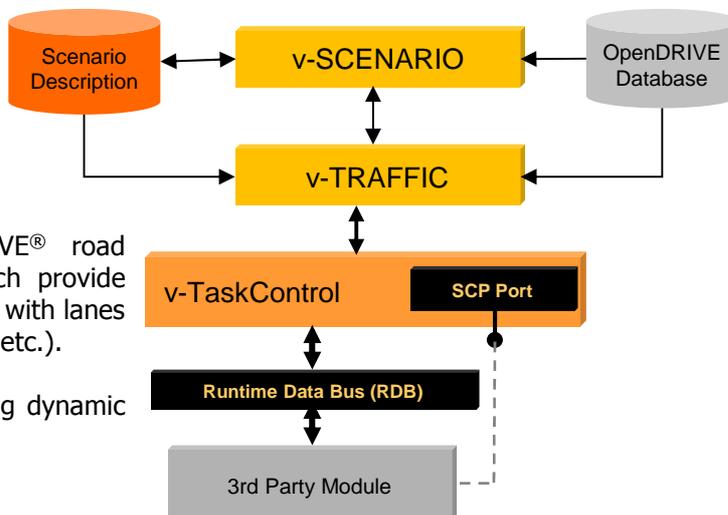# *v-TRAFFIC*™ *v-SCENARIO*™ - Traffic and Scenario Simulation

Our solution for scenario simulation consists of two components:
v-SCENARIO – offline editor and online monitor for traffic scenarios
v-TRAFFIC – the actual traffic and scenario simulation engine.

Traffic scenarios are based on OpenDRIVE® road networks (see also www.opendrive.org) which provide the "static" features of the scenario (e.g. roads with lanes and signs/signals, junctions, crossings, objects etc.).

On top of this, the user may add the following dynamic features:
- players (vehicles and pedestrians)
- objects (e.g. obstacles)
- animation paths
- controller programs for traffic lights
- triggers and actions

All features are added and configured interactively in the intuitive v-SCENARIO editor.

Players representing vehicles consist each of a driver model, a single-track vehicle dynamics model and a graphical 3d-model. An extensive database of parameter sets for driver models, vehicle dynamics models and 3d meshes is available, thus providing a very large number of potential combinations.
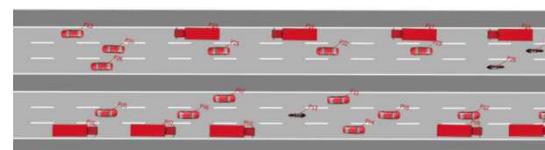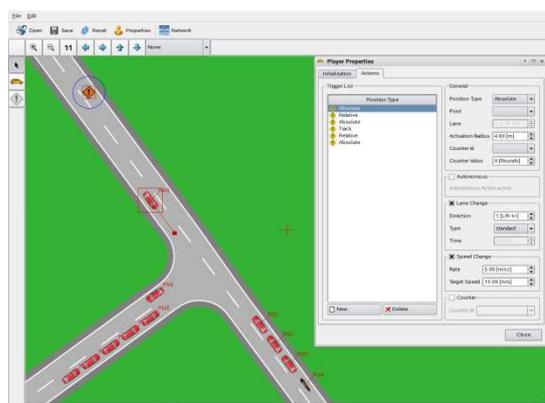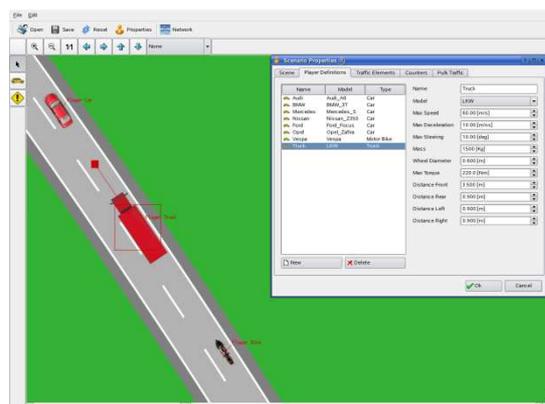
The main driver and vehicle dynamics parameters may be modified by the user in v-SCENARIO; all parameters may also be modified online.

Pedestrian simulation is realized using 3rd party software; it provides various motion and gesture schemes.

Vehicle (i.e. driver) behavior may be computed in any of the following ways:
- autonomous
- action controlled
- externally controlled
- combinations of above features

Vehicles may navigate autonomously in the OpenDRIVE network, they may be assigned to waypoint paths (i.e. paths consisting of OpenDRIVE roads and lanes) or they may follow polyline paths which are independent of the underlying road network.

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Pedestrians may follow explicit polyline paths or perform standing "action" at any location in the database.

Actions that may be assigned (also in combination) to vehicles are:
- speed change (with configurable target speed and change rate)
- lane change (with configurable target lane and duration)
- autonomous behavior
- access of path shape
- general simulation action (via so-called SCP)

Actions that may be assigned (also in combination) to pedestrians are:
- access of path shape
- motion pattern (e.g. run, walk)
- gesture

In addition, players may also execute general simulation actions like
- simulation control (e.g. stop)
- display of symbols
- modification of environment (weather, time-of-day)
- all other features specified in the simulation control protocol (SCP)

Actions are executed by triggers. They may be executed only once, for a given number of times or indefinitely. Trigger types are:
- absolute location (x/y-position or road position)
- relative location (distance to player or time-to-collision)
- time-based
- external trigger source (i.e. by user or 3rd party module)

v-TRAFFIC computes the behavior of most entities internally but also accepts inputs from outside (either as entire players or only as control commands for internally computed players). By this, an interactive simulation with multiple external data sources (e.g. simulators) is feasible and the user may influence the behavior of all entities substantially.

The gateway for the connection to the traffic and scenario simulation is the v-TaskControl (see VTD data sheet).

	Driver Model	Dynamics Model
fully internal player	v-TRAFFIC	v-TRAFFIC
externally influenced internal player	v-TRAFFIC + user actions	v-TRAFFIC
externally controlled internal player	user	v-TRAFFIC
fully external player	user	user
internally controlled external player	v-TRAFFIC	user