

Automating Next Generation Mobility

```
zf_next_generation_mobility =  
(software, data)  
* innovation;  
return  
zf_next_generation_mobility;
```



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Development
Innovation & Technology



Dr. Nico Hartmann

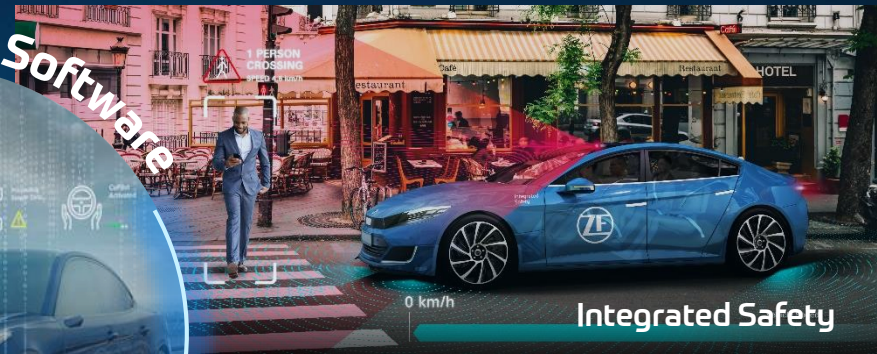
Software Solutions



Uwe Class

Advanced System
Development

Software is driving innovation at ZF now

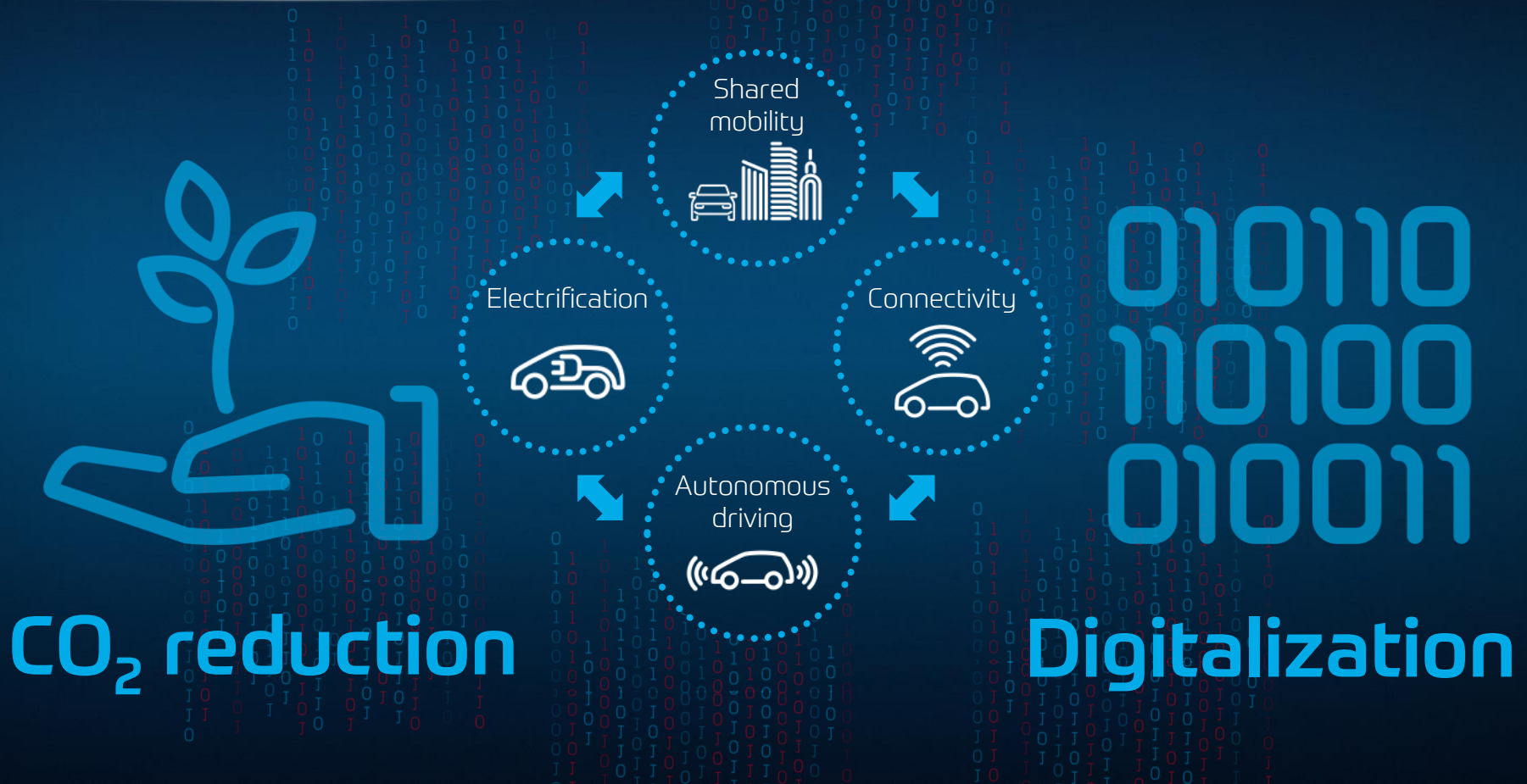


ZF Software enables Automating Next Generation Mobility



The future of
mobility is
powered by
software

The future of mobility is powered by software



The mobility experience of the future is defined by functions implemented in software



Ride Hailing



Trajectory Execution
Performance Drive



Energy
Management



Pre-Crash
Detection



Highway Driving /
Traffic Jam Assist



Emergency
Braking Assist

Software-Defined Car

Software can provide updates, upgrades and complete new functions to a car throughout its lifetime



Permanent
upgrade

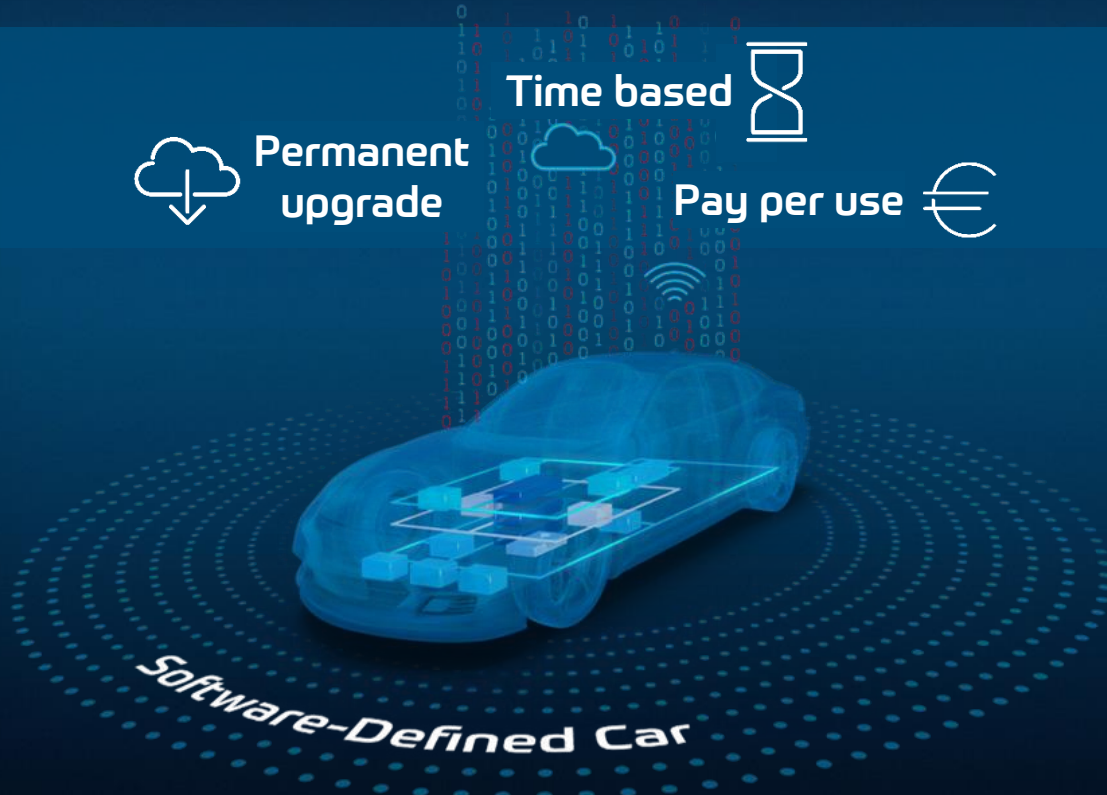
Time based



Pay per use €



New business models
& value streams



Example



Pure e-Drive

Software can provide updates, upgrades and complete new

SOFTWARE
EMPOWERS CO₂
REDUCTION.

YOU ARE KIDDING ME. THIS EVPLUS
APP REDUCES EMISSIONS AND
ALSO SAVES MONEY?



YES, IT IMPROVES OUR
PURE-E INDEX! SAVES US
80 BUCKS AND WE CAN
DRIVE DOWNTOWN.

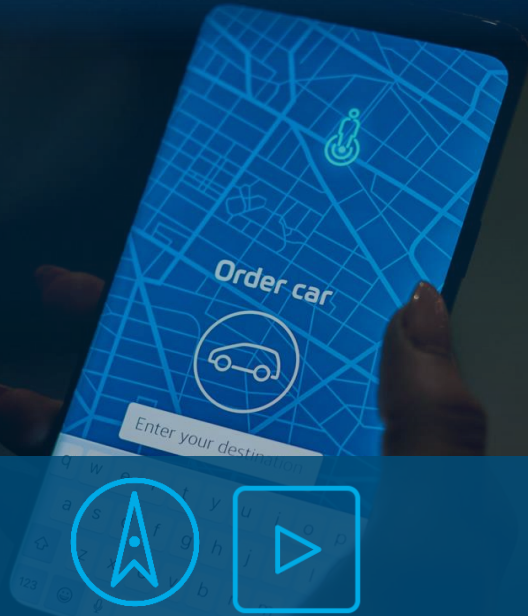
models
streams

ple

re e-Drive

are-Defined Car

But: the software-defined car is more than a smartphone on wheels!

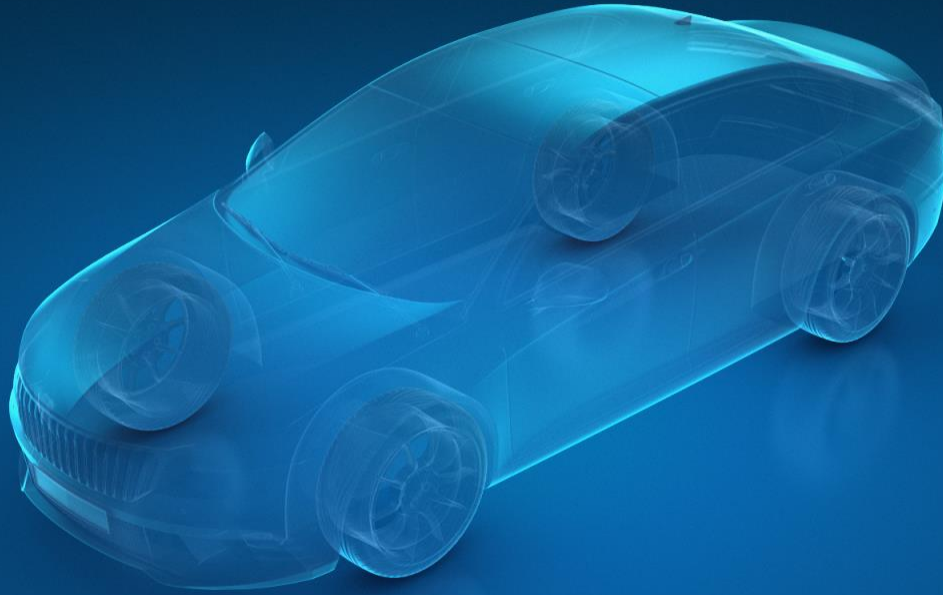


Focus on infotainment,
communication and smart life



Helps to ensure comfortable and safe
driving and can protect your life

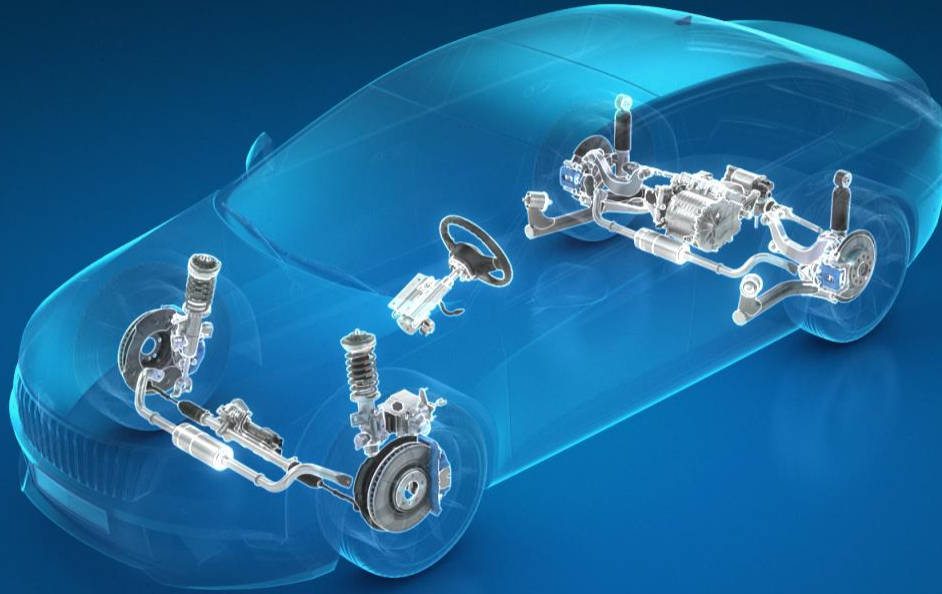
The software-defined car requires innovative smart systems



The software-defined car requires innovative smart systems

Hardware

Smart actuators

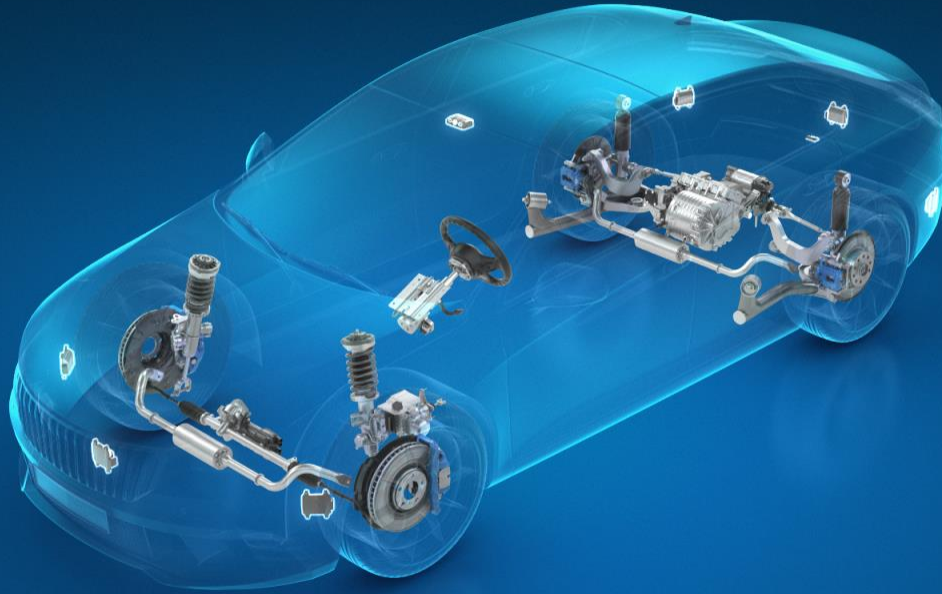


The software-defined car requires innovative smart systems

Hardware

Smart actuators

Intelligent sensors



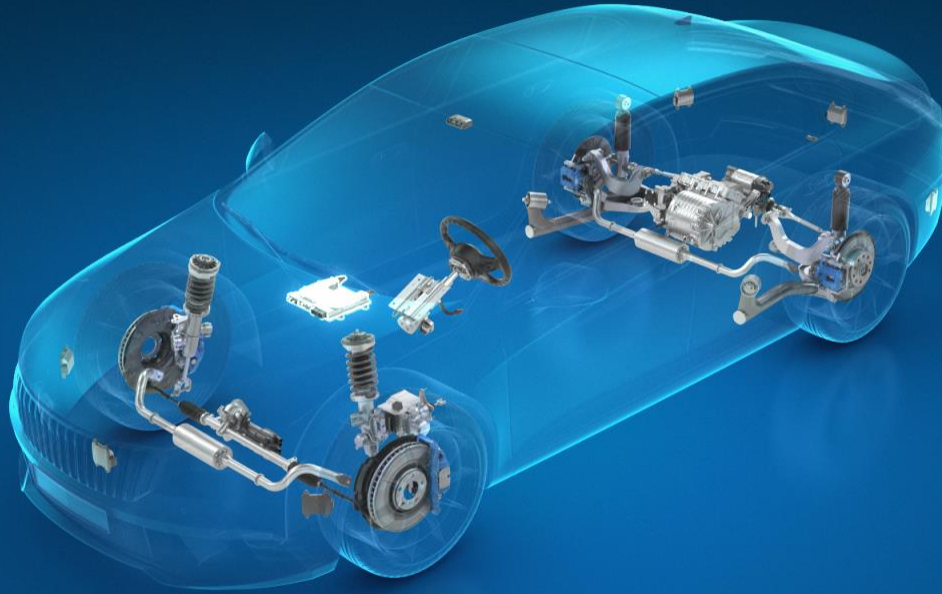
The software-defined car requires innovative smart systems

Hardware

Smart actuators

Intelligent sensors

More processing
power



The software-defined car requires innovative smart systems

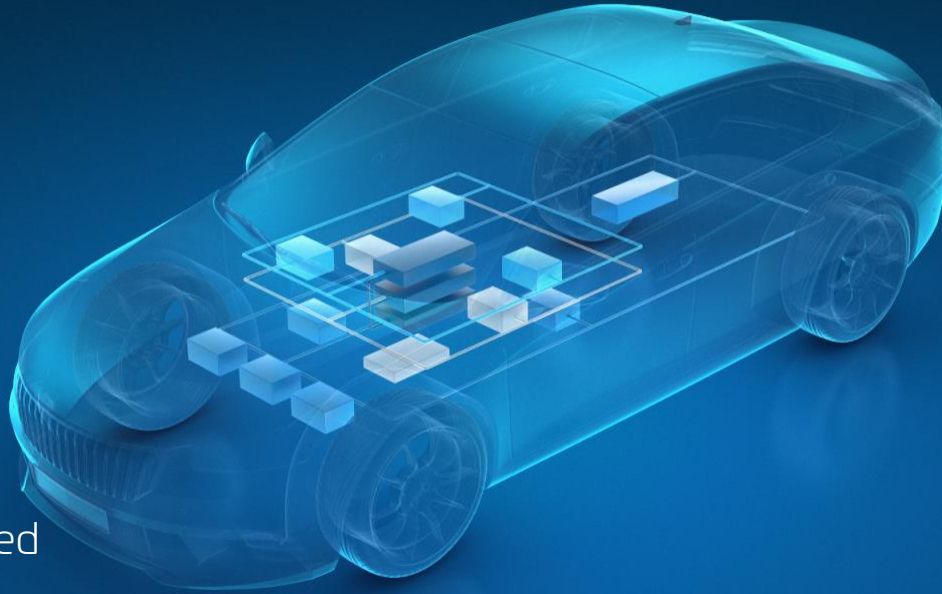
Hardware

Smart actuators

Intelligent sensors

More processing
power

Domain or zone-based
E/E architecture



The software-defined car requires innovative smart systems

Hardware

Smart actuators

Intelligent sensors

More processing power

Domain or zone-based E/E architecture



Software

Hardware independence

Flexibility

Scalability

Compatibility

Upgradability

The software-defined car requires innovative smart systems

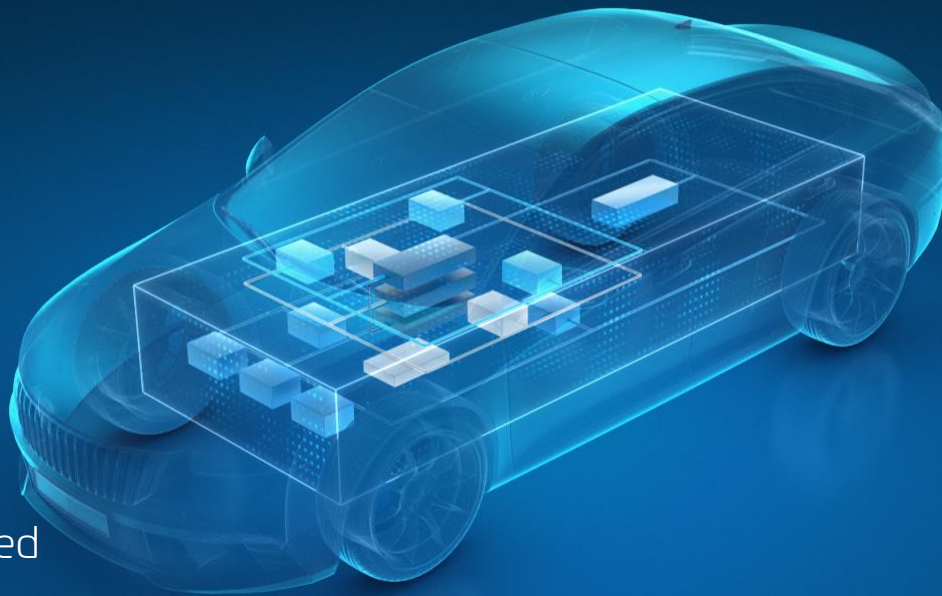
Hardware

Smart actuators

Intelligent sensors

More processing power

Domain or zone-based E/E architecture



Software

Hardware independence

Flexibility

Scalability

Compatibility

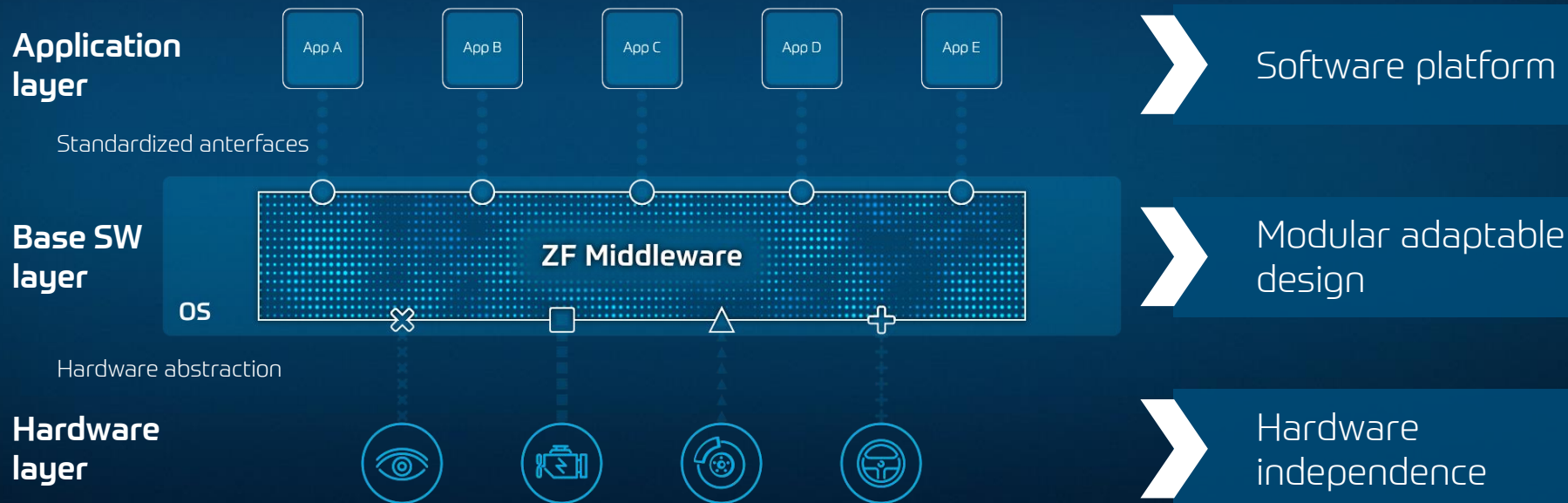
Upgradability



ONE key enabler and connecting element: middleware

**ZF Middleware
is the enabler
for all software
functions**

ZF Middleware enables efficient communication between software functions and smart hardware



**ZF Middleware
provides
independence and
compatibility to
make vehicle
platforms future-
proof**

Software platform for developing, integrating & operating functions across vehicles

Efficient development of compatible software functions for all parties

Ensures future upgradability as well as safe, secure and fast operation of the SW functions in the vehicle

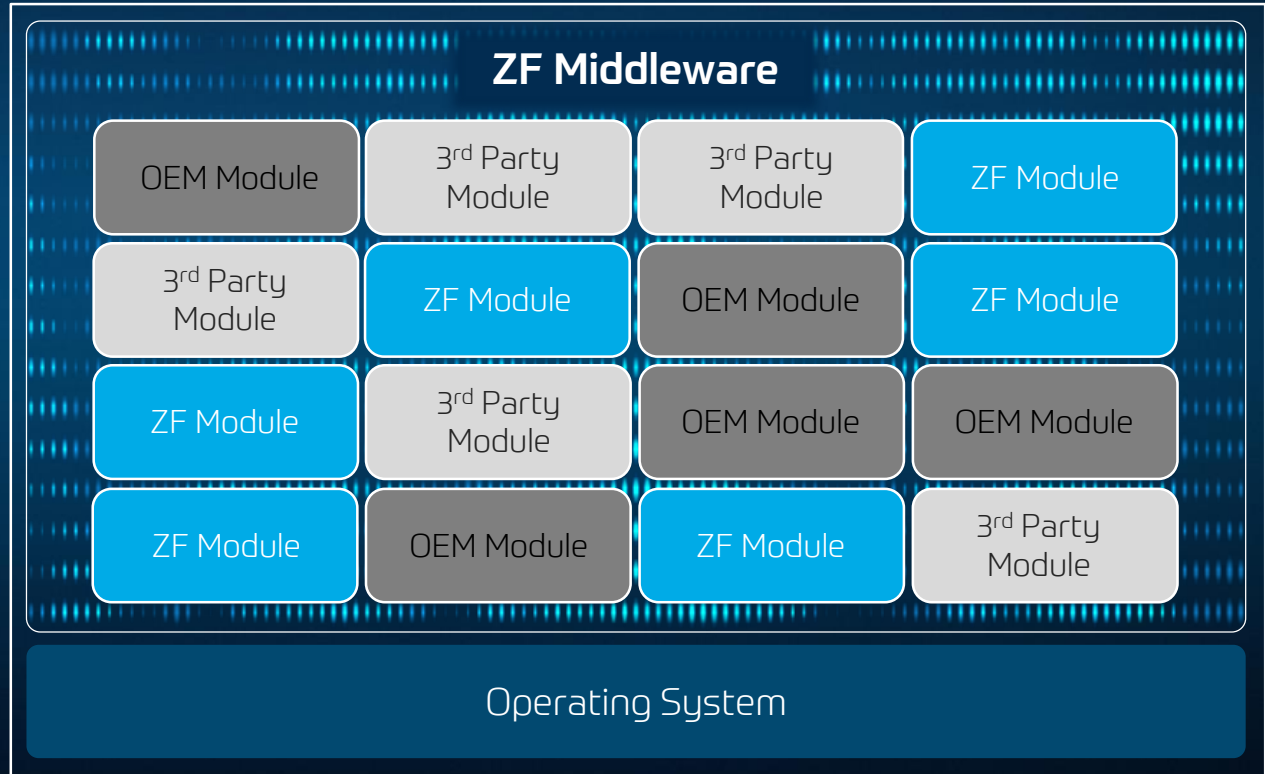
Usable for multiple vehicle platforms



ZF Middleware is modular and adaptable to customer requirements and their OS

Integration of
complementing modules
based on the needs of the
OEM

Adaptable to OEM
requirements and their OS

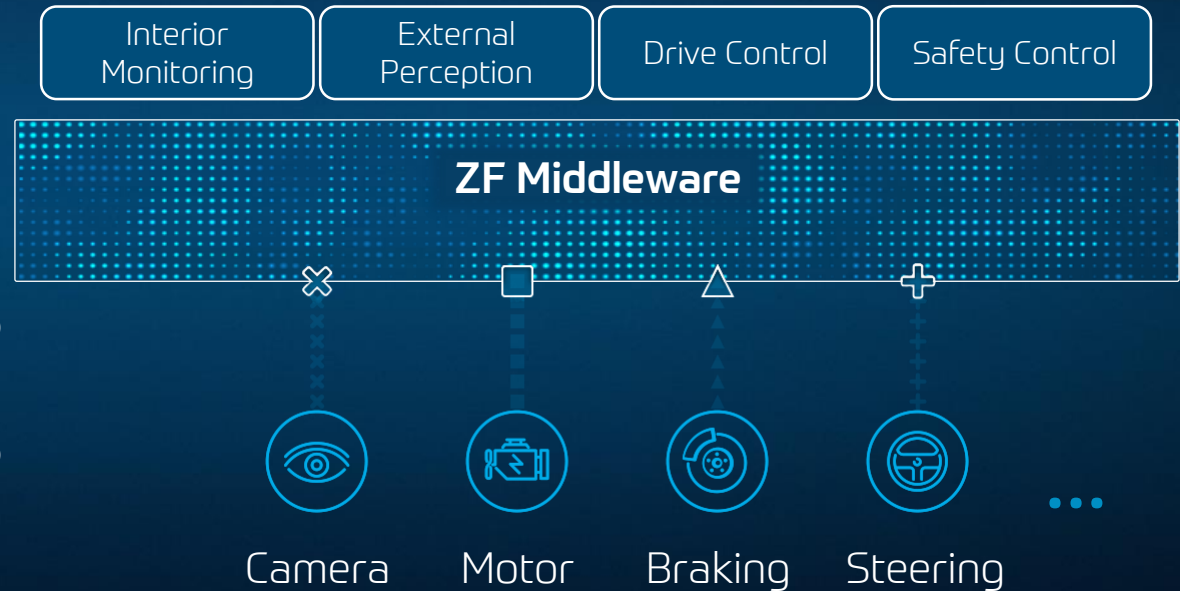


ZF Middleware provides hardware independence and can integrate components from all sources

Middleware ensures that SW functions can address the relevant hardware and provides standardized "virtual" components

Hardware abstraction provides suitable adapters and translates hardware specific instructions to a "universal" vehicle language

Hardware
abstraction



ZF Middleware enables an efficient integration of software functions

Architecture Benefits

Hardware abstraction

Provides access and two-way communication with components from all manufacturers

Interface abstraction

Facilitates running SW functions from all developers (ZF, OEMs, 3rd parties) and is adaptable to every OS

Innate Benefits

Safe

State-of-the-art fail-proof functioning of all systems (e.g. steering, braking)

Secure

State-of-the-art shielding of vehicle software environment from external threats or manipulation

Fast

State-of-the-art low latency communication for all systems

Software Development Benefits

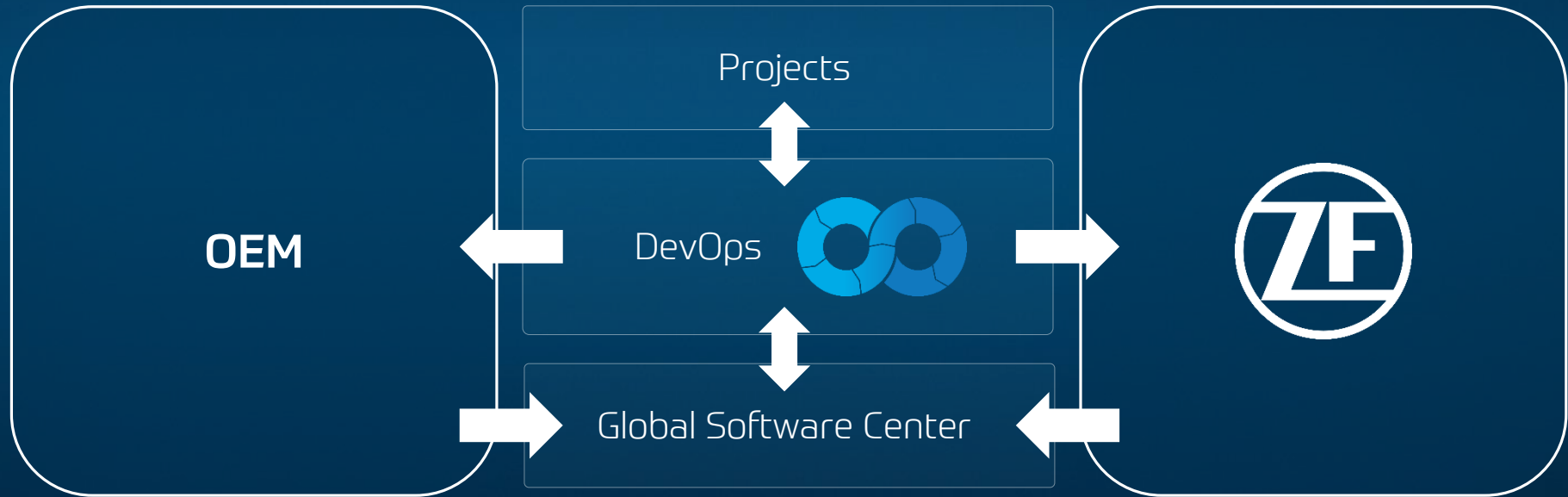
Save time and effort

Use of standardized stacks and abstraction layers facilitates development of software functions ("software release in a day")

Concentrate on your USP

Use of middleware lets OEMs focus on the visible and tactile elements of the mobility experience: functions, features and the UI

Software projects are run jointly with our customers based on agile co-engineering



Global Software Center

ZF's approach to accelerate software deployment

Project is the boss

E-Mobility

Vehicle
Motion Control

Automated
Driving

Integrated
Safety

Commercial &
Industrial



Integration Services



On Cloud



Middleware



DevOps



Validation



AI & Security

Global Software Center

Software-enabled
functions & features in...

Automated Driving

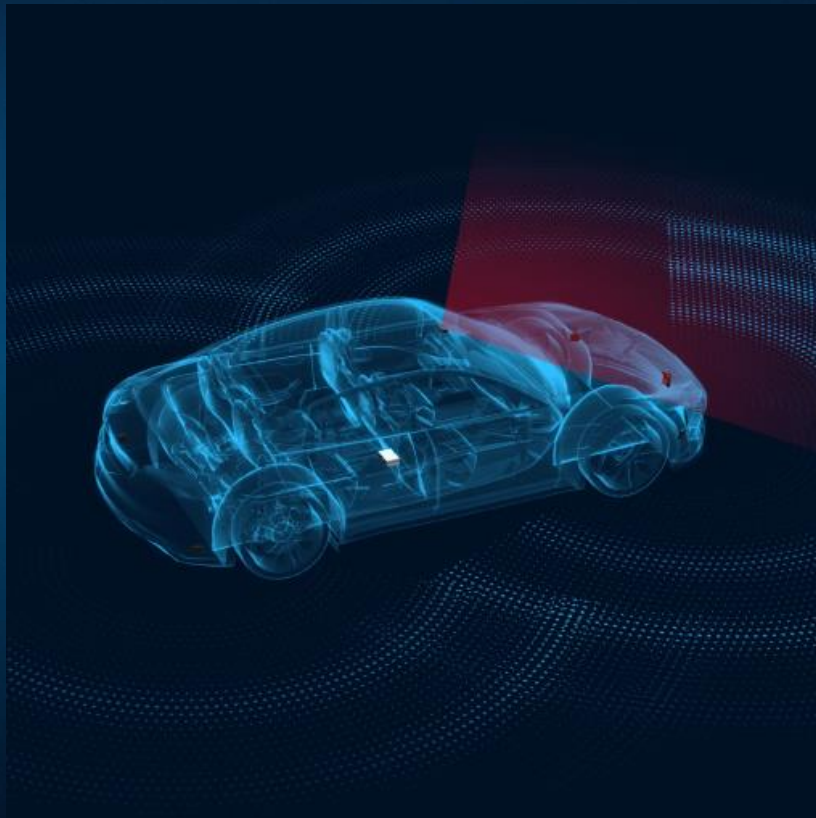


ZF coASSIST offers affordable Level 2+ automated driving

- Traffic jam support
- Highway driving support
- Driver-initiated lane change
- Driver-initiated highway exit
- Route following assist
- Driver monitoring system

Comfort & convenient function suite

EuNCAP compliant

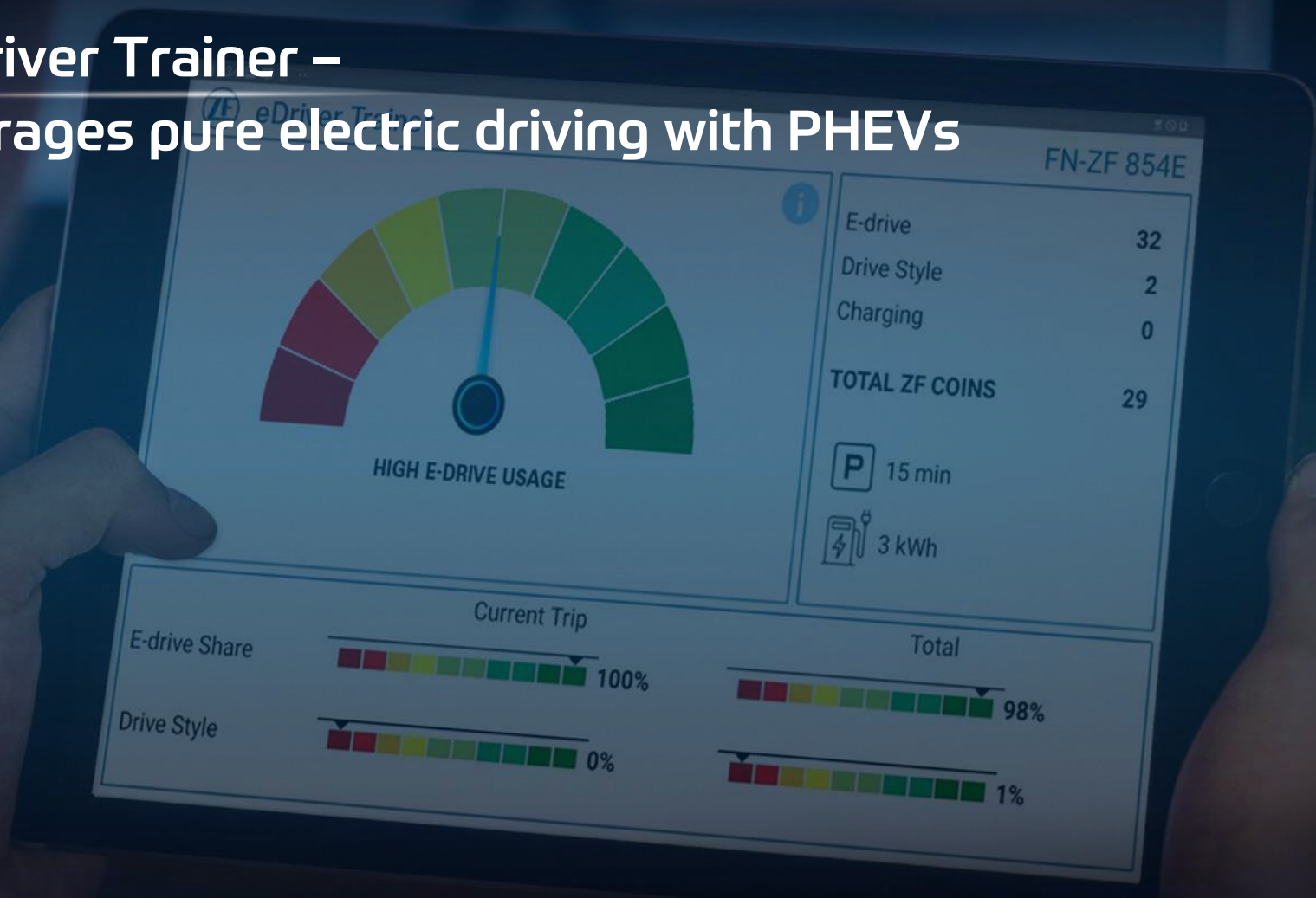




Software-enabled
functions & features in...

Electric Mobility

ZF eDriver Trainer – Encourages pure electric driving with PHEVs

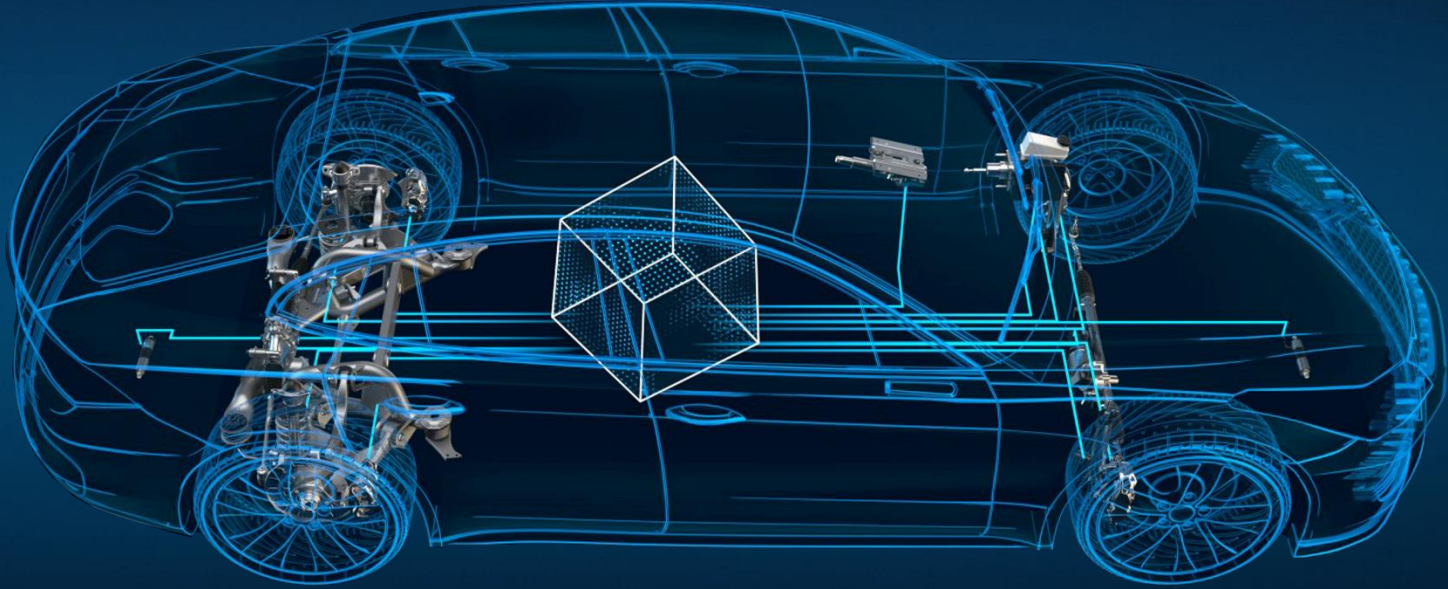


Software-enabled
functions & features in...

Vehicle Motion Control



cubiX® - Chassis control coordinator

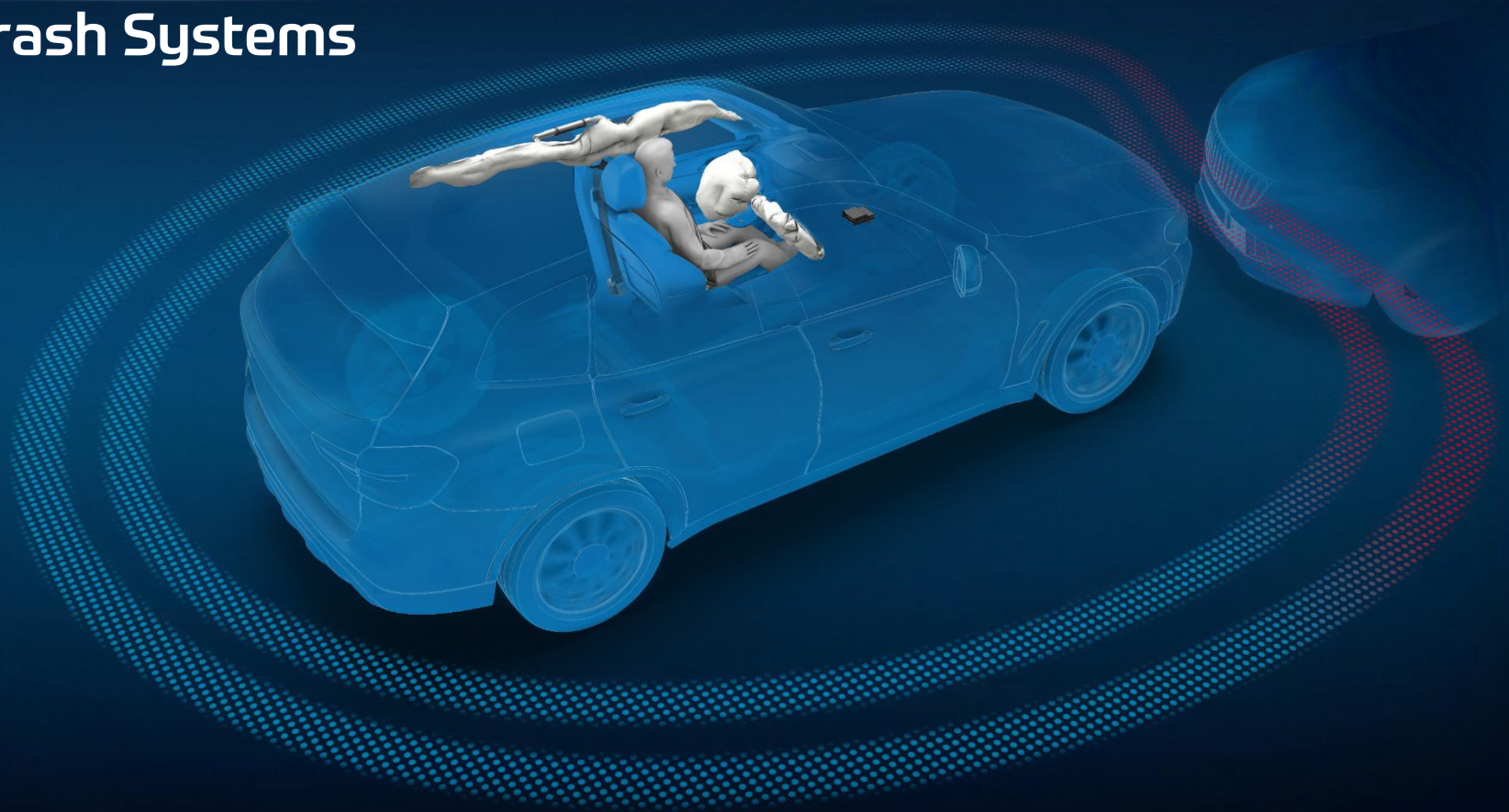


Software-enabled
functions & features in...

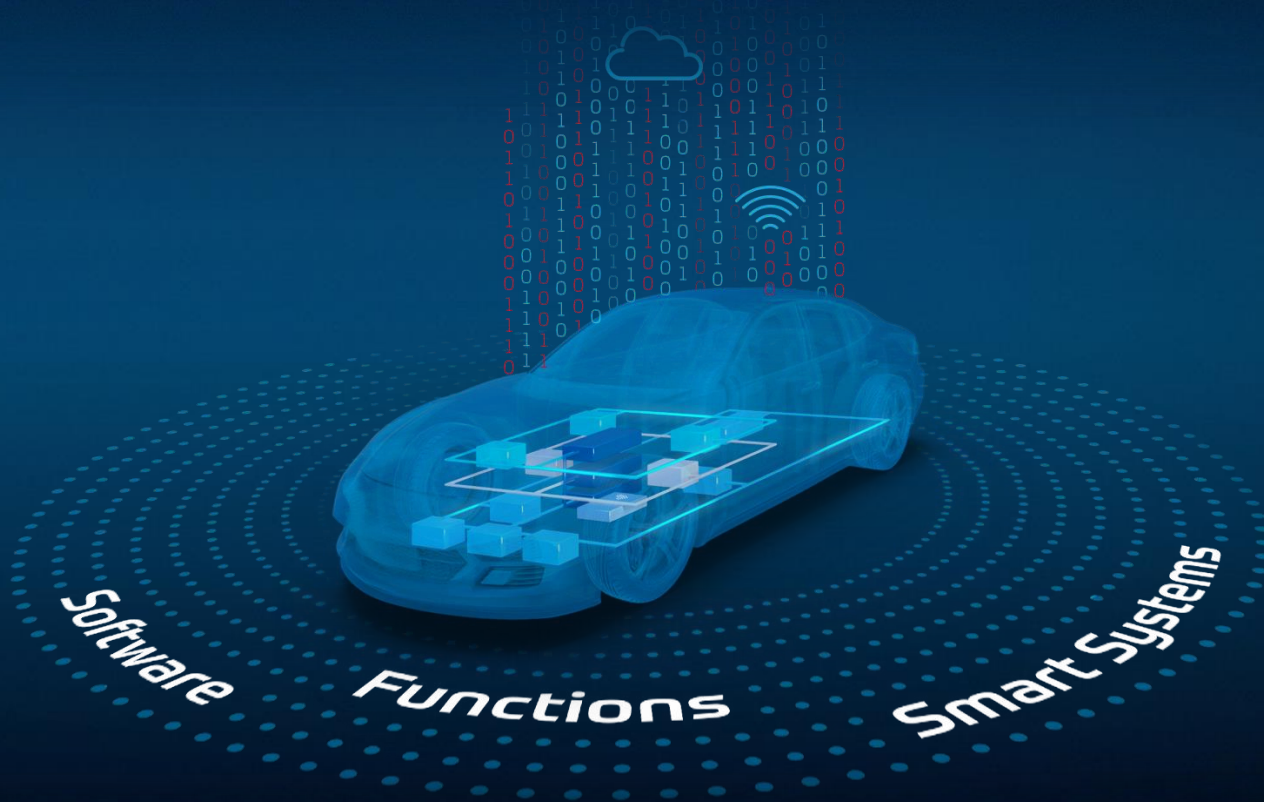
Integrated Safety



Predictive Safety – Perception based activation of Pre-Crash Systems



ZF is a unique system solutions provider across hard- and software, bringing software-defined cars to life



Automating Next Generation Mobility

```
zf_next_generation_mobility =  
(software, data)  
* innovation;  
return  
zf_next_generation_mobility;
```