Safe Drive Initiative
The Autonomous Vehicle
Governance Ecosystem:
A Guide for Decision-Makers

COMMUNITY PAPER

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Contents

Foreword

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The accelerated rise of new technologies, changing consumer preferences and emerging mobility services are currently transforming the automotive industry, making it ripe for disruption.

We are at an exciting and significant moment of change, driven by the race to deliver the connected, autonomous vehicles (AVs) of the future. The rise of artificial intelligence, robotics and mobility services are shaking up the traditional automotive sector, paving the way for a technological shift towards fully automated driving.

Although it might seem a paradox in such a competitive sector like the automotive industry, collaboration is the only way to succeed in the major challenge posed by AVs – safety assurance.

An example of the benefits of such collaboration can be found in the semiconductor sector. In the early days of semiconductor manufacturing, microchip companies effectively competed on the basis of their manufacturing processes, and to an extent, their ability to develop clean rooms. By agreeing on best practices, industry stakeholders were able to free up resources to focus on product design and development, unlocking innovations in speed and cost reduction, spurring the growth of the computer industry.

It can be hard for companies to decide where to participate in the crowded ecosystem of alliances, coalitions, standards working groups and technical bodies. Simultaneously, regulators are trying to establish the technical footing necessary to underpin their future AV policies. While there is a vast knowledge base being developed in these coalitions and standards, it can be difficult to know where to start and which standards are appropriate references to include in policies.

Although it is true that many of these coalitions and standards organizations exist to increase commonality among the industry and drive harmonization across markets, the reality is that the vast spread of these groups are in many ways competing for space in a crowded ecosystem.

One must not overlook the benefits of participating in such groups, however. Standards working groups and industry coalitions are excellent sources of knowledge sharing, presenting the opportunity to refine the state of the art while providing industry leaders with visibility to inform strategic roadmap, product requirements and engineering decisions.

The vision of The Autonomous is to revolutionize the way the mobility industry works and help diverse stakeholders collaborate towards safe AV development. We are convinced that technical and safety challenges in AVs cannot be overcome by a single player. What the industry needs is an ecosystem of diverse members ranging from car manufacturers, technology suppliers and regulatory authorities to disruptors, thought leaders, academia and governmental institutions.

Hence, the World Economic Forum and The Autonomous have partnered to create this report and provide a clear picture of the various types of alliances, coalitions, standards bodies and partnerships available for industry decision-makers.

We hope that by highlighting the activities of these industry alliances and consortia, we will provide guidance to decision-makers and encourage them to join forces and share the enormous costs and risks of designing and building AVs. The rules of competition are redefined in today's digital economy and the value of diverse networks for the new nature of innovation in the mobility sector cannot be overstated.

We would like to thank all the people involved in this valuable project – at The Autonomous and the World Economic Forum – for their thorough and professional collaboration. This joint publication is the result of our combined efforts. As the development of automated driving is far from complete, we are confident that this report provides pathways for numerous opportunities for future successful collaboration in the AV space.

Executive Summary

The conventional automotive industry is a mature, highly regulated, consolidated global business environment, which was conventionally accustomed to lengthy processes of product development and engineering developed and refined through the 20th century. However, with the advent of connectivity, electrification, automated driving and shared mobility, these titans of industry have been forced to become agile, fast-moving organizations as driven by the race to deliver the connected, autonomous vehicles (AVs) of the future.

The automotive industry, being so established, has developed alongside a substantial ecosystem of technical bodies to develop international, regional and national standards to enable conformity, safety and harmonization of engineering efforts across markets. With the AV sector emerging so rapidly, the international standards bodies' lengthy process of standards development is being tested as industry and policy-makers consider their future needs for assessing the safety of automated vehicles.

This has given rise to a rapidly growing ecosystem of industry alliances and consortia, as industry stakeholders come together to co-create guidance, technical solutions and other tools in the absence of suitable standards – although many of these activities are intended to precede and evolve into technical standards themselves, or provide supplementary technical knowledge to accompany standards.

These alliances and consortia are typically formed to address a specific industry need, and hence are often focused on a singular domain, topic or common purpose. With an ever-increasing number of alliances and consortia forming, it becomes difficult for industry decision-makers to map the ecosystem, decide where to participate, or how to utilize the know-how produced from these consortia.

The reason for this is twofold. First, these consortia typically work independently of one another, with little alignment on common goals across groups. Second, there is a lack of a "single picture" summarizing the focus of these consortia.

The purpose of this white paper is to provide a landscape of relevant industry alliances, consortia and other groups, while also highlighting the activities of key standards bodies, to provide guidance to decision-makers from industry, as well as other stakeholders from the public sector about these activities.
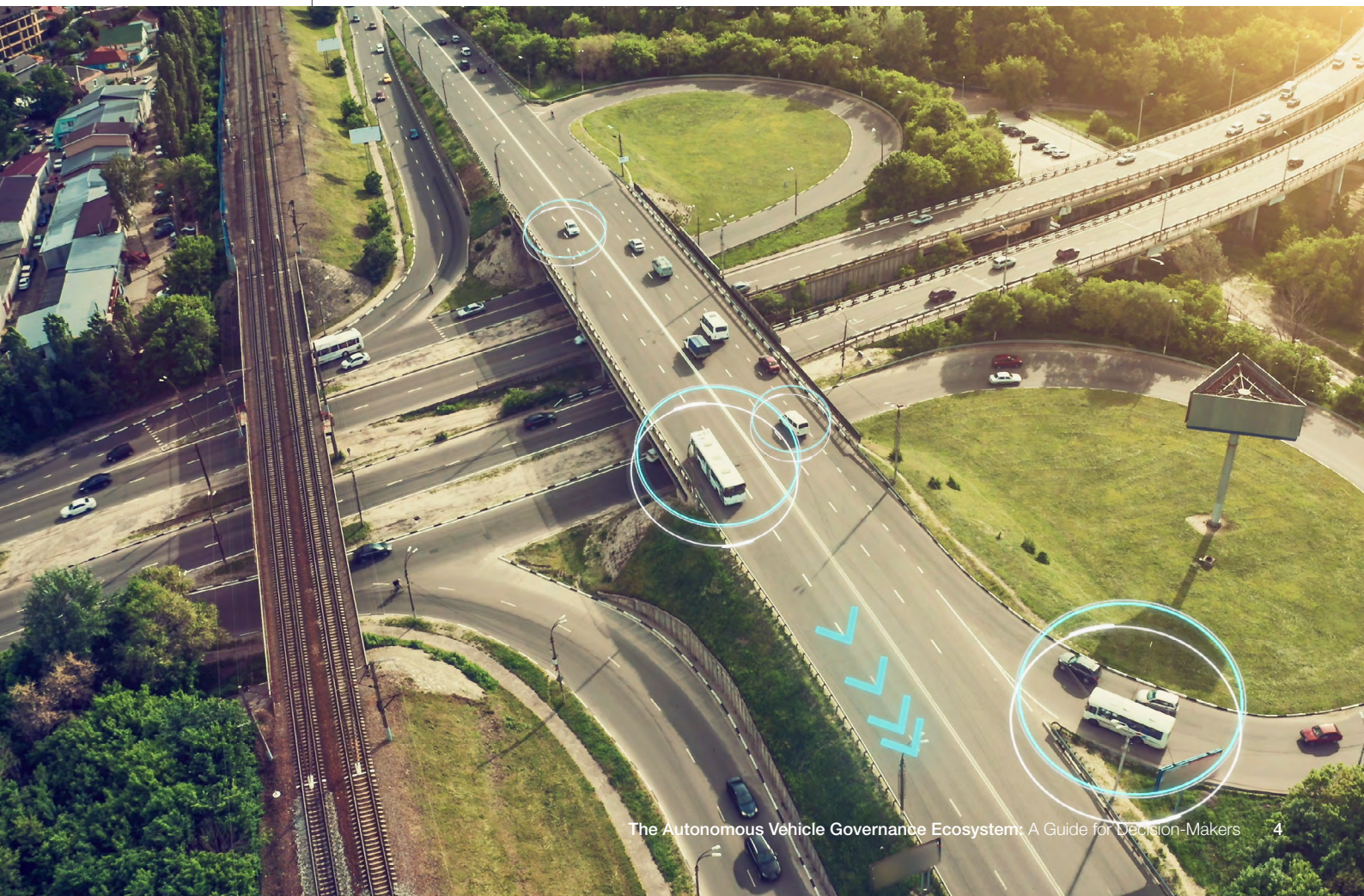
1 | Ecosystem Overview

How industry consortia, standards bodies and regulators collaborate in the automotive sector.
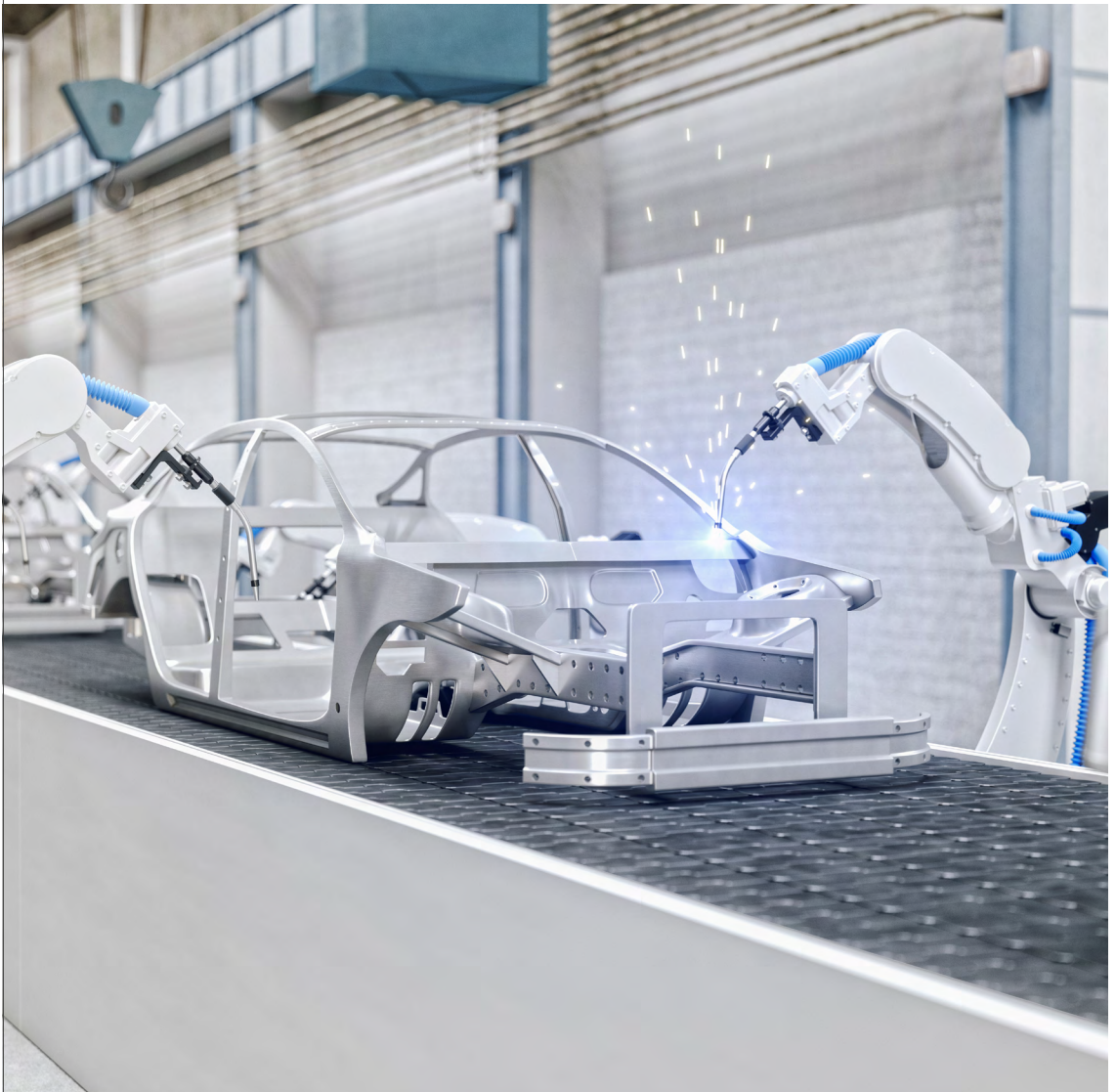
Standards bodies, industry consortia and regulators co-exist in a mutually beneficial ecosystem, driven by the common need to develop governance solutions and technical guidance.
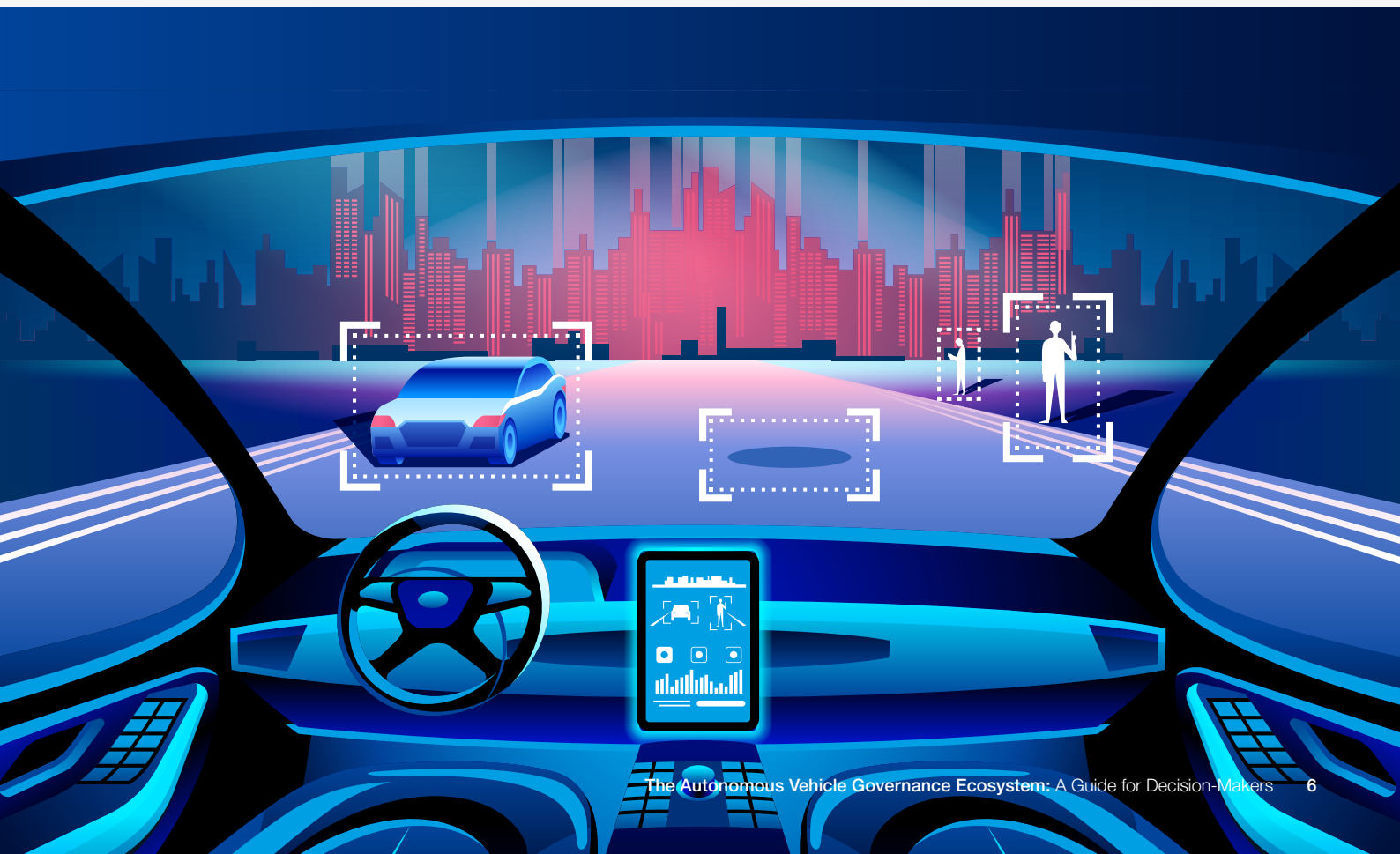
FIGURE 1 | Autonomous vehicle governance ecosystem

Autonomous vehicle industry bodies, alliances and other coalitions have been formed in recent years to address governance gaps, increase collaboration and knowledge sharing, initiate pre-standards research and in some cases advocate for specific policy positions.

Standards bodies are the conventional source of knowledge sharing, harmonization and standardization developed to support the automotive industry's needs.

A significant portion of automotive standards activity is geared toward engineering safety, so it is natural that these standards organizations are intensely focusing their efforts on autonomous driving.

Regulators, governments and policy-makers are responsible for setting out requirements for autonomous vehicles in their respective markets, through enacting regulations, laws and in some cases sponsoring the development of national standards.

Industry Alliances
& Consortia

Influence & advise

Initiate & support

Regulators

Sponsor or commission

Provide knowledge base
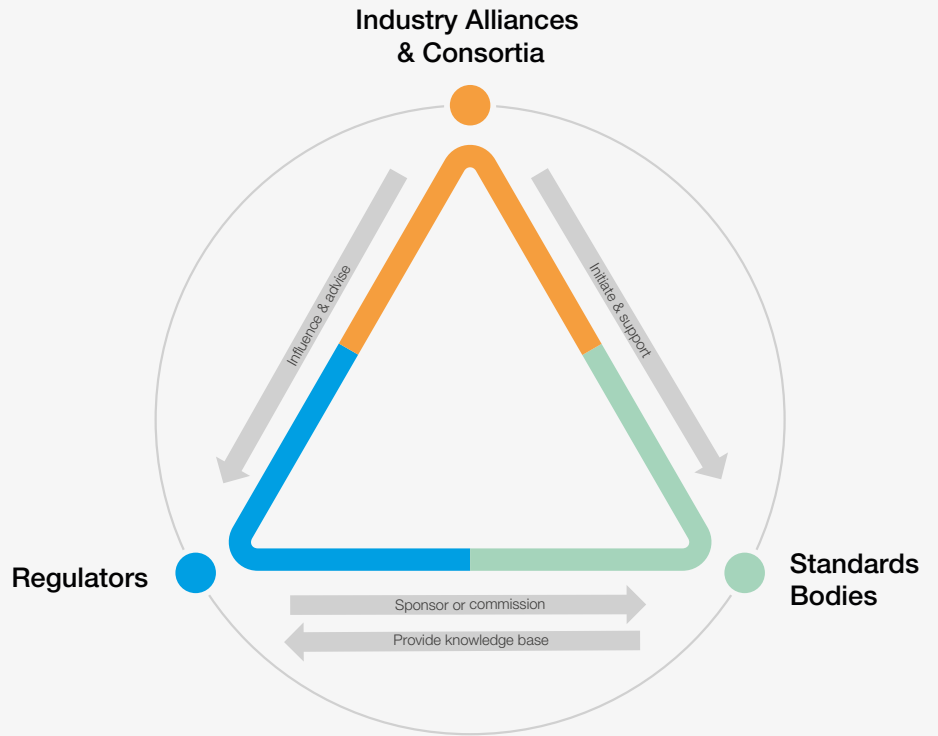
Standards
Bodies

(2) Standards Bodies

This section highlights a selection of leading standards organizations that are actively developing standards for AVs.
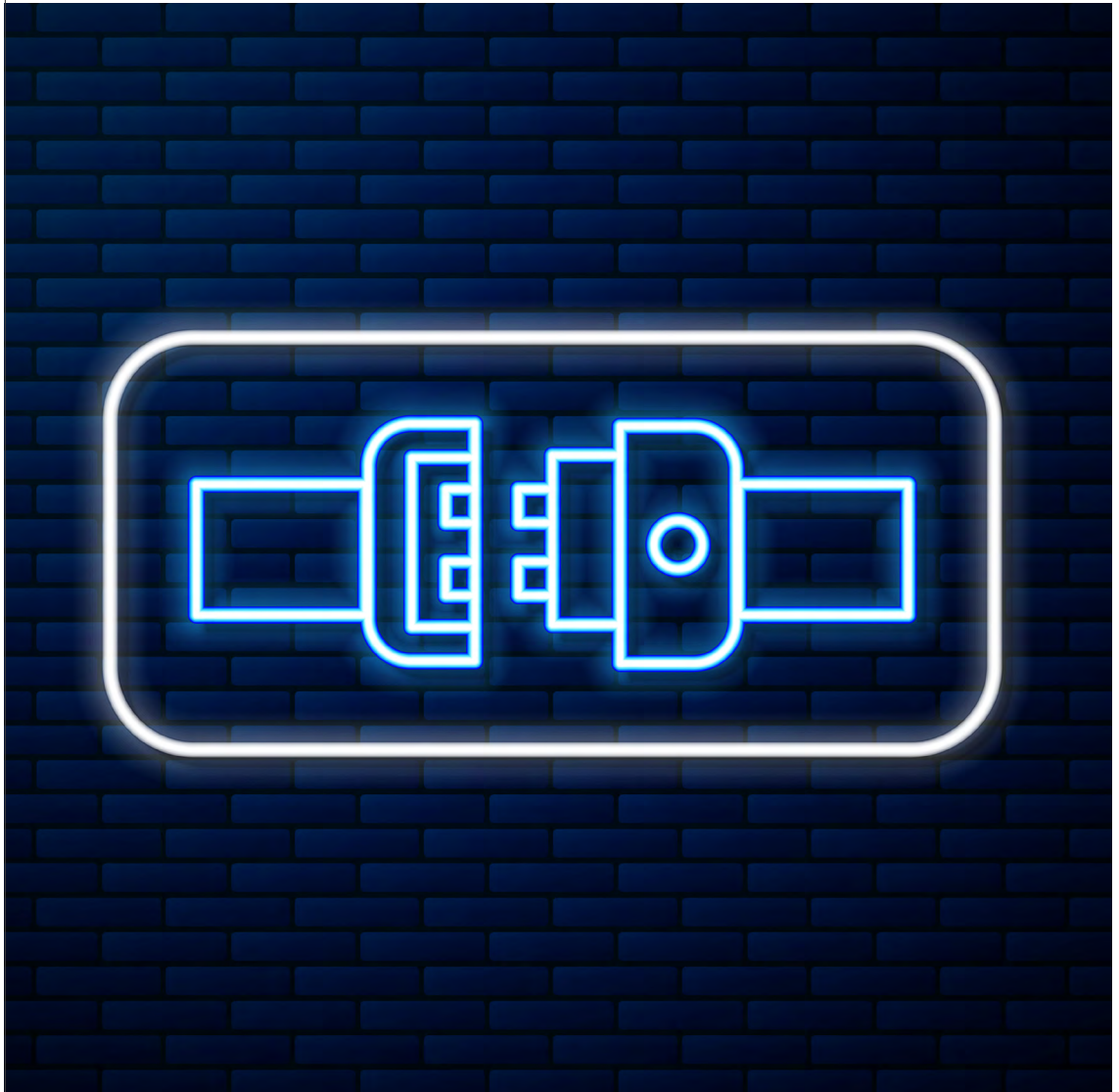
Broadly, the purpose of standards organizations in the automotive sector is to develop, produce, publish and maintain technical standards to meet the needs of the automotive sector. To date, a large portion of automotive standards development has focused on safety, and many of the leading bodies developing standards for autonomous vehicles are doing so by building on existing work in conventional safety features, across both passive (such as seatbelts) and active (collision avoidance and mitigation) safety systems.

Many standards are voluntary in nature, meaning that they are offered for adoption by industry stakeholders without being codified into a legal mandate, although some standards are adopted by legal regulators and become mandatory in a given market. Some governments commission standards bodies (which may be fully or partially funded by the government) or other agencies specifically to undertake standards development for the purposes of fulfilling a role in regulations. For example, in the United Kingdom, the British Standards Institution (BSI)'s autonomous vehicle activities are highly integrated with the broader work of the UK government to support the development of AV policy from a technical standpoint.

This section highlights a selection of leading standards organizations that are actively developing standards for AVs.
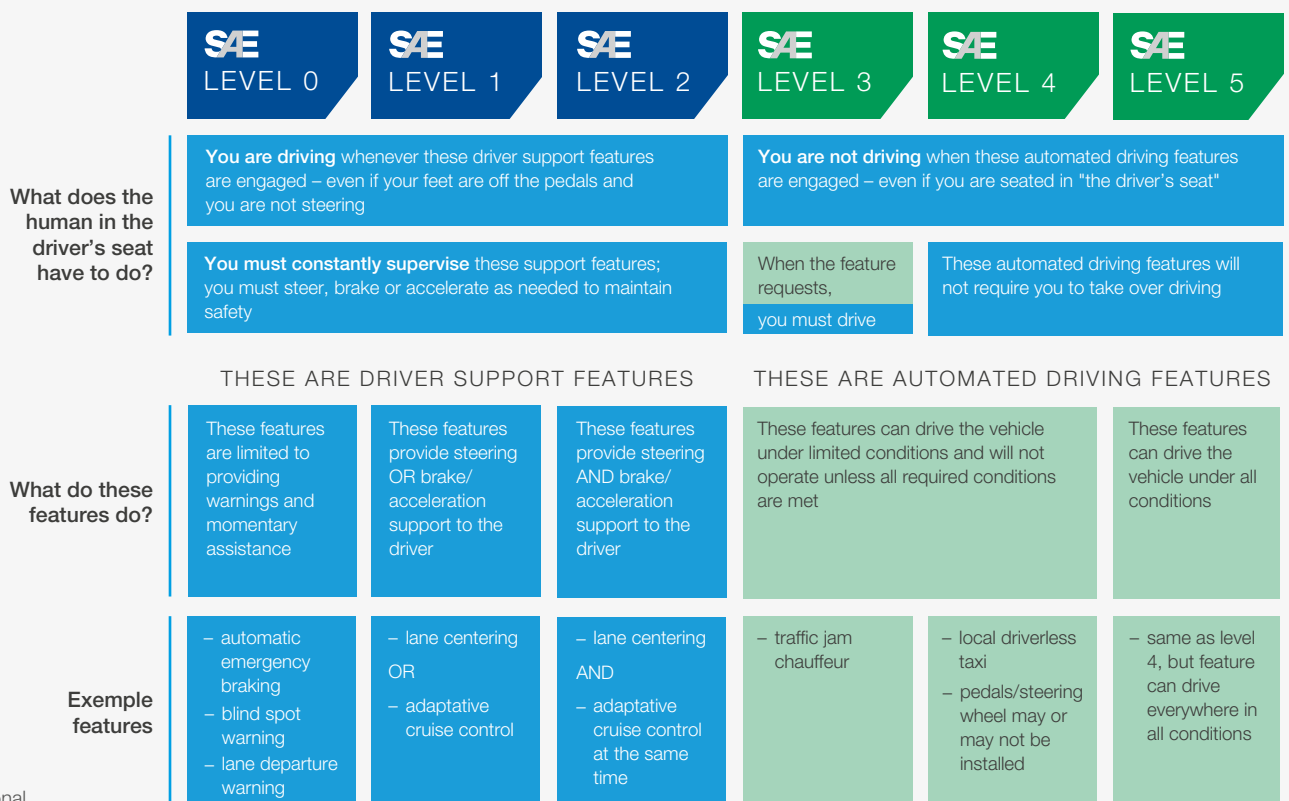
2.1 | SAE International

SAE International (SAE), formerly known as the Society of Automotive Engineers, is a professional association and standards organization headquartered in the United States. Originally founded in 1904, SAE's initial focus was to establish a member base of automotive engineers and publish a journal, compiling technical papers and knowledge from the industry. As of 2019, SAE had 128,000 members in 94 countries.[1] SAE is a member-funded organization.

SAE's stated mission is to advance mobility knowledge and solutions for the benefit of humanity;[2] this translates to a vision to connect and educate mobility professionals across industries and to build voluntary, consensus-based standards. As of 2018, SAE maintained an online database of over 37,000 standards, covering domains including safety, performance, quality, cost optimization and product life cycle management.[3]

Building on a long history of developing automotive standards, SAE is highly active in the AV sector. The most ubiquitous of these is SAE J3016 Levels of Driving Automation, first published in 2016.[4] Commonly known as SAE Levels, these terms have become widely adopted to describe driver assistance and automated driving systems around the world. These levels of driving automation were not intended to form the basis of policy frameworks, rather to provide a taxonomy to classify the conceivable spectrum of automated driving systems.

FIGURE 2 | **SAE J3016 – Levels of Driving Automation**

	SAE LEVEL 0	SAE LEVEL 1	SAE LEVEL 2	SAE LEVEL 3	SAE LEVEL 4	SAE LEVEL 5
What does the human in the driver's seat have to do?	You are driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering			You are not driving when these automated driving features are engaged – even if you are seated in "the driver's seat"		
	You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety			When the feature requests, you must drive	These automated driving features will not require you to take over driving	
	THESE ARE DRIVER SUPPORT FEATURES			THESE ARE AUTOMATED DRIVING FEATURES		
What do these features do?	These features are limited to providing warnings and momentary assistance	These features provide steering OR brake/ acceleration support to the driver	These features provide steering AND brake/ acceleration support to the driver	These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met		These features can drive the vehicle under all conditions
Exemple features	– automatic emergency braking – blind spot warning – lane departure warning	– lane centering OR – adaptative cruise control	– lane centering AND – adaptative cruise control at the same time	– traffic jam chauffeur	– local driverless taxi – pedals/steering wheel may or may not be installed	– same as level 4, but feature can drive everywhere in all conditions

Source: SAE International

Beyond a broad portfolio of standards, taxonomies and other materials to support industry development of AVs, SAE has also launched the Automated Vehicle Safety Consortium (AVSC) to bring together industry experts involved with the testing and development of autonomous vehicles to share knowledge and develop and publish best practice guides specifically to further the safe deployment of AVs.[5]

2.2 | ISO

The International Organization for Standardization (ISO) is an international body comprising representatives from 165 national standards organizations, and is headquartered in Geneva, Switzerland. ISO has published over 23,000 international standards covering a wide range of sectors in technology and manufacturing. Its standard development activities are led by 792 technical subcommittees, in collaboration with a large number of international, regional and national organizations.[6]

ISO's mission is to facilitate world trade by providing common standards among nations, and to build common best practices for development of technical standards worldwide.

ISO's position as a global standards body gives it a unique ability to lead the co-creation of global technical standards in many industries. To date, ISO's work in the AV sector has been largely through the development of automotive safety standards, which are also applicable to conventional passenger cars. The most frequently discussed standards in the AV sector are:

– **ISO 26262: Road vehicles – Functional safety**[7] – defines functional safety for automotive equipment applicable throughout the life cycle of all automotive electronic and electrical safety-related systems.

– **ISO/PAS 21448: Road vehicles – Safety of the intended functionality**[8] – provides guidance on the applicable design, verification and validation measures needed to achieve safe system operation, reducing hazard risk of functional insufficiencies of the intended functionality even when components are operating correctly, or are impacted by foreseeable misuse.

– **ISO/TR 4804: Road vehicles – Safety and cybersecurity for automated driving systems – Design, verification and validation**[9] – provides steps for development and validation of automated driving based upon core principles of safety and cybersecurity by design.

Each of these standards represents essential engineering competences for industry stakeholders to satisfy, but they are not explicitly intended to underpin policy frameworks.

2.3 | Underwriters Laboratories

Underwriters Laboratories (UL) is a nonprofit organization whose mission is to advance public safety through the discovery and application of scientific knowledge. In addition to conducting safety science research and creating safety education programmes, UL develop standards to guide the safe, sustainable commercialization of evolving technologies, including autonomous vehicles. UL employs collaborative and scientific approaches with partners and stakeholders to drive innovation and progress toward improving safety, security and sustainability.

UL's principal activity in autonomous vehicles centres on **ANSI/UL4600: Standard for Safety for the Evaluation of Autonomous Vehicles and Other Products**, published in April 2020.

UL 4600 encompasses fully autonomous systems that can move, such as self-driving vehicles. This standard seeks to address the ability of autonomous products to perform safely and as intended, without human intervention, based on their current state and ability to sense the operating environment. The standard uses a claim-based approach, which prescribes topics that must be addressed in creating a safety case. It is intended to address changes required from traditional safety practices to accommodate autonomy, such as lack of a human operator to take fault mitigation actions.

This standard was developed with broad input and support from an extensive network of stakeholders. Significant technical contributions were provided by Philip Koopman of Edge Case Research.

Due to the rapidly advancing technology behind autonomous products, revisions to UL 4600 are underway, and a second edition is anticipated in the near future. Additionally, Underwriters Laboratories is forming a Standards Technical Panel to develop a first edition safety standard for autonomous trucking as well as a first edition for unmanned aerial vehicles.

Since the launch of UL 4600, the standard and its methods have been frequently cited in a range of global policy documents exploring the governance needs of autonomous vehicles.

2.4 | British Standards Institution (BSI)

Formed in 1901, the British Standards Institution (BSI) was the world's first National Standards Body. Its role is to help improve the quality and safety of products, services and systems by enabling the creation of standards and encouraging their use. BSI is appointed by the UK government as the designated National Standards Body and represents UK interests at the International Organization for Standards (ISO), International Electrotechnical Commission (IEC) and European standards organizations (CEN, CENELEC and ETSI). BSI publishes over 2,700 standards annually, underpinned by a collaborative approach, engaging with industry experts, government bodies, trade associations, businesses of all sizes and consumers to develop standards that reflect good business practice.

In 2019, BSI was commissioned by the UK government's Centre for Connected and Autonomous Vehicles (CCAV) to lead a programme of guidance and technical standards, working with industry, to support the development of automated vehicles in the UK. The programme has been delivered in conjunction with the UK Department for Business, Energy and Industrial Strategy, Department for Transport, Innovate UK and Zenzic.

In creating a series of BSI Publicly Available Specification (PAS) documents, a type of fast-track standard, and supporting resources such as a live vocabulary of CAV terms and definitions, BSI is supporting AV trials and development in the United Kingdom. The documents have been downloaded in more than 50 countries, thus providing an important source of good practice globally.

Examples include:

– **BSI PAS 1881 – Assuring the Safety of Automated Vehicle Trials and Testing** – is currently being used to support the design and assessment of safety cases on automated vehicles trials.[10]

– **BSI PAS 1883**, published in 2020, provides a taxonomy for describing the attributes of the ADS (Automated Driving Systems) Operational Design Domain, or ODD. PAS 1883 will help organizations to communicate the attributes of their vehicles ODD in a consistent, reliable way, promoting confidence and safety.[11]

– **PAS 1882 – Data collection and management for automated vehicle trials** – provides a specification for collection of accident data during AV trials and **PAS 1884**, both due to publish in 2021, guidelines for AV safety drivers.[12]

BSI develops its standards through an open, consensus-based process involving all relevant stakeholders. A key feature of BSI's programme has been the integration with the UK's CAV ecosystem, including trialling organizations and live R&D projects, helping ensure good practice found in BSI's PAS 1880 series is based on practical experience from running and operating real AV trials and from UK research.

2.5 | ASAM

The Association for Standardization of Automation and Measuring Systems (ASAM) is a non-profit organization specializing in standardizing toolchains in the automotive development and testing domain. ASAM's activities focus on six key domains: measurement and calibration, diagnostics, ECU networks, software development, data management and analysis, and simulation. Latest efforts have been to develop automated driving simulation model data exchange standards. Projects under that domain are known as the OpenX series of standards, namely OpenDRIVE, OpenCRG, OpenSCENARIO and OSI (open simulation interface).

2.6 | IEEE

The Institute of Electrical and Electronics Engineers (IEEE) is a non-profit member-based institution dedicated to advancing technology through publishing scientific and industry best practice work. IEEE is also engaged in standardization efforts. The standards are developed in working groups and address a wide range of domains, including aerospace, power electronics, communications and information technology. To address challenges in the automated driving domain, IEEE is currently facilitating two working groups:

– IEEE P2846, also known as Assumptions for Models in Safety-Related Automated Vehicle Behavior, aims to achieve a minimum set of reasonable assumptions used in foreseeable scenarios to be considered for road vehicles in the development of safety-related models that are part of automated driving systems (ADS).

– IEEE P2851, also known as Exchange/ Interoperability Format for Safety Analysis and Safety Verification of IP, SoC and Mixed Signal ICs, provides an exchangeable exchange/ interoperability format for safety analysis and safety verification activities.
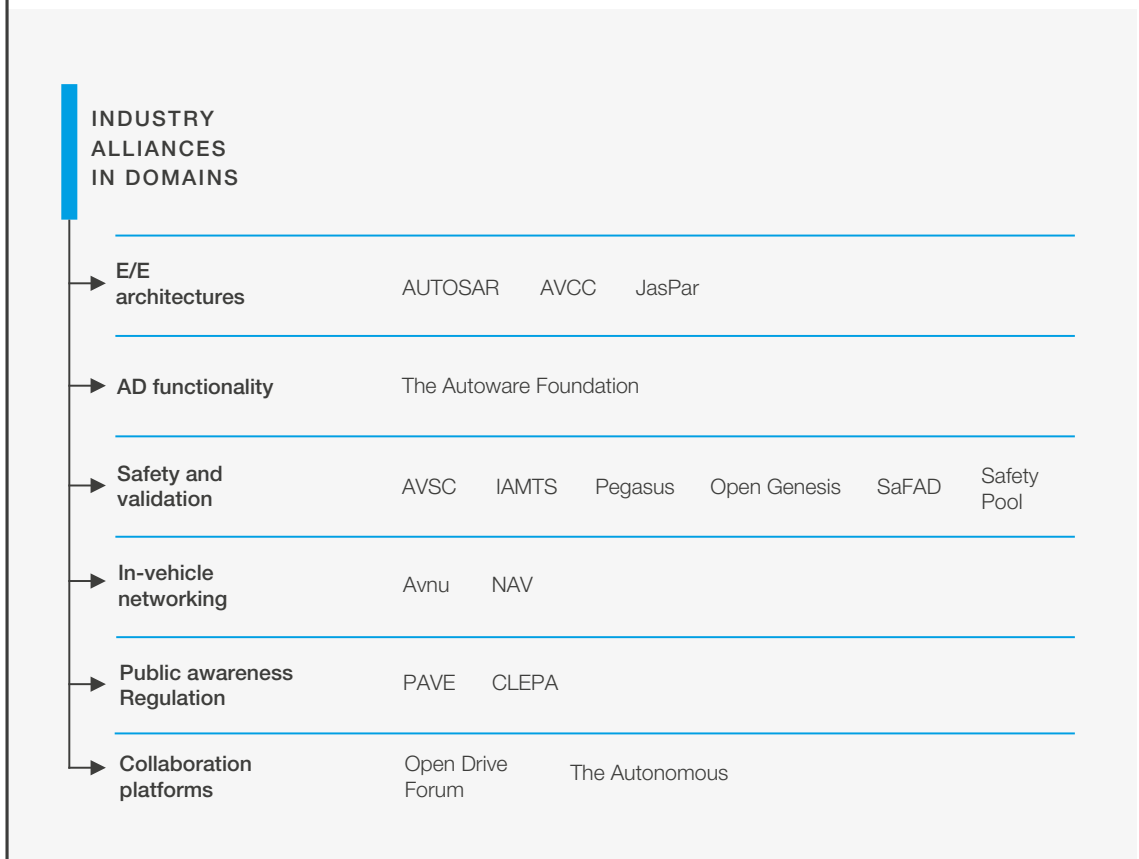
(3) Alliances and Consortia

This section highlights a selection of industry alliances and consortia that have formed around key issue areas.
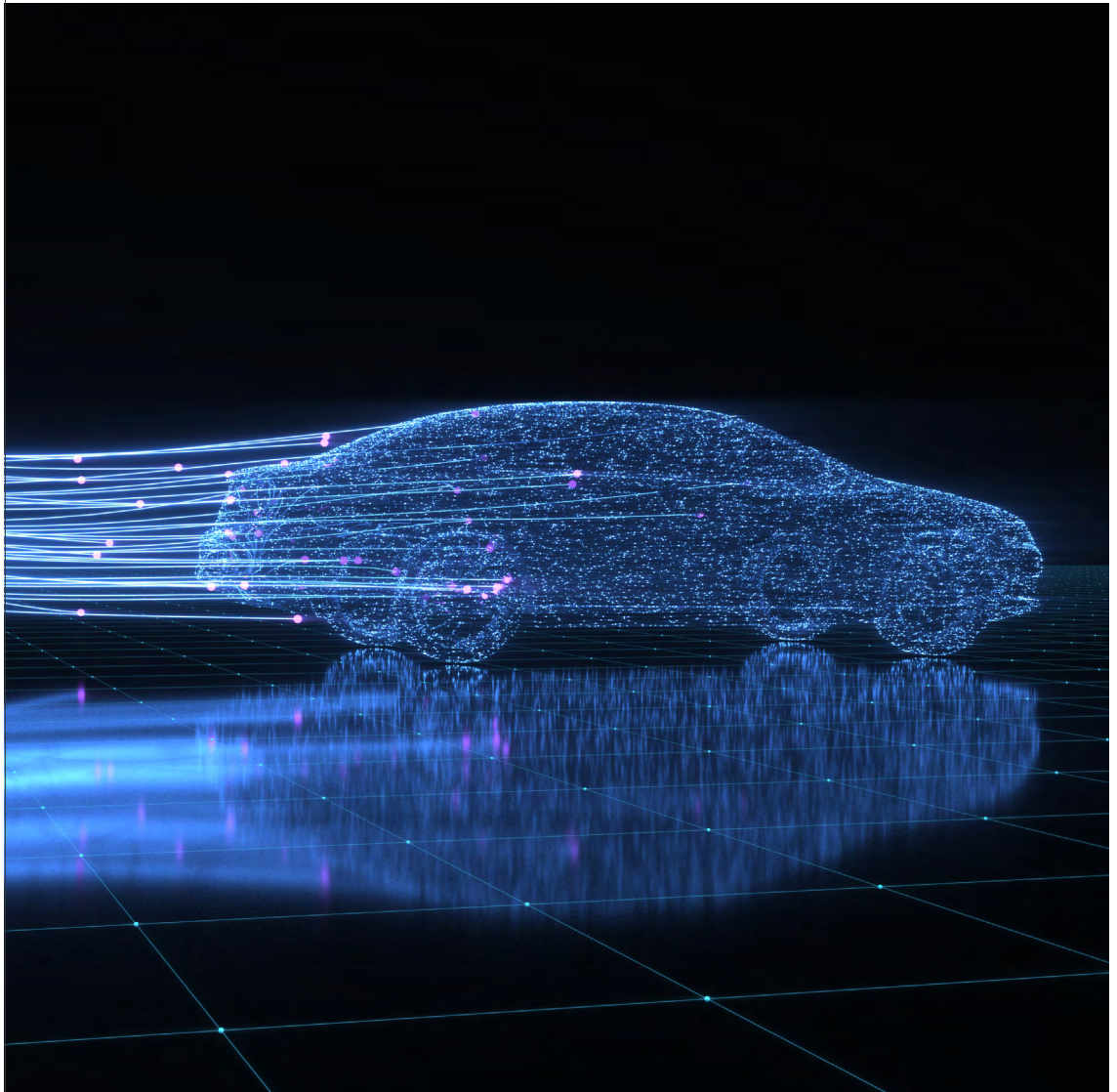
Over the years, various industry alliances have been created to share the burden of relevant challenges in the automotive domain. Today, the development of automated vehicles opens a vast amount of multi-disciplinary challenges that further emphasizes the need for shifting from a do-it-alone approach towards a do-it-together one. This section highlights a selection of industry alliances and consortia that have formed around key issue areas.

FIGURE 3 Landscape of industry alliances

INDUSTRY ALLIANCES IN DOMAINS

E/E architectures	AUTOSAR	AVCC	JasPar			
AD functionality	The Autoware Foundation					
Safety and validation	AVSC	IAMTS	Pegasus	Open Genesis	SaFAD	Safety Pool
In-vehicle networking	Avnu	NAV				
Public awareness Regulation	PAVE	CLEPA				
Collaboration platforms	Open Drive Forum	The Autonomous				

3.1 | Electrical /Electronic (E/E) Architectures

With the enormous pace of innovation in the vehicle's functionality, the amount of electronics hardware, network communications, software applications and wiring (all converging under the name electrical/electronic (E/E) vehicle architecture) found in vehicles has increased significantly. A contemporary passenger vehicle contains dozens of electronic hardware elements that run a considerable amount of software and are interconnected across multiple domains and functions. This leads to a significant increase in complexity, development effort and cost of automotive electronic architectures. To address these challenges, the automotive industry is collaborating on novel E/E architectural approaches.

AUTOSAR
One alliance aiming at addressing the complexity challenge is AUTOSAR (AUTomotive Open System ARchitecture).[13] Established in 2003, it is a global alliance that includes car manufacturers, technology suppliers, and companies from the semiconductor and software industry. Throughout the years, AUTOSAR has proposed and realized software architectural concepts and development methodologies that have made a significant impact in automotive software development.

Today, AUTOSAR is tackling arising challenges resulting from the introduction of AVs. The so-called AUTOSAR Adaptive Platform focuses on solutions for high-performance computing automotive electronic architectures and use cases, such as fail-operational capabilities. The adoption of all AUTOSAR methodologies is 100% voluntary.

Autonomous Vehicle Computing Consortium (AVCC)

The technological innovation necessary to power automated and assisted driving vehicles requires collaboration at an industry level, culminating in a common architecture on which compute systems can be based. Significant challenges to deployment include:

– Ultra-high-performance computing requirements within the power, thermal and size constraints of a vehicle

– Compute adjustments for the workload as you move from assisted driving to fully autonomous operation

– Security and safety concerns such as firmware protection, threat modeling, privacy, regional regulatory and standards compliance

– Public fears and misperceptions

The AVCC brings the industry together to help focus industry innovation[14] around key initiatives such as:

– Defining a reference architecture and platform to meet the automated and assisted driving performance goals within the power, thermal and size constraints of a vehicle

– Developing software API requirements for each building block in an automated and assisted driving system

– Offering recommendations and benchmarks to help move today's prototype systems to deployment at scale

– Acting as an innovation hub to ideate over common technological challenges

From reference architecture to security specifications, performance benchmarking to image processing specifications, the number one AVCC objective is to make automated and assisted driving vehicles a mass market reality.

3.2 | Automated Driving Functionality

An essential part of autonomous vehicle development is the core Automated Driving System functionality, a significant portion of which is the development of software to sense the vehicle's environment, and plot and execute the dynamic driving task.

Autoware Foundation

The Autoware Foundation aims at developing open-source solutions in the scope of self-driving mobility.[15] Members of the foundation include key automotive industry players as well as government and research institutions.

Three key umbrella projects developed and promoted by the Autoware Foundation are Autoware.AI, Autoware.Auto and Autoware.IO.

Autoware.AI, based on ROS 1, was the original Autoware open source project. the Autoware.

AI project has successfully built "All-in-one open-source software solution enabling automated driving functionality (localization, detection, prediction, and planning).

Autoware.Auto is based on a redesigned architecture, some times known as Autoware 2.0. It is built on ROS 2 and following best practices and standards to be high quality and easier to certify.

Finally, Autoware.IO looks EEA of the vehicle, functional safety aspects of the hardware and software system, integration of sensor technologies as well as different silicon platform implementation. The Autoware.IO project aims at developing a hardware reference platform with tools, unified interfaces, and test frameworks to enable the integration of automated driving functionalities developed leveraging Autoware.AI and Autoware.Auto software stacks.

3.3 | Safety and Validation

Recently, the industry has found that the so-called brute force testing approach that focuses on extensive testing of vehicles on public roads by driving is not an efficient single way of proving automated vehicles are safe. Instead, a multi-disciplinary set of complementary approaches are needed to develop and demonstrate AV safety. Today, several industry alliances exist to address challenges in AV safety and validation.

AVSC

The Automated Vehicle Safety Consortium (AVSC) aims at establishing safety and testing principles for SAE Level 4 and Level 5 automated driving systems. The AVSC is comprised of a range of car manufacturers, automated driving technology developers and a standards developing organization.[16]

The AVSC focuses on defining best practices for:

– Testing AVs at the development and deployment stage

– Data collection and sharing for event reconstruction

– Interactions between AVs and emergency services

These best practices are intended to enhance and accelerate relevant standards. Some of their recently released best practices include:

– Data collection for automated driving system dedicated vehicles to support event analysis

– Passenger-initiated emergency trip interruption

– Description of a framework for operational design domains

IAMTS

The International Alliance for Mobility Testing and Standardization (IAMTS) is an international alliance focusing on the testing, standardization and certification of automated vehicles.[17] The alliance includes a wide range of members ranging from system suppliers and automated driving technology developers to research, standardization and certification bodies.

The activities of the alliance can be categorized into three main functions:

– Providing an overview of automated driving test bed facilities worldwide

– Building a rich portfolio of test beds for automated vehicles

– Defining test bed quality criteria, which are essential for the audit and certification process

Pegasus

In addition to long-term partnerships and consortia, the industry has been collaborating on short-to-mid-term research projects. One example is the Pegasus project, a joint project between 16 industry and research partners, TÜV SÜD and the German Federal Ministry of Economic Affairs and Energy, which aims to assess and validate AVs.[18]

The objective of the project, which ran from 2016 to 2019, was to establish generally accepted criteria, tools, methods and scenario databases for the testing and validation of AVs. The project's outputs are currently forming the basis of a standardization process at ASAM with the following names: OpenCRG, OpenDRIVE and OpenSCENARIO.

Safety Pool

Led by Deepen.ai and supported by the World Economic Forum, Safety Pool is an open incentive-based brokerage of driving scenarios shared among autonomous vehicle developers. Safety Pool's primary purpose is to encourage AV companies to share scenario data with one another to further development of AVs, while ensuring that near misses recorded in the real world are not repeated.[19]

Safety Pool is also being explored as a potential open scenario library to underpin future performance-based regulations for AVs, as developed by the Forum's Safe Drive Initiative.[20]

SaFAD

A voluntary collaboration group of 12 automotive industry leaders, ranging from OEMs, tier one suppliers and technology providers, established Safety First for Automated Driving (SaFAD) to support the further standardization activities for SAE Level 3 and Level 4 automated driving systems. An outcome of their work has been a technical white paper, which describes a comprehensive approach for safety-relevant topics in the automated driving system.[21]

In this approach, SaFAD defines 12 principles for safety by design across engineering capabilities, elements and architectures. Relevant verification and validation methods are described to demonstrate a positive risk balance of an automated driving system compared to an average driver. The principles and methodology from the SaFAD white paper are being used in the ISO standardization process under the name ISO/PRF TR 4804.[22]

OpenGenesis

The OpenGenesis project is a collaboration between TÜV SÜD and the German Research Center for Artificial Intelligence (DFKI).[23] The project aims to build a collaboration platform to share knowledge, methods, and tools for assessment and certification of artificial intelligence-based autonomous driving applications.

3.4 | In-Vehicle Networks

The in-vehicle networks of today require high-bandwidth, low-latency, while being reliable and light-weight. This paper identifies two alliances that are working on addressing this subject.

Avnu
The Avnu alliance comprises Ethernet technology developers and silicon suppliers that work together on low-latency, time-synchronized and highly reliable communication network solutions.[24]
The most prominent examples of their work are Audio Video Bridging (AVB), Time Synchronized Networking (TSN) standards that enable classic Ethernet networks to achieve the low-latency target goals, time-synchronization and high reliability.

NAV
The Networking for Autonomous Vehicles (NAV) alliance aims at establishing an in-vehicle network platform that meets the needs of highly of future automated driving systems.[25] The alliance focuses on:

– Developing a specification for high speed, in-vehicle networks to improve their interoperability, security and reliability

– Promoting best practices and solutions that are compatible with these specifications

Members of the alliance comprise OEMs, tier one suppliers and mapping technology developers.

3.5 | Public Awareness and Regulation

Public adoption of autonomous vehicles is a crucial to their acceptance and widespread use. Two such initiatives have been identified in this study:

PAVE
People in Autonomous Vehicles in Urban Environments (PAVE) is a coalition that gathers industry and non-profit groups to enhance public and policy-makers' understanding of autonomous vehicle technology.[26] Their intention is educational and does not advocate for a specific technology or public policies. PAVE achieves this by:

– Providing an educational website and social media channels

– Hands-on demonstrations of driverless vehicles

– Organizing relevant conferences and public forums to engage with the public

– Informing policy-makers with real facts about self-driving technologies to help them make informed decisions

CLEPA
CLEPA brings together over 120 global suppliers from the automobile sector and more than 20 national trade associations and European sector associations for the sake of closer alignment on a diverse set of regulatory matters.[27]

The association aims to tackle challenges varying from reaching consensus and international adoption of a legal framework for road safety (testing of vehicles, traffic regulations and driver training) to data processing regulations (e.g. control and management of the collected road data, data privacy, etc.), and other relevant technical standards and liability matters.

3.6 | Collaboration Platforms

The collaborations described in the past sections are all examples of groups and other bodies established to tackle particular challenges in the automotive industry and automated driving domains. Some organizations further consolidate the efforts by building a platform for collaboration between relevant automotive ecosystem actors. Below are two examples of such collaboration platforms.

Open AutoDrive Forum
The Open AutoDrive Forum has the objective of generating globally applicable, state-of-the-art solutions for automated driving that ultimately can be used as input for standardization bodies.[28]

The Open AutoDrive Forum also includes local authorities in the discussions for a closer alignment on regulatory matters. One of the focal points of the forum participants has been a reference ecosystem architecture for automated driving that includes the definition of building blocks of the automated vehicle (sensors, environmental model, localization, etc.) and the road infrastructure (e.g. digital maps, data collection centres, etc.).

The Autonomous

The Autonomous is an open platform that aims at building an ecosystem of all actors involved in the development of safe autonomous mobility. Ecosystem members range from car manufacturers, technology suppliers and regulatory authorities to disruptors, thought leaders, academia and government institutions.

The goal of The Autonomous is to generate new knowledge and technological solutions tackling key safety challenges in the autonomous mobility domain.[29] To achieve that, The Autonomous introduced two strategic streams:

1. Event Stream – aims to facilitate discussions and networking for leading executives and experts from the autonomous mobility ecosystem

2. Innovation Stream – aims to facilitate cooperation among industry to work on global reference solutions for various safety challenges. As part of the Innovation Stream,

The Autonomous will kick off and facilitate Working Groups to enable the co-creation of recommended practices and concrete developments.

The benefits of joining The Autonomous initiative are:

– Developing safe and best-in-class solutions thanks to the wisdom of the crowd

– Reducing potential liability risks by tightly working with government and regulatory institutions

– Reducing development costs by creating and agreeing on modular and reusable technical solutions and sharing development efforts

– Reducing the risk of unsuitable development, by jointly defining the state-of-art and state-of practice

– Accelerating the learning curve by collectively learning from individual failures

Acknowledgements

Contributors

The World Economic Forum's Safe Drive Initiative is a global, multistakeholder and cross-disciplinary initiative intended to help shape the development of successful autonomous vehicle policy and improve the safety of AV pilots. The project has engaged leaders from private companies, governments, civil society organizations and academia to understand AV policy, identify challenges and define principles to guide future policy solutions. The opinions expressed herein may not correspond with the opinions of all members and organizations involved in the project.

Lead authors

Endnotes

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