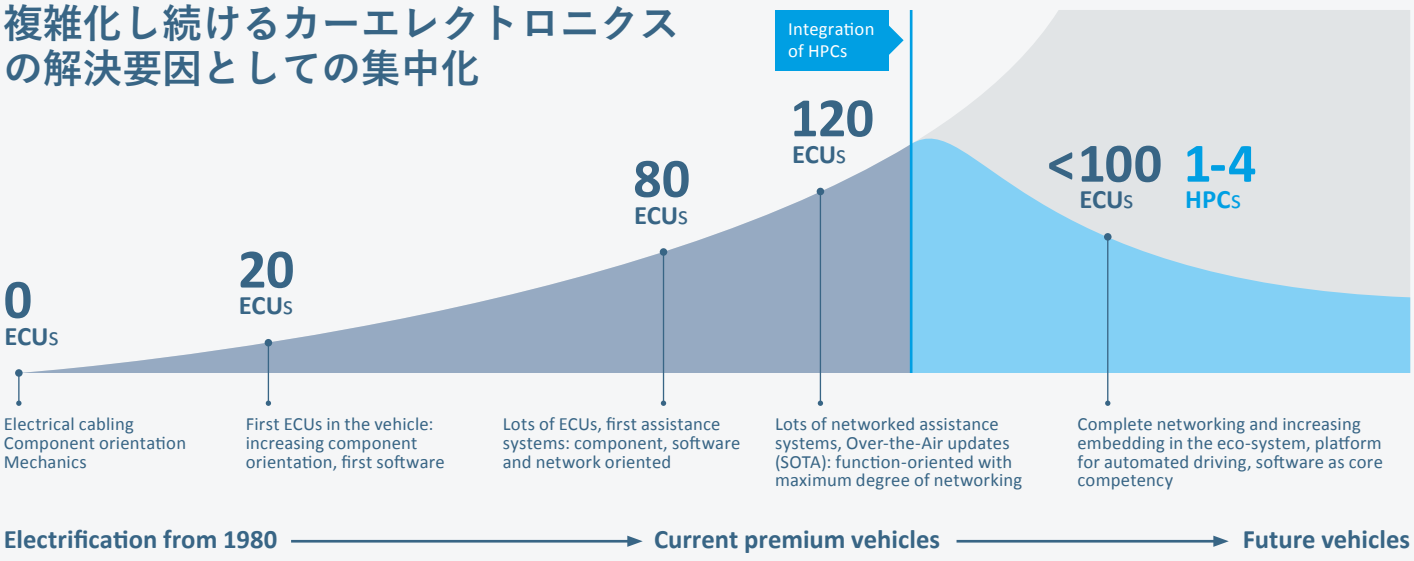
複雑化し続けるカーエレクトロニクスの解決要因としての集中化

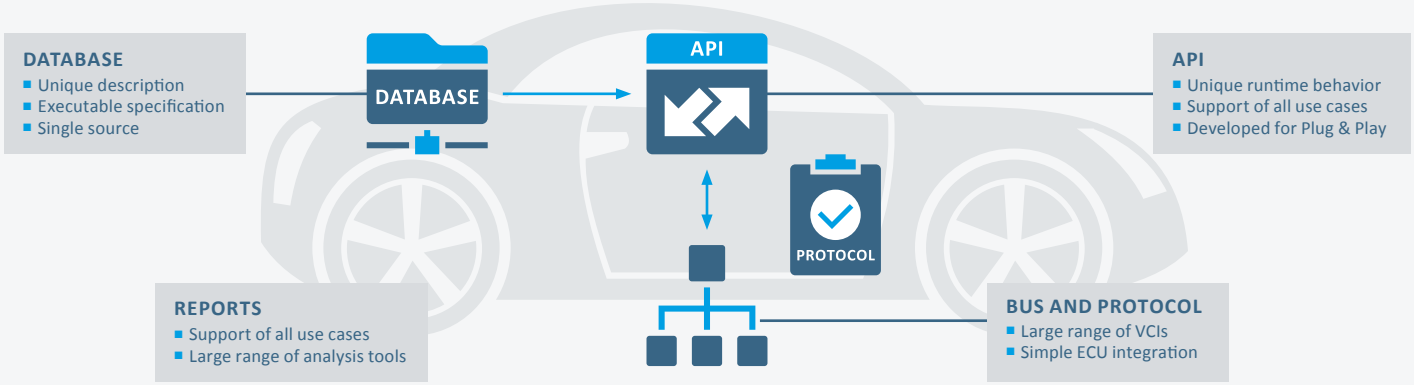


車両診断の標準化
品質、効率、投資保護に注力

競争に関係のない分野で標準規格を使用することは、自動車のライフサイクル全体にわたって多くの利点をもたらす。車両診断を標準化する主な利点のひとつは、特に中央診断データベース（標準：ODX ISO 22901-1、Open Diagnostic Data Exchange）の開発を通じて、エンジニアリング時間が大幅に短縮されることである。エンジニアリング、製造、サービスにおいて、一度作成されたデータを再利用できる可能性があり、同じデータ形式をベースとし、標準化されたインターフェイスを持つさまざまなメーカーのツールが利用可能になることで、既存の非常に異質な世界を大幅に簡素化することができます。また、診断ツールを全社的にモジュール化することで、さまざまな事業部門における個々のコンポーネントの高いリサイクル性を実現することができる。例えば、適切なインターフェースのおかげで、診断ハードウェア（VCI、Vehicle Communication Interface）は、ほぼ互換性があり、特定のアプリケーションのために異なるメーカーから入手することができる。(例：製造では高性能なインターフェイス、アフターセールスでは安価なインターフェイス）基盤となる診断ランタイムシステムも、性能、標準準拠、柔軟性、コストなどの要求に応じて、異なるメーカーから購入することができる。標準化により、単価を大幅に削減することが可能になる。

包括的な相互運用性を実現し、お客様の投資を保護するために、Softing Automotive社は公認の国際規格に体系的に依存している。
ASAM、SAE、ISOなど、自動車・カーエレクトロニクス分野の主要な標準化委員会の積極的なメンバーとして、当社はテクノロジーの未来のため活動している。そのため、当社のお客様は標準化の効果を直接享受することができる。

標準化の利点



Interview with Prof. Dr.-Ing. Stefan Goß

自動車産業における現在の動向と、それらが車両診断の標準化に与える影響

Stefan Goß博士に、自動車産業における現在の動向と、それが標準化、特に車両診断に与える影響について聞いた。Goß博士はヴォルフェンビュッテル（ヴォルフスブルク）にあるオストファリア応用科学大学の教授であり、車両システム・サービス技術研究所の所長である。電気工学と電子工学の基礎に加え、車両診断、自動車専門知識、文書管理とセキュリティについても教えている。Goß博士は以前、ドイツの大手自動車メーカーを含む民間企業で数年間勤務していた。現在は教授職の傍らフリーランスの自動車工学コンサルタントとして、さまざまな部門が新技術にどのように対処しなければならないかを身をもって体験している。Goß博士は、現在E/Eアーキテクチャーが直面している最大の課題のひとつは、新しいバスシステム、特に物理層のイーサネットへの移行にあると考えている。この分野では、イーサネットへの移行が光バスシステムにも及ぶかどうかが議論されているが、Goß博士はこの問題について明確な見解を持っている：

"今後何年、何十年と、自動車には光ファイバーではなく銅が使われ続けると思います。
工場での光ファイバー・ケーブル・システムの修理工程では、例えば曲げ半径や座屈半径への対応など、特殊な能力が要求されます。
住宅で見られるような光ファイバーとは異なり、自動車では特にこの技術に対応しなければならない世界的なアフターセールス活動に関して、まったく異なる課題が生じます。
とはいえ、高周波数などの技術開発により、銅線に関しても大きな課題があります。トレーニングにおいて、私たちが講義や研究所で取り組んでいるのは、まさにこのことなのです。"

„HPCはカーエレクトロニクスにおけるスケーラブルなドライバー"

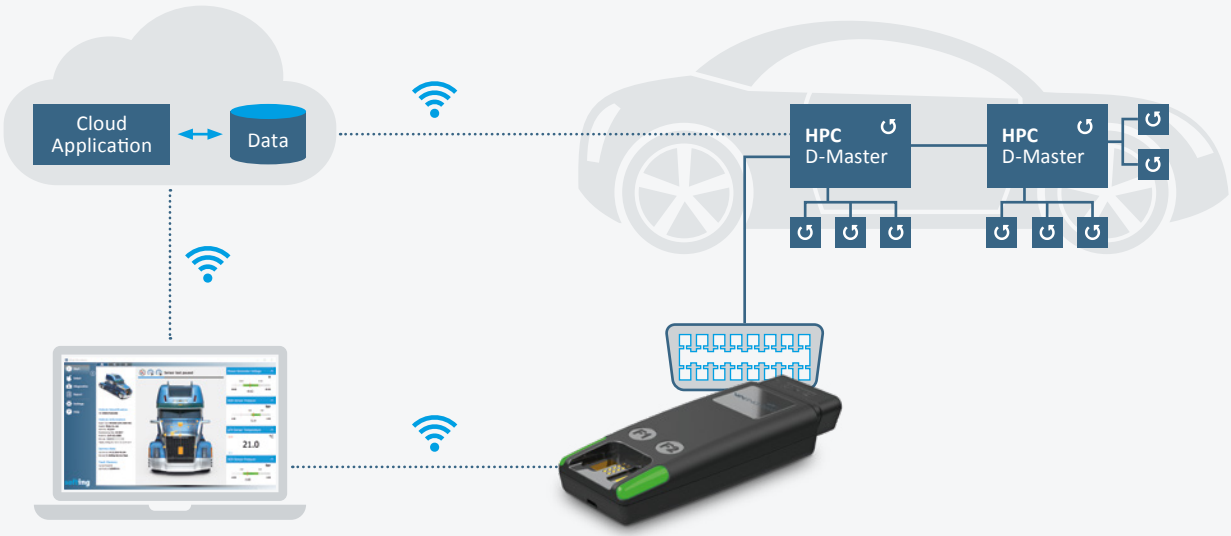
新型車の技術革新が進むにつれて、E/Eシステムの複雑さが増し、車載HPC(High Performance Computers)の必要性など車載通信への要求も高まっている。それにもかかわらず、現在のところ、自動車メーカーはサプライヤーに対して、必要なコンピューティング・パワーを常に確保できるという保証を提供することができない。Goß博士に、高性能コンピューター（HPC）の今後の発展について聞いた：

"20年後でさえ、自動車は3台の高性能コンピューターと数個のシンプルなセンサーで構成されることはないだろう。その主な理由は技術的なことではなく、単に自動車メーカーの複数サプライヤー戦略にある。今日、交渉はハードウェア・レベルで行われている。多種多様なメーカーからのソフトウェア・コンポーネントの購入が、2、3台のHPCに凝縮されるとは想像できない。したがって、分散化されたコンポーネントやアーキテクチャは依然として存在するだろう。これらはおそらく、より少ない制御ユニット
業界では現在、高性能コンピューターにあらゆるものを組み込んで軽量化し、材料、特に銅を節約しようという傾向が見られる。とりわけ、HPCと通信するための制御装置には、ワイヤレス技術の利用が求められている。とはいえ、ゴース博士は、このような高揚感には懐疑的である：

„Through the safety requirements of ISO 26262 relating to func-tional safety, this current hype will give way to a phase of “so-bering up”. In 20 years’ time, we will still need things like CAN and LIN. The key argument is the good relationship between data rates, safety and costs. The HPC approach remains undisputed, but not everything should be incorporated wholesale into the HPCs.“

Diagnostics in transition – centralized computing power

For every main vehicle function, there is an electronic control unit, ECU. Every ECU monitors its environment – what is referred to as self-diagnostics. The ECUs are connected to one another via bus systems – generally via a central gateway that is also connected to the OBD jack. A repair shop employee can thus connect an external tester in which algorithms read data from the ECUs and combine it to create meaningful repair instructions. Autonomous driving nevertheless requires much greater computing power in the vehicle than can currently be provided via present-day ECUs. Consequently, at least two high-performance computers (HPCs) – for reasons of redundancy – will be incorporated into the vehicle.



For the most part, we talked to Dr. Goß about HPCs in passenger cars, but we are also interested in his opinion with regard to trucks and mobile working machinery. According to the expert, HPCs will play an even more important role in this domain:

„At the automotive engineering faculty, we see the need for high-performance computers in the fields of agricultural and ship technology with their high requirements. To a certain extent, agricultural machines are already fully-autonomous when driving in the fields. Every effort should be made to share experiences and competences with these pioneering industries. Ensuring the scalability of HPCs in these fields would make good technical and economic sense. That is why we have created a new slogan for our faculty: Shaping the mobility of tomorrow.“

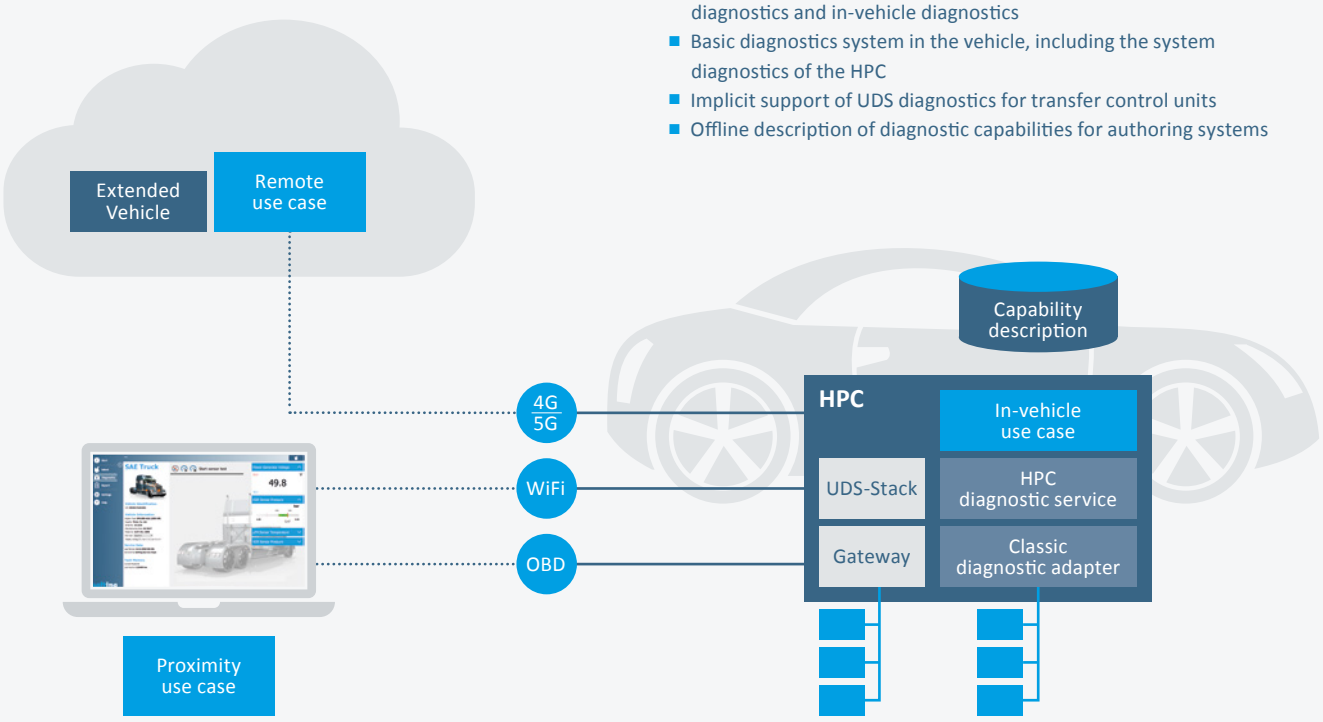
„SOVD will Become the Future Diagnostics Standard“

The more efficient vehicles fitted with HPCs bring with them major progress, while presenting the automotive industry as a whole with new challenges. This is also true of diagnostics. The UDS diagnostic communication protocol (ISO 14229, Unified Diagnostic Services), for example, will no longer be sufficient in the future. The use of a new SOVD standard (Service-Oriented Vehicle Diagnostics), defined by ASAM e.V., will be necessary both for repair shops and for remote diagnostics. SOVD defines an interface that facilitates vehicle diagnostics in the repair shop directly on the vehicle (proximity), via remote access (remote) or as a tester directly in the vehicle (in-vehicle). To simplify standardization and subsequent implementations, as many existing mechanisms and standards should be used as possible (e.g. TCP/IP).

In the discussion focusing on high-performance computers in vehicles, the issue of self-diagnostics is often raised. Despite SOVD, it is also unrealistic to envisage the repair shop outsourcing diagnostics completely to the vehicle in the future because a sensor is generally only installed in the vehicle for values required for the actual driving function. If, for the purposes of repairs, readings are required that the vehicle itself cannot generate, they must be taken on-site by a mechatronics engineer using a measuring instrument. According to Dr. Goß, the picture is nevertheless different for error-finding procedures, which are based on standard processes:

SOVD – Service-Oriented Vehicle Diagnostics

- Support for use cases: diagnostics beside the vehicle, remote diagnostics and in-vehicle diagnostics
- Basic diagnostics system in the vehicle, including the system diagnostics of the HPC
- Implicit support of UDS diagnostics for transfer control units
- Offline description of diagnostic capabilities for authoring systems



„SOVD Leads to a Rescaling of the Diagnostics Applications“

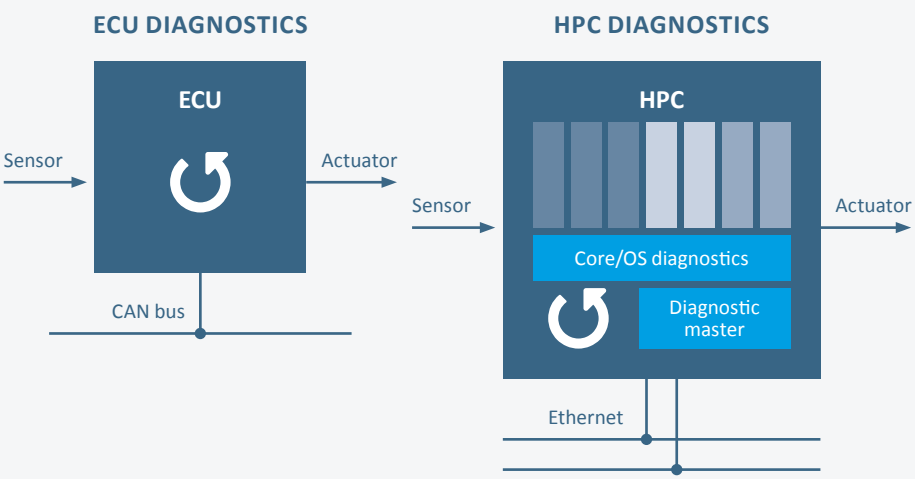
„If the specific vehicle data is available in the vehicle, the fault-finding process can also be conducted remotely via ‘Request and Response’ by means of outsourced diagnostics in the vehicle. Today, a tester has to be proficient in diagnostics for a wide range of vehicles, whereas a tester in the vehicle need only deal with the diagnostics data for the vehicle in question. This will simplify diagnostics. However, it will not be reduced to a browser function as expert knowledge or downstream processes often still play a role. On the other hand, the topic of SOVD requires another form of cooperation between diagnostic tester developers and engineers as well as vehicle manufacturers. Requirements management for the next generation of diagnostic testers must be coordinated precisely and shaping this coordination represents a huge opportunity for all those involved.“

Today, SOVD is still a matter for the future that needs to prove its worth. Ultimately, standardization is always linked to political or techno-economic goals. Current trends offer potential for further standardization. We asked Dr. Goß what would still need to be standardized for things to be better in the future:

„In the field of automated driving, or in other words if, in case of doubt, a driver can or must take over the driving functions after a certain reaction time, I certainly expect more standards to be developed for the purposes of comprehensible homologation and type approval. Those who are genuinely responsible for granting operating licenses and homologations will lay down additional major requirements with regard to standardization with a view to making provision for uniform, trustworthy type tests and approvals. I am expecting certain influences here. One of the major drivers is bound to be vehicle self-diagnostics.

The second driver will be insurances, because conventional vehicle liability insurance will become less relevant as the vehicle is no longer steered by the driver. Product liability through the manufacturer will thus have greater significance. The safety of the technology must naturally also be scrutinized. Only when this has been deemed safe can product safety be achieved. Once this confirmation has been obtained, the type approval or operating license can be granted. In my opinion, this explanatory variable of how to check the technology will be accompanied by further standardizations in the medium term.“

In this respect, it will also be interesting if a duty to provide proof is introduced, and reliable records have to be kept as to whether the vehicle was driving in autonomous, fully-automated or partially-automated mode. Modern vehicles are now fitted with an event data recorder, the vehicle equivalent of a “black box”. Dr. Goß nevertheless believes this is insufficient for future challenges:



New diagnostic capabilities in HPCs

At least two new diagnostic tasks must be implemented in HPCs. The first is the system diagnostics of the HPC, which constantly monitors the function of the operating systems and the distribution of tasks to the different processor cores, while the second is a diagnostics master that consolidates the self-diagnostics at the functional level. Furthermore, each HPC also performs today's self-diagnostics. It monitors inputs and outputs as well as the significantly increased number of signals via the Ethernet connection to other HPCs.

„The current event data recorders are insufficient. To ensure the authenticity of what a recorder registers before and after a crash, appropriate measures are necessary. The aim should be for the data to be consulted unchanged to ensure that the triggers can be read and analyzed with complete integrity, ultimately pushing accident forensics – and thus standardization – to new levels."

„Standardization Facilitates Massive Efficiency Gains but Should not Lead to Overregulation"

Dr. Goß therefore shares our philosophy that standardization can be a driver of quality. To stick with the example of type testing, type approval and issuing an operating license, overall quality begins with the quality testing of the products, which generally consist of networked hardware and software. The safe clearance test to issue an operating license is a fundamental indication of how mass-produced products will later work in the market. Dr. Goß adds:

„If standards are then in place allowing those concerned to conduct the test as well as possible and to issue the operating license with the best possible conscience, then we have made good progress. It is here in particular that I see the direct and immediate link between quality and standards. I can especially see major advantages for the launch of new mass-produced products."

A huge improvement in quality has also been achieved in standardization committees in recent years in the fields of communication technology and data processing. There is a strong awareness of the need for standards, and competent people have been delegated by companies. Standards are made by people who have the relevant basic knowledge and long-standing experience and who, above all, know how to make standards and where standardization is meaningful for everyone concerned. Numerous OEMs and suppliers nevertheless call on their own technologies and, in doing so, hope to create a positive unique selling point. This also raises the question, however, of whether a proprietary solution promotes a unique selling point as an optional extension or attempts to undermine a standard in order to dominate the market. Dr. Goß recommends differentiating:

„I believe that the reasons for adopting a proprietary solution are a key basis for discussion. Is it a positive extension or is it really an attempt to gain market power? This distinction should always be kept in mind."

In our day-to-day business, we often see that people try to establish in-house solutions as "de facto standards" ahead of established standards. This raises the question of whether it is a good idea in the long run to be dependent on one provider. This is the case, for example, if you are dependent on a specific cable instead of using the existing standard. For end customers, this is less of a problem, but for vehicle manufacturers and suppliers, it results in a high level of dependency. One of the major advantages for our customers is that they are not dependent on our products. With regard to this, we asked Dr. Goß how he sees the future viability of proprietary solutions:

„Many firms attempt to make use of proprietary solutions that is detrimental to the market. But I am also concerned that there will be overregulation in the form of standards and regulations. Take this example: On the one hand, we have the ISO and the ISO standards. These are generally implementation independent. Alongside this, we have the United Nations Economic Commission for Europe, or UNECE, which has a major impact on the mobility industry through the ECE regulations. And then you have the legislators, both at the national and continental levels such as Europe, Asia or the US. So there are three strong influences competing with one another and which may even contradict one another. In short, we have the ISO, the UNECE and the legislators.

I am a founding member of ISO standard 20730, working on it right up to its publication. In the use cases described in this standard (e.g. reading the chassis number, etc.), it was standardized with bits and bytes. In these use cases, the protagonists requested that everything be made "mandatory". If the UNECE then comes along and demands that a specific standard be made mandatory for a specific technology, the European Union adopts this recommendation in a European regulation. And in one fell swoop, an entire ISO standard, for example ISO 20730, becomes legally binding. Often, not all the parties that prescribe them are capable of assessing the related technical and business impacts. If the parties affected, be they vehicle or tool manufacturers, then come forward and complain that it is quite simply not economically feasible, it is already too late. And that is why I advise caution. Over-standardization combined with overregulation is dangerous and would be detrimental to the necessary degree of freedom and creativity. Incidentally, in the case of ISO 20730 and following a lengthy discussion, only those use cases that were absolutely necessary were given the status of "mandatory"."

„Degrees of Freedom in Standardization Allow for Differentiation – Ultimately in Customer Satisfaction, Too“

Avoiding this situation is one of the reasons why Softing Automotive is involved in standardization committees, as this enables us to conduct discussions – for example concerning the definition of the SOVD standard – within a competent circle of experts before taking it to the ISO. While Dr. Goß is a keen advocate of standardization, he nevertheless stresses that there are also benefits to complementary proprietary solutions:

„In diagnostics, we differentiate between the exhaust tract, for which legislators have considerable influence and set guidelines right down to the last DTC, and the field of diagnostics for the non-exhaust tract. In light of the existing standards, the latter offers OEMs a high degree of freedom in implementing diagnostic options. Some vehicle manufacturers use this to provide repair shops with highly sophisticated offboard diagnostics mechanisms. They do this as customer satisfaction is strongly influenced by providing successful service and avoiding repeat repairs.

Beyond standards, however, functionalities in the field of diagnostics make sense as additions for fault finding (type and location of a fault). This allows a vehicle manufacturer to develop a competitive advantage that can have a positive impact on their product and on customer satisfaction. And that can, in principle, be seen in every diagnostic tool through the Block Exemption Regulation. In this case, the EU has rightly ensured that there are no constraints. However, legislators – and not even the standardization body – should not interfere in these proprietary extensions.“

With SOVD, we defined an interface at ASAM that really only concerns the outermost interface and no longer the implementation. On the one hand, this means that manufacturers can implement proprietary solutions very simply on the vehicle behind the SOVD interface. This provides the necessary degree of freedom for OEMs. On the other hand, there are suppliers of HPCs and conventional ECUs. The SOVD interface allows them standardized implementation so that several manufacturers can be served efficiently. We asked Dr. Goß for his opinion:

„It is primarily the OEM-specific self-diagnostics in the vehicle that are affected by the fact that parts of the offboard diagnostics migrate into the vehicle with SOVD. If we have such a "partial" diagnostic tester on-board, vehicle manufacturers have greater freedom as to what they can make available externally in the responses. To this end, SOVD provides the shell for a standardized answer. But with regard to the content itself, the vehicle manufacturers' degree of freedom remains unchanged. I don't believe that vehicle manufacturers will want to start making their content less visible again, because the ODX data can already describe the diagnostic functionality – even of HPCs. I think that the EU will clearly demand that ODX data be sold – at non-discriminatory prices. In addition to the fact that SOVD provides a self-describing data format, the diagnostic content implemented must be presented transparently in one way or another. Perhaps through the sale of ODX data or similar documentation. In this respect, content will not be veiled and obscured again as it used to be "in the dark ages". The legislators will see to that.“

„PoC Demonstrates the Possibility of Standards-Based ePTI Test Procedures“

The sale of data under the aegis of the legisaltor is an established procedure. In the course of the ePTI (electronic Periodic Technical Inspection), vehicle manufacturer data is collected by a central location and made available to the officially recognized expert as part of an inspection tool. In the future, a standard could describe the device-independent provision of ePTI test procedures for inspection tools.

ePTI – Electronic Periodic Technical Inspection (ISO 20730)

Due to the increase in electronic safety-relevant systems in vehicles, these must be examined in accordance with Directive EU/2014/45, Implementing Regulation EU/2019/621 and §29 of the national Road Traffic Act (StVZO), together with appendices as part of the main inspection. The inspection uses a vehicle interface. For this purpose, an appropriate device is required that controls the communication possibilities with the vehicle and provides a user interface for the officially recognized expert or inspector.

We asked Dr. Goß how he sees the relationship between ePTI, proprietary solutions and data trustees:

„For the overall architecture of offboard and remote diagnostics systems, proprietary solutions are a disadvantage if individual instances present themselves as independent data trustees following a business model. It is a shame that our free market economy is not fully driven in this approach. This is where I am trying to prove that it works. That is precisely why we created the Proof of Concept together with you at Softing and Volkswagen and demonstrated a manufacturer-independent implementation of ePTI procedures based on the ODX and OTX standards."

„Even Complex Functions can be Outsourced to the Cloud – For Example for Extended Vehicles"

Another trend is the Extended Vehicle. In the future, vehicles will have a permanent wireless connection to an external backend. And this would not simply be used to place an emergency call after a crash. Here is a simple example: A vehicle manufacturer has a voice recognition system for proper nouns, such as place names. When someone wants to navigate to a location, the driver specifies the destination by stating the name of the town, the street and the house number. The voice recognition system can be implemented using hardware and software in the vehicle or via the backend. That is exactly how it works when using Google Navigation on a smartphone. The route is not calculated on the smartphone but in a backend. That means that data and functions are outsourced and processed in the backed during the journey. For Extended Vehicles, there are already two ISO standards (ISO 20078 and ISO 20079), which are currently being promoted with regard to implementation.

In coming years, the topic of the Extended Vehicle will also have a major impact in its own diagnostics in connection with highly-automated and fully-automated driving, but also with SOVD.

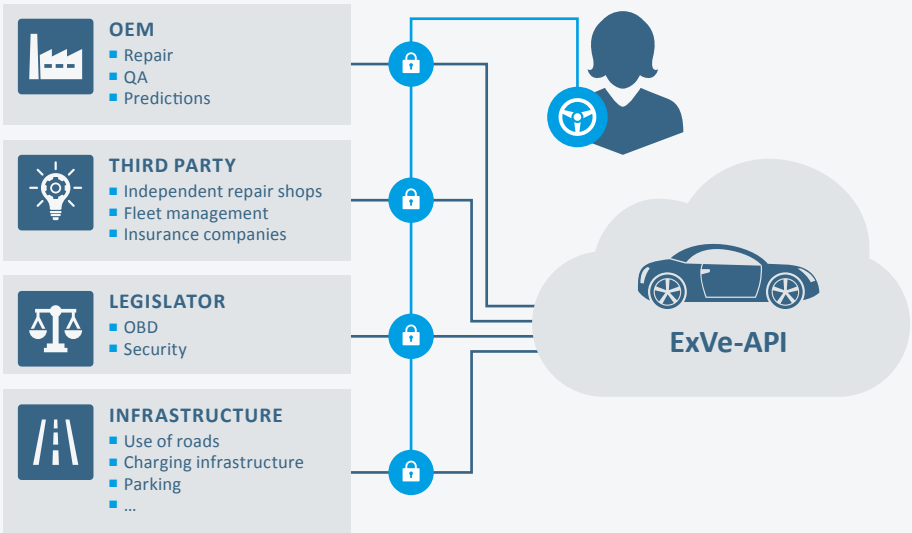
Dr. Goß recommends that the Extended Vehicle aspect should already be taken into account today when planning new diagnostics technologies and with regard to tool support for testing Extended Vehicles.

In addition to the advantages of complementary proprietary solutions, the use of standards in non-competition-relevant areas nevertheless offers numerous advantages across the entire vehicle life cycle, for example:

- increase in quality
- far shorter engineering times
- recyclability of data created
- much lower unit costs

We asked ourselves why vehicle manufacturers and suppliers might nevertheless use proprietary solutions. We agree with Dr. Goß and suspect that there is often insufficient awareness of the value of investing in diagnostics.

For decades, Softing Automotive has relied on the advantages of standardization. Dr. Goß too is convinced of the considerable savings potential of using standardized solutions. Standards must nevertheless incorporate backward-compatible scope for proprietary extensions in order to facilitate unique selling points for OEMs and other market players. Generally speaking, there are corresponding hardware and software libraries for standards, provided that they have been released.



Extended Vehicle (ExVe)

Accessing vehicle data remotely can already play a part in numerous value-added services. At present, however, proprietary solutions are provided which are often mutually exclusive, e.g. because they use dongles on the OBD jack. Standardized access via a cloud application in accordance with ISO 20078 offers different stakeholders access – under full access control by the vehicle owner. Softing's remote access technology makes it possible to create such solutions.

Softing Automotive Electronics GmbH | Richard-Reitzner-Allee 6 | 85540 Haar, Germany
Phone +49 89 45 656 -420 | **E-mail** info.automotive@softing.com | **Internet** www.automotive.softing.com