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OPEN-Source Solutions
for Software-defined
Vehicles Help to Break Silos

eTAS



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Open Source over Software Silos

The automotive industry is undergoing a deep transformation. Software is now the central driver of innovation, enabling advanced vehicle functions, intelligent systems, and connected services. Notably this paradigm shift demands new development approaches that balance safety, efficiency, and innovation. Etas describes how the Eclipse Safe-Open-Vehicle-Core (S-CORE) approach lays the groundwork for this.

For vehicle manufacturers (OEMs), the shift towards software-defined vehicles (SDVs) brings with it a level of complexity that is hardly manageable with traditional development models. Automotive software must not only be innovative, but also cyber-secure, functionally reliable, and maintainable for decades. At the same time, it requires the rapid and continuous deployment of new features – and thus more efficient, cost-effective development processes with short time-to-market. While this

is the expectation, the reality for OEMs is characterized by fragmented software architectures, potential vendor lock-in, and stringent safety and cybersecurity requirements.

HIGH EFFORT, LOW ADDED VALUE

The enormous fragmentation of the software landscape contributes significantly to high development costs and long development cycles. To put

this in perspective: While essentially two operating systems have become dominant for billions of smartphones, the relatively small automotive ecosystem has between 20 and 30 different platform software variants. This fragmentation leads to massive duplication of effort: Development, integration, and qualification processes for safety and security are repeatedly performed on countless software and hardware platforms. As a result, a large portion of the effort is channeled into non-differ-

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entiating basic software like middle-
ware and core functions that every
OEM needs, but which offer no brand
differentiation or discernible added

value to the customer, **FIGURE 1**.

Proprietary solutions from individ-
ual suppliers only offer superficial
relief, as they often lead to excessive
vendor lock-in. This not only weakens
OEMs' negotiating position regarding
prices and licensing models, but also
stifles their innovative capacity, as
they are bound to the development
cycles and technological specifica-
tions of the respective supplier. Tech-
nology changes become uneconomi-
cal or even impossible, and strategic
flexibility is severely impaired.

In addition, there are stringent
requirements for functional safety
and cybersecurity; compliance with
standards such as ISO 26262 and ISO/
SAE 21434 is, after all, non-nego-
tiable. However, the immense effort
required for the rigorous validation
of safety-critical systems, for compre-
hensive testing, for the integration of
security controls, and for secure up-
date mechanisms, sometimes across
multiple vehicle lines, further increases
cost and development time.

OVERCOMING PROPRIETARY SILOS

All these complex requirements and
uncertainties of SDV development call
for a more agile and collaborative devel-
opment approach. Until now, collabo-
ration in the industry has mostly been
based on defining standards. However,

this has resulted in countless different
and proprietary implementations that,
while functioning for a manageable
number of platforms, no longer scale
with the shift to SDV. Frequent updates,
short release cycles, and rapid feature
rollouts are hardly manageable with
this approach. Each isolated solution
generates new interfaces, variants,
and dependencies, which massively
increases project risk and complicates
the transfer of functions across model
series and vehicle generations.

True innovation, however, is most
likely to emerge when the industry col-
laborates on the issue itself and open-
source software (OSS) is the crucial
enabler for this. It provides a common
foundation for legally compliant col-
laboration, accelerates development,
and ensures transparency. By overcom-
ing their proprietary silos, OEMs and
suppliers can focus on developing genu-
ine unique selling propositions instead
of constantly reinventing the wheel.

MIDDLEWARE BASIS FOR MICROPROCESSOR SYSTEMS

The Safe Open Vehicle Core (S-CORE)
project within the Eclipse SDV Working
Group embodies this new approach. It
provides a standardized, open software
stack that serves as a common platform
for all stakeholders in the automotive eco-
system. S-CORE's focus is clearly on the

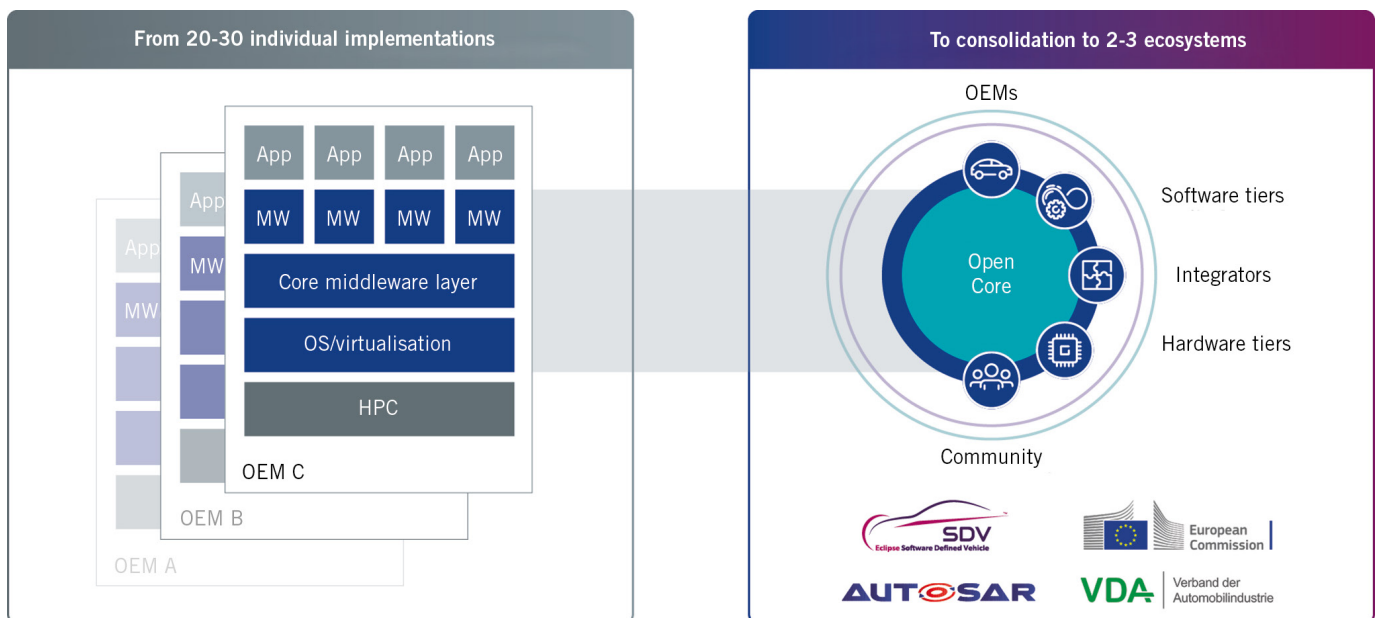


FIGURE 1 There are currently 20 to 30 different platform software variants in the automotive sector.
For efficient software development, consolidation into a few systems is essential (© Etas)

software below the application layer: It is an open, modular middleware base for microprocessor systems. It provides non-differentiating functions and components with standardized APIs that all market participants can use. As a safety- and security-oriented open-source platform for POSIX-compliant operating systems such as QNX or Linux, it is specifically designed for ASIL-B applications and engineered to meet the highest standards of safety and real-time capability, **FIGURE 2**.

The goal is to facilitate the integration and reuse of software across vehicle lines and generations. The open-source solution addresses the stated requirements for SDV-compliant software platform development: S-CORE, as a common foundation, reduces industry-wide fragmentation, facilitates the integration of software components, and supports compliance with critical security and cyber protection standards.

DIFFERENTIATION DESPITE SHARED BASE

Open collaboration during development allows the entire industry to benefit from collective intelligence, faster problem-solving, and ultimately higher code quality. The open-core model ensures that the software foundation remains robust, scalable, and future-proof, while enabling all stakeholders to actively participate in its development. At the same time, everything

that manufacturers use to differentiate themselves in the market remains outside the scope of S-CORE. The platform creates a reliable, jointly maintained foundation on which companies can then develop their own brand-specific innovations. Manufacturer-specific applications, the individual brand experience, and vehicle functions at the application level are explicitly not part of S-CORE, because that is precisely where competition and differentiation should continue to take place.

NEW KEY FEATURES

Within this clearly defined framework, S-CORE, as a modular, service-oriented software layer, provides key technical performance features for modern vehicle architectures:

- The platform enables the dynamic deployment of applications, standardized inter-process communication, and lifecycle management of in-vehicle software components.
- S-CORE supports service discovery, secure communication between processes, and centralized resource management.
- The platform enables the integration of software across different domains (multi-domain integration) and provides robust update mechanisms.
- Features such as application isolation, health monitoring and policy-based execution control ensure that system

integrity is maintained throughout the entire lifecycle of the vehicle.

These features allow OEMs and suppliers to develop complex software functions – for example in the area of driver assistance – on a common, safety-compliant and stable basis and to make them available for future vehicle generations.

LESS DEVELOPMENT EFFORT

Primary advantage for OEMs: Using S-CORE significantly reduces the total cost of ownership (TCO). While manufacturers previously developed and maintained redundant basic software, the shared platform now enables massive component reuse. This is measurable through a decreasing number of interface variants and reduced development, re-validation, and – in the medium term – maintenance costs across multiple product cycles.

Accordingly, S-CORE significantly reduces time-to-market. A standardized foundation with clear, stable interfaces immediately reduces integration effort and makes software updates more predictable. Faster software integration and a higher release frequency subsequently enable new vehicle functions to be made available to customers more quickly. The companies participating in the S-CORE initiative expect up to 40 % less effort for the development, integration, and maintenance of non-differentiating software, as well as up to 30 % faster time-to-market through shared, automotive-

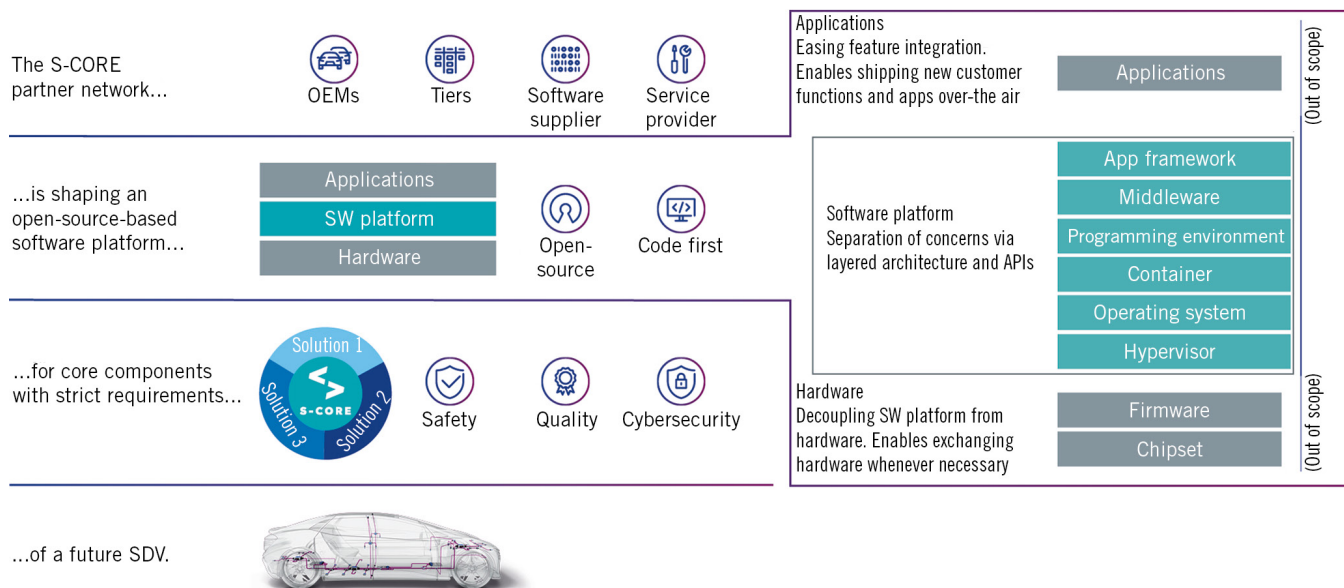
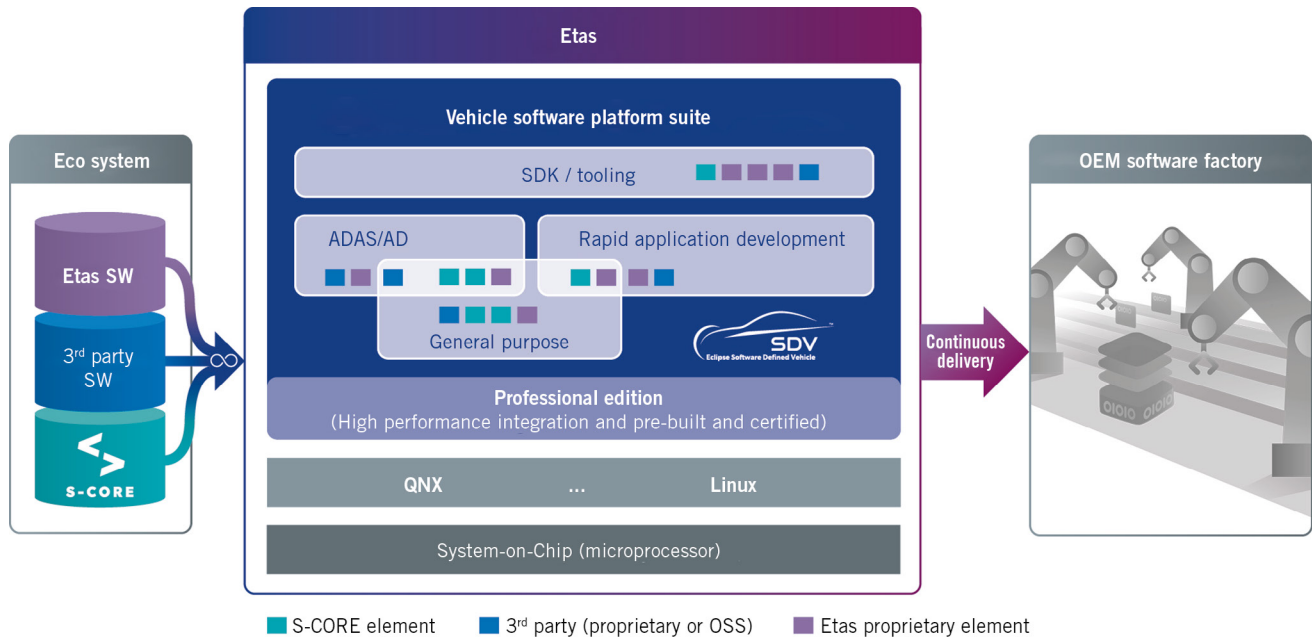


FIGURE 2 Eclipse S-CORE is an open-source stack developed collaboratively by stakeholders from across the automotive value chain, serving as a middleware base below the application layer (© Etas)

FIGURE 3 Distributors refine the open S-CORE source code into production-ready middleware that can be seamlessly integrated into OEMs' development processes (© Etas)



quality components [1].

Furthermore, S-CORE reduces dependency on individual suppliers and mitigates the strategic risk of vendor lock-in. The resulting flexibility and increasing negotiating leverage represent a decisive advantage for future platform and sourcing decisions.

FROM SOURCE CODE TO SERIES PRODUCTION

However, it's also true that while Eclipse S-CORE, with its open-source code, provides the technological foundation for the vehicle's software platform, it's not directly usable in series production. This is where S-CORE contributors like Etas also act as expert distributors. They transform the open-source stack into a production-ready, S-CORE-based middleware, which is then provided to OEMs as a production-ready distribution. This distribution is specifically tailored to the requirements of automotive software developers: consistently pre-configured, version-traceable, and prepared for efficient integration into series development processes. Ideally, it also integrates other selected open-source components from

the Eclipse SDV ecosystem, supports industry-standard toolchains, and is consistently aligned with modern CI/CD workflows.

The S-CORE distributor also handles quality assurance and hardening: Through systematic testing, continuous updates and fixes, and preparation for safety and security certifications, the software itself is transformed into a product that OEMs can reliably use. The result is a dependable, expandable platform (e.g., Etas Vehicle Software Platform Suite) that accelerates innovation while ensuring compliance with functional safety and cybersecurity requirements, as well as maintainability throughout the vehicle's entire lifecycle, **FIGURE 3**.

CONCLUSION

The transformation to software-defined vehicles (SDVs) can hardly be managed with traditional development models anymore. For OEMs, it's time to break free from proprietary silos and concentrate their innovative power where it directly impacts the customer experi-

ence. Here, the S-CORE initiative paves the way: by sharing responsibility for the secure and robust software foundation, the industry frees up significant resources. And while qualified S-CORE distributors prepare the middleware for series production, the OEM can focus on its core competencies: creating unique brand experiences and innovative customer features. The shared S-CORE foundation thus becomes a catalyst for genuine, individualized innovation and a competitive advantage in the SDV era.

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