

# Synopsys Automotive VDK for Level 4 Virtual ECU Abstraction

## Introduction

Next-generation vehicles and automotive systems integrate powerful computing platforms, multiple networks, and increasing software content operating complex physical systems autonomously. Virtual prototyping (ie. digital twin) delivers a digital representation of a product or system under development and are essential to accelerating the automotive digital transformation. It enables earlier development and testing, higher productivity, and continuous delivery of better, safer, and more secure systems at lower cost.

## Synopsys Automotive VDK for Level 4 Virtual ECU Abstraction

Establishing digital twins for automotive electronics requires powerful simulation technologies enabling the execution of virtual ECUs individually or integrated into a virtual vehicle. Synopsys is the only company providing a complete range of virtual ECU simulation technologies from Level 1 through Level 4 virtual ECU abstraction.

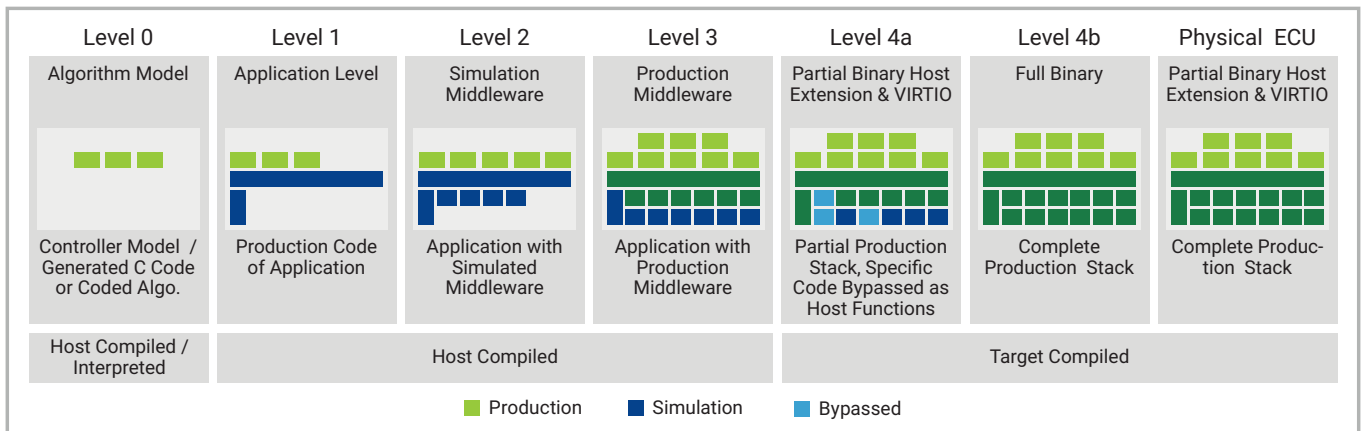


Figure 1: Virtual ECU Abstraction Levels

## Digital Twin Level 4 Virtual ECU Abstraction Use Cases

Level 4 virtual ECU abstraction refers to the ability to execute target compiled automotive software. They can be used to establish virtual processor-in-the-loop (PiL) and virtual hardware-in-the-loop (HiL) environment enabling earlier validation from the hardware dependent software to the full software stack.

Level 4 virtual ECU are not a monolithic representation of the full hardware or nothing. Several considerations can be made in its representation.

- Full binary Level 4 virtual ECU (4b) can use production code for all software layers. They enable full stack validation, driver testing, system boot and re-flashing/OTA testing, functional safety validation, security testing and integration in CI/CD flows.
- Partial binary Level 4 virtual ECU (4a) bypasses specific code as 'Host Functions' via Host Extension and VIRTIO driver substitution, and abstract further hardware component aligned with the intended use cases. Use cases supported by Level 4a are similar to Level 4b but for directed validation with the intent to start validation even earlier and deliver faster simulation performance.

Effectively deploying Level 4 virtual ECUs requires validated and proven libraries of microcontrollers, system-on-chips, ASICs and board level components.

## Unique Collaboration and Expertise + Broadest Portfolio of Automotive Virtual MCUs and SoCs

With the #1 position in silicon design and verification and the broadest portfolio of silicon IP, Synopsys has been engaged with semiconductor companies for decades. This unique position has enabled deep relationships and center of excellence collaborations for the development of virtual models from individual ICs to processors. These relationships deliver key components:

- Access to all required information for modeling early
- Access to software and test suites to ensure the highest model quality
- Joint model development and validation with proactive roadmap development
- Use of virtual models for internal semiconductor SW development and SW/HW validation
- Joint enablement of SW ecosystem
- Simplified access for automotive companies (single source solution)
- Global, expert, and clear support channels for virtual models
- Large service organization to tailor virtual MCU and SoC starting point to specific needs

The following list provides a sample of Virtual MCU and SoC starting points.

### MCU and SoC VDKs

- Infineon (AURIX and TRAVEO families)
- Marvell Ethernet Switch
- NXP (MPC 5xxx and all S32 families)
- NVIDIA
- Qualcomm
- Renesas (RH850 and R-CAR families)
- Samsung
- ST Microelectronics (Stellar family)
- Texas Instrument

### Board level model for IC components

- Analog Devices
- Cypress
- Denso
- Infineon
- Marvell
- Maxim
- Melexis
- Microchip
- Micron
- Nexperia
- NXP
- On Semiconductor
- Qualcomm
- Rohm
- Samsung
- Seiko Epson Co.
- ST Microelectronics
- Texas Instrument
- Winbond
- ZF

Please [contact Synopsys](#) for specific SoC/MCU or IC model requirements.