

OpenDRIVE

managing the road ahead

7th Meeting

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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

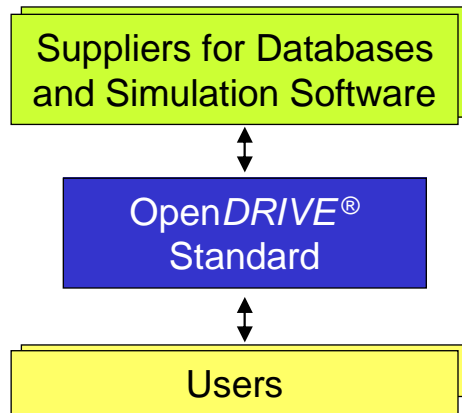
What is OpenDRIVE?

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

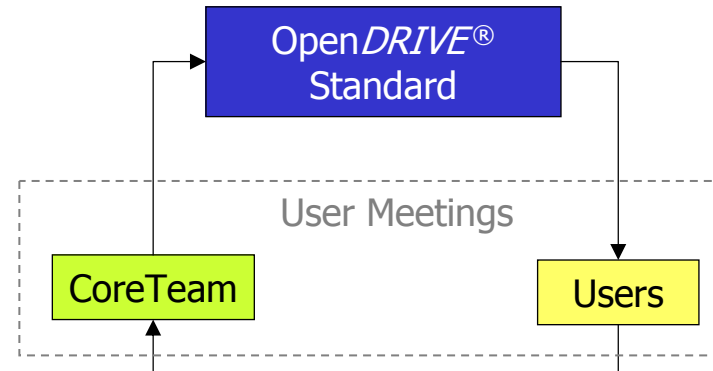
- 2008** – Work, don't meet! – More users, more feedback

- 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	Link to website...
 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. Link to website...
 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. Link to website...
 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. Link to website... DLR <i>Institute of Transportation Systems</i> uses OpenDRIVE® as road description for generating virtual landscapes based on real world data. Link to website...
 Fraunhofer IVI	OpenDRIVE® supports the efficient development of road networks in the Fraunhofer IVI driving simulator and facilitates the exchange with other research partners. Link to website...
 KRAUSS-MAFFEI WEGMANN	Link to website...
 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. Link to website...
 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. Link to website...
 TESIS DYNAware	Link to website...
 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. Link to website...
 TECHNISCHE UNIVERSITÄT MÜNCHEN	The OpenDRIVE® standard facilitates efficient exchange of data between universities and industrial partners. Link to website...
 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. Link to website...
 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. Link to website...

Please register!

It's free
and
without obligations.

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



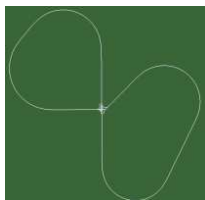
VIRES Town

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



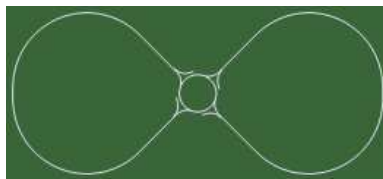
VIRES 8 - simple

- 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

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!