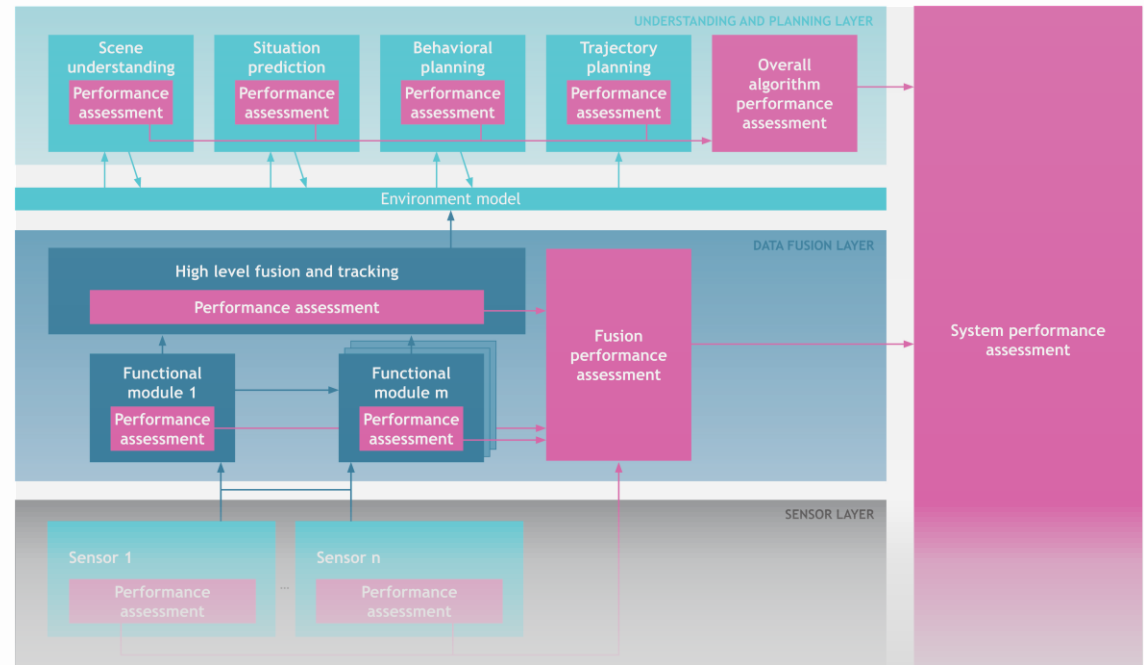




Requirements & Architecture

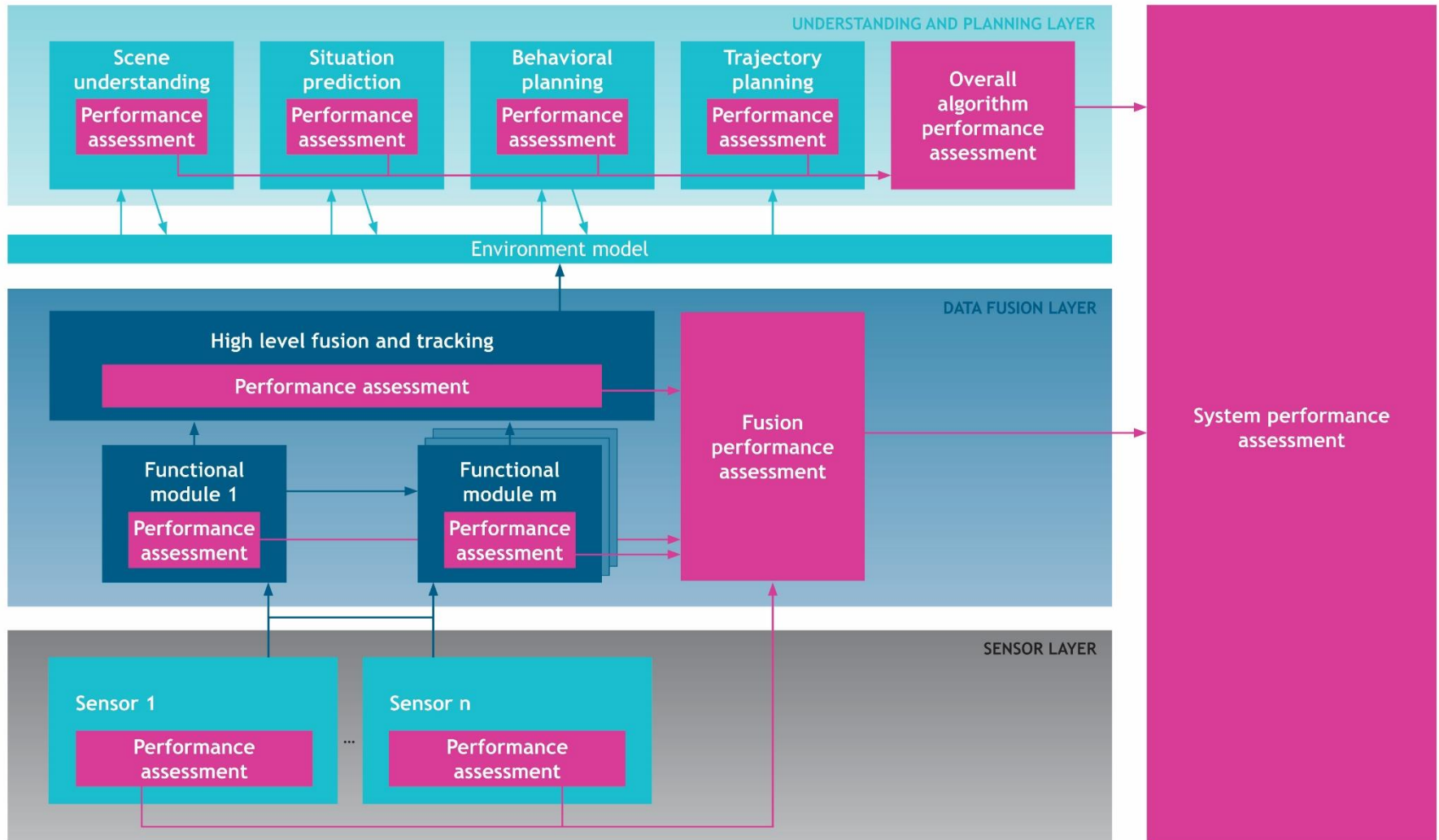
Final Event Ulm
May 16th, 2018

Bernd Schäufele
Fraunhofer FOKUS

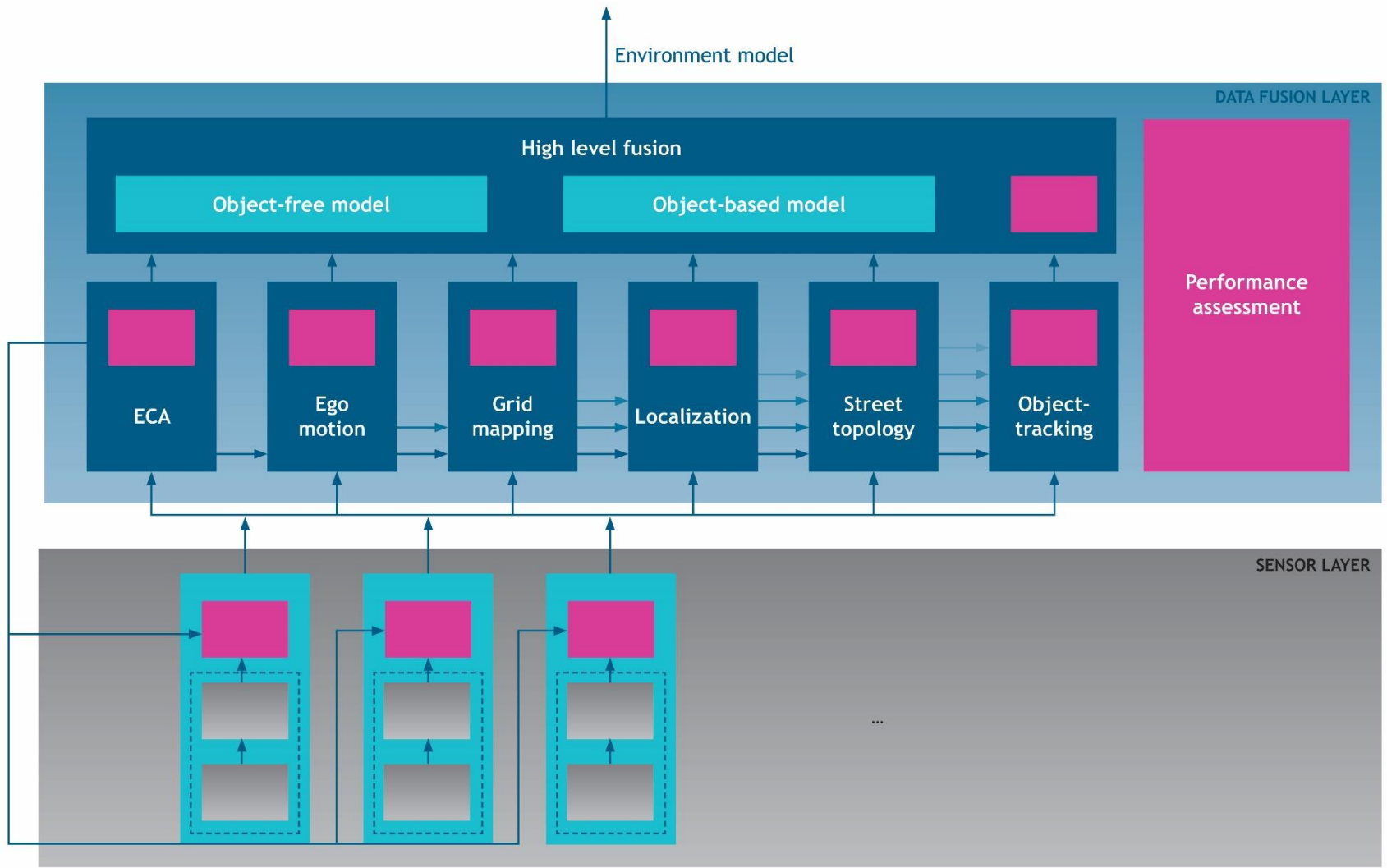


RobustSENSE Architecture

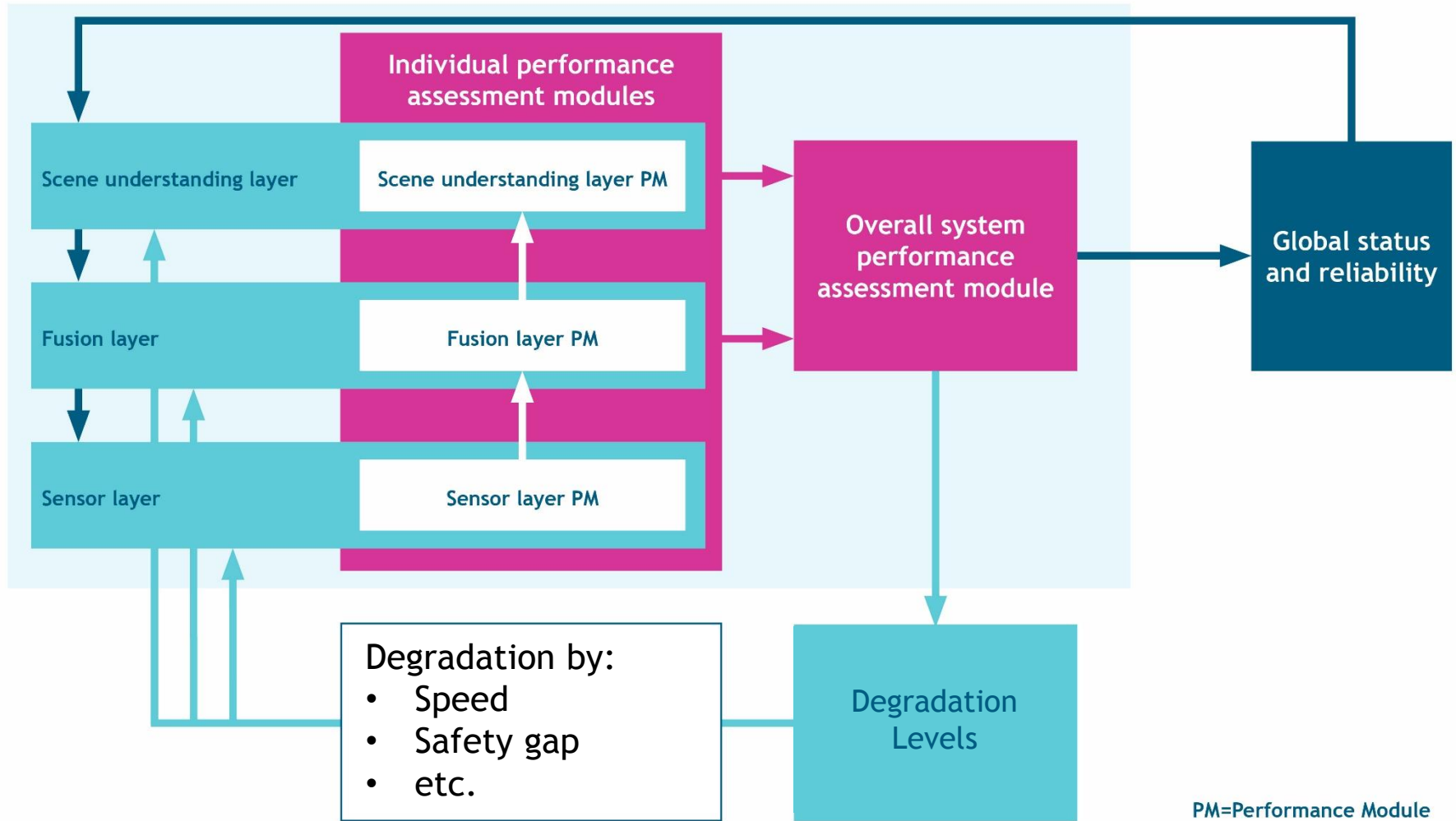
Architecture - Overview



Architecture - Sub-module Architecture



Architecture - Performance Assessment View



▼ Metrics example - LIDAR

ID	Name	Description	Data type	Unit	Minimum	Used by
LM1	Confidence Index	The confidence index for assessing the sensor performance level	Float		0	Fusion modules
LM2	Average sensing distance	The average of the current possible sensing distance	Integer	m	0	Fusion modules
LM3	Maximum sensing distance	The maximum of the current possible sensing distance	Integer	m	0	Fusion modules
LM4	LIDARWorking	Indicates if the RADAR sensor is up and running correctly.	Boolean	-	-	Fusion modules

Metrics definition

▼ Metrics definition website

▼ Definition from developers

▼ Metrics per component

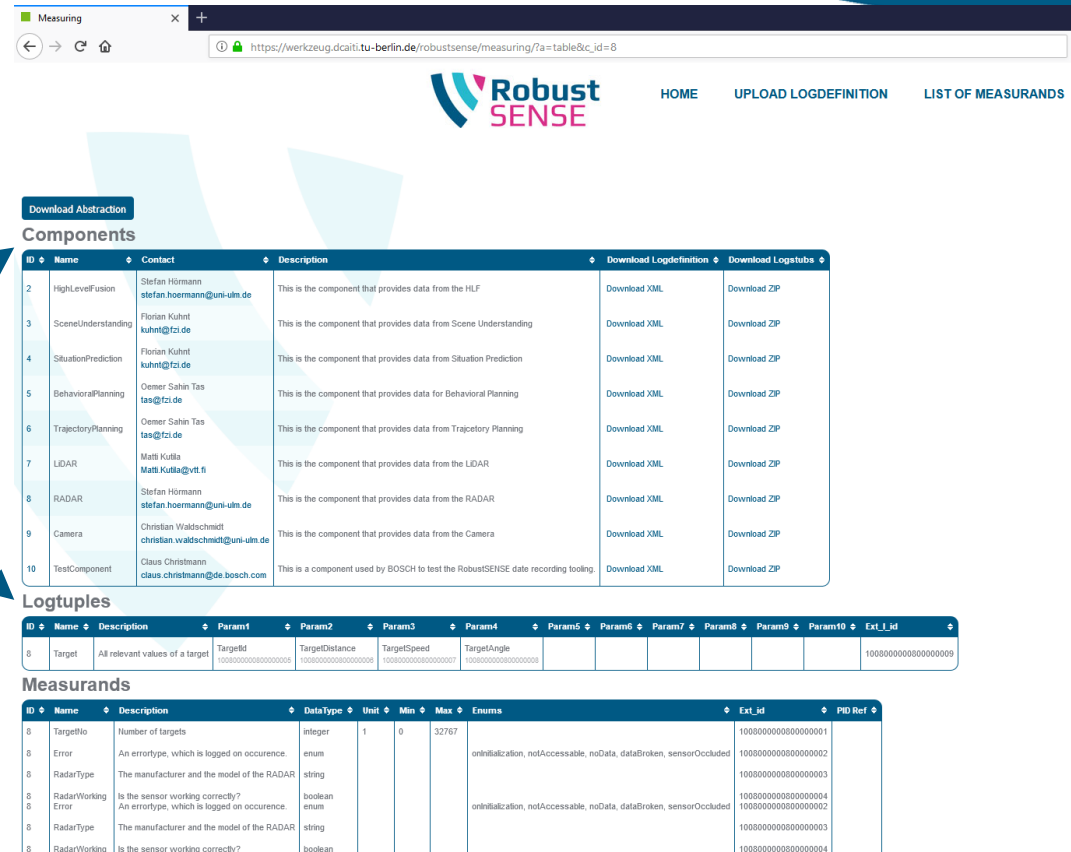
▼ Metrics

▼ Combined metrics

▼ Individual metrics

▼ Complete list

▼ Logging API generated



Measuring

https://werkzeug.daili.tu-berlin.de/robustsense/measuring/?a=table&c_id=8

Robust SENSE

HOME UPLOAD LOGDEFINITION LIST OF MEASURANDS

Download Abstraction

Components

ID	Name	Contact	Description	Download Logdefinition	Download Logstubs
2	HighLevelFusion	Stefan Hörmann stefan.hoermann@uni-ulm.de	This is the component that provides data from the HLF	Download XML	Download ZIP
3	SceneUnderstanding	Florian Kuhnt kuhnt@fzi.de	This is the component that provides data from Scene Understanding	Download XML	Download ZIP
4	SituationPrediction	Florian Kuhnt kuhnt@fzi.de	This is the component that provides data from Situation Prediction	Download XML	Download ZIP
5	BehavioralPlanning	Oemer Sahin Tas tas@fzi.de	This is the component that provides data for Behavioral Planning	Download XML	Download ZIP
6	TrajectoryPlanning	Oemer Sahin Tas tas@fzi.de	This is the component that provides data from Trajectory Planning	Download XML	Download ZIP
7	LIDAR	Matti Kutlia Matti.Kutlia@vt.ti	This is the component that provides data from the LIDAR	Download XML	Download ZIP
8	RADAR	Stefan Hörmann stefan.hoermann@uni-ulm.de	This is the component that provides data from the RADAR	Download XML	Download ZIP
9	Camera	Christian Waldschmidt christian.waldschmidt@uni-ulm.de	This is the component that provides data from the Camera	Download XML	Download ZIP
10	TestComponent	Claus Christmann claus.christmann@de.bosch.com	This is a component used by BOSCH to test the RobustSENSE data recording tooling.	Download XML	Download ZIP

Logtuples

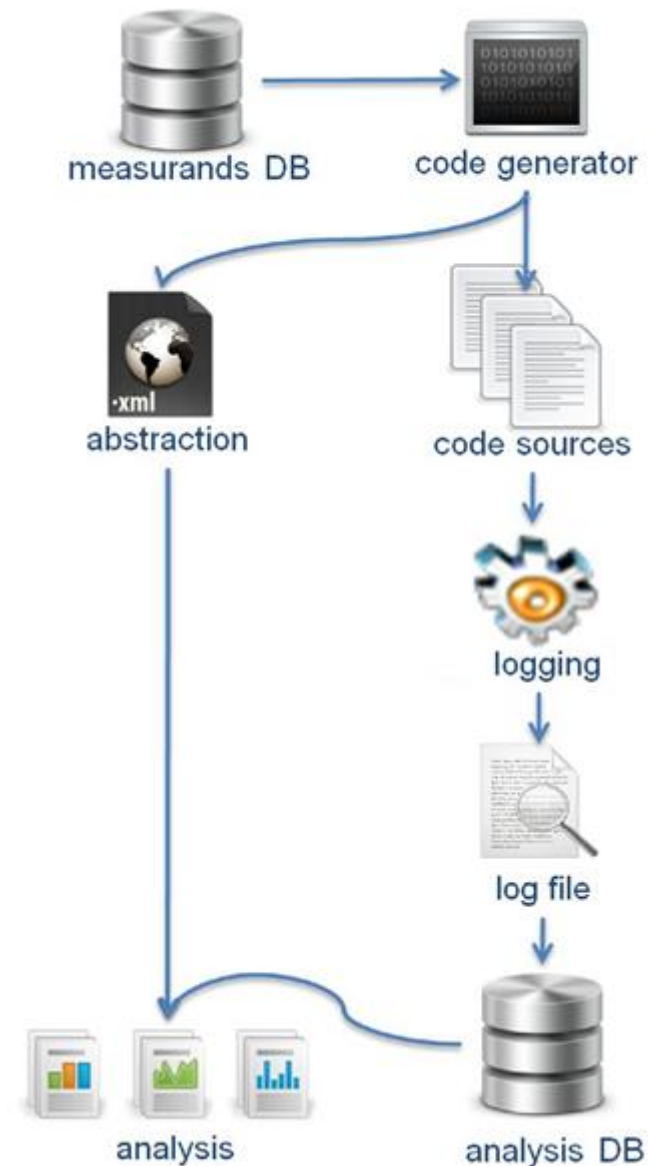
ID	Name	Description	Param1	Param2	Param3	Param4	Param5	Param6	Param7	Param8	Param9	Param10	Ext_Id
8	Target	All relevant values of a target	TargetId 10080000000000000000	TargetDistance 10080000000000000000	TargetSpeed 10080000000000000000	TargetAngle 10080000000000000000							10080000000000000000

Measurands

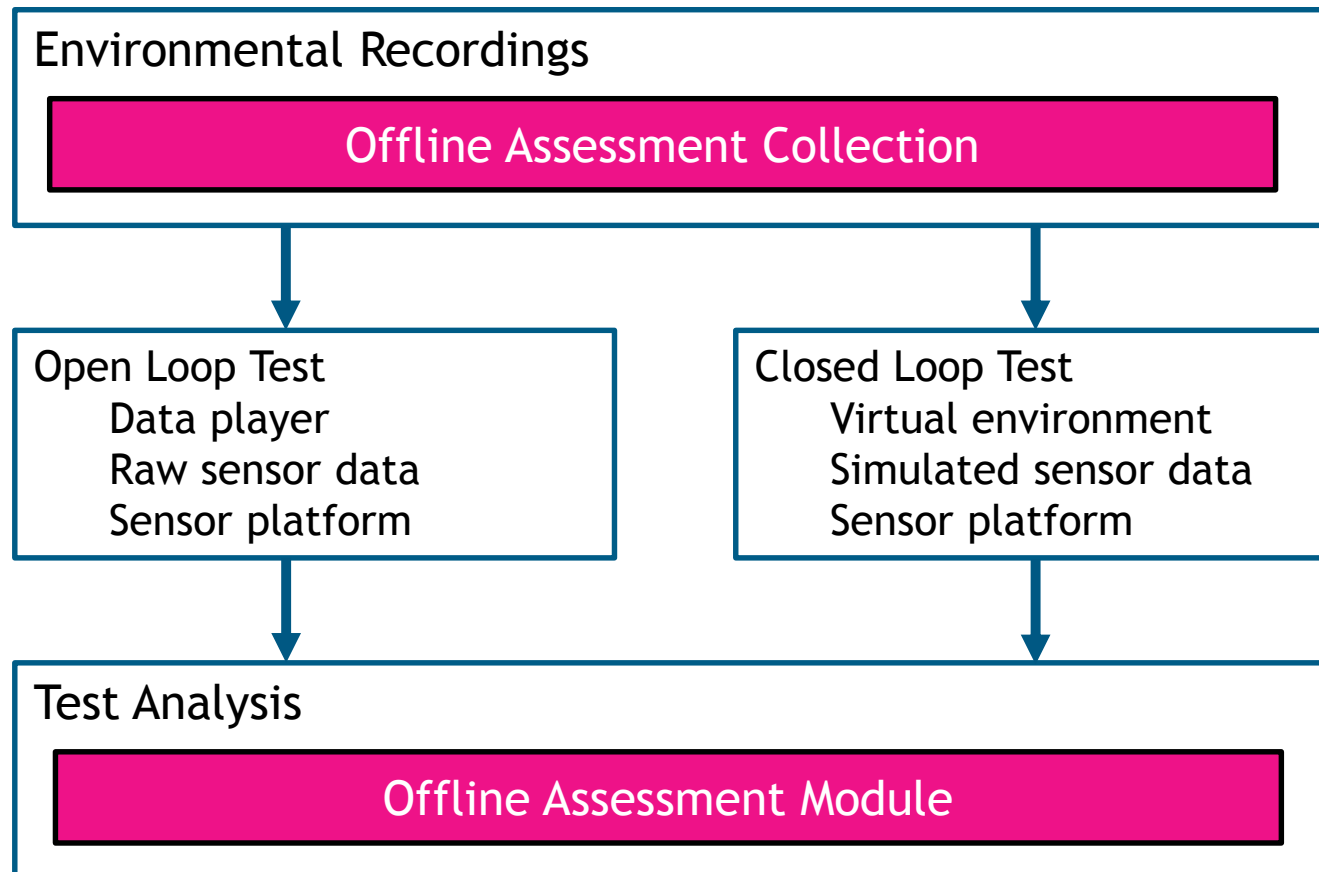
ID	Name	Description	Data Type	Unit	Min	Max	Enums	Ext_Id	PID Ref
8	TargetId	Number of targets	integer	1	0	32767		100800000000000000000001	
8	Error	An error type, which is logged on occurrence.	enum				initialization, notAccessible, noData, dataBroken, sensorOccluded	100800000000000000000002	
8	RadarType	The manufacturer and the model of the RADAR	string					100800000000000000000003	
8	RadarWorking	Is the sensor working correctly?	boolean					100800000000000000000004	
8	Error	An error type, which is logged on occurrence.	enum				initialization, notAccessible, noData, dataBroken, sensorOccluded	100800000000000000000002	
8	RadarType	The manufacturer and the model of the RADAR	string					100800000000000000000003	
8	RadarWorking	Is the sensor working correctly?	boolean					100800000000000000000004	

Solution for Offline Assessment

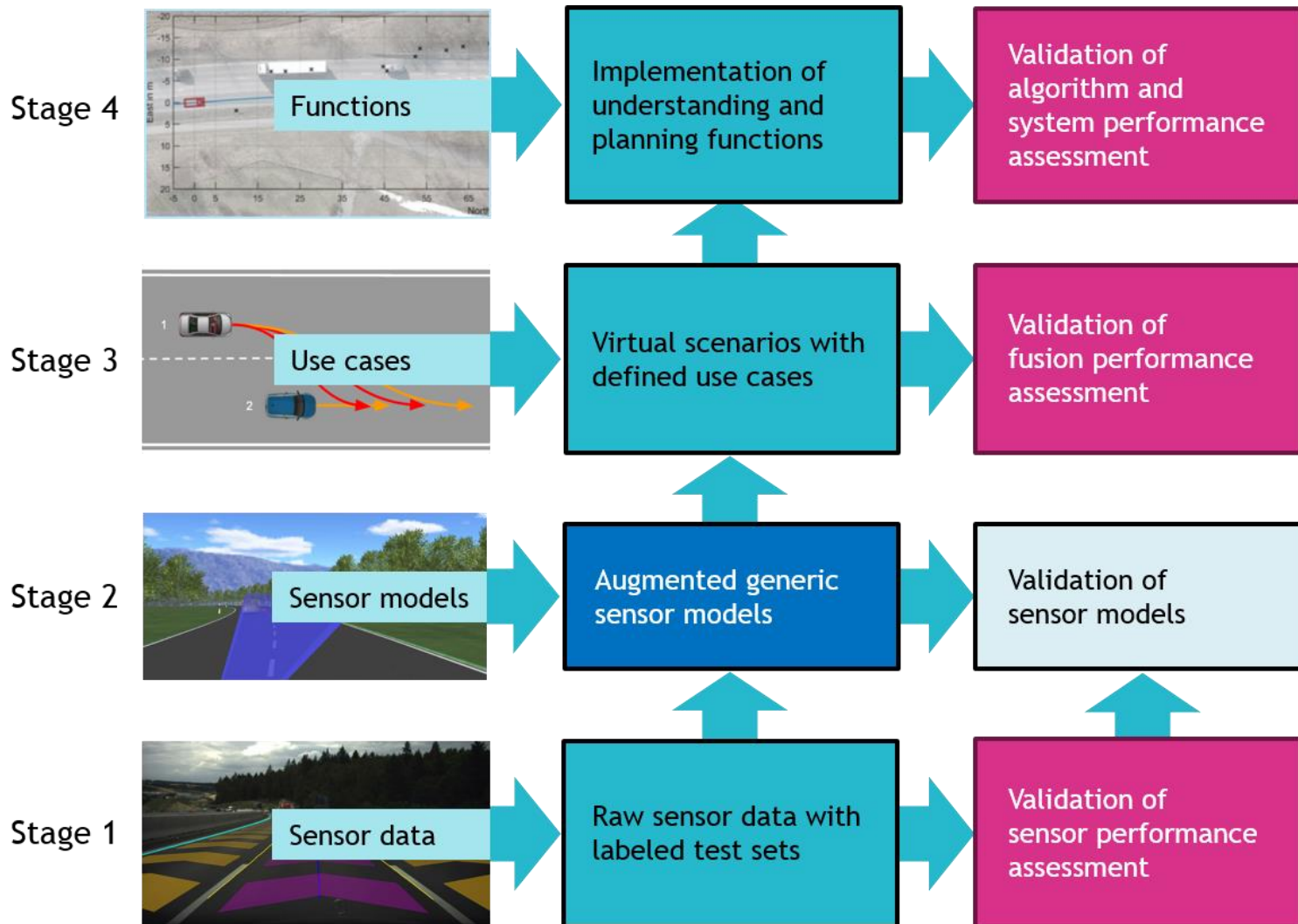
- ▼ Uploaded definitions stored in DB
- ▼ Code generator for different platforms
 - ▼ x86 Windows
 - ▼ x86 Linux
 - ▼ Java VM
 - ▼ extensible
- ▼ Generated logging API
 - ▼ Automated logging
 - ▼ Uniform format
- ▼ Log files created
- ▼ Imported to analysis DB



▼ Offline and online validation

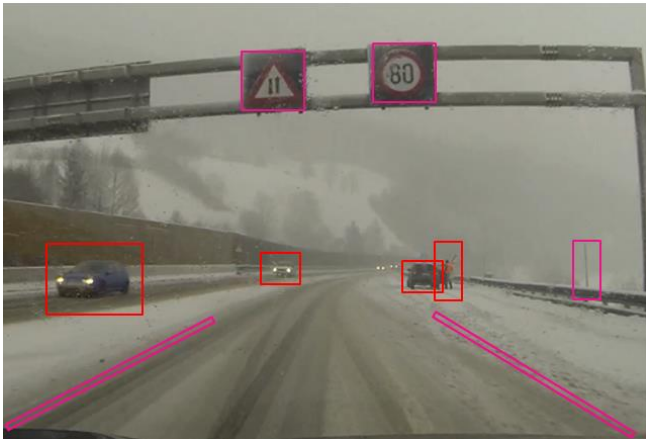


Validation Methodology



Demonstration of Validation Environment

▼ Winter driving



Key Achievements

- ▼ Reference architecture for robust automated driving
- ▼ Metrics for performance assessment on all layers
- ▼ Open and closed loop validation methodology
- ▼ Uniform measurement tool for comparison between vehicles
- ▼ Virtual validation environment for safe and repeatable testing