

From Silicon to Simulation: Enabling the End-to-End Software-Defined Vehicle Workflow

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Addressing The Future of Connected, Autonomous, & Intelligent Systems

SYSTEMS

SILICON ELECTRONICS DESIGN

AUTOMATION & AI

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ANSYS

SYSTEMS



MODEL-BASED



EMBEDDED SOFTWARE



DIGITAL TWIN



SAFETY ANALYSIS

PHYSICS



FLUIDS



ELECTRONICS



OPTICS

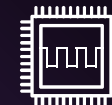


STRUCTURES



MATERIALS

SEMICONDUCTOR & SOFTWARE



EDA



SILICON IP

AI & MACHING LEARNING



CONCEPT

PRELIMINARY DESIGN

DETAILED DESIGN

INTEGRATION

TESTING/VALIDATION

PRODUCTION

OPERATION / DIGITAL

Inflection Point: Shift from HW Integration to SW System Integration



Marriage

Big Bang Integration

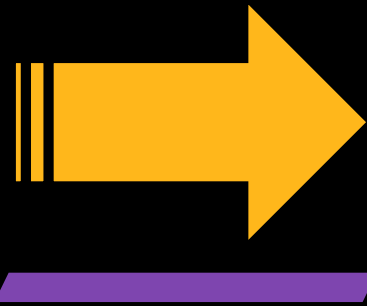
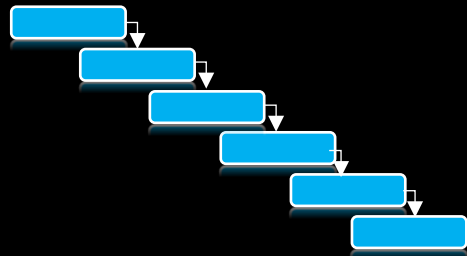
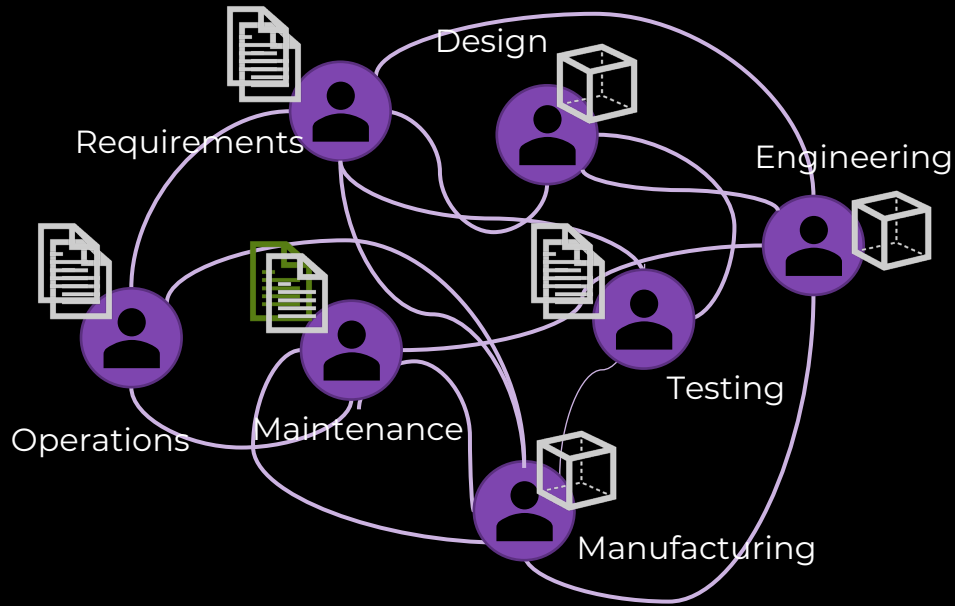


Vehicle performance is now determined by:

- Software architecture
- Compute platforms
- Continuous Updates

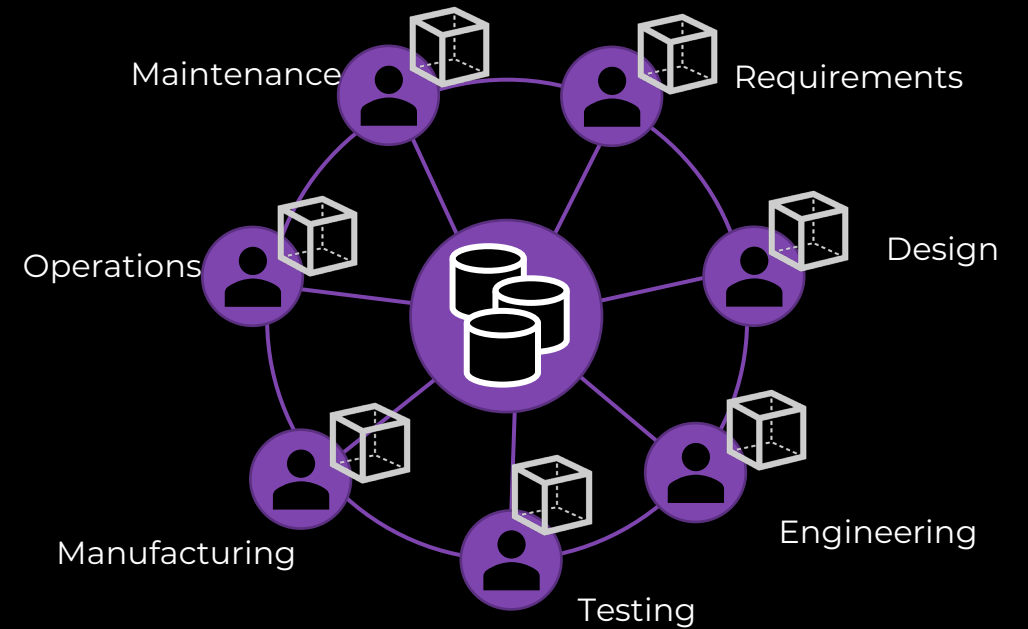
Shift from Traditional Engineering to Digital Engineering

Current State



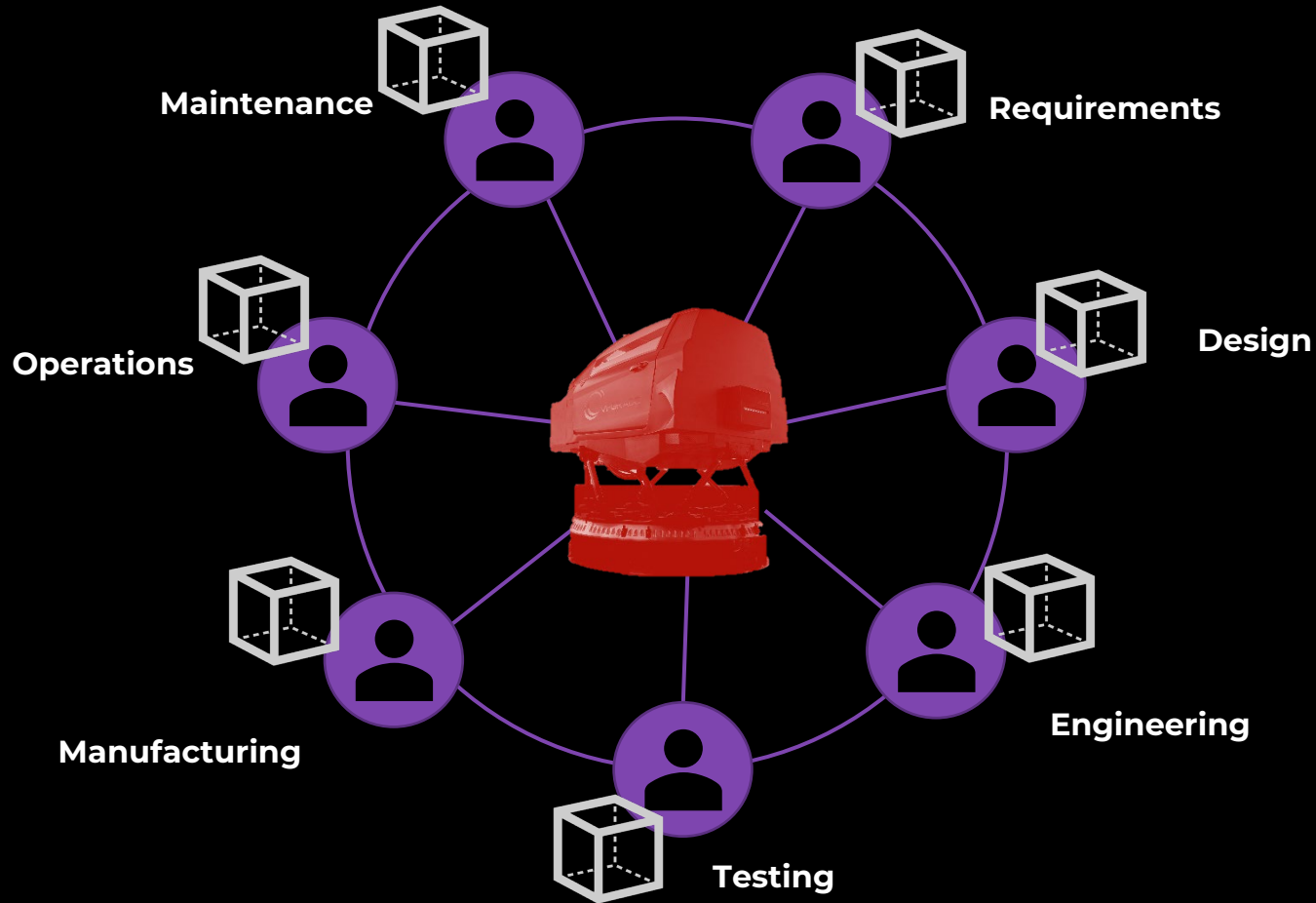
- Model-based
- Collaborative
- Agile
- Connected
- Traceable:
 - Right Information
 - Right Time
 - Right Format
- Dev(Sec)Ops

Desired State



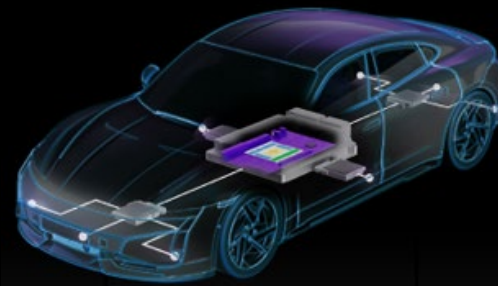
Driving Simulator as first Vehicle Prototype

Simulator as the integration platform



Enable virtual validation via simulation by reusing data across the digital thread

Synopsys: From Silicon to System



Customer-Experience Vehicle Applications

Vehicle Dynamics

Braking System



Function
(e.g. Braking)

ADAS

Sensor



Function
(e.g. Lane Keeping)

Powertrain

Powertrain



Function
(e.g. BMS)

Silicon to System

ECU SW Stack

ECU SW Stack

ECU SW Stack

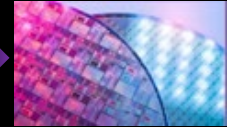
Silicon IP/ Blocks



Architecture



Silicon



ECU



ECU



ECU

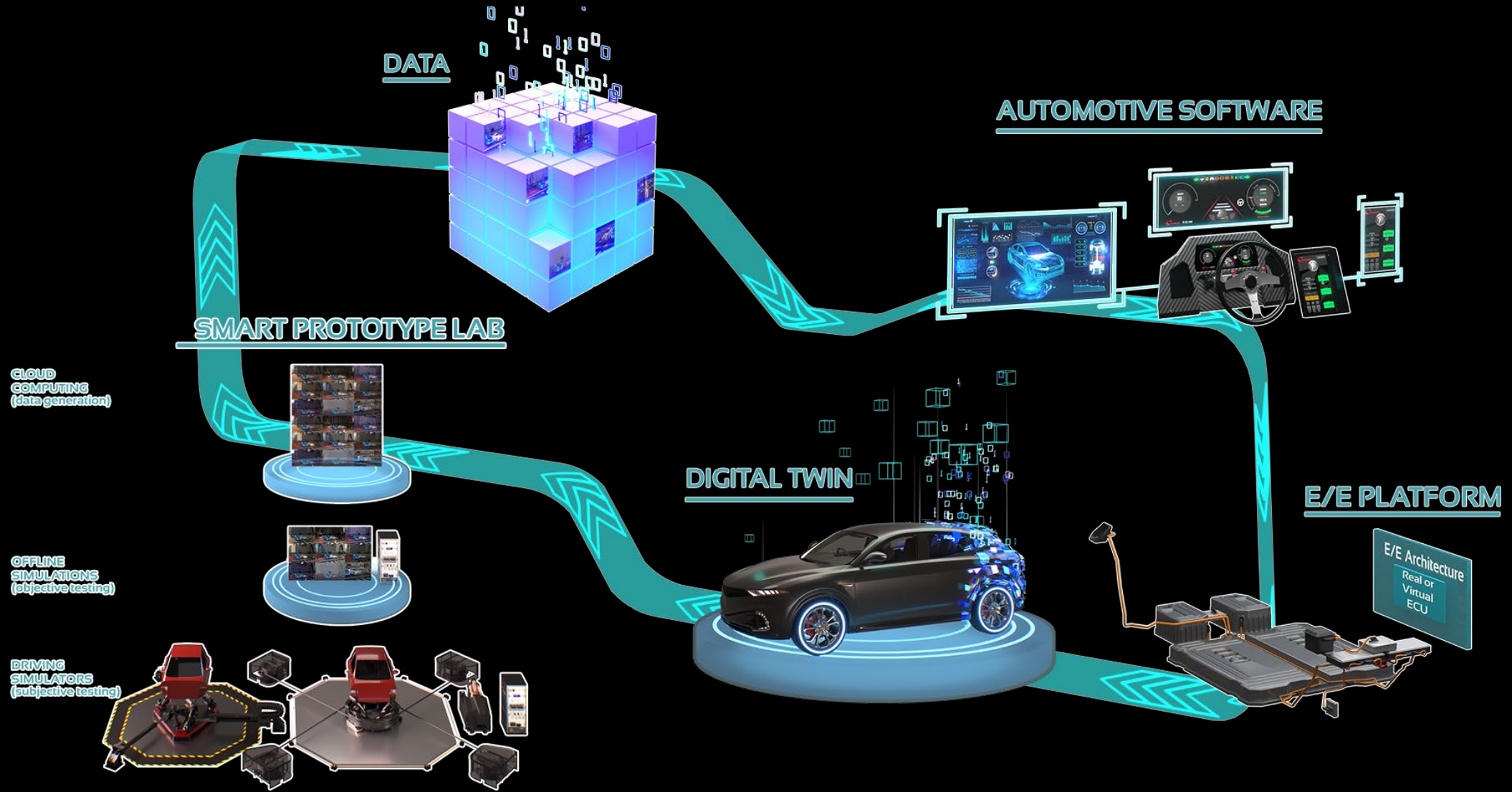


Software

Full Virtual Vehicle Integration Platform



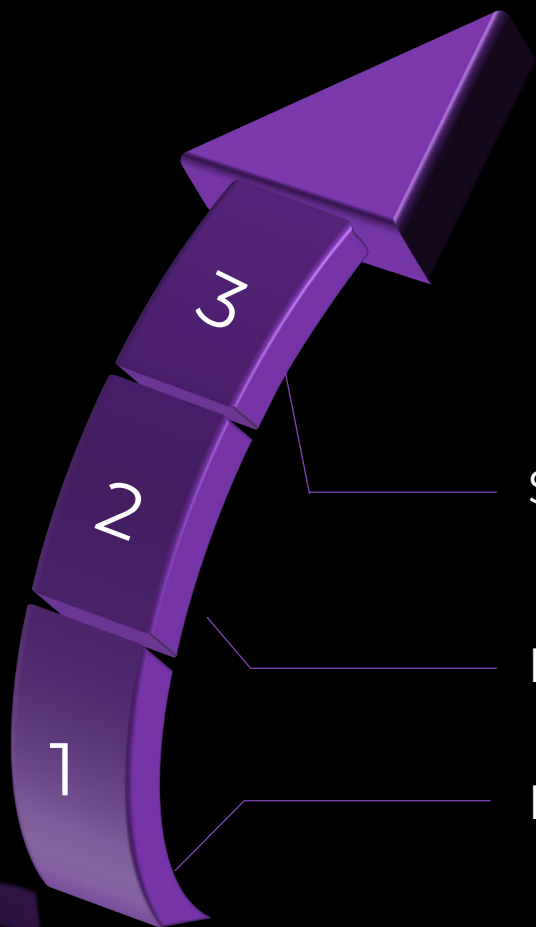
From Silicon to Simulation: End-to-End Process



Can We Talk About The Dragon In The Room?



Digital Transformation: Learning From China



Software First Mentality

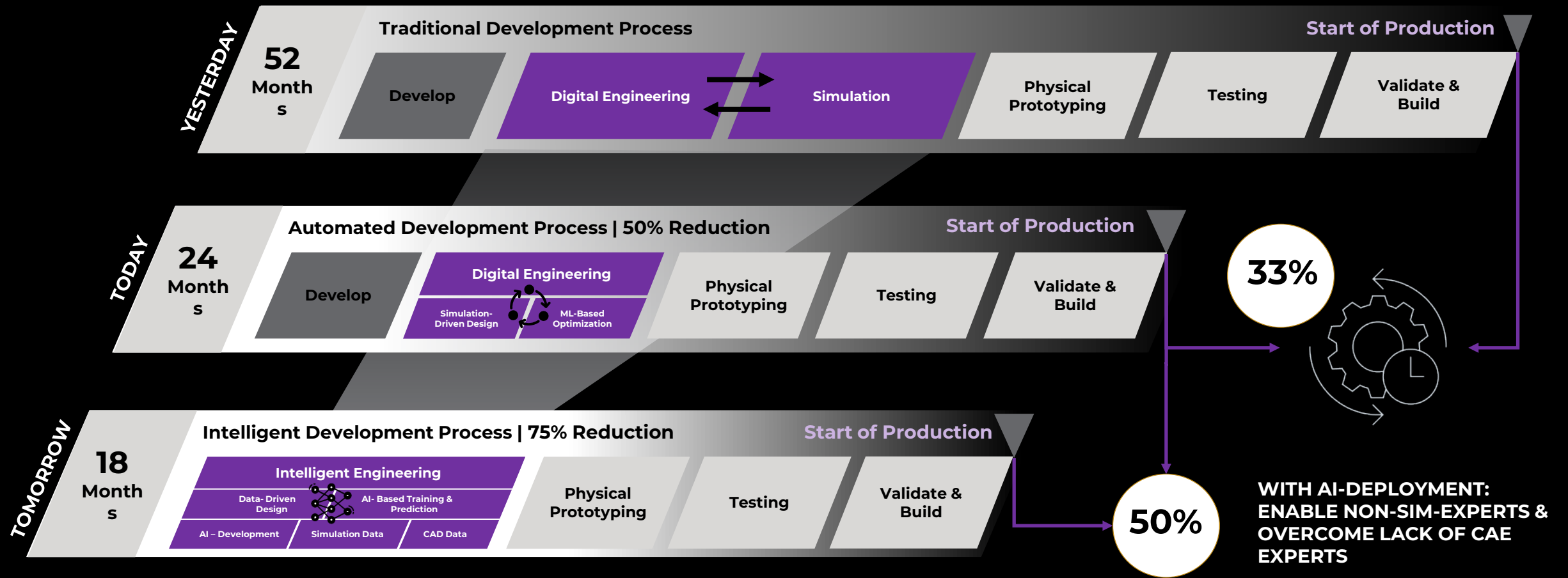
Data usage from car fleet: Correction with OTA

Digital Engineering



Connected Digital Thread Shortens R&D processes

Speeding your time to market connecting people – process – technology



Example: Physics Based E-powertrain Model for Simulators

Moving beyond simplified model representations

Shift Left – Early Validation



Enables physics-based behaviour



Captures dynamic interactions between current demand, losses, voltage, and temperature in real time

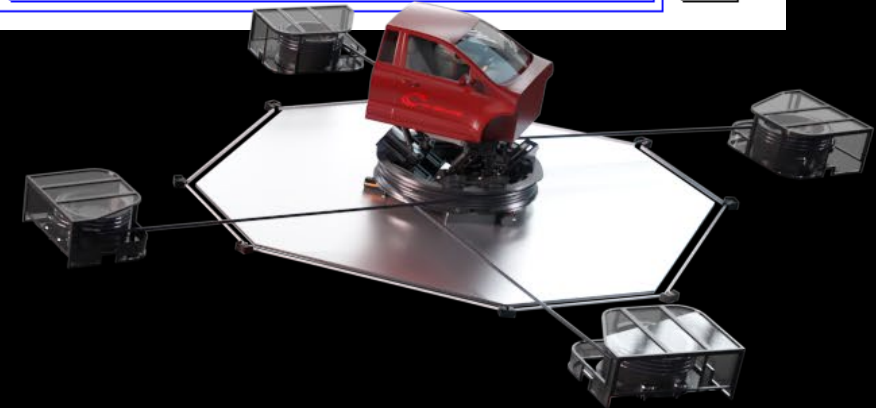
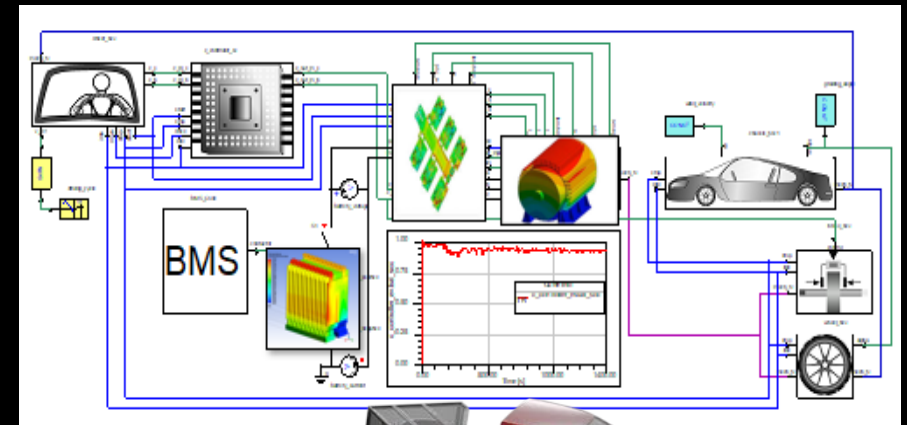


Improves realism in driver-in-the-loop (DiL), software-in-the-loop (SiL), and controller validation scenarios



Supports evaluation of:

- System behaviour under dynamic and extreme operating conditions
- Physical limits, constraint activation, and recovery characteristics
- Performance and efficiency trade-offs across operating regimes and boundary conditions



SYNOPSYS[®]

Software Development before
Electronic and component
exists



Vehicle Validation before
prototype exist

End-to-End Virtual Development Process