

# Open Standards for Driving Simulation

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# Introduction

VIRES Simulationstechnologie GmbH

# Introduction

## Who is VIRES?



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Austria

Founded: 1996  
Staff: 34+  
Management: Marius Dupuis  
Wunibald Karl

www.vires.com  
www.opencrg.org  
www.opendrive.org  
www.openscenario.org

**Focus on key product: VIRES Virtual Test Drive®**



Partner in Standardization Initiatives:

Open **CRG** Open **DRIVE** Open **SCENARIO**

Partner in Research Projects:



+ additional ones  
(2 starting 2018)

Partner in:

Auto Drive Challenge  
(via MSC.Software)





# Driving Simulation

What's this?



## Driving Simulation **DiL**

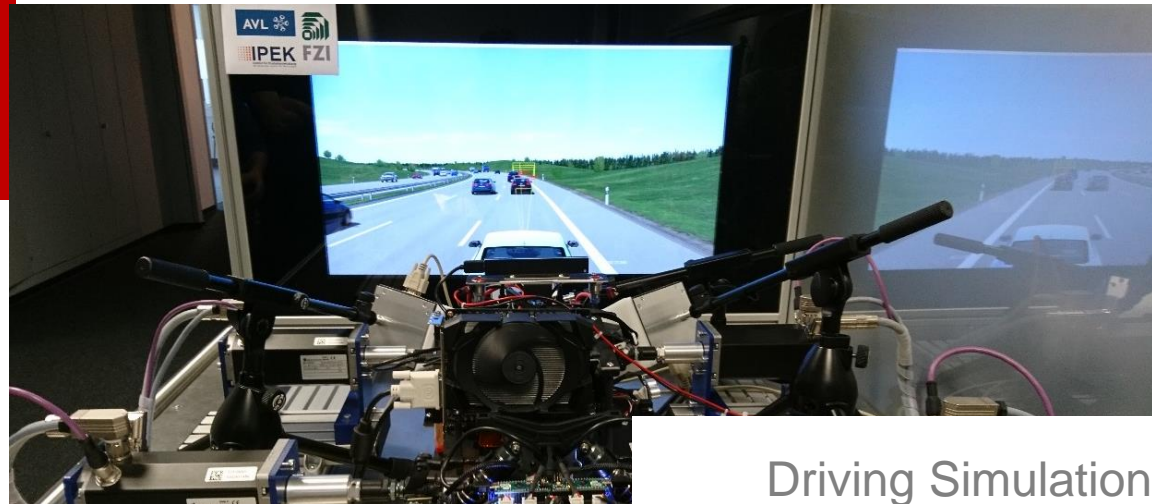


# Driving Simulation

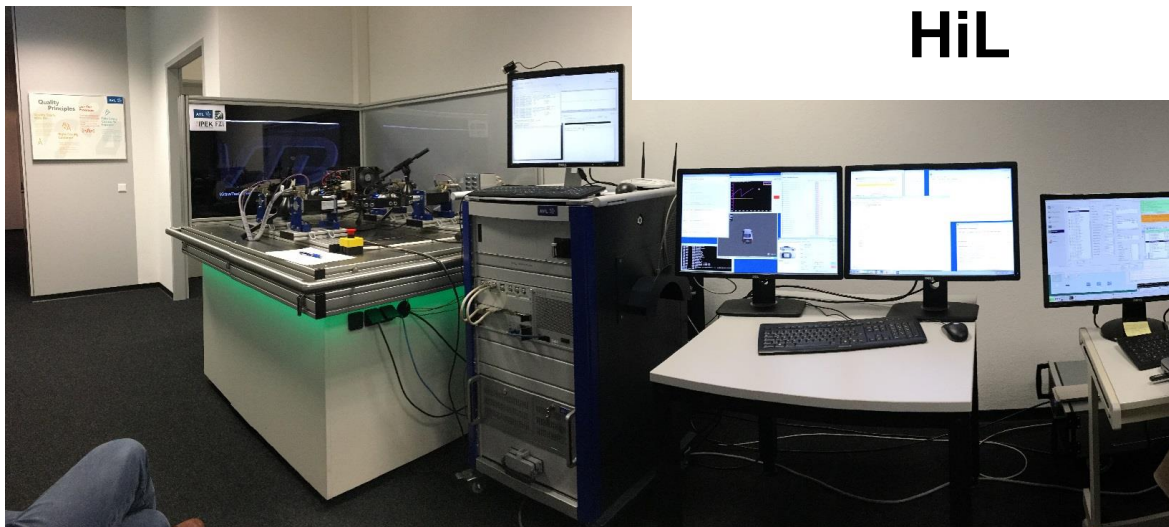
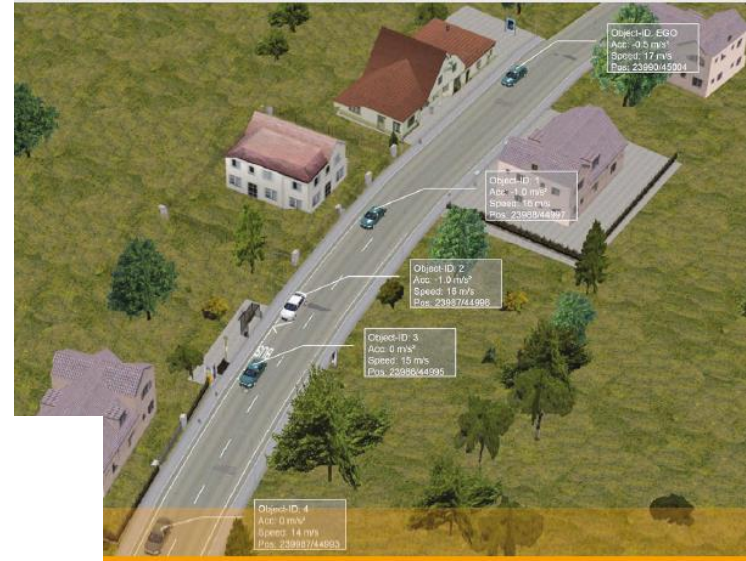
## Example (AdamsRT and VTD)







## Driving Simulation HiL



## Hardware-in-the-Loop- Test von vorausschauenden Fahrerassistenzsystemen

Die neue Generation von Fahrerassistenzsystemen verwendet neben physikalischen Umfelddaten auch logische Informationen zur vorausschauenden Berechnung von Fahrsituationen. Diese Informationen stammen aus Navigationsdatenbanken, von Service Providern oder aus der Vernetzung mit anderen Fahrzeugen. Für die Absicherung derartiger Systeme an einem Hardware-in-the-Loop-Prüfstand ist eine Integration dieser Daten in bestehende Testprozesse notwendig. In diesem Artikel wird aufgezeigt, wie die Audi AG gemeinsam mit der Audi Electronics Venture GmbH durch den Einsatz innovativer technischer Lösungen eine Simulation derartiger Szenarien ermöglicht.

# Driving Simulation **ViL**

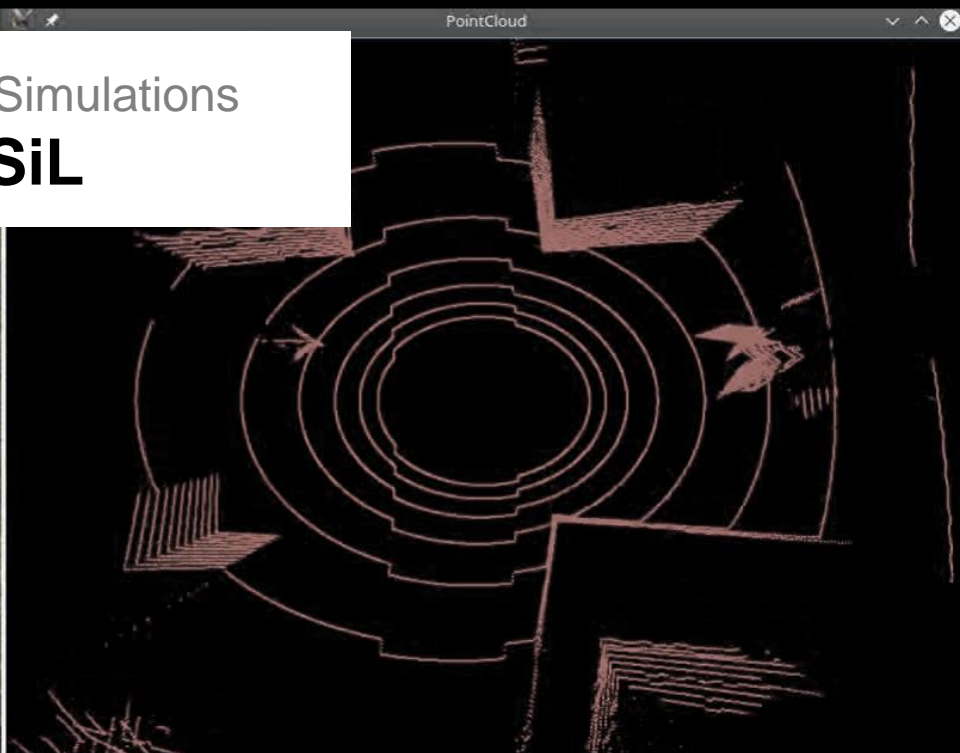






# Driving Simulations

## SiL



Simulation Frameworks

e.g.



ROS





# Motivation

Why Driving Simulation?

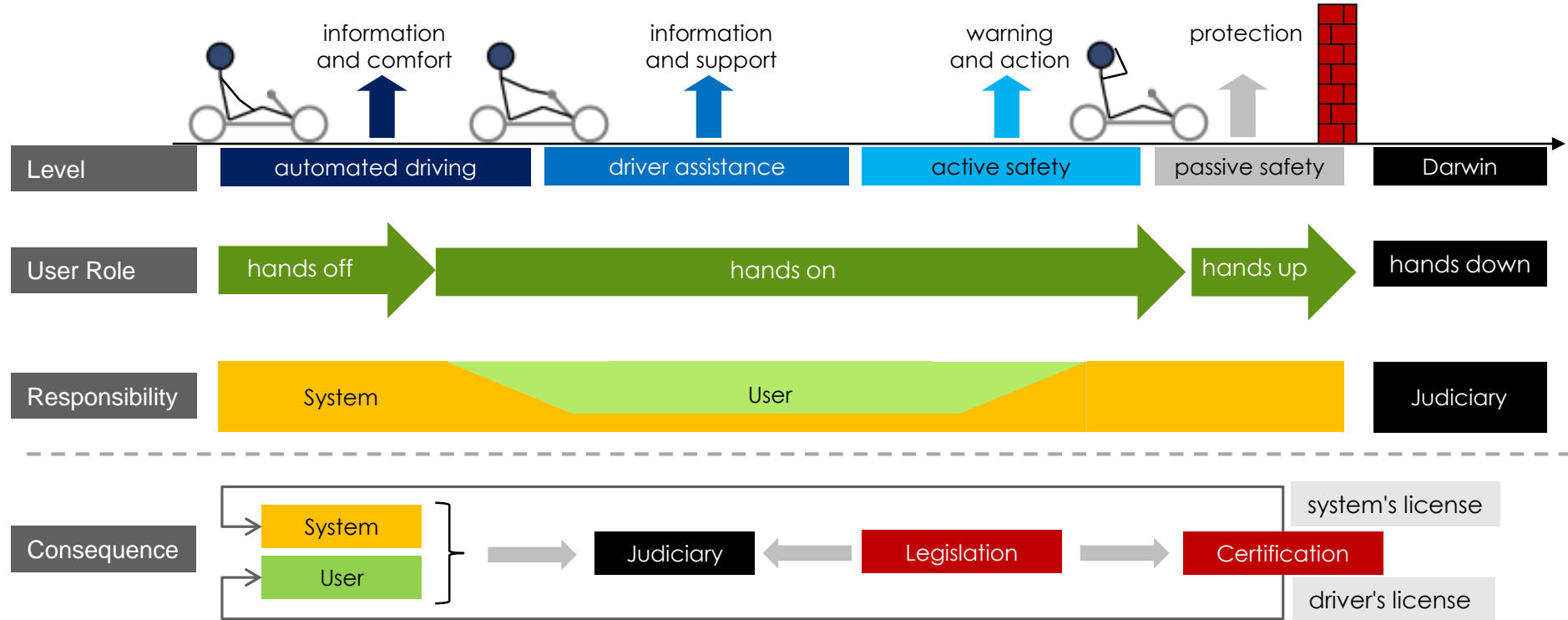
# Motivation

## things can go wrong...



# Motivation

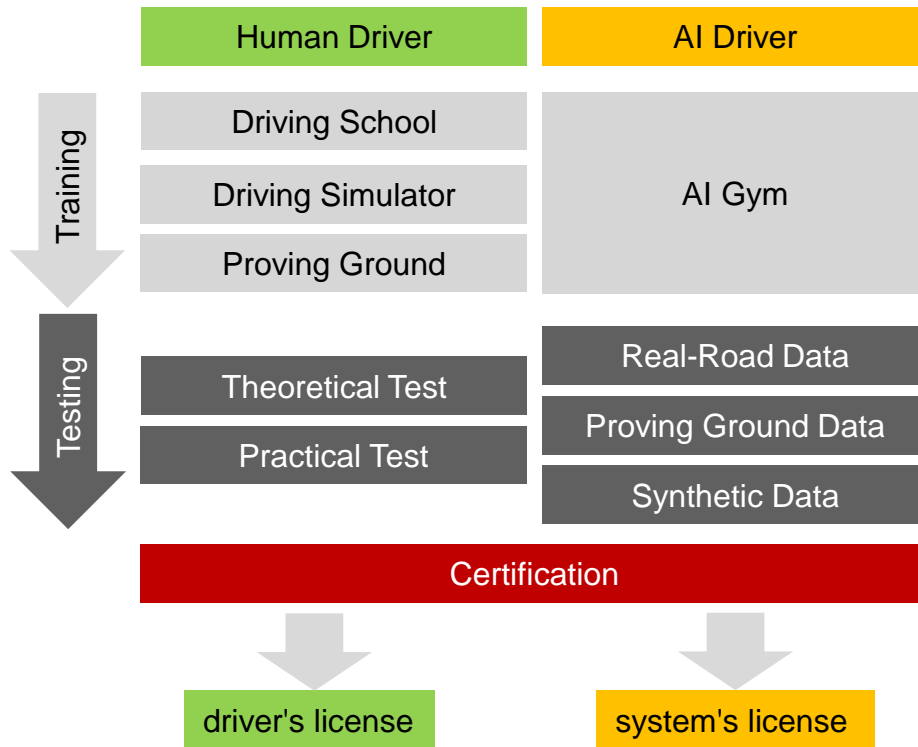
## Highly Automated Cars Have To Be Safe!





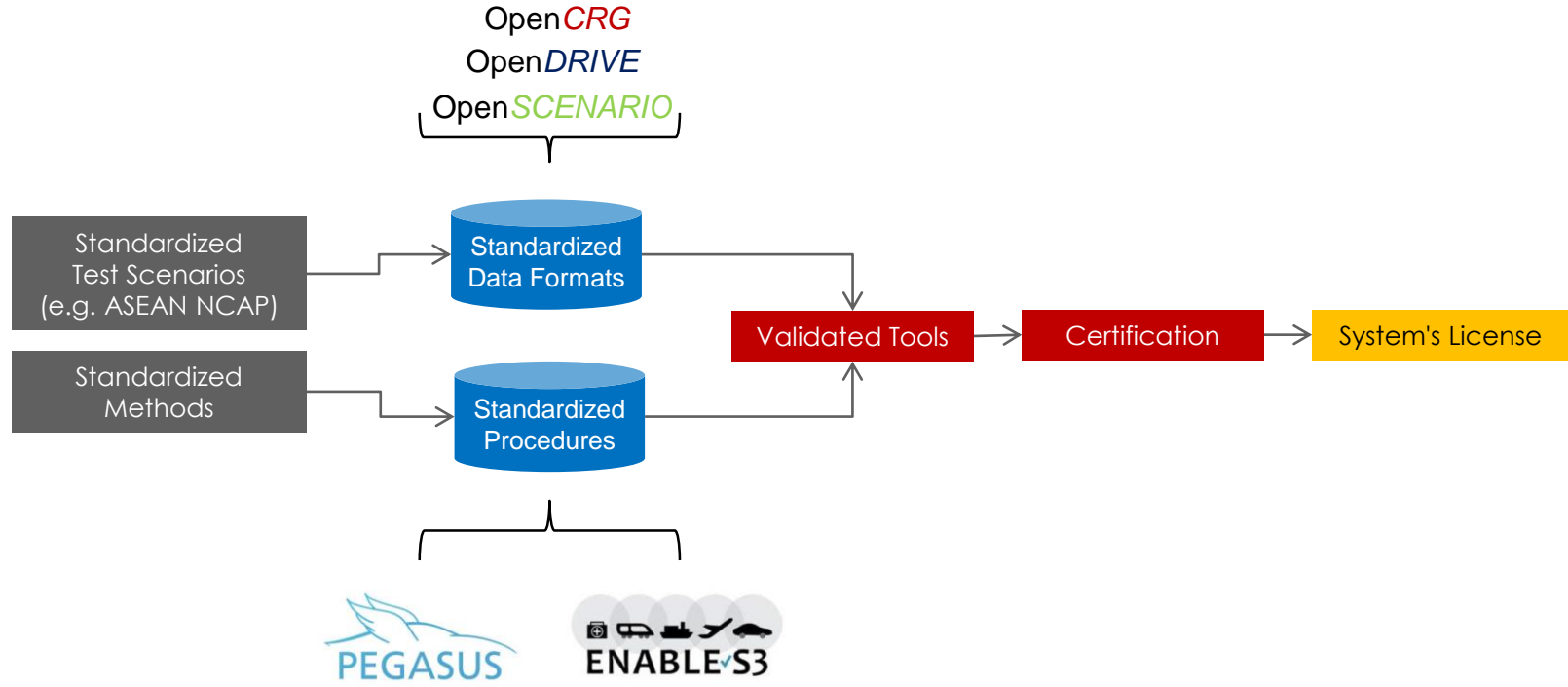
# Motivation

## Certification Requires Training and Testing



# Simulation-Based Certification

## Standards and Validated Tools Required!



# Simulation-Based Validation and Certification

## A few Building Blocks...



Open *SCENARIO*



Simple Steering



Two lane changes



Two lane changes & emergency brake



Lane change right/left



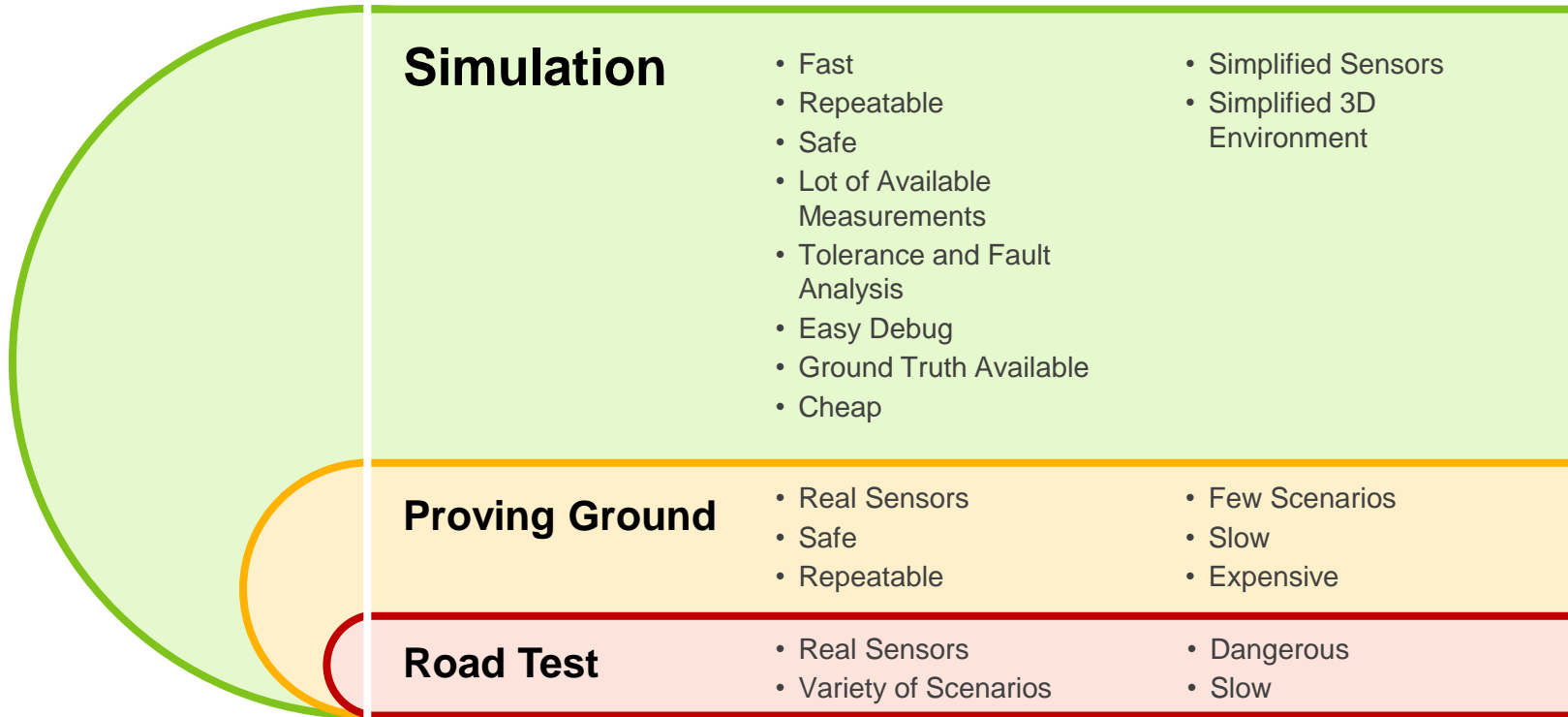
Overtaking



Traffic jam and corridor

# Simulation-Based Validation and Certification

## Assuring Proper Coverage of “Corner Cases”





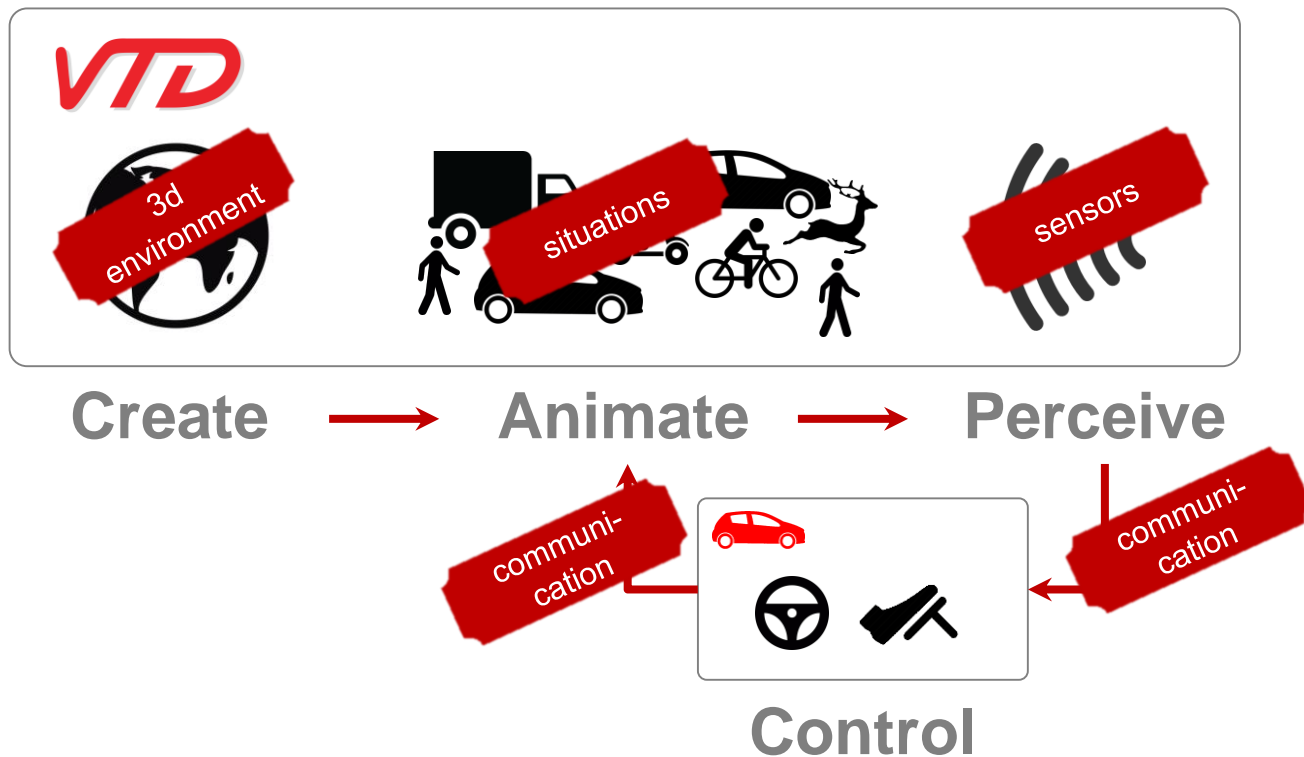


# Environment Simulation

Standards Make Life a lot Easier...

# Standards for Environment Simulation

## Application



# Standards for Environment Simulation

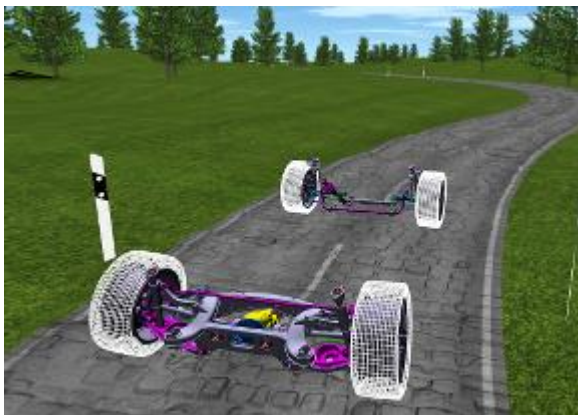
## Inspired by VIRES

Open*DRIVE*



network  
2006+

Open*CRG*



surface  
2008+

Open*SCENARIO*



maneuvers  
2016+

Static Content

Dynamic Content

# Standards for Environment Simulation

## Open*DRIVE*



## Open*CRG*



## Open*SCENARIO*



### initiators

Daimler  
VIRES

Audi  
BMW  
Daimler  
Porsche  
Volkswagen

asc(s)  
Daimler  
HLRS  
Opel  
Porsche  
VIRES

### seed funding

internal

initiators

initiators

### type

open format

open source

open format+



# Standards for Environment Simulation

Open*DRIVE*



Open*CRG*



Open*SCENARIO*



**funding**

intern

**management**

ASAM

team

VIRE

ASAM

Daimler

intern

ASAM

team

ASAM's **tasks**

collect requirements and write the documents

run issue tracking and support system

run website

run newsletter

# Standards for Environment Simulation

12 years in the making...

## Our Rulebook

### **ACT**

- Standards will only gain momentum if someone takes the lead

### **CO-OPERATE**

- Invite and include interested parties

### **IGNORE**

- Ignore your company's short-term interests

### **FOCUS**

- Standardize in batches that can be handled and maintained

### **CREATE**

- There's a whole universe left to be standardized!



Thank You.

