OpenDRIVE
managing the road ahead

7th Meeting
February 01, 2011

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**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
**Definition**

**What is OpenDRIVE?**

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

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

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)
A Brief History

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
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 für Luft- und Raumfahrt e.V.

At DLR Institute of Robotics and Mechatronics, 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...

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...

OpenDRIVE® is used 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 network data. Link to website...

RTI has found the OpenDRIVE® standard to be comprehensive in its coverage of features needed for our autonomous traffic driving on compliant data. Link to website...

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...

The OpenDRIVE® standard facilitates efficient exchange of data between universities and industrial partners. Link to website...

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, 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...

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

**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
  - 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
Applications

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

Image courtesy of Daimler
**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!