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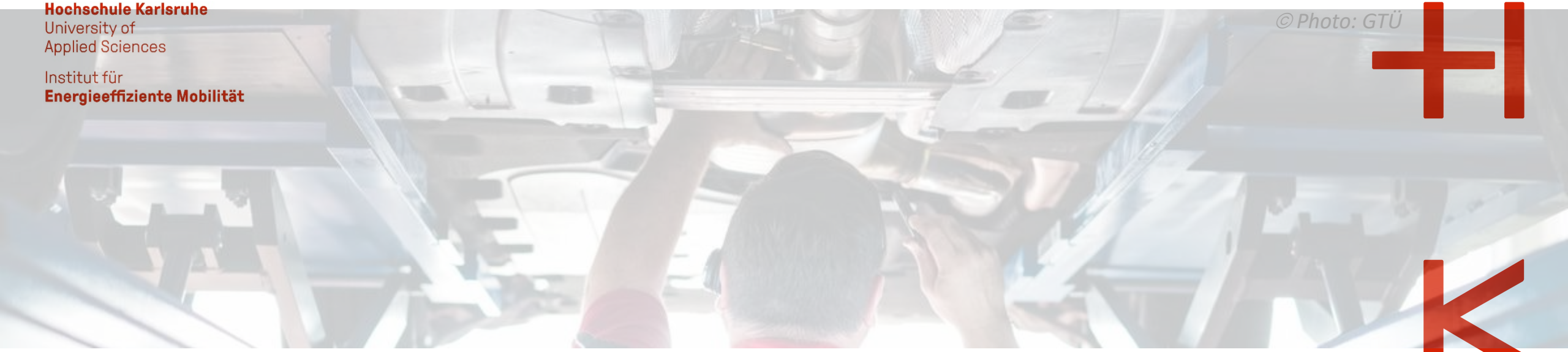

Challenges for Periodic Technical Inspections of Intelligent Cars

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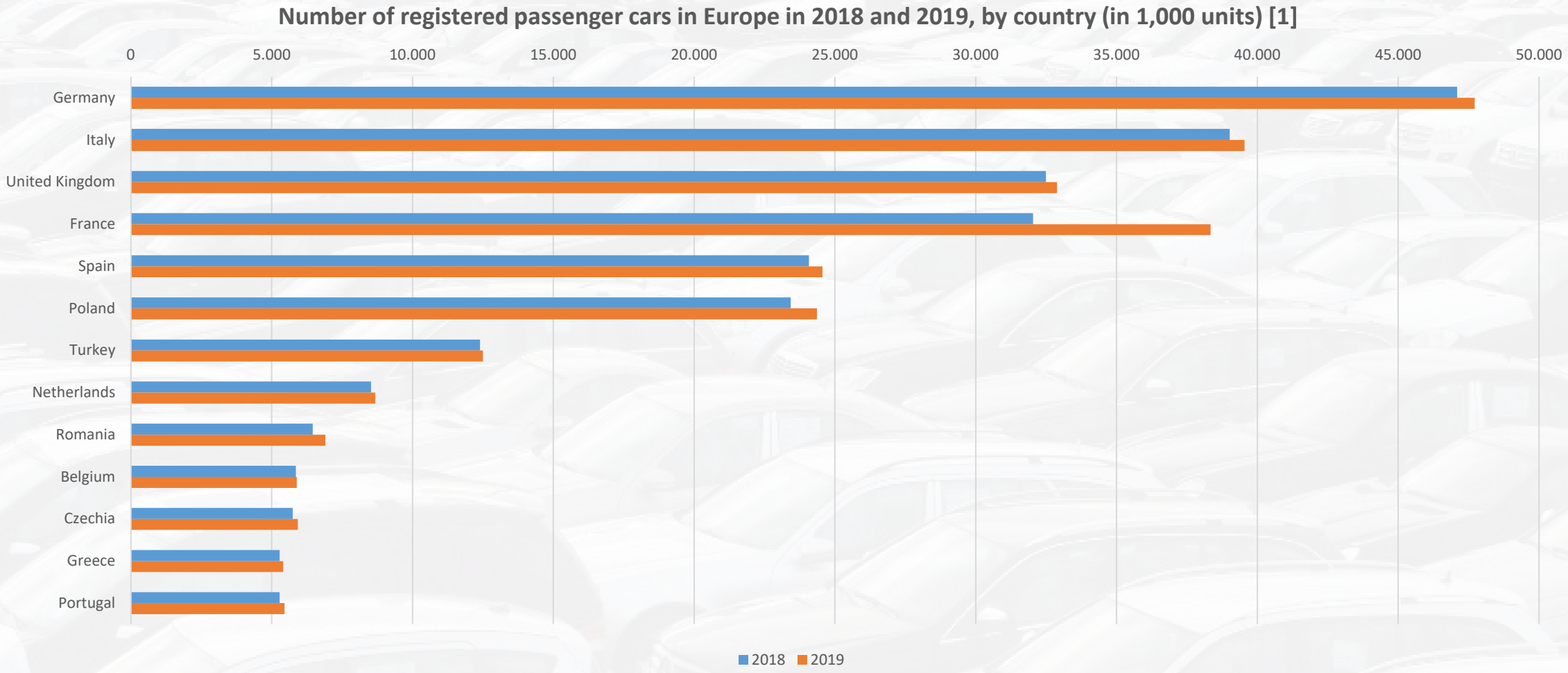
Agenda

1. Registered passenger cars in Europe
2. Periodic Technical Inspections (PTI)
3. Development of Intelligent Vehicles
4. Challenges for PTI of Intelligent Cars
5. Improvements for the PTI
6. Conclusion & Outlook

Number of registered passenger cars in Europe

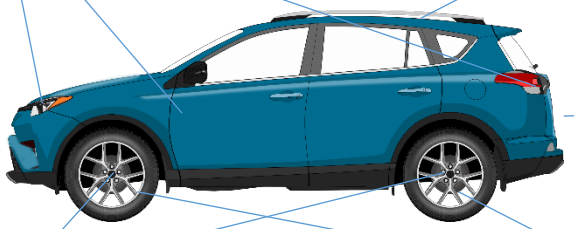


Periodic Technical Inspections (PTI) in Germany

- 12.5 Mio. vehicles (26%) in Germany are 5-9 years old [2]
- PTI is mandatory every 2-3 years for german passenger cars
- Visual, functional, and electronic inspection without disassembly

27 % of defects in lighting equipment and other parts of the electronic system

10 % of defects in chassis, frame, body, parts attached to it

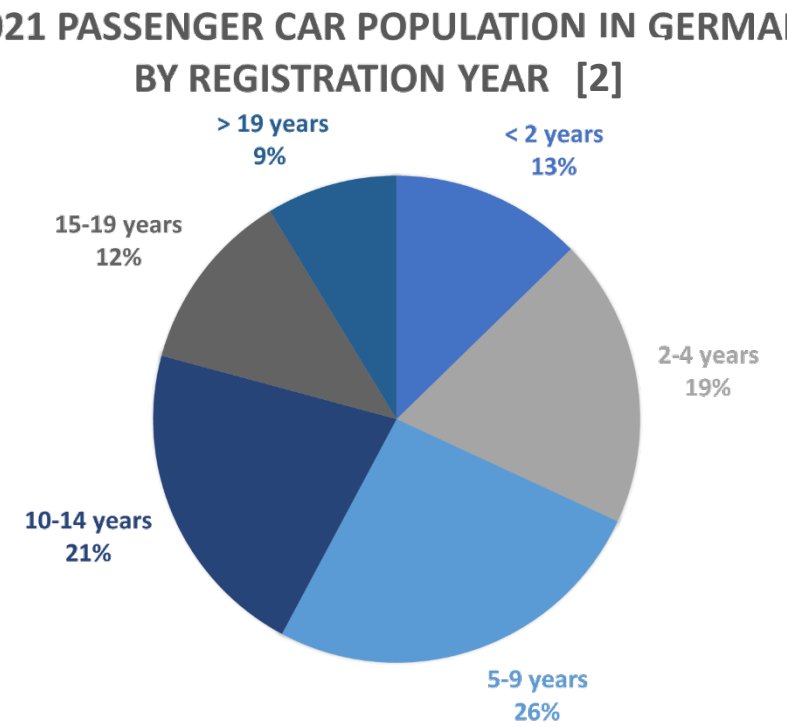


17 % of defects with an environmental Impact

16 % of defects in Axels, Wheels, Tieres, Suspension

18 % of defects in the Braking System

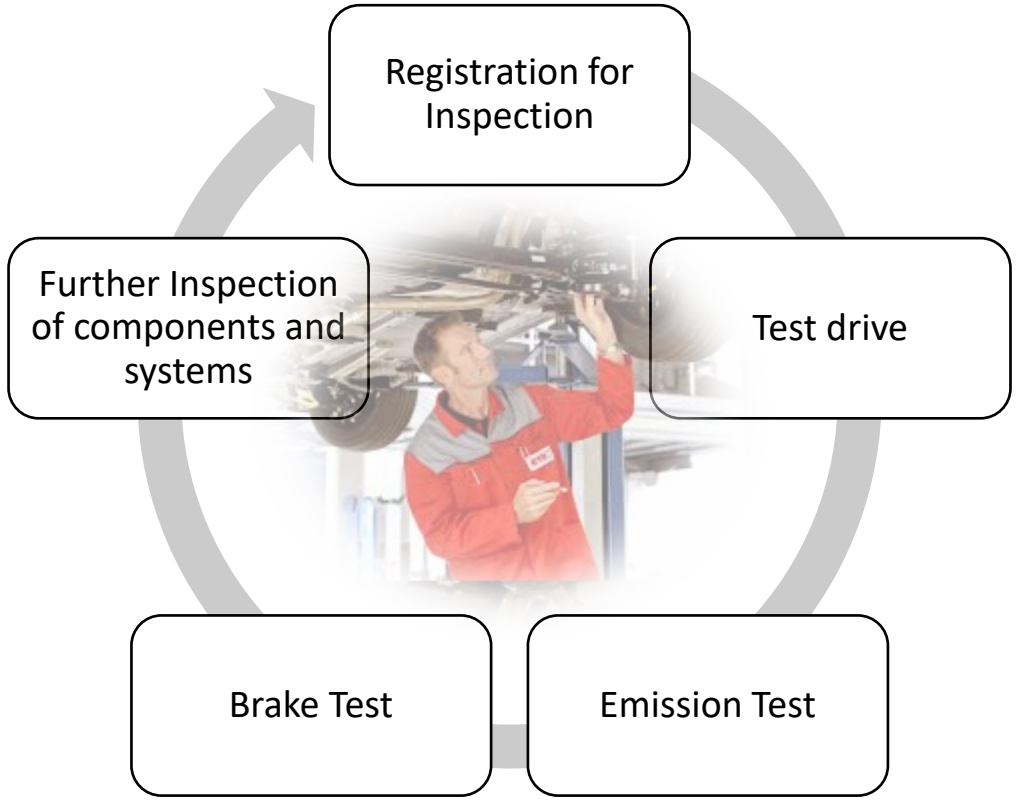
*Statistics of [3] for 2020



Periodic Technical Inspections (PTI) in Germany

EU Directive 2014/45/EU demands the examination of:

- Identification and classification of the vehicle
- Braking equipment, Steering, Visibility
- Photometric equipment and other parts of the electric installation
- Axles, wheels, tires, suspension
- Chassis, frame, platform, attached parts
- Environmental impact



➡ Inspection of equipment, condition, function, and performance.

Development of Intelligent Cars

- Human fault is main reason for accidents [4]
- 20 times more computational power [5]
- > 100 Million Lines of Code [6]
- Advances in technology lead to autonomous, connected vehicles

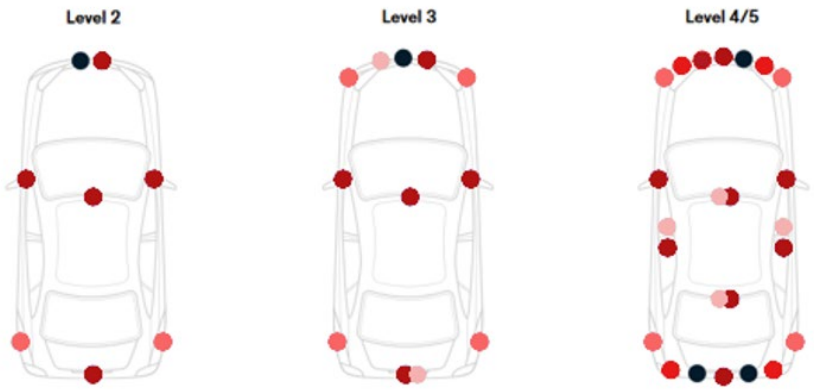
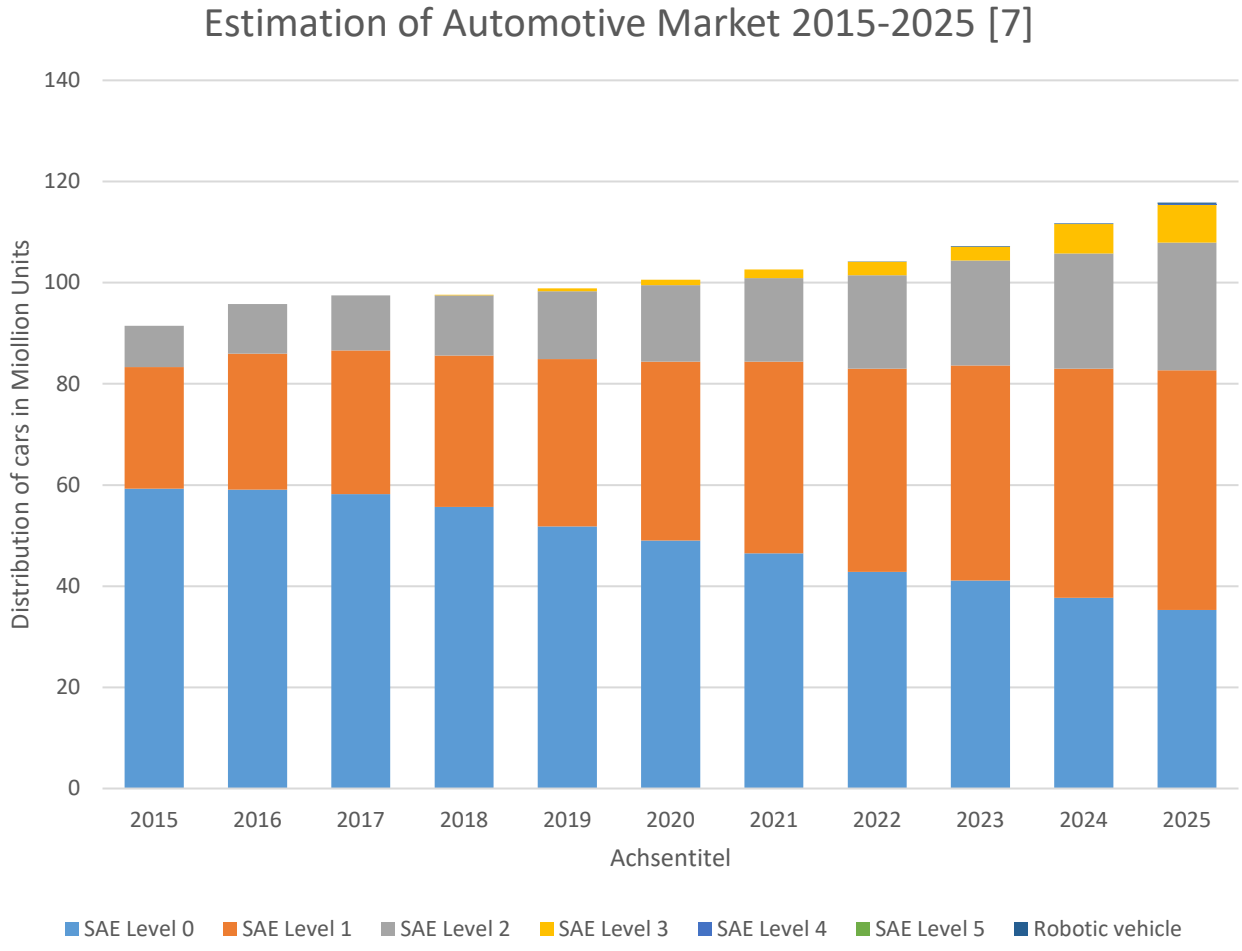
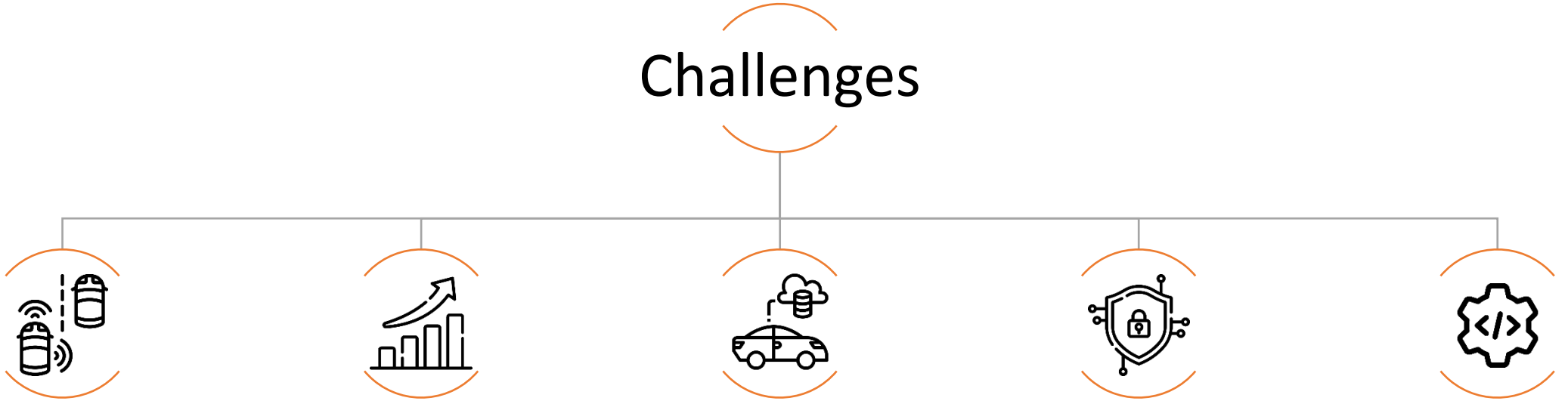


Figure: Sensors in intelligent vehicles according to [8]



Challenges for PTI of Intelligent Cars



Challenge I

Environmental perception

Challenge II

Growing complexity

Challenge III

Accessability of data

Challenge IV

Security Validation

Challenge V

Identification of unauthorized SW/HW manipulations

Improvements for the PTI

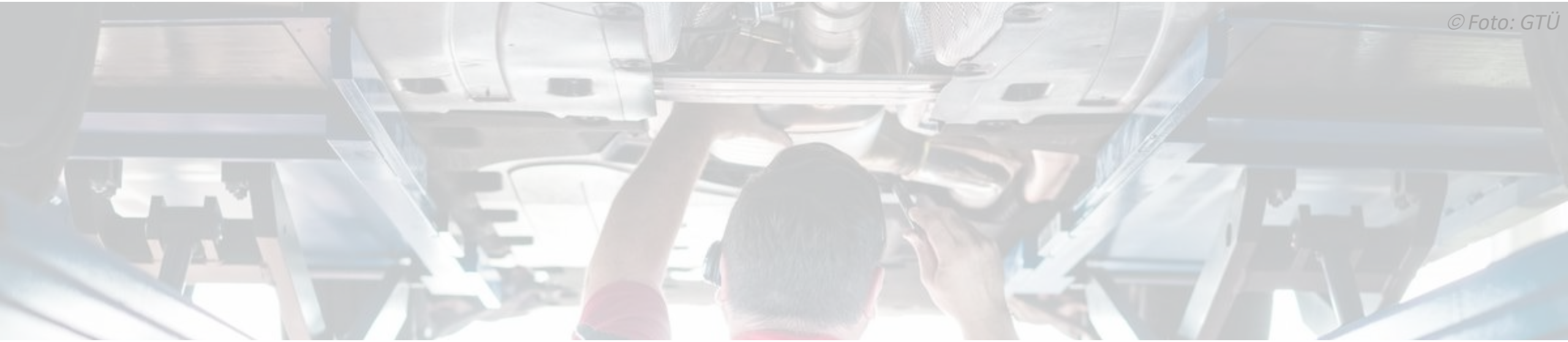
	Composition	Condition	Function	Effectiveness
Current State	Assessment and identification of built-in parts and components	Assessment of wear and tear	Actuation of control devices to assess timely and correct execution	Measurement for compliance with specified limit values
Security	Check SW/HW to correspond OEM specifications	Threat assessment to identify deprecated security measures	Security testing and read out self-diagnosis results through OBD to monitor correct functioning	CSMS assessment and detection of unintended behavior
Autonomous Driving	Check hardware and software to correspond to the specifications of the OEM	Assessment of the current state of the sensor and actor systems required to perform the driving functions	On-Board-Diagnostic and inspection of the associated functions	Assessment of the performance of the sensors and actors required to perform the driving functions

Conclusion & Outlook

- PTI regularly assess the road safety and environmental sustainability (2014/45/EU)
- SAE Level 4 vehicles predicted for 2025 [7], further development of intelligent vehicles expected
- Current PTI inspection criteria are not sufficient
- Challenges include sensor condition, growing complexity, data accessibility, security validation, and identification of unauthorized HW/SW manipulation
- Domains for improvements have been identified

Outlook

- Monitoring of projects, initiatives, standards, and regulations
- Identify evaluation methods for inspection engineers that enable an assessment of the roadworthiness



Thank you for your attention!

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Sources

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