PTV GROUP

the mind of movement

PTV Vissim in Co-Simulation for Automotive Development

Dr.-Ing. Thomas Benz

Dr. Dario Menichetti

Experience and expertise.

40 Years

2,500 Cities

120 Partners

THE WORLD BANK

International Transport Forum

European Commission

PORSCHE SE

PTV GROUP
the mind of movement

Agenda

1. PTV Vissim basics
2. Interfaces
3. Co-simulation
4. The Offer

PTV GROUP
the mind of movement

Agenda

1. PTV Vissim basics
2. Interfaces
3. Co-simulation
4. The Offer

PTV GROUP
the mind of movement

PTV Vissim
product introduction

PTV GROUP
the mind of movement

What is PTV Vissim?

Multimodal microscopic traffic flow simulation

Individual entities

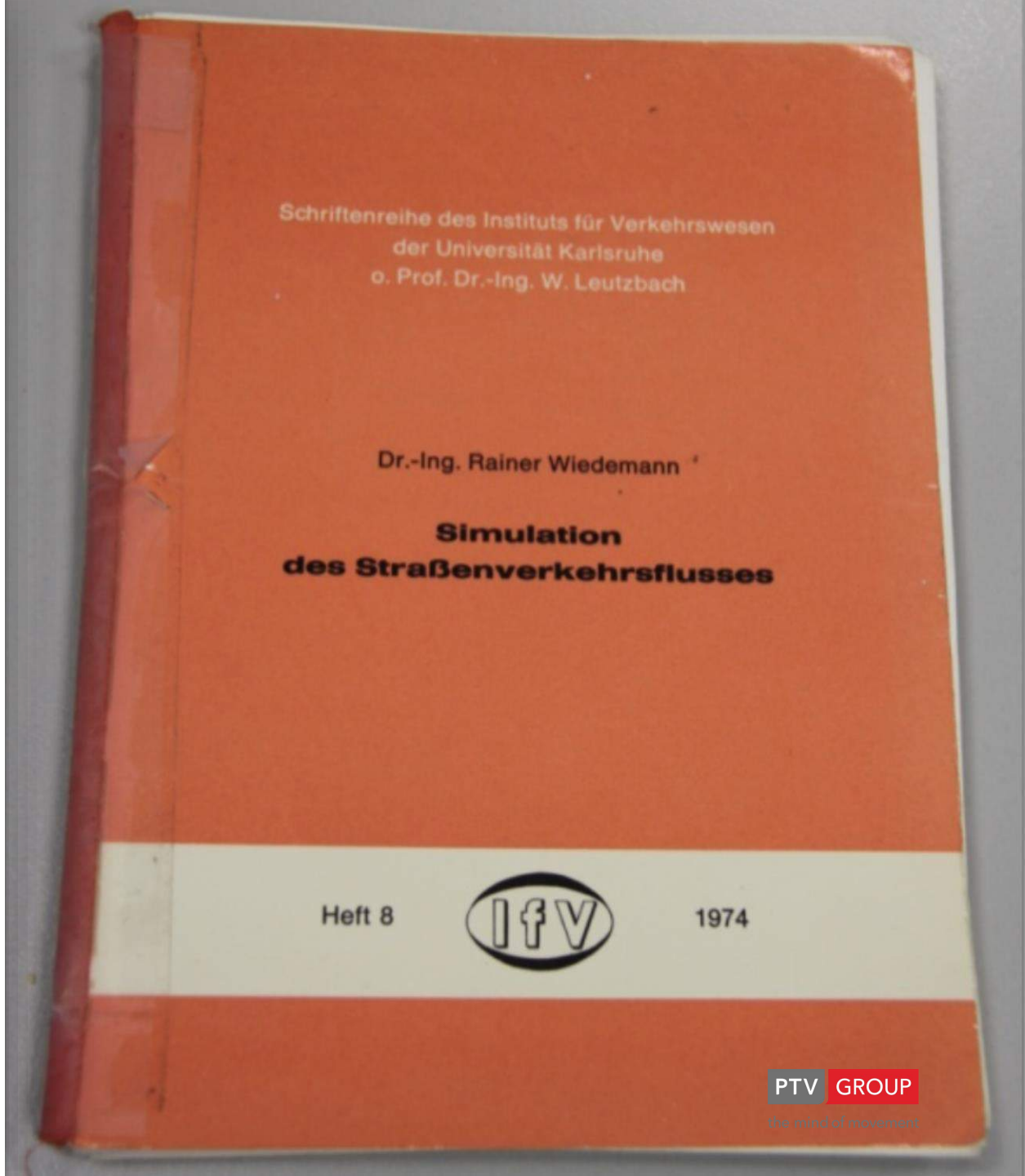
Cars, trucks, busses, bikes, pedestrians

- Traffic flow model which moves each participant according to sophisticated movement model
- Full traffic control model (traffic signals, VMS, etc.)

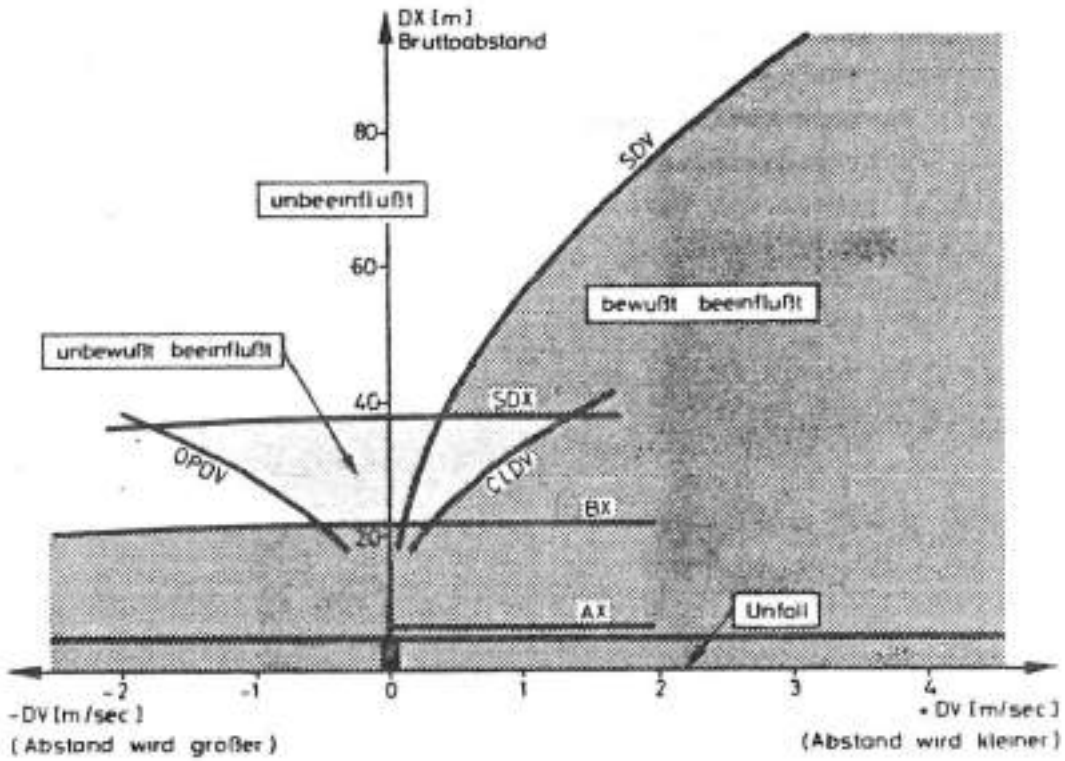
PTV GROUP
the mind of movement

History of PTV Vissim

- Development started during early 1970’s at the University of Karlsruhe, Germany.
- First commercial release of PTV Vissim in 1993.
- Market leader in traffic simulation for 25 years.



PTV Vissim basics



- “Driver as a controller”: reaction to outside stimuli, other vehicles etc.
- Driver’s perception: visual input of environment <> “Sensor”
- Driver’s reaction: longitudinal and lateral <> “Actuator”

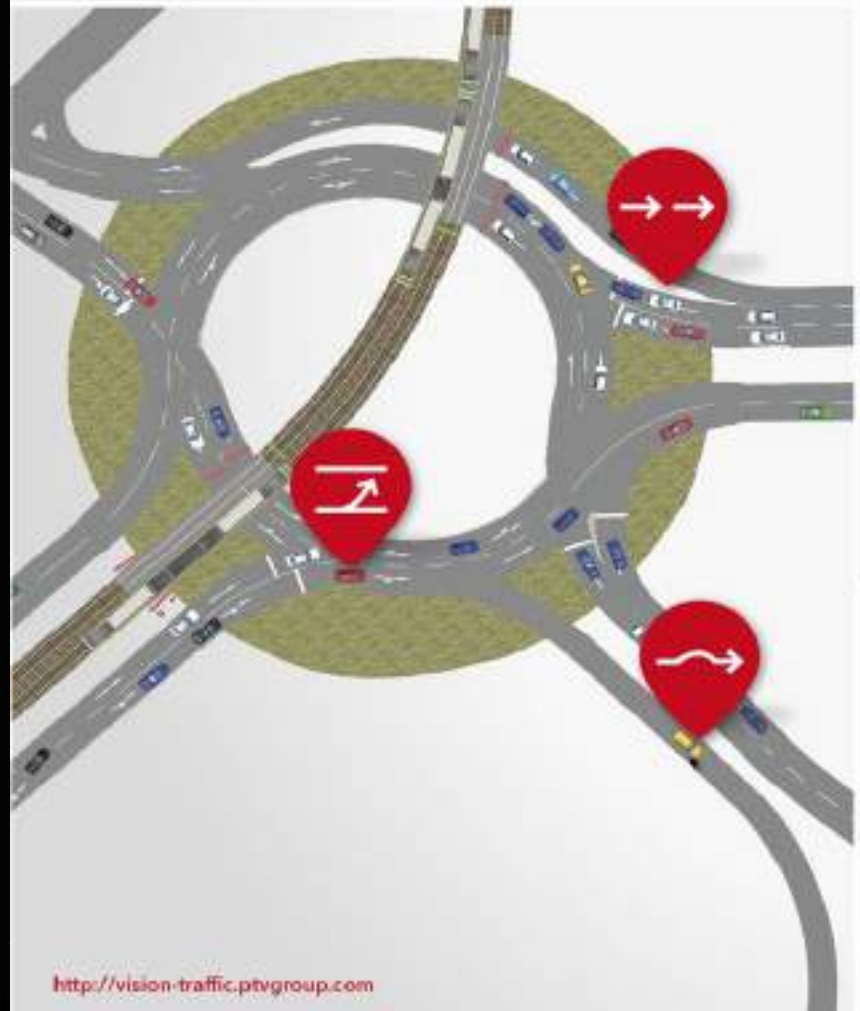
PTV GROUP
the mind of movement

PTV VISSIM

the mind of movement

SIMULATING DRIVING BEHAVIOUR

The modelling of driving behaviour is the core of traffic simulation. Vehicle movement models are a key element in being able to replay dynamics in a realistic manner. A distinction is made between three models:



FOLLOWING MODEL

The psycho-physical car-following model by Prof. Rainer Wiedemann was developed at the Karlsruhe Institute of Technology in 1974 and 1999. It describes the movement of traffic on a single lane. The model is implemented in the PTV Vissim simulation software and can be adjusted by the user via parameters in line with local conditions.

The vehicle following model describes 4 states:

1. FREE DRIVING

The driver proceeds at his or her desired speed provided there are no obstacles in front of him or her. Such obstacles may include, for example, slow moving vehicles, red traffic lights or potential collisions with vehicles changing lanes.

2. APPROACHING

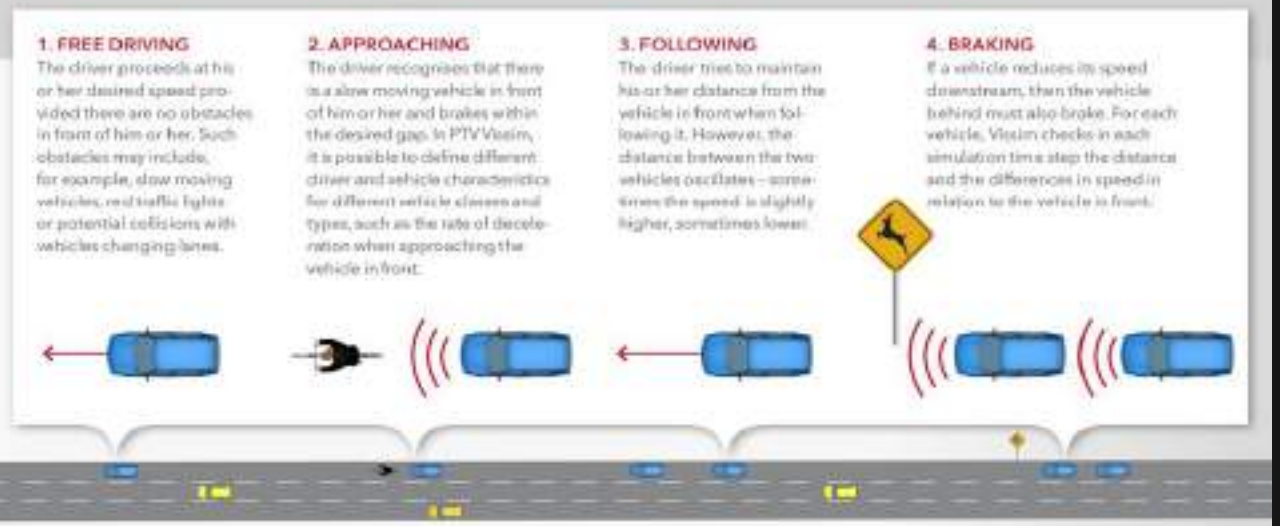
The driver recognises that there is a slow moving vehicle in front of him or her and brakes within the desired gap. In PTV Vissim, it is possible to define different driver and vehicle characteristics for different vehicle classes and types, such as the rate of deceleration when approaching the vehicle in front.

3. FOLLOWING

The driver tries to maintain his or her distance from the vehicle in front when following it. However, the distance between the two vehicles oscillates – sometimes the speed is slightly higher, sometimes lower.

4. BRAKING

If a vehicle reduces its speed downstream, then the vehicle behind must also brake. For each vehicle, Vissim checks in each simulation time step the distance and the differences in speed in relation to the vehicle in front.



LANE CHANGING

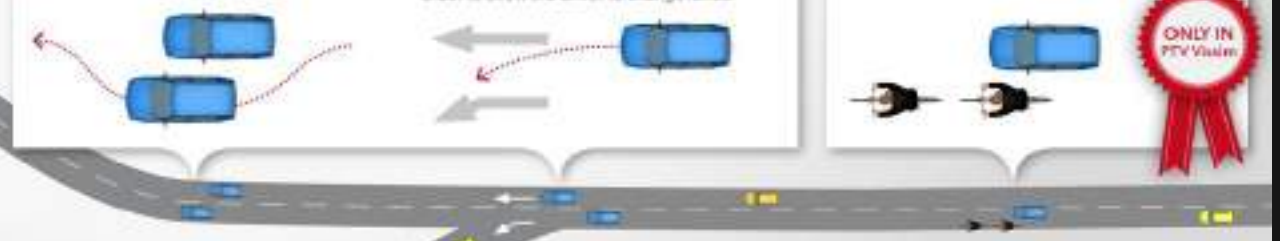
There are two different types of lane changing:

1. FREE LANE CHANGING

Free lane changing takes place when overtaking slow moving vehicles, i.e. when an individual's desired speed is higher than the person in front. Attention must be paid to ensure that vehicles in the other lane are not unduly affected by this.

2. NECESSARY LANE CHANGING

This occurs if the driver needs to change lane, e.g. in order to follow a route. The closer the driver gets to the decision making point, the more aggressively the driver behaves and is prepared to accept the hindrances posed by other drivers. Other vehicles also co-operate in order to allow the driver to change lanes.



LATERAL BEHAVIOUR WITHIN A LANE

NON-LANE BASED BEHAVIOUR

The choice of position within a lane is always important if vehicles are able to overtake each other within a particular lane and are able to be side-by-side. This is the case on cycle paths or on regular streets in certain regions, for example.

ONLY IN PTV Vissim

http://vision-traffic.ptvgroup.com

Agenda

1. PTV Vissim basics
2. Interfaces
3. Co-simulation
4. The Offer

PTV GROUP
the mind of movement

Description of Interfaces

COM Interface

- Advantage: COM script has access to all data inside PTV Vissim which can be made visible in a list window (and some more).
- Disadvantage: COM script cannot affect the lateral movement of the vehicle. No direct lane change can be performed (only a desired lane change can be triggered). COM can be slow.

DriverModel.DLL Interface

- Advantage: PTV Vissim passes only information of the nearby vehicles and about the upcoming road along the vehicle's route to the DLL, so the DLL doesn't need to know the network.
- Disadvantage: Routing cannot be changed (but lateral behavior and lane changes must be decided by the DLL).

DrivingSimulator.DLL interface

- Advantage: Only positions in world coordinates are exchanged, the vehicle can be moved completely freely inside the network.
- Disadvantage: The network must exist on the side of the vehicle algorithm, too.

PTV GROUP
the mind of movement

Agenda

1. PTV Vissim basics
2. Interfaces
3. Co-simulation
4. The Offer

PTV GROUP
the mind of movement

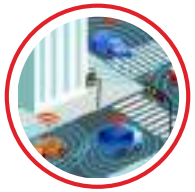
Why co-simulation?

Challenges

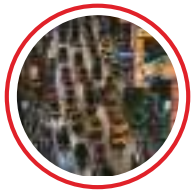
- Inclusion of unexpected or non-connected objects
- Scenario completeness
- Self organization of vehicles
- Unrealistic/Unachievable scenario

Solutions

Vehicle sensing (object detection)



Vehicle communication (other vehicle or pedestrian’s intent)



Running different scenarios taking into account intentions

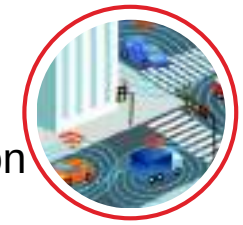
Real-world physics

Results analysis and visualization

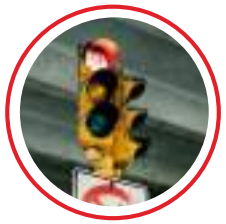
Vehicle dispatching

Solutions

Vehicular Communication



Results analysis

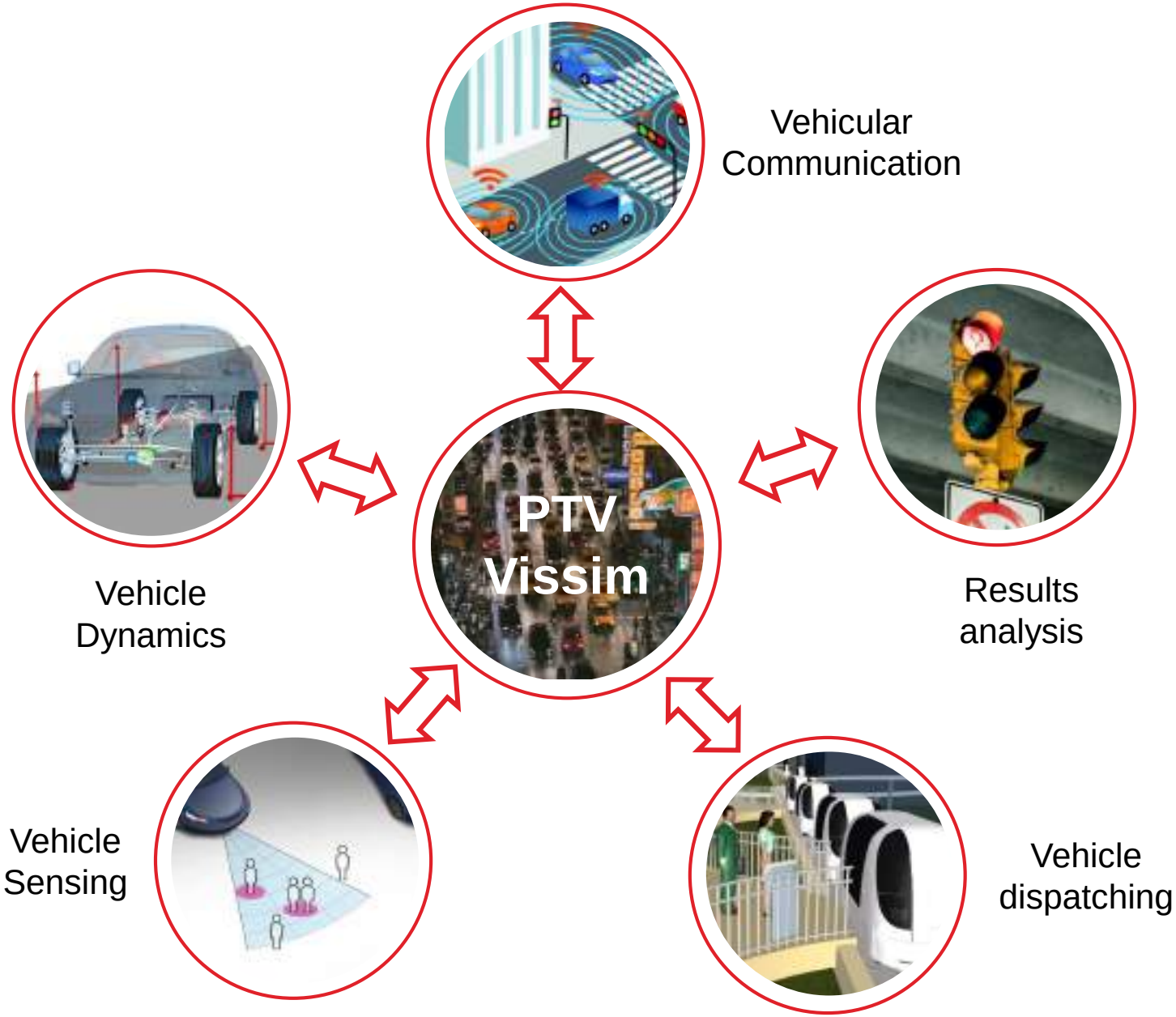


Vehicle Dynamics

Vehicle dispatching

Traffic Simulation

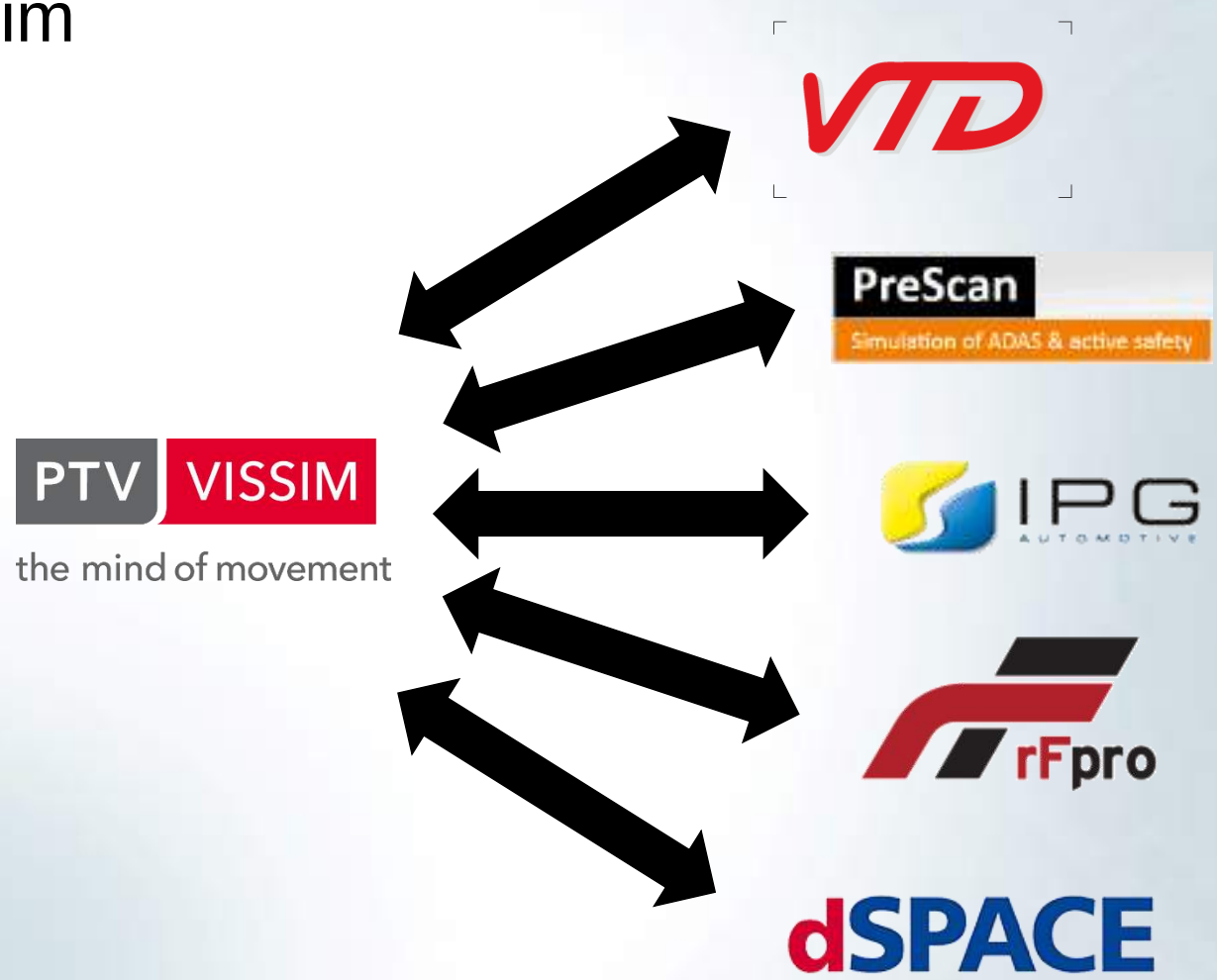
Vehicle Sensing



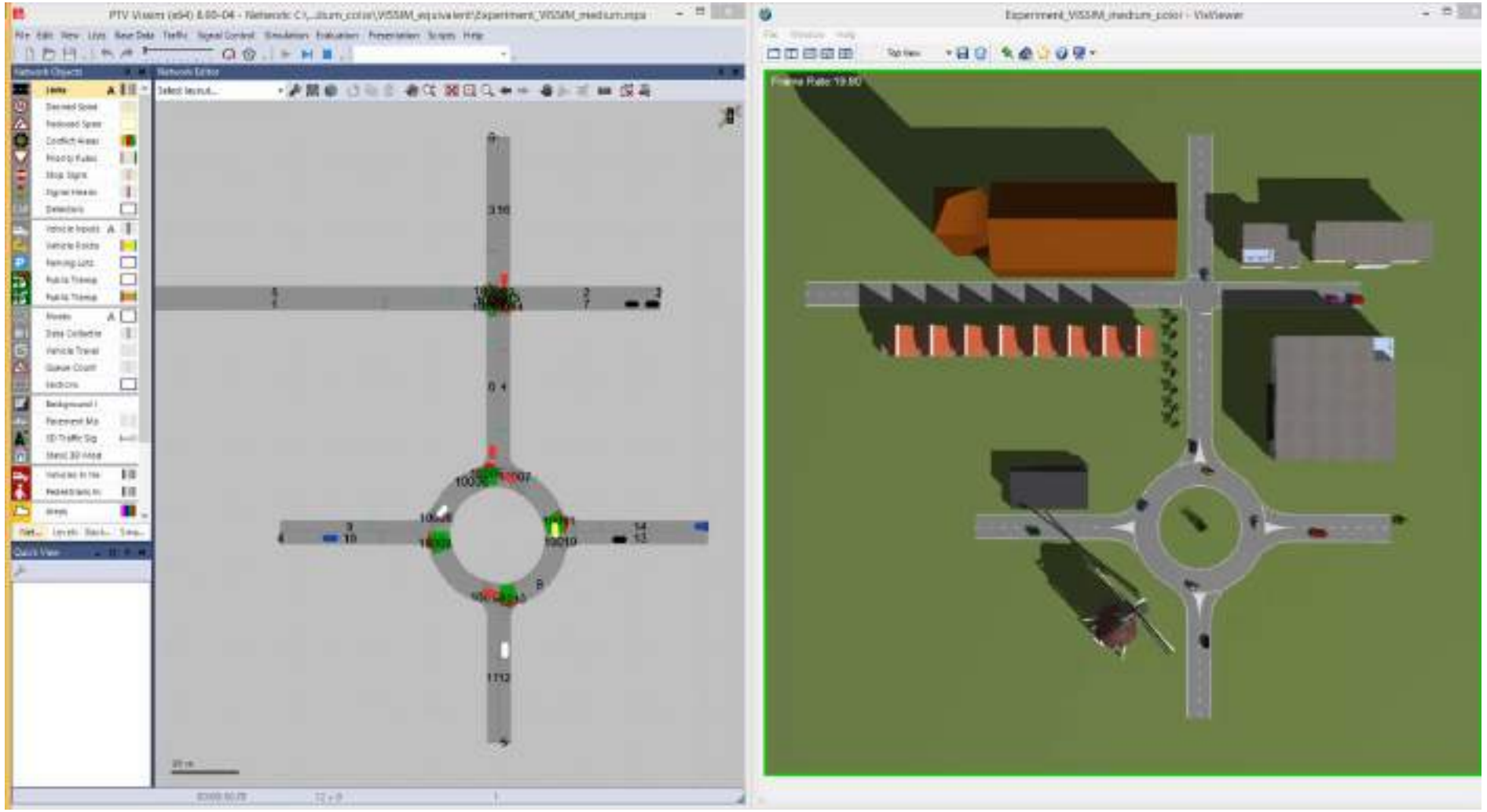
Simulation package PTV Vissim

PTV Vissim provides traffic in the simulation tool chain and a link to:

- Sensor simulation like PreScan, …
- Vehicle dynamics like CarMaker, VTD…
- Visualization with rFpro, …

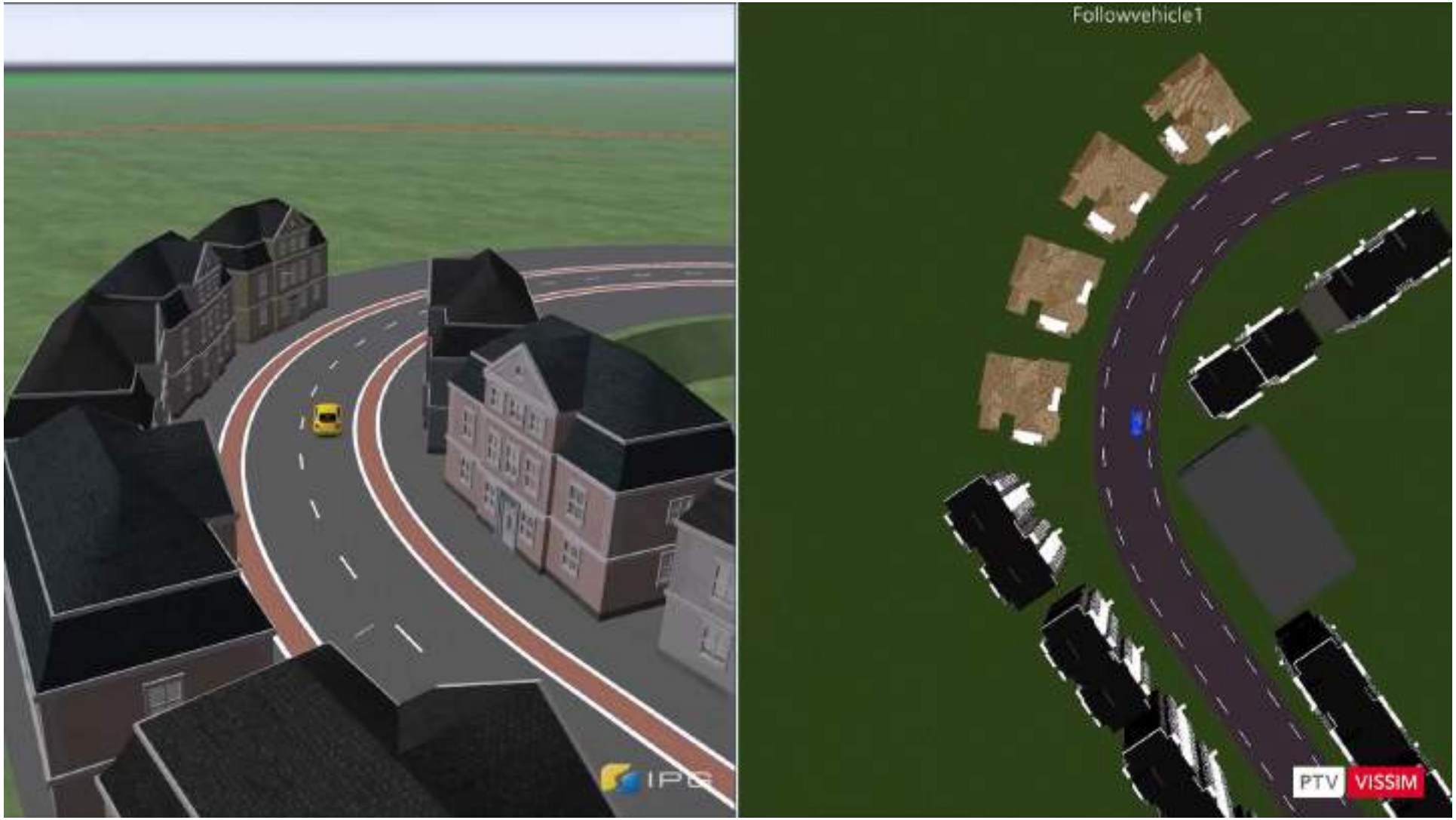


Example: Co-Simulation Vissim + PreScan



PTV GROUP
the mind of movement

Example: Co-Simulation Vissim + CarMaker



PTV GROUP
the mind of movement

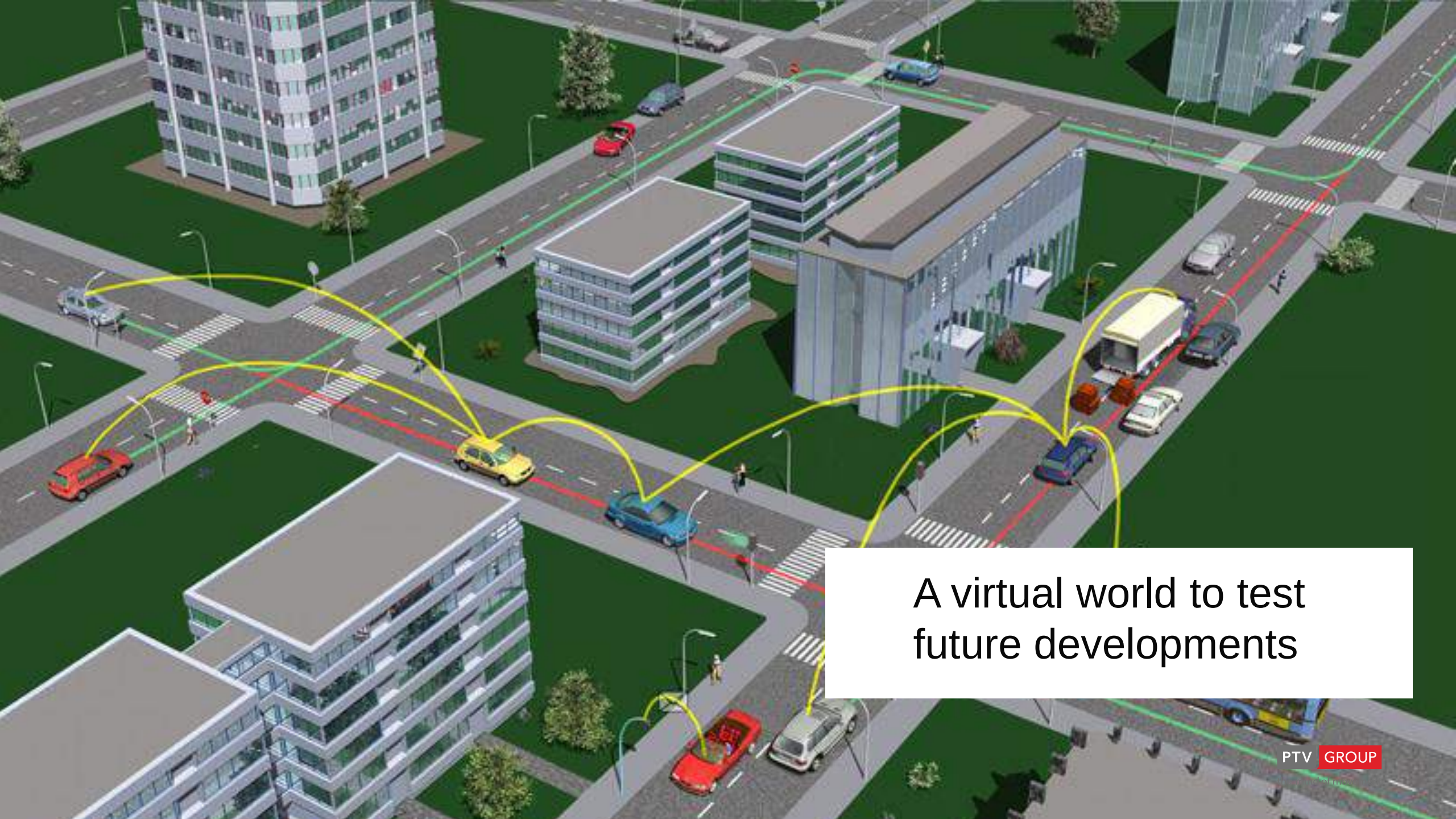
Agenda

1. PTV Vissim basics
2. Interfaces
3. Co-simulation
4. The Offer

PTV GROUP
the mind of movement

Our offer
PTV Vissim in automotive development

PTV GROUP
the mind of movement



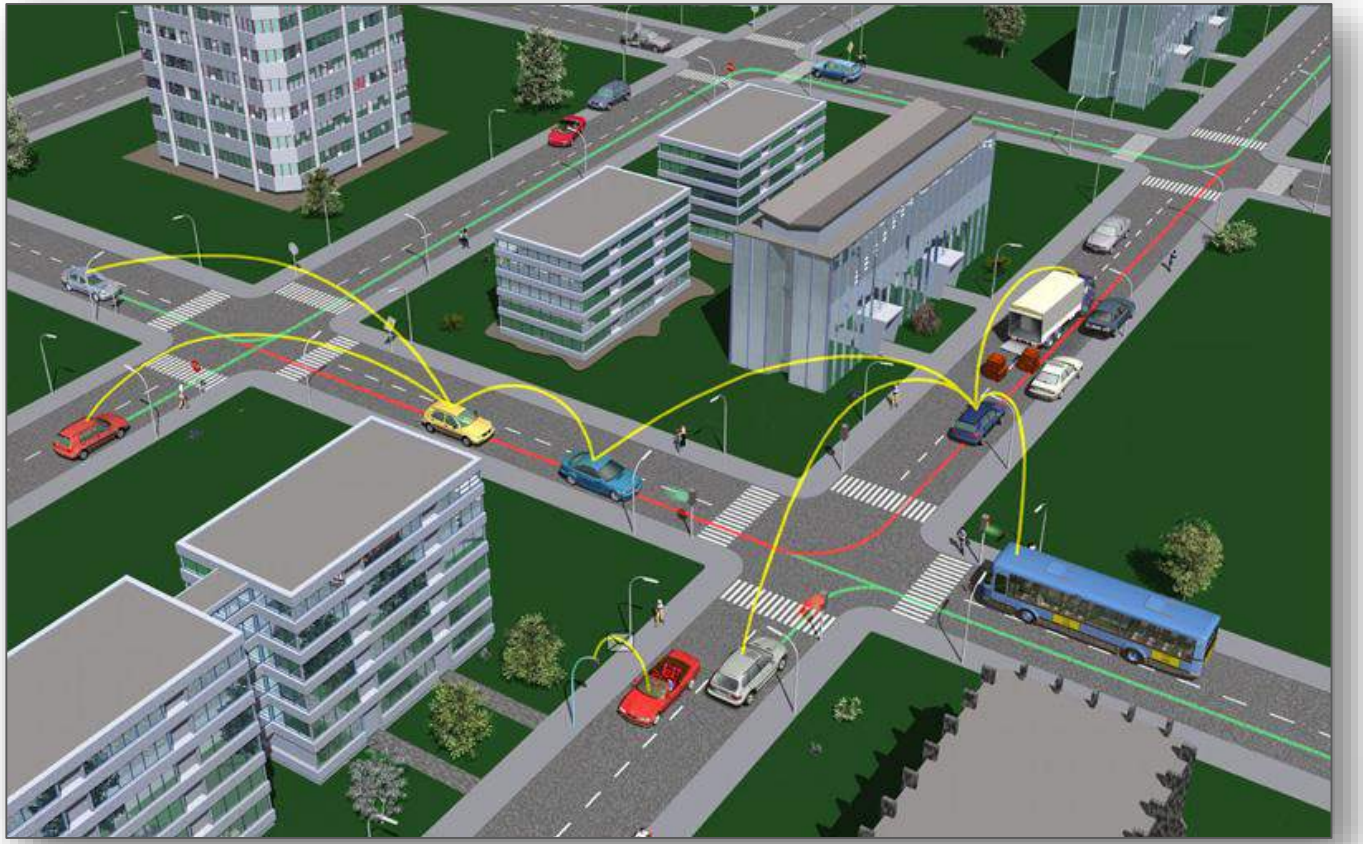
A virtual world to test future developments

PTV GROUP

Our portfolio

PTV GROUP
the mind of movement

- Set-up a virtual world
- Build bespoke evaluation
- Links to existing engineering tools
- Training, new content, support, continuous dialog



PTV GROUP
the mind of movement


PTV GROUP
the mind of movement
Join the conversation.
#MindofMovement