
# Requirements beyond classic simulation

ASAM concept project discussion group

TÜV SÜD

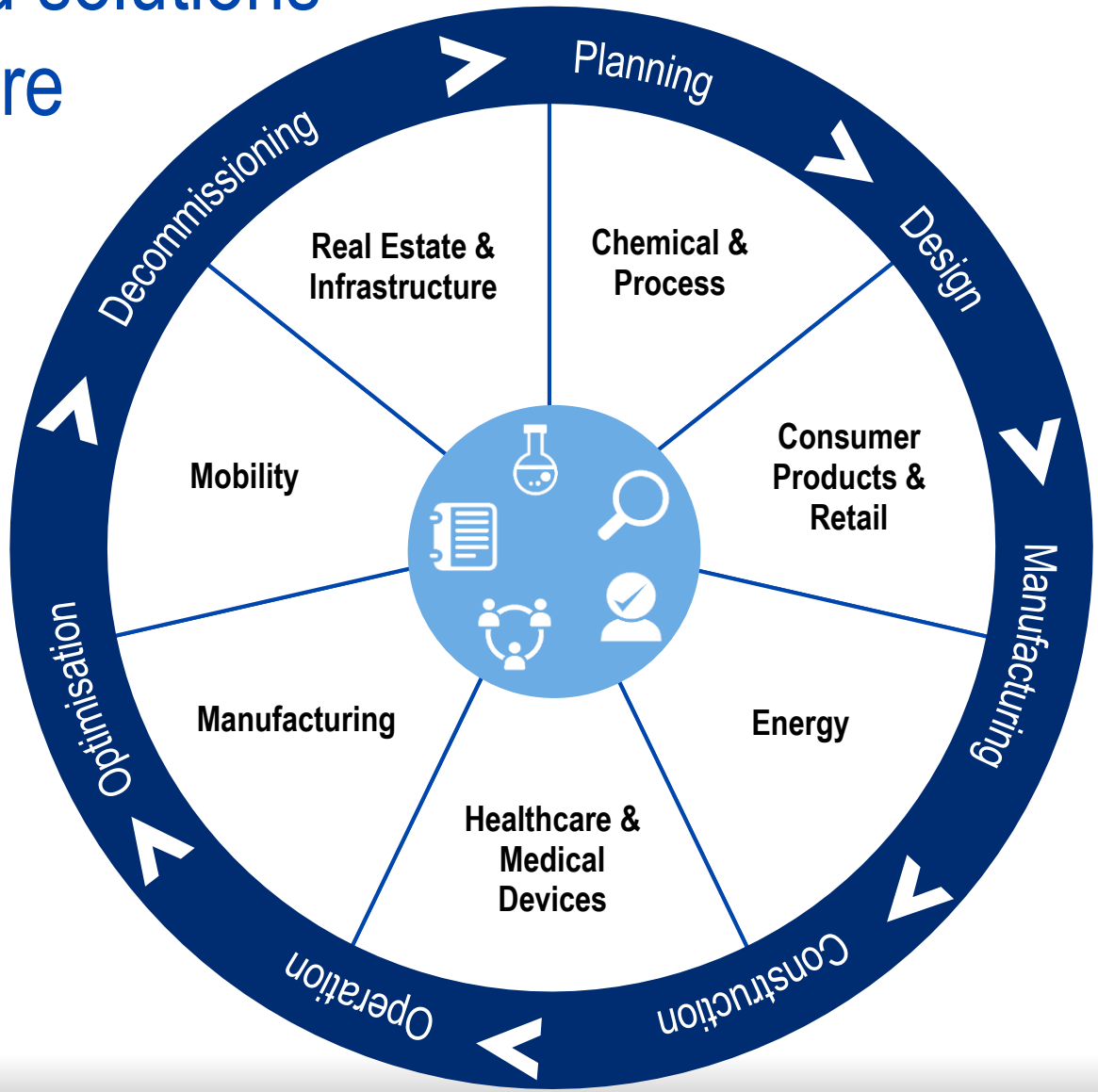
Mehr Wert.
Mehr Vertrauen.

Add value.
Inspire trust.


# Agenda

- Introduction of TUV SUD
- Use cases of TUV SUD
- Summary / Requirements beyond classic simulation

# End-to-end solutions for the entire business lifecycle




## SERVICES

- TESTING AND PRODUCT CERTIFICATION
- INSPECTION
- AUDITING AND SYSTEM CERTIFICATION
- KNOWLEDGE SERVICES
- TRAINING

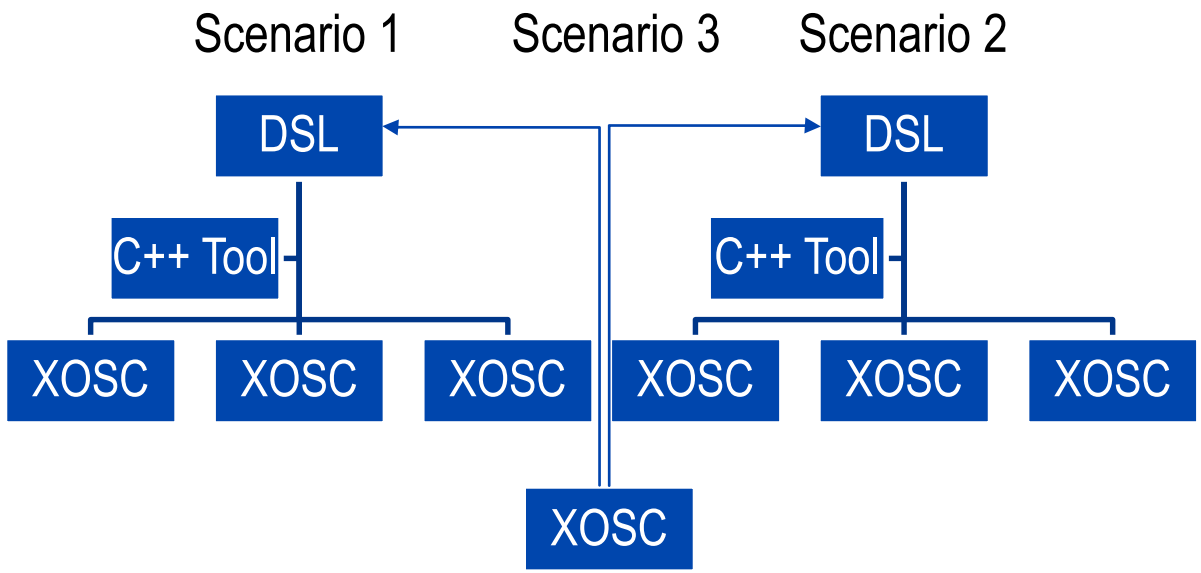
# Mobility sector

Key services for the Automotive, Rail and e-Mobility industries

- Car dealership and fleet management
- Component and full-vehicle testing
- International regulatory compliance (Homologation)
- Periodic technical inspection
- Road safety and traffic solutions

# Use Case of TUV SUD (I)

## Simulation as a service




## Derived requirements

- The DSL is a chance to make sharing and storing of openSCENARIO files easier.
- Correlation between DSL and openSCENARIO format must be deterministic in both directions
- *Discussion during presentation and edited after presentation:*
  - *Advantage when you derive DSL from XOSC is that you can see if your new XOSC fills any gaps you had between your previous XOSC*
  - *Deriving DSL from XOSC should be possible in order to see from which origin it comes.*

# Use Case of TUV SUD (II)

## UNECE Regulations

- **UN R 79 Annex 8 [e.g. LKA Systems]**
- 3.2. Tests for ACSF Category B1 Systems
- 3.2.1. Lane keeping functional test
- 3.2.1.1. The vehicle speed shall remain in the range from $V_{smin}$ up to $V_{smax}$.
- The test shall be carried out for each speed range specified in paragraph 5.6.2.1.3. of this Regulation separately or within contiguous speed ranges where the $ay_{smax}$ is identical.
- 3.2.1.3. The vehicle manufacturer shall demonstrate to the satisfaction of the Technical Service that the requirements for the whole lateral acceleration and speed range are fulfilled. This may be achieved on the basis of appropriate documentation appended to the test report.

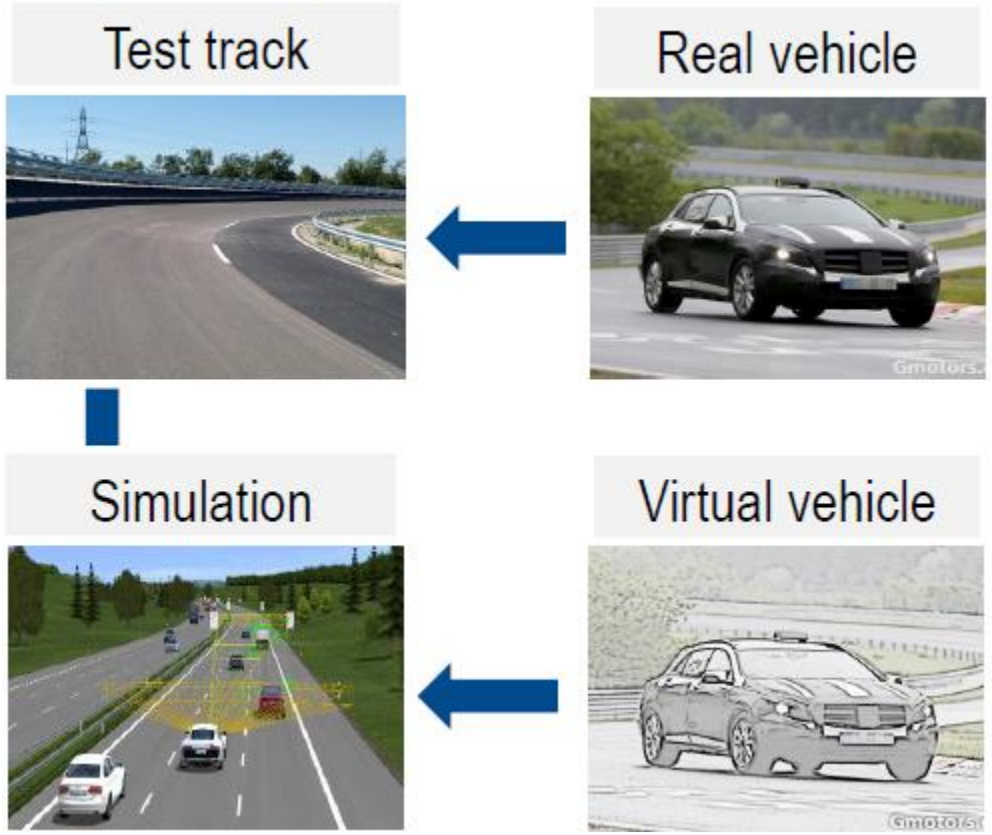
- **UN R 131 [e.g. AEBS]**
- 6.5. Warning and activation test with a moving target
- 6.5.1. The subject vehicle and the moving target shall travel in a straight line, in the same direction, for at least two seconds prior to the functional part of the test, with a subject vehicle to target centreline offset of not more than 0.5m.
- The functional part of the test shall start with the subject vehicle travelling at a speed of 80 ± 2 km/h, the moving target at speed of the value specified in Table I, column H of Annex 3, and a separation distance of at least 120 m between them.

## Derived requirements

- No concrete scenario but logical scenario
  → Need for high level scenario description
- Certain parameters and conditions should be part of a DSL
- Need for a state of the art scenario description that covers whole parameter ranges
- DSL has the chance to be sufficient for test case descriptions

# Use Case of TUV SUD (III)

## Simulation validation




## Derived requirements

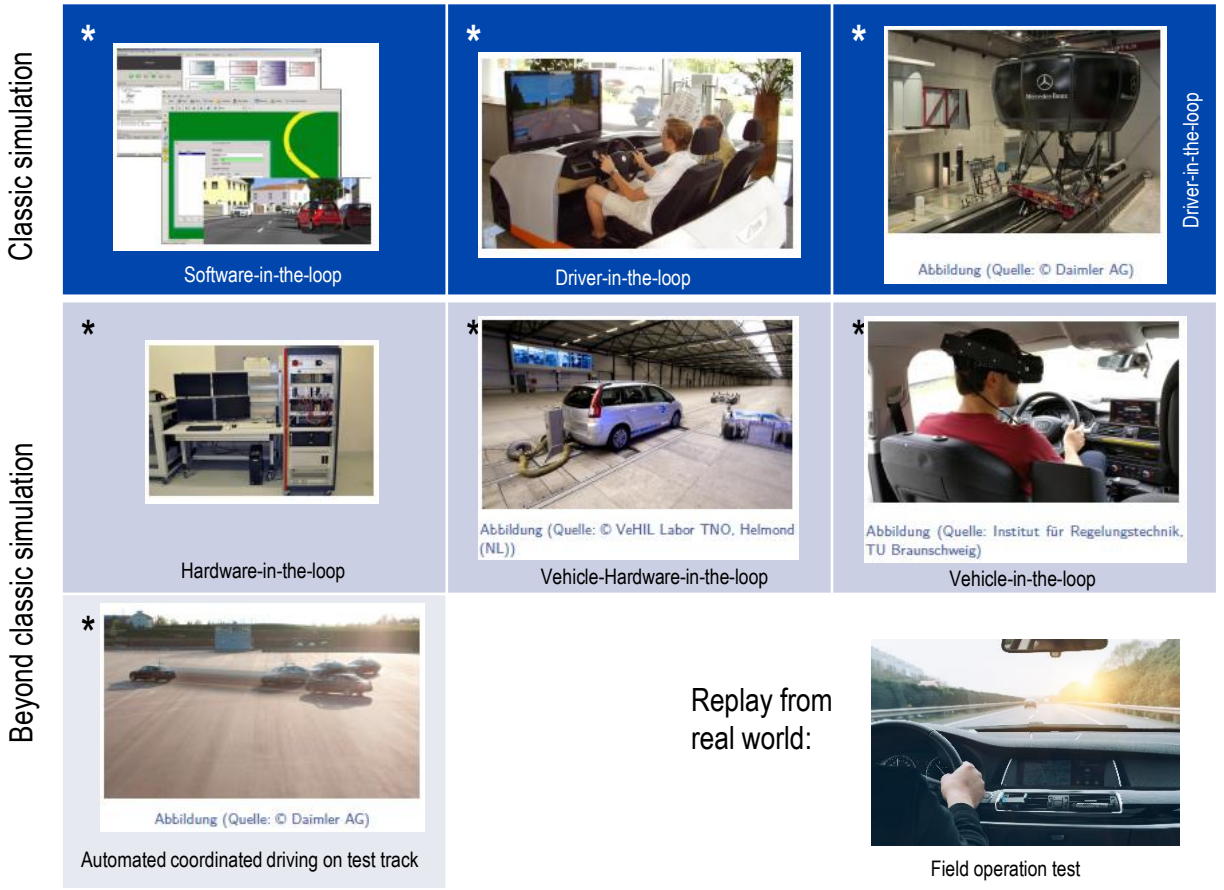
- Validation of simulators with a high level description of scenarios (in addition to concrete XOSC) would allow different simulation results (that‘s desirable)
- Triggers are essential (e.g. relative distances, THW, speed, acceleration, timing, absolute position, synchronization points)
- Ranges for parameters are more important than concrete values
- DSL and openSCENARIO must be suitable across all kinds of simulation
  → Comparison of simulation results against test track results is possible

# Outlook for autonomous driving vehicles

Full video: https://www.youtube.com/watch?v=o1PdZ4um62g


# Requirements beyond classic simulation

- Simulation has many faces; DSL should cover all of them
- Possibility to derive XOSC from DSL and other way around
- Test case description by UNECE should be used as one input for DSL
- Scenario description with DSL should be possible in such detail (with triggers), that it might imply test specifications
- Outlook: There might be more requirements beyond testing of autonomous vehicles




*Pictures taken from Schuldt, F.: Towards testing of automated driving functions in virtual driving environments

# Thank you for your attention!

**Christoph Miethaner**
Testing methods
Autonomous Driving & ADAS
TÜV SÜD Auto Service, Daimlerstraße 11
85748 Garching, Germany
Christoph.miethaner@tuev-sued.de