ASAM Ideation Workshop

Experiences and takeaways of ika's handling and processing of field data in various federal and European projects for automated driving

Höhenkirchen, December 2, 2019

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Institute for Automotive Engineering (ika)

Institute for Automotive Engineering
Mission of ika and fka

Leading Education and Research in Automotive Engineering

> Education

- Profound & interdisciplinar education on a high level
- Early introduction of students into research projects
- Holistic education of scientific employees

⇨ ***Creativity and internationalisation***

> Public funded Research

- Research on fundamentals and innovative concepts
- excellent basis for IP and publications
- Formation of national and international networks

⇨ ***Perception as creative minds & coordinators***

> Industrial Research

- Transformation of IP into innovation
- neutral, competent partner with focus on technology
- development of personality and project management

⇨ ***Social responsibility***

Creating Ideas and Driving Innovation for Safe, Efficient and Exciting Mobility

Projektziele.

Die Entwicklung eines methodischen Ansatzes für den Sicherheitsnachweis hochautomatisierter und autonomer Fahrzeuge (SAE-Level 4/5) zur Homologation im urbanen Umfeld.

OEM-/Tier1-übergreifende Definition „Stand der Technik“ für die Absicherung automatisierter Fahrfunktion L4/5.

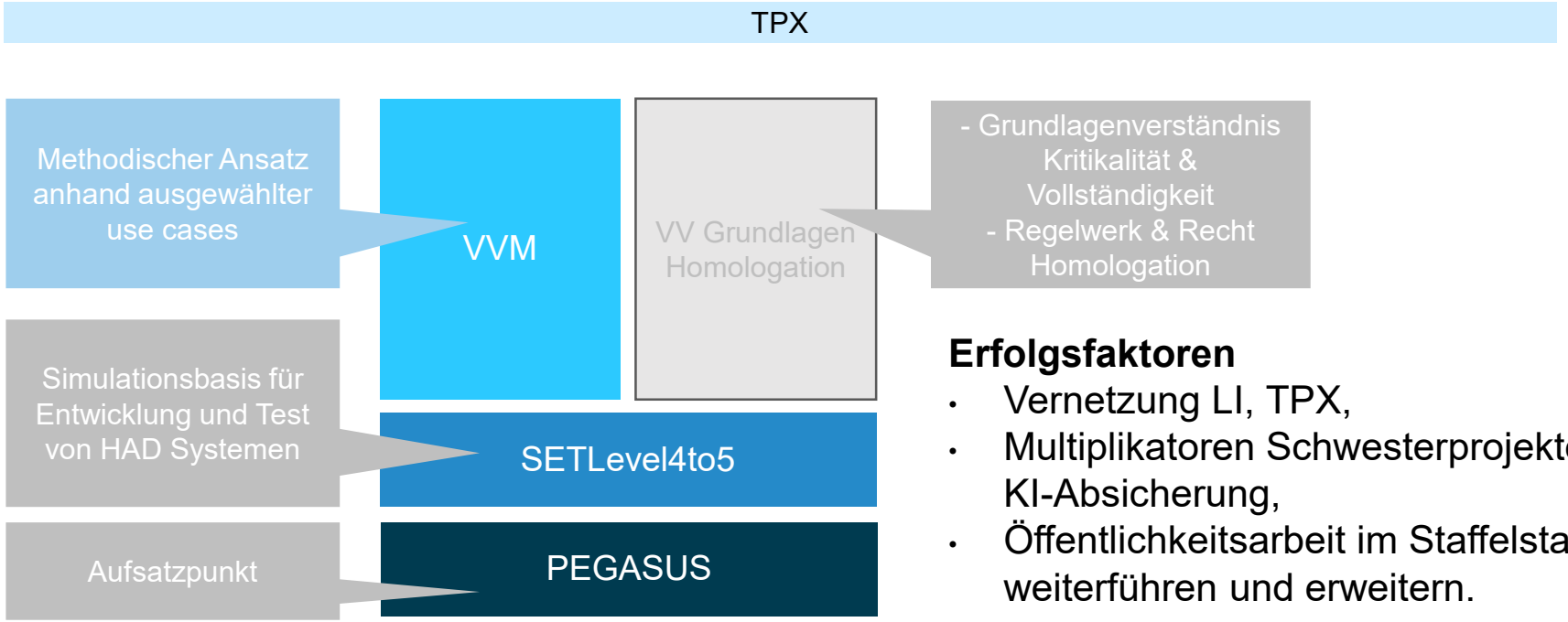
OEM/Tier1-übergreifende **Grundlage für Gesetzesdiskussion.**

Verbreitung des V&V Vorgehens, d.h. **Industrialisierung, internationale Harmonisierung und Standardisierung (Fortführung PEGASUS Aktivitäten).**

VVM Einordnung in Projektfamilie.

Gesamtansatz Verifikation und Validierung autonomer Systeme

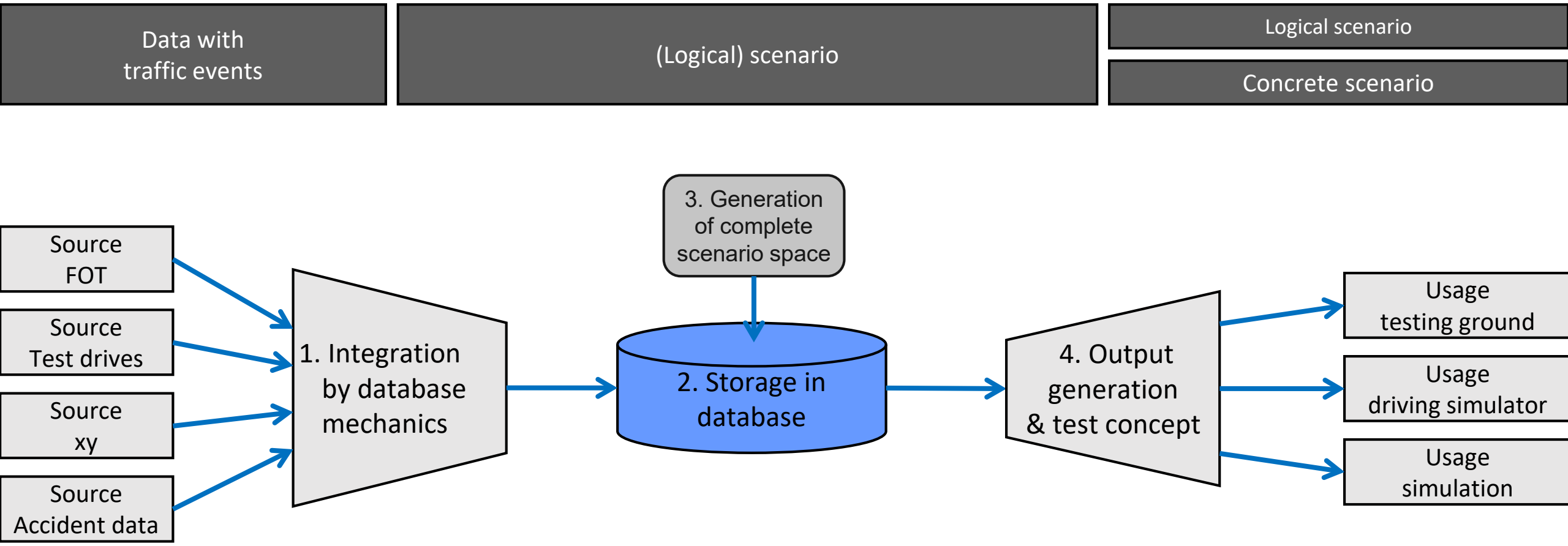
Blockbild Projektfamilie VV



Erfolgsfaktoren

- Vernetzung LI, TPX,
- Multiplikatoren Schwesterprojekte: SETLevel4to5, KI-Absicherung,
- Öffentlichkeitsarbeit im Staffelstab zu PEGASUS weiterführen und erweitern.

Safety Assurance and Impact Assessment of Automated Driving
Deriving Scenarios: The Scenario Database: Conceptual approach



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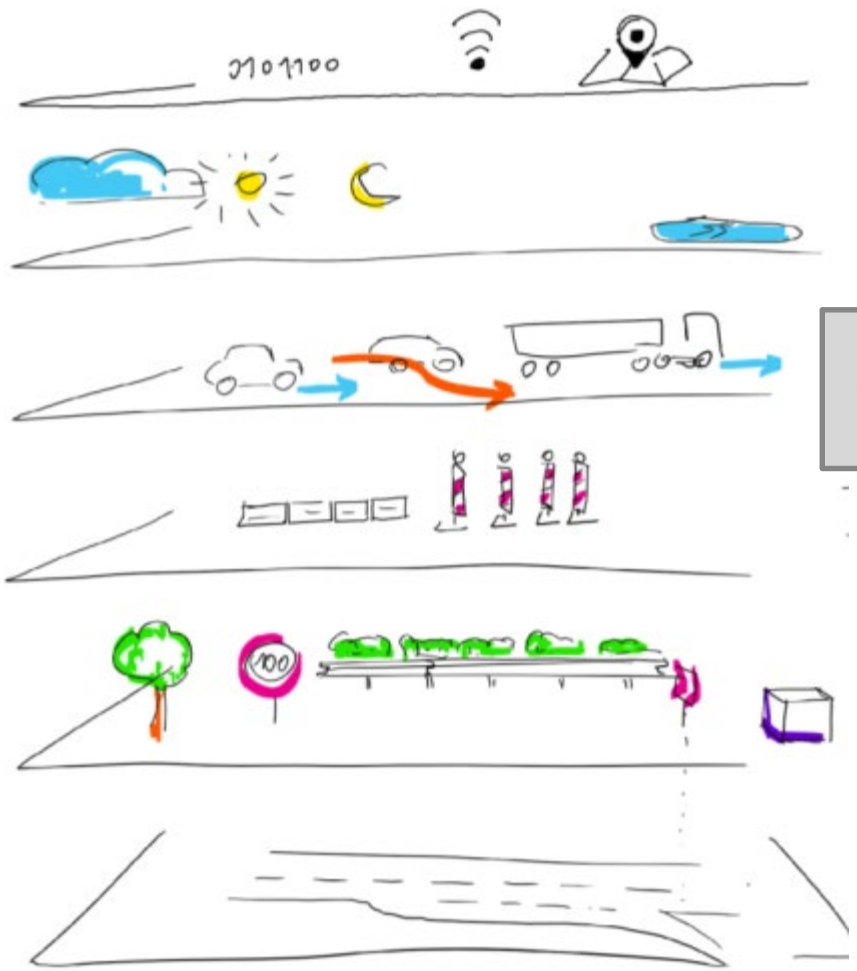
Data Layer Model for Scenario Description



Layer 6

Digital information:

e.g. V2X information on traffic signals, digital map data

=> Availability and quality of information communicated to subject vehicle

Layer 5

Environmental conditions

Light situation, weather (rain, snow, fog…) temperature

=> environmental influences on system performance

Layer 4

Movable objects

Vehicles, pedestrians moving relatively to ownship

=> relevant traffic participants and their motion incl. dependencies

Layer 3

Temporal modifications and events

Road construction, lost cargo, fallen trees, dead animal

=> temporary objects minimizing / influencing the driving space

Layer 2

Road furniture and Rules

traffic signs, railguards, lane markings, bot dots, police instructions

=> including rules, where to drive how

Layer 1

Road layer

road geometry. Road uneveness (openCRG),

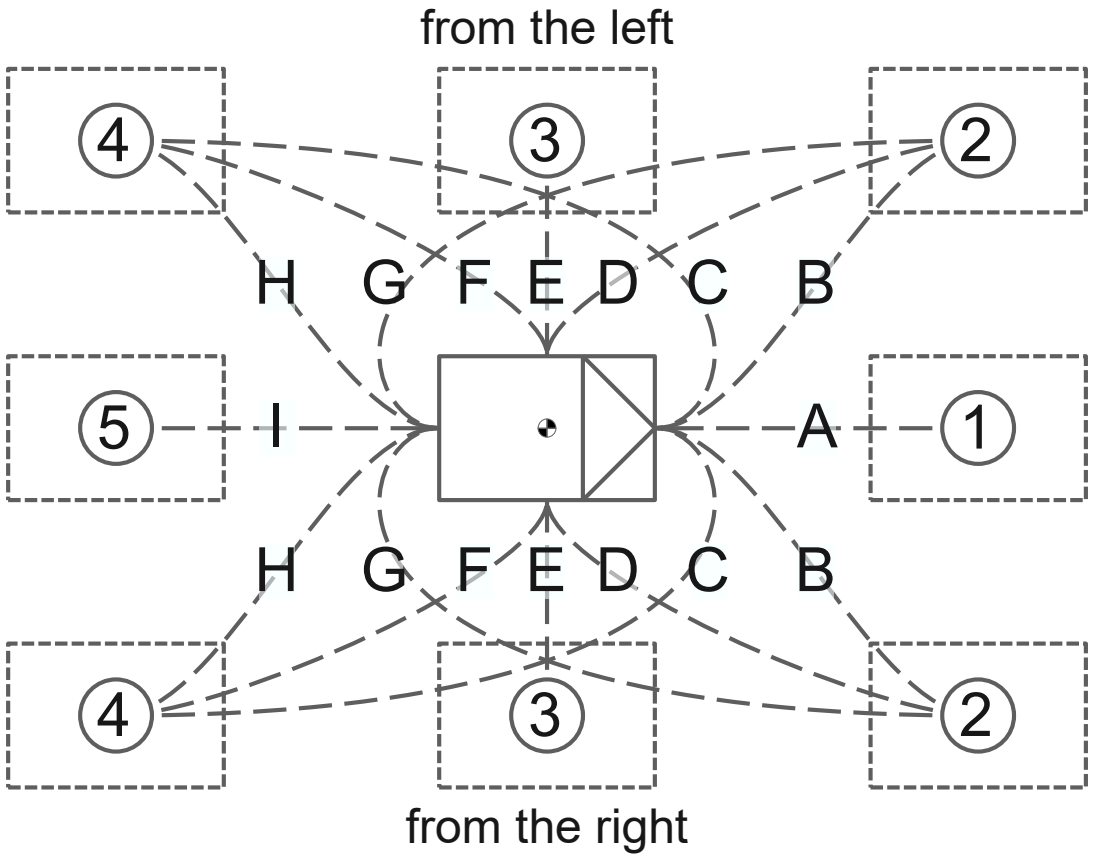
=> physical description, no scenario logics

[1] Bock et al. 2018: Data Basis for Scenario-Based Validation of HAD on Highways

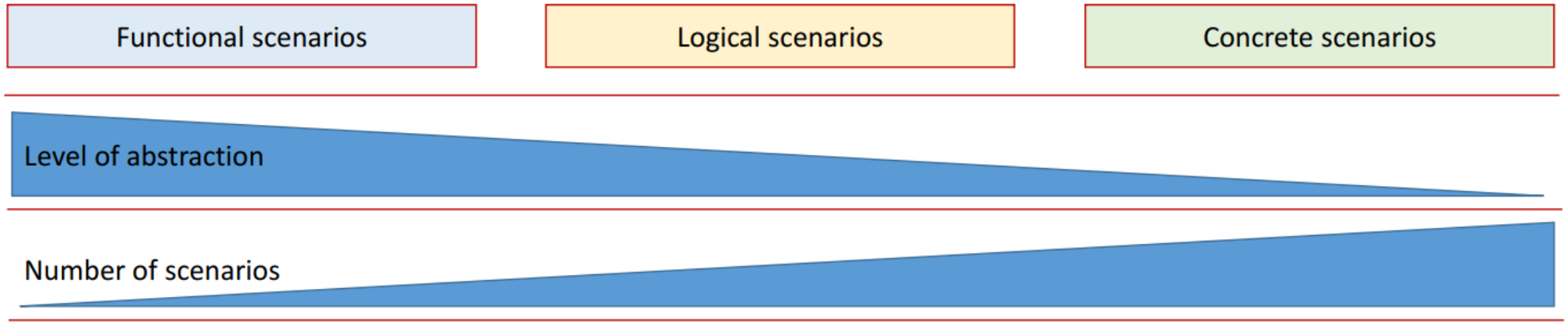
[2] Bagschik et al. 2018: Ontology based Scene Creation for the Development of Automated Vehicles

Base-Scenarios (Layer 4) Motorway

Impact	Initial position	Path	Indication
Front	1	A	Lead vehicle challenger
	2	B	Slower turn into path challenger
	4	C	Overtaking turn into path challenger
Side	2	D	Slower side swipe challenger
	3	E	Side swipe challenger
	4	F	Overtaking side swipe challenger
Rear	2	G	Slower rear end challenger
	4	H	Rear end turning into path challenger
	5	I	Rear end challenger
Non	-	-	Uninfluenced/Free driving



Safety Assurance and Impact Assessment of Automated Driving
Scenario Concepts: Scenario Description Levels



Functional scenarios include operating scenarios on a semantic level. The entities of the domain and the relations of those entities are described via a linguistic scenario notation. The scenarios are consistent. The vocabulary used for the description of functional scenarios is specific for the use case and the domain and can feature different levels of detail.

Logical scenario is a model of **the time sequence of scenes whose parameters are defined as ranges**, which begins with an initial condition and, at a defined point in time, the behavior of the main actor (vehicle under test) is not further specified.

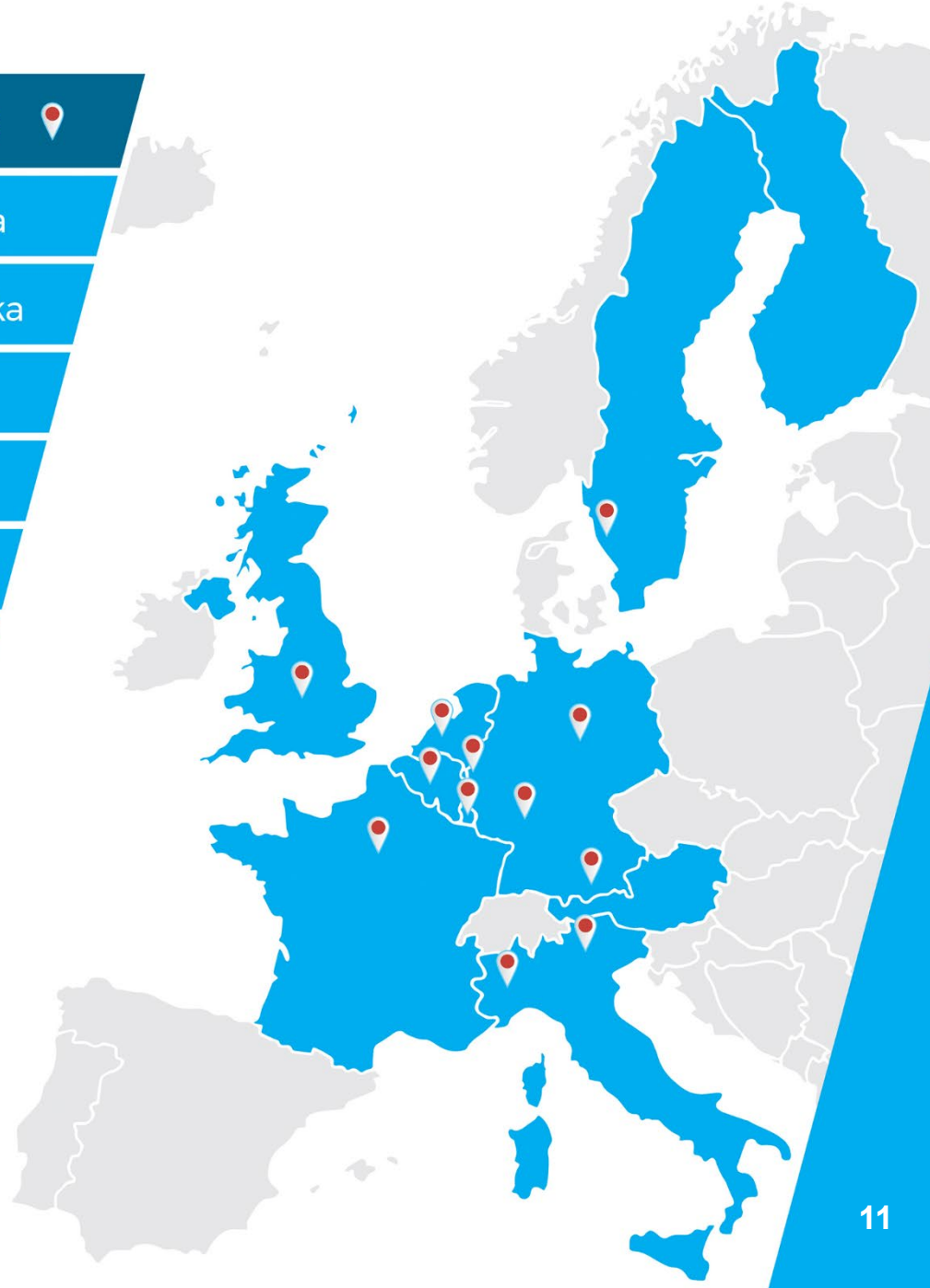
A concrete scenario is a **parameterized model of the time sequence of scenes (logical scenario),** which begins with an initial condition and at a defined point in time, the behavior of the main actor (vehicle under test) is not further specified.

[BAG17]

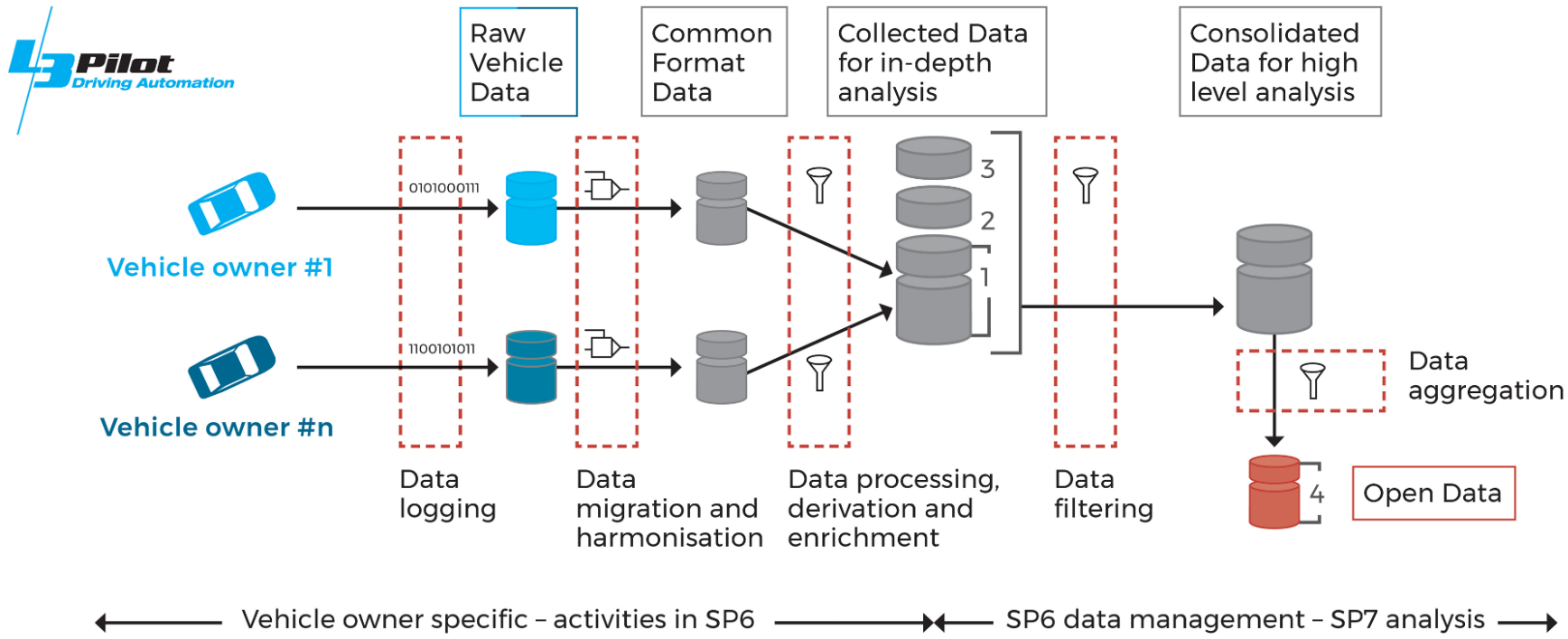

L3Pilot
Driving Automation
1,000
drivers
100
cars
10
countries

Pilot across Europe

COUNTRY / REGION / PARTNER	
BE / Brussels	Toyota
DE / Aachen	Ford / ika
DE / Munich	BMW
DE / Offenbach	Honda
DE / Wolfsburg	VW
DE / Ingolstadt	Audi
FR / Paris and other regions	REN / PSA
IT / Turin and Trento	CRF
LU / *NL*	Aptiv
SE / Gothenburg	Volvo
UK / Coventry	JLR
+ Cross-border activities	



L3Pilot Data Flow



Categories of data:

1 Derived Vehicle Data (CAN, GPS, PIs, video, and/or video annotations)
2 Subjective Data (interviews, questionnaires, simulator studies)
3 External Data (weather, map, ...)
4 Open Data (aggregated data)

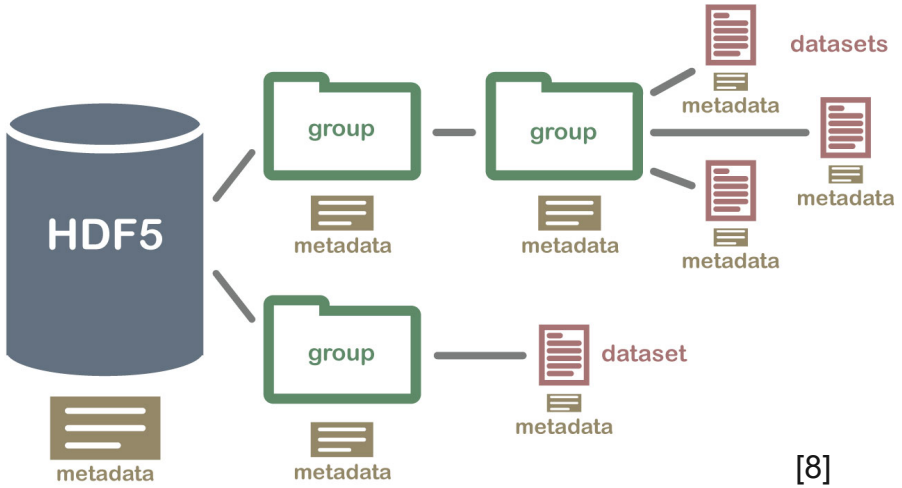
Tools provided by SP5

L3Pilot Common Data Format
Homologated Format for Data Transfer

- Many file formats were checked
- Hierarchical Data Format (HDF) was selected
- Portable, binary format
  - Compression optional
- Open source and free to use
- Available for many platforms & languages
  - Windows, Linux, …
  - Matlab, C/C++, Python, Java, …

- Enums for signals that aren't quantifiable

- https://github.com/l3pilot/l3pilot-cdf



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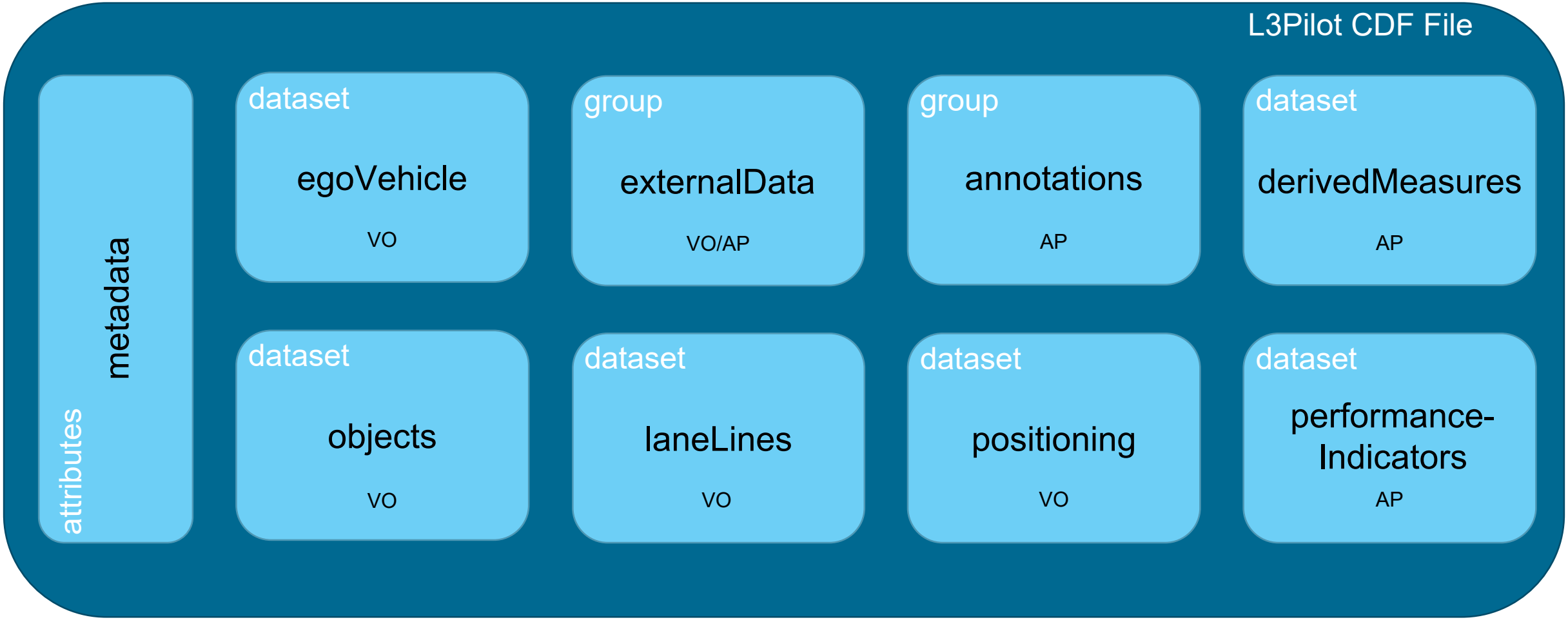
L3Pilot Common Data Format
Structure with Analysis Results



VO – vehicle owner

AP – analysis partner

Expectations
And open questions

- How can the collected metadata be used?
  - Influence of metadata on driver performance, driving function performance
- Homologated Data Format
  - Data format is important, not structure of database
- Clear definition of the meaning of “scenario”
- Is manual or automatic labelling considered?
- Interesting for us are data on object list level

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