Tokyo Systems Engineering Summit December 2023

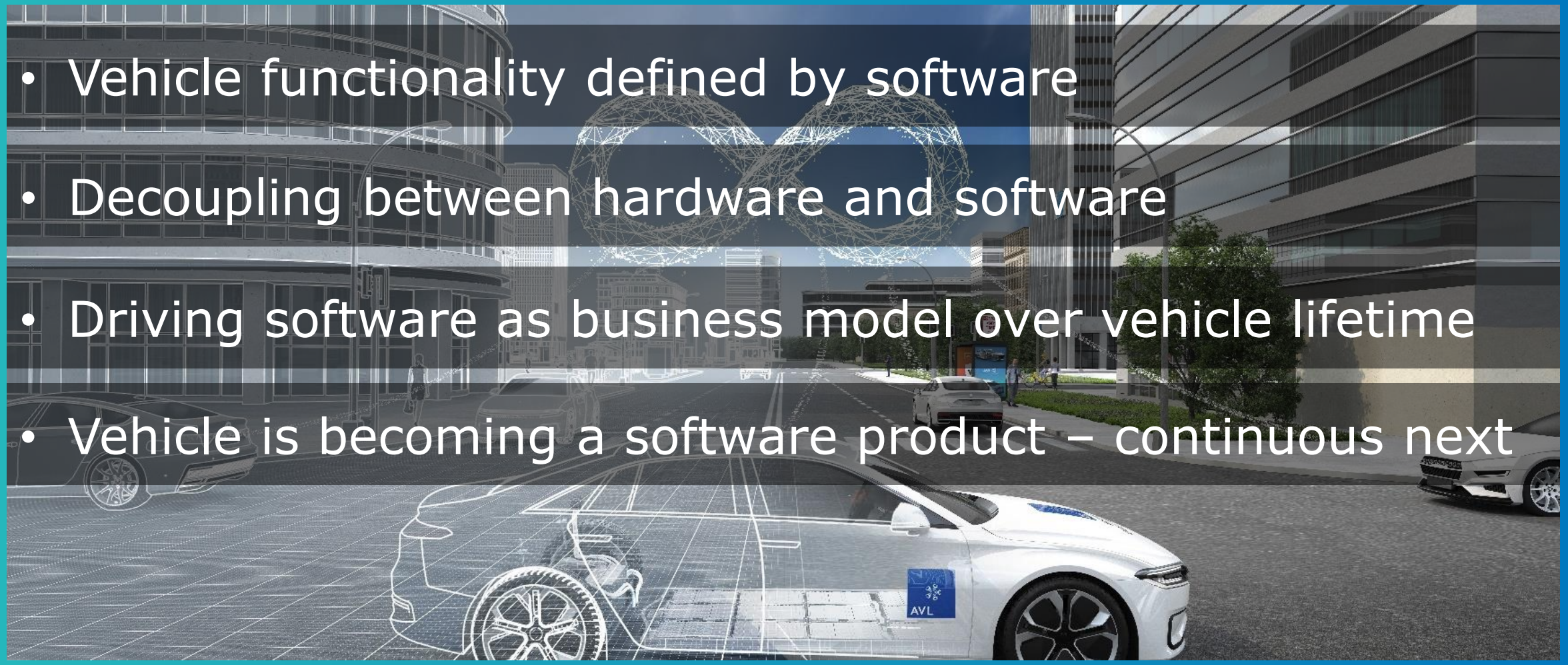
Acceleration through **Smart** Combination of **Methodologies** and **People**

AVL | Jens Poggenburg | Executive Vice President

Source: ©WJP

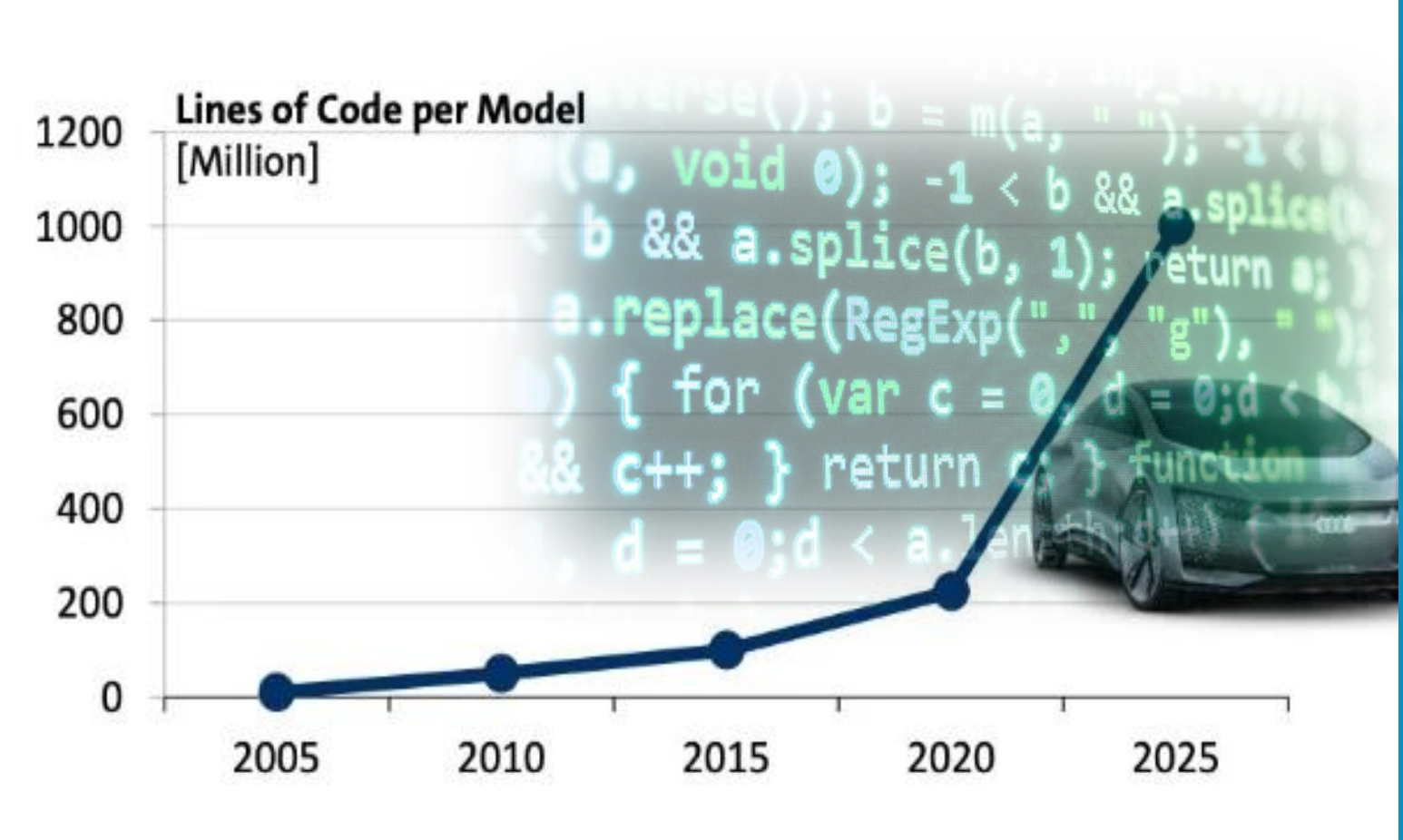
Customer in the center

Software Defined Vehicle – Why? What?



- Vehicle functionality defined by software
- Decoupling between hardware and software
- Driving software as business model over vehicle lifetime
- Vehicle is becoming a software product – continuous next

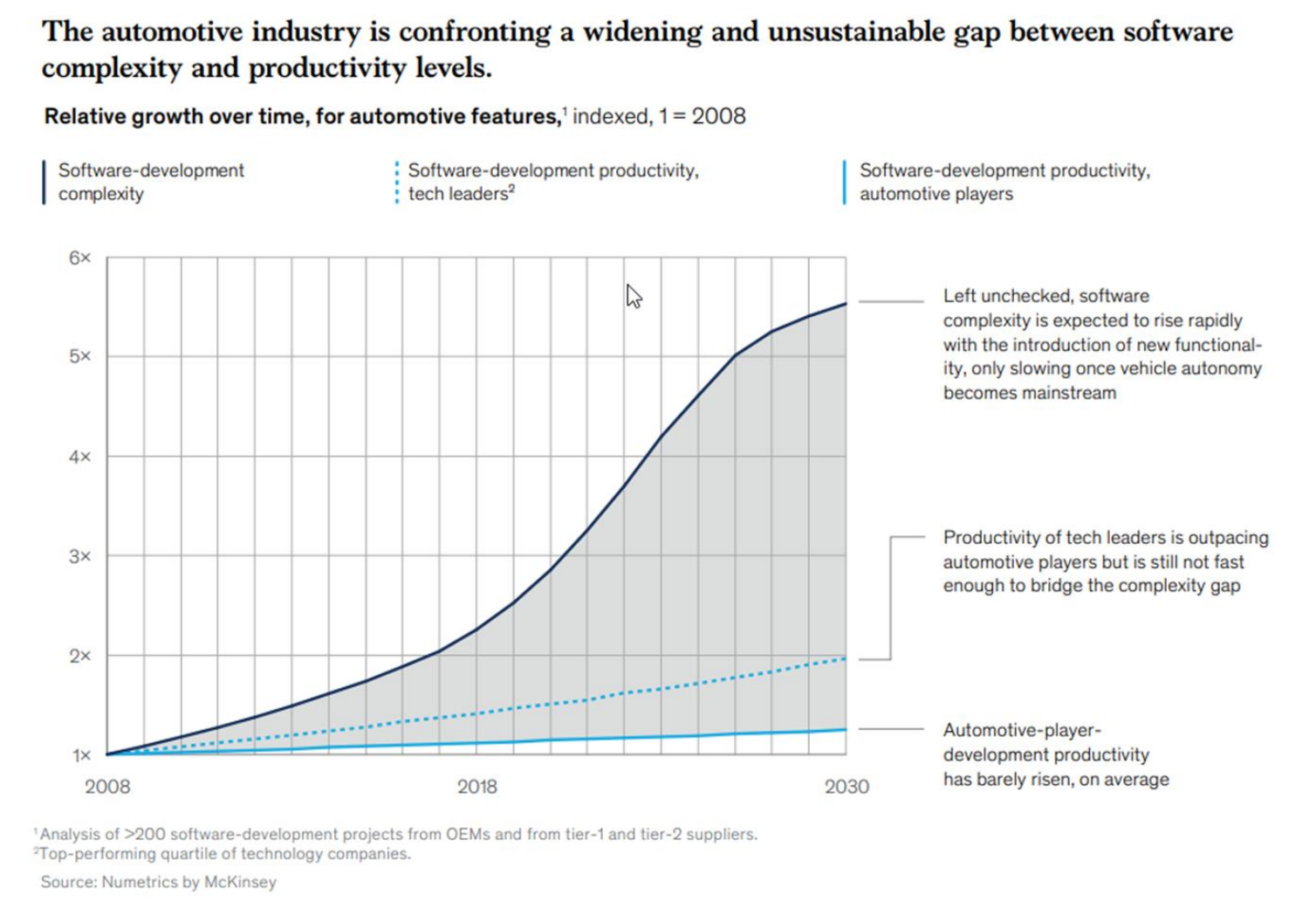
Key challenges for Software Defined Vehicle - **FUTURE**



- > 200-300 million lines of code expected
- Level 5 AD driving will take up to 1 billion lines of code

Source: a slide from a 2020 presentation by Herbert Diess highlights the VW software ambition

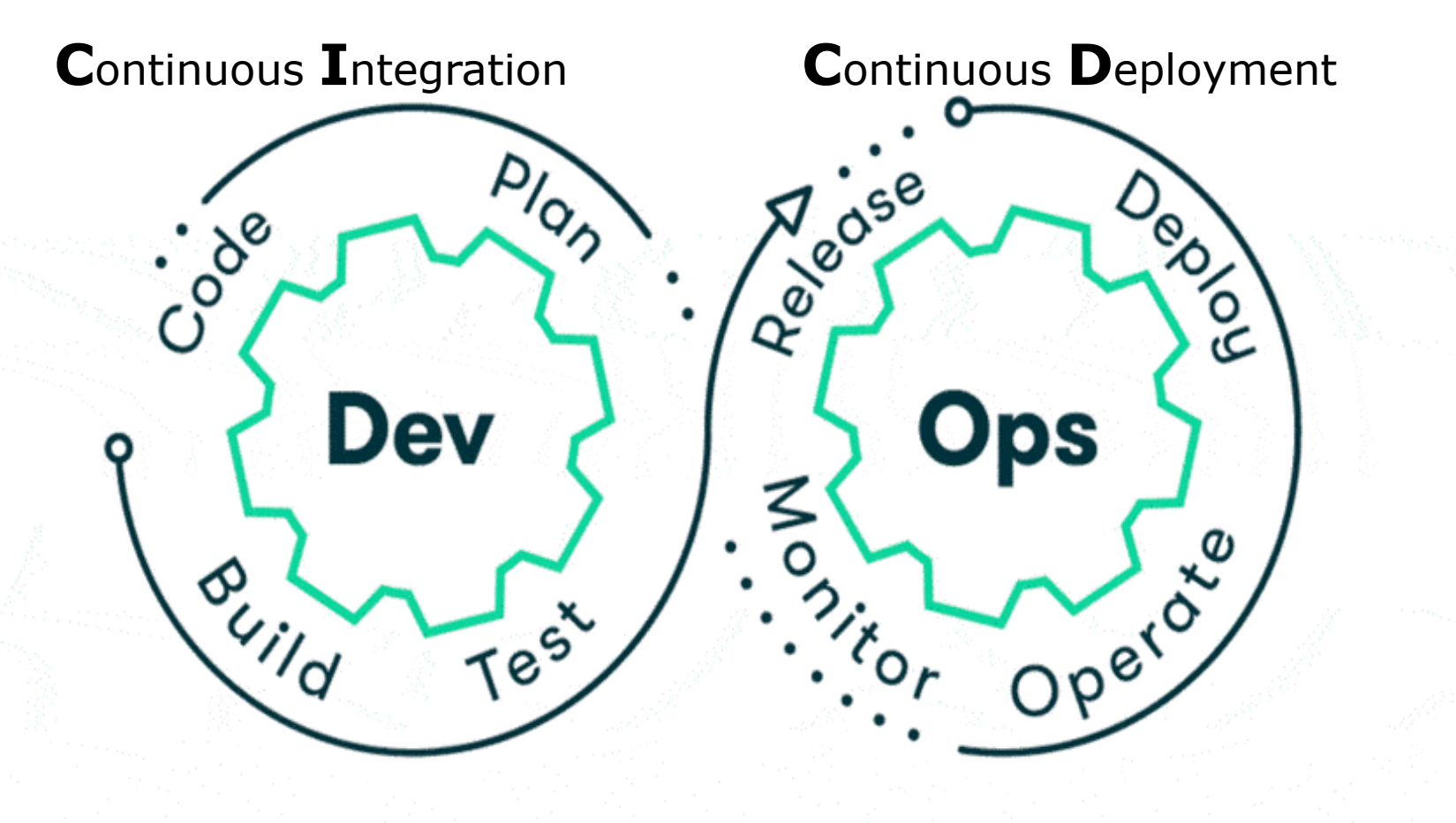
Key challenges for Software Defined Vehicle Dev. Process



- Software Delivery Speed defined by Development Process
- Continuous Update and Deployment over Lifetime
- Cybersecurity, Risk and Variants Management until EOL

What can we learn from SW development?

Requires modern software development strategies Continuous DevOps



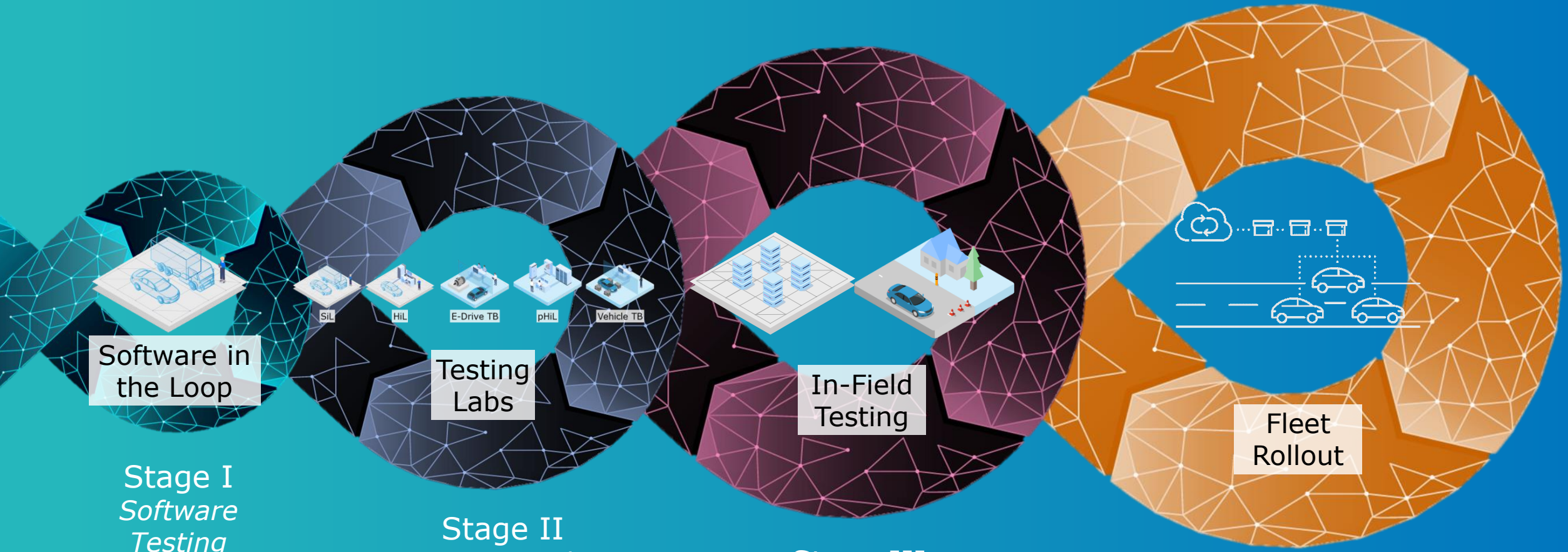
DevOps is composed by two main elements

- **Continuous Integration AND Continuous Deployment**

DevOps is first of all a mentality shift

Speed | Rapid Delivery | Scalability

Staging for Software



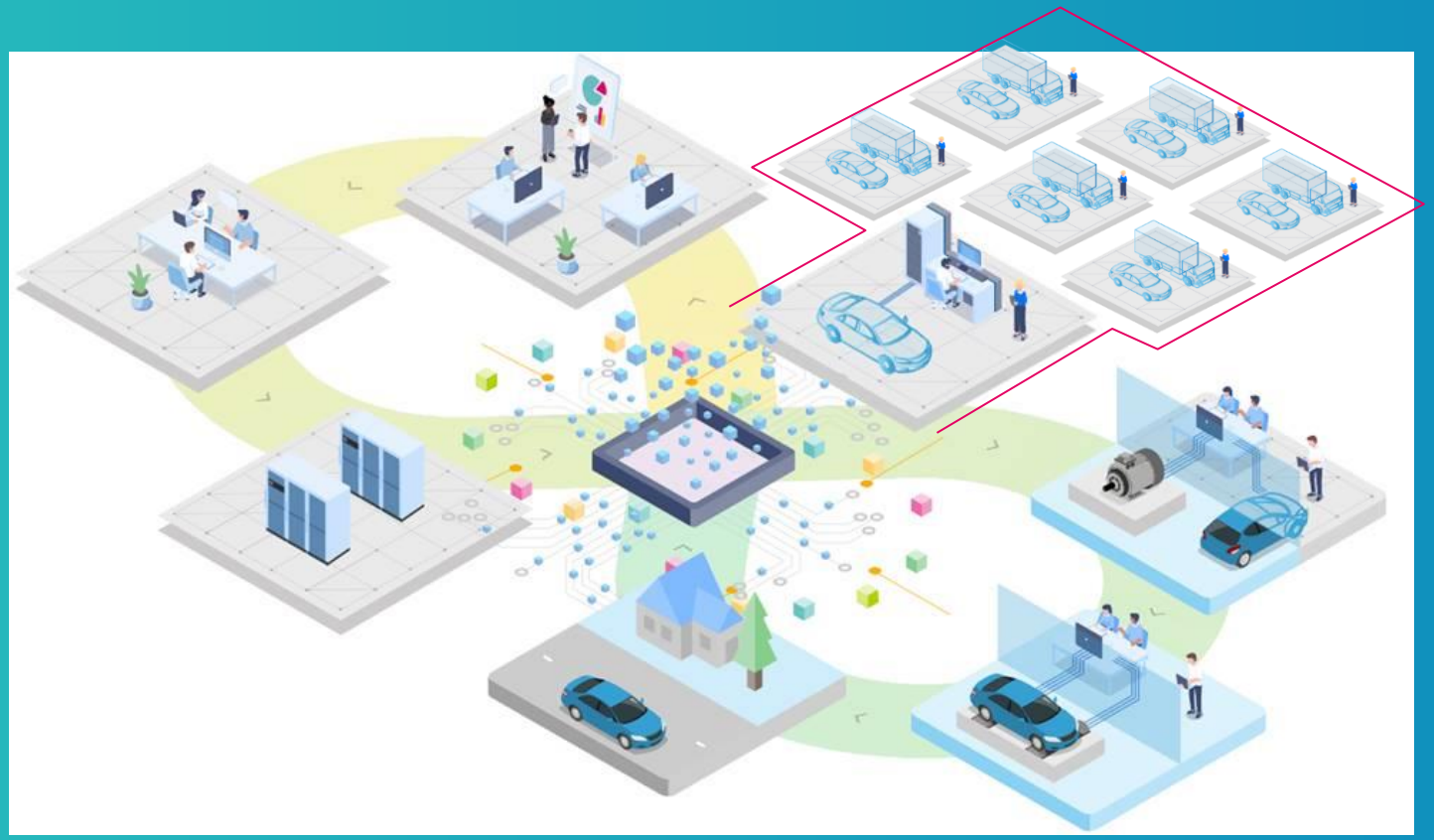
Stage I
Software Testing

Stage II
Functional Testing & Calibration

Stage III
Shadow-Mode

Stage IV
OTA Ring Release's

What is the new narrative?

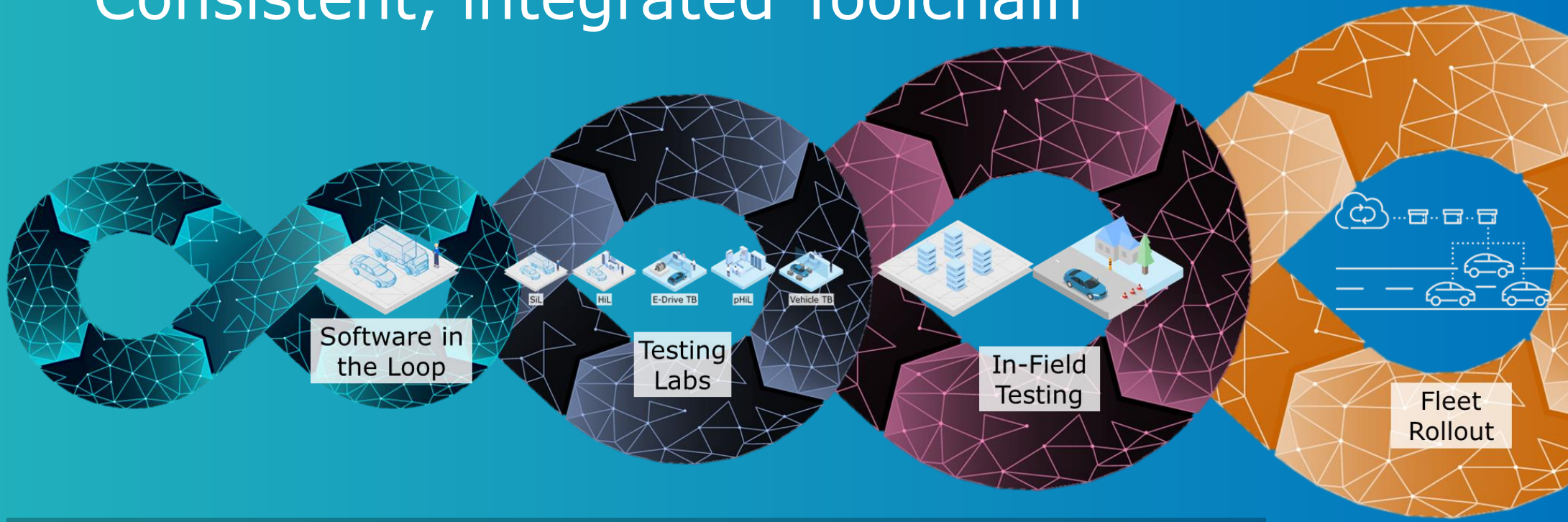


Testing software and HW development updates **in sync** with the development cycles **for all vehicle variants**

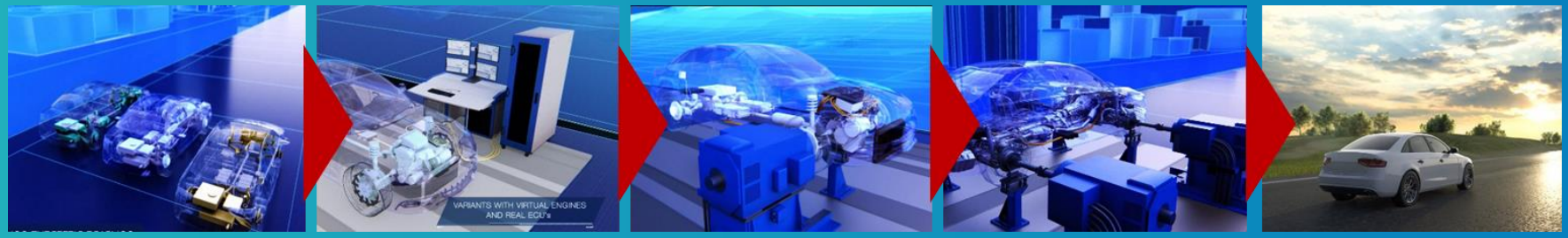
Reduce physical testing effort, increase flexibility and reduce costs

Conduct the right test in the correct test environment

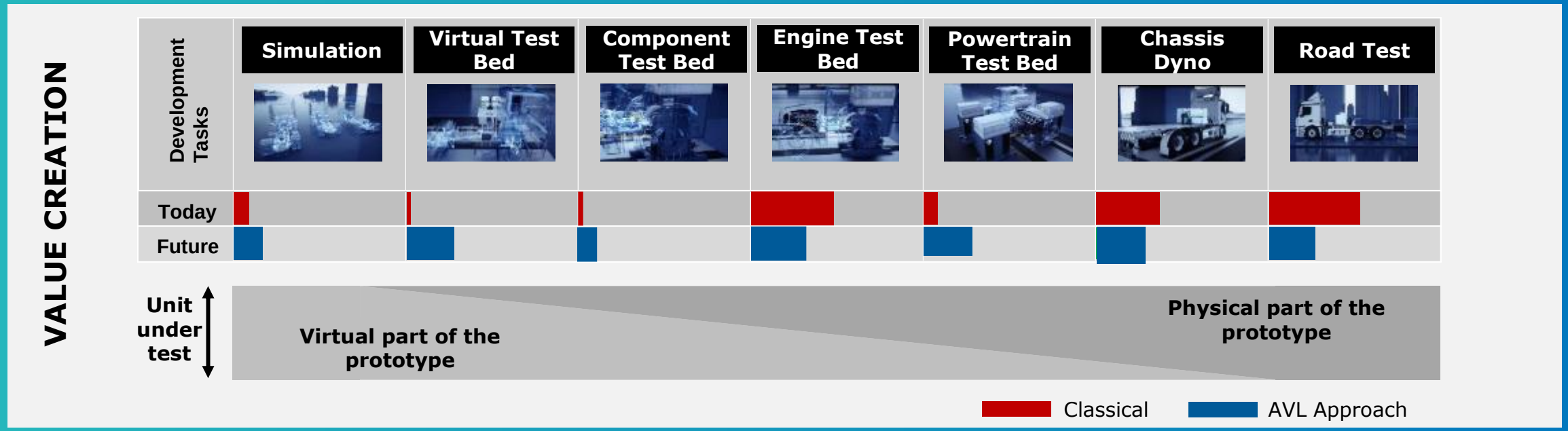
Consistent, integrated Toolchain



Continuous Design, Verification and Validation



Application of the concept to tangible value creation



REDUCE

Time

By making sound decisions earlier

REDUCE

Costs

By shifting tasks in cheaper environments

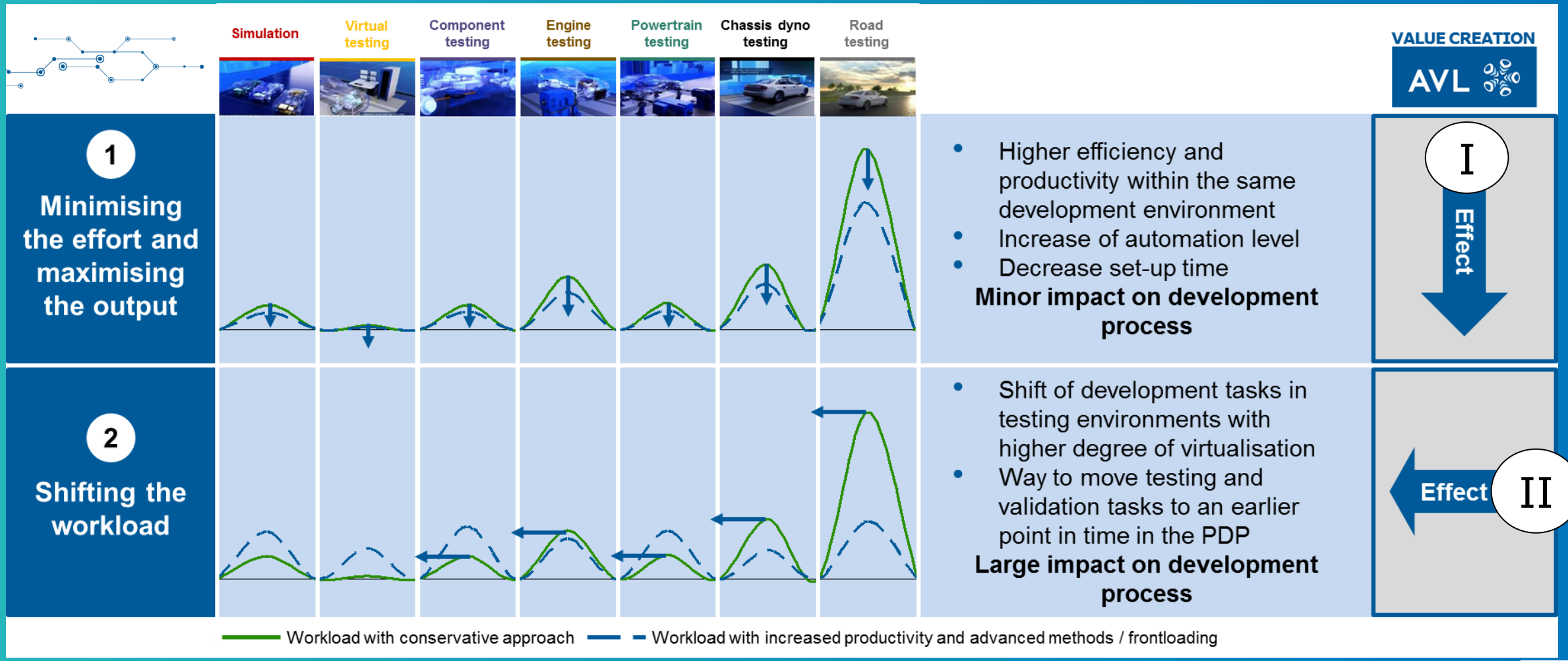
INCREASE

Quality

By increasing system knowledge earlier

- Making early, fast and sound decisions
- Bridge the best from virtual & real world
- Reuse & Ease of use
- Bringing together versatility and flexibility
- Collaboration and knowledge sharing

The **AVL Value Creation Approach** to **maximize** the **Output** and enable **Left-Shift**



HV-Integration
Productivity gains in a nutshell*

Prototype vehicle only	VS	With Integration and Powertrain Testbed usage
Approximately **28** IN-VEHICLE TEST WEEKS (8/5)	**85% LESS** PROTOTYPE VEHICLE USAGE	Approximately **4** IN-VEHICLE TEST WEEKS (8/5) **12** INTEGRATION TB TEST WEEKS (16/5)
Approximately **500** WEEKS REQUIRED	**40% LESS** ENGINEERING EFFORT	Approximately **300** WEEKS REQUIRED

* Data from AVL PTE in comparison with road testing, for one prototype phase (LEAD Variant)

Possible Efficiency gain:
Emulation of missing components

50% Cost reduction

Reproducible & up to 24/7 automated Testing
Less Prototypes & Function driven development & Testing
Higher Test Coverage
Manpower shift and optimization → Frontloading

Value Creation program

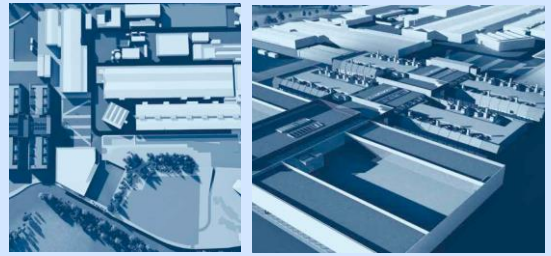
Identify ways to improve process and methodology, start pilot projects and knowledge transfer

Value Creation work streams

Platform for expert discussions

Based on existing infrastructure & processes

- Start with analysis of existing workflows/ tasks
- Estimate existing effort distribution over environments
- Prioritization of tasks with highest efficiency impact



Improvement measures in specific roadmaps

- Process and organizational improvements
- Mature and advanced methodology
- Advanced tools to simplify and facilitate testing and development

Implementation and pilot projects

- Hands-on training with engineers and staff
- Training concepts
- Knowledge transfer

With AVL’s staged software delivery process risk can be managed proactively

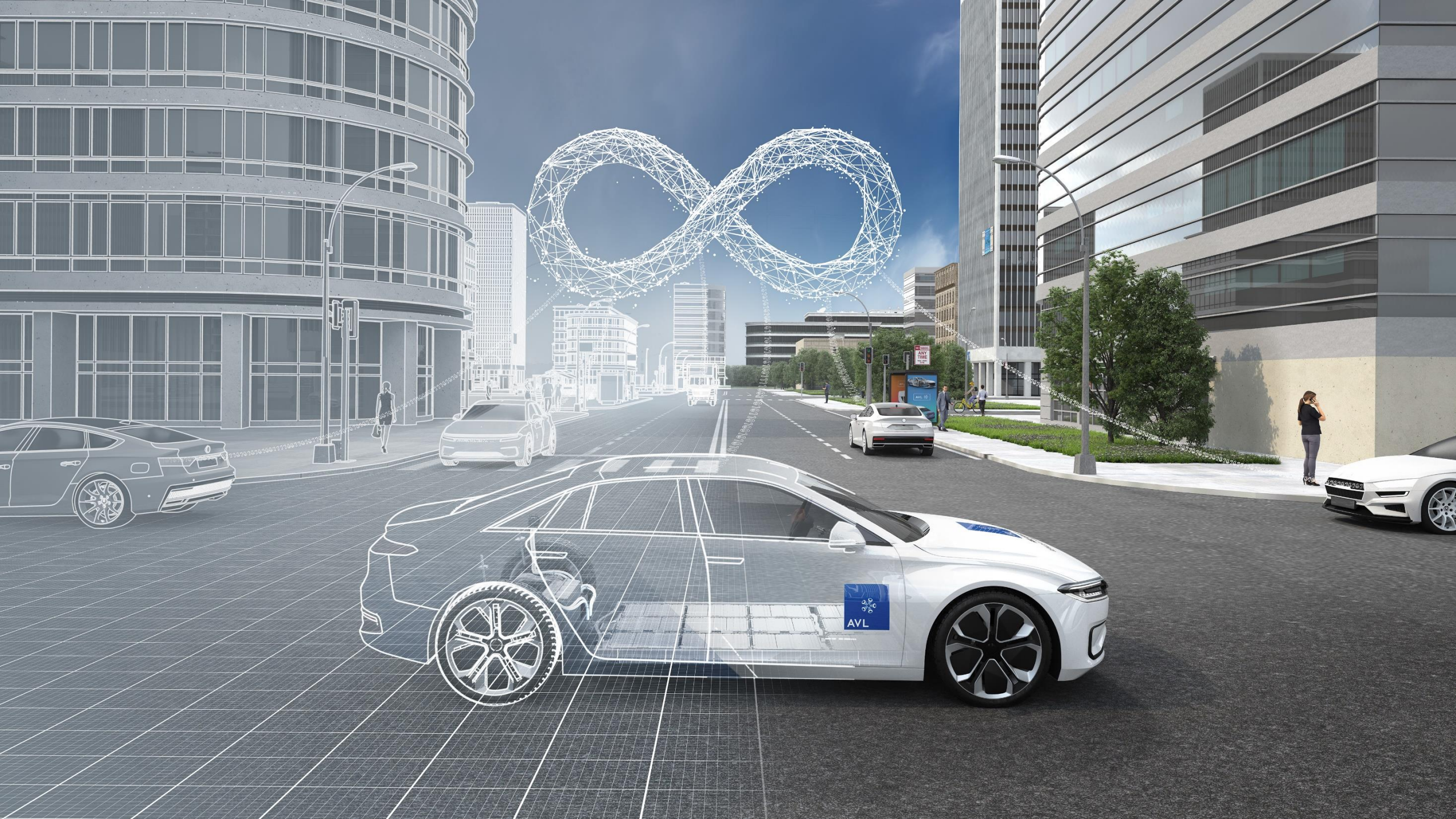
Engineering know how to support our customer within new software centric development

Combining automotive know-how with software development is key for speed

Consistent and seamless toolchains for continuous verification & validation

We owe it to the planet

Source: ©WJP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