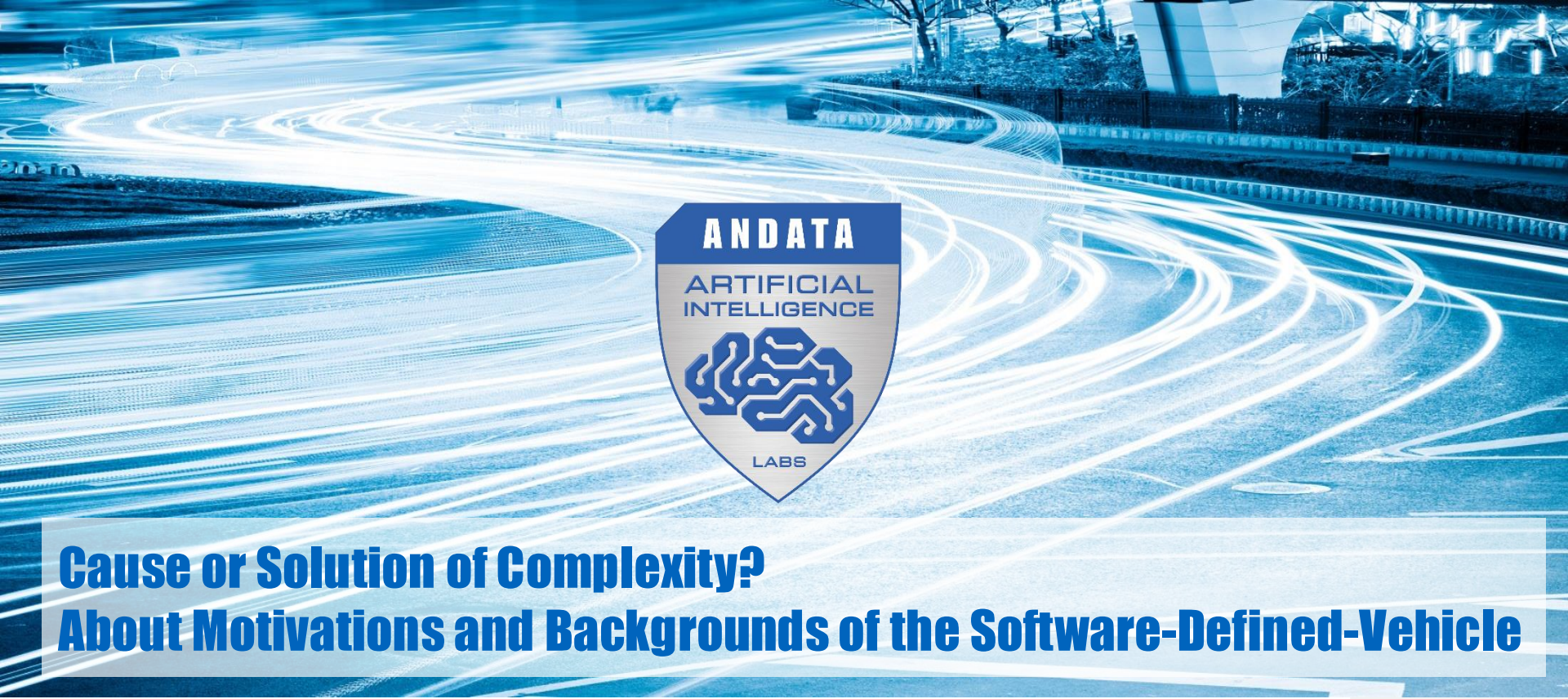

Cause or Solution of Complexity?
About Motivations and Backgrounds of the Software-Defined-Vehicle

Dr. Andreas Kuhn
www.andata.at
Vienna, 2026-11-13

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Fields of Competence

- Artificial Intelligence
- Data Mining
- Big Data Analytics
- Modeling and simulation
- Predictive Model based Control
- Distributed Control
- Signal Classification
- Swarm Intelligence
- (Embedded) Software
- Decision Support Systems
- Robustness and Complexity Management

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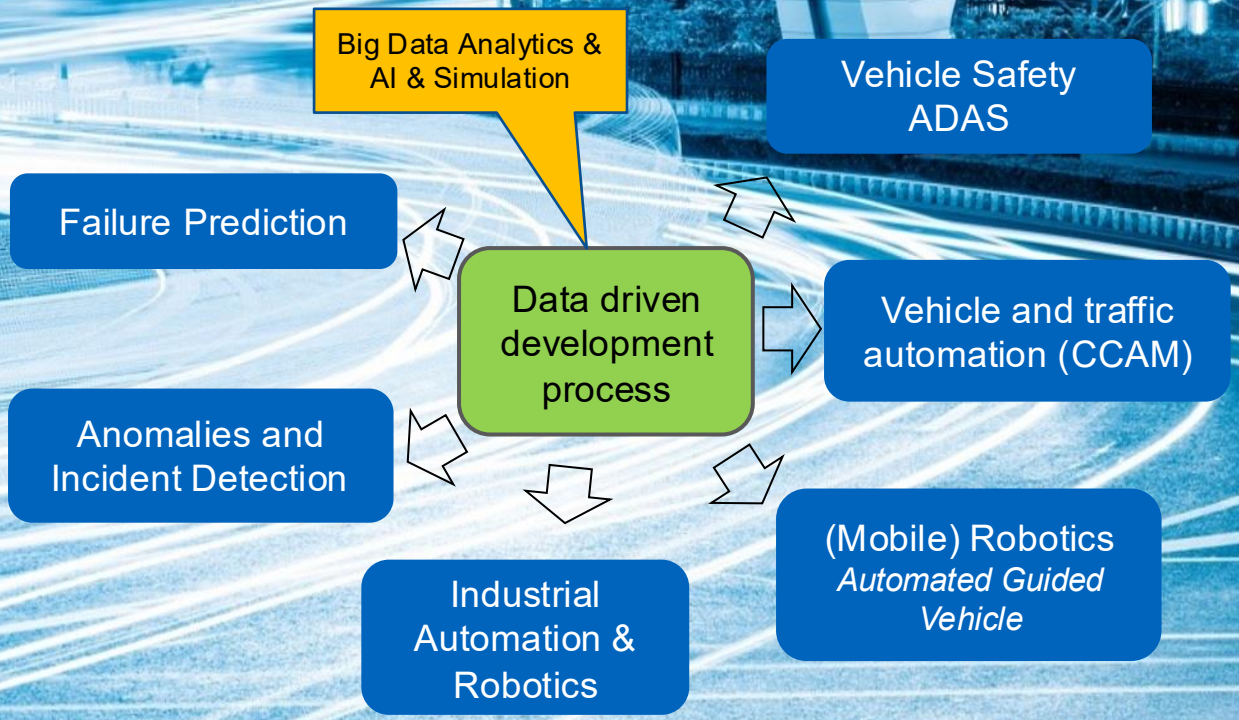

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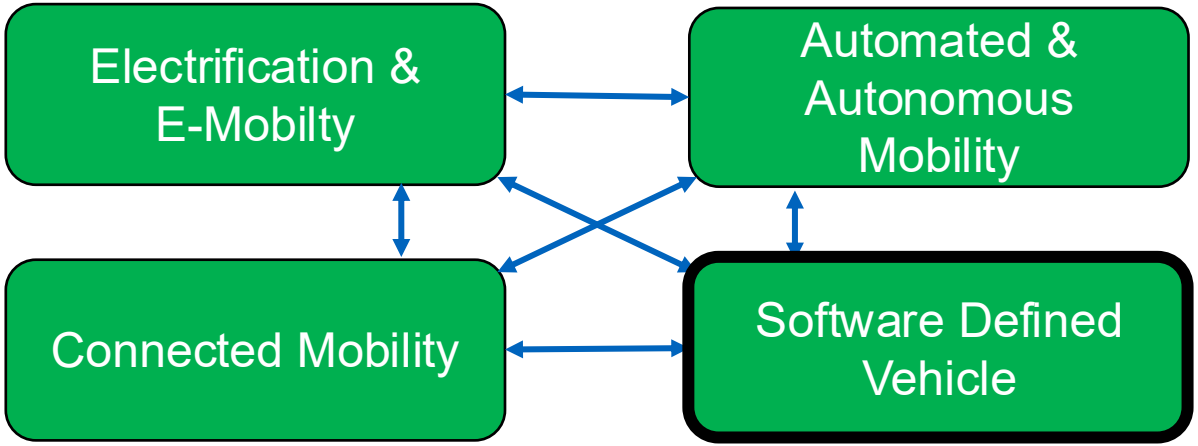
Mega-Trends in the Ongoing Transformation of Automotive Industry



Hardware-centric organisations
Heavy weight processes
European Bureaucracy
Old-school development
Expert-centric

Software-centric organisations
Agile processes
China power & speed
New development approaches
Artificial Intelligence

Will China wipe out the European automotive industry?

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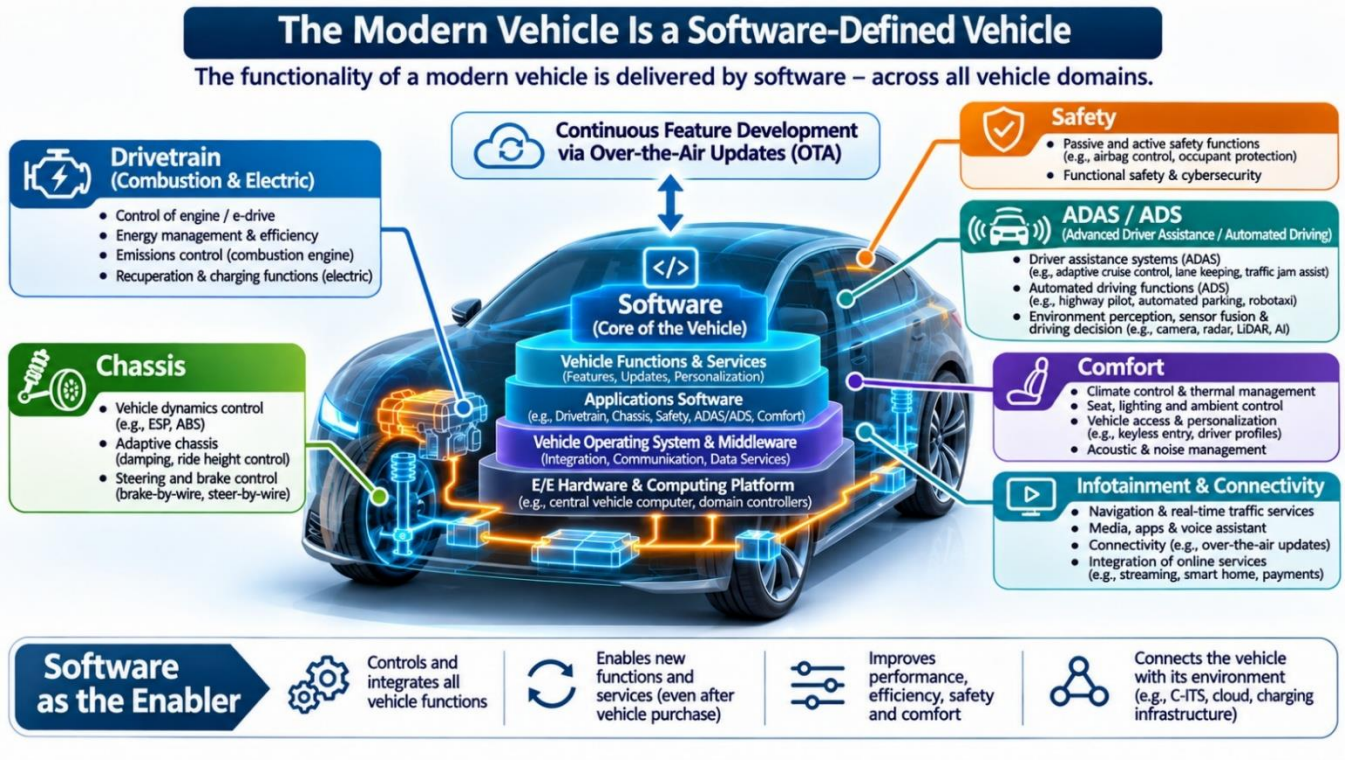
Vehicle Functionality: *Software as the Key to Vehicle Functions*



- Functionality to the limits of physical feasibility
- Virtual Sensors for un-measurables like risks for
  - collisions/accidents
  - failures/damages
  - congestions

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Artificial Intelligence: *Expanding the Possibilities*





Vehicle Functions	Vehicle Development & Safeguarding (Software) Production

Automation

- Physical AI
- Scenario and Test Case Generation
- Design Acceleration
- Requirements Management
- Prediction Models
- Situation Detection
- Information Design
- AI Coding
- Virtual Sensors
- Anomalies Detection
- Conformity and Integrity Checks
- …

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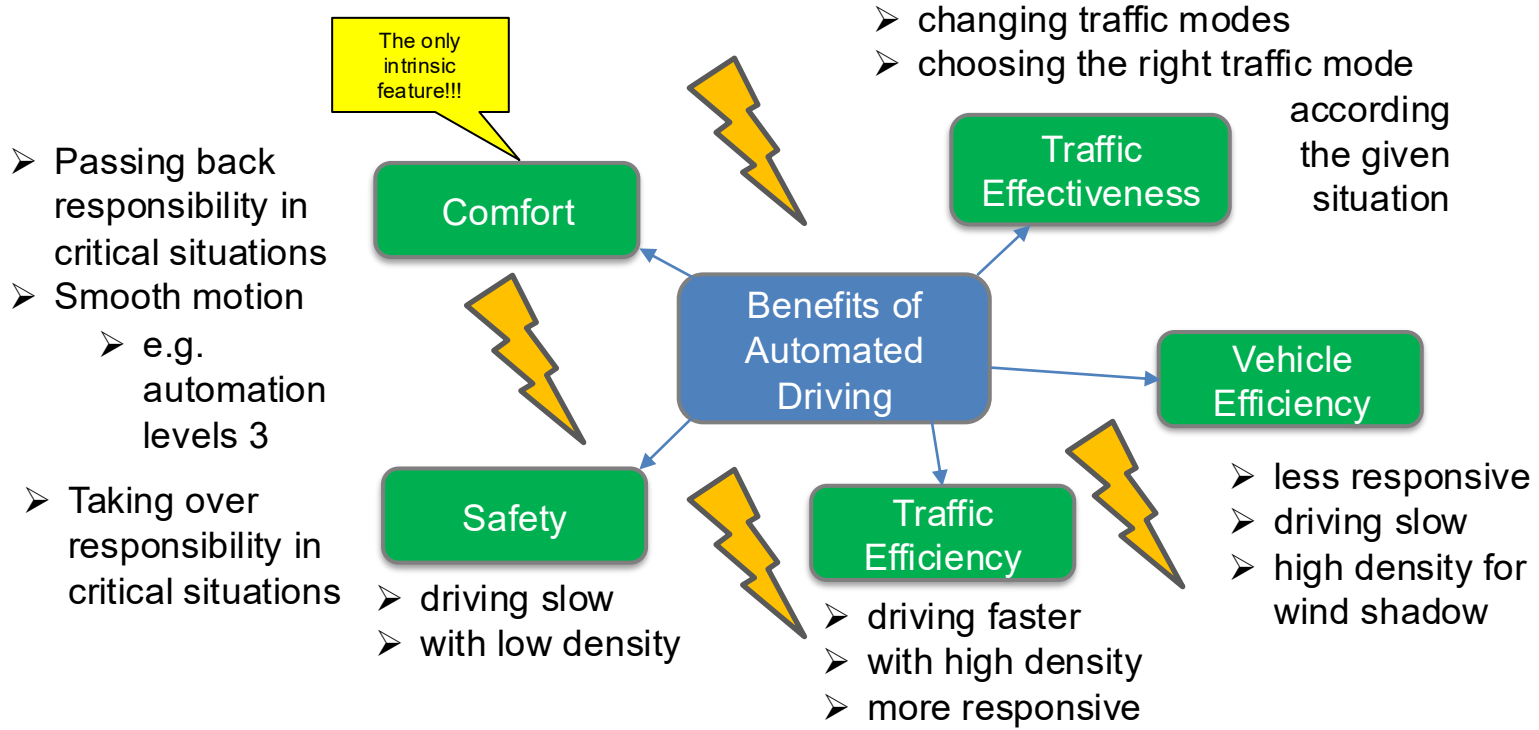
Physical AI: *Compliance with Nature/Physics required*



- "With software one can do anything!", "NO! Respect physics/mechanics!"

➢ Traffic and CCAM is full of conflicts! Identify and explore paretos first!

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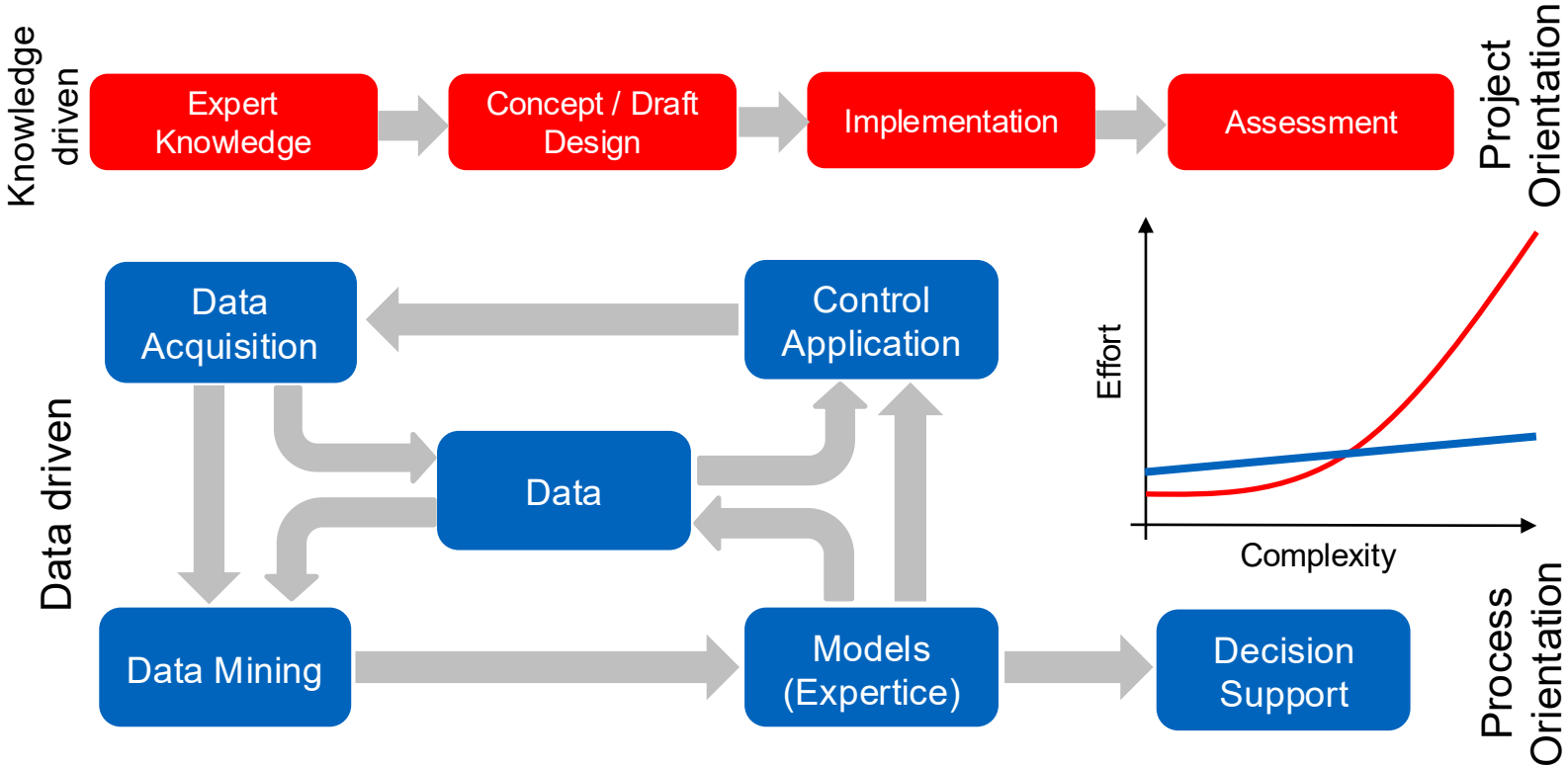
Development Processes: *Data Driven Approaches*

- Overwhelming complexity requires new development and testing paradigms



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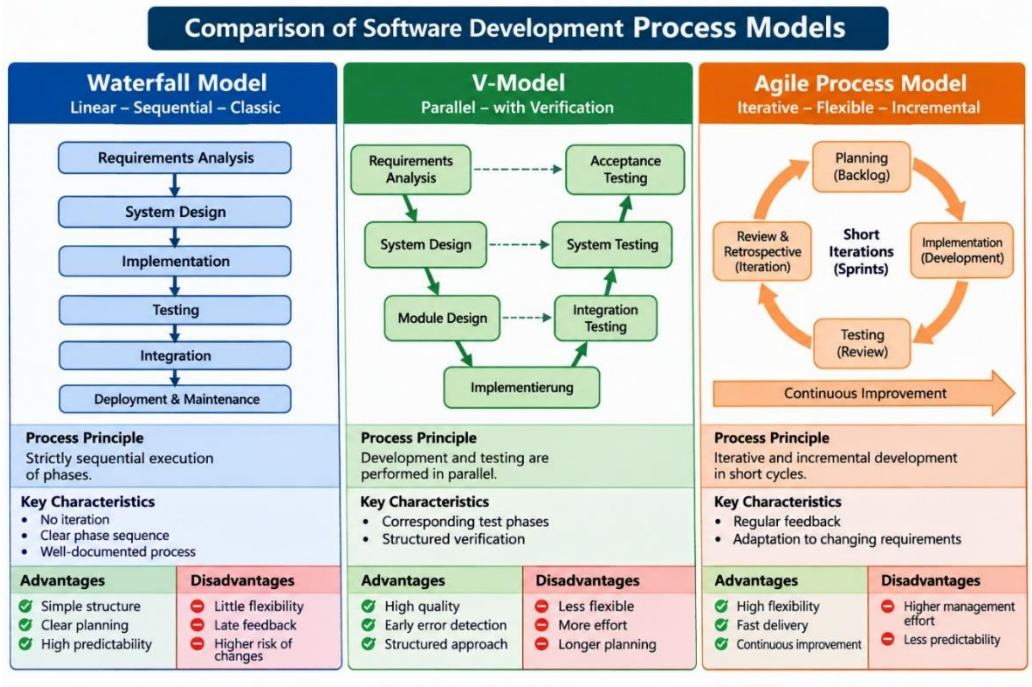
Software Process Models: *The Way to Work Systematically*

From One-Time Development to Continuous Evolution



- All in common: top-down ↔ requirements first and not bottom-up ↔ (draft) solution first

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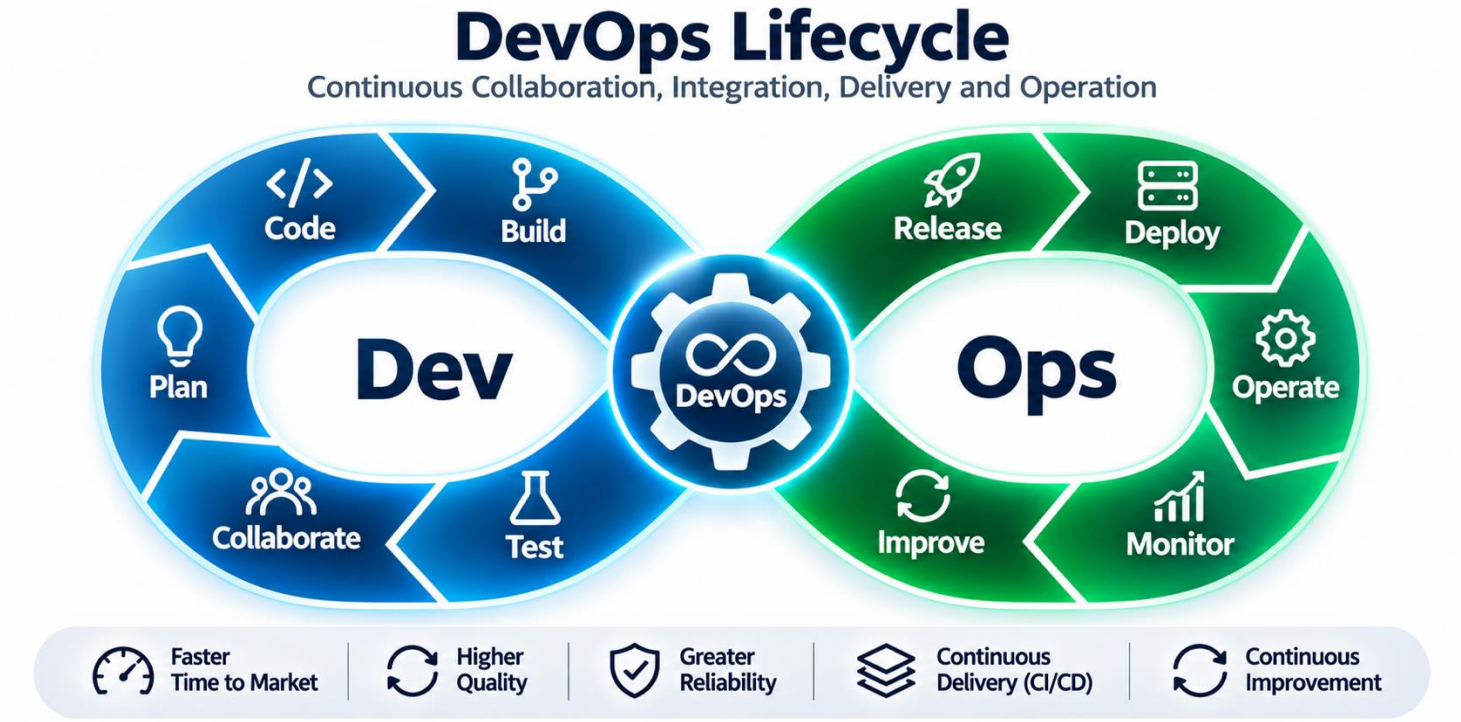
DevOps: *Improving Functions Throughout the Lifecycle*



- Assures steady improvements and learning
- Assures flexibility & adaptability

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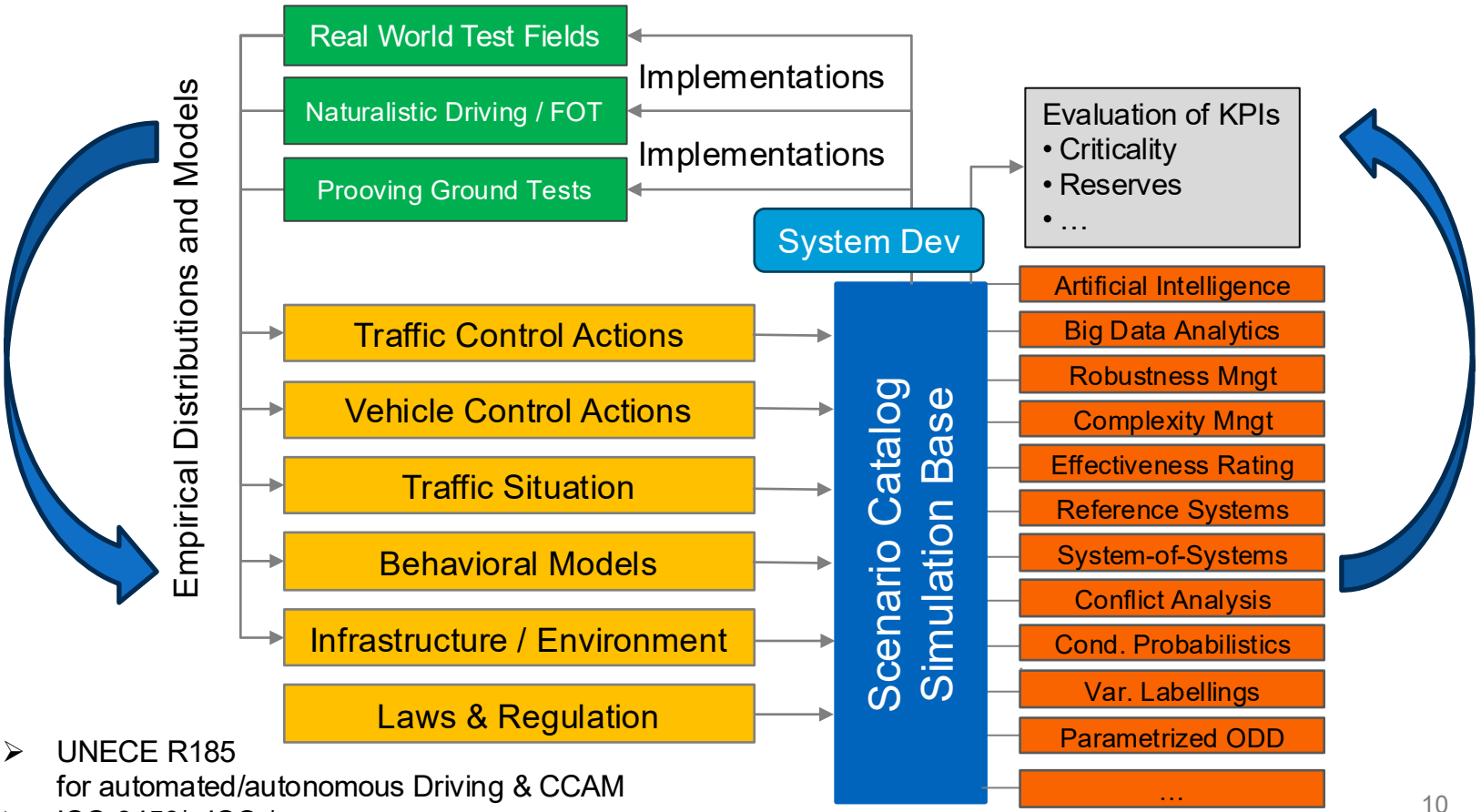
Development Process: *Scenario Based Approaches ADAS&ADS, CCAM*



- UNECE R185
  for automated/autonomous Driving & CCAM
- ISO 3450*, ISO *, …

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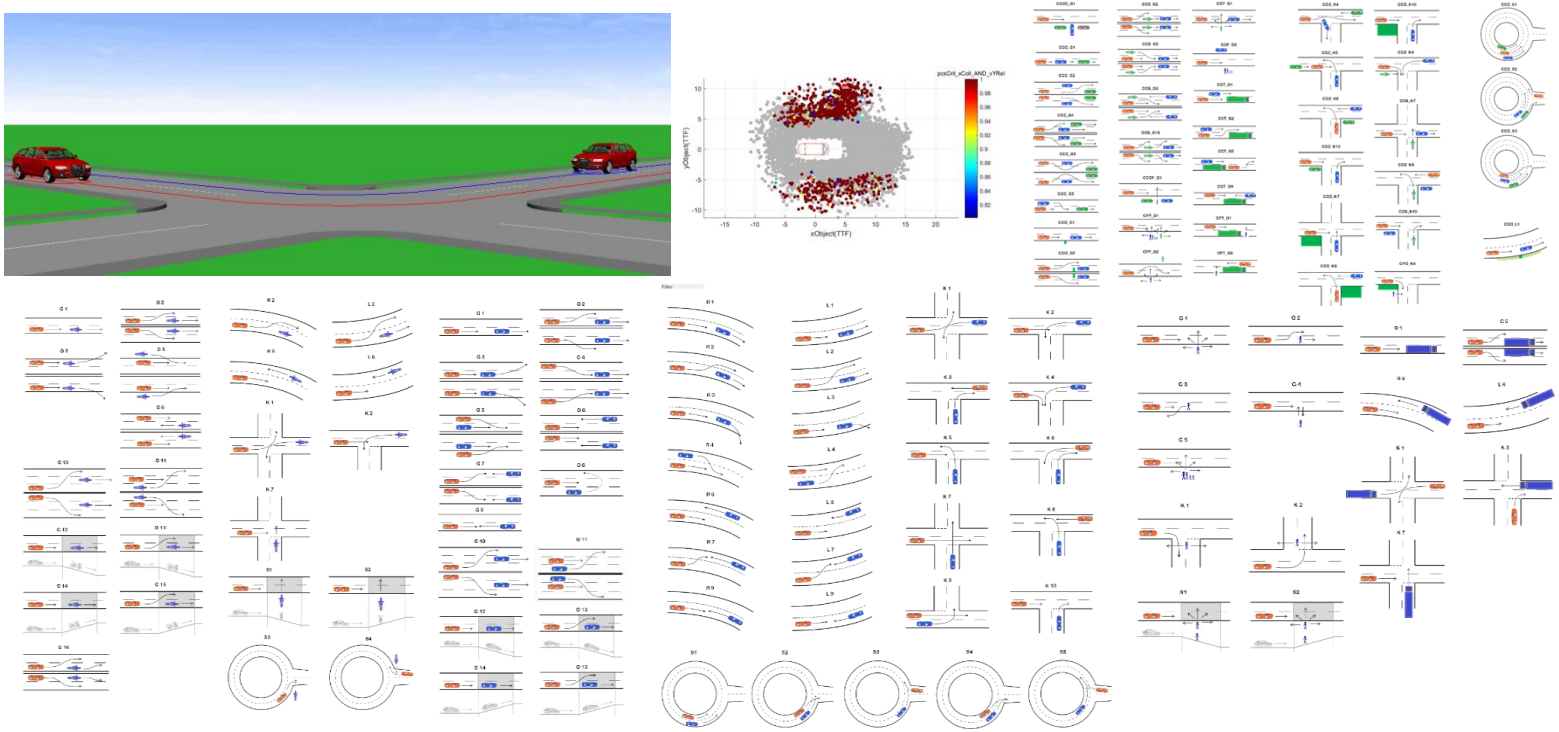
Continous Testing & Approval: *Software & Functions*



- Keep collecting scenarios / cases from real world operations
- ODD management, steady increase of scenario base
- Requires advanced approval to complement real world and virtual tests

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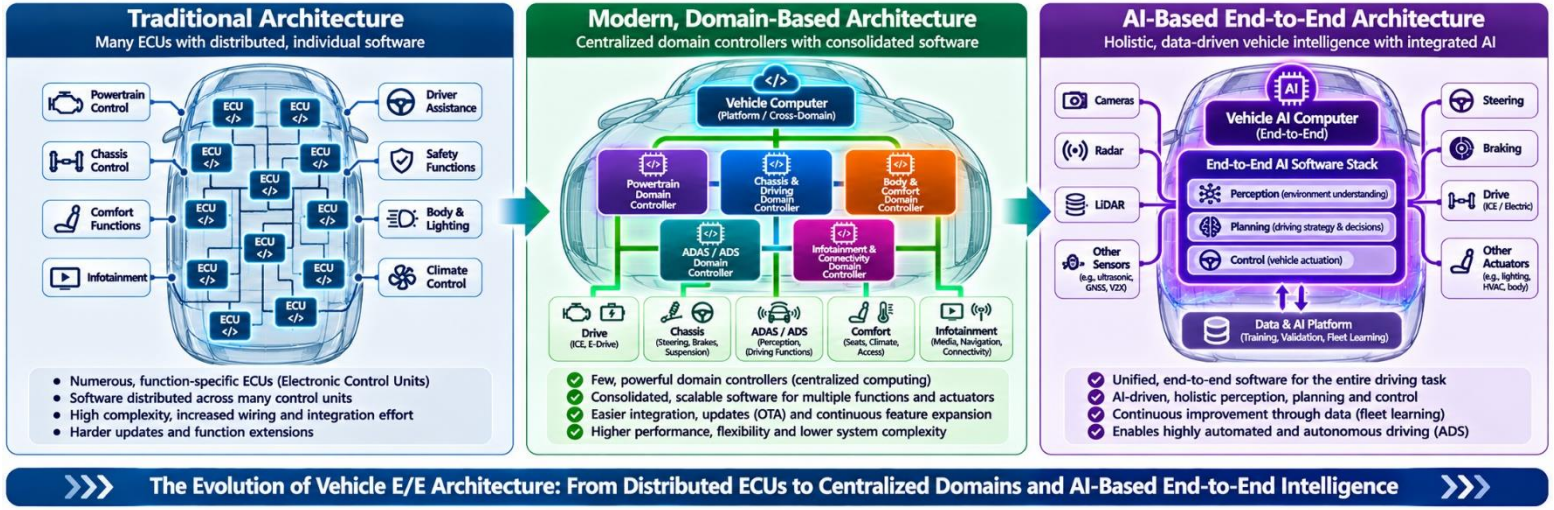
System Architectures: *Thinking in Functions and Systems Rather Than in Isolated Components*



- Architecture determines modularization
- Modularization determines synergies
- Modularization determines scalability

- But beware of fixed long-term organizational structures and solid silos, determining the architecture in the next cycle (Conways laws!)

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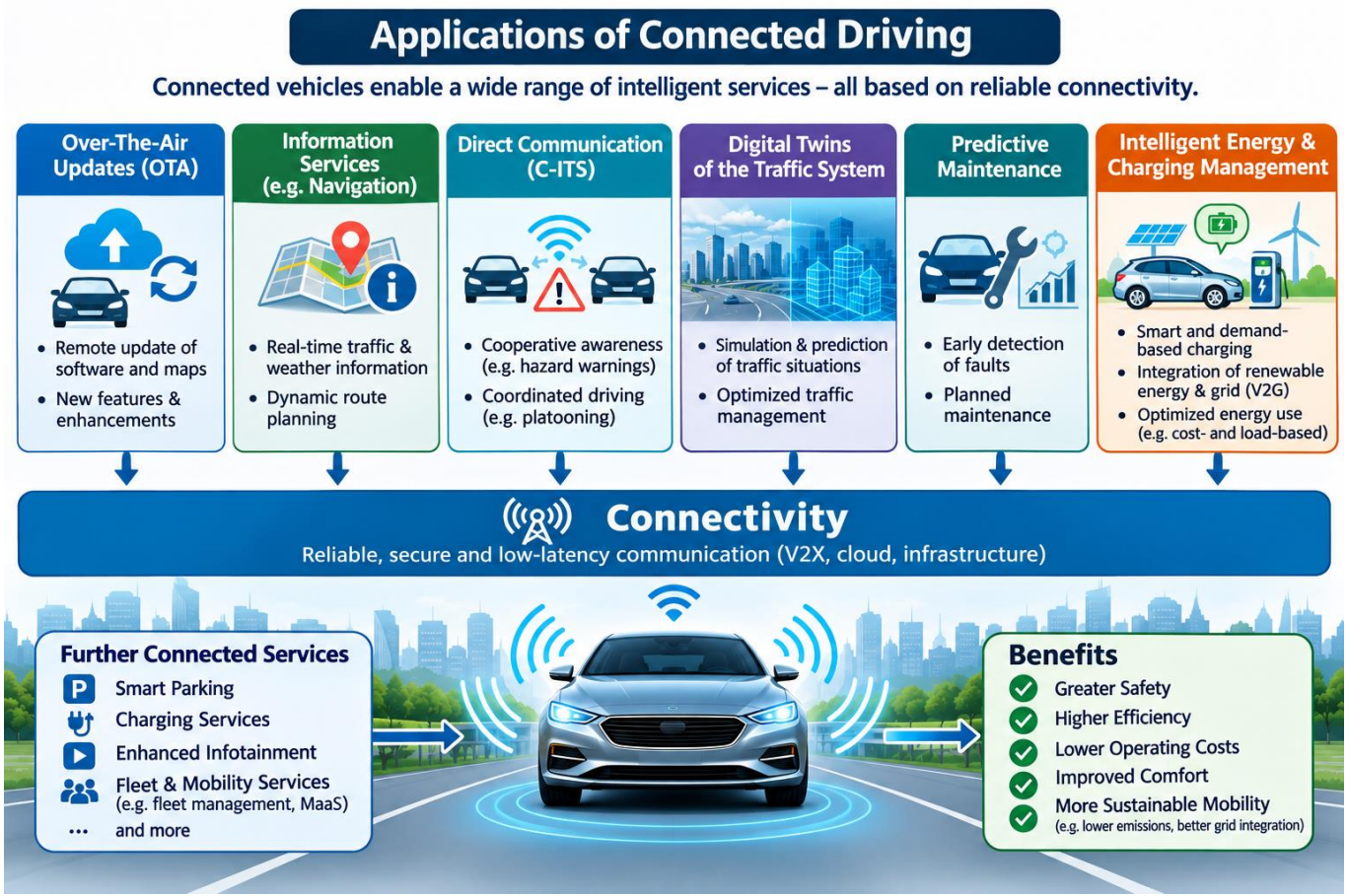
Connectivity: *Applications and Functions*



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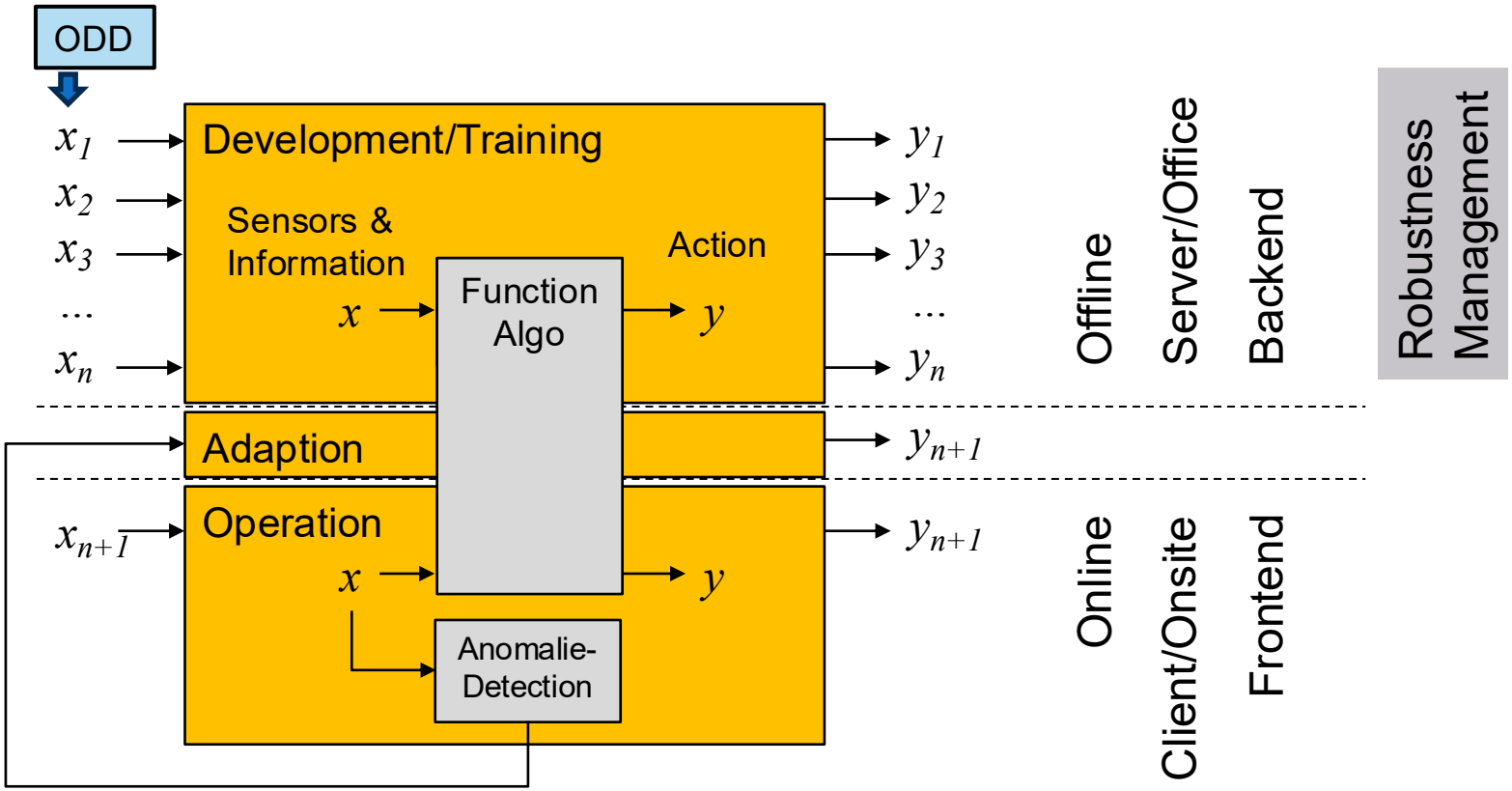
AI Procedures for „Connected Development“



➢ Collective (Co-)Learning Systems

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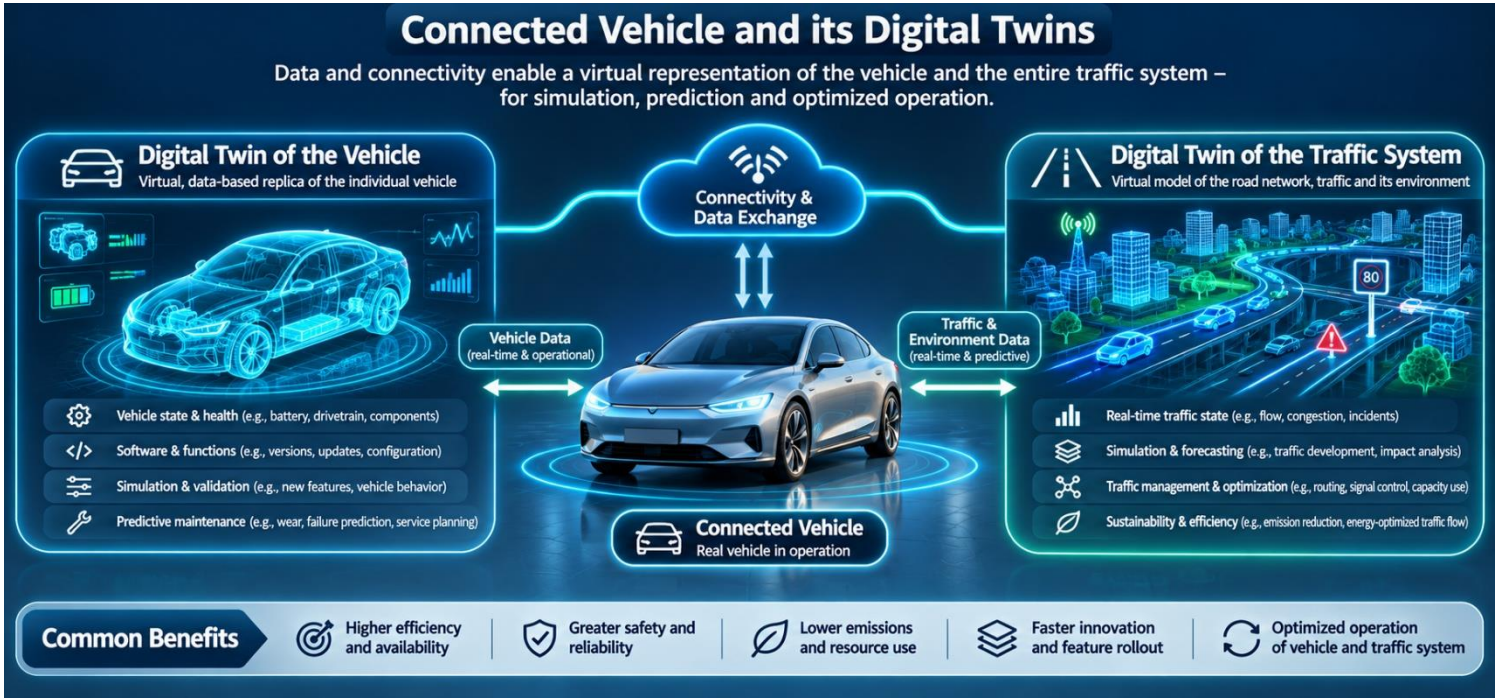
Digital Twins: For Internal and External Behaviours



- Enhancing vehicle functions with services/information, the vehicle cannot acquire/process on ist own
- Using the vehicle as a sensor for others (3rd parties)
- Platform for trustworthy information exchange in real-time

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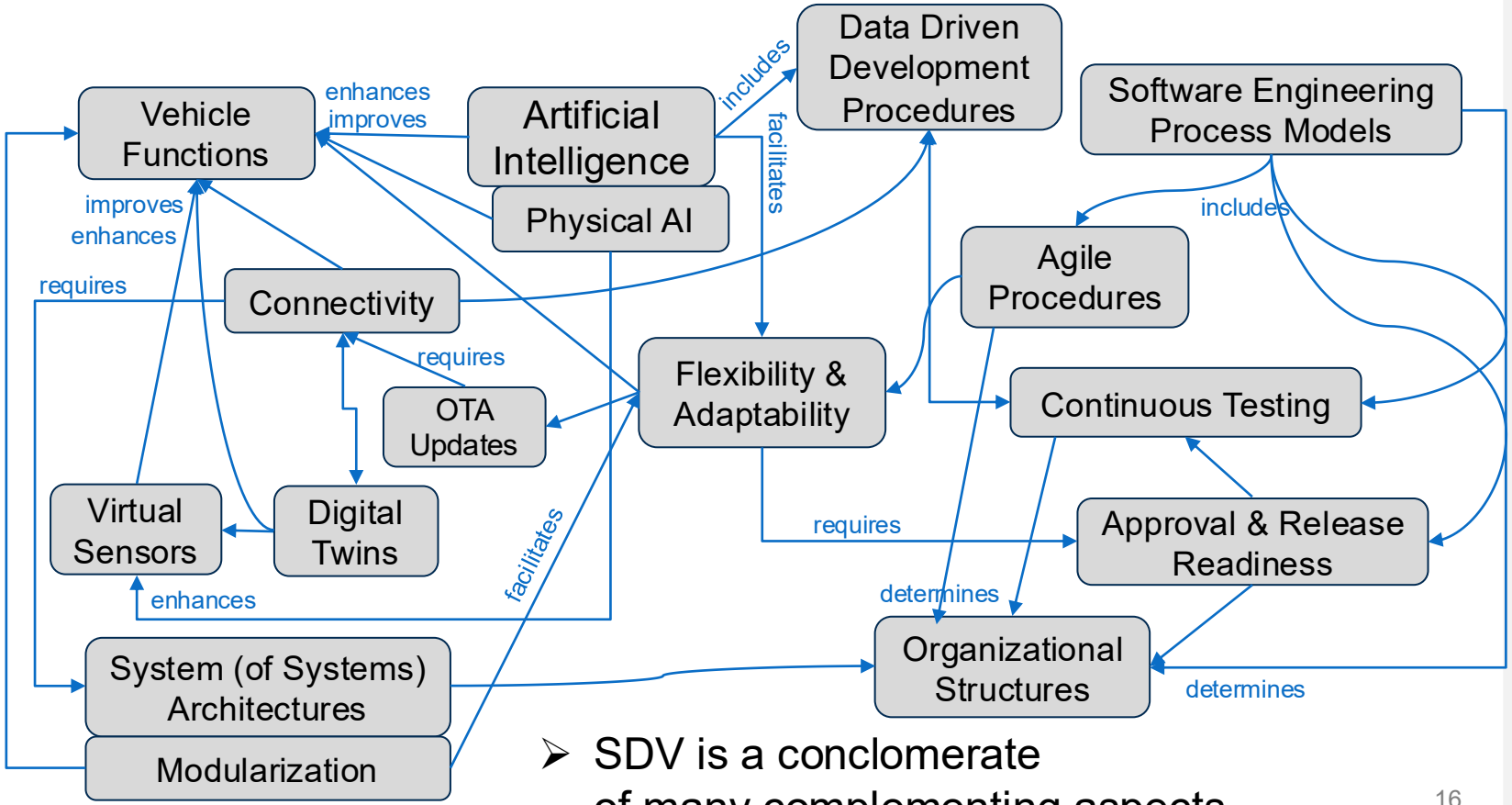
Summary: *The SDV is a new development paradigm, not merely a software product function*



- SDV is a conclomerate of many complementing aspects

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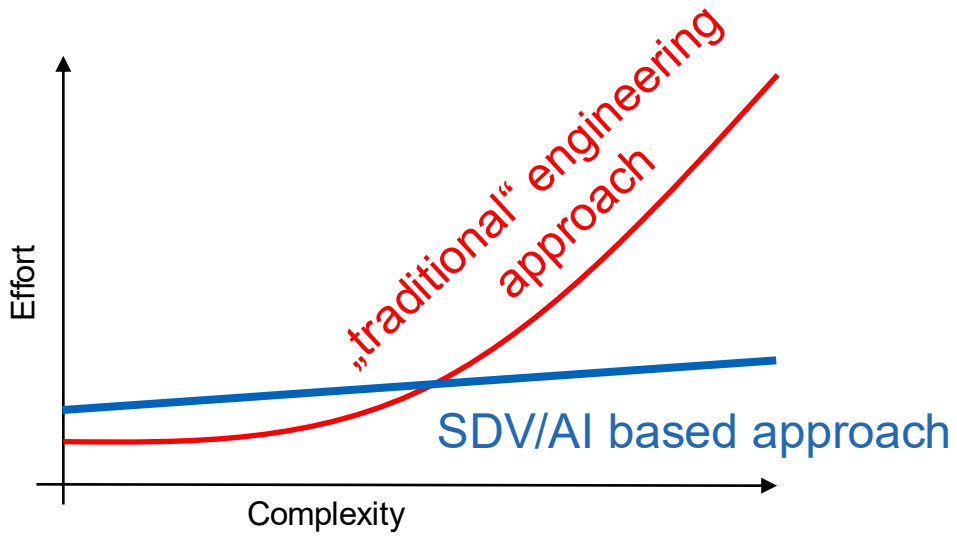
Conclusion



- Given complexity can only be tackled by neat combination of
  - AI + data and scenario based approaches incl. simulation
  - agile software process engineering models

➢ SDV & AI-DV plus accompanied processes are the solution to manage the complexity

➢ Sloppy application ends in exponential effort growths

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About the Company

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- Building blocks for traffic automation

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Physical AI & Virtual Approval with AI

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➢ **Building the foundations for „Software Defined Mobility“!**
➢ **Leveraging AI, Digital Twins, Scenario-Management for Automated Traffic and Intelligent Control**

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