



Siemens-Microsoft
Enabling simulation at scale

Unrestricted

ADAS / AD V&V framework on Azure cloud



Plan



Execute



Report

- Realistic simulation, ready for robust virtual verification:
 - Real data import
 - High fidelity sensors, environments and vehicle physics

Massive simulation: advanced parametric sampling, automated processes and extensible execution infrastructure

Requirements-driven simulation: assets continuity and verification traceability

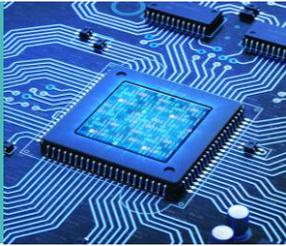
ADAS/AD V&V framework on Azure cloud

Benefits



Shorter time-to-market and lower development costs

Use powerful modeling capabilities to frontload system simulation
Use next generation simulation orchestration for improved coverage
Troubleshoot implementation issues earlier in development



Enabling HAD verification in a reasonable amount of time

Efficient execution platform for planning and submission
Advanced parametric sampling and results reporting
Faster insight into system under test



Development process efficiency increase

Scenarios-driven and metrics-driven requirements as input for simulation
Connect critical scenarios experience to system engineering
Enable rapid and robust development process



Compliance with audits and relevant standards

Full simulation activity traceability to be ready for liability issues
Validation methodology (e.g. ISO26262) is reflected by Polarion data management



Automated scenario creation from test drive data

**Automatic conversion of Ibeo laser scanner data
to virtual PreScan scenarios**



Simcenter Prescan

Ready to use sensor models

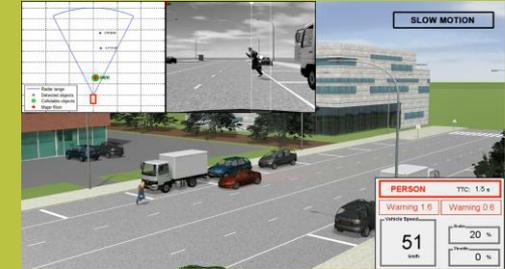
(sensors models validation + non regression process to be included)



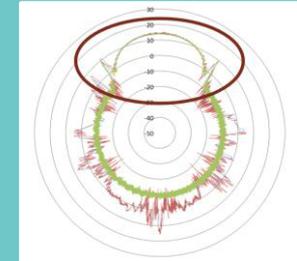
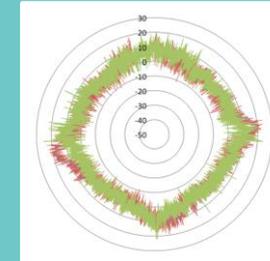
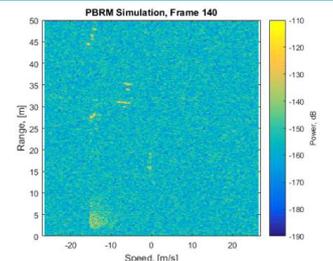
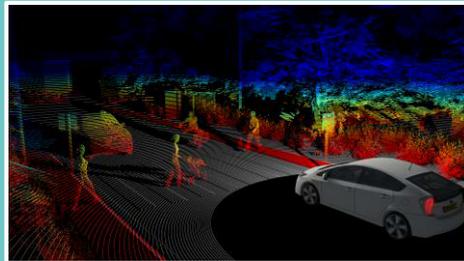
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Ingenuity for life

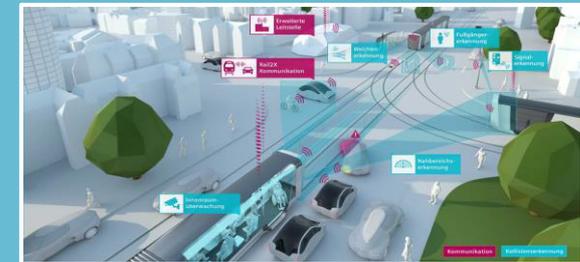
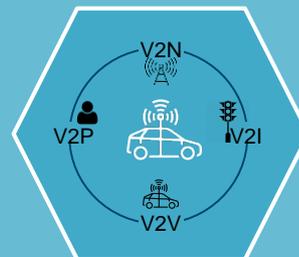
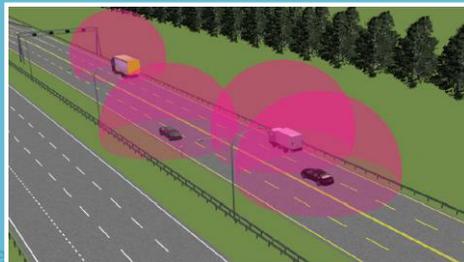
Camera



Radar & Lidar



V2X & Ultrasonic



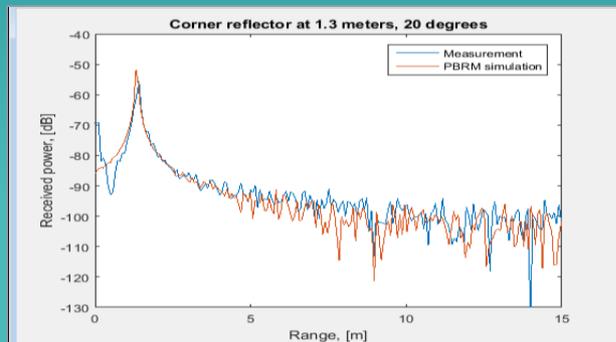
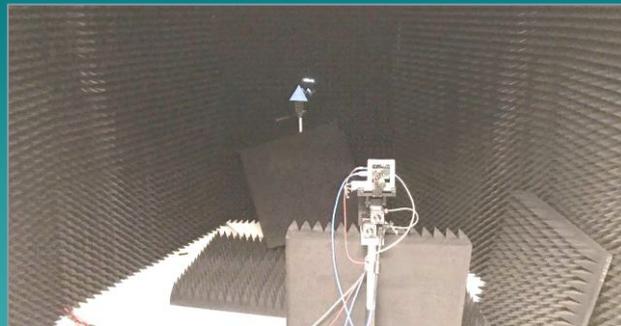
Radar Simulation example

Development with models validation in mind

Validation

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Two projects for radar models validation performed in close collaboration with major Dutch Tier2 and Japanese Tier1



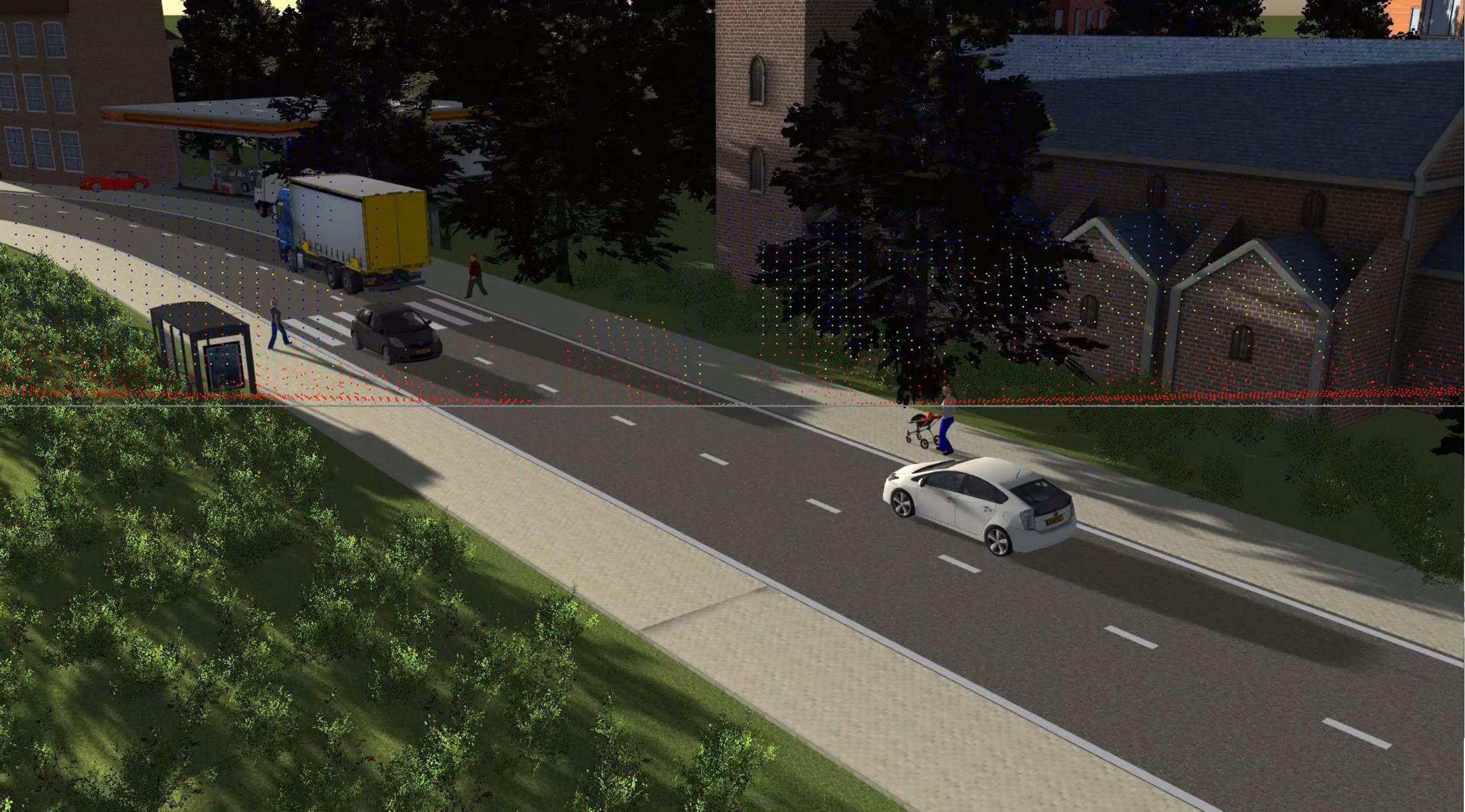
From a lab...



To a test track...



To the real world...



ADAS / AD V&V framework on Azure cloud

Covered use cases



Functional testing, robustness mapping or verification coverage

At-scale Model-in-the-Loop and Software-in-the-Loop orchestration
for ADAS/AD CAE groups

Open-loop cases:

sensor design or specification, computer vision, sensor fusion, embedded software components testing

Closed-loop cases:

testing integrated systems, full autonomous vehicles or V2x ecosystems in their environments

Vehicle physics optimal fidelity available when needed
(vehicle dynamics, powertrain, actuators)

ADAS/AD V&V framework

Simulation production: overall workflow and AEBS example

- ❖ IBEO imported highway and city scenarios
 - ❖ Created highway and city scenarios with OpenDrive import
 - ❖ Off-the-shelf Euro NCAP and ADAC scenarios content in Simcenter Prescan
- Total: 50 parametrizable safety scenarios**

- ❖ Long and short range radar probabilistic models
- ❖ AEBS in C/C++ code
- ❖ ABS, ESC models
- ❖ 15 DOF chassis with Pacejka tires
- ❖ Braking system physics including actuation and its controls

Process automation:

- ❖ Write preliminary auxiliary files
- ❖ Pre-guesstimate relevance of current test case (challenge level) with some expressions. If unreasonable, test case replaced.
- ❖ Vehicle dynamics-only initialisation run to determine initial ego chassis state
- ❖ Execute the main co-simulation run
- ❖ Run a specific post-processing python script

- ❖ Scenarios parametric sampling method: latin hypercube sampling on 5 to 10 parameters, with 100 test cases per scenario allocated budget
- ❖ Input parameters dependencies enforcement across models: drives parameters consistency and relevance of generated test cases
- ❖ Post-process metrics with expressions: gives safety and performance high level insight

- ❖ Azure cloud submission and execution
- ❖ Parallelized execution monitoring from local machine
- ❖ Result analysis during execution from local machine

- ❖ Display safety and performance metrics at simulation plan level (5000 runs) to provide failure modes patterns view in test cases space.
- ❖ In-depth results analysis for some selected runs based on overview
- ❖ **Discovered problem 1:** Bad weather conditions provoke too much radar waves attenuation, which leads to targets non detection and sometimes near accidents situations
- ❖ **Discovered problem 2:** AEBS' road network mapping contains flaws and leads to wrong emergency braking triggers generating very bad comfort or even collisions

Automated reports generation: AEB testing key findings and simulation activity summary



Info:

Region: Japan

Test case automation for hardware-in-the-loop
Radar and Camera simulation use-cases

PreScan at Honda R&D

Masahito Shingyoji, Chief Engineer, Honda R&D

" We applied PreScan real-time HIL for testing our camera – radar system. Extensive test scenarios were simulated using test automation to maximize the efficiency of development cycle. We used it to test our ADAS applications such as LDW, FCW and TSR, and are now extending to AEB and ACC along with precise vehicle dynamics models of CarSim. "



Info:

Region: Korea

ADAS algorithm development and R&D

PreScan at HMC

Yongsun Kim, Part Manager, Hyundai Motor Company R&D Center

" Hyundai Motor Company (HMC) has been using PreScan software for several years now to develop and verify new ADAS functions such as pre-crash. We particularly value the capabilities of the software in the area of scenario definitions, the easy interface to our existing vehicle dynamics models, the broad database of different sensing technologies and the professional support that we receive from the local TASS team. As a result we recently planned to extend our PreScan usage to our autonomous driving development and research. "



Info:

Region: Germany

ADAS and HMI development R&D

PreScan for Driving Simulator

**Thomas Passegger, Truck Product Engineering,
Daimler Trucks**

" When upgrading our truck driving simulators for ADAS and HMI studies, we selected the PreScan software from TASS International for the world, scenario and sensor simulation. Its accurate sensor models and flexible scenario definition enable us to do active safety system analysis and HMI studies with a driver in the loop. Their engineering team did a great job connecting PreScan to our existing control and vehicle dynamics models. "