

**Ko-HAF**  
KOOPERATIVES  
HOCHAUTOMATISIERTES FAHREN



# Ko-HAF – Safety by Cooperation

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Continental Teves AG & Co. oHG

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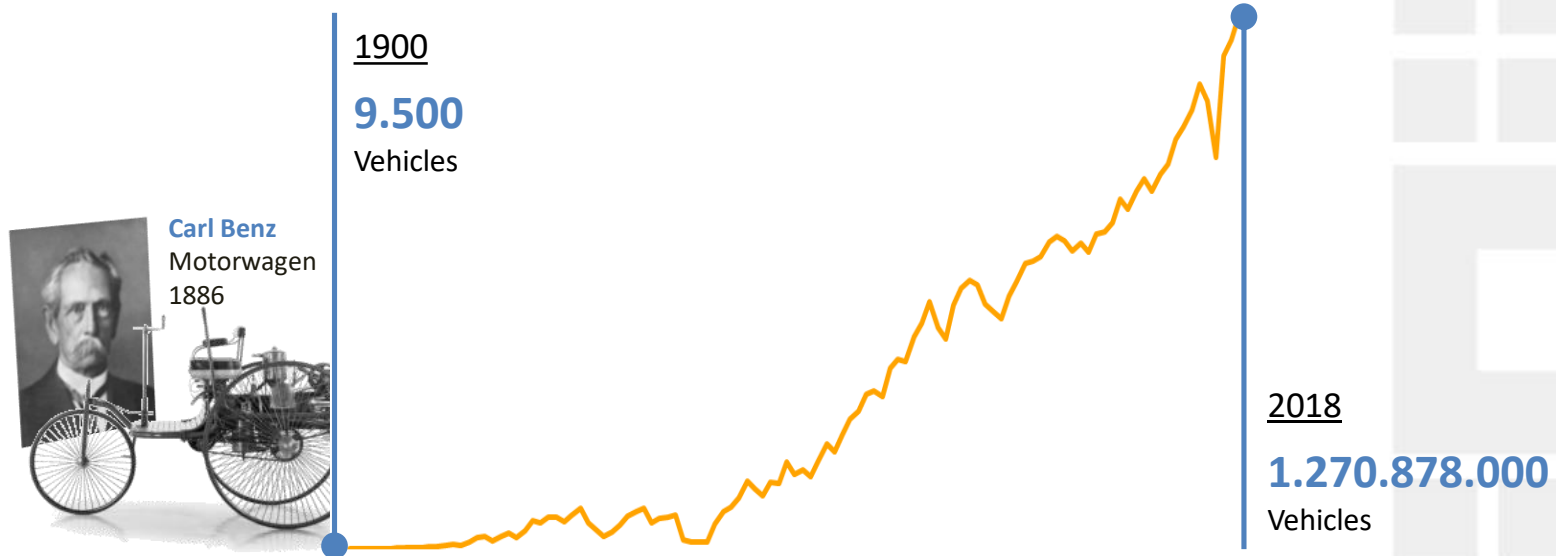


Bundesministerium  
für Wirtschaft  
und Energie

aufgrund eines Beschlusses  
des Deutschen Bundestages

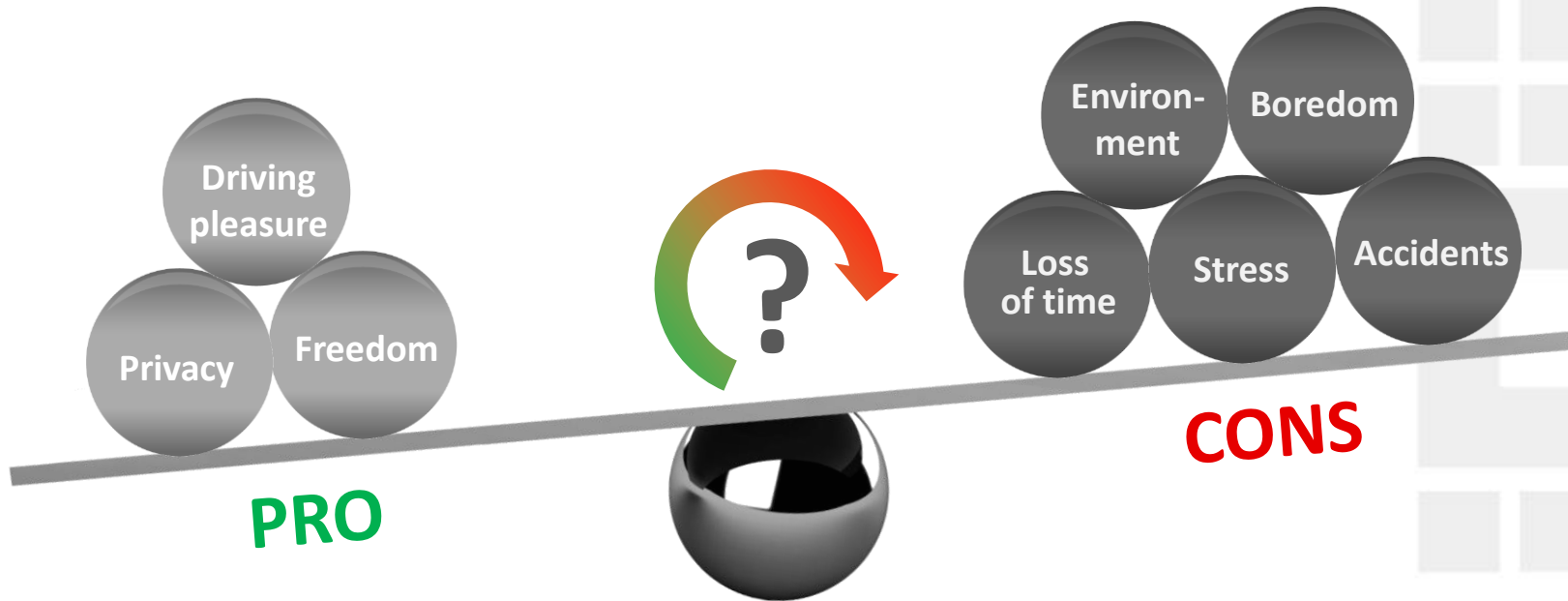
# Individual Mobility?

## An Enormous Success Model!

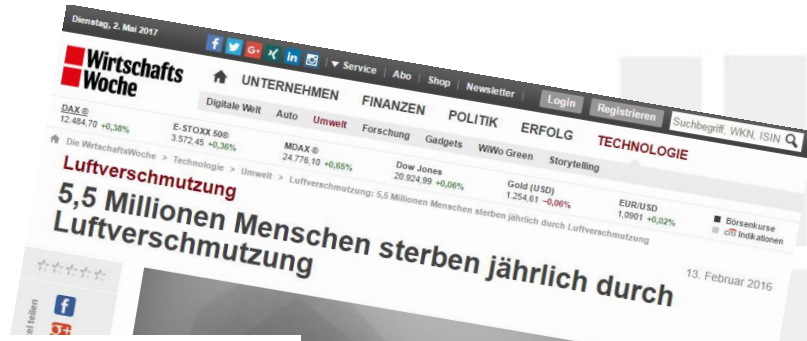
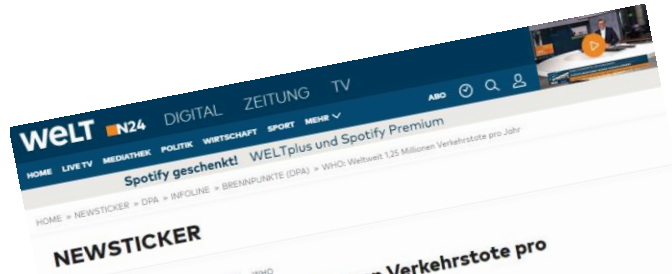


# Individual Mobility?

## Successful Model in Danger?



# Individual Mobility? Successful Model in Danger?



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Nachrichten > Gesundheit > Diagnose & Therapie > Weltgesundheitsorganisation WHO > WHO-Report: Verkehrsunfälle die größte Gefahr für Jugendliche

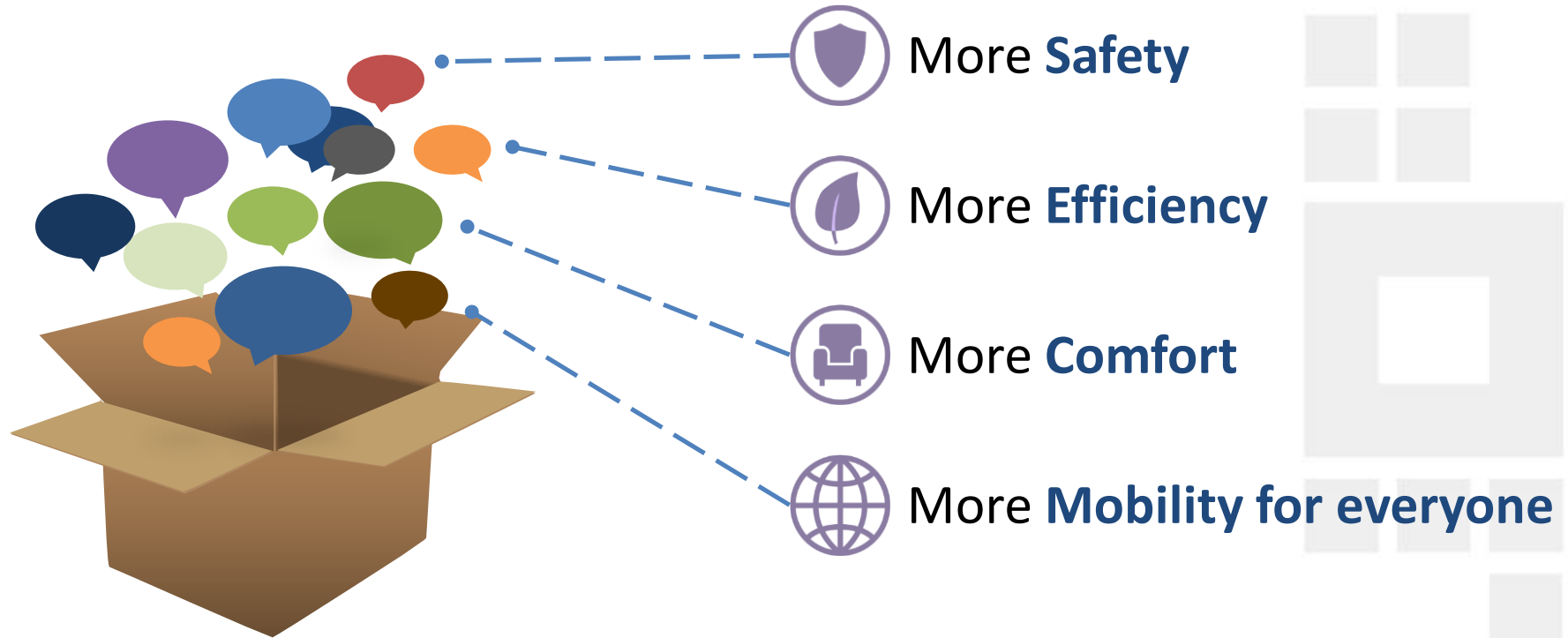
**WHO-Bericht**  
**Verkehrsunfälle sind die größte Gefahr für Jugendliche**

Etwa 1,3 Millionen Kinder und Jugendliche im Alter von 10 bis 19 Jahren sterben pro Jahr. Die Weltgesundheitsorganisation fasst die größten Gefahren in einem Report zusammen und mahnt, mehr für den Schutz der Heranwachsenden zu tun.



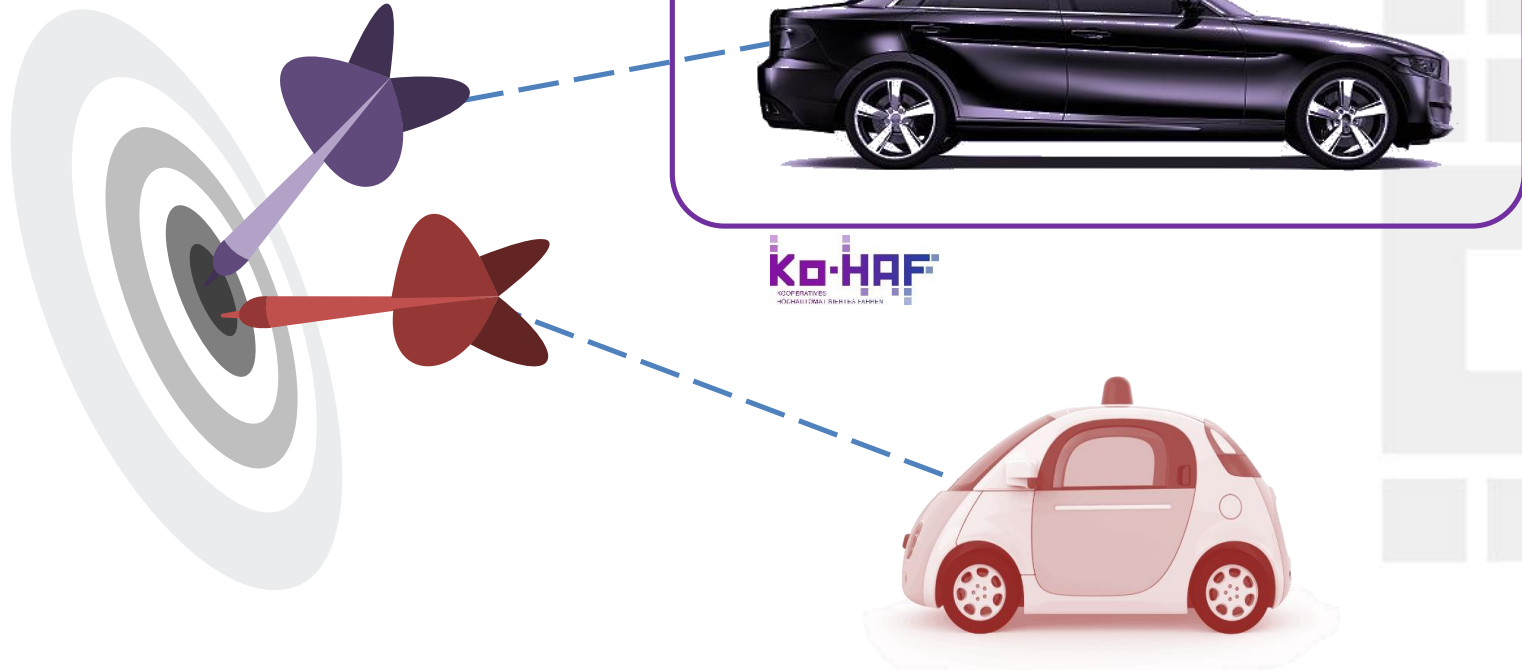
# Automated Driving

## A Solution for many Challenges

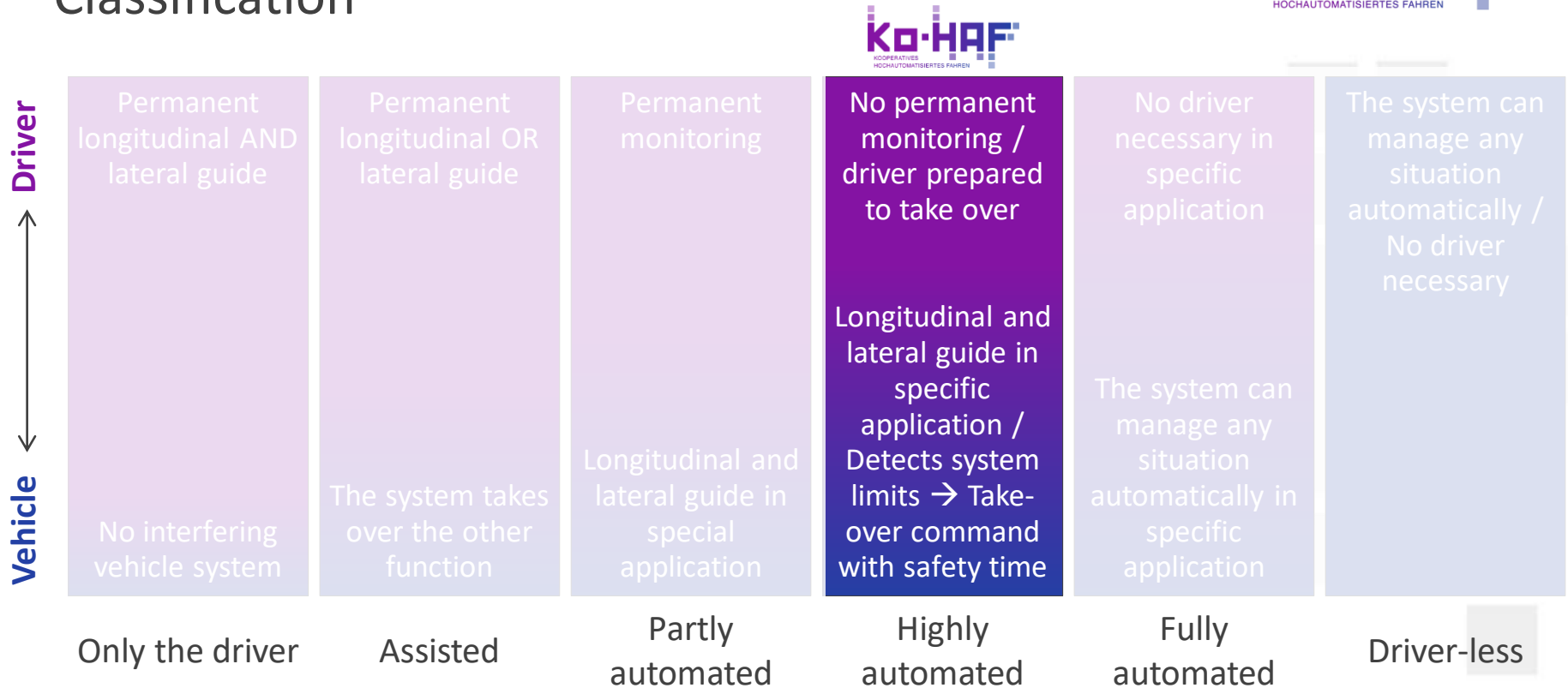


# Automated Driving

## Two Ways to Success!



# Automated Driving Classification





<b>Project duration</b>	<b>06/2015 – 11/2018</b>
Specification and concept phase	– 05/2016
Development / implementation of the interaction between the safety server (back-end) and the vehicle (front-end)	– 05/2017
Implementation of the Ko-HAF function for normal and emergency operation	– 02/2018
Trial phase	– 11/2018
<b>Overall volume</b>	<b>36.3 M€</b>
<b>Funds from the German Ministry for Economic Affairs and Energy (BMWi)</b>	<b>16.9 M€</b>

Supported by:



on the basis of a decision  
by the German Bundestag

OEM	Suppliers	Small and medium-sized companies	Public institutions	Research organisations
				

Ko-HAF aims at the **highly automated driving of the second generation**, this means

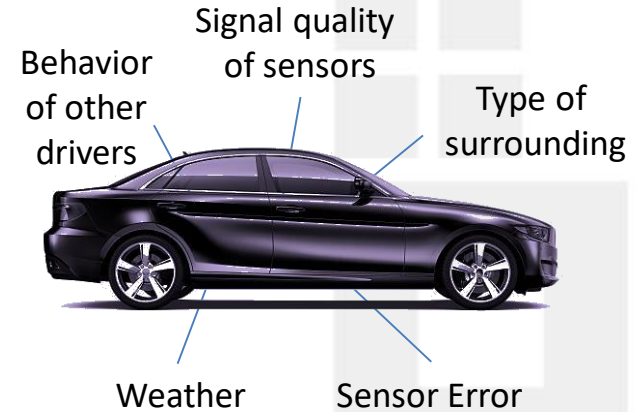
- **Turn away** from the task of driving  
Ko-HAF contribution: **You can use your time in the car at will!**
- At speeds of **up to 130 km/h**  
Ko-HAF contribution: **You drive relaxed and safe on highways!**
- **Availability in extraordinary situations** and in complex highway scenarios  
Ko-HAF contribution: **You do not have to take over yourself all the time!**

# Highly Automation in Ko-HAF

## Big Challenges

### Sensor technology and environment modelling

- It suddenly becomes **necessary that the driver takes over** (e.g. road marking ends, very complex course of the road at construction sites, ...)
- At 130 km/h and a 10 seconds advance warning, a situation at a distance of **over 350 m must be perceived** in order to warn the driver **in time** that he will have to take over.
- On-board environment sensors that will be available in the foreseeable future **do not provide this capacity!**



How can the car detect critical situations  
**safely and in time?**

# Highly Automation in Ko-HAF

## Big Challenges



### Validating and securing

- How do we test highly automated driving?
- Securing expenses increase with increasing system complexity. Automated vehicles are very complex!
- How do we get a representative overview of possible hazardous situations (field tests, extended accident analyses)?
- How do we test technologies at their limits?

How do we ensure that the automated vehicle **operates safely in all situations** and "passes the driving test"?

# Highly Automation in Ko-HAF

## Big Challenges

### Human

- What is the **driver's role**?
- Integration and Validation of **non driving related activities**
- Concept and design of transitions



How can man and machine share driving  
**harmoniously and clearly?**

© BMW

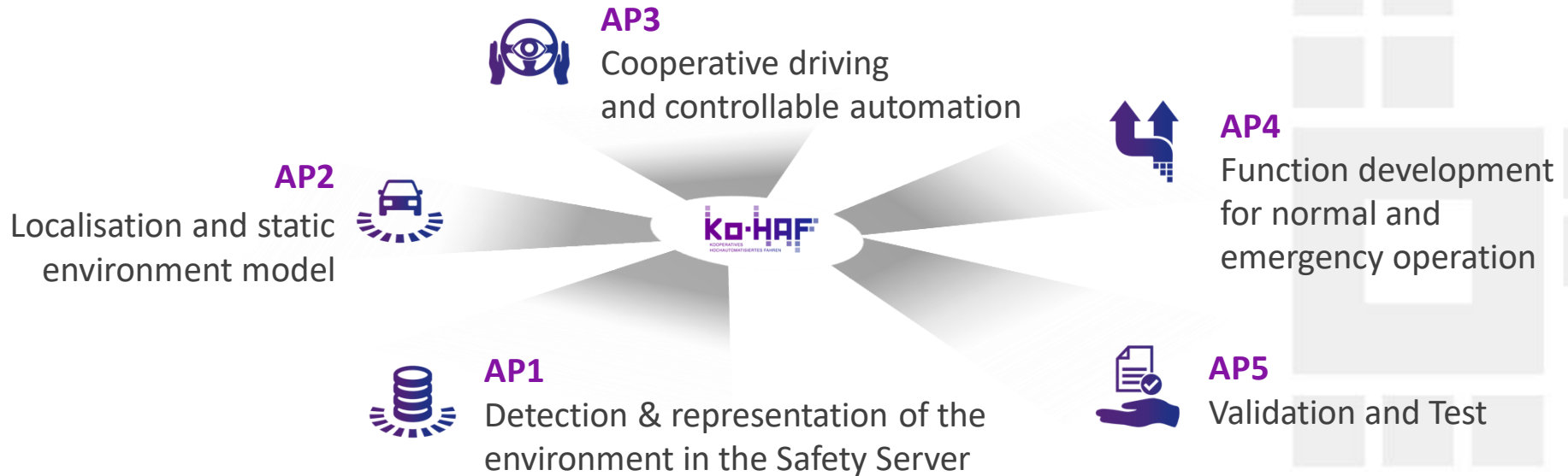
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# High Automation in Ko-HAF

## Benefits of Swarm Knowledge



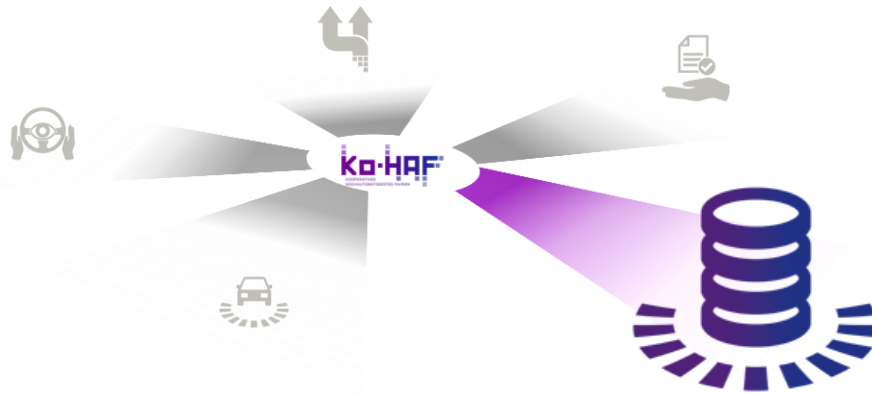
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# Ko-HAF Workpackage 1

## The Safety Server

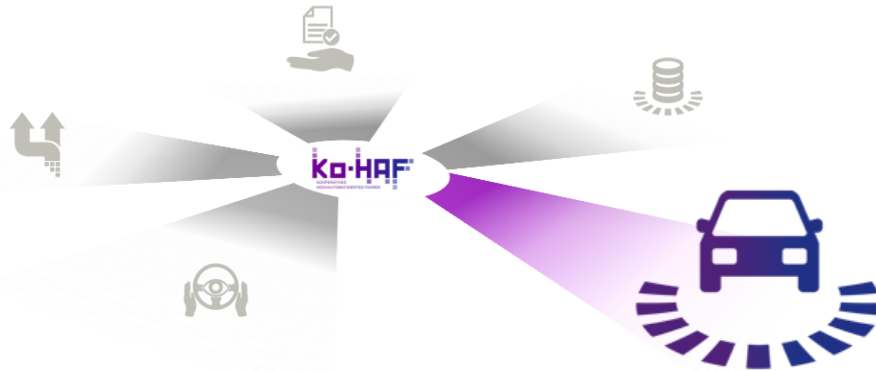


### AP1 Detection & representation of the environment in the safety server

- Increase of the anticipation exceeding the range of sensors existing today by collective perception
- The prototypical back-end service Safety Server combines the heterogenous landscape of the test cars.
- Cars and external data sources provide more up-to-date data than ever before
- Precise maps thus become up-to-date maps

# Ko-HAF Workpackage 2

## Interface to the Car



### AP2 Localisation and static environment model

- Transmission of environment data to a central back-end
- High-precision localisation with a robust availability
- Fusion of the sensor-based environment model with back-end data

# Ko-HAF Workpackage 3

## Man uses Function in the Car



### AP3 Cooperative driving and controllable automation

- Specifications of the test scenarios and aspects of the man-machine interaction
- Modelling the driver availability and vigilance
- Investigation of automation effects
- Transition concepts optimised for HAD
- Recommendations for methods and interaction concepts



### AP4

Function development for normal and emergency operation

- Environment modelling and situation analysis
- Development of highly automated driving functions
- Anticipatory reaction to danger points
- Transition into a minimal risk state

# Ko-HAF Workpackage 5

## The Functions are tested



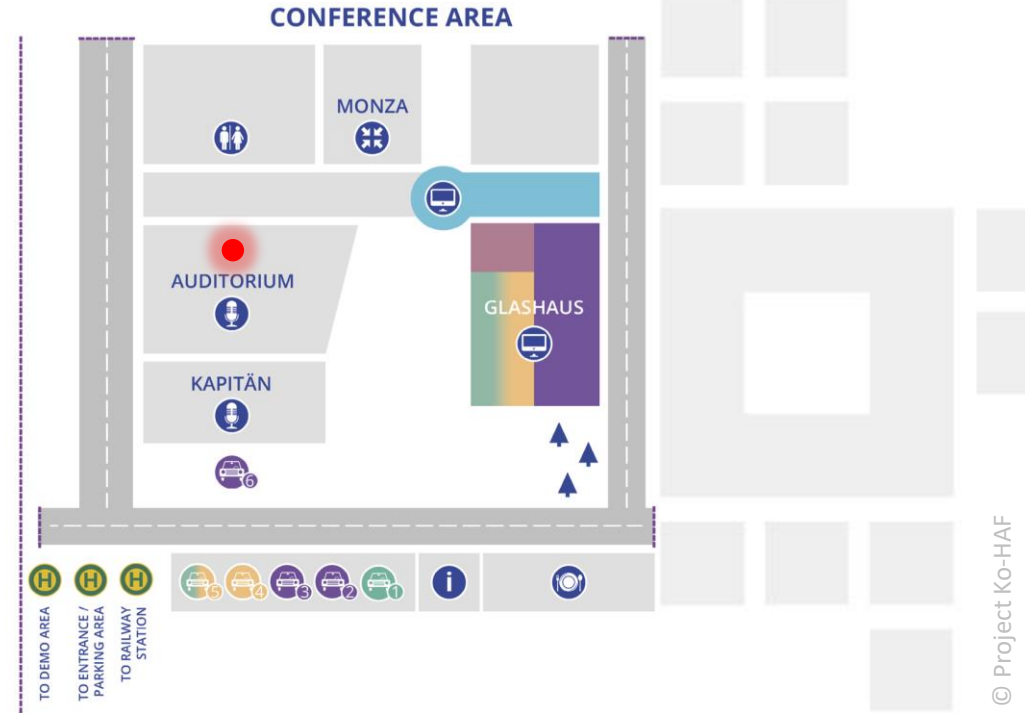
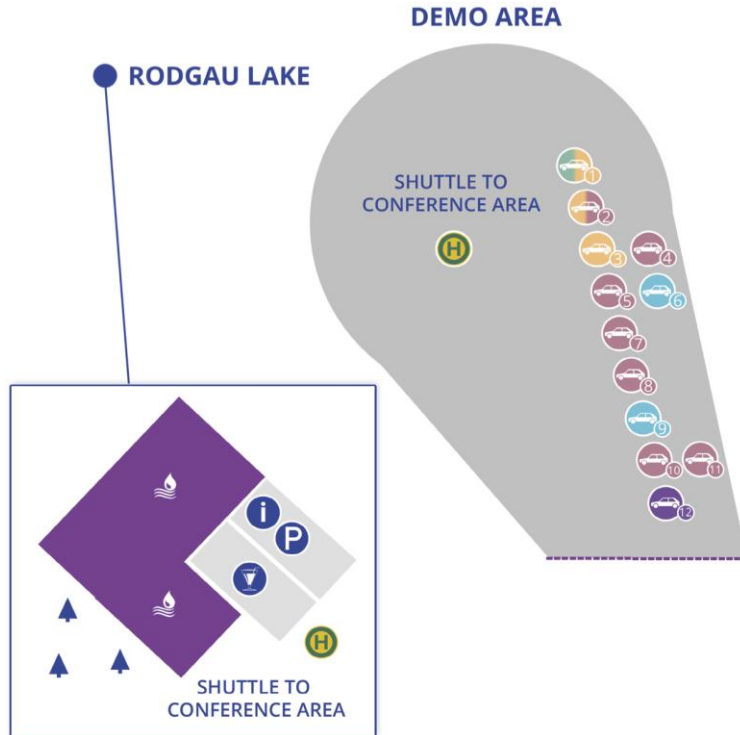
### AP5 Validation and Test

- **Test methods** for testing automated driving functions
- Setup of **virtual trial test environment** (HW/SW)
- Setup of **test tools** for reality trials
- **Trial testing** new highly automated driving functions

# Conclusion / Expected innovations

- **Collective perception** by means of a communication among the vehicles and the safety server (back-end)  
→ extended perception of the environment
- **Collection of data** in the vehicle including auto-localisation and interaction with the safety server
- **Gapless transition** between normal operation and active safety functions and between different automation levels
- **Transfer into the safe state** (emergency operation), e.g. in case of a driver blackout (no reaction to the take-over command)
- **Experimental joint trial testing** of the HAD functions on highways in mixed public traffic
- Development of **test and evaluation methods** for highly automated systems

# Ko-HAF Experience the Results In Cars and in Discussions







# Stay in Contact



## Project coordination

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# Thank you for your attention!

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 Bundesministerium  
für Wirtschaft  
und Energie

aufgrund eines Beschlusses  
des Deutschen Bundestages

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