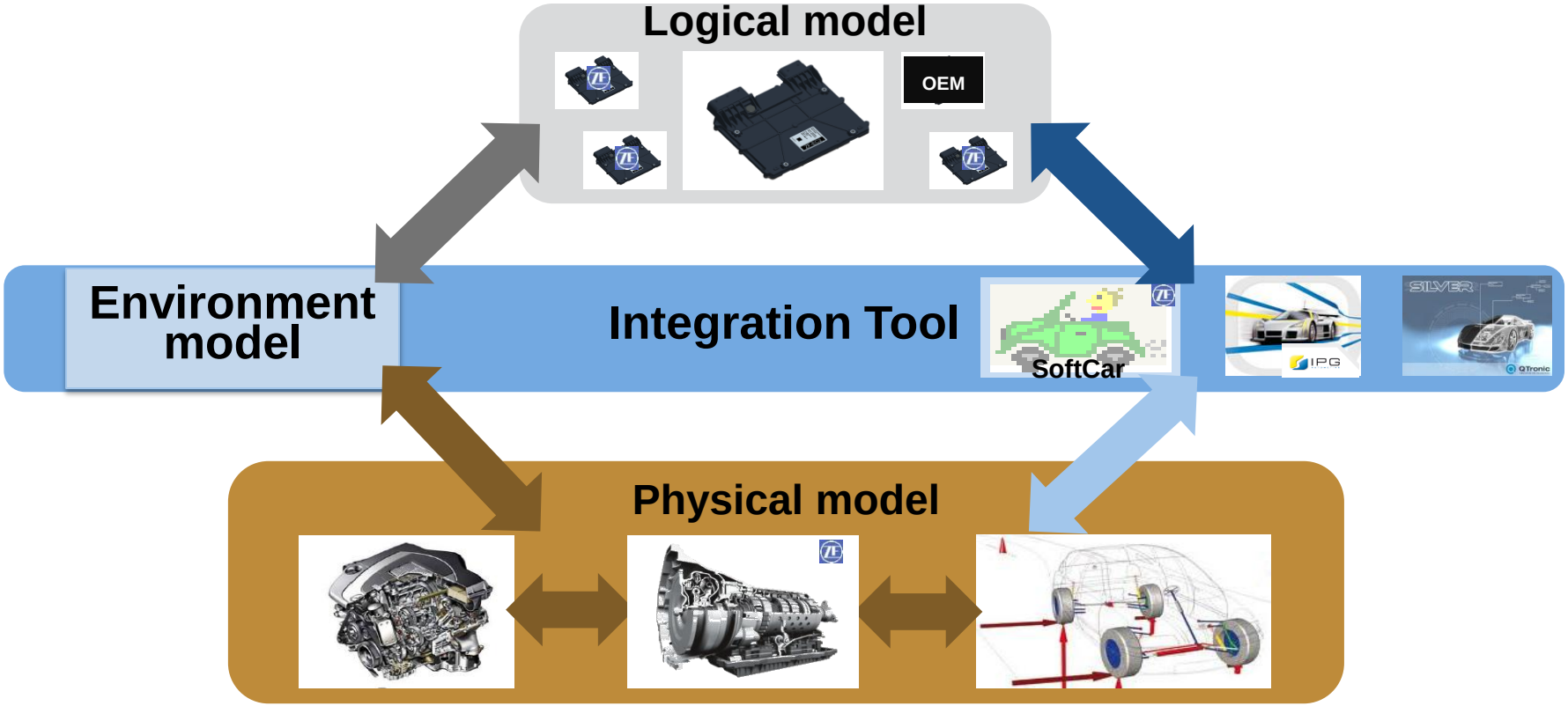
UseCase: Software-in-the-Loop Simulation



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Benefits using FMI

- Less dependency on tools and versions
  → reduce of cost and maintenance effort
- Same integration approach on both sides
  → less integrational effort
- Sharing models of core competence
  → improved prospects of software development and testing
- Model-exchange instead of co-simulation
  → avoid numerical issues

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Challenges

- IP-Protection (models and parameters)
- Documentation and responsibility (model boundaries)
- Identical results between different integration tools
- Exchange of interface definitions

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Benefits of using standards for model exchange

Summary

- Model exchange among different tools increases flexibility
- Re-Use of models reduces modeling effort and leads to better quality
- Share of models among different companies with less integrational effort

FMI suggests Plug-and-Play, but some effort needs to be done

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