

# OpenDRIVE

managing the road ahead

*7<sup>th</sup> Meeting*

*February 01, 2011*

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DAIMLER

## *Agenda*

- 16:30 Welcome, Agenda and Introduction of Participants
- 16:35 OpenDRIVE – available since five years now
- 17:00 User Report by BMW Research and Technology
- 17:15 User Report by VTI
- 17:30 User Report by DLR
- 17:45 User Report by TrianGraphics
- 18:00 Technical Issues for OpenDRIVE 1.4
- 19:00 From OpenFormat to OpenSource
- 19:20 Roadmap and Next Meeting

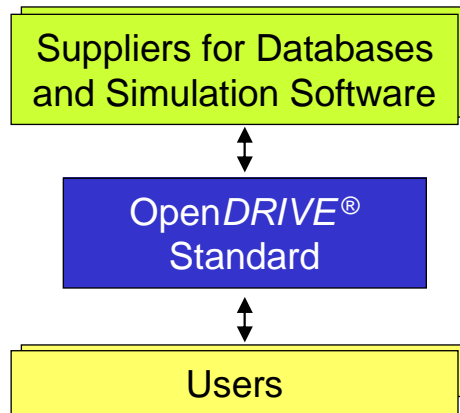
## What is OpenDRIVE?

**OpenDRIVE** is an **open format** for the description of **road networks**

- usage for free
- XML-based
- human readable
- customizable
- extensible
- established



## A Simple Idea



### Benefits

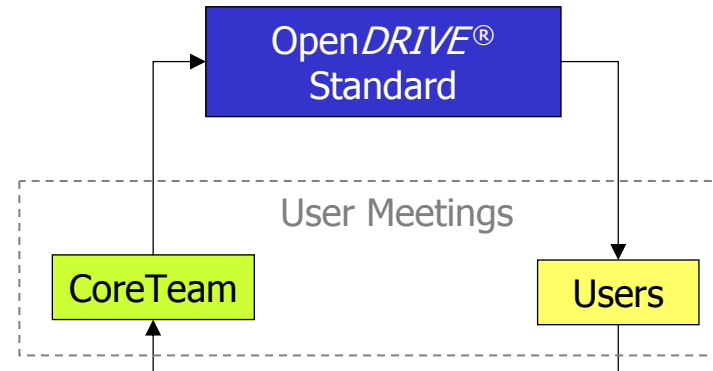
- simplified exchange of road networks between simulators
- creation of database pools for multi-party projects
- selection from a broader range of suppliers

### Elements

- road geometry
  - reference line
  - elevation / superelevation
  - lanes etc.
- signaling
  - signs / signals
- road type and speed profile
- macroscopic road surface
  - materials
  - patches
- infrastructure
  - tunnels
  - bridges etc.
- arbitrary objects
- variations (data sets)
- custom extensions (user data)

- 2005** – Daimler and VIRES “invent” OpenDRIVE, based on Daimler’s DRIVE format
  
- 2006**
  - *Jan./Feb.:* Activation of OpenDRIVE website, publication of V 0.6
  - *May:* Publication of V 0.7, meeting at VIRES, installation of core team
  - *July:* OpenDRIVE 1.0, user meeting at Daimler
  - *October:* OpenDRIVE 1.1, OpenDRIVE at DSC in Paris
  
- 2007**
  - *March:* user meeting at BMW, discussion of Road Surface Data
  - *September:* OpenDRIVE 1.2, meeting at DLR
  
- 2008** – Work, don't meet! – More users, more feedback
  
- 2009** – TrainALL request for standardization
  
- 2010**
  - *Jan.:* User Meeting at Rheinmetall Defence Electronics
  - OpenDRIVE V 1.3 at DSC in Paris
  
- 2011** – *Feb.:* User Meeting in Monaco

## A Well Managed Format













### Core Team

- Martin Strobl / BMW Forschung und Technik GmbH
- Hans Grezlikowski / Daimler AG
- Andreas Richter / Deutsches Zentrum für Luft- und Raumfahrt e.V.
- Dr. Günther Nirschl / Fraunhofer-Institut IVI
- Ekkehard Klärner / Krauss-Maffei Wegmann GmbH & Co. KG
- Dr. Bernhard Bock / Rheinmetall Defence Electronics GmbH
- Ingmar Stel / TNO
- Marius Dupuis / VIRES Simulationstechnologie GmbH
- Mats Lidström / VTI

## Users

**OpenDRIVE**  
managing the road ahead

 Audi Electronics Venture GmbH	<a href="#">Link to website...</a>
 BMW Group Research and Technology	BMW Group Research and Technology applies OpenDRIVE® and is convinced by its key benefits like the facts that OpenDRIVE® is a comprehensive and community proven approach for describing road networks as well as it enables the exchange of software components and databases. <a href="#">Link to website...</a>
 DAIMLER	Daimler uses OpenDRIVE® in its driving simulators as an efficient road description standard and profits from well-proven utilization and exchange between different applications. <a href="#">Link to website...</a>
 Deutsches Zentrum DLR für Luft- und Raumfahrt e.V. in der Helmholtz-Gemeinschaft	At DLR <i>Institute of Robotics and Mechatronics</i> , the OpenDRIVE® standard is used for road definitions in the context of simulations for the assessment of mechatronic vehicle components and vehicle dynamics control systems. <a href="#">Link to website...</a> DLR <i>Institute of Transportation Systems</i> uses OpenDRIVE® as road description for generating virtual landscapes based on real world data. <a href="#">Link to website...</a>
 Fraunhofer IVI	OpenDRIVE® supports the efficient development of road networks in the Fraunhofer IVI driving simulator and facilitates the exchange with other research partners. <a href="#">Link to website...</a>
 KRAUSS-MAFFEI WEGMANN	<a href="#">Link to website...</a>
 Mercedes-Benz technology	The MBtech Group uses OpenDRIVE® in its tool suite along the automotive development and testing chain as it is a very clever, flexible and de-facto standard format for road networks. <a href="#">Link to website...</a>
 Realtime Technologies, Inc	RTI has found the OpenDRIVE® standard to be comprehensive in its coverage of features needed for our autonomous traffic driving on correlated data. <a href="#">Link to website...</a>
 TESIS DYNAware	<a href="#">Link to website...</a>
 TrianGraphics Intelligent Terrain Solutions	TrianGraphics GmbH has integrated OpenDRIVE® export into their database generation system Trian3D Builder. Thus the automatic urban generation with roads and complex crossings is usable in driving simulators. <a href="#">Link to website...</a>
 TECHNISCHE UNIVERSITÄT MÜNCHEN	The OpenDRIVE® standard facilitates efficient exchange of data between universities and industrial partners. <a href="#">Link to website...</a>
 VIRES Simulationstechnologie GmbH	With OpenDRIVE® we were able to standardize key components of our tool-chain and make them available to a broad customer base without further adaptations. <a href="#">Link to website...</a>
 vti FINDING A BETTER WAY	VTI, Swedish National Road and Transport Research Institute, is an independent and internationally prominent research institute within the transport sector. VTI is a world leader in several areas, for instance in simulator technology. VTI's high fidelity vehicle simulators use OpenDRIVE® as the standardized road database in order to enhance the software environment and be compatible with external simulator facilities. <a href="#">Link to website...</a>

Please register!

It's free  
and  
without obligations.

...and quite a few more across the planet.



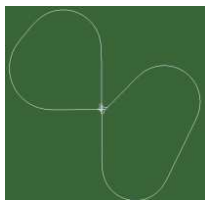
### VIRES Town

- Cross-country and inner-city roads with various OpenDRIVE elements
- Available since V 0.7



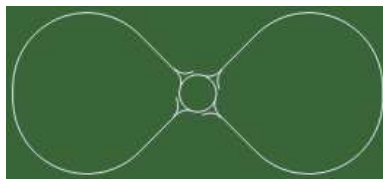
### VIRES 8 - simple

- simple crossing with traffic lights in endless course



### 8 - complex

- complex crossing with traffic lights in endless course



### VIRES 8 - roundabout

- roundabout in endless course

More examples welcome!



## **An Established Format**

- Papers
  - DSC 2006, 2008, 2010
  - SafetyExpo 2010
  - AutoTest 2010
- Free Software
  - OpenRoadEd
- References
  - Wikipedia
  - VTI Simulator Technology
  - Virtual Terrain Project
  - Papers and theses about testing driver assistance systems, road creation, vehicle-in-the-loop testing, road visibility, intelligent agents in driving simulation, traffic simulation
  - Simulation of urban mobility (SUMO) within AutoNomos
  - Driver behavior models

### Existing

- Vehicle Driving Simulation
- Tram Driving Simulation
- Railroad Simulation
- Conversion and Export of Navigation Data

### New Fields

- Town and Country Planning?

# *User Reports*

# *Partner Project*

## Partner Project

- road surface
- open format + open source
- tire and vibration simulation
- funded by automotive industry
- managed by VIRES
- release 1.0 in Q2/2010
- user meeting in June 2010
- available in
  - Delft tire
  - ADAMS
  - etc.
- [www.opencrg.org](http://www.opencrg.org)

OpenCRG®  
managing the road surface ahead



Image courtesy of Daimler

# *Standardization*

## Situation

- The OpenDRIVE format is a de facto standard
  - standardization by proliferation
  - total number of users: unknown
  - confirmed contacts: 50+
  - years in service: 5
- Other formats emerged in 2009
- TRAIN-ALL project aims for formal standardization of road description
  - Nov. 11, 2009: meeting TRAIN-ALL / VIRES / OKTAL for a first brainstorming on the issue of formal standardization
  - Jan. 22, 2010: OpenDRIVE and RoadXML decide for mutual assessment of each other's format until mid 2010; results are to be evaluated by TNO
  - June / August 2010: VIRES / OKTAL provide reports to TNO
  - evaluation still pending

# *Discussion / Roadmap*



## Data Format (V 1.4)

- Handling of GPS co-ordinates
- Intersection Design
- Templates

## Services

- Style guide

## Software

- Any volunteers for free software?
- Test Tools required
- **VIRES OpenDRIVE Manager "light"** now free also for commercial applications

*Thank You!*