



# Automotive 2040: Connectivity and software- defined vehicles

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## Why automotive OEMs must embrace the software revolution

### Key takeaways

- **Expect SDVs to redefine the auto sector.** SDVs represent a paradigm shift, emphasizing the separation of hardware and software, and enabling enhanced vehicle management and performance.
- **Adjust to new consumer priorities.** Software-enabled features are set to become key purchasing criteria for consumers, equaling or even surpassing traditional hardware attributes such as speed and handling.
- **Investment will pay off.** OEMs will need to invest in new technologies and infrastructure, but, ultimately, this approach can bring significant cost savings and accelerate time to market.
- **Collaborative ecosystems will emerge.** OEMs, tech firms and semiconductor companies are each likely to drive new ecosystems, presenting new opportunities and challenges.
- **It's time to reassess the value chain.** The value chain for vehicle electronics will experience a significant transformation – both OEMs and suppliers will need to carefully consider their positions.

- **In a nutshell**

What's next for the automotive industry? The sector is experiencing a transformative shift towards software-defined vehicles (SDVs), led by advancements in electrification and driver assistance technologies. This transition emphasizes the separation of hardware and software, enabling enhanced vehicle management and consumer experiences through regular software updates.

By 2040, software-enabled features are expected to become key purchasing criteria for consumers, equaling or even surpassing traditional hardware attributes such as speed and handling. OEMs must adapt quickly to this evolving landscape, with a strategic focus on developing seamless, integrated digital experiences.

Collaborative ecosystems will play a critical role in fostering innovation and reducing development costs; it's time for vehicle manufacturers to consider partnering with tech and semiconductor companies. To remain competitive, traditional electronics Tier-1 suppliers should also reevaluate their value chain dynamics and pivot towards higher-value software products, ensuring agility in operations and responsiveness to market changes.



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**"For consumers, the difference between a vehicle today and an SDV in 2040 is like the difference between an analogue watch and a smartwatch."**

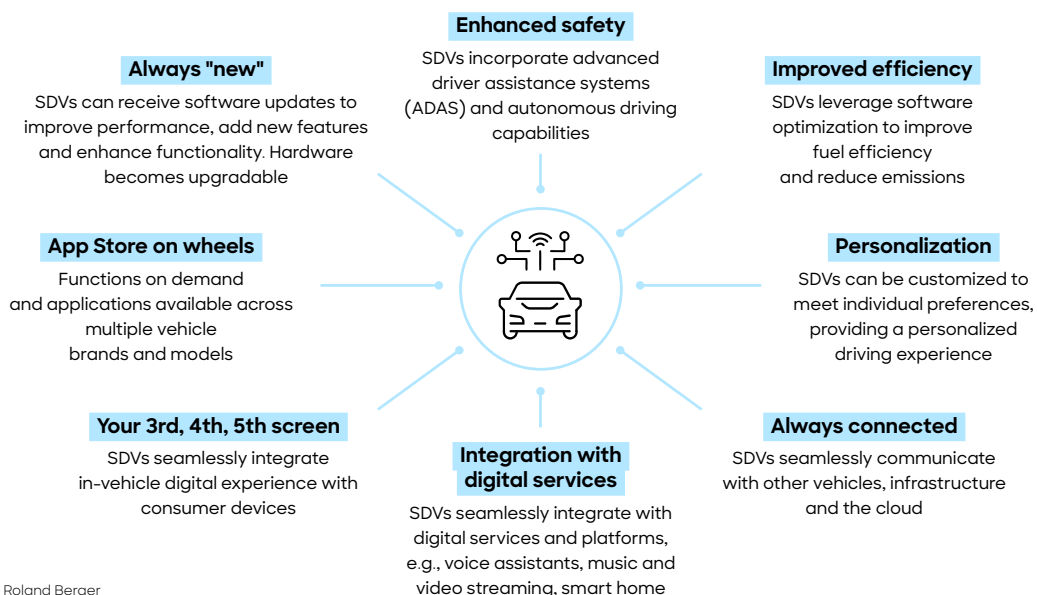
- **Software-defined vehicles are redefining the auto sector**

The automotive industry is undergoing a significant transformation. Increasing electrification and the integration of advanced driver assistance systems (ADAS) are ushering in the age of software-defined vehicles. The contrast between an SDV in 2040 and a standard car today will be like comparing a smartwatch with a fully analogue one. SDVs represent a paradigm shift that emphasizes the separation of hardware and software, allowing for enhanced vehicle management and performance through regular software updates. This flexibility enables manufacturers to respond quickly to changing consumer demands and regulatory requirements, thereby improving safety, connectivity and overall customer experience. The automotive sector is poised to redefine its technological landscape, creating a new ecosystem where software capabilities are as crucial as mechanical performance.

- **A bold new world of consumer choice**

The growing importance of software-enabled features will fundamentally alter how consumers evaluate vehicles. The SDV of 2040 will be like an "App Store on wheels," giving drivers access to a multitude of functions on demand, ranging from entertainment options to advanced vehicle performance features. Continuous updates will ensure vehicles remain current and capable, allowing for enhancements that improve functionality over time. And greater use of software will enable consumers to tailor their vehicles to meet individual preferences, making the driving experience more engaging and enjoyable. Additionally, SDVs promise improved fuel efficiency and advanced safety features powered by artificial intelligence and sophisticated sensor technologies, further solidifying their appeal to consumers.

## Software-driven features will reshape the customer experience, becoming key purchasing criteria



Source Roland Berger

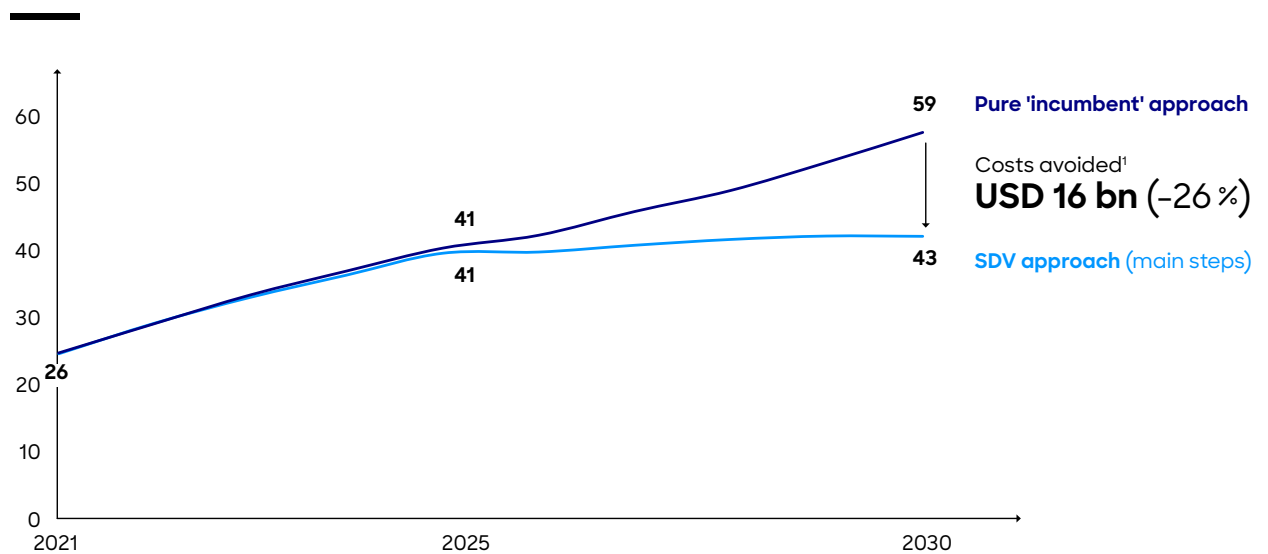
Roland  
Berger

- **SDVs offer major advantages for OEMs**

The shift to SDVs will push OEMs to invest in new technologies and infrastructure, but, ultimately, this approach can bring significant cost savings for OEMs. In fact, we believe that SDVs would help cut overall software spend by 26 % versus the traditional approach. SDVs can accelerate time to market, lower the cost of materials and reduce development costs by shortening cycles, with greater automation and an integrated toolchain.

## SDVs can help OEMs reduce costs

OEMs' in-vehicle software budget, 2021-30 [USD bn]



<sup>1</sup> Assuming fixed SW feature level in all scenarios

Source Roland Berger

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Scalability across various vehicle segments also becomes easier. Meanwhile, the ability to perform over-the-air updates will not only enhance vehicle value but enable OEMs to address software-related issues promptly, improving customer satisfaction. The equation is simple: embracing SDVs will be essential for automakers to remain competitive after 2030.



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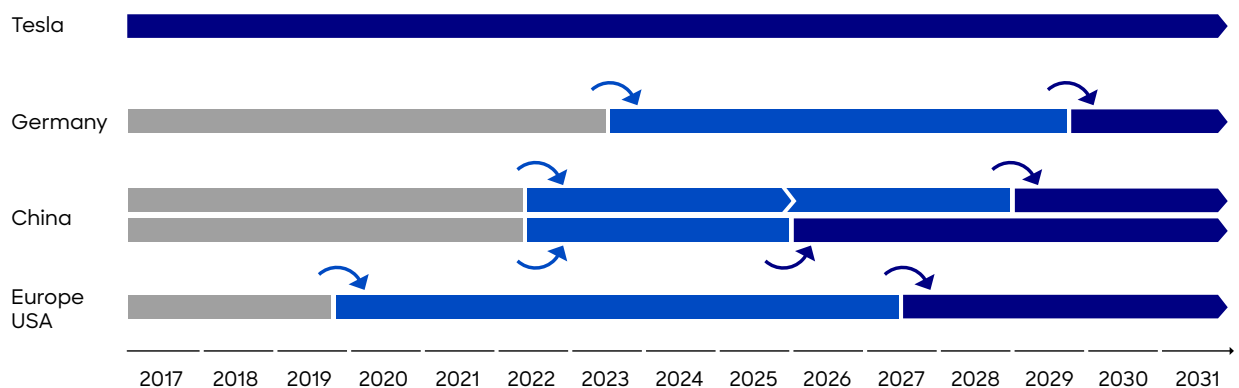
**"Cars will become app stores on wheels, with hundreds of FODs (functions on demand) and applications available across multiple vehicle brands and models."**

- **The speed of transition varies among OEMs**

The transition to SDVs is already underway, but timelines vary significantly across different OEMs. Major players in the industry are investing heavily in new electronic and electrical (E/E) architectures, focusing on microservices and a central and zonal approach. Tesla currently leads the way due to its agile development processes and lack of legacy systems. Western OEMs are following suit, but their progress is often hampered by legacy structures and the complexities of integrating new technologies. In China, automakers are now rapidly catching up in the transition to E/E architectures. The varying timelines highlight the competitive landscape, where those who can adapt quickly are likely to capture greater market share and consumer loyalty.

## OEMs will follow different paths to the SDV approach

Timeline of E/E architecture implementation by origin of OEM, 2017-31



SOP of architecture summarized by OEM group:

Distributed
  Domain architecture
  Central & zonal architecture

↪ Small transformation step towards central & zonal architecture

↪ Radical transformation step towards central & zonal architecture

Source Roland Berger

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Berger**

- **New ecosystems in the automotive landscape**

With no cross-OEM standards or ecosystems for vehicle software in place, OEMs are continuing to ramp up in-house development. But this requires major upfront investment and complicates integration, driving up implementation costs. In response, we expect the emergence of ecosystems to reshape the automotive landscape. Small companies lacking in resources for in-house development are particularly likely to benefit.

## Three potential pathways for new E/E and software ecosystems

### Scenario 1

#### SemCo-driven ecosystems

- Leading semiconductor players (SemCos) **actively push standards** in ADAS/autonomous driving and partially in infotainment, creating a **de facto hardware-specific standard** and gaining significant power over OEMs and Tier-1 suppliers
- **OEMs react** by **joining forces** with smaller SemCos to create their own **hardware-agnostic standard**, leading all SemCos to **adjust to the same standard**

### Scenario 2

#### Tech player-driven ecosystems

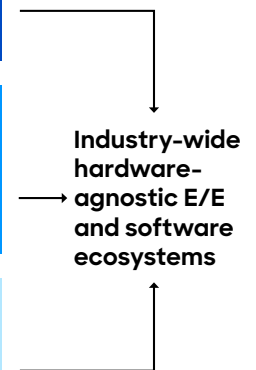
- **Tech players** develop **hardware-agnostic standard middleware** (e.g. a holistic Android system), providing an **open-source platform** to achieve a strong **competitive position** in the value chain and **increase their share of the profit pool** by leveraging their existing core business of data-driven services/functionalities

### Scenario 3

#### OEM-driven ecosystems

- OEMs (most likely new OEMs or Tier-1 suppliers) introduce **open-source architectures** and middleware either to gain **scale for themselves** (cooperation with other OEMs) or to **sell solutions/features** based on this
- OEM-driven ecosystems emerge fast due to already **high pressure to optimize costs**

Source Roland Berger



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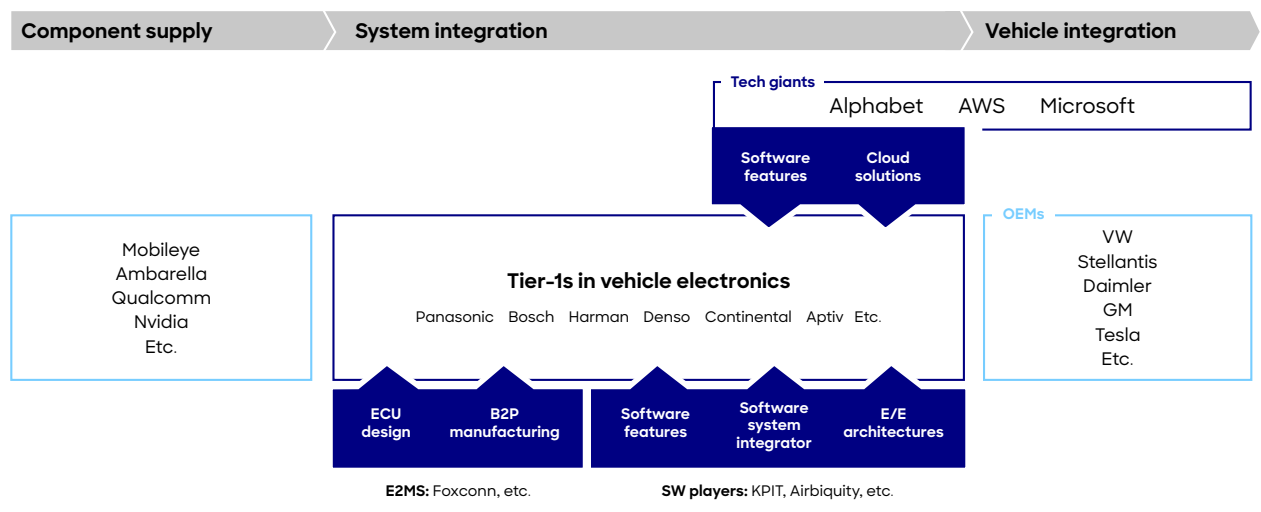
Three main ecosystems look likely to emerge, each presenting unique opportunities and challenges: semiconductor companies may leverage their expertise to create hardware-centric ecosystems that simplify integration at a lower initial cost for OEMs; an ecosystem driven by tech companies could offer open-source solutions that facilitate rapid, low-cost market entry; lastly, OEM-driven ecosystems may disrupt existing power dynamics, enabling collaboration among manufacturers to share resources and expertise, which would lower costs.

- **Assessing the impact across the value chain**

The value chain for vehicle electronics will experience a significant transformation. Assuming cross-OEM ecosystems emerge, in-house development would decline significantly. While such ecosystems can provide major cost benefits, particularly for smaller OEMs that lack the resources for cost-competitive solutions, they also raise concerns about sunk costs and potential obsolescence of existing technologies. On the supplier side, traditional Tier-1 suppliers will face increased pressure as new entrants seek to capture market share, necessitating a reevaluation of their business models. The system integrator model may become less viable as the synergies of combining hardware, software and integration capabilities under one roof fade. To remain relevant, Tier-1 suppliers must pivot towards new hardware domains or develop higher-value software products.

## SDVs could transform the E/E value chain

E/E value chain



Source Roland Berger

Roland Berger



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"Software-defined vehicles create new business opportunities and fresh value pools, especially for OEMs."

# The road ahead

- 1 Embrace the SDV revolution:** OEMs must prioritize the transition to software-defined vehicles (SDVs) by 2030 to stay competitive, leveraging software capabilities as a core aspect of vehicle performance.
- 2 Focus on consumer experience:** As software-enabled features become primary purchasing criteria, invest in creating a seamless, personalized in-vehicle experience that integrates with consumers' digital lives.
- 3 Adapt quickly to market changes:** Monitor industry trends and adopt best practices from early SDV adopters to accelerate your transition and capture market share.
- 4 Foster collaborative ecosystems:** Build partnerships with tech and semiconductor companies to create integrated ecosystems that enhance innovation and reduce development costs.
- 5 Reevaluate value chain dynamics:** Prepare for the shift towards cross-OEM ecosystems by reassessing business models, ensuring agility in operations, and focusing on higher-value software products to remain relevant.

## *Further reading*

→ [AUTOMOTIVE OUTLOOK 2040](#)

→ [THE AUTOMOTIVE INDUSTRY TRANSITIONING FROM HARDWARE TO SOFTWARE](#)

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