

# AESIN Special Interest Group Software Defined Vehicle

*What is the Software Defined Vehicle?  
Insights from the AESIN network*

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# AESIN SPECIAL INTEREST GROUP - SOFTWARE DEFINED VEHICLE

**White paper:** What is the Software Defined Vehicle? Insights  
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## Acknowledgements



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## Introduction

The software-defined vehicle (SDV) initiative is widely discussed automotive concept that promises to transform the way mobility solutions will be architected, designed, and delivered. The SDV will encompass software and hardware components, such as sensors, processors, and wireless networks, to enable advanced features including real-time data processing, in-service vehicle configuration automated driving, and cloud-based services. However, the development of SDVs is not without its challenges. These challenges include cybersecurity risks, data privacy concerns, standardization issues, and regulatory frameworks.

This white paper provides the current view of the AESIN community on what the software-defined vehicle is touching on the market perspective, the SDV process, business perspectives and a comparison between the traditional vehicle and the SDV.

## Software Defined Vehicle: Definition

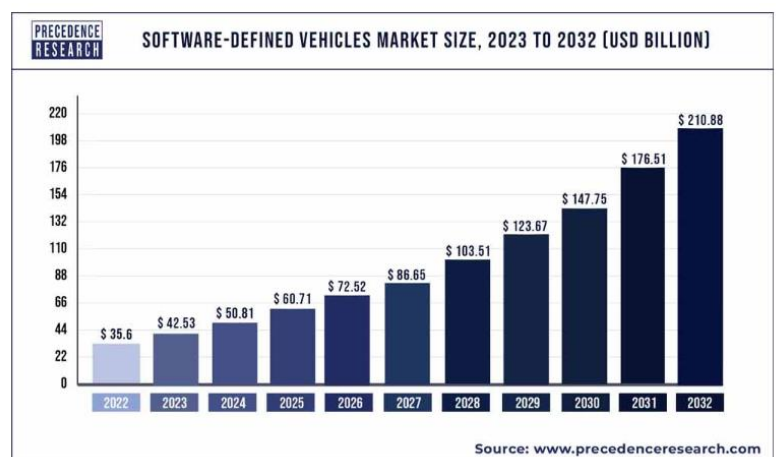
The term “Software Defined Vehicle” covers a wide spectrum of embedded software and design tools, and also connectivity outside the vehicle to cloud-based resources, but a widely accepted definition in the automotive industry is “A vehicle where the features and functions are primarily enabled through software”. This document further qualifies the definition, to reflect the different roles that AESIN members could assume with SDV activities.

Design and market decisions on feature innovation, and vehicle functions are primarily driven by the automotive OEMs, and they have specific needs to meet their revenue and market share objectives. SDV also impacts Tier 1 and Tier 2 suppliers, and this paper attempts to summarise their contribution also.

## Market Perspective

Software has become one of the fastest-growing elements of the vehicle, and the value of the “SDV Market” is predicted to double in the next five years. There are many market factors which make the SDV different. The SDV goes beyond being just a “connected car”. Over its life, it will make best use of the underlying (and increasingly commoditised) hardware to provide updates to and new driver features in software form. An SDV might be referred to as a “computer on wheels”, or “a smartphone on wheels”, even

though software and ECUs (electronics control units) have been used in vehicles since the early 1980’s. The difference today arises because an SDV will include one or more new high-power “central compute units” to host the changing and evolving software applications, rather than utilising the established architecture of resource-constrained ECUs within the underlying distributed E&E embedded system.



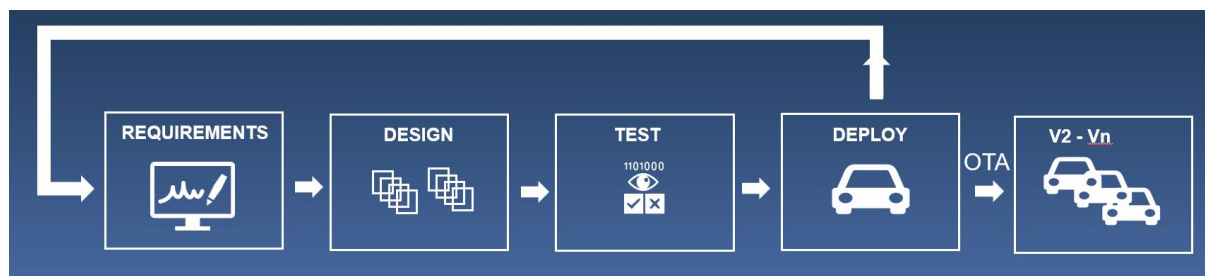
In an SDV, software features really are a differentiator between the vehicle manufacturers (OEMs). The OEMs are looking to roll-out new and unique features, they aren't just "fast following". The SDV is an enabler for today's Automotive CASE Megatrends (Connected, Autonomous, Shared, Electrified) and it also presents an opportunity for the OEMs to make aftersales from subscription services or App Stores, beyond traditional servicing and parts.

In a SDV we might talk about the "user" rather than the "owner" or the "driver". The user gets excited by, and talks about the new features and latest software updates such as "my car just got blind-spot monitoring" and not just "my car has a six litre-engine and 20-inch alloy wheels". Interestingly, the vehicle contains its best feature set at the point of sale, but also its worst, as the vehicles features and functions continue to evolve in the field throughout its life.

It is worth noting that the SDV should not be considered as simply a platform for data collection ("big-data mining"). Although there may be many useful applications for data that can be collected, especially considering diagnostics, preventative maintenance (prognostics) etc., users will not welcome an SDV whose primary goal is for marketing or advertising. User privacy should always be respected especially taking into consideration aspects such as recent GDPR legislations.

## SDV Process

The process for software development follows well-proven steps, and these are now being widely adopted by Automotive OEMs and their suppliers. Managing and tracking requirements, through design, implementation, test and delivery to customer expectations is exactly the same for software as for any other part of the vehicle. With software we have the added benefit of being able to quickly issue changes and updates, potentially delivered "over the air" (OTA). If there is a change or upgrade request, this can ripple through the process more quickly than a traditional mechanical part could.



There are many suppliers of specialist tools contributing to the SDV design cycle – the OEM has the task of selecting the best tools for the task and forming them into a workable design flow. Matching data-formats, and managing data-integrity is a significant challenge, and often outside the traditional expertise of an Automotive OEM. One of the goals of the AESIN SDV is to provide help in providing existing proven toolsets and design-flows, making it possible to recommend "known-working" SDV design tools and best-practices.

## Appendix 1: SDV Business Perspectives and Benefits

Supply Chain Role	Business Advantages with SDV	Risks and Challenges
<b>OEM</b>	<ul style="list-style-type: none"> <li>• Innovation with feature and functions delivered by software updates</li> <li>• Improve vehicle functionality during lifetime</li> <li>• Create new revenue streams with additional features</li> <li>• Enable remote diagnostics, maintenance</li> <li>• Access to cloud-based remote apps, services</li> <li>• Leverage standards, OpenSource Software</li> <li>• Reduce recall costs when update is via Software</li> <li>• Enable a digital-media continuum between home/SmartPhone/Vehicle</li> </ul>	<ul style="list-style-type: none"> <li>• Finding sufficient resources</li> <li>• Identifying/buying the right design tools</li> <li>• Safety, Quality, Provenance concerns</li> <li>• May be easier for customers to switch brands / hardware commoditized</li> </ul>
<b>Tier 1 Software Supplier</b>	<ul style="list-style-type: none"> <li>• Expanded target market for Design Tools and Embedded Software</li> <li>• More demand for expert supplied-services, where OEMs are unable meet their own needs</li> </ul>	<ul style="list-style-type: none"> <li>• Cost / Investments</li> <li>• Which OEMs to follow / which standards to choose</li> </ul>
<b>Tier 1 ECU Provider</b>	<ul style="list-style-type: none"> <li>• Improved product re-use by using Software Variants</li> <li>• Improved software standardisation enabling IP sharing and re-use, reducing development costs (e.g. AUTOSAR, Linux, RTOS etc)</li> </ul>	<ul style="list-style-type: none"> <li>• Which target markets</li> <li>• Surviving against global competitors</li> </ul>
<b>Tier 2 Hardware Supplier Silicon</b>	<ul style="list-style-type: none"> <li>• Expanded market for complex SOCs capable of hosting CPU-hungry applications</li> <li>• Expanded market for AI, Memory, Sensor, GPU components</li> </ul>	<ul style="list-style-type: none"> <li>• Overcoming manufacturing pressure/shortages</li> </ul>
<b>Tier 2 Hardware PCB/Enclosures</b>	<ul style="list-style-type: none"> <li>• Demand for reconfigurable, re-usable hardware</li> <li>• Growth of electronics in vehicle will fuel demand for powerful hardware</li> </ul>	<ul style="list-style-type: none"> <li>• Cost</li> <li>• Slow-down in manufacturing volumes due to global economic events</li> </ul>

## Appendix 2: Traditional Vehicle versus SDV

<b>Traditional Vehicle</b>	<b>Software Defined Vehicle</b>
<b>Business Model</b> Encourages the purchase of the latest model every few (~3) years. “Big Bang” revenue at point-of-sale	<b>Business Model</b> Constant value delivery through new services; expectation of continuous improvement. Continuous revenue stream e.g. via App Store
<b>Ecosystem</b> Single dimension value network from suppliers to end customer product (Component Supplier → Tier-2 → Tier-1 → OEM)	<b>Ecosystem</b> Multi-dimensional business network with multiple avenues of revenue through further products, services, data and other assets
<b>Electrical/Electronic Architecture</b> Deeply integrated E&E architecture optimised for minimal BOM cost. Focus on freezing at POS then “big-bang” release each MY	<b>Electrical/Electronic Architecture</b> Modularised E&E architecture with redundancy for possible future use-cases and continuous evolution and release
<b>Development Processes</b> Dictated by mechanical and infrastructure constraints. High effort on planning and predication to minimise later costs due to late changes and quality issues	<b>Development Processes</b> Fast feedback loops facilitated by continuous deployment and evaluating response (CI/CD, DevOps). Focus on experimentation (even in-field) and AI/continuous learning
<b>Driver Features</b> Locked in at design and delivered at production. Innovation delivered “off-the-line” via styling, power, look-and-feel	<b>Driver Features</b> Improved over the vehicle lifetime via OTA updates. Innovation via new features delivered to ADAS, Infotainment, Security systems etc.
<b>Servicing</b> Regular (annual) service interval	<b>Servicing</b> As required via remote diagnostics or prognostics

## About AESIN

AESIN is an outstanding member-based community committed to create the next generation of UK-centric automotive electronics and software systems and supply chains.

Leading thought for ingenious, sustainable, efficient, safe, and resilient mobility through the innovative application of electronics and software systems.

Interested in finding out more about AESIN? Contact Gunny Dhadyalla: [gunny.dhadyalla@techworks.org.uk](mailto:gunny.dhadyalla@techworks.org.uk)