



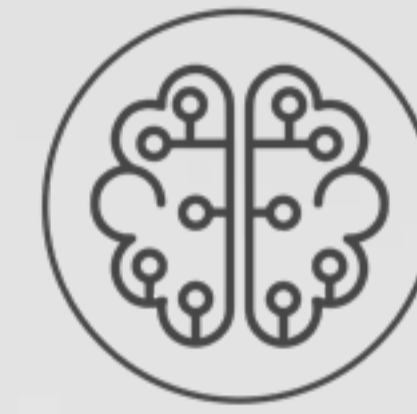
## USE 3D SIMULATION FOR THE DEVELOPMENT AND VALIDATION OF YOUR INTELLIGENT SYSTEMS



IOT



MOBILE ROBOTICS



TRAINING DATA

Whether for the development or maintenance phases in operational condition, the use of functional simulation is essential to accelerate work on embedded computing, while making it more secure.

**4DV-SIM** provides access to a suitable working environment to maximize, make reliable and capitalize on the work carried out on functional digital twins within contextualized 3D virtual environments.

**4DV-SIM** is dedicated to the development and validation of embedded software used by:

- **Mobile robotic** systems,
- **IoT** applications
- Systems embedding **A.I.**



## USE 3D SIMULATION TO

- TEST QUICKLY AND MASSIVELY
  - THE PERCEPTION AND CONTROL-COMMAND ALGORITHMS OF YOUR MOBILE ROBOTIC SYSTEMS
  - YOUR EMBEDDED IOT APPLICATIONS
- GENERATE YOUR LEARNING A.I. DATABASES
- VALIDATE AND MAKE YOUR EMBEDDED SOFTWARE RELIABLE

Access a suite of tools specially developed for the generation of sensor data and used for the development, testing and reliability of algorithms used by intelligent mechatronic systems

## A FUNCTIONAL SIMULATION to:

- Speed up the development phases
- Secure the start-up phases
- Ensure non-regression capacities
- Optimize costs thanks to plug & play simulations
- Validate the behaviour of your intelligent/ embedded systems



PLUG&PLAY

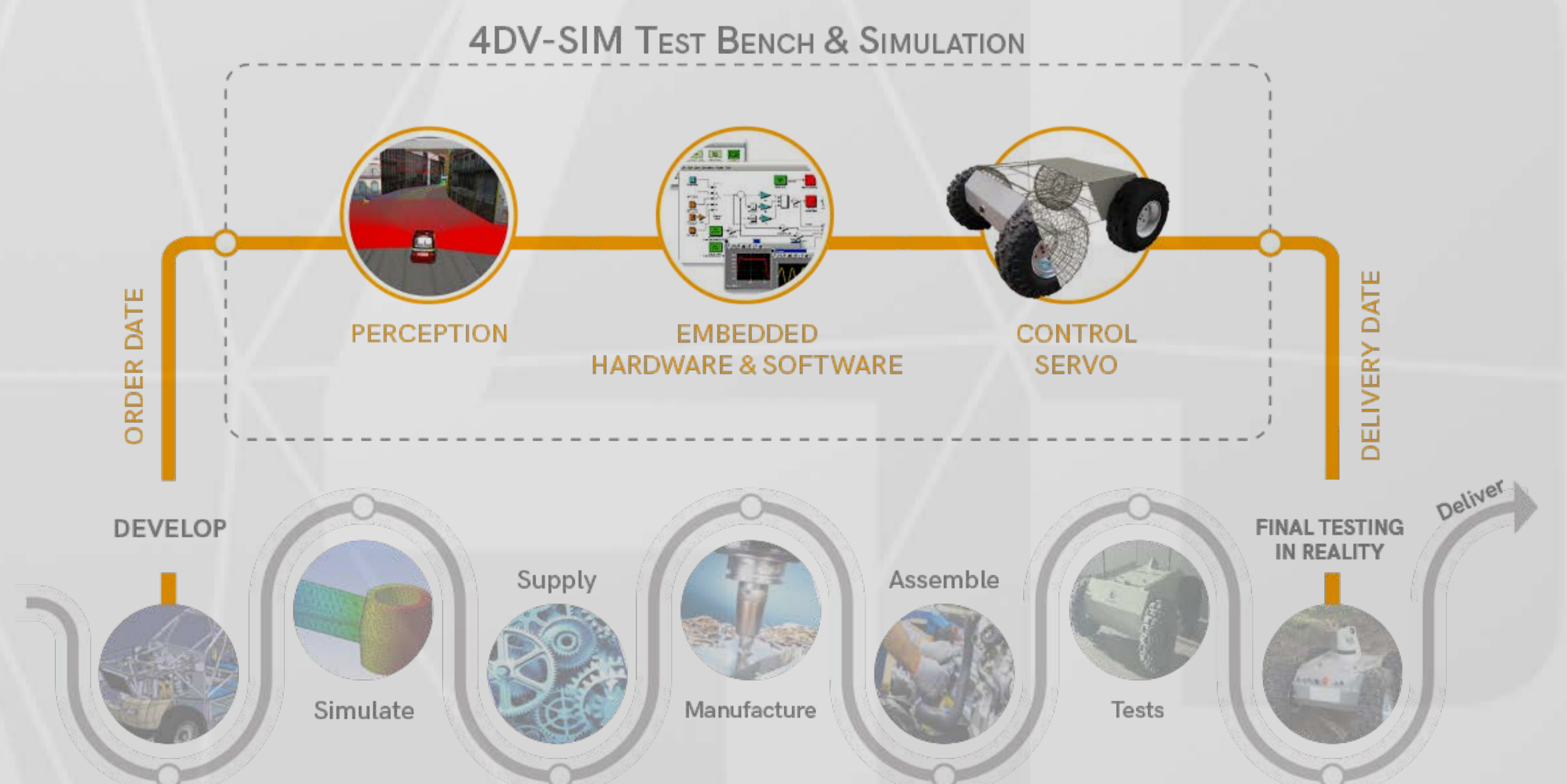


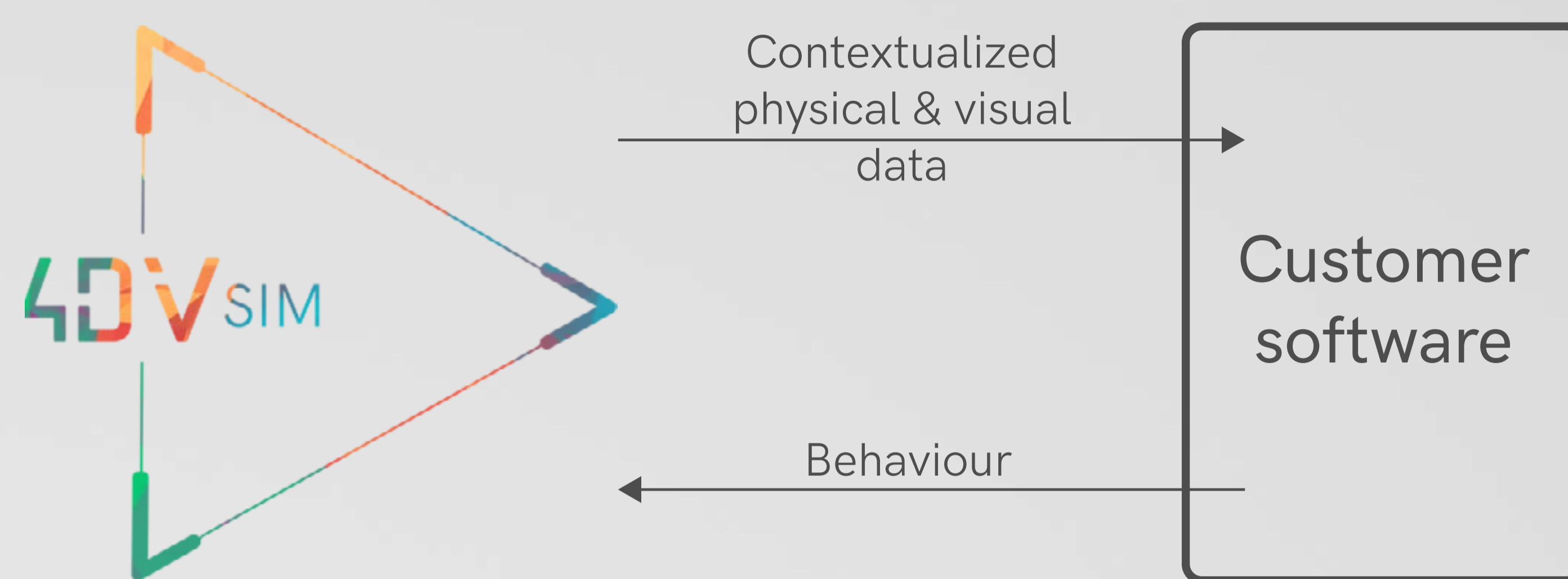
Illustration of a test bench and simulation for a robotic system

# SIMULATION OF SENSORS, RADIO COMMUNICATION FOR YOUR DIGITAL TWINS

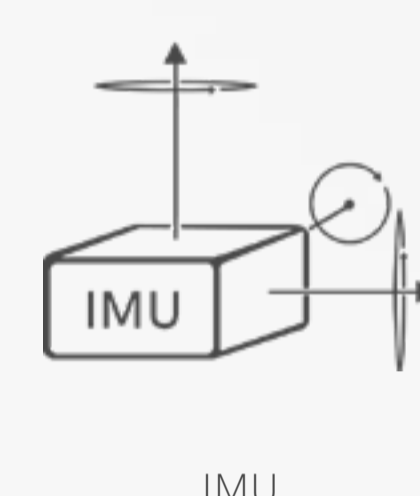
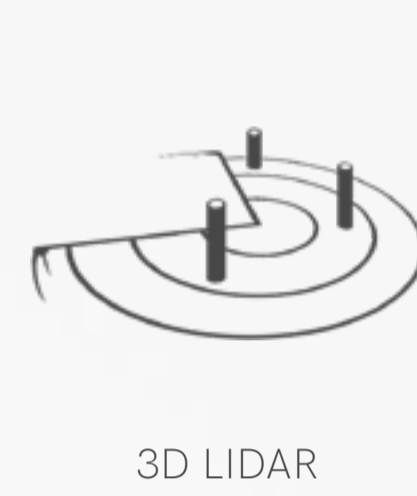
## GENERIC MODELS & EMULATED SENSORS

Generation of sensor data, SIL and HIL simulations

### AN OPEN SIMULATION



### TYPES OF SENSORS AVAILABLE:



- Perspective camera
- Fisheye camera
- Omnidirectional camera
- Thermal camera
- Ground Truth camera: *depth, normal and semantic*
- Inertial measurement units (IMU)

- 2D Lidar
- 3D Lidar
- GNSS
- Altimeter
- Gyrometer
- Anemometer
- Odometer
- Position sensor

### TYPES OF MEDIAS :

- Files
- TCP/IP
- Serial
- Bus CAN
- HD SDI
- Radio
- UWB
- Wifi

Velodyne LiDAR

SICK  
Sensor Intelligence.

PEPPERL+FUCHS

SBG SYSTEMS

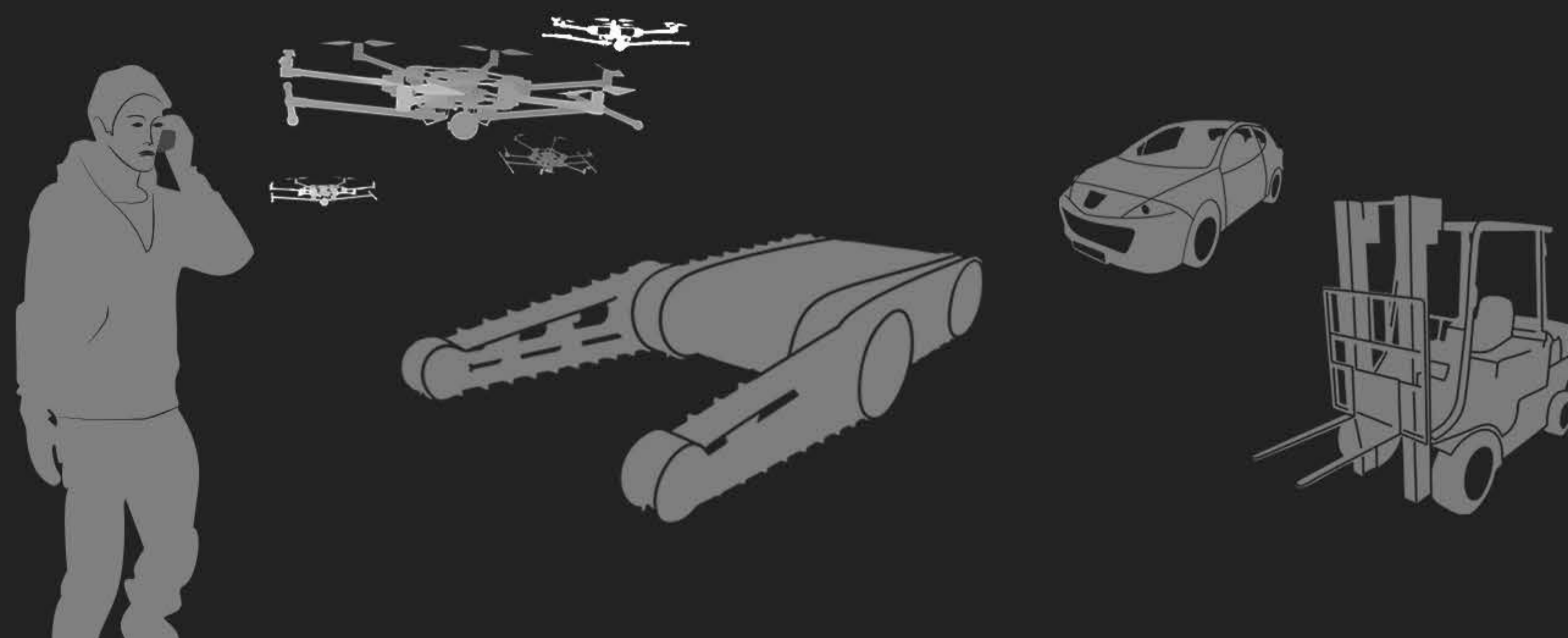
HOKUYO

OUSTER

## MULTI-AGENT SIMULATION

Wheeled vehicles, tracked vehicles, propeller drones, mobile systems, fixed and on-board systems

Simulation of the dynamics and the operating logic of the systems (Ackermann mode, differential calculation, specificities of propeller drones) including control instructions and definition of the state of the joints



## DATABASE GENERATION OF CONTEXTUALIZED ANNOTATED IMAGES

### USE IN AI

Deep-learning, reinforcement learning

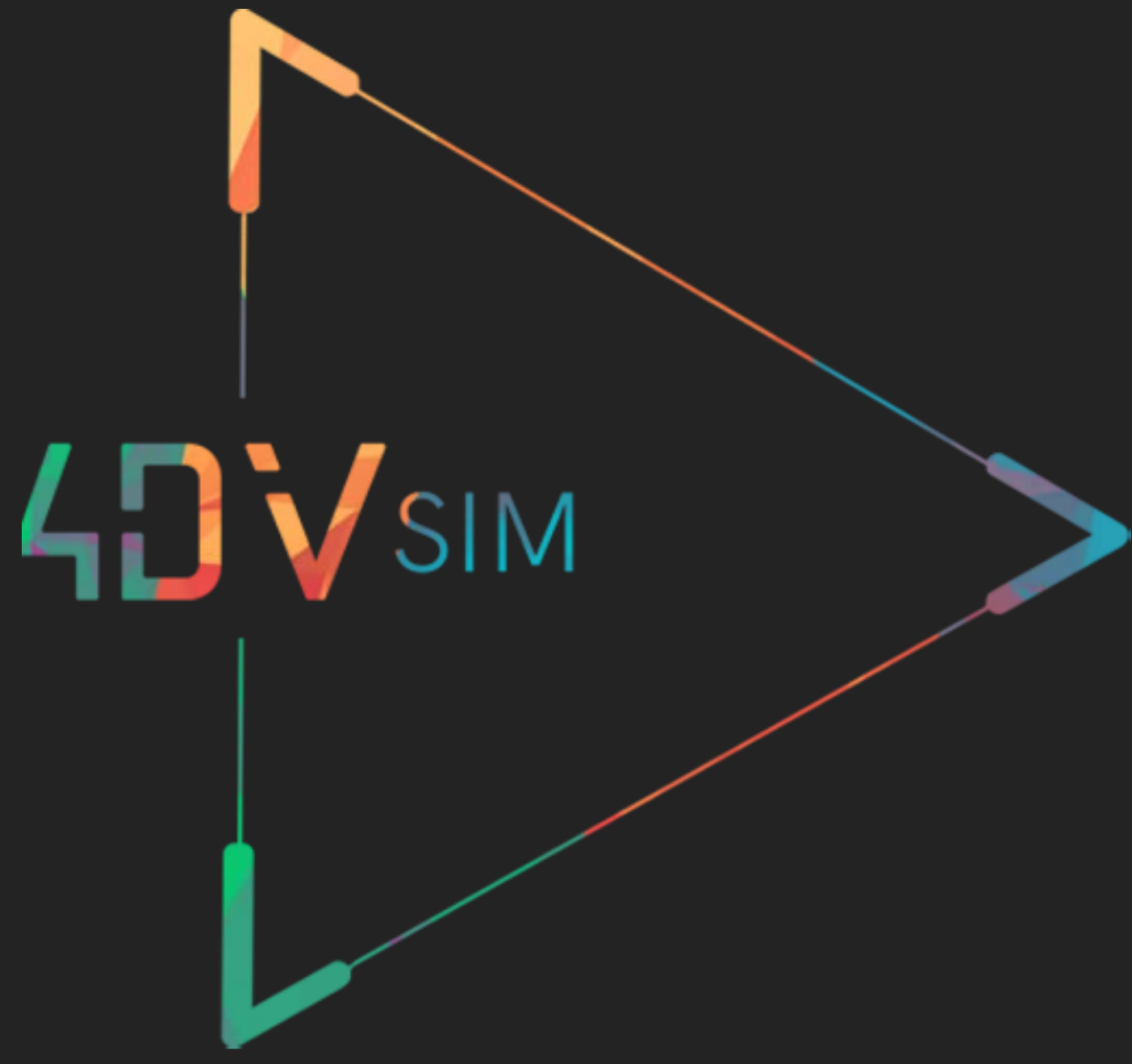
The use of high value applications using AI can be quickly blocked by the lack of real data available.

Create your own contextualized databases that are immediately usable, their variability and representativeness are adapted to the functional needs of your applications.



TRAINING DATA





# A COMPLETE ENGINEERING FRAMEWORK

From the preparation of the models, the preparation of the scenarios, **4DV-SIM** allows you to simulate in real time or in deferred time, to generate data at a high level of representativeness, to visualize and to interact with the systems.

**4DV-SIM** allows you to set up experimental designs:

- Whether in the development and fine-tuning phase to make your application algorithms more reliable,
- Whether for your learning phases, with the generation of databases for your neural networks used in deep-learning,
- Or, in the acceptance phase, to maximize the number of contextualized and variable tests that guarantee the level of maturity of the functionalities, before they are used on real equipment.

## SOFTWARE MAP OF 4DV-SIM SUITE

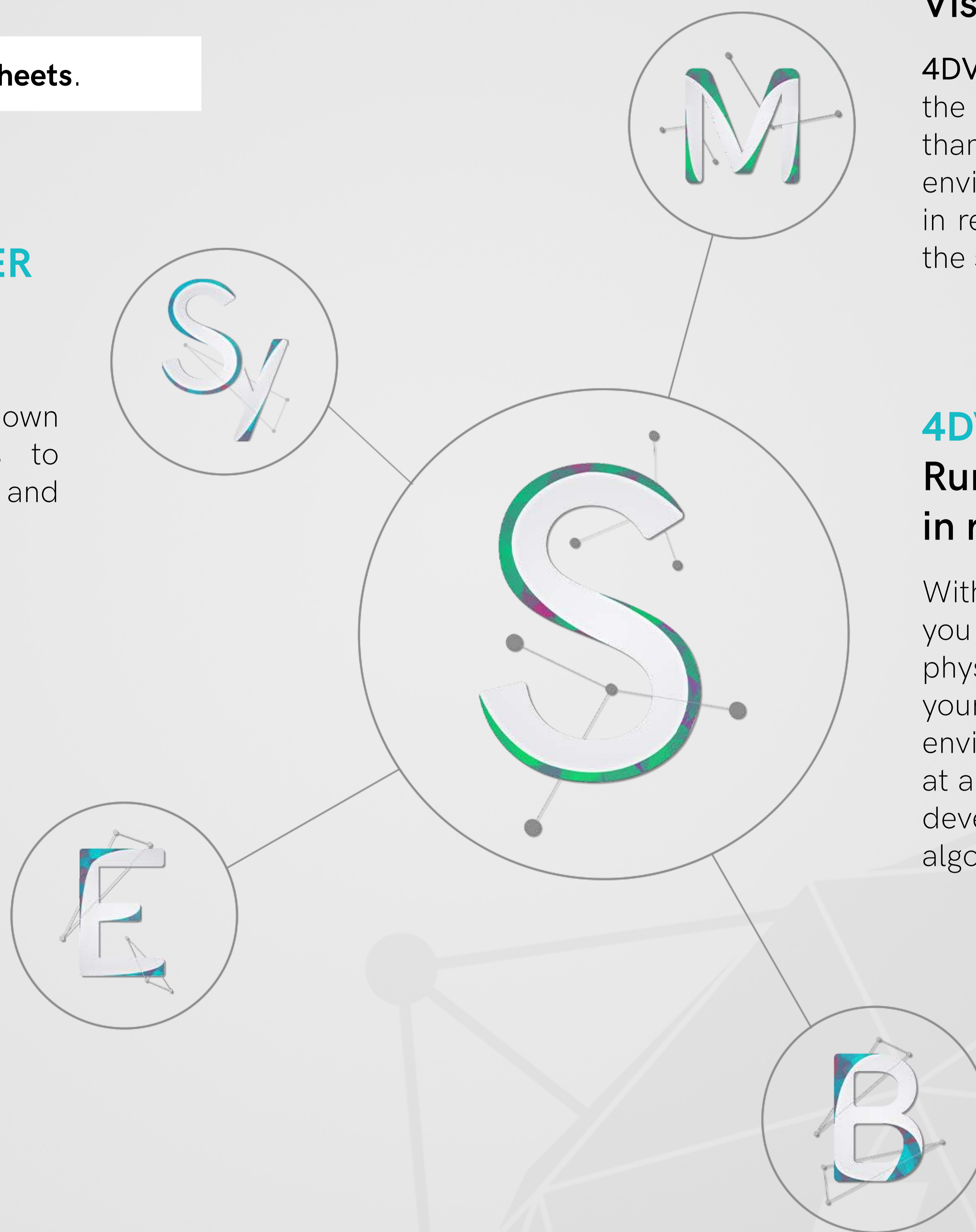
Consult our detailed **product sheets**.

### 4DV-SYSTEM DESIGNER Build your own models

**4DV-SYSTEM DESIGNER** allows you to prepare your own 3D and functional systems to work in complete autonomy and confidentiality.

### 4DV-EDITOR Setup your scenarios

With **4DV-EDITOR**, you prepare your simulation scenarios, you configure your sensors and test conditions, you interface your digital twins to work in co-simulation, in H.I.L simulation with your on-board computing, your FPV controllers.



### 4DV-MONITOR Visualize and interact

**4DV-MONITOR** allows you to visualize the sensor data generated in real time thanks to these viewers, to show the environment from above and interact in real time with the agents present in the simulation.

### 4DV-SIMULATOR Run your simulations in real time

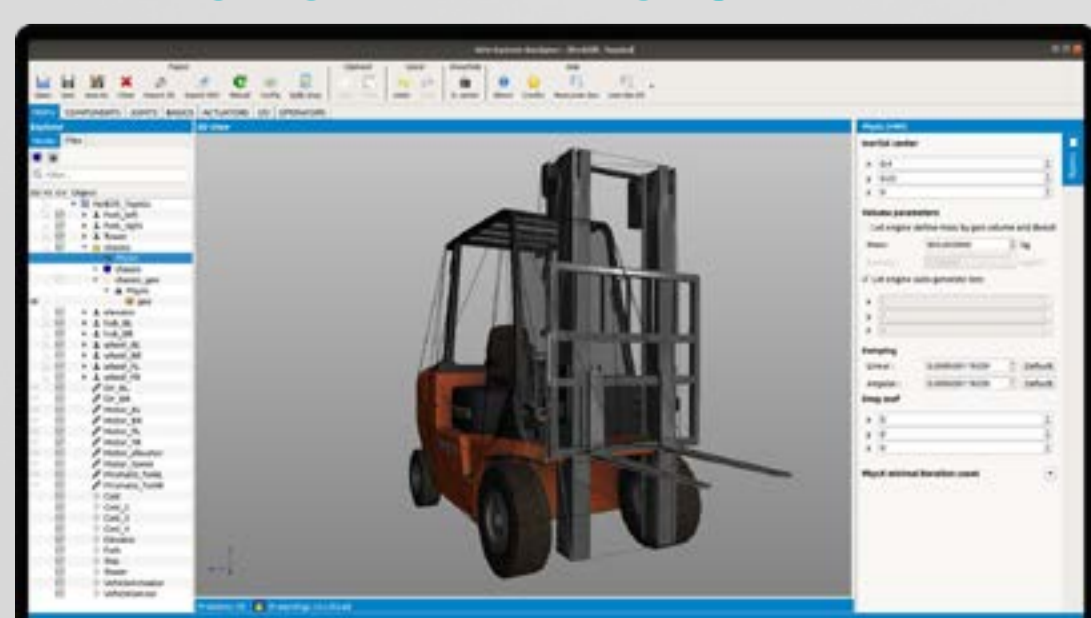
With **4DV-SIMULATOR**, you work by exploiting a visual and physical plug&play simulation of your systems, in indoor and outdoor environments. You produce sensor data at a high level of representativeness to develop your perception and control algorithms.

### 4DV-BATCH Set up your experience plans

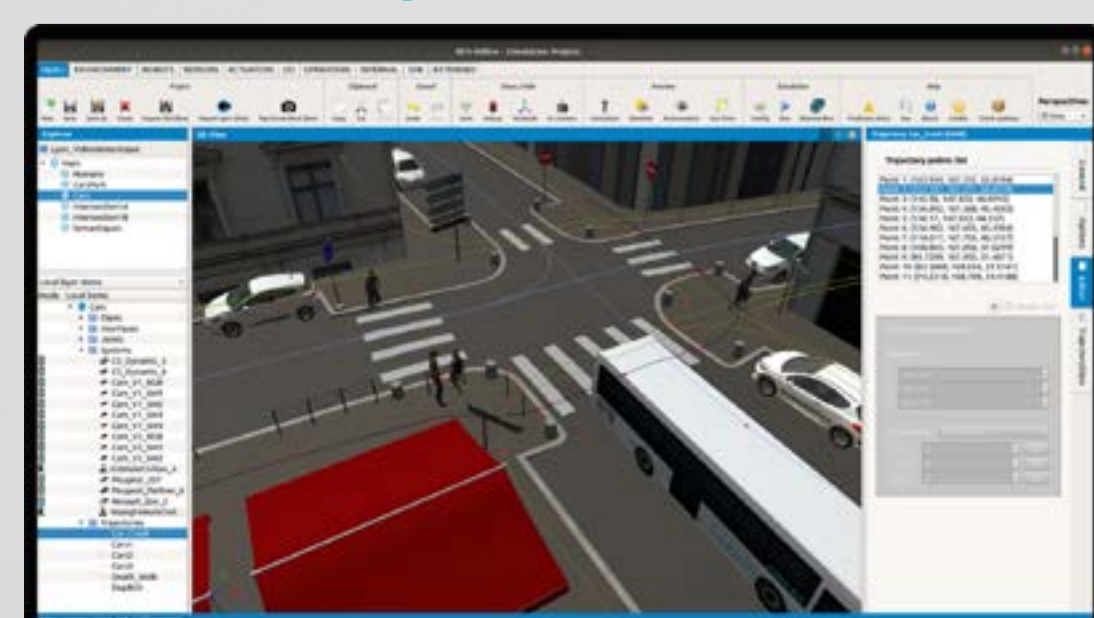
- Thanks to **4DV-BATCH**, you:
- automate the generation of experimental plans for the testing and reliability of your algorithms,
  - generate your annotated databases for learning your neural networks used in deep-learning.

## SOFTWARE GRAPHICAL USER INTERFACES

4DV-SYSTEM DESIGNER



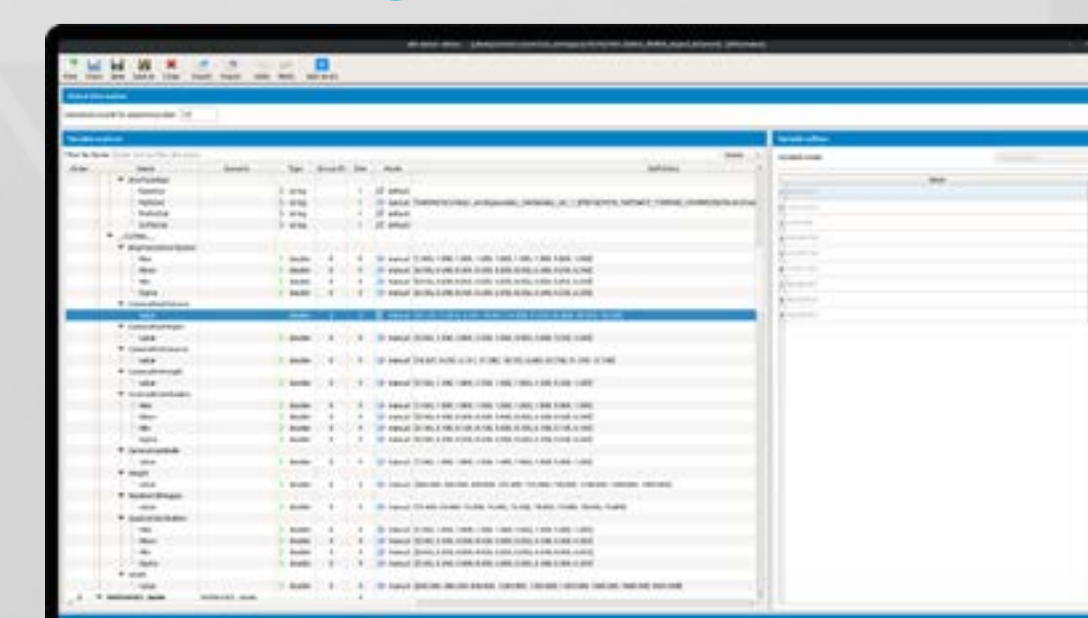
4DV-EDITOR



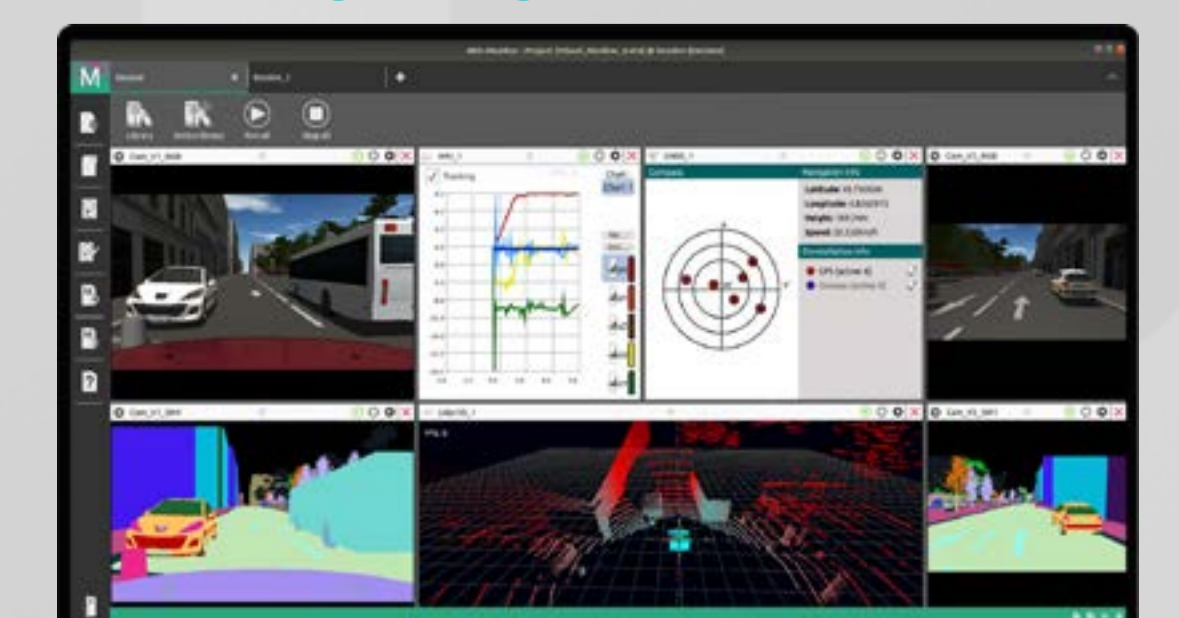
4DV-SIMULATOR



4DV-BATCH



4DV-MONITOR



# USE CASES

## AVAILABLE RESOURCES FOR VARIOUS CONTEXTS

- A library of accessible 3D resources for the creation and contextualization of simulation scenarios is available to users,
- Used in different contexts: military, urban, industrial, agricultural or in research and education, indoors, outdoors,
- Resources and functionalities are continuously added,
- The user can complete this library with their own 3D resources.

Sector of activity	Context	Fields of studies	Environmental properties
MILITARY	industrial	mobility	off-road
ROBOTICS	research and education	transport	route
AUTOMOTIVE	urban	logistics	indoor
	peri-urban	agro equipment	indoor/outdoor
	rural	detection	
	arid		

TYPE	INVENTORY
Controlled robots and vehicles	controlled robots controlled vehicles controlled drones
Environmental resources	environments static objects, kinematic vehicles pedestrians, soldiers



## INTERFACING WITH SOFTWARE AND MIDDLEWARES

**4DV-SIM** is open and allows co-simulation with software and middleware, such as MATLAB/Simulink, RTMaps, ROS, etc.

**ADVANTAGES:** exploitation of fine models of behaviour of dynamic systems, exploitation of output data of the simulator for sensor data fusion.

Flexible configuration of inputs/outputs

Compatibility with previous versions

