

# DATEX in C2X field trial

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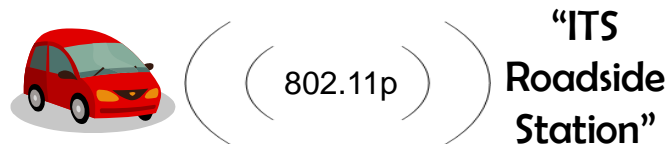
Sichere Intelligente Mobilität  
Testfeld Deutschland

**sim<sup>TD</sup>**

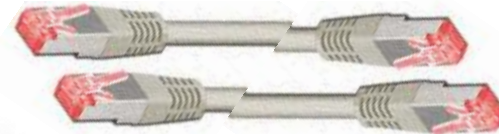


# DATEX in C2X field trial - overview

- Unusual application of DATEX II:  
connecting an ITS Roadside Station (IRS) to the urban traffic management backbone and traffic signal controllers
- Radio communication link specified by ETSI (802.11p)
- Innovative content required level B extension
  - intersection topology
  - signal phase / status information
  - vehicle data (incl. public transport & emergency vehicles)
- Use of sophisticated exchange mechanism from current standardisation effort for urban traffic management: OTS2



DATEX II



# The C2X-project sim<sup>TD</sup>

## sim<sup>TD</sup> - „Safe and Intelligent Mobility - Test Field Germany“ ...

- is a field trial which is shaping tomorrow's safe and intelligent mobility through researching and testing C2X communication and its applications
- builds upon results from various C2X R&D projects: SAFESPOT, COOPERS, CVIS, AKTIV, .....
- started in September 2008 and will run for four years up to 2012
- runs on a budget of 53 M€, in which 30 M€ are funded by



- is a joint project by leading German vehicle manufacturers, components suppliers, telecommunication companies and research institutes as well as the State of Hessen and the City of Frankfurt/Main



# sim<sup>TD</sup> partners

Vehicle Manufacturers	Suppliers	Science	Public Institutions
 <b>Audi</b>	 <b>BOSCH</b>	 <b>Fraunhofer</b>	 Hessian State Office for Road and Traffic Affairs Our Expertise Your Mobility
 <b>DAIMLER</b>	 <b>Continental</b>	 Deutsches Forschungszentrum für Künstliche Intelligenz GmbH	 <b>HESSEN</b>
 <b>Ford</b>	<b>Network Operator</b>	 <b>berlin</b>	 <b>STADT FRANKFURT AM MAIN</b>
 <b>OPEL</b>	 <b>Deutsche Telekom</b>	 Technische Universität München Lehrstuhl für Verkehrstechnik	<b>Infrastructure and traffic-signal related tasks</b>
 <b>VOLKSWAGEN</b> ARTIENGESELLSCHAFT		 Hochschule für Technik und Wirtschaft des Saarlandes University of Applied Sciences	<b>assisted by</b>
		 <b>IZVW</b>	 <b>Albrecht Consult</b>



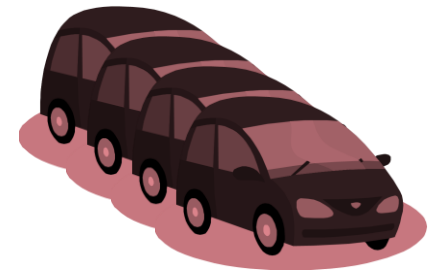
# The C2X-project sim<sup>TD</sup>

- first large scale field test for cooperative systems using 802.11p
- test and verify the C2X-communication in an operative environment beyond the demonstrator-status
- testing the complete spectrum of traffic-related functions
- research on realistic business models for operating companies and roll-out scenarios

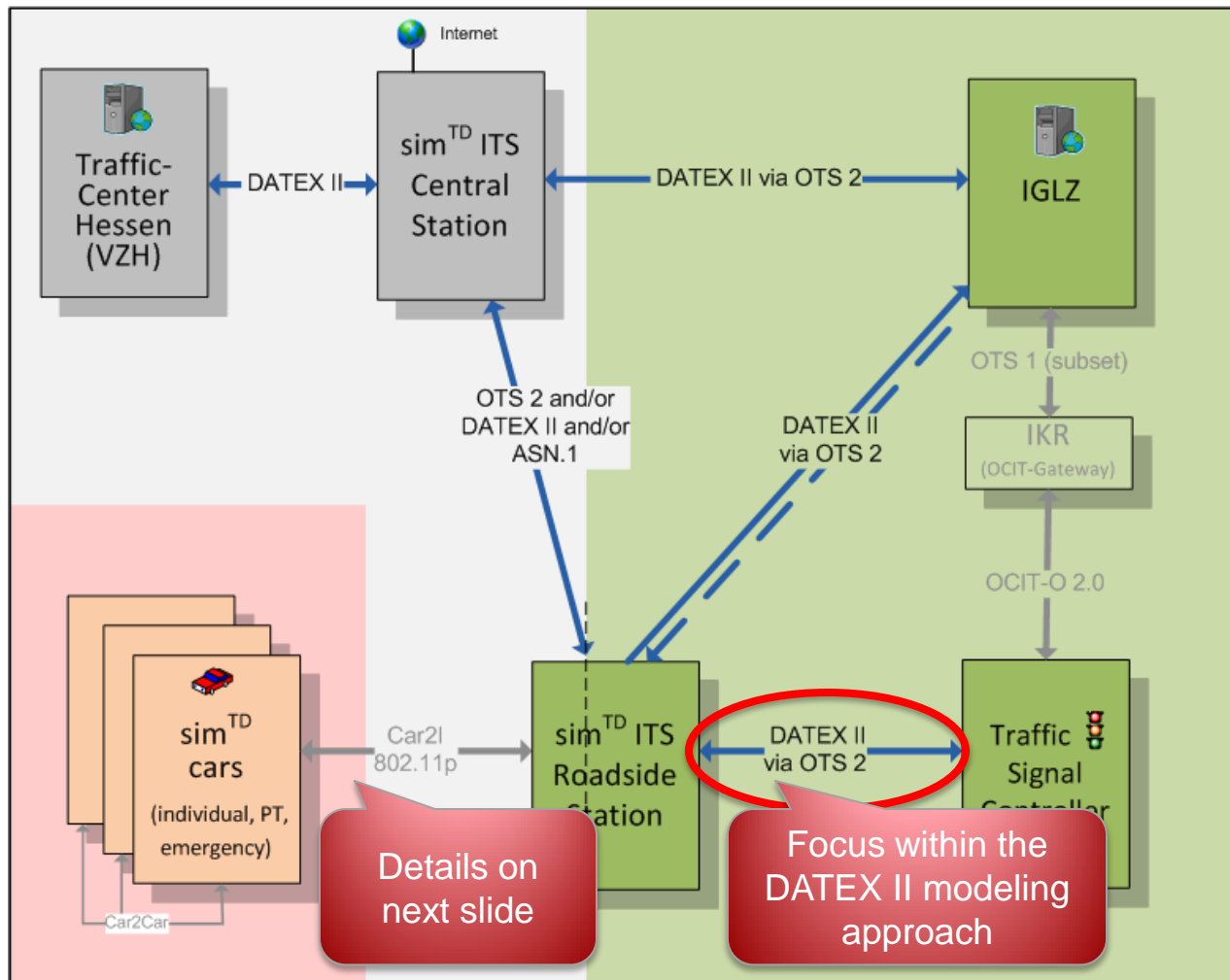
The sim<sup>TD</sup> test field (located in the Rhine-Main area of Hessen):

- up to 400 equipped sim<sup>TD</sup>-vehicles
- large number of “hired drivers”
- more than 100 “ITS Roadside Stations”

➔ C2X communication can be tested under real world conditions



# sim<sup>TD</sup> system architecture (focus on infrastructure)



**Highness:**

- federal state of Hessen
- city of Frankfurt/Main
- Automobilists

**Legend:**

- usage of DATEX II in sim<sup>TD</sup>
- not in focus

**Abbreviations:**

- IGLZ Integrated overall traffic management centre, city of Frankfurt am Main
- IKR IGLZ communication centre
- OCIT Open Communication Interface for Road Traffic Control Systems
- OTS Open Traffic Systems

Details on next slide

Focus within the DATEX II modeling approach

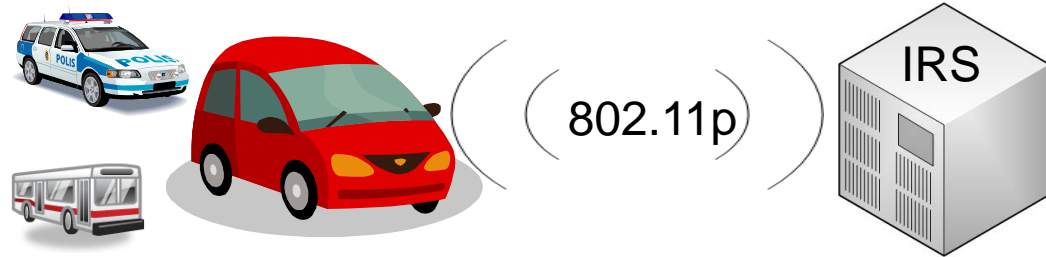


# sim<sup>TD</sup> Car-to-Infrastructure communication

The following messages are sent by sim<sup>TD</sup> vehicles (ITS-Vehicle-Stations) via IEEE WLAN-protocol 802.11p and received by IRS:

## Cooperative Awareness Messages (CAM)

- periodic messages with base information like position, speed and vehicle status (sensor value from CAN-bus)
- specified by C2C-CC and ETSI
- several profiles possible:
  - basicVehicle
  - emergencyVehicle
  - publicTransportVehicle



## Decentralized Environmental Notification (DEN)

- location-based event messages
- examples: tail of a traffic-jam, fog, obstacle warning



# sim<sup>TD</sup> functions within the scope of traffic signals

## Local traffic adapted signal control

- traffic signals receive information from sim<sup>TD</sup> vehicles (passenger cars, public transport and emergency vehicles) , e.g. position and speed  
→ sim<sup>TD</sup> vehicles substitute traditional detectors (e.g. induction loops)
- signal control unit can process a traffic-model and improve its signalisation

## Traffic light phase assistant

- ITS Roadside Station receives signal-information from the traffic signals (e.g. green- and red-phases, time to signal-switch) and broadcasts it to sim<sup>TD</sup>-vehicles within an adequate range  
→ signal-information can be displayed in the dashboard

## System-configuration with intersection-topology

- configuration data is passed to the ITS Roadside Station to allow transformation from X/Y to lanes and distance to stop line





# OTS 2 / DATEX II

OCIT: Open Communication Interface for Road Traffic Control System  
OTS: Open Traffic Systems

## Why did we choose OTS 2 and DATEX II?

- OTS 2 is used for interoperable communication between applications and components from different vendors  
(here: *ITS Roadside-Station and traffic signal controller*)
- specified as Web Service specification based on XML-schemas for Protocol Data Units and a WSDL

**but....** : data-model of OTS 2 derived from predecessor  
“OCIT-Instations” did not match requirements

- DATEX II data model provides valuable input and is easy to extend
- protocol part of OTS 2 more suitable than DATEX II exchange spec

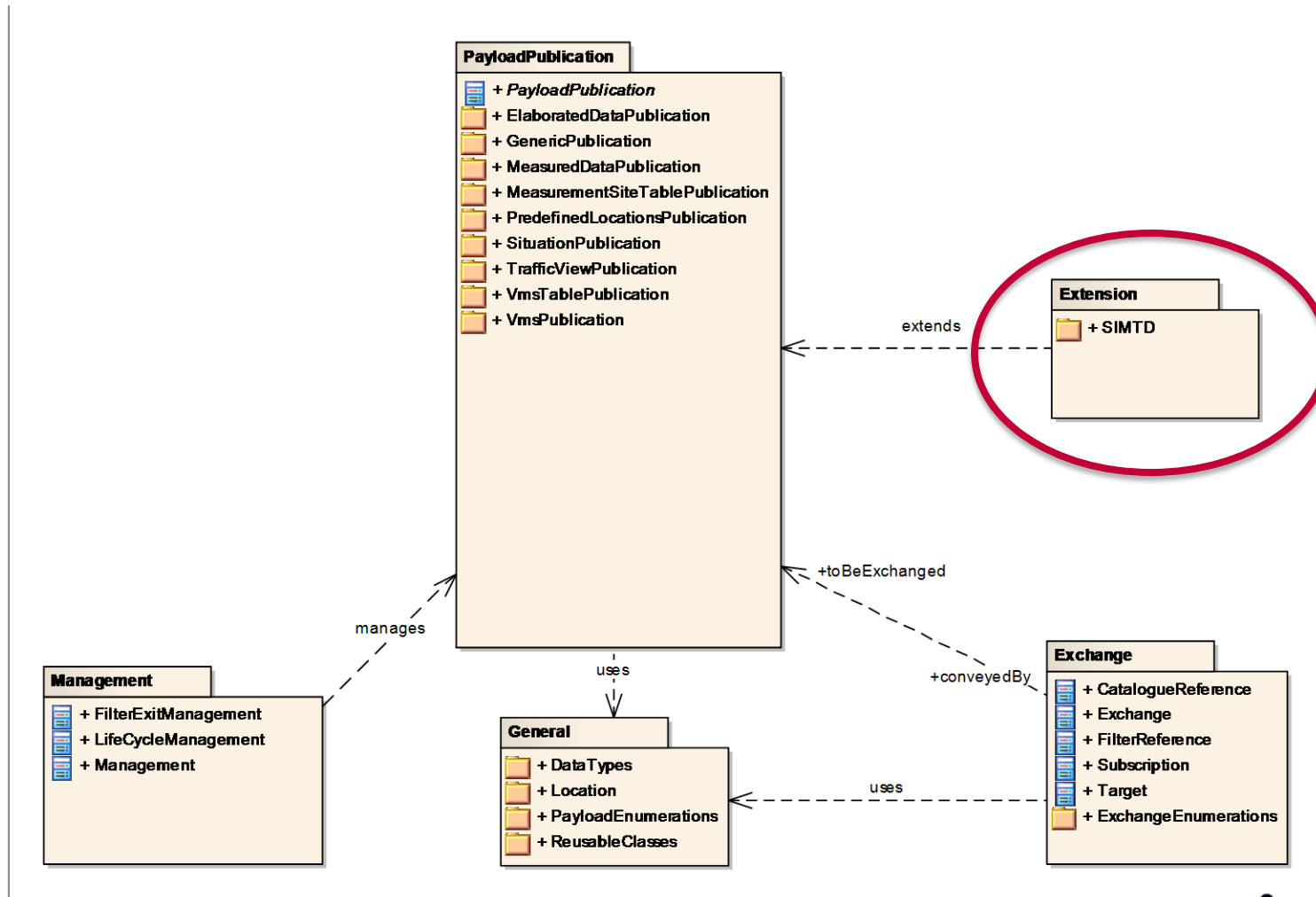


Using the OTS 2 protocol with an extended DATEX II-data model („Level B“) was the solution!

# 2 & II



# DATEX Level B-extension



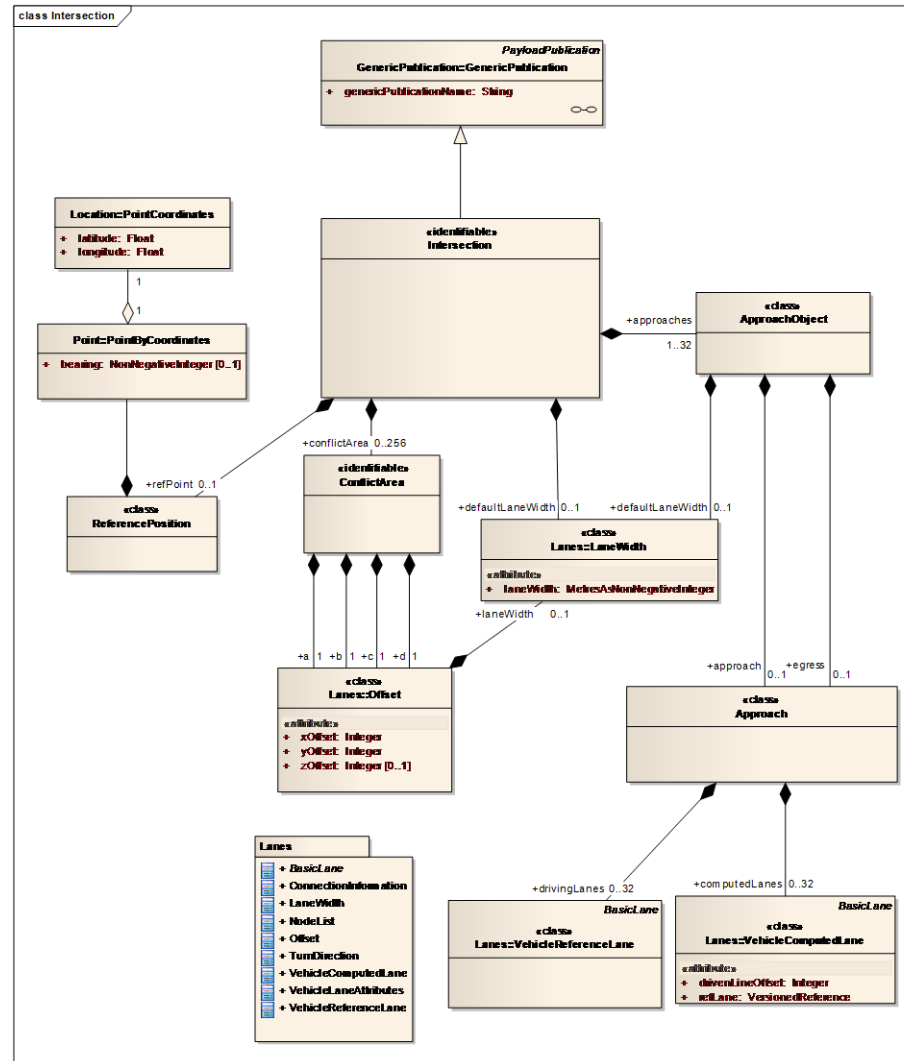
# DATEX Level B-extension

The following three packages are derived from GenericPublication:

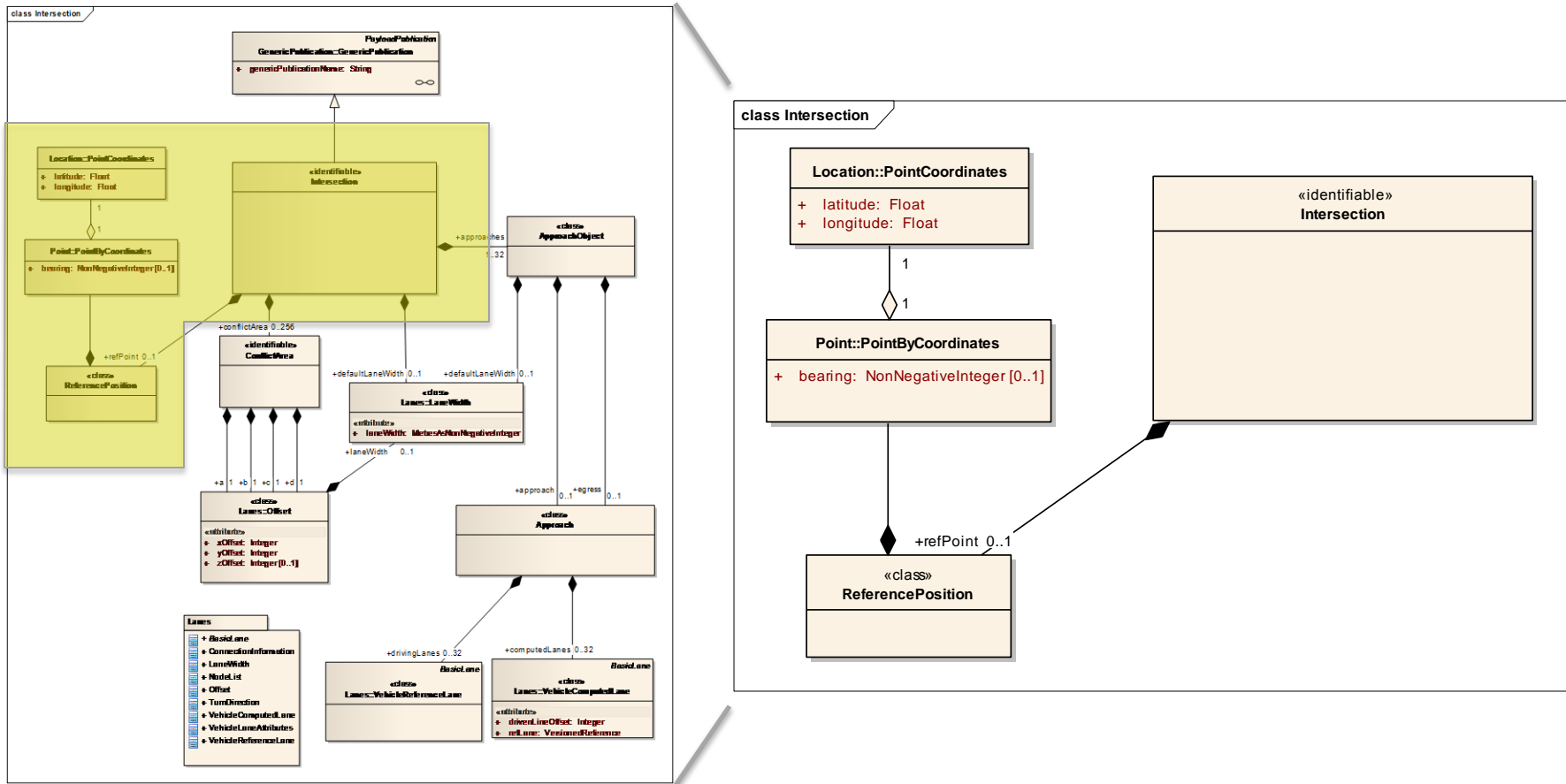
- **Intersection**
  - intersection-topology, transferred as configuration data at low frequency from signal control unit to IRS
- **VehicleData**
  - periodical vehicle status messages transferred to signal control unit
  - position information based on the intersection topology
  - special attributes for emergency-vehicles and public transport
- **SignalState**
  - data needed by „traffic light phase assistant“ function.
  - transferred from signal control unit to IRS



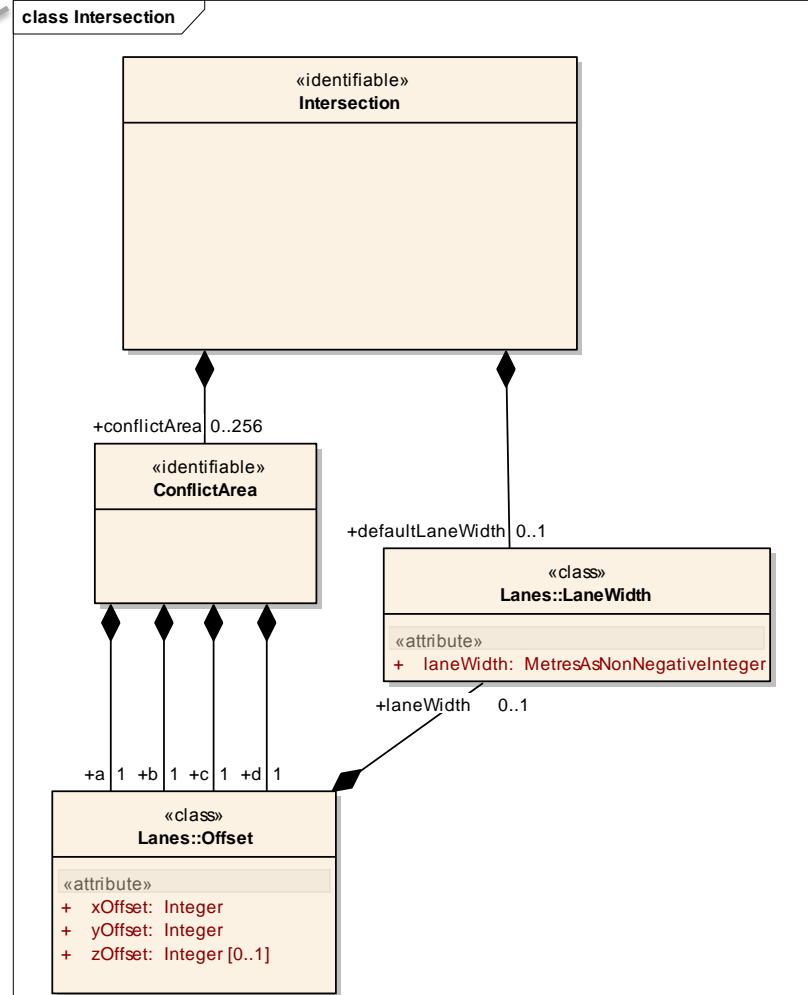
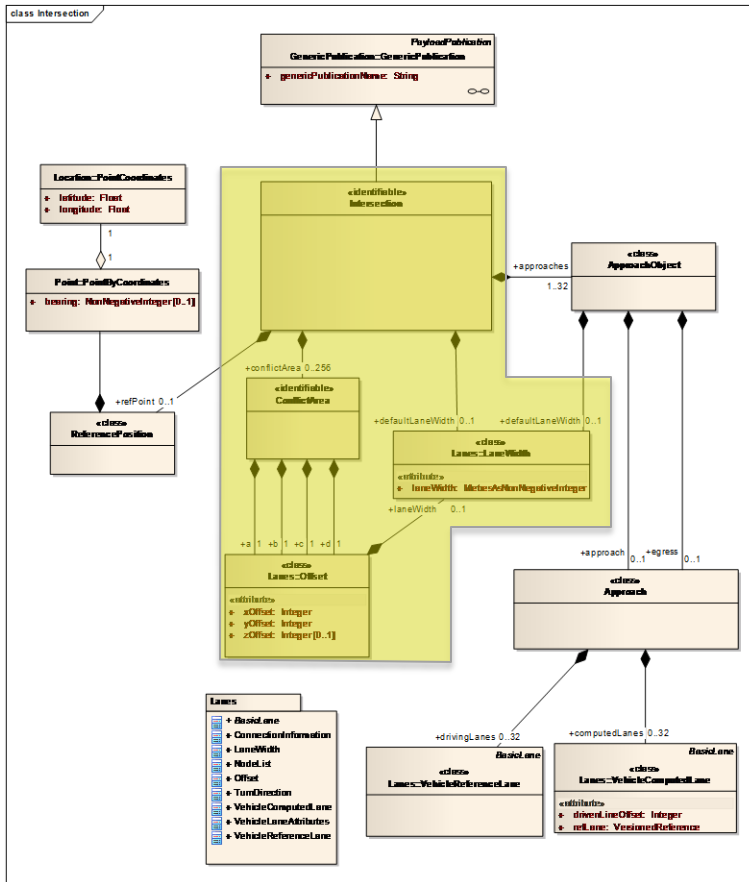
# DATEX Level B-extension: Intersection



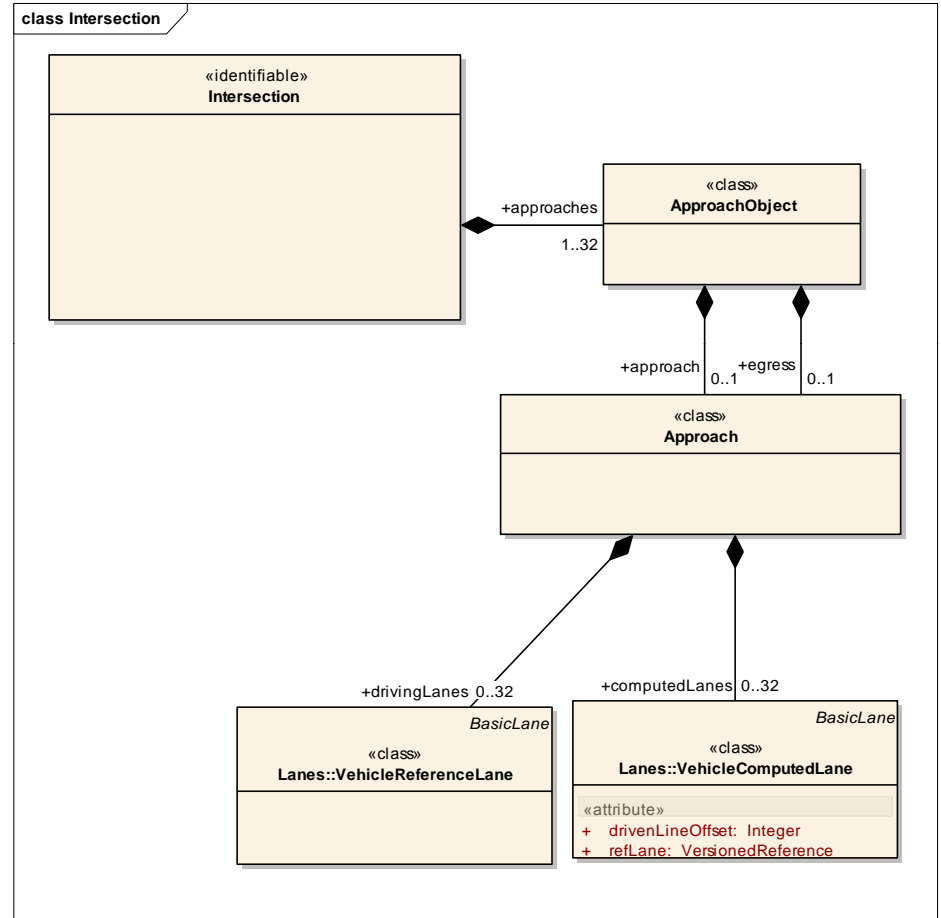
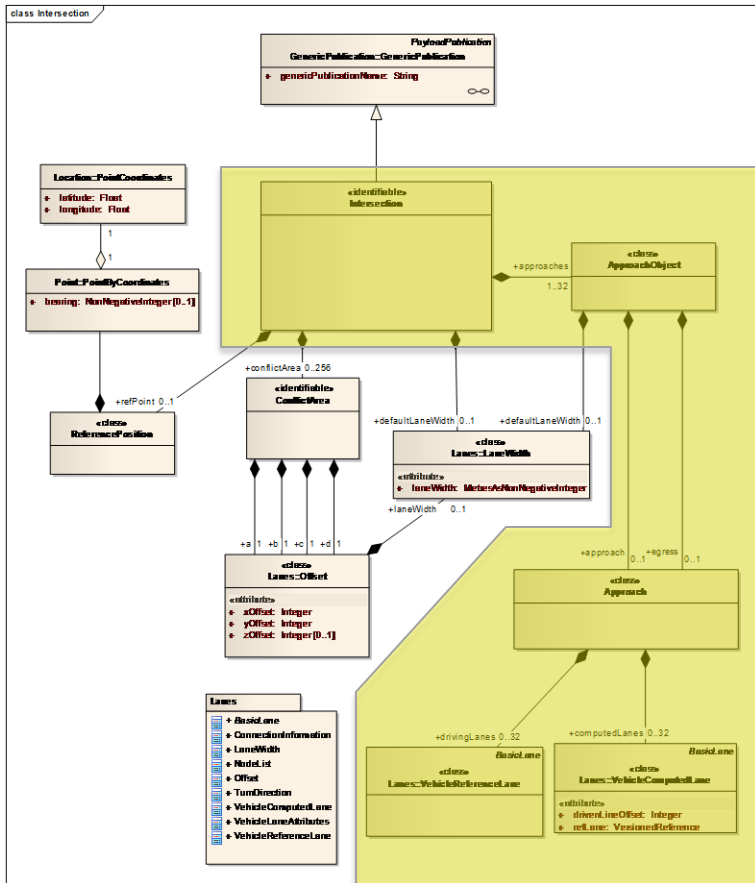
# DATEX Level B-extension: Intersection



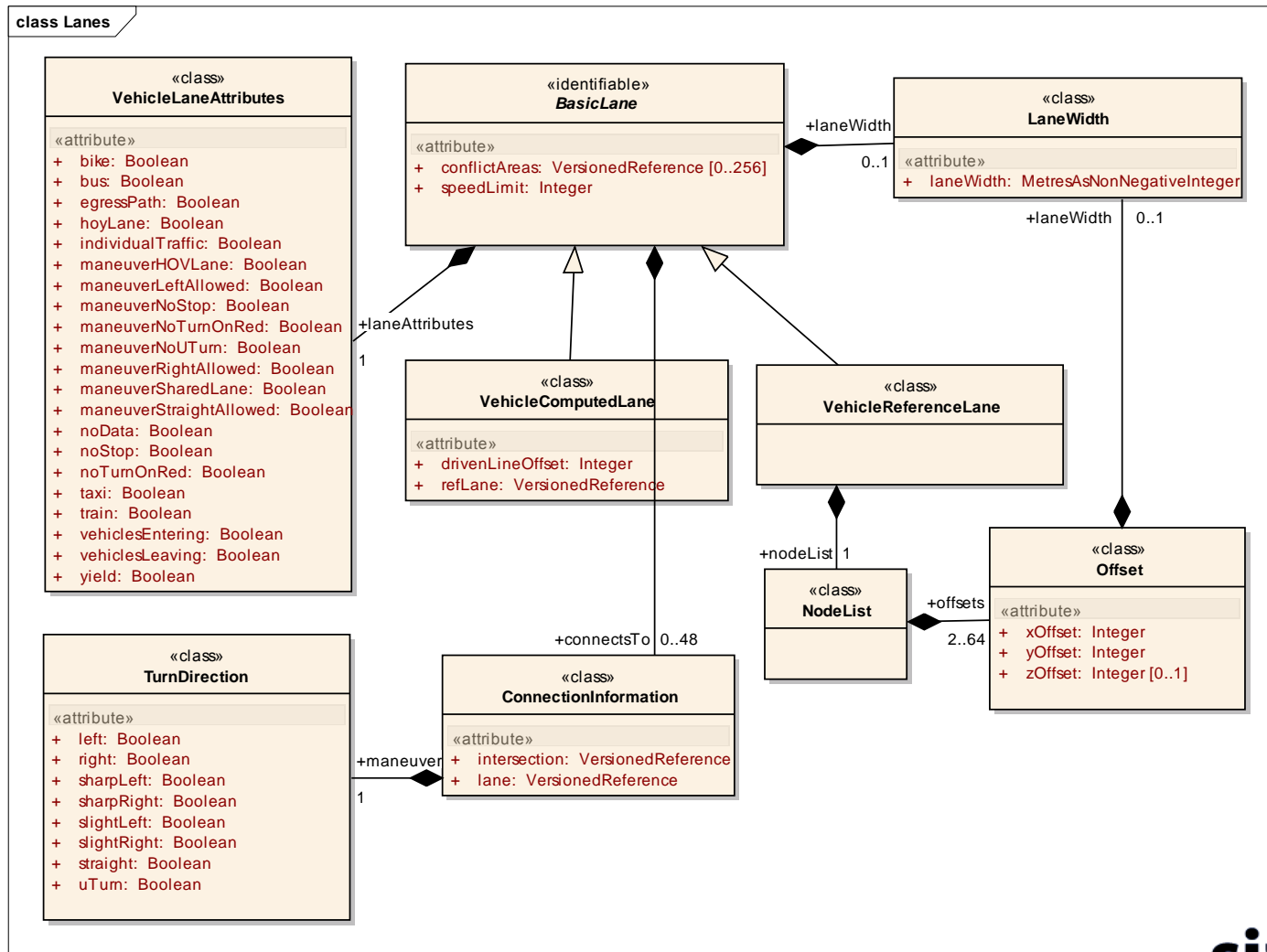
# DATEX Level B-extension: Intersection



# DATEX Level B-extension: Intersection



# DATEX Level B-extension: Intersection - Lanes

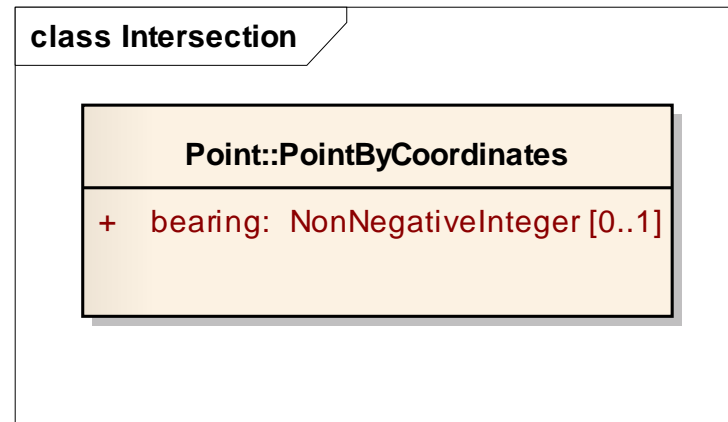




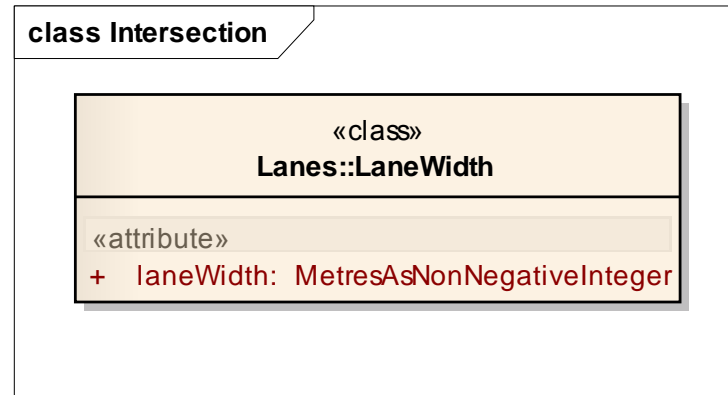
# DATEX Level B-extension

## Resusage of DATEX-elements

- **DATEX classes**

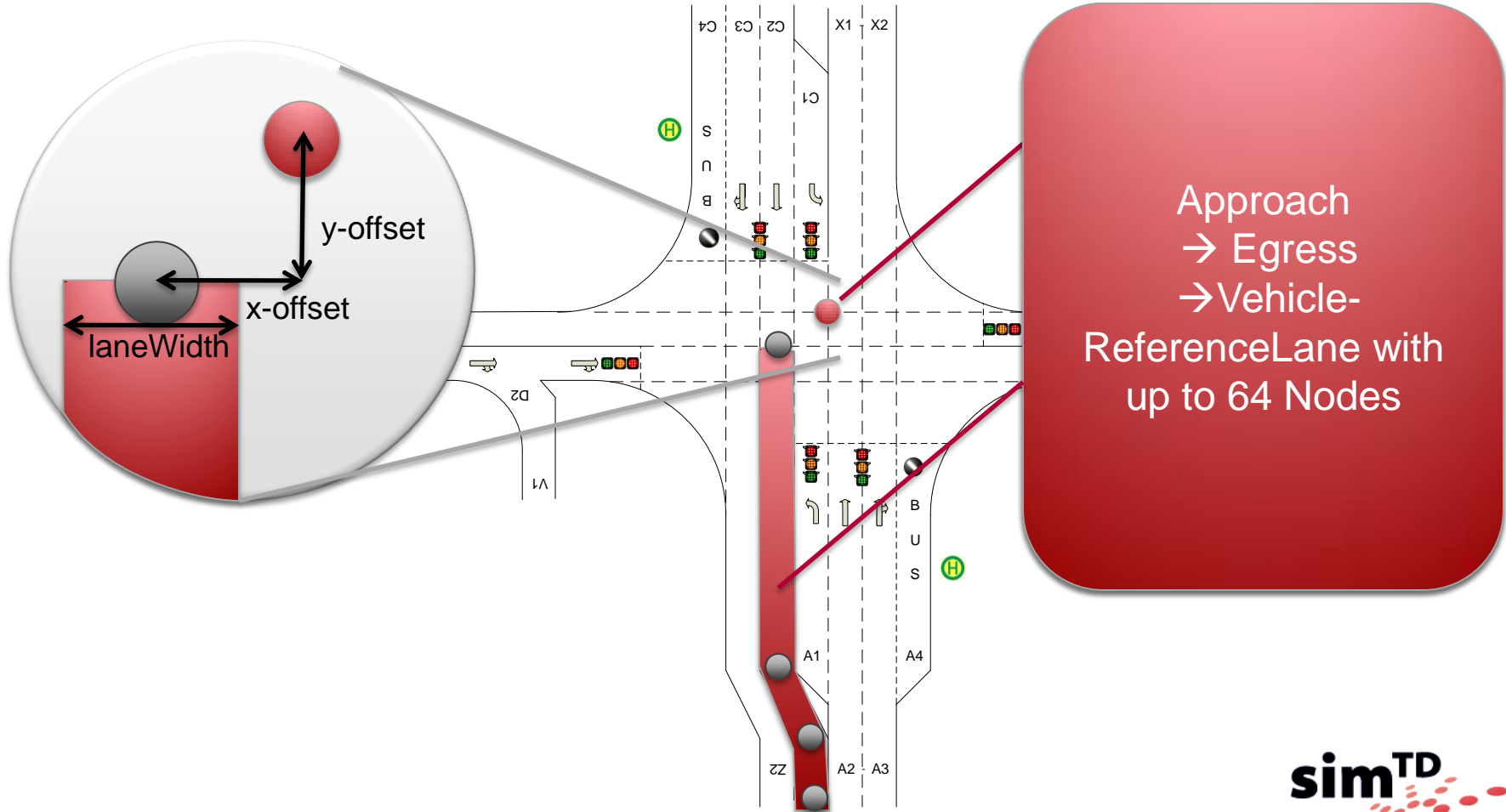


- **DATEX datatypes**



# DATEX Level B-extension

## Demonstration of intersection package

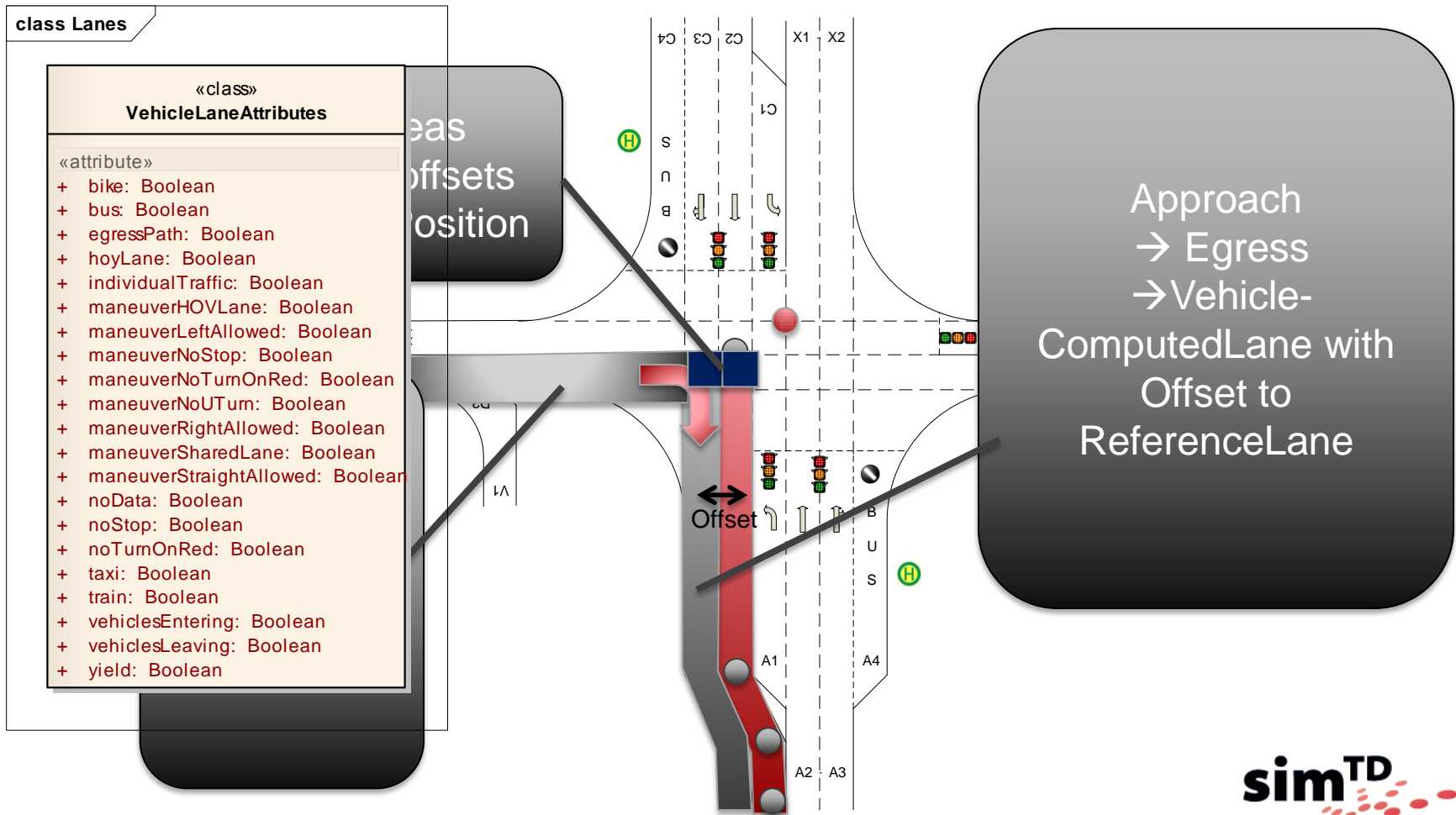


Approach  
→ Egress  
→ Vehicle-ReferenceLane with up to 64 Nodes



# DATEX Level B-extension

## Demonstration of intersection package



## Summary

- DATEX II provides an excellent structure to extend its data-model for the purpose of traffic-signal related functions
- OTS 2 provides a useful protocol to exchange these DATEX II messages
- The DATEX level B-extension for sim<sup>TD</sup> can be a basis for further developments in the traffic-control environment



**Thank you for  
your attention**

