

Current Situation in Mobility – Disruptive Changes?

dis·rup·tion:



[dis'rapSH(ə)n] *noun* disturbance or problems which interrupt an event, activity, or process

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Influence of Global and Current Trends on Mobility

Environment:

Climate Change

Economy:

Globalization

Society:

Urbanization

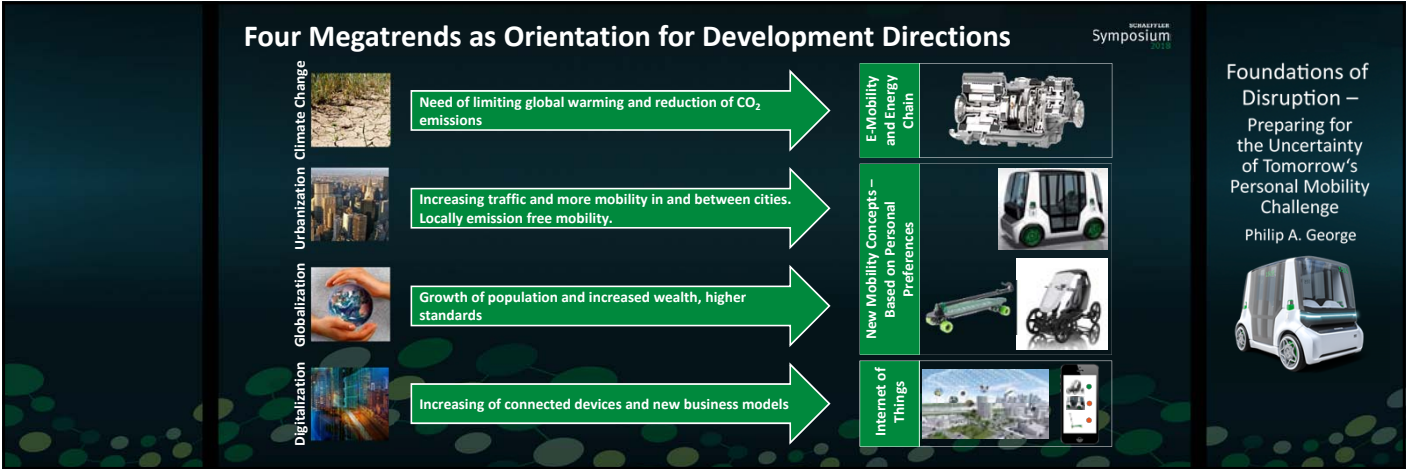
Technology:

Digitalization

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Urban Mobility – Individual Issues and Restrictions

Changing customer demands

Connectivity in daily life

Changing society structures

Growing shared economy

Increasing environmental awareness

Structural adjustments

Public transport

Car sharing

Transport mode change

New transport solutions

Game changers

Electrification

Autonomous driving

Jurisdiction & politics

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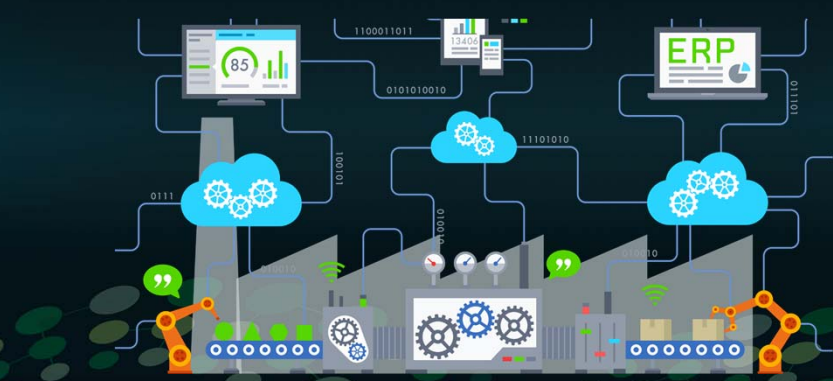
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Schaeffler’s Vision of Future Urban Mobility

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IT and Digitalization Fundamentally Change the Value Chain




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Key Success Factor – The Digital Twin

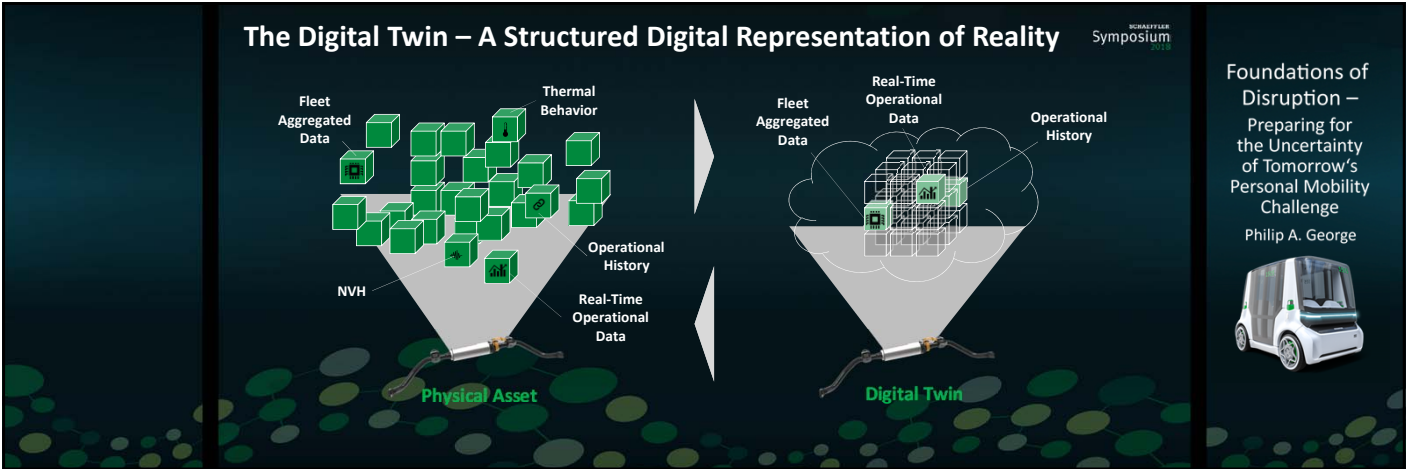
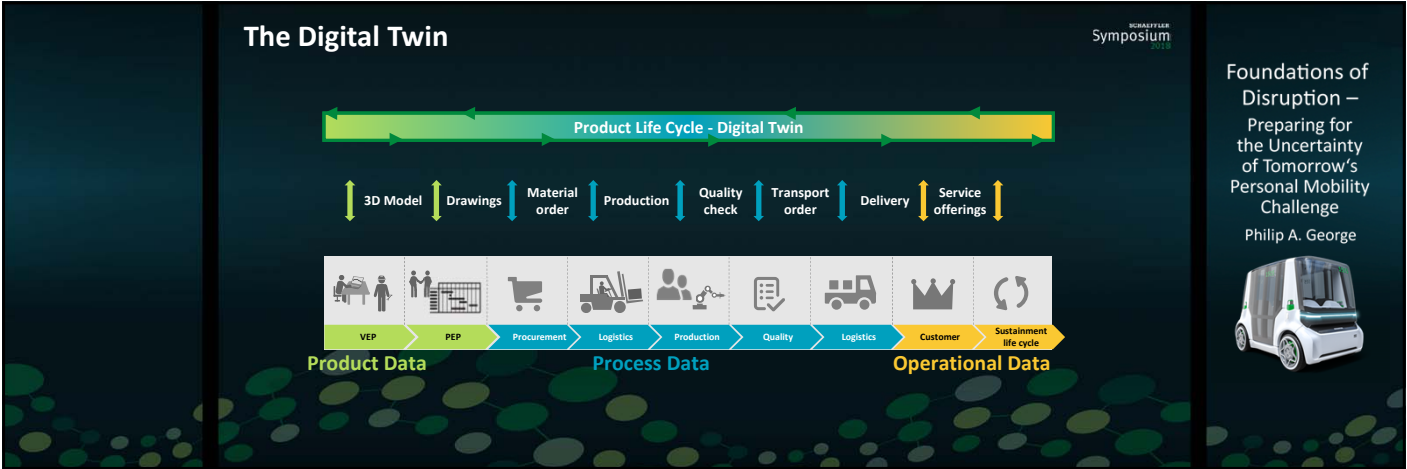


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Schaeffler's Personal Mobility Devices

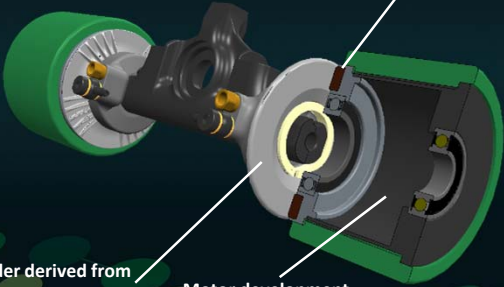


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Highly Integrated Drivetrain



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Highly Integrated Drivetrain



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Connected, Adaptive and Thereby Safe Personal Mobility


Connectivity


(vehicles, infrastructure, pedestrians)



Detection and Sensing


(vehicles, infrastructure, pedestrians)





New Vehicle Concepts

First Mile, Last Mile – Personal Mobility Devices



Highly Integrated Drivetrain

Components for Micro Mobility



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Rethinking the Bicycle Concept



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The Bio-Hybrid Addresses Today’s and Future Mobility Requirements



Use of existing infrastructure

Low total costs of ownership

Increased comfort / weather protection

No registration / no license

Emission free

Physical activity and health

Premium and lifestyle design

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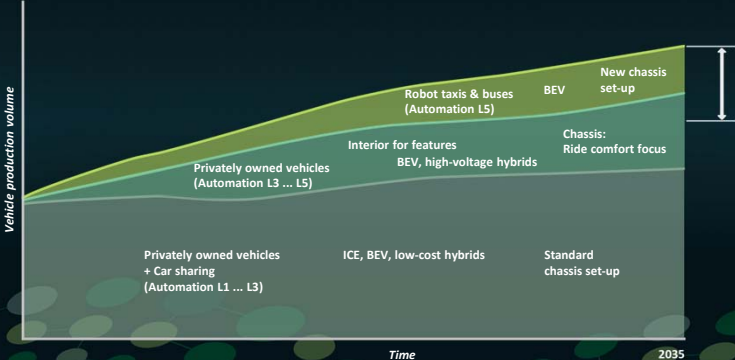
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Categories of Vehicles in the Future



Vehicle production volume

Time

2035

3 % – 15 %
Level L5

Privately owned vehicles + Car sharing (Automation L1 ... L3)

ICE, BEV, low-cost hybrids

Standard chassis set-up

Privately owned vehicles (Automation L3 ... L5)

Interior for features BEV, high-voltage hybrids

Robot taxis & buses (Automation L5)


BEV

New chassis set-up

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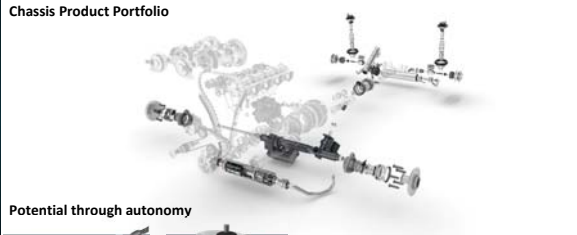


*) Source: IHS Rivalry / Autonomy 2016 & Average McKinsey 2016


Chassis Systems – Autonomy Adds Value to Our Chassis Portfolio

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Chassis Product Portfolio



Potential through autonomy



Active Roll Control (IARC) Suspension Actuators Steering Actuators

Chassis Control Actuators Drive-By-Wire Solutions Full-Driving Chassis


Key Aspects

- Chassis megatrends include Autonomous Driving, Zero Fatalities, CO₂ reduction and demographics
- Schaeffler offers wheel and chassis bearings as well as chassis actuators
- Our actuators portfolio allows for Chassis Control, Drive-by-Wire Solutions and Autonomous Driving

Further potential in Chassis Systems

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The Schaeffler Mover

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Rolling chassis




Rolling chassis with fenders and bumper



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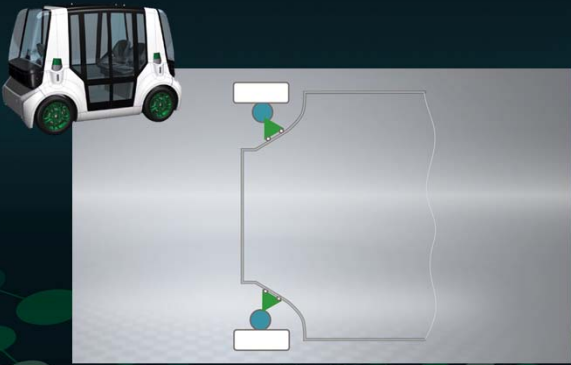
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Key Features of the Vehicle

Key Features


- ▶ All-by-wire functionality (Steering, braking, driving)
- ▶ Four-corner steering, four-corner driving
- ▶ Steering angle in drive mode: +/- 45°



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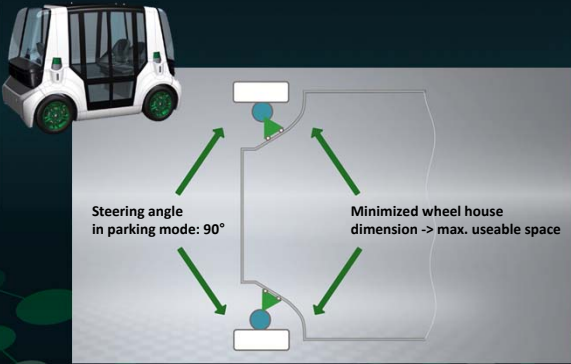
Key Features of the Vehicle

Key Features

- ▶ All-by-wire functionality (Steering, braking, driving)
- ▶ Four-corner steering, four-corner driving
- ▶ Steering angle in drive mode: +/- 45°
- ▶ Steering angle in parking mode: 90°
- ▶ Minimized wheel house dimension = max. useable space

Challenges


- ▶ Support lateral forces at steering wheel angle of 135°
- ▶ Integration steering actuator in the package
- ▶ Complete new development in 8 months



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Corner Module

Principle

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Corner Module

Principle

Concept Prototype

Steering System

Key facts

- Electric motor and planetary gear drive as rotational steering actuator
- Highest efficiency, no backlash, end-stop by software
- Redundant steering angle sensor
- Re-use of ECU and motor
- Simplified integration in vehicle E/E architecture



Motor

Gear set

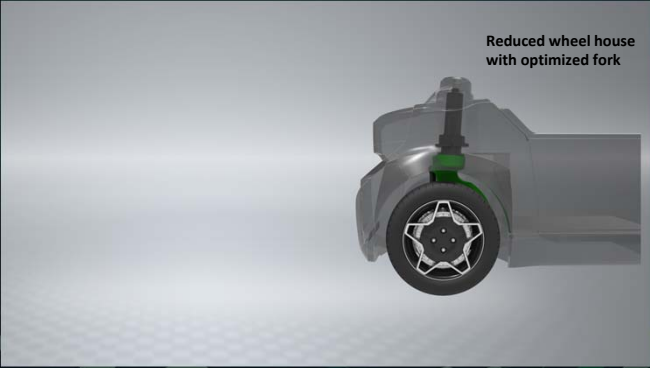
Fork

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Design of the Fork



Reduced wheel house with optimized fork

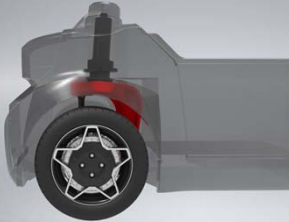
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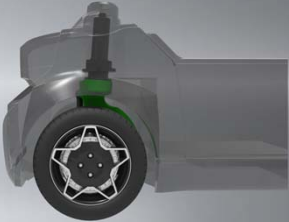


Design of the Fork

Wheel house with conventional fork




Reduced wheel house with optimized fork





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Vehicle and Drivetrain Performance



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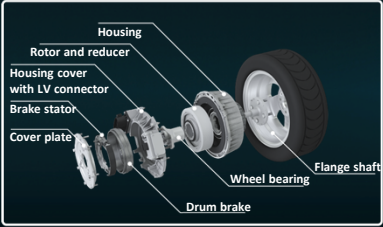
Vehicle and Drivetrain Performance

Drivetrain performance

- 13 kW Motor (peak 25 kW) @ 300 V, liquid cooled with integrated drum brake
- 250 Nm (short time (60 s) 500 Nm), rpm = 1400
- Torque is transmitted by planetary gear set to the wheel (ratio: 3.35)


Vehicle performance

- Vehicle weight: 1250 kg, load cap.: 450 kg
- Acceleration to 50 km/h: 3.3 s
- Max. speed: 80 km/h
- Max. slope: 31 %

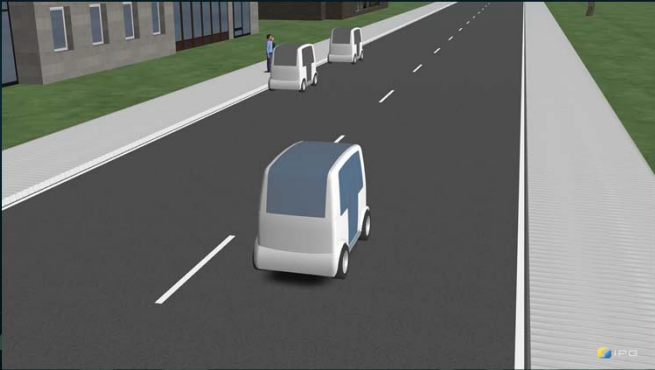


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Schaeffler Mover in Motion



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Overview Basic Maneuvers

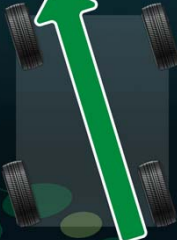
Cornering

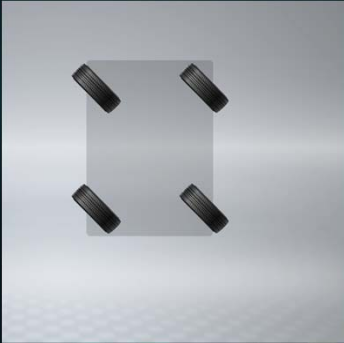
Steering angle up to $\pm 45^\circ$



Trace offset

Steering angle up to $\pm 45^\circ$






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Overview Basic Maneuvers

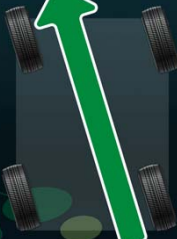
Cornering

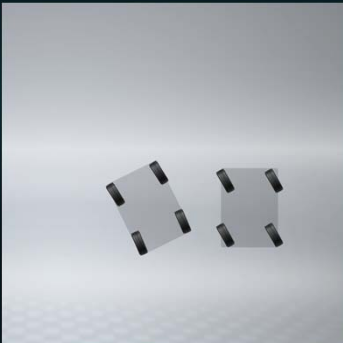
Steering angle up to $\pm 45^\circ$



Trace offset

Steering angle up to $\pm 45^\circ$






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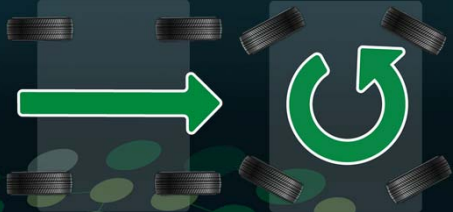
Overview Basic Maneuvers

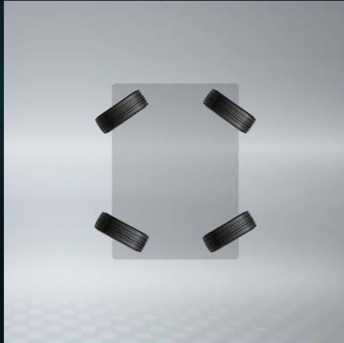
Lateral movement

Steering angle 90°

Turning

Steering angle up to +/-45°






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Autonomous Driving – Schaeffler Mover


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Cornering Module

E-Wheel Drive

Autonomous Driving




Level 0 Level 1 Level 2 Level 3 Level 4 Level 5



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Schaeffler Mover – Versatile and Clever

Intelligent corner modules enable highest maneuverability


Comfortable lane change

90° steering

Sharp cornering

Smallest turning cycle

Schaeffler Mover enables a wide variety of bodies



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