# Towards Cognitive Vehicles
## Opportunites & Challenges

Dr. Würtenberger, LT-3 | 2019 11 08

# ACES – A CORE ELEMENT OF BMW'S STRATEGY NUMBER ONE > NEXT.



Autonomous

Connected

Customer
Focus

Electrified

Sharing / Services

# THE LATEST BMW 5 SERIES.
# COMFORT AND SAFETY AT THE HIGHEST LEVEL.

Advanced Realtime Traffic Information

Intelligent Voice Assistant

Natural Language Understanding

3D View

Wrong Way Assistant

Top View Remote

Remote Control Parking

Distance Information

Gesture Control

Lane Change Assistant

Crossroad Assist

WiFi Hotspot

Crossing Traffic Warning

Lane Keeping Assistant with
Active Side Collision Protection

Night Vision

BMW Selective Beam

Lateral Parking Aid

Active Cruise Control with Stop&Go

On Street Parking Information

Rear Collision Prevention

Steering and Lane Control Assistant
up to 210 km/h

Lane Departure Warning

Speed Limit and No Pass Information

# ARTIFICIAL INTELLIGENCE IS RELEVANT ALONG THE ENTIRE VALUE CHAIN OF ORIGINAL EQUIPMENT MANUFACTURERS AND MOBILITY SERVICES.

## VALUE CHAIN

- Research & Development
- Procurement
- Supply Chain Management
- Manufacturing
- Sales and Marketing
- Aftersales & Service
- Driver / Vehicle Features
- Support Functions & Administration

- Autonomous driving
- Connected engineering
- Generative design

- Contract analysis
- Requirement management
- AI agent support (chatbot)

- Automated order placement
- Smart warehouse organization (Pick-Bots)
- Autonomous intralogistics

- Quality control
- Optimization by process mining
- Predictive maintenance

- Virtual product genius
- Targeted advertisement-placement
- Emotion and sentiment analysis

- Intelligent personal assistant
- Fleet management
- Connected foresight

- Digital workplace assistant
- Workflow improvement
- Automated document analysis

- Digital agent (chatbot)
- Help desk automation
- Predictive maintenance

# AI AS KEY TECHNOLOGY ENSURES OUR INNOVATION LEADERSHIP IN AUTOMOTIVE. FOR OUR CUSTOMER, OUR VEHICLE AND OUR PROCESSES.

## Customer Value

- core technology for data driven products & services
- need for new business models in digital customer ecosystem

## Increasing Efficiency

- maximum automation of routine tasks
- common infrastructure across various divisions

## Acceleration

- continuous product improvement through machine-learning
- analysis & learning from customer behavior
- machine-assisted data evaluation of core business processes

## Quality Optimization

- data-driven evaluation & processing
- evaluation & prediction of customer behavior
- real-time feedback in corporate processes
- replace workflow by standard AI building blocks & AI services

# INTELLIGENT DRIVING AND BEING DRIVEN.



Smart Interior as a Living Space.

THE BMW iNEXT.
LEVEL 3 HIGHLY-AUTOMATED DRIVING.

TEST FLEET ENABLED FOR LEVELS 4 AND 5.

LEVEL 1 – 3

LEVEL 4 – 5

FULLY-AUTOMATED

# „HEY BMW!"
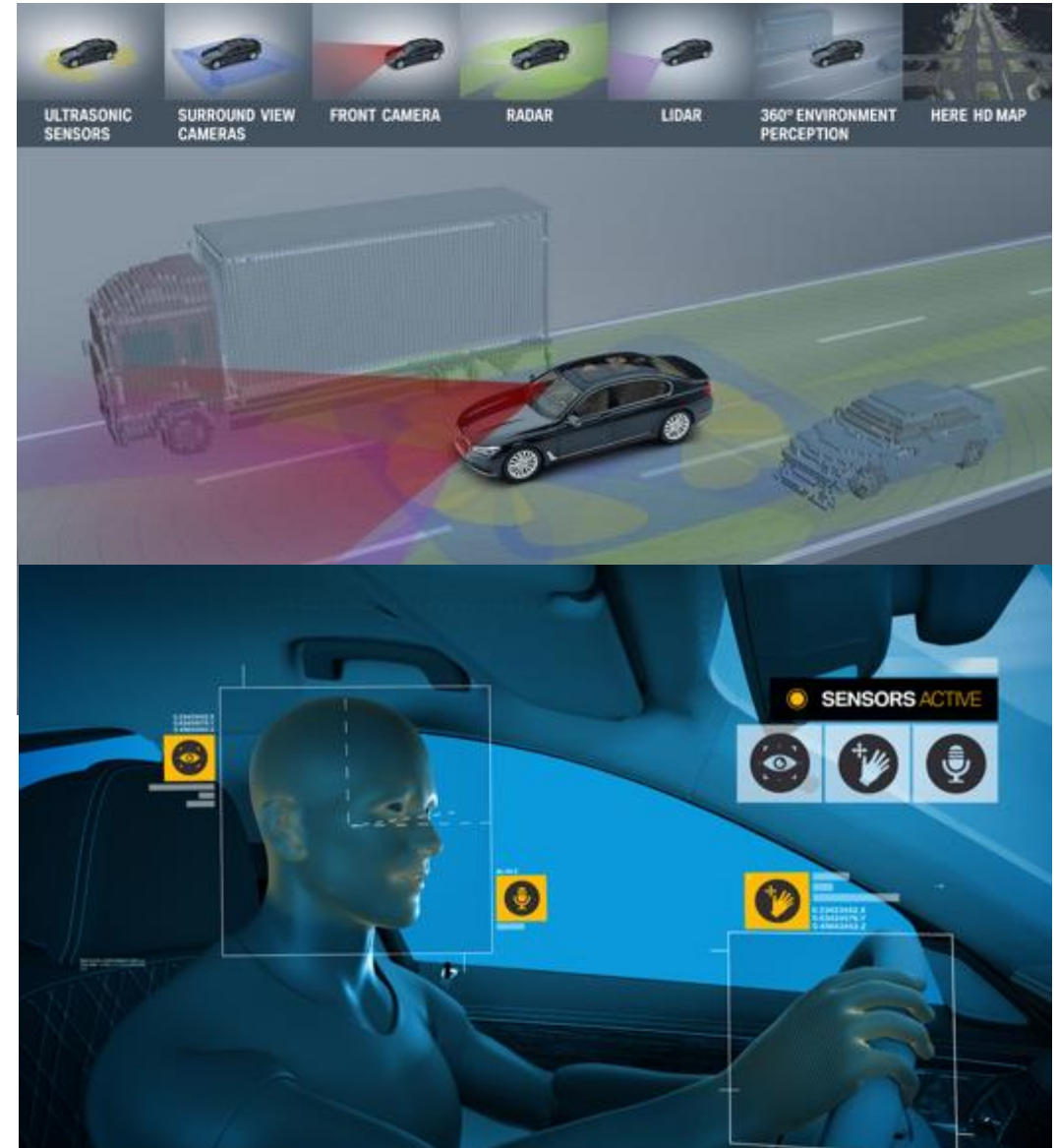# INTELLIGENT PERSONAL ASSISTANT.

# TOWARDS COGNITIVE VEHICLES: CHALLENGES

- Efficiency
  - Mobile application
  - On-board computation
  - Limited resources

- Cognitive architectures
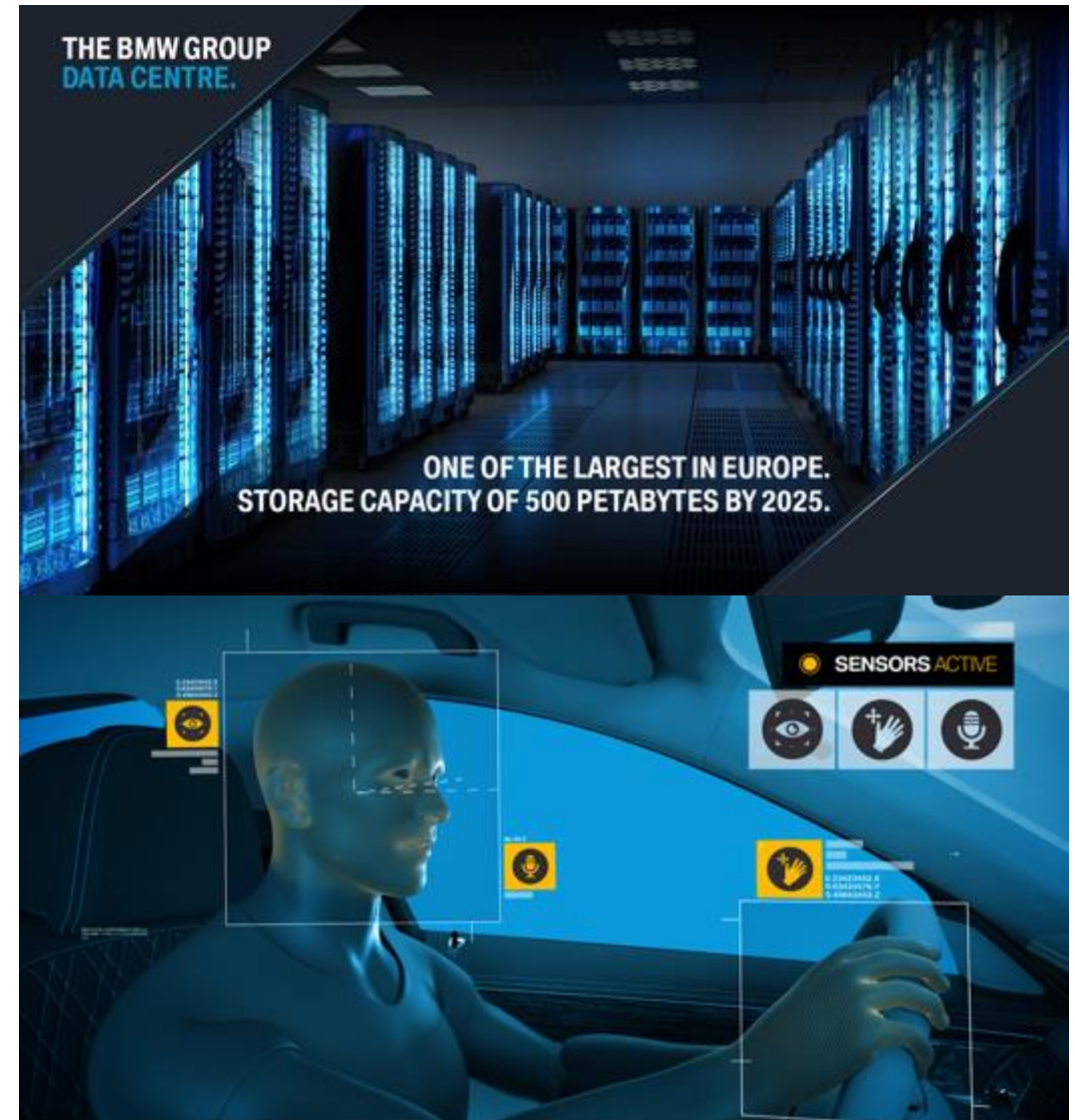  - Integration into vehicle
  - Personalization

# COGNITIVE VEHICLES CHALLENGES: EFFICIENCY

- Perception
  - Rich sensor setups (internal and external)
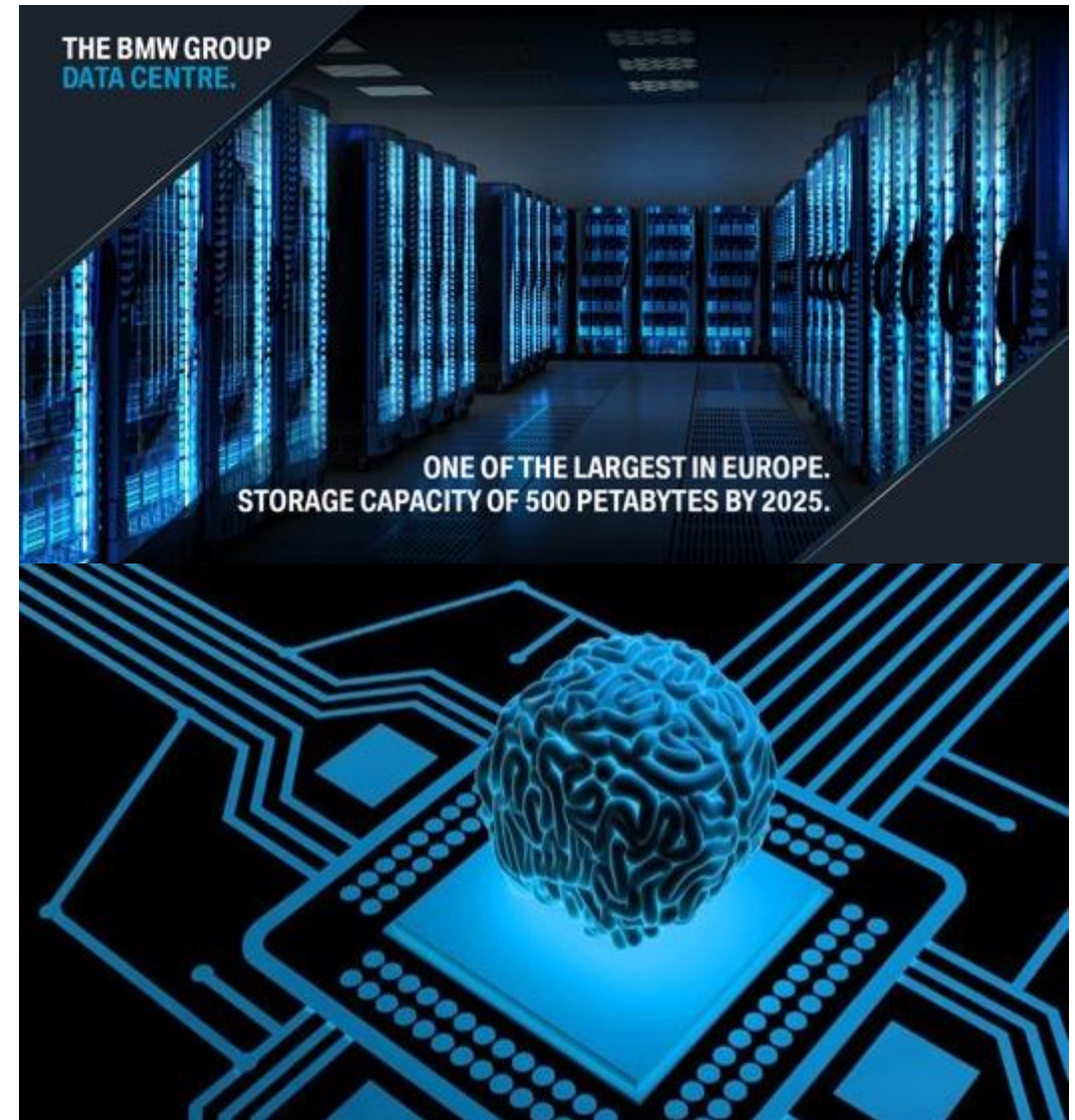  - Preprocessing
  - Sensor Fusion

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  - Choice of relevant data
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  - Continuous data streams
  - Local processing vs. cloud computation

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  - Local processing vs. cloud computation
- Energy
  - Brains/biological systems vs. computers
  - synchronous vs. event-based



THE BMW GROUP
DATA CENTRE.

ONE OF THE LARGEST IN EUROPE.
STORAGE CAPACITY OF 500 PETABYTES BY 2025.

# COGNITIVE VEHICLE CHALLENGES: ARCHITECTURES

- Integration in the overall vehicle architecture!

- Combination with traditional components
  - "Best of both worlds"?
  - Where to use cognitive/biologically-inspired systems?

- Safety considerations, explanability, etc.

- Personalization
  - Cultural differences
  - Driving behaviour
  - Acceptance of automation
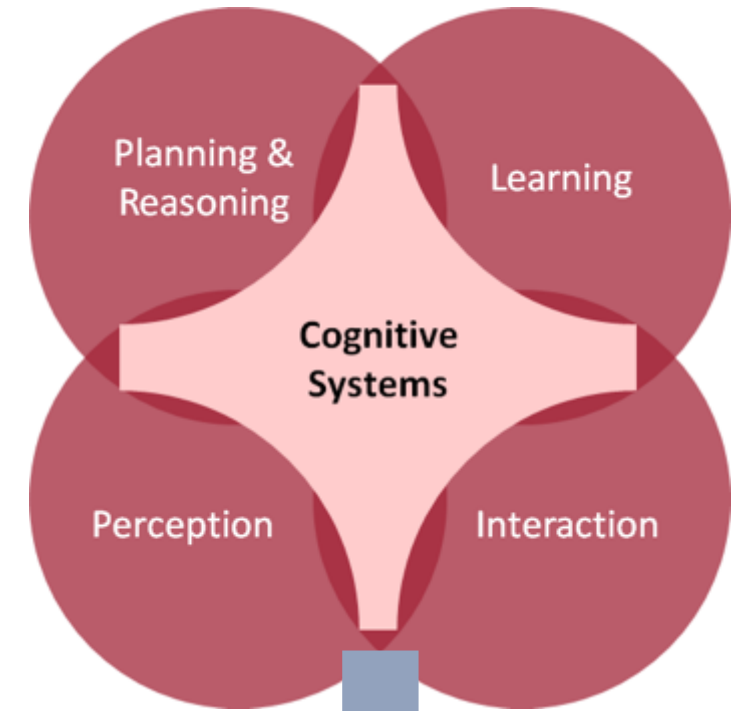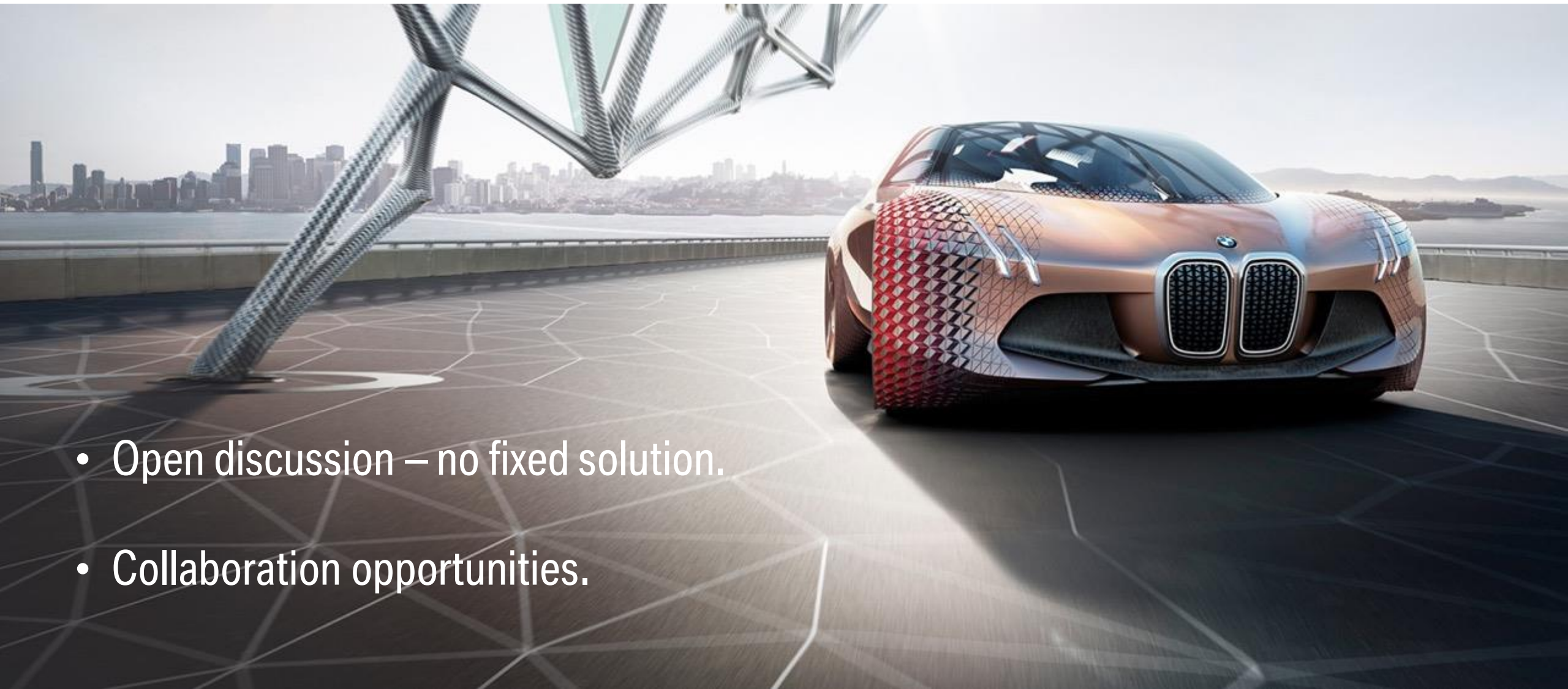
- Open discussion – no fixed solution.

- Collaboration opportunities.

THANK YOU.

THE NEXT
100 YEARS