

Felix Fahrenkrog
Adrian Zlocki

From development to type approval

Technical Workshop

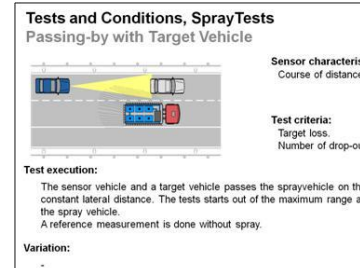
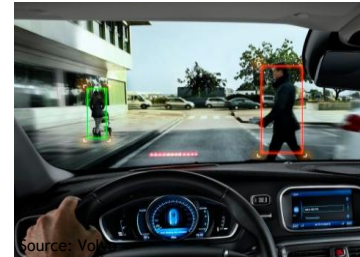
Athens, Greece
21-22 APRIL 2016



// Motivation

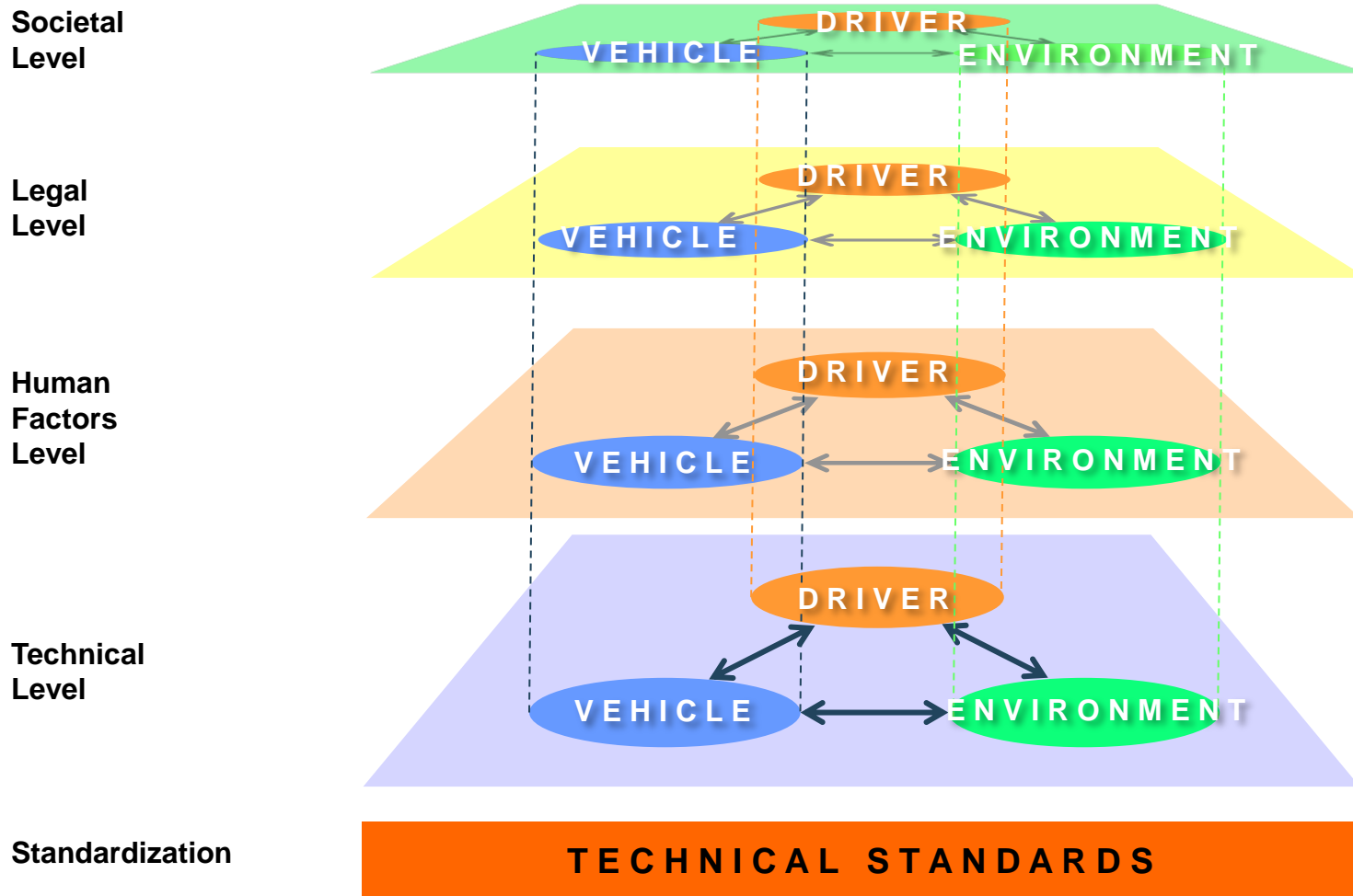
Challenges & Goals of Automobile Development

- **ADAS and automated driving** show high potential for current challenges
- Definition of test protocols for ADAS (e.g. Pedestrian AEB) and higher levels of automation are in **research stage**
- Today manufacturers perform evaluation by means of **individual test methods and tools**
- Evaluation framework for automated driving **does not exist and requires research**



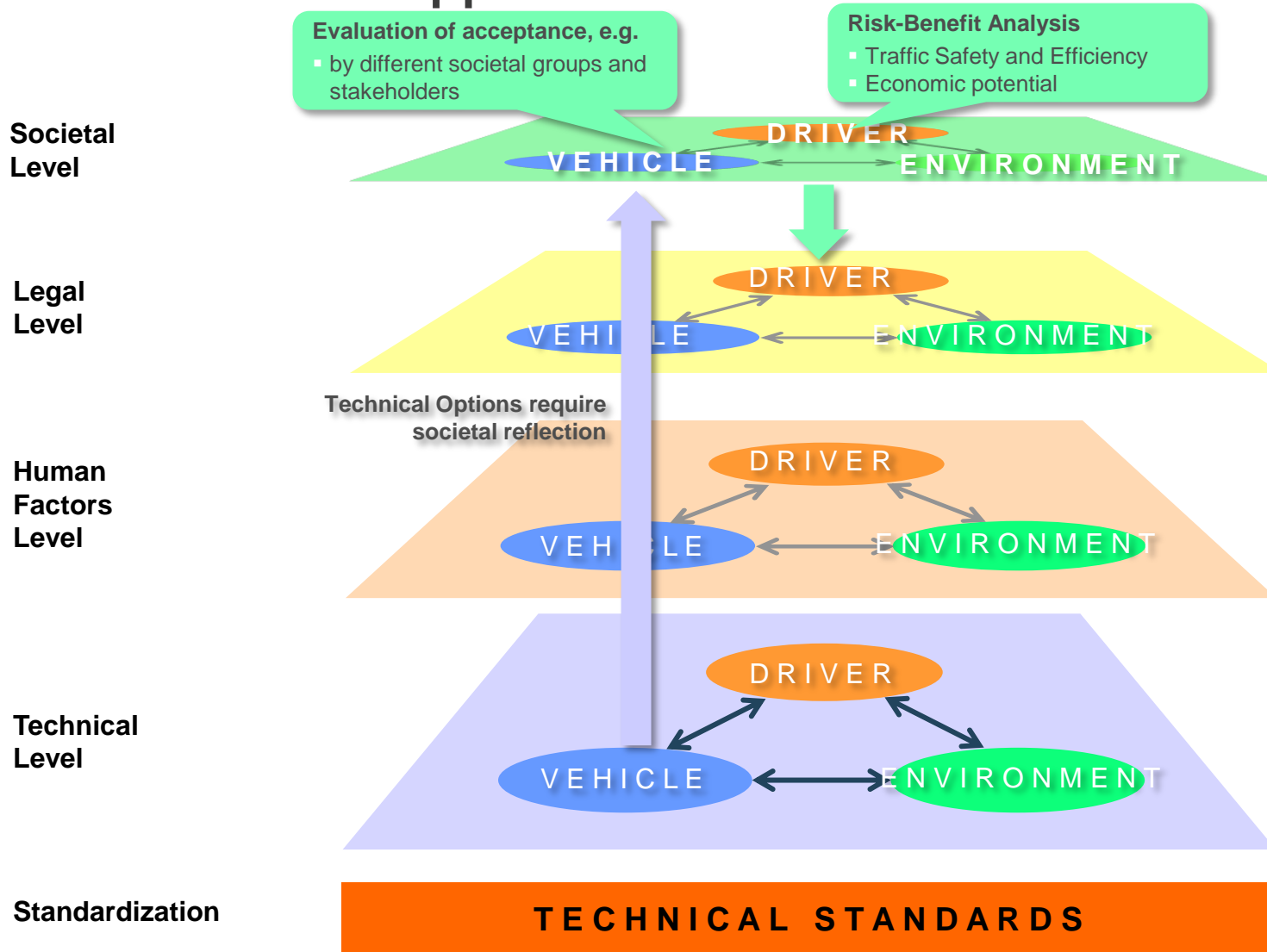
// Challenges & Goals

Structured Approach of Evaluation areas



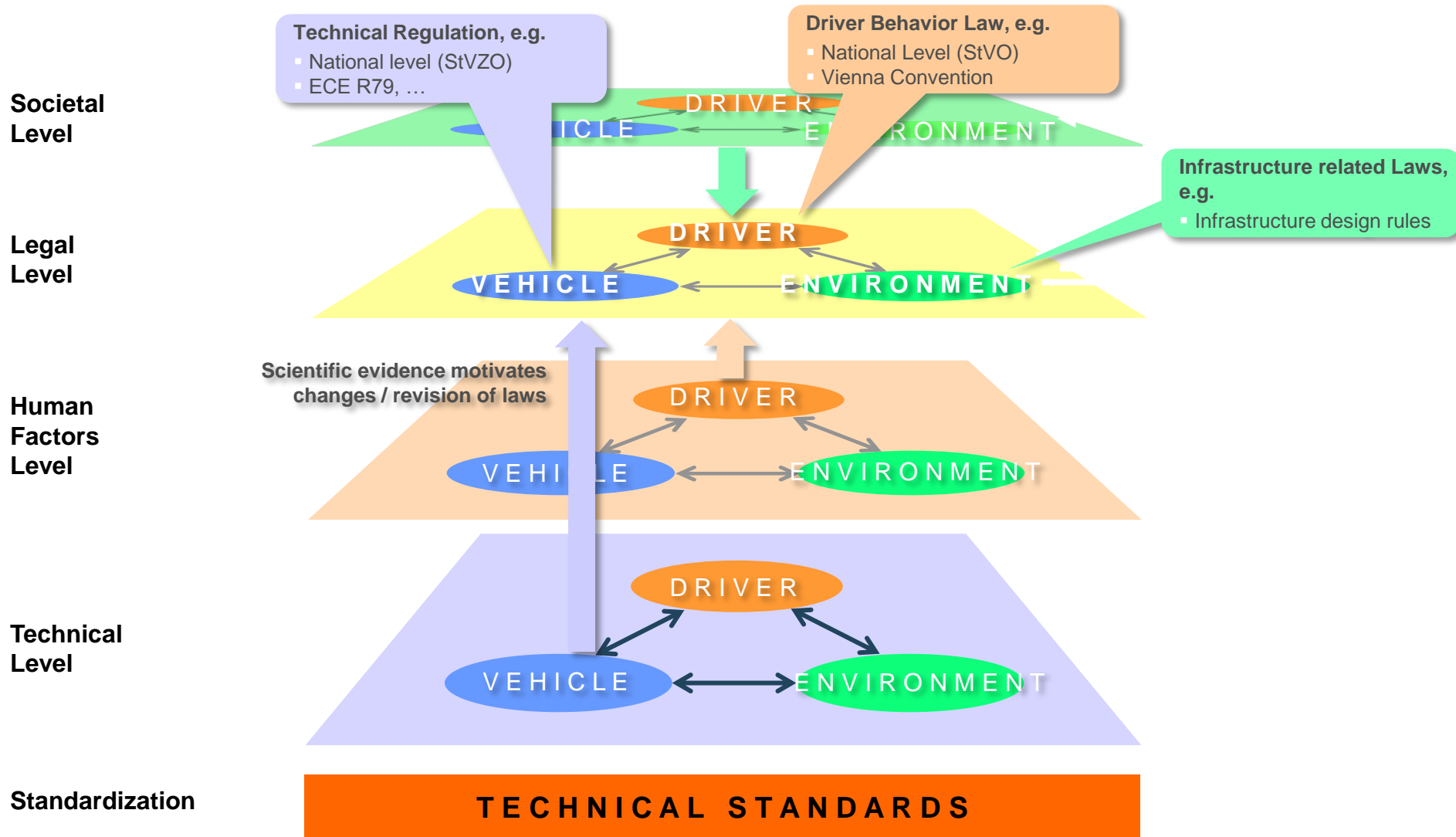
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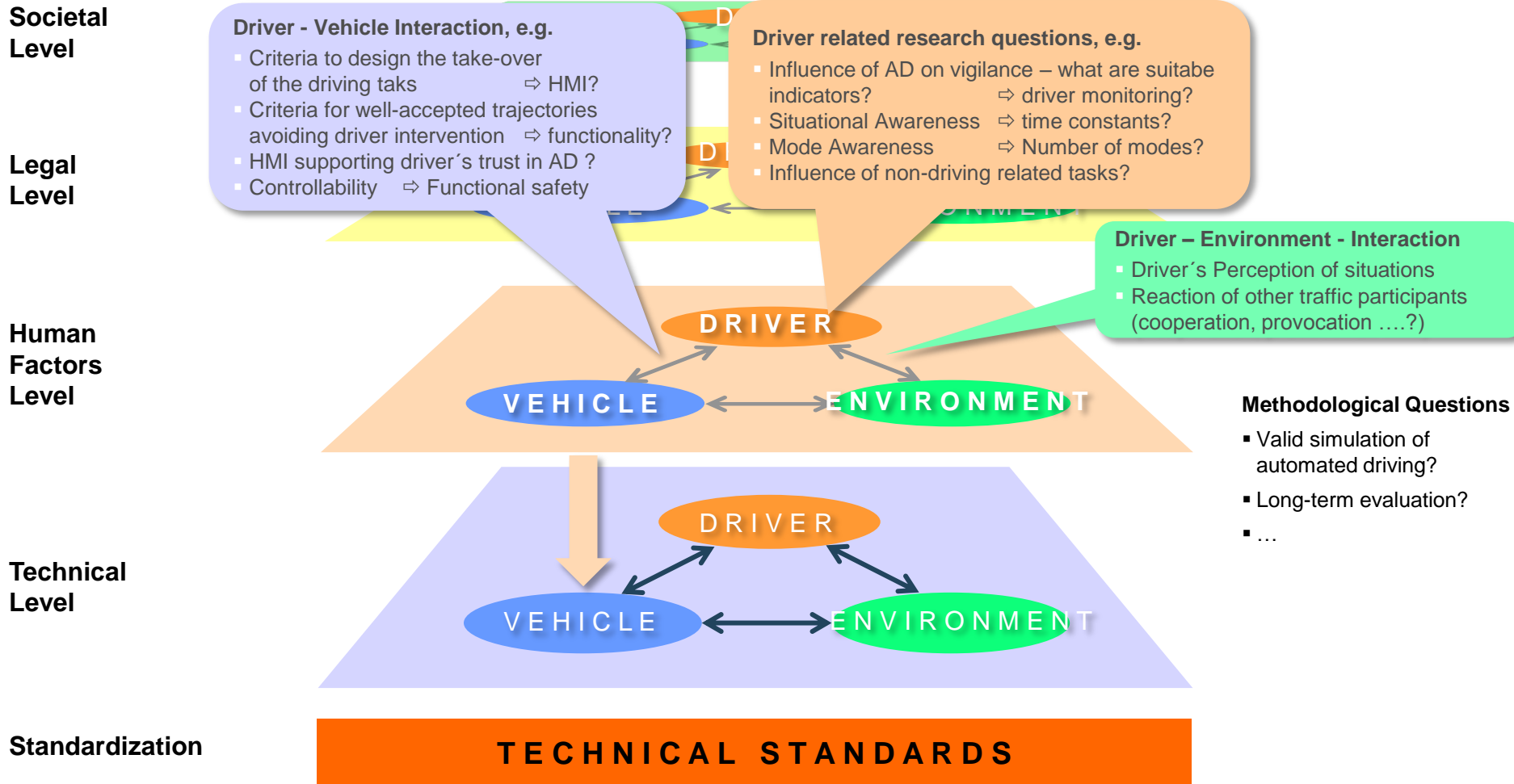
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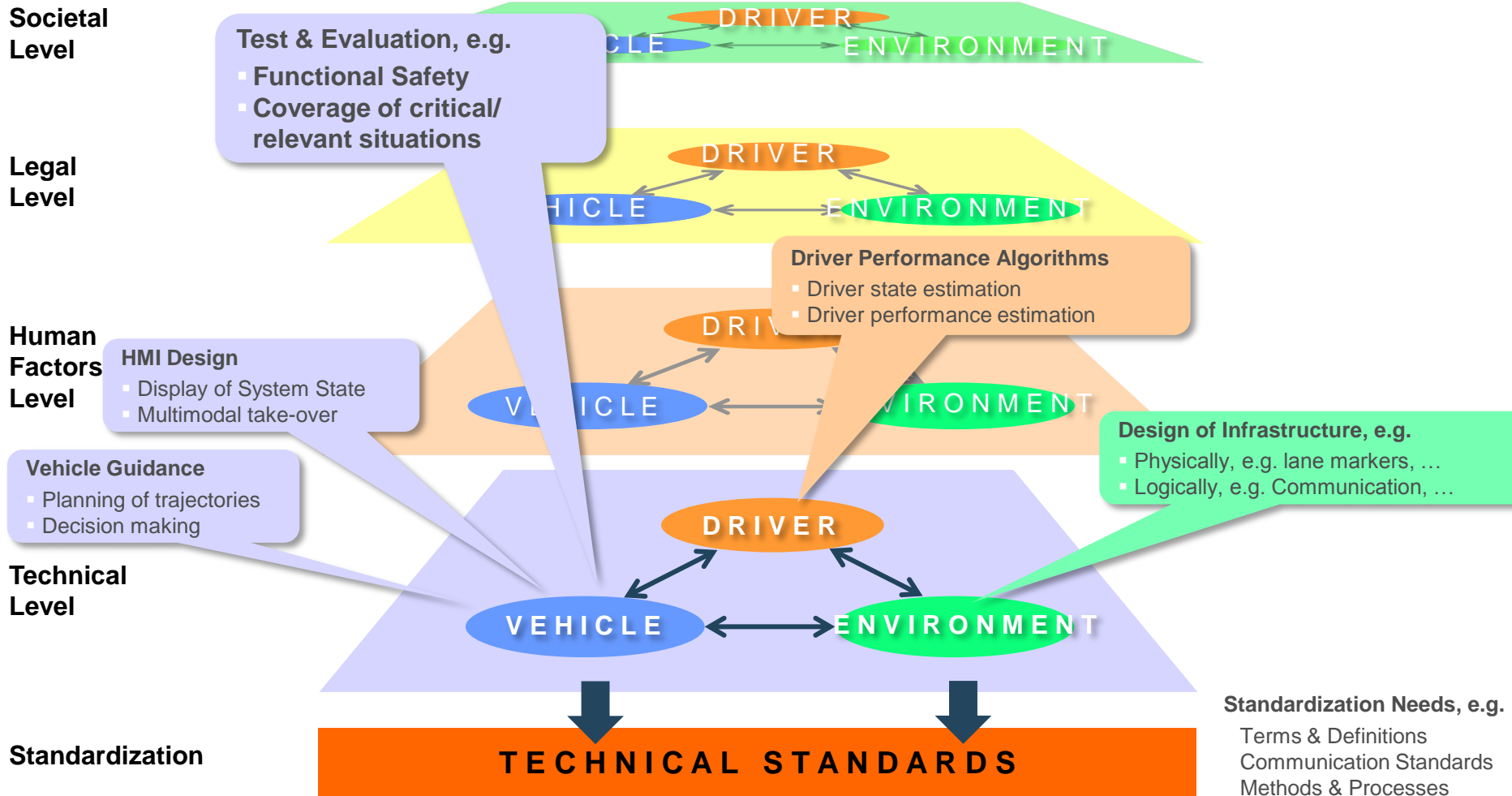
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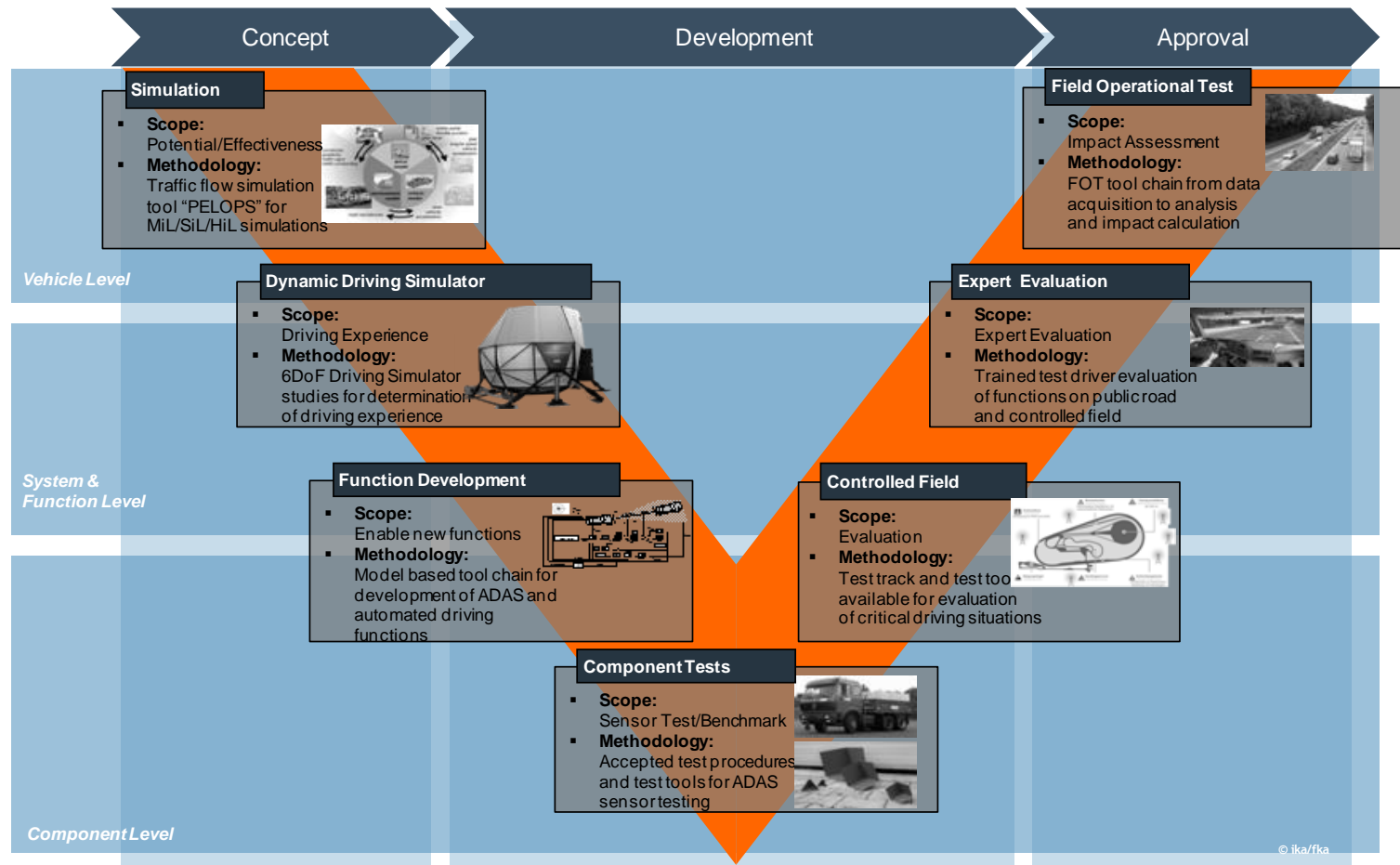
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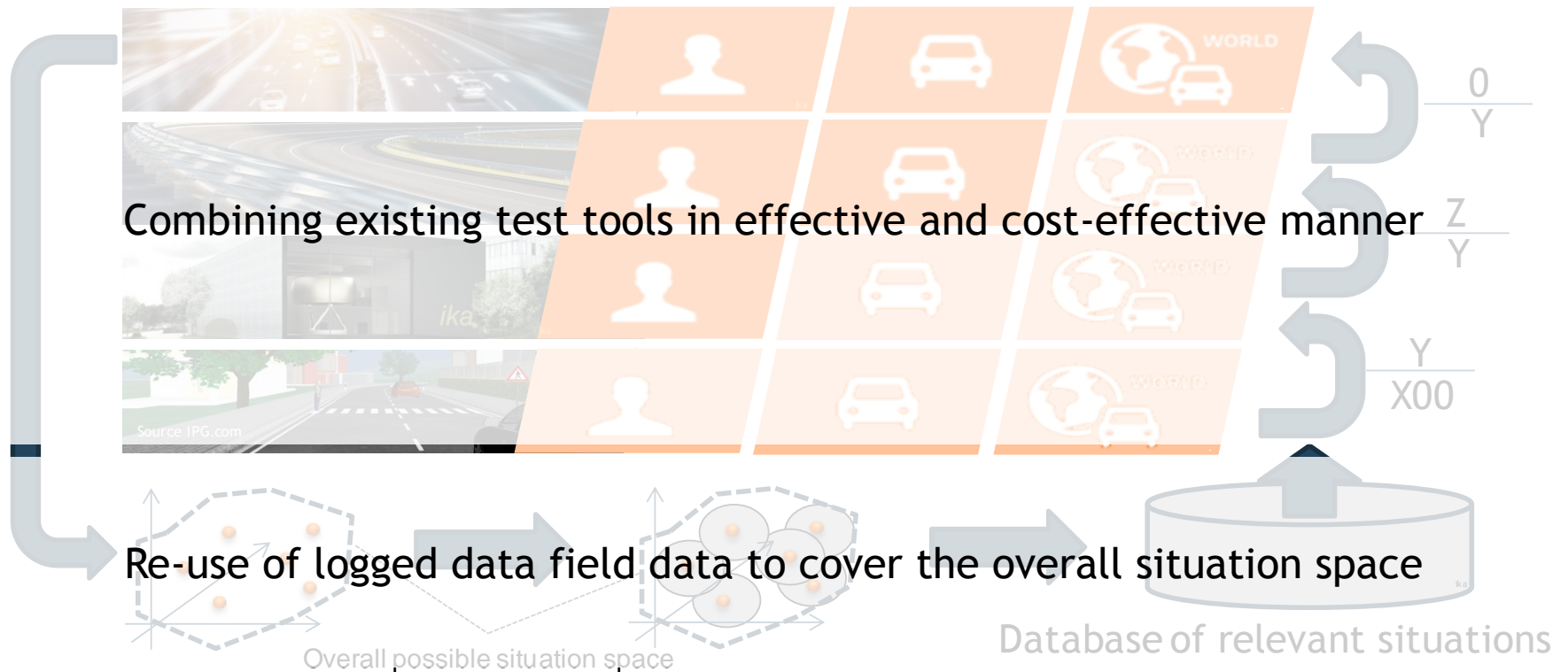
// Overview on test tools

- Overview on selected test tools along the development process



// Outlook: Approach for the safety validation

- How to validate / verify that the a automated driving functions safe enough for the market introduction?
 - Circle of relevant situation approach [ECK13] [ZLO15]

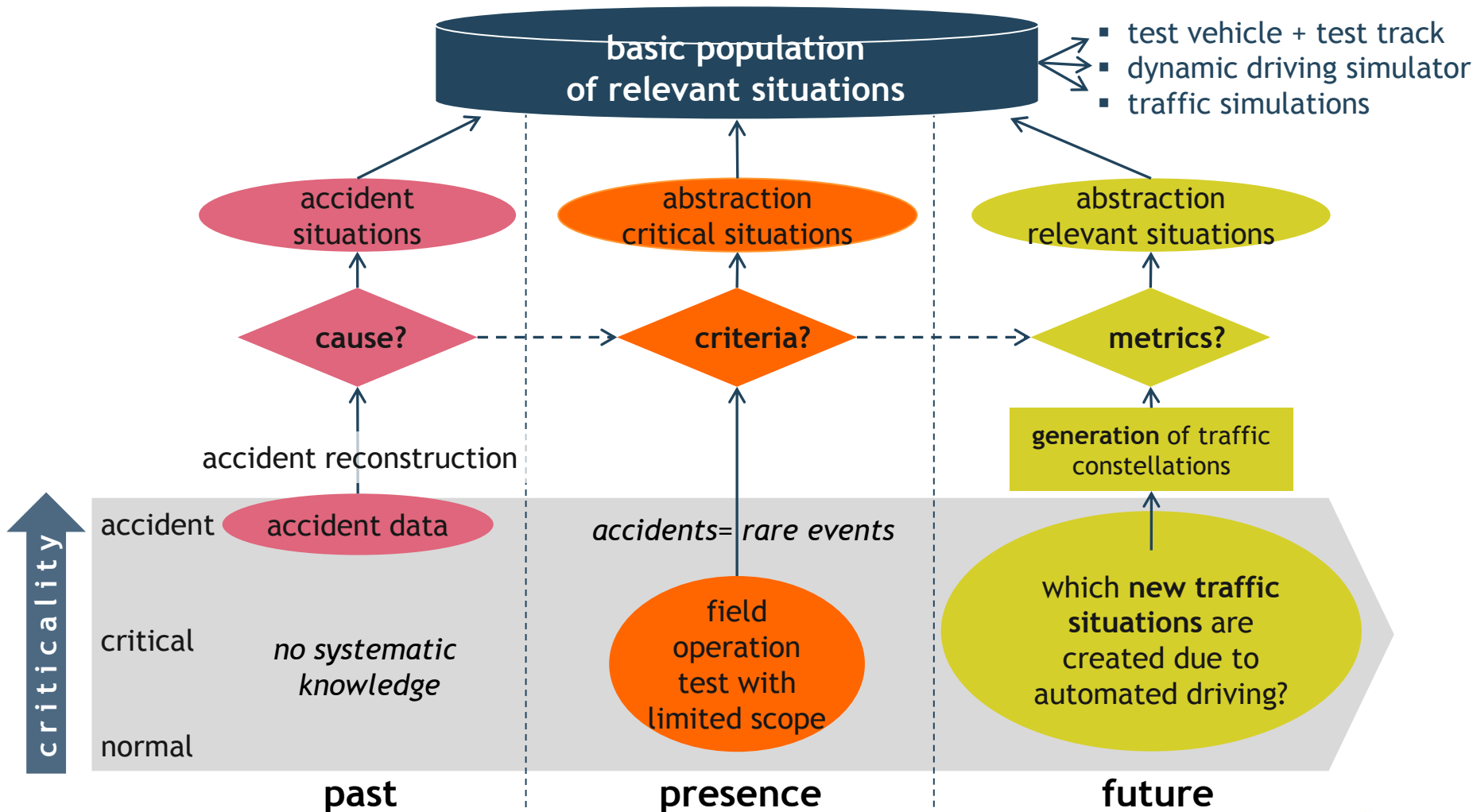


[ECK13]: Eckstein, Zlocki; Safety Potential of ADAS - Combined Methods for an Effective Evaluation; 23rd ESV; 2013

[ZLO15]: Zlocki, Eckstein, Fahrenkrog; Evaluation and sign-off methodology for automated vehicle systems based on relevant driving situations; 94th Annual TRB Meeting; Washington D.C.; 2015

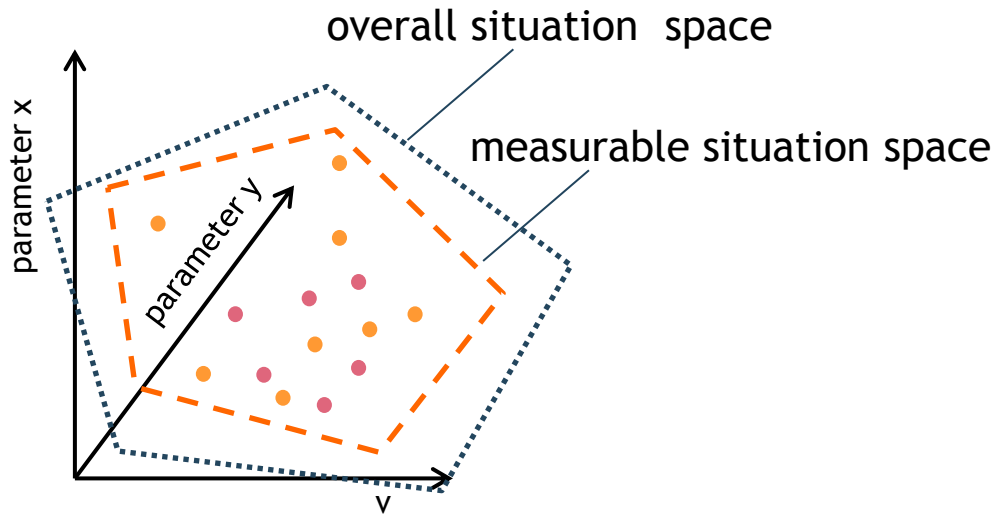
// Evaluation Methodology

Sources and Population of relevant Situations

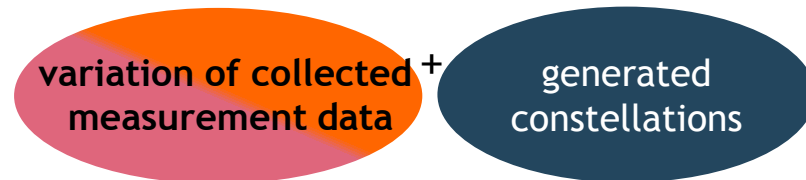
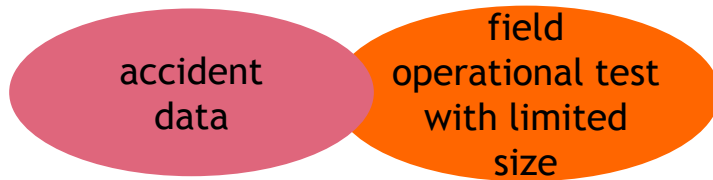
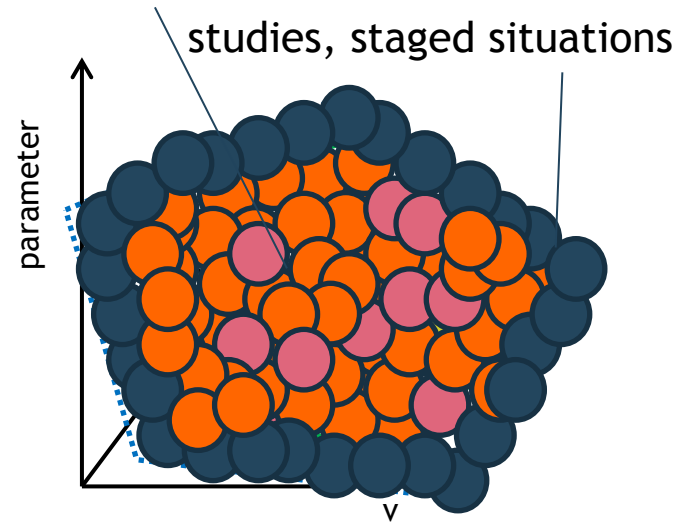


// Evaluation Methodology

Increase of relevant Situation Space



variations by means of simulations

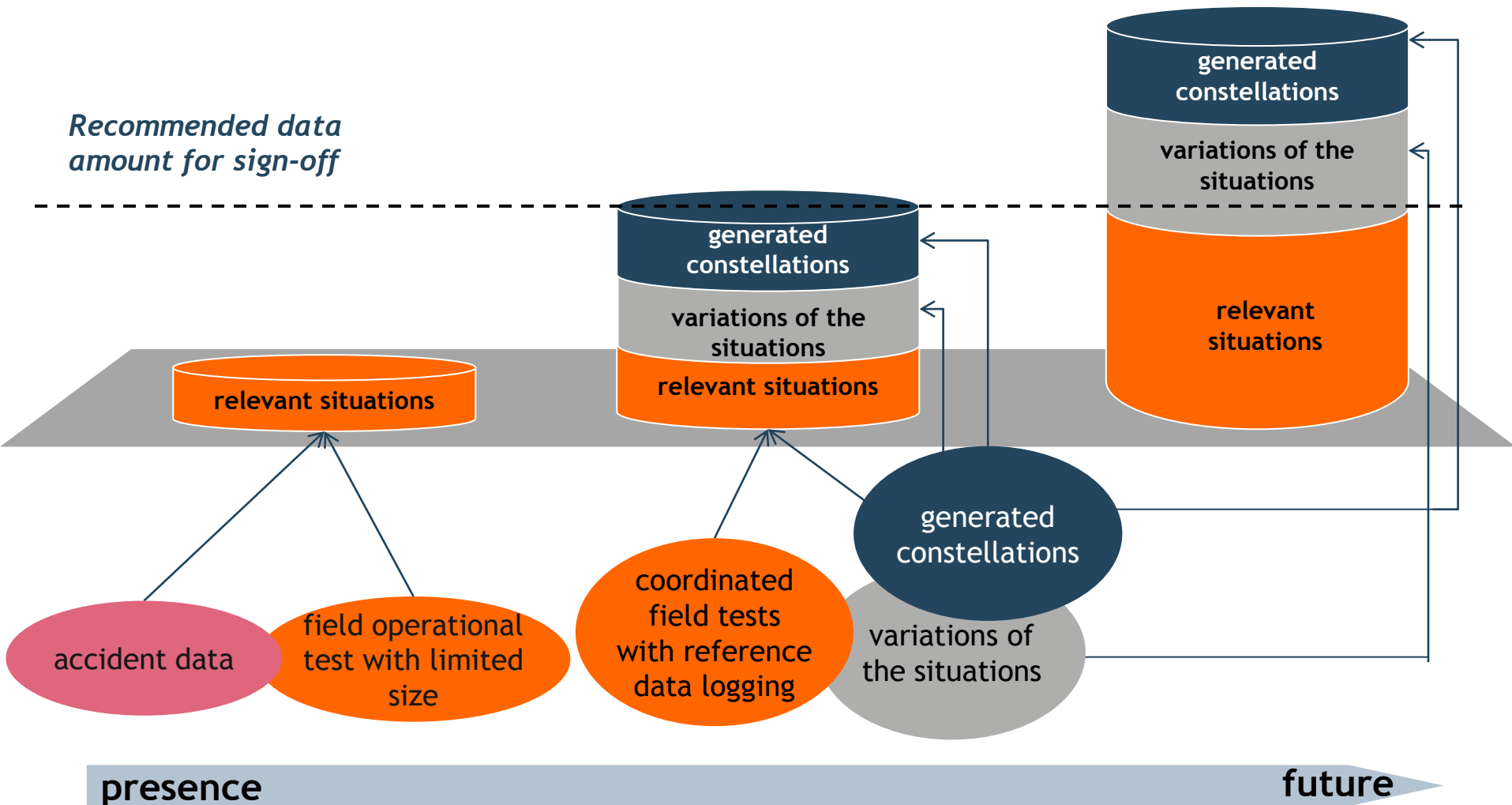


- Measurable relevant situations determined
- Measurable relevant situations are independent of functions
 - Missuse- cases
 - Interactions with other traffic participants
 - etc.

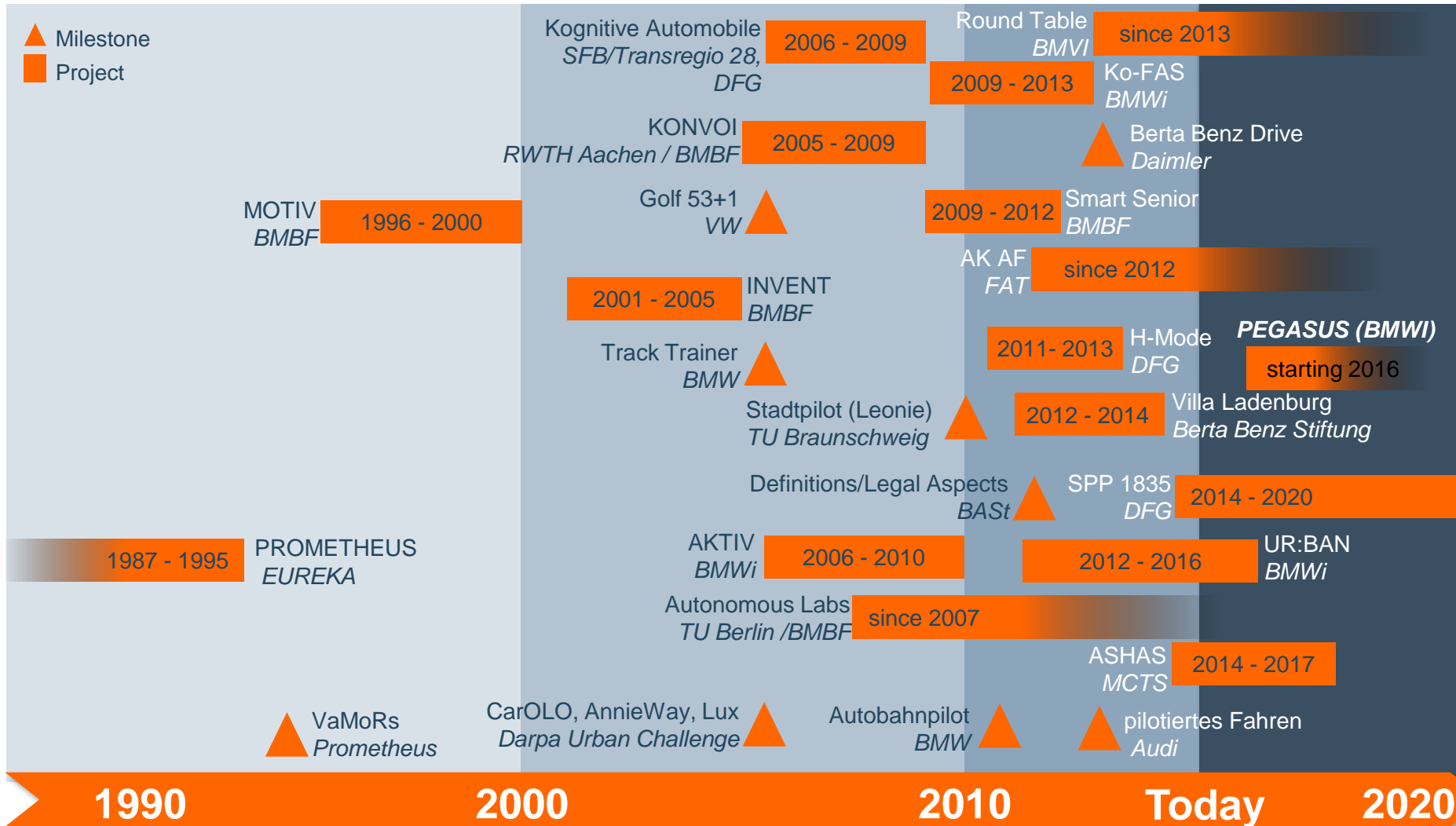
- Simulative variation of determined situations
- Measurable situation space enhanced by simulations
- Overall situation space filled by means of generated constellations
- Overlap ensures completeness of situations space

// Evaluation Methodology

Data Base Population over Time

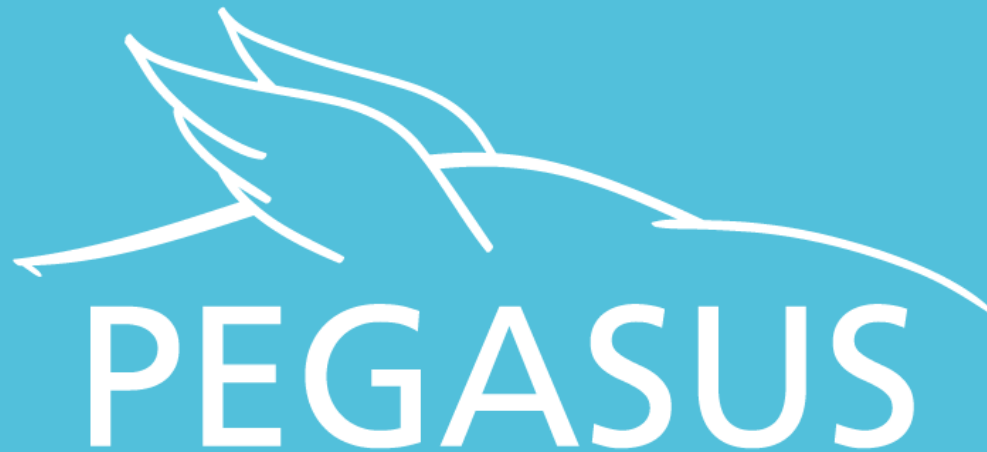


// Research on Automated Driving in Germany



// PEGASUS

- German research project for test standards of automated driving



Gefördert durch:



aufgrund eines Beschlusses
des Deutschen Bundestages

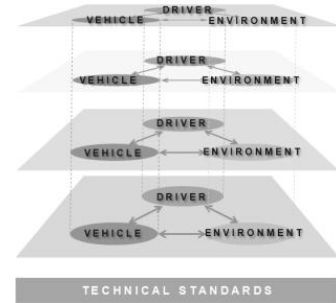
// PEGASUS

- **German research project for test standards of automated driving**
- **Project duration:**
 - 01st January 2016 to 30th June 2019
- **Partners:**
 - Audi, BMW, Daimler, Opel, Volkswagen, Automotive Distance Control, Bosch, Continental, TÜV Süd, fka, iMAR, IPG, QTronic, TraceTronic, Vires, DLR, TU Darmstadt + 12 subcontracting partners
- **Budget:**
 - 34,5 Mio. Euro (16,3 Mio. Euro Funding)
- **Research Questions:**
 - How can the quality and (functional) safety of the automated driving function be tested and verified?
- **Considered System:**
 - Highway Chauffeur

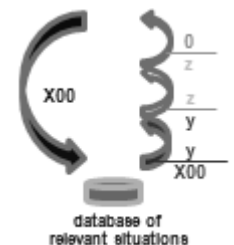
[Köster, Lemmer, Plättner, Wie gut müssen automatisierte Fahrzeuge fahren?, AAET, 2016]

// Conclusion

- Future ADAS and Automated Driving offer the potential to significantly improve traffic safety, efficiency and driving experience.
- Automated Driving not only offers potentials but also many challenges - these can be structured according to the 4-level model
- Research activities on automated driving have started, yet many research areas require new methods and solutions especially for valuation.
- The circuit of relevant situations offers an efficient and valid evaluation and sign-off procedure for all existing evaluation methods.



Adapt//Ve
Automated Driving





Co-funded by
the European Union

Adapt*://*Ve

*Automated Driving Applications and
Technologies for Intelligent Vehicles*

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Technical Workshop

Thank you.

