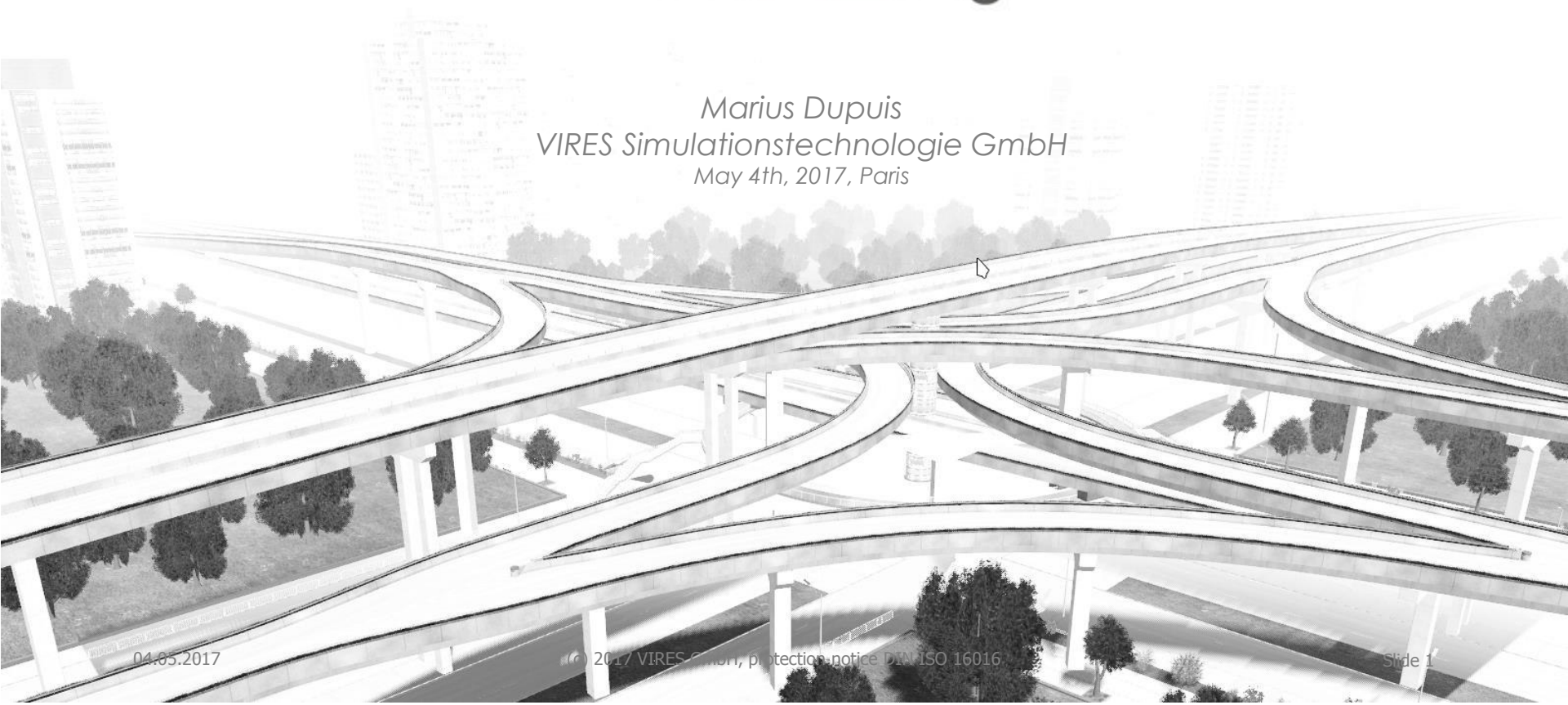
OpenDRIVE

managing the road ahead

goes

railML.org

Marius Dupuis
VIRES Simulationstechnologie GmbH
May 4th, 2017, Paris



Summary

Summary

OpenDRIVE®
managing the road ahead

a road is a road is a road is a road is a road is a road is a road is a road is a road
is a road is a road is a road is a road is a road is a road is a road is a road is a
road is a road is a road is a road is a road is a road is a road is a road is a road is
a road is a road is a road is a road is a road is a road is a road is a road is a road
is a road is a road is a road is a road is a road is a road is a road is a road is a
road is a road is **a road** is a road is a road is a road is a road is a road is a road is
a road is a road is a road is a road is a road is a road is a road is a road is a road
is a road is a road is a road is a road is a road is a road is a road is a road is a
road is a road is a road is a road is a road is a road is a road is a road is a road is
a road is a road is a road is a road is a road is a road is a road is a road is a road
is a road is a road is a road is a road is a road is a road is a road is a road is a
road is a road is a road is a road is a road is a road is a road is a road is a road is
a road is a road is a road is a road **is a road** is a road is a road is a road is a road
is a road is a road is a road is a road is a road is a road is a road is a road is a
road is a road is a road is a road is a road is a road is a road is a road is a road is
a road is a road is a road is a road is a road is a road is a road is a road is a road
is a road is a road is a road is a road is a road is a road is a road is a road is a
road is a road is a road is a road is a road is a road is a road is a road is a road is
a road is a road is a road is a road is a road is a road is a road is a road is a road
is a road is a road is a road is a road is a road is a road is a road is a road is a
road is a road is a road is a road is a road is a road is a road is a road is a road is
a road is a road is a road is a road is a road is a road **is a road** is a road is a road
is a road is a road is a road is a road is a road is a road is a road is a road is a
road is a road is a road is a road is a road is a road is a road is a road is a road is
a road is a road is a road is a road is a road is a road is a road is a road is a road
is a road is a road is a road is a road is a road is a road is a road is a road is a
road is a road is a road is a road is a road is a road is a road is a road is a road is
a road is a road is a road is a road is a road is a road is a road is a road is a road

Summary

OpenDRIVE®

*is designed for **driving simulation***

Applications

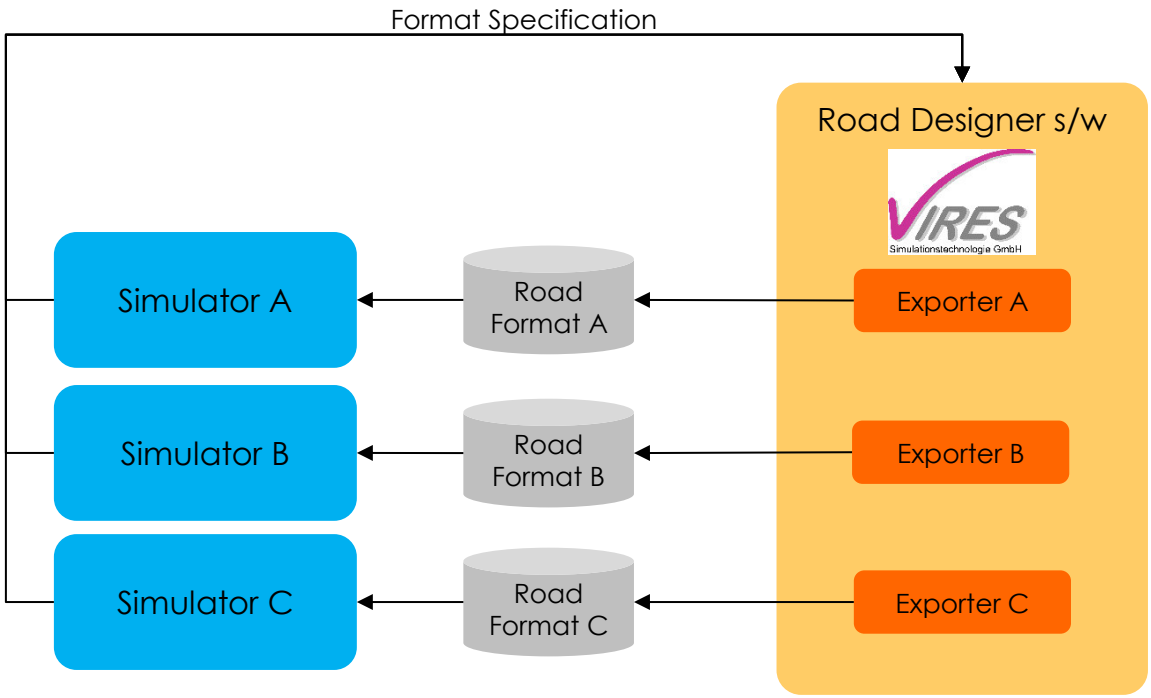
Applications

Applications

History

History

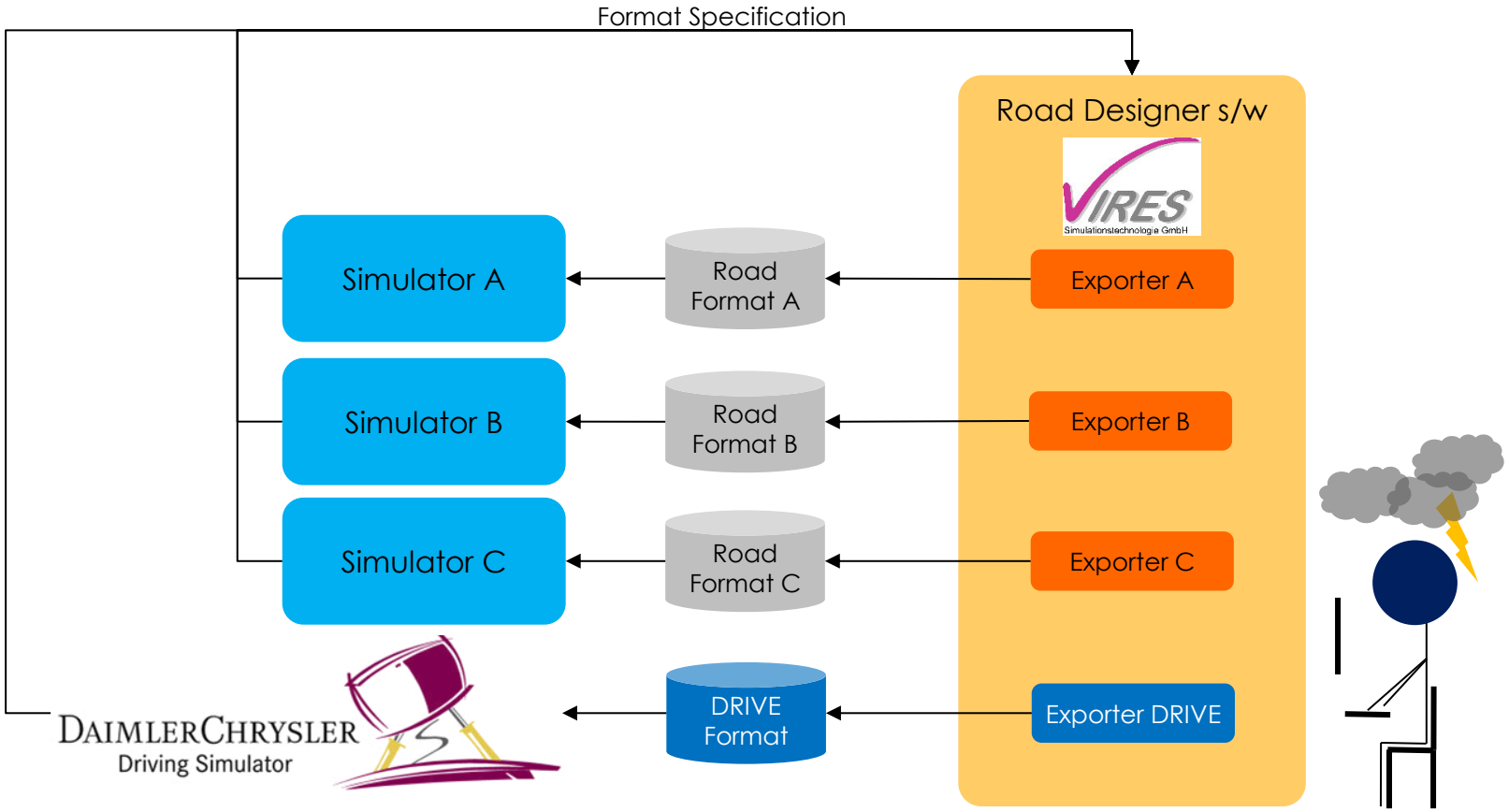
Before 2004...



→ n ways to describe the same thing!

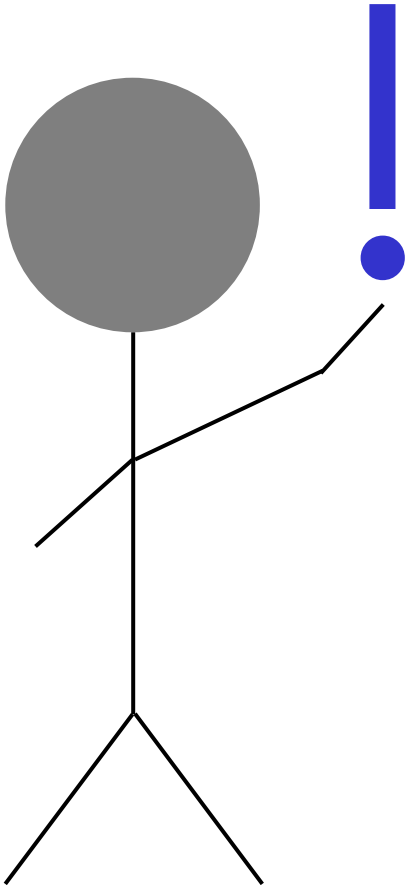
History

Back in 2004...



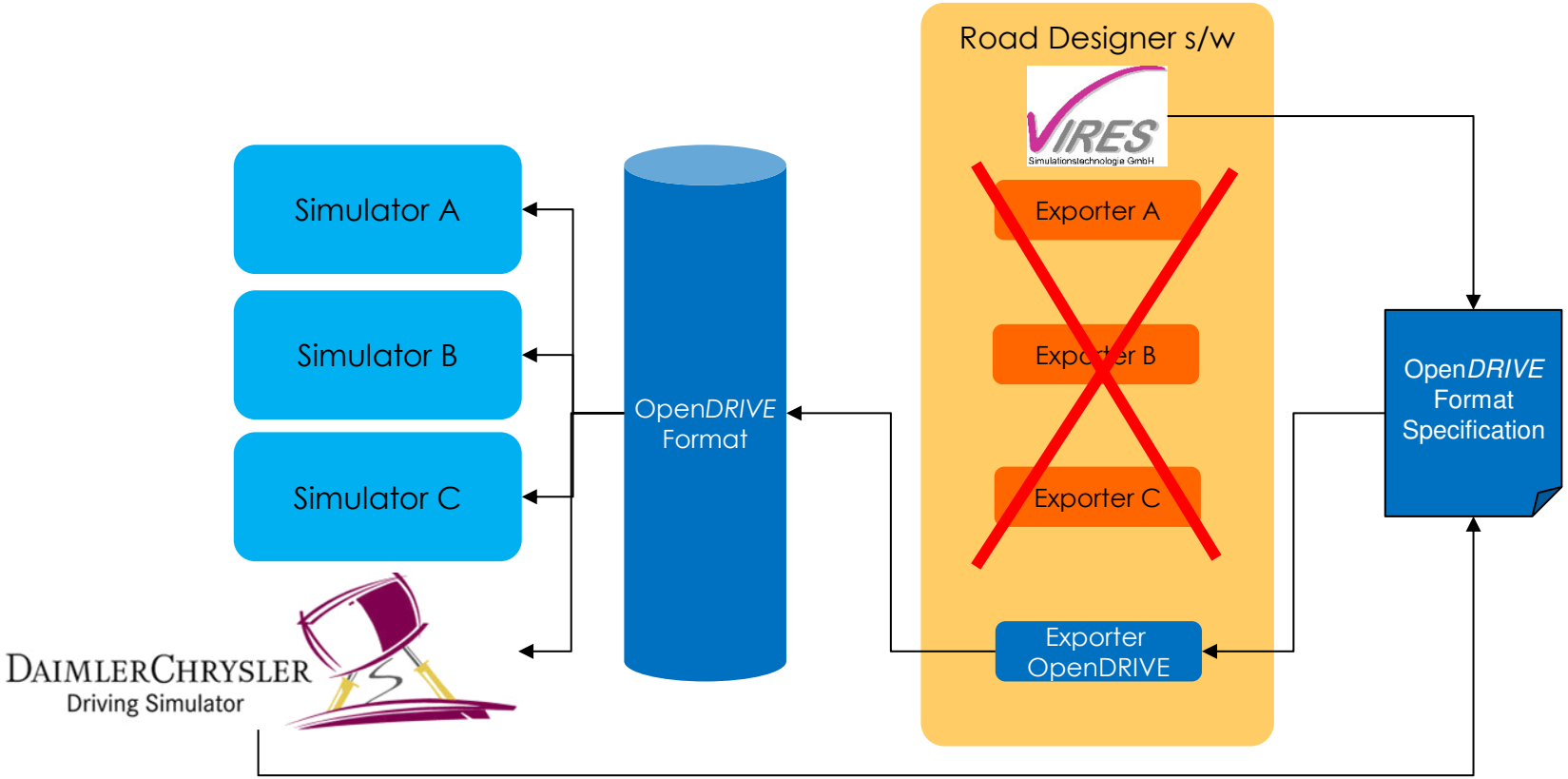
History

Starting 2005...



History

Starting 2005...



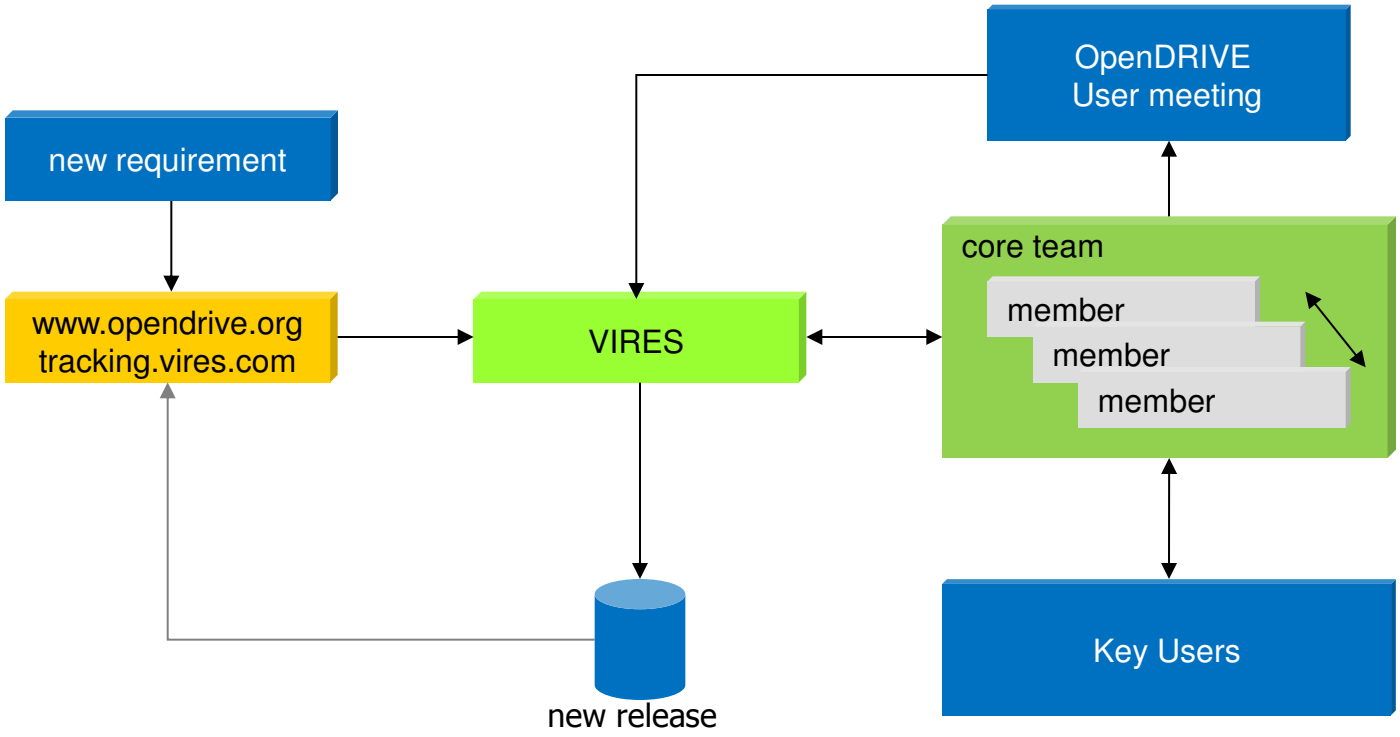
Status

Status – what we have today

OpenDRIVE®
managing the road ahead

- **Website:** www.opendrive.org
- **Newsletter:** newsletter@opendrive.org
- **Support:** tracking.vires.com / opendrive@opendrive.org
- **Specification:** 1.4H (last stable)
  1.5 (draft)
- **Style Guide:** available on Open*DRIVE*® website
- **Viewer:** availabe on Open*DRIVE*® website
- **Validation:** Open*DRIVE*® validator in ticket system
- **Core Team:**
  - **BMW:** Mohammad Bahram
  - **Daimler:** Hans Grezlikowski
  - **DLR:** Andreas Richter
  - **HERE:** Alex Goldberg
  - **KMWEG:** Ekkehard Klärner
  - **Rheinmetall:** Dr. Bernhard Bock
  - **VIRES:** Marius Dupuis
  - **VTI:** Laban Källgren
  - **3D Mapping**: Philip Paulsteiner
- **Users:** uncounted (OEMs, Tier1s, tool suppliers, research institutes, universities, mapping companies...)

Development Process



How open is it?

- OpenDRIVE® is an open format, not a public format
- The specification of OpenDRIVE® is publicly available for free on www.opendrive.org
- Use of the OpenDRIVE® format is free (no license fees apply) and only subject to the license agreement provided with the specification

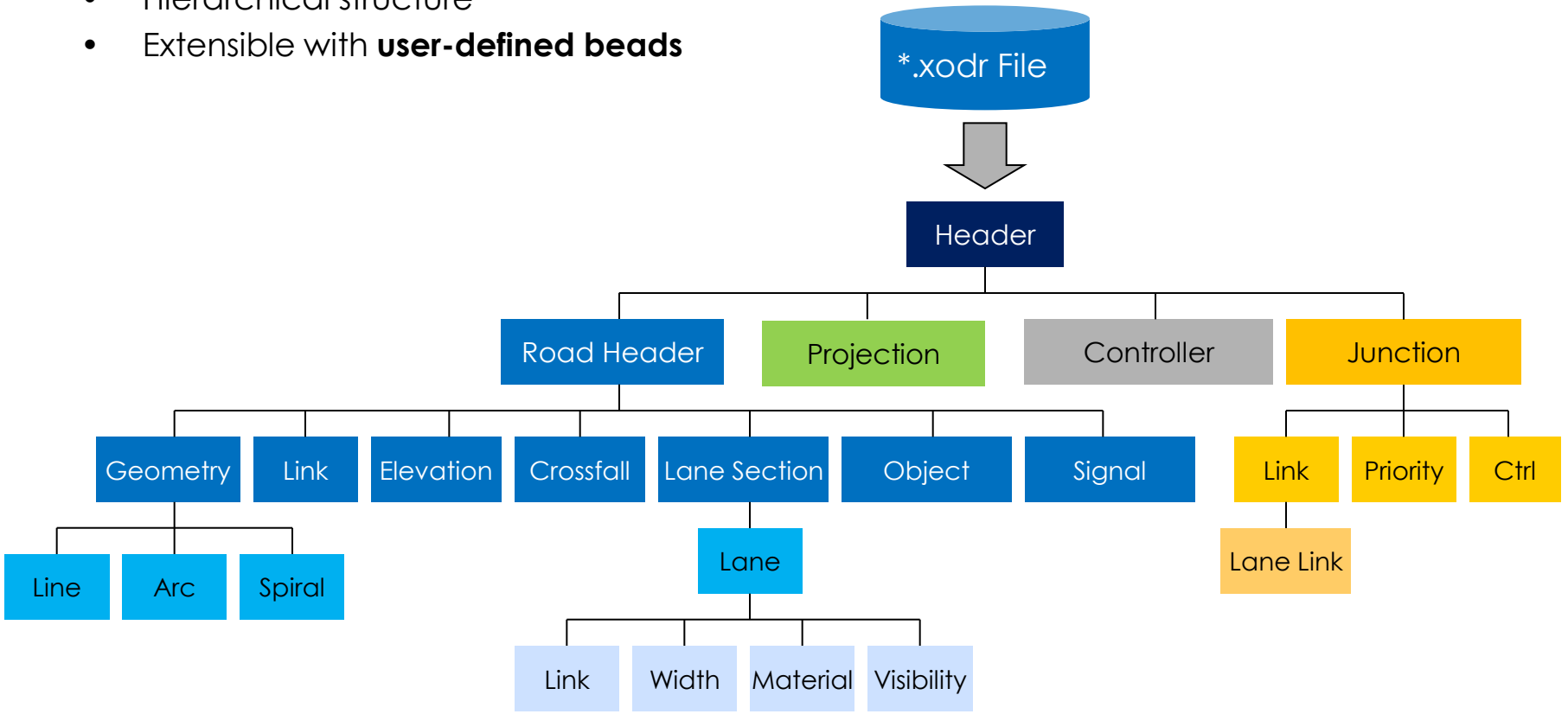
- The trademark, website and data format are owned by VIRES Simulationstechnologie GmbH, Germany
- VIRES manages the data format, the website and the information exchange within the OpenDRIVE community

currently being discussed

Technical Issues

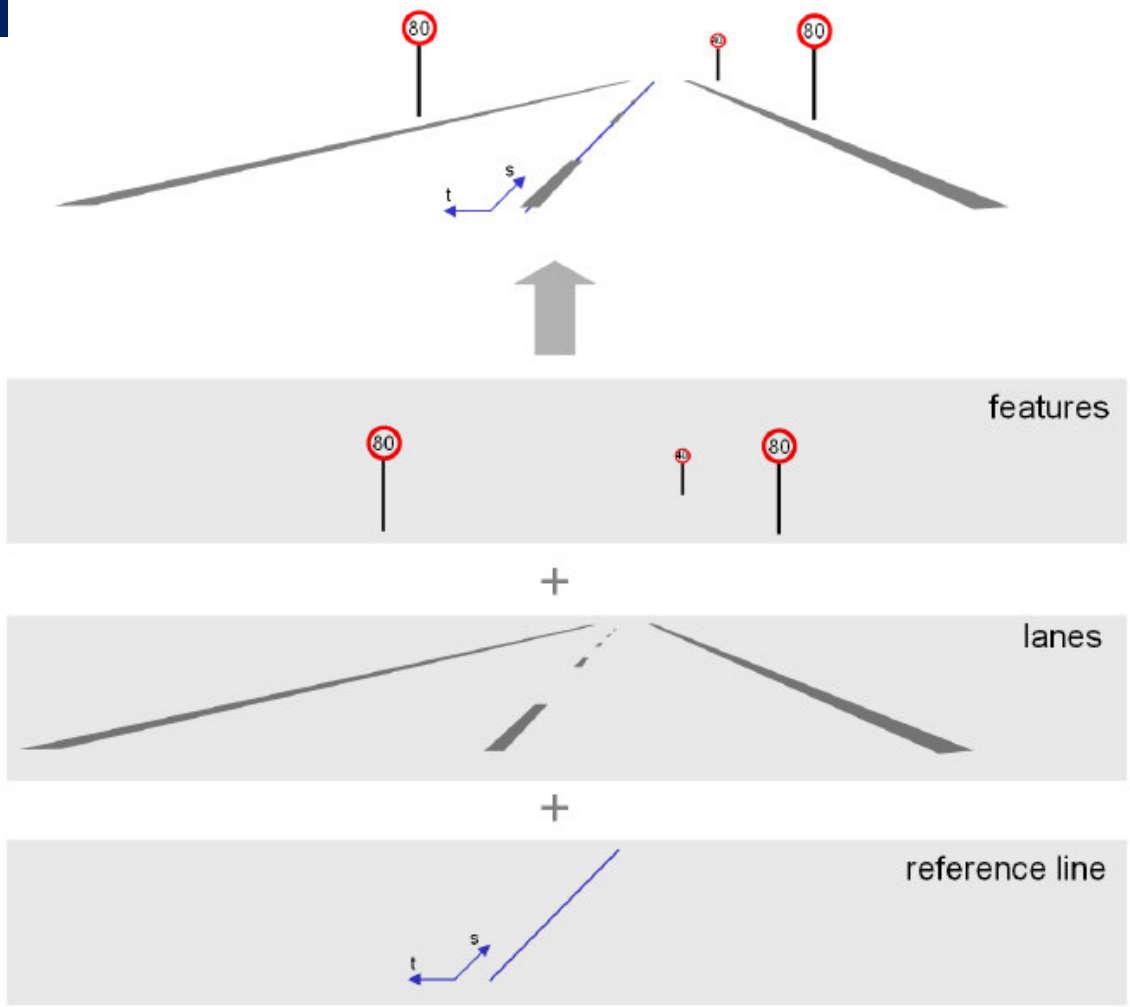
File Format

- XML Format
- Hierarchical structure
- Extensible with **user-defined beads**



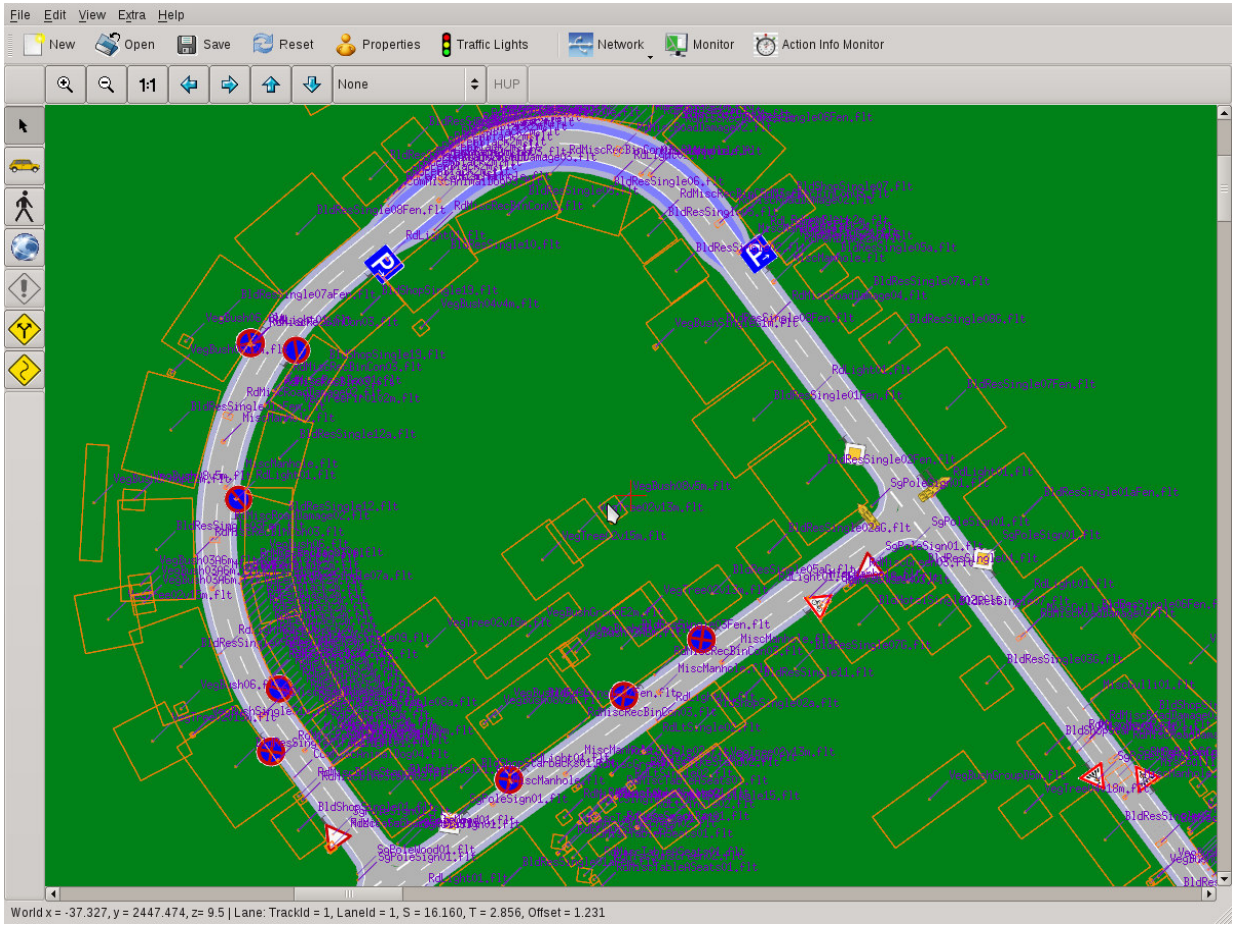
Note: the above figure is not complete and only shows a fraction of available beads

Road Structure



All features are described **relative** to a road's **reference line.**

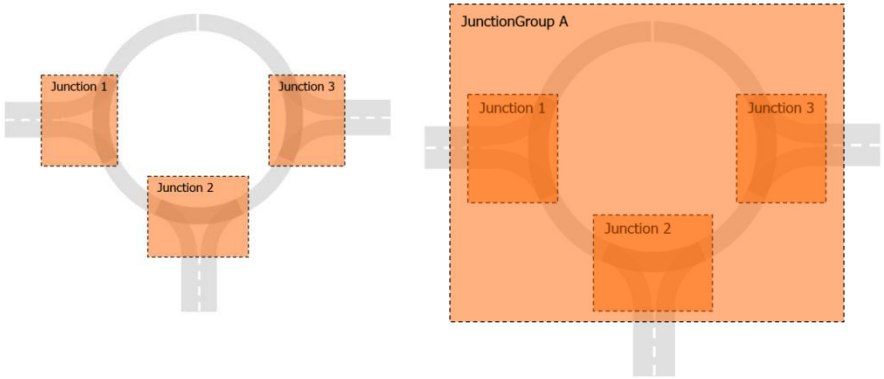
Road Structure



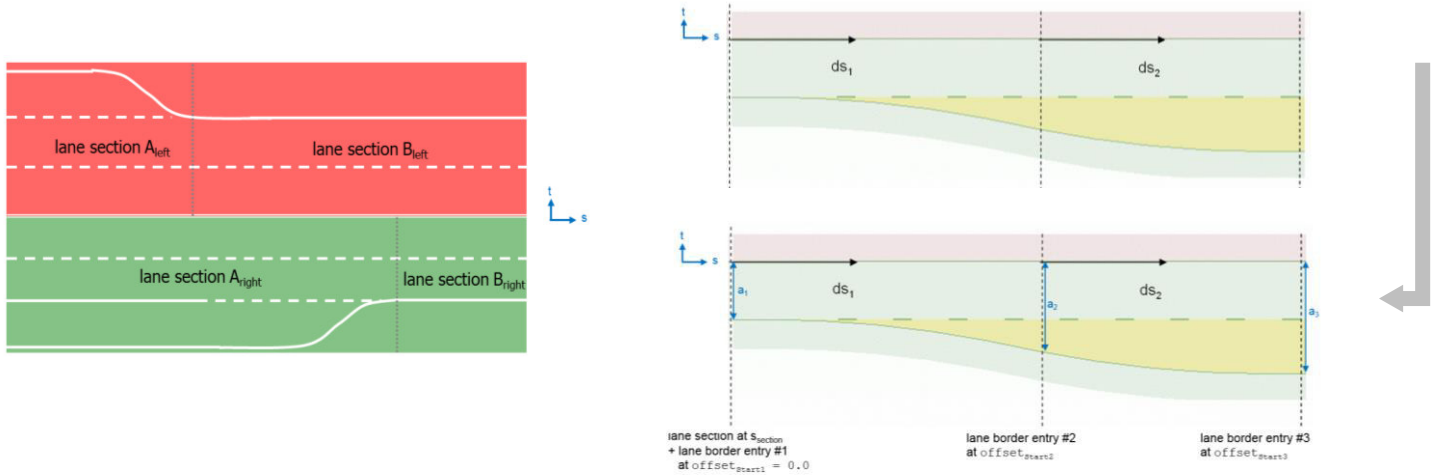
OpenDRIVE® covers areas / objects **beyond the lane border**.

Flexible Concepts (Examples)

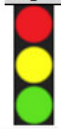
Road Connection



Lanes



Signals / Signs

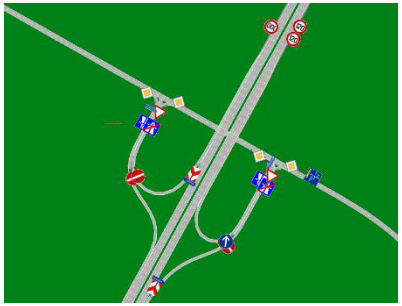
signal	type	subtype	signal	type	subtype	signal	type	subtype
	1.000.001	-		1.000.008	-		1.000.011	10
	1.000.002	-		1.000.008	10		1.000.011	20
	1.000.002	10		1.000.008	20		1.000.011	30
	1.000.007	-		1.000.009	10		1.000.011	40
	1.000.007	10		1.000.009	20		1.000.011	50
	1.000.007	20		1.000.010	10		1.000.012	10
	1.000.007	30		1.000.010	20		1.000.012	20
							1.000.013	-
							1.000.014	-

Extended Scope

Behind the Scene – Extended Scope

Partnership: Road Surface

OpenDRIVE®

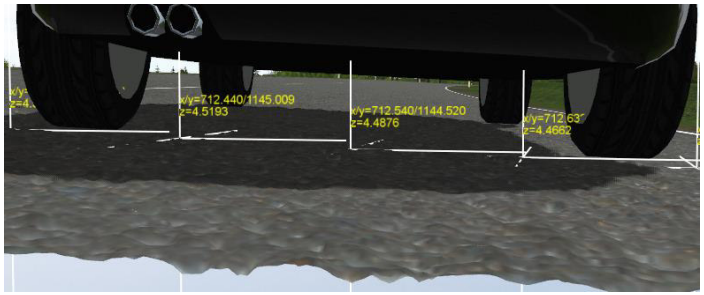


Road Network

+

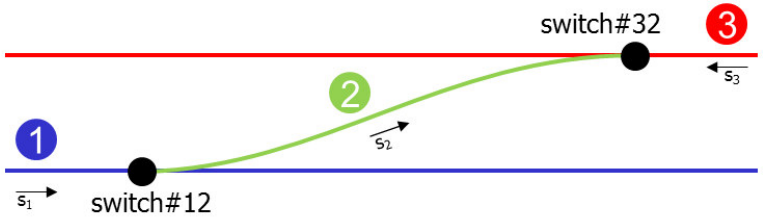
OpenCRG®

Road Surface

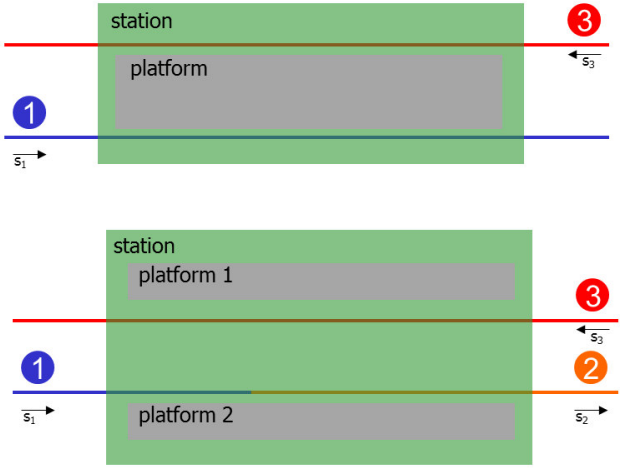


Mixed Concepts

Switches (vs. junctions)



Stations

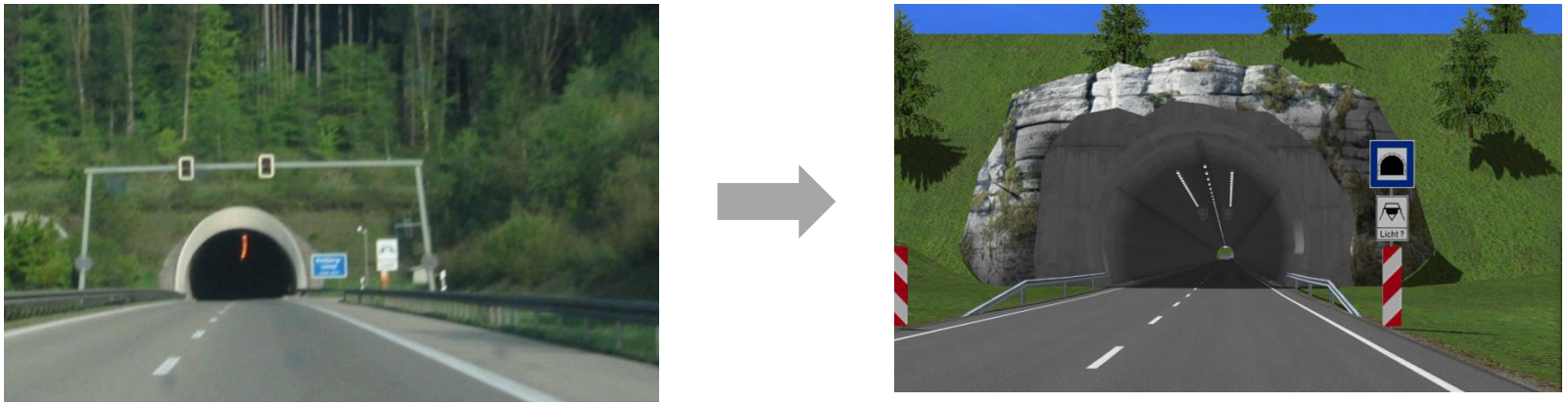


Challenges

Driving simulation has **changed**:

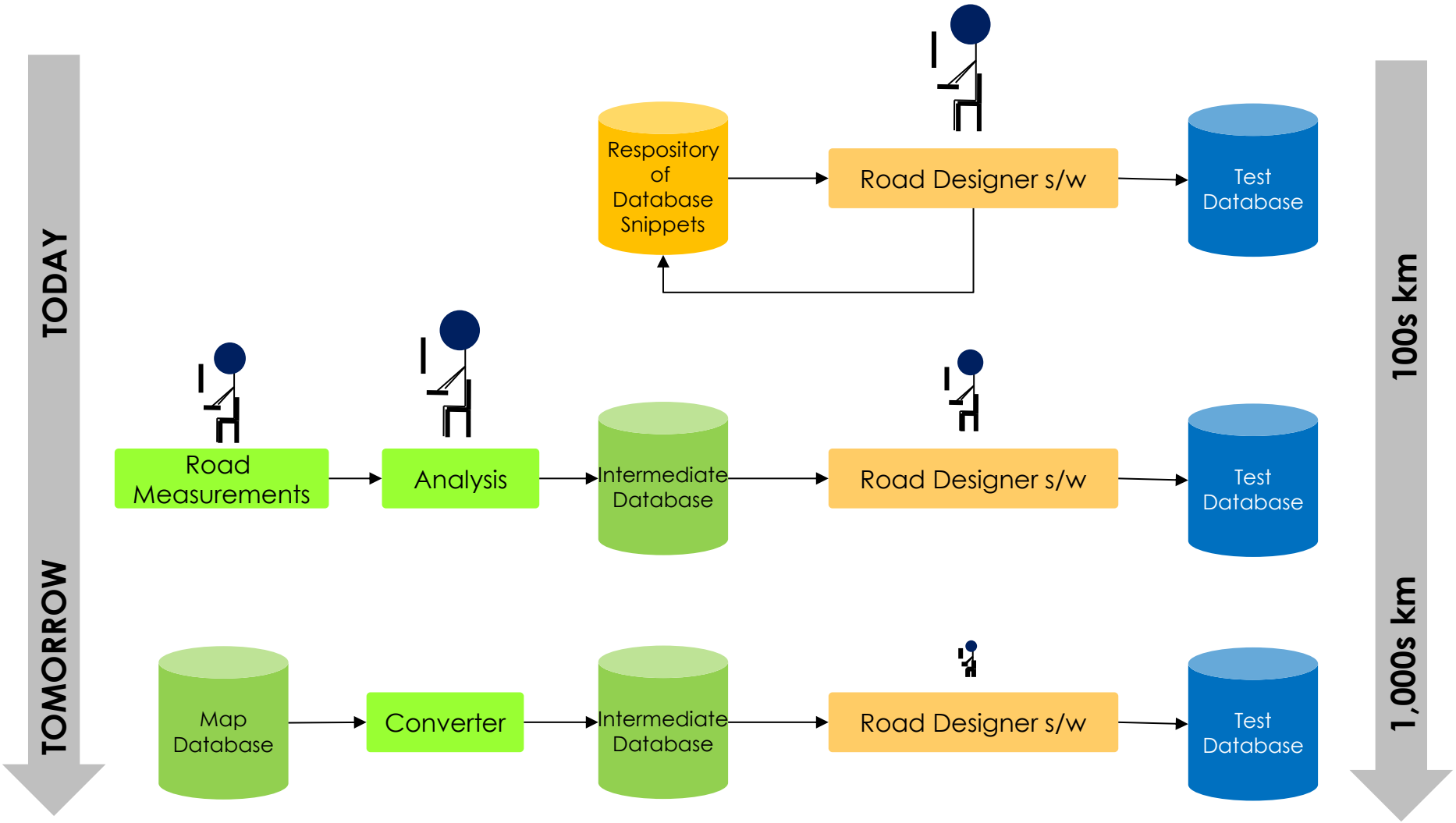
- virtual testing of ADAS etc. has become mandatory
- virtual tests have to be validated against real test rides
- localization data has to be included
- real sensor data has to be matched with virtual sensor data
- the focus is shifting from human learning to machine learning

→ The need for describing **real road networks** in Open*DRIVE*® has increased.



Challenges – Data Sourcing

The **sourcing** of road network data has **changed**:



Challenges – Data Quality

The **quality** of road network data has to **improve**

- support of localization features
- high level of details (e.g. traffic islands, traffic light and sign contours etc.)
- road surface features
- materials
- etc.

→ Sensor simulation should be able to work like the real stuff.

Conclusion

Conclusion

- OpenDRIVE® is a **mature** format
  - in service since 2006

- OpenDRIVE® is a **living** format
  - recently adapted and permanently under review for new use cases

- OpenDRIVE® is an **open standard**
  - large user base
  - available for free without any strings attached

- OpenDRIVE® has to meet current and future **challenges**
  - availability of large road networks
  - highly detailed representation of the real world
  - processes and tools for sourcing from other available data

Thanks for your attention!

Questions?

Join the team...

OpenDRIVE®
OpenCRG®
OpenSCENARIO