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SIEMENS DIGITAL INDUSTRIES SOFTWARE

System-of-systems design for software-defined vehicles

Deploy a next-generation approach to design the next generation of automobiles

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Meet tomorrow’s vehicle requirements

A wave of innovation is reshaping the automotive industry and creating exciting business opportunities. Software-defined features like head-up displays, autonomous valet parking, and connected infotainment are just a few next-generation vehicle differentiators. To successfully innovate and implement those features, you will need to upgrade your development process.

Your chosen approach to vehicle design should help you master the multidisciplinary complexity associated with software-defined features. But it should also support the the function of the vehicle in the environment which extends the scope of your engineering activities to traffic, obstacles, communication with other vehicles, maintenance, and connectivity to surrounding infrastructures. In this way, your vehicle becomes a system of systems (SoS).

With system-of-systems design, you can build your vehicle as a modular, full-system simulation model that is decomposable into subassembly models and interface definitions and also interacts with its surroundings. By keeping and maintaining a single product definition that links software needs upfront, SoS design enables optimization and validation activities for all stakeholders simultaneously, helping you deliver software-defined vehicles today that also serve tomorrow’s requirements and opportunities.

Key drivers of change

Environmental concerns and regulatory pressures. To continue reducing emissions and meet looming regulatory requirements, manufacturers must accelerate the development of high-quality, alternatively powered vehicles.

Consumer demand. Customers are urgently demanding ADAS safety features, connectivity, sophisticated infotainment, and personalization from their vehicles.

Competitive differentiation. In an increasingly crowded marketplace that includes OEMs and tech startups, automakers must find ways to distinguish their offerings.

Security concerns. As vehicles become more connected and reliant on software, they are also more vulnerable to cyberattacks.

Industry trends

Vehicle electrification. Manufacturers must deliver EVs with sophisticated energy management systems to optimize battery usage, extend range, monitor battery health, and control thermal management.

Autonomous driving and ADAS. The drive toward autonomy requires integrated, software-defined systems that process massive amounts of data in real time, make instant decisions, and learn from vast scenario datasets.

OTA updates and remote diagnostics. Vehicles are now being diagnosed remotely and are receiving regular over-the-air software updates to improve performance, fix bugs, and even add new features.

Cybersecurity. Robust, secure, and frequently updated software is crucial to protect vehicles from potential malicious attacks and to protect user safety and privacy.

Integrate then build

Software-defined vehicle development involves many stakeholders, including participants from multiple disciplines but also from various suppliers and business partners. Getting them to understand the common goals and to collaborate on them can be challenging. Some may be blinded by their own priorities or reluctant to share critical information to protect their intellectual property (IP). SoS design helps you address such concerns upfront and get everyone aligned to meet all functional and safety requirements. Without SoS design solutions,catastrophic errors like an autonomous vehicle failing to recognize a person crossing the road outside of a designated crosswalk can occur.

Define and optimize the best concept

SoS design helps you select and elaborate on the most efficient vehicle architecture using multidisciplinary system simulation. As part of this process, you will convert requirements into parameters for functional component models and their interfaces and decompose them into discipline targets. By keeping all levels linked, stakeholders will make informed decisions in the context of the overall picture.

Guide continuous verification and validation

When following a SoS design approach, all stakeholders will systematically stay integrated throughout the development cycle and beyond. Therefore, you can leverage defined elements like requirements, parameters, interface definitions, scenarios, and more to guide validation activities. Continuously considering the comprehensive system will help you frontload decisions, spot mistakes earlier, verify requirements, and save time and cost.

Keep improving your design

SoS design helps you further reduce cost and improve the overall performance of your vehicle by fostering the reuse of system models and data captured throughout the product lifecycle, including from the field. By feeding this data back into design, you can continuously improve your future products in less time and with fewer resources.

What sets Siemens apart?

Our engineering mindset: We design, build, and maintain some of the most complex systems in the world

The most comprehensive digital twin: The width and depth of our offering is unmatched

Integrated system lifecycle management: We deliver enterprise-scale system data management

Extended to suppliers: We help you create model-based design chains for continuous cross-product verification

Your benefits

- **Comprehensive.** Covers the full range of disciplines you need to build full equipment models
- **Open.** Integrates easily and flexibly with legacy processes, systems, and data
- **Accessible.** Easy to use and fit for both experts and occasional users
- **Flexible.** Can be deployed at scale, on-premises or via the cloud

> Using Siemens Polarion ALM and its reuse capability helps product-focused R&D companies like us solve the problem of reusing from products to projects."

Sangyoung Park, Senior Research Engineer, Hyundai Motor Group

Collaborate on common goals in an agile environment

Our decades of automotive industry experience at Siemens means we know what it takes to design next-generation features and vehicles. Through Siemens Xcelerator™, our comprehensive and integrated portfolio of software and services that is accessible as a cloud-based SaaS solution powered by Amazon Web Services (AWS), we offer automotive manufacturers an SoS design infrastructure where all development stakeholders can collaborate on common goals and continuously consider the impact of their decisions on all levels, including vehicle systems, subsystems, and external networks.

Master complex multidisciplinary design

Siemens uniquely combines proven and future-proof mechanical, electrical, electronics, and software development capabilities, all integrated into a product lifecycle management (PLM) system with powerful system modeling capabilities. This will enable simulations on full equipment systems, capturing their complete multidisciplinary nature, as well as concurrent engineering activities for design, verification, and validation across those disciplines.

Orchestrate the development cycle

By keeping all stakeholders continuously integrated, our software lets you be the master of ceremony throughout the entire vehicle development cycle. At the core of our PLM system is a powerful digital infrastructure for secure and traceable data sharing, which automatically drives capabilities like requirements, configuration, change, and program management.

Accelerate innovation easier and at scale

Siemens software is open and interoperable to work with domain-specific solutions and third-party tools. Additionally, it is flexible and personalized. You can tune your solution to the needs of individual stakeholders using embedded low-code capabilities. And you can directly leverage our decades of expertise, bundled in readily available, preconfigured industry- and domain-specific capabilities.

About Siemens Software and Systems Engineering

With Software and Systems Engineering from Siemens, you can develop safe, cybersecure, compliant, high-performing software-defined automotive products. Multi-domain system modeling enables you to frontload software considerations while continuously checking for integration issues from the concept phase through development and into the field. This process accelerates development, avoids late engineering changes, maximizes functional reuse, and minimizes physical testing to help you innovate, update, and monetize software-centric features throughout the vehicle lifecycle.

For more information on Siemens Software and Systems Engineering visit siemens.com/sse or follow us on LinkedIn and Twitter.

Siemens Autonomous Vehicle Development.

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