



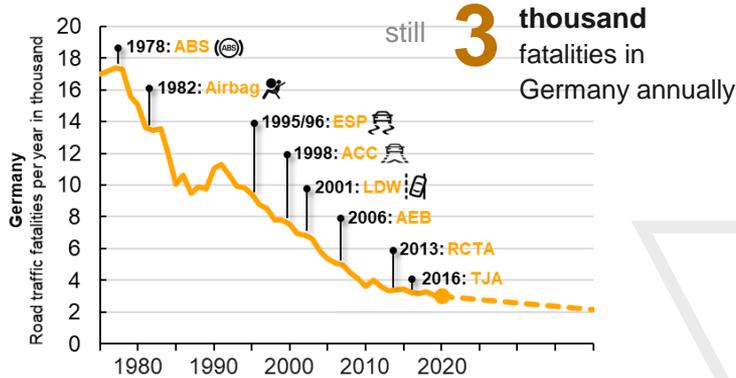
TechTalk **SAFETY AND MOTION**

*SAFE MOBILITY*  
= *SAFE MOTION*  
= *SAFETY AND MOTION*

# The Story of Vehicle Safety

## The path towards Vision Zero

### Traffic Fatalities<sup>1</sup>



### Twofold Approach

Increase performance and automation to reduce human error

Increase installation rates of established safety systems



Over **1.35** million people worldwide die in road accidents every year

Another **50** million are injured.

<sup>1</sup> Sources: Data for 2019, Federal Statistics Office, Germany (Destatis) | Global Status Report on Road Safety 2018, World Health Organization  
ABS: Antilock Braking System | ESP: Electronic Stability Program | LDW: Lane Departure Warning | AEB: Autonomous Emergency Braking | RCTA: Rear Cross Traffic Alert | TJA: Traffic Jam Assist

# Our Vision Zero

Safe Mobility Is Our Passion – Saving Lives Our Devotion



## Normal Driving



**“Safe Stop and Stand Still”**

## Hazardous Situations



**“Vehicle Stabilization and  
Emergency Brake”**

## Crash



**“Mitigate the Impact”**

Safe and Dynamic Driving Toward Vision Zero



# Our Heritage

## Over 40 years of safety systems experience



 <p><b>1989</b> MK IV</p> <p>Anti-lock Braking System</p>	 <p><b>1995</b> MK 20</p> <p>Traction Control System</p>	 <p><b>2000</b> MK 60</p> <p>Electronic Stability Program</p>	 <p><b>2011</b> MK 100</p> <p>ADAS ready</p>	 <p><b>2016</b> MK C1</p> <p>Recuperation HAD ready</p>	 <p><b>Today</b> MK C2</p> <p>Gateway to Future Brake Systems</p>
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new features, increasing performance, vertical/horizontal integration, ...

 <p><b>1986</b></p> <p>Front-crash</p>	 <p><b>1996</b></p> <p>Side-impact</p>	 <p><b>2007</b></p> <p>Roll-over</p>	 <p><b>2011</b></p> <p>Pedestrian</p>	 <p><b>2016</b></p> <p>Pre-Crash</p>	 <p><b>Today</b></p> <p>SAFE Platform</p> <p>Benchmark for Enhanced Passive Safety</p>
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# Automotive Transformation

4 major trends are driving the requirements to safety



## Digitalization

- › Changing user expectation  
→ **smart IoT device**
- › Continuous upgrades and updates  
→ **homologation, function partitioning**
- › Decoupling HW from SW  
→ **modular & portable software functions**



## Electrification

- › Changed wheel brake actuation profiles  
→ **corrosion robustness**
- › Recuperation, skateboard chassis  
→ **brake-by-wire**  
→ **dry brake**
- › New interior designs  
→ **configurable restraint systems**



## Autonomous Mobility

- › No driver as fallback  
→ **fail operational brake system**  
→ **high system availability**
- › Occupant Freedom  
→ **anticipatory & connected restraint systems**



## Sustainability

- › Emission regulations  
→ **significantly reduced brake dust emissions**  
→ **increased efficiency**
- › Circular Economy  
→ **recycling rate**  
→ **remanufacturing rate**  
→ **design for environment**

▶ Safety innovations needed to make the transformation happen. Safety is not negotiable!

# Automotive Transformation

## Enablers to manage growing complexity



### E/E Architecture

- › High-Performance Computer
- › IP based Ethernet Networks
- › Service Oriented Architectures

### Connectivity

- › Over the Air Updates
- › Cyber Security
- › Data Handling
- › V2X Communication
- › Edge/Cloud Computing

### Artificial Intelligence

- › Vehicle functions enhancement
- › Online/offline learning
- › Predictive Maintenance
- › Product Optimization
- › Data Engineering

### Systems Excellence

- › New Materials
- › Vertical/Horizontal Integration
- › Vehicle Function Expertise
- › Safe Engineering Process

▶ The key requirements for new solutions and features are reliability, safety and security

# All Future Cars Need a Brake System

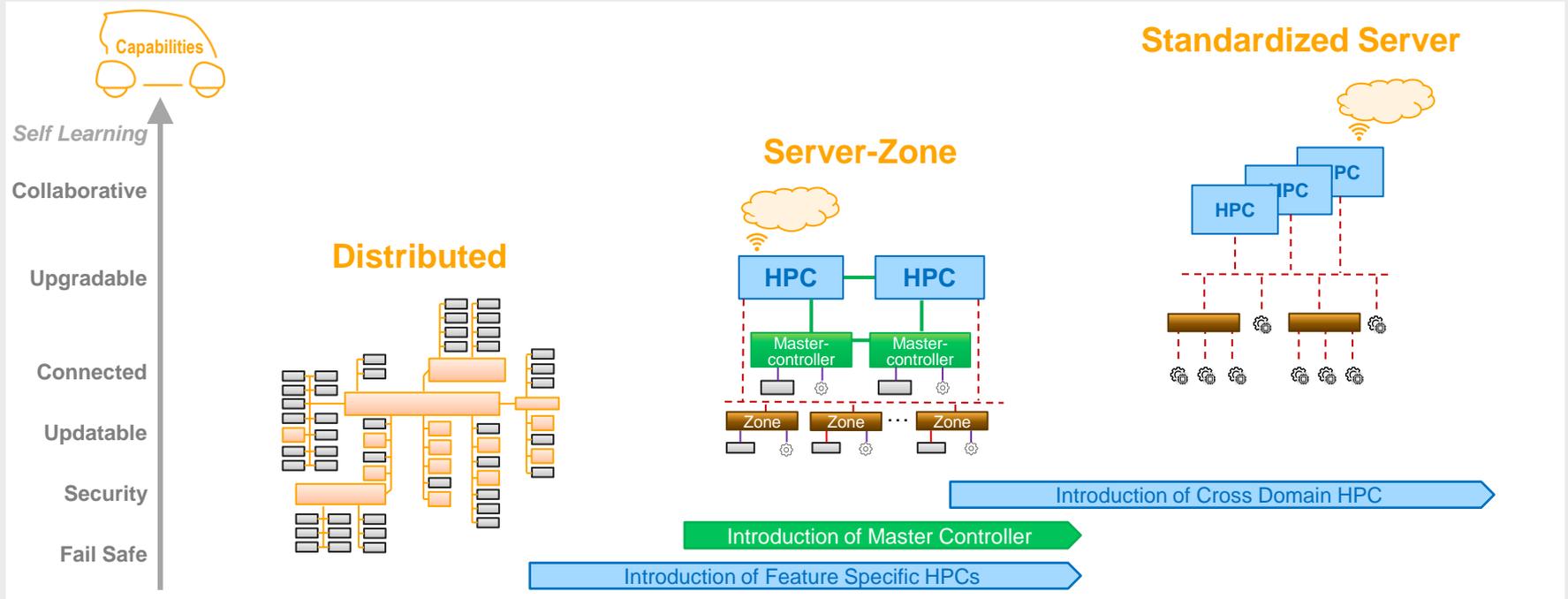
Friction brakes with electronic brake system stay dominant



					
	Normal Braking	Emergency Braking	Stabilization	Standstill Management	Fail Operational
Friction Brake & EBS	✓	✓	✓	✓	✓
Recuperation only	✓	✗	✗	✗	✗

# E/E Architecture Transformation

## From “diversified” to “standardized” E/E

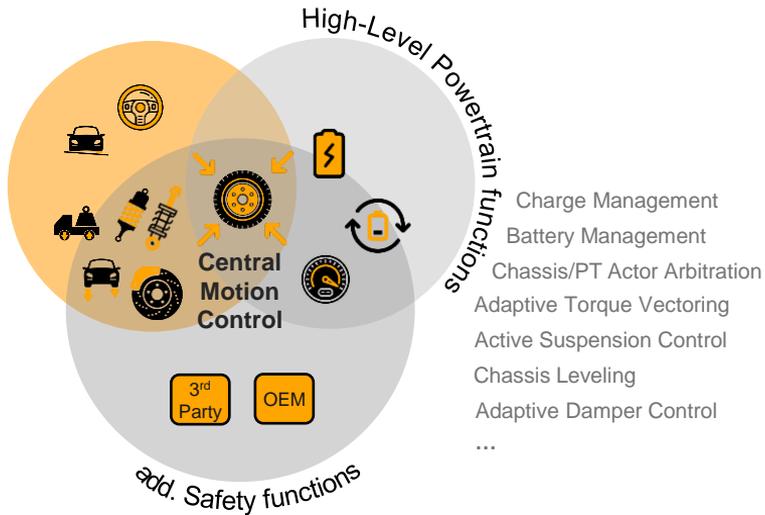


▶ Standardization paves the way towards E/E architecture transformation

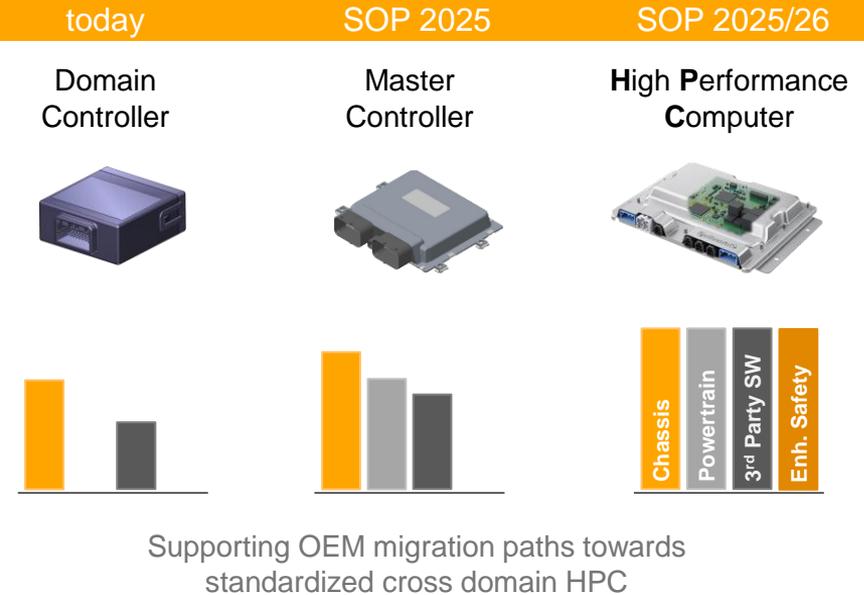
# Future Motion Systems

## Safety & Motion Integration Platform

### Modular Software Applications



### Scalable Safety & Motion Integration Platform



▶ Modular and scalable integration platform to host chassis and cross domain applications

# Safety and Motion Business

## Portfolio transformation and extension



### Future Brake Systems



All future **cars need a brake** system: Portfolio extension towards full by-wire, dry and emission free braking

### Integrated Safety Systems



Restraint systems become **anticipatory and connected**. Sensors will become more intelligent

### Future Motion Systems



Safety & Motion Integration platform and **Central vehicle motion management** to control actuators effectively

Safe Mobility = Safe Motion = **Safety and Motion**

***THANK YOU!***