ANNUAL REPORT 2024

5GAA - Connected Mobility For People, Vehicles and Transport Infrastructure

5GAA
Automotive Association

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All data comprised in this report reflect
the situation until 31 December 2024.

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FOREWORD

Christoph Voigt
Chairman of the 5GAA Board

The 5G Automotive Association (5GAA) is pleased to present its Annual Report for the calendar year 2024. 5GAA brings together automotive, technology, and telecommunications companies on a global level to develop end-to-end solutions that make future mobility and transportation services smarter, safer, and more sustainable. We concluded 2024 with the update of our 2030 Visionary Roadmap, which confirms the path we have charted collectively for the global roll-out of Cellular-to-Everything (C-V2X) technology. While continuous efforts are required to achieve the global introduction of advanced use cases for connected and automated driving, we reached several key milestones throughout 2024 that we can all be proud of.

With the support of many 5GAA members, 5G-V2X Direct has been integrated into Audi and BMW vehicles to demonstrate that this pioneering technology is capable of protecting Vulnerable Road Users. In line with the 5GAA Roadmap, this demonstration underlined the continuous commitment of major European automakers to 5G-V2X following 5GAA's Open Statement in 2023. At the same event, we also showcased, for the first time on public roads in central Berlin, ready-to-deploy, interoperable safety awareness alerts via 4G and 5G networks with low latency thanks to Multi-Access-Edge Computing and precise positioning, building on a US demonstration in 2023.

In 2024, we also continued establishing our ecosystem leadership on future technical enablers with a landmark technical report outlining a clear vision for integrating Non-Terrestrial Networks (NTN) as a complementary layer to Terrestrial Networks, enhancing coverage and services for connected vehicles. Taking the technology to the road in 2025, we will follow up with the first-ever 5GAA demonstration of NTN for automotive use in Paris.

This year's report also celebrates our significant strides in advancing C-V2X technology globally and building trusted relationships with public authorities. The release of the final US Department of Transportation (US DOT) Deployment Plan for Lifesaving V2X Technologies, the Federal Communications Commission (FCC) adoption of C-V2X rules in the 5.9 GHz band, and the adoption of the EU ITS Work Programme (2024-2028) embody the authoritative voice 5GAA has become. In Asia-Pacific, we noted a growing interest from the Indian government in the potential of C-V2X, resulting in the creation of an ITS Task Force, mirrored by our new WG6 India sub-group. After our high-level delegation visit to China in 2024, we are now working to capitalise on this success for an engaging 5GAA meeting week in Shanghai in October 2025. We also maintain close dialogue with authorities and partners in Korea and Japan around the future of V2X technology.

International collaboration remains integral to our approach. Regular engagement between 5GAA members and road operators facilitates invaluable exchanges on connectivity-related topics and the infrastructure essential for a truly connected ecosystem.

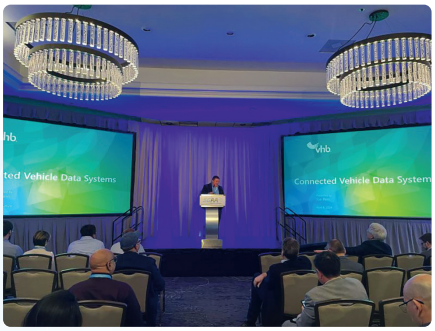
As we reflect on the past year's achievements and set our sights on future possibilities, the Board has initiated a dialogue around 5GAA strategic topics for 2025-2035 to include broader mobility advancements. V2X and safety will remain a continued priority at the heart of 5GAA's mission while we explore new areas such as worldwide connectivity and Software-Defined Vehicles (SDV). A comprehensive update will be shared with all members in the second half of 2025.

The Board would like to extend its gratitude to the dedicated members, partners, and collaborators who have played an instrumental role in shaping the continuing evolution of 5GAA. We want to personally commend 5GAA's former Managing Director - Johannes Springer - once again for his leadership and dedication to the association and welcome his successor, Christof Schmidt. Together, we pave the way for a connected, automated, and sustainable future of mobility.

HIGHLIGHTS OF 2024

1. **February:** Tokyo Meeting Week and Workshop on 'Enabling New Services with Next-Generation ITS in Japan'.

2. **March:** Joint Association Statement on US Department of Commerce's Inquiry into Connected Vehicles.



3. **April:** Orlando Meeting Week and Interactive 100 Session.

4. **August:** US DOT Deployment Plan for Lifesaving V2X Technologies.

5. **September:** ETSI C-V2X Plugtests™ and Workshop 'Gearing Towards Advanced V2X Use Cases: The Impact of ETSI Release-2 Standards', Malaga.

6. **October:** Berlin Meeting Week: Demonstration of 5G-V2X Direct and Mobile Network Communications and Conference.

7. **November:** Delegation visit to China and meetings with key stakeholders and FCC adoption of C-V2X rules in the 5.9 GHz band.

8. **December:** 5GAA Roadmap 3.0.

Vision and Strategy

5GAA bridges the automotive and telecommunication industries to address society's connected mobility needs, bringing inclusive access to more innovative, safe, and environmentally sustainable services and solutions integrated into intelligent road transportation and traffic management.

Successfully unlocking the societal benefits of V2X requires untangling complex technical, regulatory, and go-to-market issues. This is 5GAA's core mission. It implies the challenge of achieving alignment and cooperation between automakers and their suppliers, Mobile Network Operators (MNOs), service providers, and Infrastructure Owner-Operators (IOOs). The cornerstones of this vision are synergies between C-V2X Direct and Mobile/Cellular Network communications modes and technology evolution.

Our collective success will be benchmarked against the realisation of our Visionary Roadmap 2030 and its deployment milestones, which outline our strategic objectives and priority areas. This global ambition translates into specific regional strategies led by sub-groups in our policy working group.

Membership

Build a representative membership and impactful partnerships. Drive active and enriching member engagement.

INNOVATION

Supporting innovation

- Leverage innovative solutions together to advance connected mobility

STANDARDS

Contributing to standards

- Plan pre-standardization of automotive connectivity with a multi-release perspective

ADVOCACY

Advocating to policymakers

- Proactively address opportunities and threats
- Position 5GAA around strategic ecosystems

DEPLOYMENT

Advancing C-V2X deployment

- Lift barriers
- Accelerate time-to-market

Updating Our **Visionary Roadmap 2030**

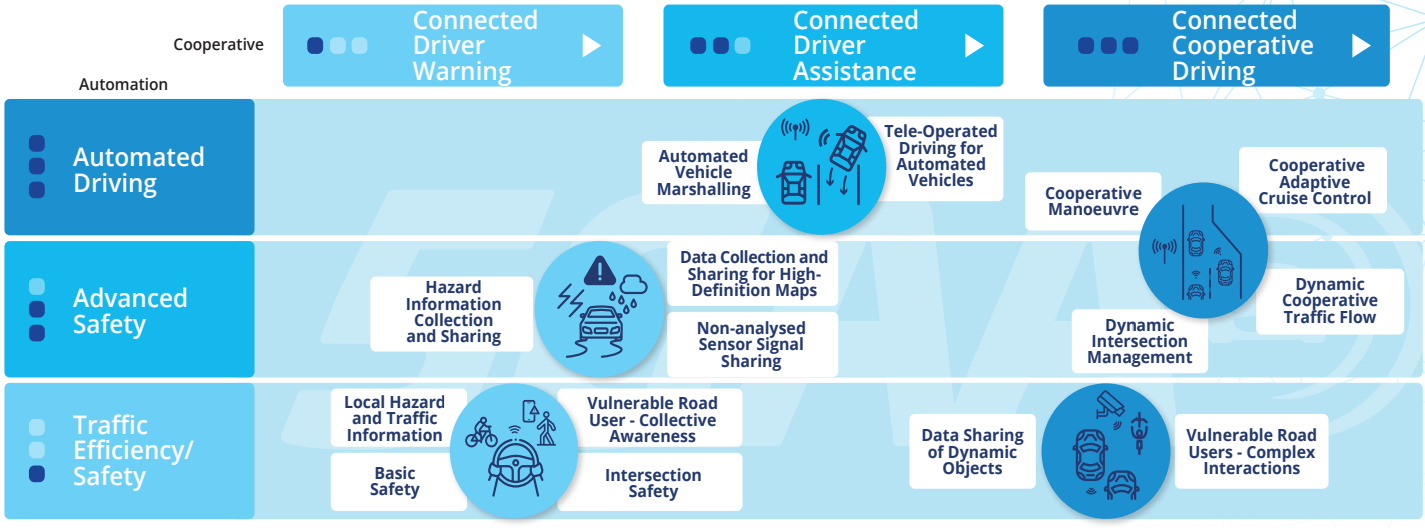
In December 2024, 5GAA released the third version of the C-V2X Roadmap. It provides an updated vision and state of play for the global deployment of more innovative, safer, and more sustainable mobility and transportation services. Since the release of the first Roadmap in 2020 and the second in 2022, the number of connected vehicles has grown significantly, with more than 300 million vehicles worldwide now featuring advanced connectivity. This has improved hazard warnings and led to more cities offering services such as green-light pre-emption for emergency vehicles. Further C-V2X market uptake is expected in Europe and China following the inclusion of new connected use cases in their respective NCAP programmes.

Overall, the C-V2X market evolution tends to confirm the trends observed in our 2022 Roadmap. Nonetheless, further work is still required for cooperative automated driving use cases to reach market readiness, e.g. around direct support of V2X for Advanced Driver-Assistance System (ADAS) functions, despite progress in level 3 (L3) vehicle certification. In Europe, OEMs have explicitly expressed their support for 5G-V2X Direct communications to pave the way for automated driving. The latest Roadmap also investigated the potential of new technologies like Multi-Access Edge Computing (MEC) and NTN for deployment from 2027 onwards.

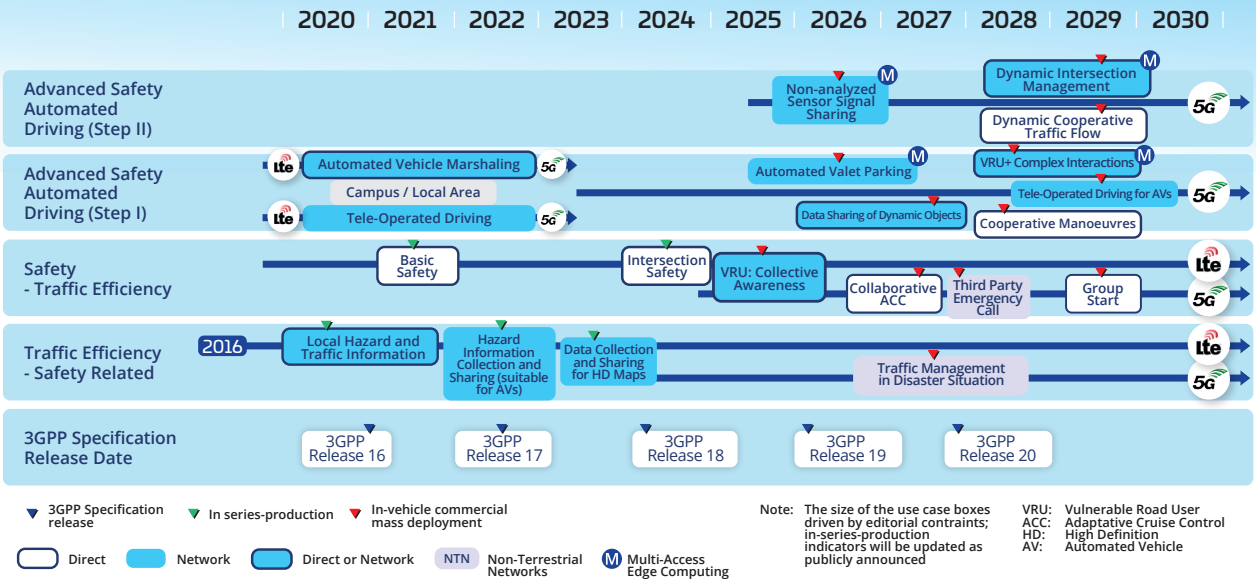
Overall, our Roadmap 3.0 reiterates the importance of collaboration between the automotive industry, telecom companies, and road operators, focusing on traffic safety and efficiency. For the first time, the Roadmap includes road operators' perspectives on deploying use cases with a particular focus on North America and the EU region. Improving traffic safety and efficiency is a core priority for road operators. This is reflected in government initiatives adopted in 2024, such as the EU ITS Directive and the US DOT V2X National Deployment Plan.

Other promising developments occurred in 2024, following South Korea's decision to opt for C-V2X in 2023. After granting a series of waivers, the US FCC adopted its final rules for the 5.9 GHz band. Japan is now reviewing its spectrum allocation for C-V2X Direct Communications. In China, the latest strategy release, 'Vehicle-Infrastructure-Cloud Integrated Systems – VICIS' (June 2024), foresees an integrated approach encompassing both Direct Communications and Mobile Networks.

Overall, the 5GAA Roadmap recommends leveraging the increasing number of connected vehicles to improve traffic safety, efficiency, comfort, and sustainability, underscoring the importance of both Direct Communications and Mobile Networks for connected mobility and protecting vulnerable road users.



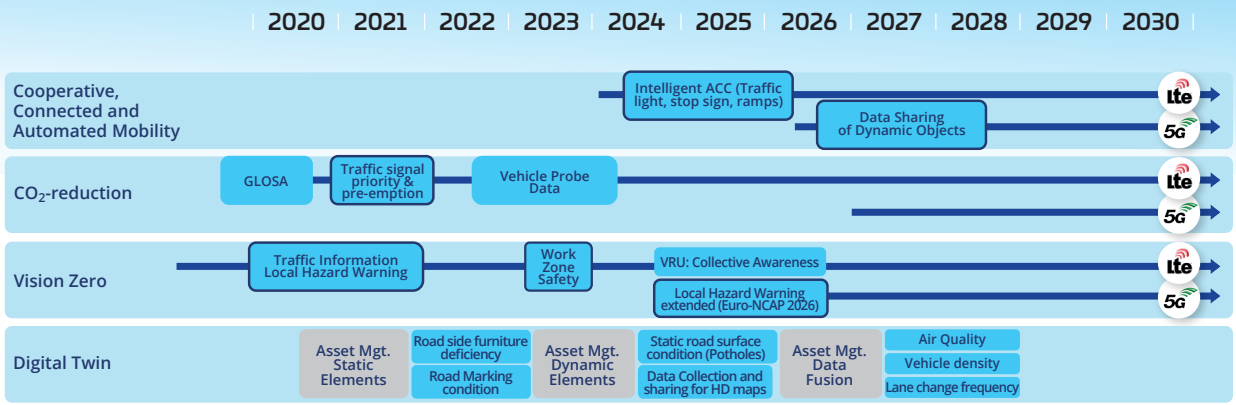
Globally expected timelines for mass deployment of advanced connected vehicle use cases



Note: The size of the use case boxes driven by editorial contraints; in-series-production indicators will be updated as publicly announced

VRU: Vulnerable Road User
ACC: Adaptative Cruise Control
HD: High Definition
AV: Automated Vehicle

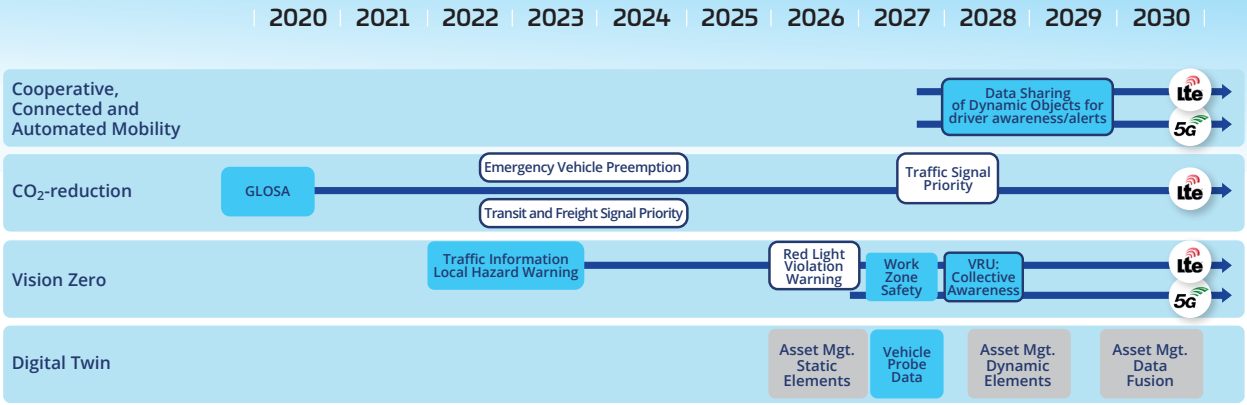
Timeline to C-V2X infrastructure deployment in Europe



Note: The size of the use case boxes driven by editorial contraints; in-series-production indicators will be updated as publicly announced

VRU: Vulnerable Road User
ACC: Adaptative Cruise Control
GLOSA: Green Light Optimal Speed Advisory
HD: High Definition

Timeline to C-V2X infrastructure deployment in US



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Based on US V2X Deployment plan

9 Priority Areas 2024-2025

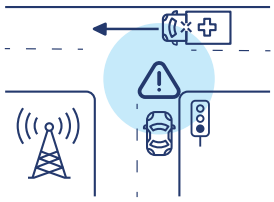
In line with the updated Roadmap, 5GAA has set forth strategic objectives and priority areas to guide its work programme focus through 2024-2025. These priorities balance the association's short-term implementation goals, leveraging existing technologies, and its longer-term ambition to prepare for the roll-out of advanced services and related technology enablers.

It also foresees a specific focus on meaningful use case groupings such as End-to-End Motion Control (e.g. Automated Valet Parking and Automated Vehicle Marchalling) to achieve market readiness by 2026 and Vulnerable Road User (VRU) Protection, which remains a key safety objective of 5GAA. Adding to the initial six priorities, the 5GAA Board incorporated three new dimensions in 2025: a clear focus on the execution and implementation of readily available technology and 'Day 1' services, working towards data integration from/to traffic management and road operators as well as defining a transition path or mitigation measures to ensure the continuity of legacy services. This annual report explores how 5GAA has addressed each priority area and the steps we have taken to achieve our goals.

By working together towards implementing our vision and this strategy, 5GAA and its members continue to nourish a thriving V2X ecosystem in all respective regions, delivering upon our ambition for society while fostering new business opportunities for our members.

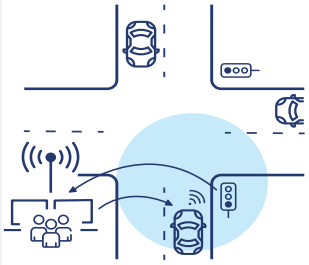
1 Day1 Implementation

Focus on execution and implementation of **readily-available technology and 'Day 1' services**



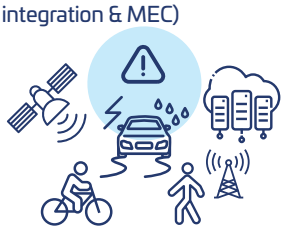
2 IOO Data Exchange

Data **delivery from/ to traffic management and road operators**



3 V2N Adoption

Speed up and scale up service penetration leveraging latest innovations (incl. Terrestrial networks (TN) / non-terrestrial networks (NTN) integration & MEC)



4 VRU Protection

Advance market access/interoperability of **VRU protection** solutions with impactful showcases

5 LTE- and 5G-V2X Direct

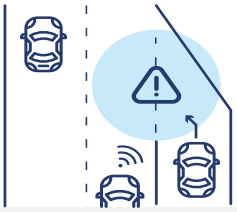
Guidance on a successful **launchpad** for **LTE-V2X Direct** (Americas, Asia) and prepare for **5G-V2X Direct** (Europe)

6 Motion Control

End-to-end **motion control service** implementation (e.g. AVP, AVM, ...) for market-readiness by 2026 (incl. input to standards, profiles, interoperability)

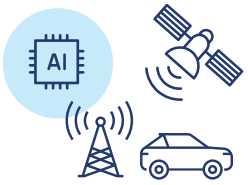
7 V2X for Automation

Prepare for **V2X** deployment incl. integration within **vehicle automated functionalities** as well as automated vehicle fleets (incl. trust)



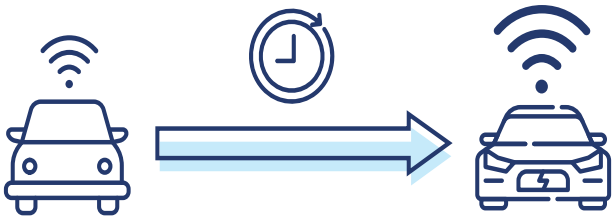
8 Technology Enablers

Scope **new technology enablers** within and beyond 5G: precise positioning, NTN, integrated sensing communication (ISAC), SDV and 'AI and compute/ML'



9 Legacy Services

Define transition path or mitigation measures to ensure continuity of **legacy services**



Advancing Connected Mobility Worldwide

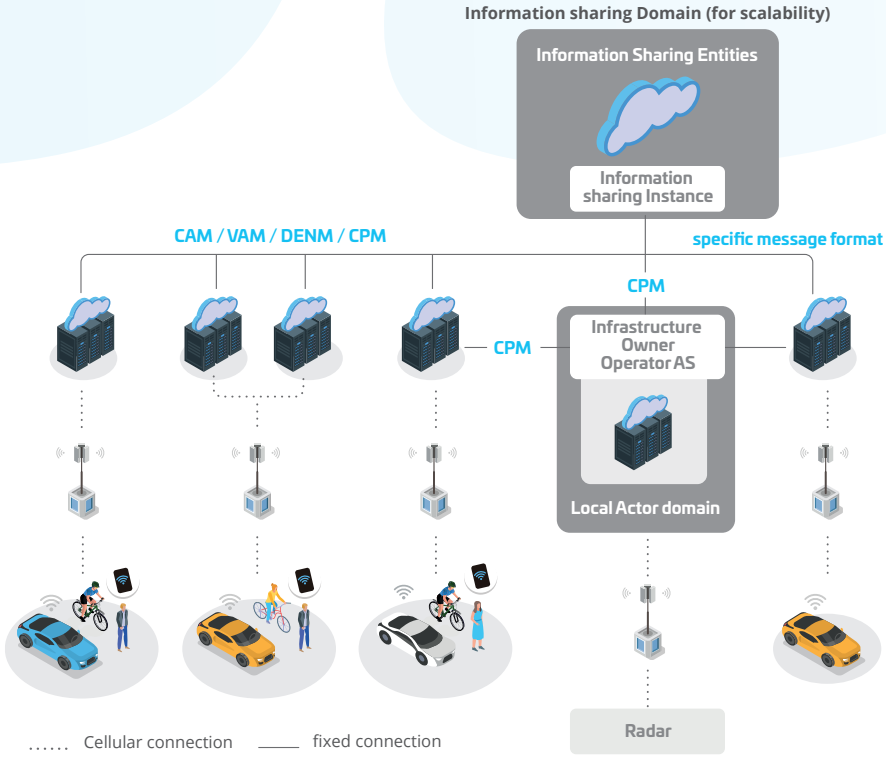
Day 1 Implementation

Today, two-thirds of new cars sold in the world's leading automotive markets are connected, and several manufacturers have already chosen 5G as the technology of choice. Yet, in most countries, efforts are still required to achieve scalable vehicular data exchange, viable architectures, and advanced network features to fully benefit from the technology.

Considering the challenges surrounding the large-scale deployment of specific use cases, the 5GAA Board launched a dedicated 'Go-to-Market' work item. The main objective of this is to better understand underlying constraints and market considerations by consistently evaluating value chain dynamics, market barriers, and scalability. After defining a robust methodology and testing it on challenging use cases – e.g. intersection safety and VRU collective awareness – the work item is looking to provide recommendations and insights to target problematic market entry barriers. 5GAA also wants to provide concrete answers to national road authorities who want to know how mobile networks would enable secure, scalable and real-time capable data exchange supporting their mobility management, public safety, and road maintenance activities. This entails a transformative approach and new digital methods of operating and collaborating between key ecosystem stakeholders, global automotive OEMs, service providers, and IOOs.

Described in the 5GAA White Paper 'Road Traffic Operation in a Digital Age: A Holistic Cross-Stakeholder Approach', the novel V2N2X information-sharing system architecture ensures bidirectional communication delivering static, semi-static, and near real-time data for safe and efficient transportation. It has triggered substantial interest by the Intelligent Transportation Systems Joint Program Office (ITS JPO), reflected in the US Department of Transportation (USDOT) plan to accelerate V2X deployment 5GAA also clarified the established best practices around security, privacy, and data quality for Mobile Network Communications (Uu) in a dedicated position paper.
A new work item on V2N2X is in the pipeline as a follow-up. It aims to outline integration paths with national ITS reference architectures and potential enhancements per stakeholder system operation required to make the end-to-end information flows and their systems real-time capable.

Lastly, 5GAA launched a new work item on the C-V2X Application Reasonableness for Transportation Safety (CARTS) to assess KPIs for C-V2X communication interfaces, focusing on safety and mobility as well as environmental and convenience benefits. It thus concentrates on near-term deployable V2X systems that provide safety alerts without controlling the vehicle. The project will also address incremental improvements in mobile network and direct communication technologies.



Scan the QR code to read the 5GAA White Paper.

Scan the QR code to read the Position Paper.

Scan the QR code to read the 5GAA V2N2X Report.

V2N Services Penetration

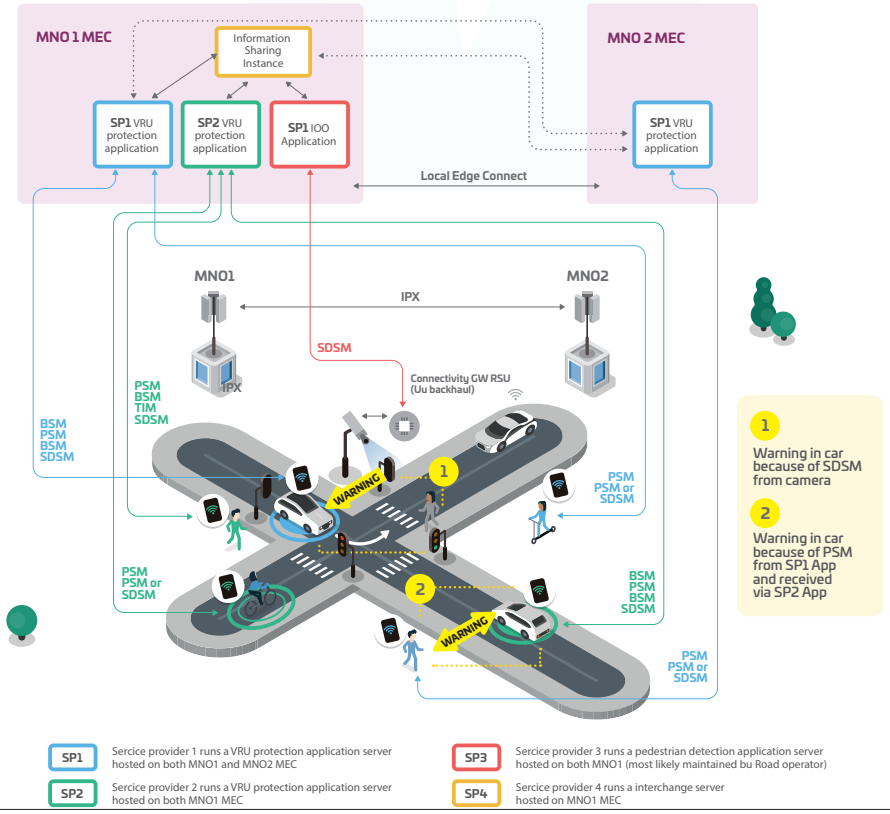
Leveraging the millions of connected cars via mobile networks already on the road today, V2N services have a direct path to scale. Innovations such as edge computing can also enable the many use cases requiring stringent latency and reliability as well as significant data exchange from and between vehicles and infrastructure. Supporting specific performance requirements is key to realising those use cases.

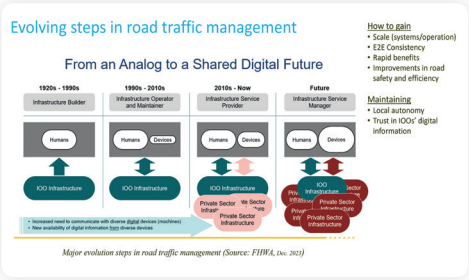
Since 2019, 5GAA has conducted live trials showcasing Mobile Edge Computing applications and use cases involving multiple MNOs, OEMs, and vendors. Previous work items, including MEC4AUTO, gMEC4AUTO, and 5GMEC4AUTO, have established a comprehensive framework for testing the interoperability of such MEC systems.

In 2023, the 5GAA demonstration in Detroit (USA) underlined that this cross-MNO MEC interconnect architecture met use case requirements, with potential for further optimisation. Reflecting upon lessons learned from Detroit, our VRU-DEMO work item highlighted the need for standardised MEC/cloud interfaces and common guidelines for delivery protocols and data exchange. This ensures that interfaces meet service requirements (e.g. latency, reliability) while minimising data traffic and operational costs. Standardisation will encourage stakeholder participation in the V2N ecosystem.

Going one step further in exploring a multi-MNO, multi-service provider interconnect scenario (leveraging 5GAA V2N2X system architecture), 5GAA showcased during Berlin Meeting Week MEC's capabilities implemented in real-life scenarios using public mobile networks on public roads. The objective was to show the readiness of V2N2X systems to operate in realistic, uncontrolled situations, delivering VRU presence awareness information. Members successfully leveraged public 5G networks to demonstrate how standardised safety-awareness messages can be delivered with low latency, improving traffic safety and enhancing VRU protection.

During Berlin Meeting Week, 5GAA also signed a memorandum of understanding with the Automotive Edge Computing Consortium (AECC) to collaborate on harnessing the power of MEC and network APIs, accelerating the deployment of related infrastructure and services, improving safety, and optimising traffic flows.





Major evolution steps in road traffic management (Source: FHWA, Dec. 2023)

IOO data exchange

Engaging with IOOs to ensure a seamless exchange of relevant mobility data and enable cloud based services at scale is a key objective. To that end, 5GAA engages worldwide with leading organisations to advance digital enhancements to infrastructure data and data collection.

In the USA, Road Digital Infrastructure (RDI) figures prominently in the US DOT Research, Development, and Technology Strategic Plan 2022-2026. Building on the DI4US and V2N2X work items, 5GAA has actively engaged with the Federal Highway Administration (FHWA) - part of US DOT - on RDI matters. The DI4USNEXT work item structures 5GAA input into dialogues with US DOT, State DOTs, and other relevant IOOs and stakeholders such as the I-80 Coalition.

In Europe, 5GAA is also engaged in regular dialogue with road operators in anticipation of the mandatory implementation of Safety-Related Traffic Information (SRTI) foreseen by the revised ITS Directive on the core and comprehensive trans-European network for roads by 31 December 2026 at the latest.

Scan the QR code to read the US DOT Research, Development, and Technology Strategic Plan 2022-2026.

Market Access/Interoperability of VRU Protection Solutions

Ensuring market access and interoperability is crucial for VRU protection solutions, as widespread adoption depends on seamless integration across different networks, service providers, and vehicle manufacturers. 5GAA is actively working to demonstrate the feasibility of V2N-based safety systems and accelerate their deployment.
The V2N-DEMBER work item documented the live public showcase of V2N services for VRU protection conducted in central Berlin in October 2024. Moving beyond controlled testing environments, this event showcased real-world performance using Deutsche Telekom and Vodafone's public mobile networks. The system architecture involved multiple MNOs, V2N service providers, and a central information-sharing instance.

The successful showcase highlighted how V2N2X systems enhance road safety by delivering low-latency VRU presence alerts to drivers. Standard ETSI-ITS messages were exchanged via Message Queuing Telemetry Transport (MQTT) services, with alerts transmitted through smartphone apps, roadside-mounted radar, or directly integrated into vehicle dashboards. A pre-event network survey confirmed strong performance conditions, and live service-level measurements further validated the system's effectiveness. Key challenges identified included global navigation satellite system (GNSS) signal degradation in urban environments and the logistical complexities of conducting live demonstrations on public roads.

The V2N-DEMBER results confirm the readiness of V2N-based VRU protection solutions for real-world deployment, reinforcing their potential to improve road safety through advanced connectivity and interoperability.

Participating members:
Anritsu, Bosch, Commsignia, Deutsche Telekom, Keysight, LGE, Vodafone

Launchpad for LTE-V2X and 5G-V2X Direct

5GAA continues to address barriers and prerequisites for large-scale deployment of C-V2X Direct Communications globally, while taking into account regional specificities and priorities.

In 2024, 5GAA launched the 'SCMS Policy supporting V2X Commercial Deployments for North America' work item detailing global best practices for securing V2X Direct Communication and the Certificate Policy (CP). The technical report, set for publication in 2025, aims to provide comprehensive guidelines for a common SCMS approach, in collaboration with SCMS Manager LLC.

The 'Misbehaviour Detection for V2X: Operational Aspects' work item analysed the current state of V2X misbehaviour management, making it accessible to non-experts. Its conclusions will serve as the foundations for future technical and policy specifications. 5GAA is now planning a third work item on misbehaviour management, including a possible demonstration in Q4 2025, to showcase the entire process of misbehaviour management, from detection to revocation.

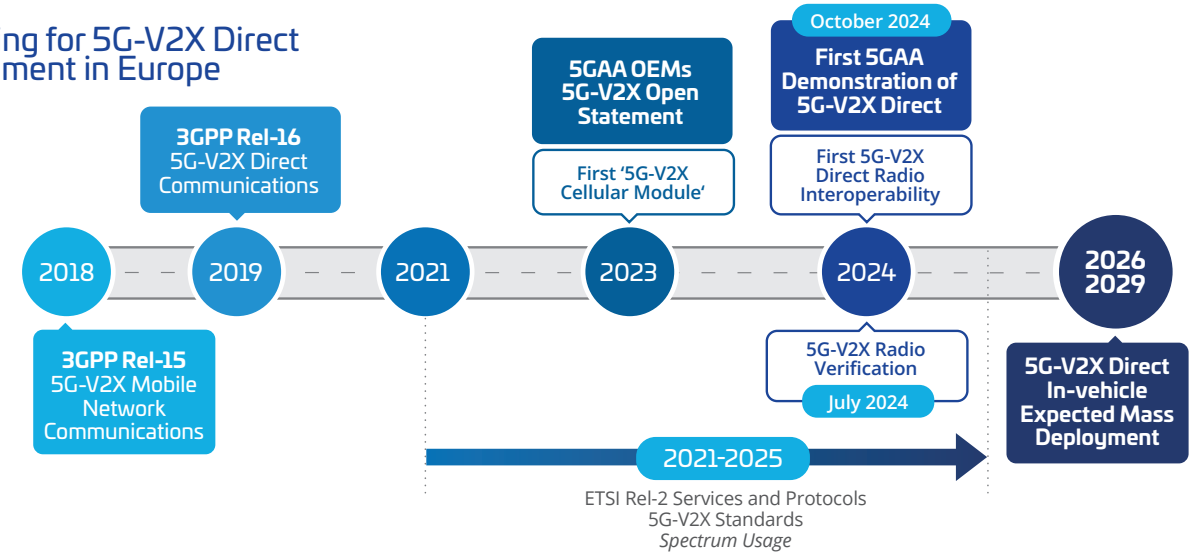
In 2024, 5GAA pushed for the advancement of 5G-V2X technology, including the new Direct Communications radio technology (also called NR-V2X). It started in Europe with the very first 5G-V2X demonstration, following the publication of 5GAA OEMs' letter on 'Europe Converging Towards 5G-V2X Including Direct Communications', in 2023.

Under the work item '5G-V2X Direct Communication Evaluation Approach', 5GAA concluded in 2024 a first evaluation of the technology governing the relationship between services, messages, NR V2X lower layer parameters, and data traffic models according to automotive requirements. Simulation results show that NR-V2X technology serves the selected multicast use cases well.

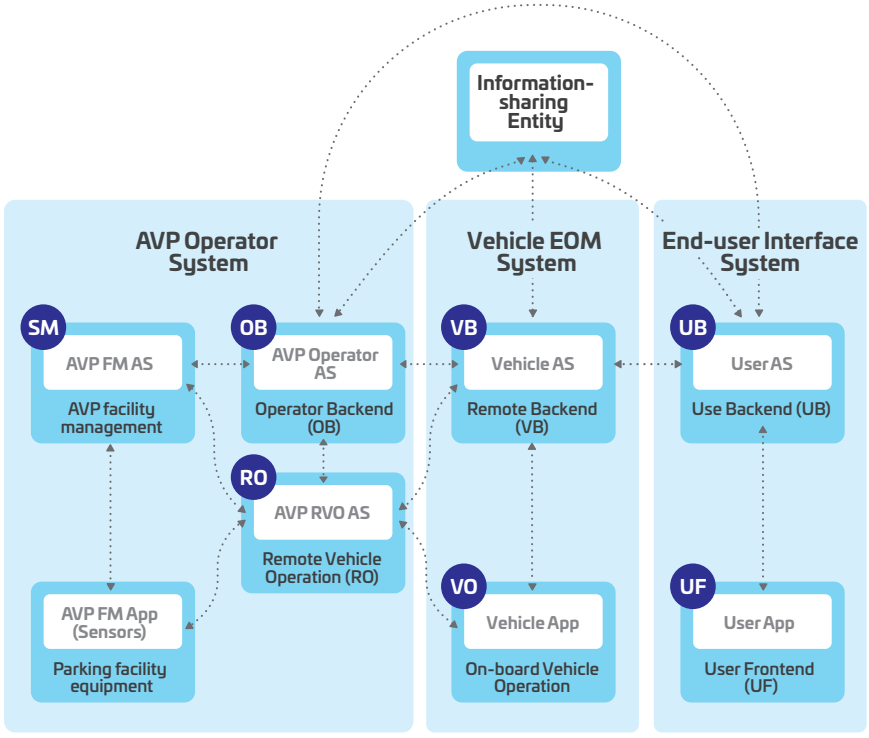
Throughout 2024, the 5G-V2X-Profiles work item progressed on defining Use Case Implementation Profiles (UCIPs) for selected use cases, namely Hazardous Location Information (HLI), VRU protection, and Cooperative Lane Merge (CLM). The UCIPs outline the triggering conditions and data-quality requirements, as well as other advanced capabilities. In parallel, the work item is developing Communication and System Profiles (CSPs) for On-Board Units (OBUs) and Road-Side Units (RSUs), which complement the UCIPs by outlining the basic system settings and environments, requirements and configurations for a successful implementation of 5G NR-V2X in vehicles. Overall, 5G-V2X profiling work follows a similar approach to LTE-V2X Direct, for which ETSI standardised a system profile that references 3GPP specifications and previous work done in C2C-CC and C-ROADS.

In October 2024, during Berlin Meeting Week, 5GAA successfully demonstrated the use of 5G-V2X to communicate seamlessly between two vehicles from different OEMs (Audi and BMW), as well as with pedestrians and bikes. Audi, supported by Commsignia and Autotalks, also demonstrated a use case for 'cooperative parking' based on 5G-V2X Direct. These demos showcased the new stage reached by the 5G-V2X ecosystem, which is getting a step closer to market readiness by the 2026-2029 time horizon, as predicted in the 5GAA Roadmap.

Preparing for 5G-V2X Direct Deployment in Europe



Application-level system architecture for AVP Type-2



5GAA App. Layer System Architecture	ISO 12768-1 System Architecture
Avp Operator Application Server (AVP Operator AS	Operator backend (OB)
AVP Remote Vehicle Operation Application Server (AVP RVO AS)	Remote vehicle operation (RO)
Vehicle Application Server (Vehicle AS)	Vehicle backend (VB)
Vehicle Application (Vehicle App)	On-board vehicle operator (VO)
User Application Server (User AS)	User backend (UB)
User Application (User App)	User frontend (UF)
AVP Facility Management Application Server (AVP FM AS)	Safety Manager (SM)
AVP Facility Management Application (AVP FM App)	
Information Sharing Entity (Interface for service discovery)	(This is out scope of the ISO standard)

End-to-End Motion Control Service

Automated Valet Parking (AVP) is nearing market readiness, with End-to-End Motion Control Services are now technically feasible thanks to advances in communication networks and system integration. 5GAA is actively working to accelerate deployment by addressing standardisation and interoperability challenges, ensuring seamless operation across different service providers and OEMs.

The AVP-Ready work item led to an update of the 5GAA technical report on AVP Type-2, detailing the technological framework and deployment strategies for driverless parking. It explores system architecture, cellular/mobile public networks, Stand-alone Non-public Networks (SNPN), and PC5 Direct Communication solutions, emphasising Quality of Service (QoS), network slicing, authentication, and roaming.

The report outlines key AVP operations, including vehicle check-in, parking, retrieval, and value-added services like Electric Vehicle (EV) charging. It highlights the importance of secure, end-to-end encrypted communication, mutual authentication, and robust time synchronisation for functional safety. Industry-wide standardisation remains crucial to ensuring compatibility across different stakeholders and reducing market fragmentation.

The conclusions reaffirm AVP Type-2's potential to transform parking experiences while addressing technical and safety challenges. Moving forward, 5GAA will focus on vehicle motion control applications, such as Automated Vehicle Marshalling (AVM), to drive further innovation in manufacturing and logistics.

Scan the QR code to read the technical report.

Prepare for V2X deployment including integration within vehicle automated functionalities

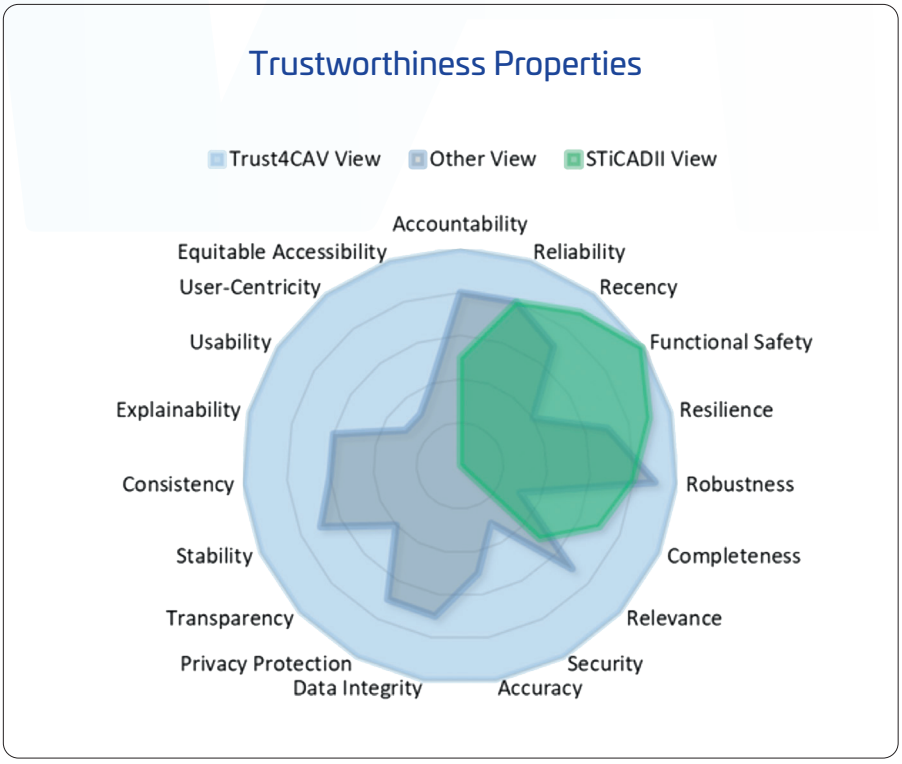
V2X deployment and its integration into automated vehicle functionalities is expected to significantly improve safety and efficiency. However, it requires a significant step forward in terms of trust among connected mobility stakeholders. 5GAA is actively working to address these important challenges related to communication, trust, and automation.

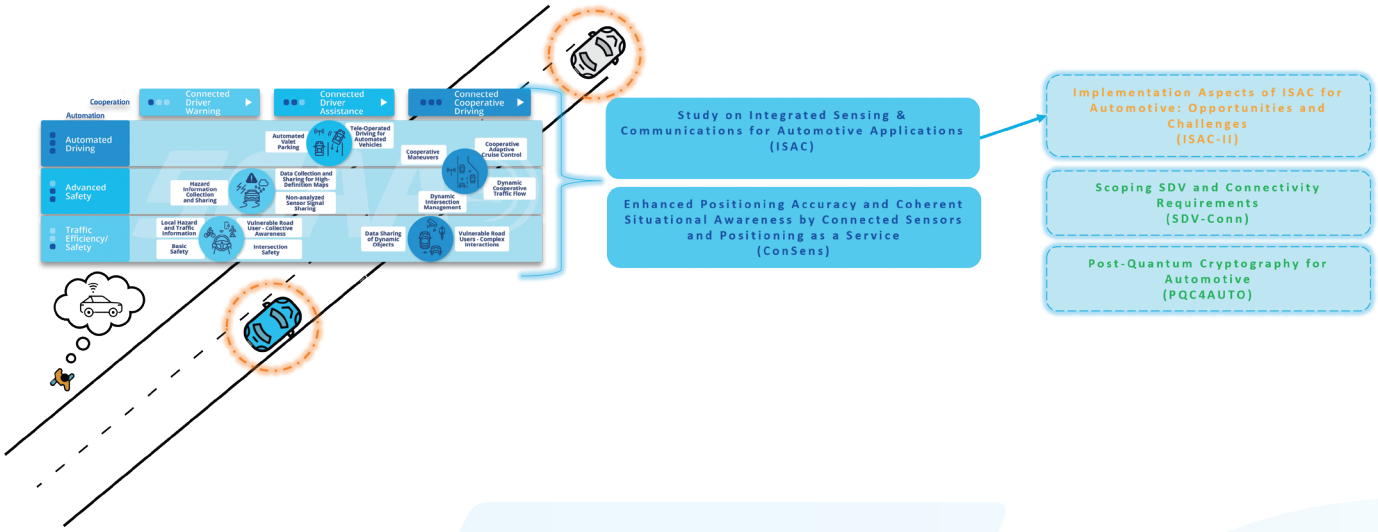
The completion of the work item on 'Safety Treatment in Connected Automated Driving Functions' Phase II in 2024 marked a milestone in defining functional safety requirements for V2X use cases. A related white paper, published in early 2025, introduced mutual trust concepts as a foundation for safety-relevant V2X applications. The current work item 'Creating Trust in Connected Automated Vehicles' (Trust4CAV), set for completion by mid-2025, builds on earlier findings regarding the definition of trust and trust relationships (WI Trust4AUTO) by creating methodologies to assess trustworthiness in Connected and Automated Vehicles (CAVs), ensuring consistency with global safety standards.

Future 5GAA efforts focus on addressing V2X security requirements and enhancing ADAS/ADS functionalities; for example, how infrastructure-based messages (CPM/SDSM, SPAT) can be trusted and integrated into sensor fusion and ADAS/ADS functions (leveraging work item 'Intersection Safety for Infrastructure Sensor-Sharing').

5GAA continues to engage around global NCAP developments, ensuring that V2X technologies are effectively incorporated into vehicle safety protocols and promoting their broader adoption to enhance road-user protection.

5GAA also explored in a work item on the integration of Uncrewed Ground Robots (UGRs) in ITS. C-V2X communication enables UGRs to interact with traffic signals, infrastructure, and other vehicles. Key recommendations from the report include the development of standardised protocols and pilot projects to refine this integration and ensure interoperability across manufacturers and systems.

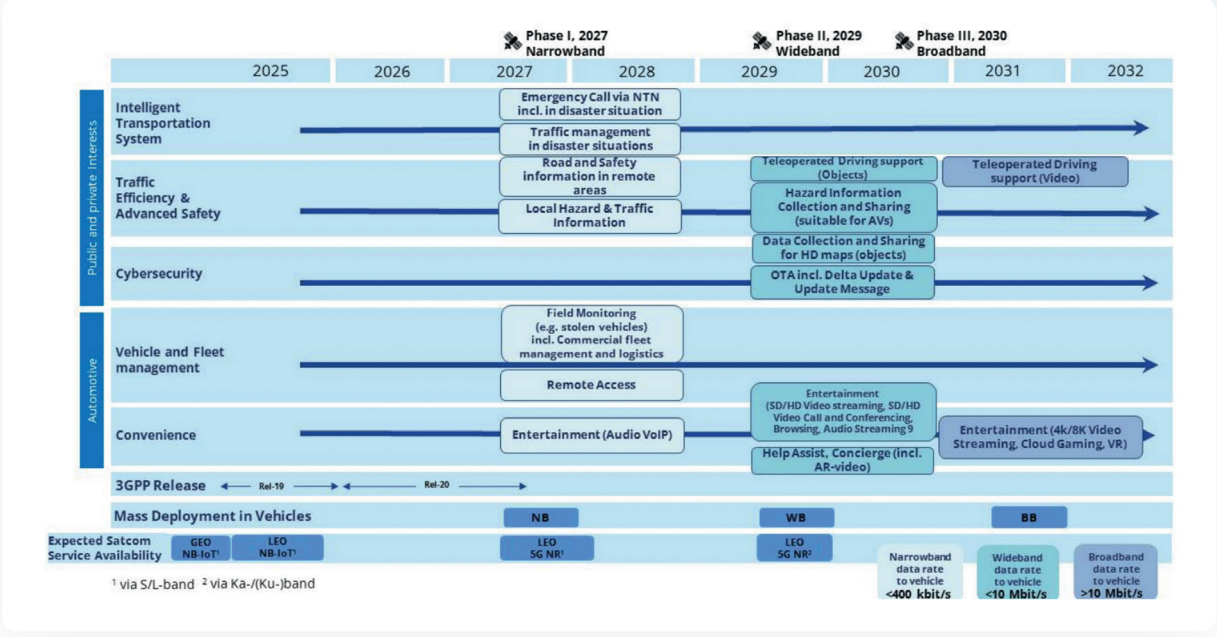


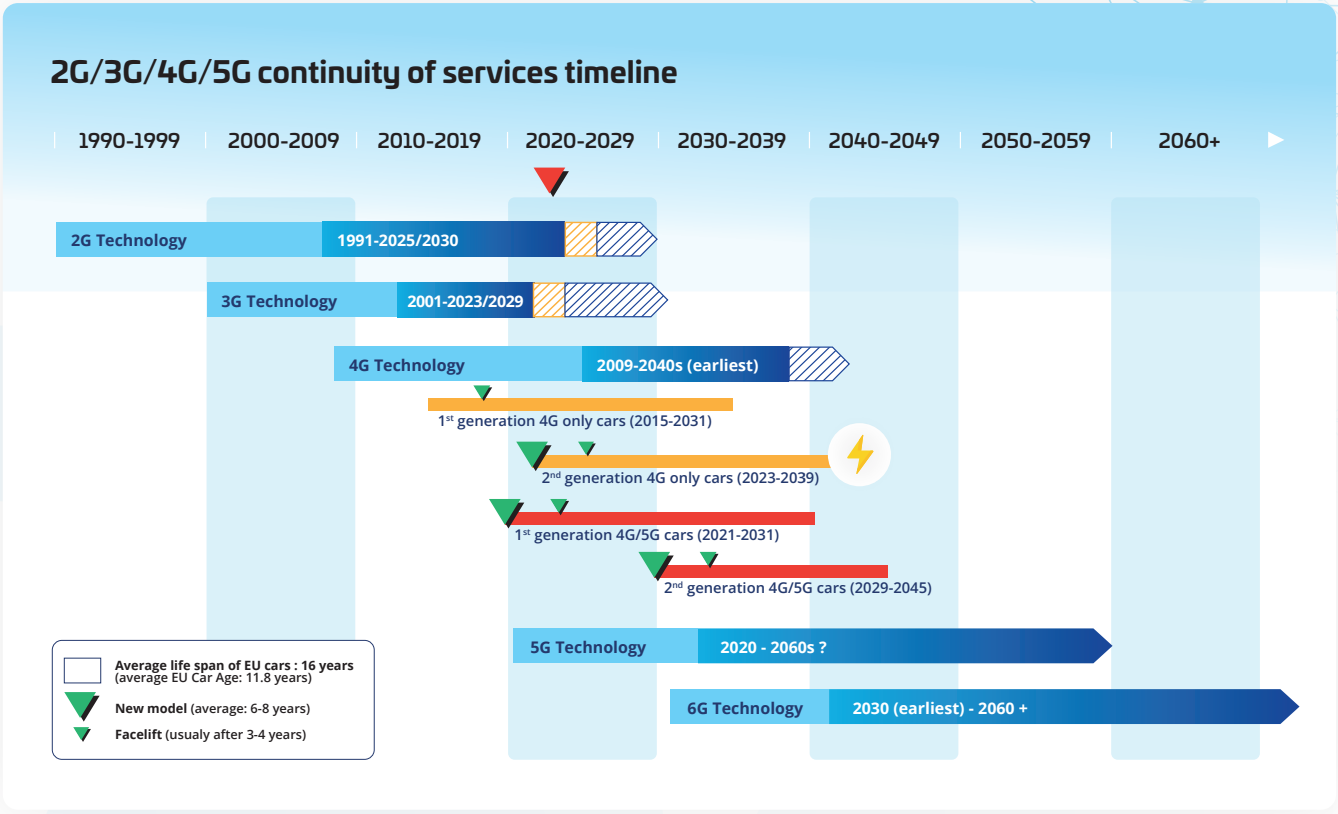


New Technology Enablers

5GAA is paving the way to the future of automotive connectivity by shaping a wide range of new technology enablers within and beyond 5G, from service requirements to standardisation.
In Q3 2024, 5GAA issued a report on integrating terrestrial and non-terrestrial networks in order to enhance vehicle connectivity, especially in remote areas. It recommends deploying Low-Earth Orbit (LEO) satellites for extensive coverage and high data rates. The report emphasises developing specific antenna parameters for automotive NTN user equipment and aligning with global standards. It also includes the first dedicated 5GAA NTN roadmap identifying the main clusters of services and their deployment time-scale from 2024 to 2030. Ongoing work now aims to provide a detailed framework for NTN implementation, addressing challenges like business modelling and regulation.

Other 5GAA initiatives aim to enhance situational awareness and communication capabilities for connected vehicles. The work item on Integrated Sensing and Communications (ISAC) focuses on defining use cases and requirements for these next-generation vehicular systems and identifying implementation and/or regulatory challenges. The ConSens work item leverages the 5G-V2X ecosystem to enhance situational awareness and positioning precision, focusing on VRU protection at intersections. It aims to realise reliable situational awareness using a digital twin platform.
5GAA continues to explore critical technological advances shaping the future of connected mobility. In collaboration with GSMA, 5GAA is investigating the impact of Post-Quantum Cryptography (PQC) on the automotive industry, assessing potential security threats and mitigation strategies. Additionally, 5GAA is launching a new work item on Software-Defined Vehicles to evaluate their connectivity needs, implications for V2X architecture, and security requirements. Both initiatives will help shape industry standards and ensure that next-generation mobility solutions remain secure, interoperable, and aligned with evolving technological landscapes.





Transition Path for Legacy Services

Technology is evolving at a faster pace than the average vehicle's operating life. It is important, therefore, to plan for the transition of legacy services to ensure smooth continued functionality and regulatory compliance. 5GAA is actively working to identify and address these issues when they arise, e.g. for Ultra-wideband (UWB) coexistence with IMT bands and the deployment of Next-Generation eCall (NG eCall).

UWB technology, widely used in automotive passive entry and start systems, operates in the 6 GHz and 8 GHz bands. However, the ITU's decision to study portions of the 7.125-8.4 GHz range for potential International Mobile Telecommunications (IMT) use raises concerns about interference. 5GAA launched a work item to analyse UWB technology and IMT-2030 parameters, define an evaluation framework, and determine potential mitigation measures. Initial results are expected by mid-2025, with further studies possible depending on the findings.

NG eCall leverages 4G/5G networks for enhanced emergency response, replacing traditional 2G/3G-based systems. With EU legislation mandating NG eCall by 2026/2027, 5GAA initiated a work item to support industry compliance in achieving such a short transition. Key objectives include consolidating regulatory requirements, coordinating testing activities, and producing implementation guidelines. Additionally, the challenge of eCall services for the legacy fleet amid 2G/3G network shutdowns is being addressed in collaboration with WG6-EU.

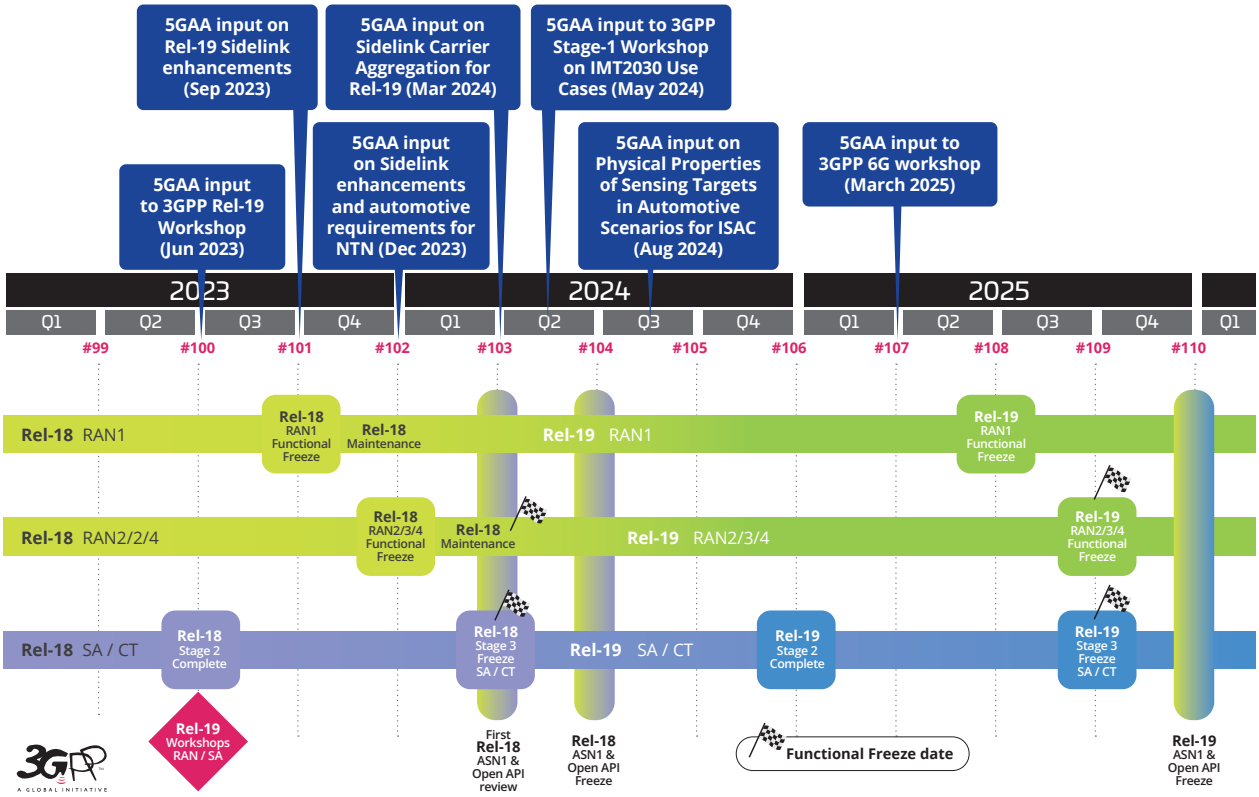
Shaping future automotive connectivity standards

3GPP Release-19 and 5G-Advanced Contributions

After successfully submitting its consolidated proposals for new features, requirements, and study items as input to the 3GPP RAN Rel-19 Workshop in 2023, 5GAA followed up in 2024 with several additional contributions on topics such as Sidelink Carrier Aggregation (CA), Physical Properties of Sensing Targets in Automotive Scenarios for ISAC, and Non-Terrestrial Network Enhancements for automotive.

In May 2024, 5GAA contributed to the 3GPP Stage-1 Workshop on IMT2030 Use Cases. We emphasised the need for 6G to evolve from 5G/5G-Advanced in a way that aligns with the longer timeframes for technology adoption in the automotive industry. The submission highlighted key priorities such as secure, reliable, and low-latency communication for safety and advanced driving, improved connectivity for immersive in-vehicle experiences, and enhanced VRU protection. It also stressed the importance of sustainability and network continuity through a combination of terrestrial and non-terrestrial networks. Additionally, 5GAA identified key future capabilities, including improved sensing and automated driving services, ensuring that next-generation communication systems effectively support the automotive industry's needs beyond 2030.

Looking at 2025, 5GAA's contribution to the upcoming 3GPP 6G Workshop builds on its previous input but also introduces several new priorities. Once again, 5GAA will reinforce the need for a smooth, cost-effective, and sustainable transition to 6G while expanding on key automotive-specific innovations.



Regional standards

5GAA actively engages in regional standardisation efforts, providing contributions as needed to support the development and alignment of key automotive connectivity standards.

Europe

5GAA has actively engaged with the European Telecommunications Standards Institute, or ETSI, particularly in discussions related to Integrated Sensing and Communications. Following ETSI's launch of four new work items within the Specification Group for Integrated Sensing and Communications (ISG ISAC), 5GAA has aligned its efforts with its own study on ISAC for C-V2X applications with further collaboration anticipated. Additionally, 5GAA has maintained exchanges with ETSI's ISG Multi-access Edge Computing Group, particularly regarding the publication of MEC Phase III deliverables, which are closely linked to 5GAA's ongoing work on 5GMEC4AUTO.

USA

Following the release of the US DOT National V2X Deployment Plan, 5GAA monitors with US members and stakeholders the standardisation needs that may arise from the plan implementation. Various deployment initiatives enabled by the National V2X Deployment Plan require continued coordination among public sector agencies and industry to align interfaces, operational practices, and regulatory processes. 5GAA encourages early V2X deployers, explores the value of innovative V2X applications in cooperation models and works towards V2X integration into a seamless and interoperable roadway digital infrastructure ecosystem.

China

Regarding China, the 5GAA WG6 China sub-group provided a thorough overview of the standardisation-related work, which has progressed in the various relevant organisations. The main research objectives of standardisation appear to have shifted to the collaboration between vehicles, roads, and pedestrians with the edge and service cloud platform. For more information about these developments, consult the relevant V2X State of Play in China (V2).

Global

In 2024, the International Telecommunication Union, or ITU, established a new Expert Group on Communications Technology for Automated Driving (C-ITS EG-ComAD). This initiative aligns with the UNECE World Forum for Harmonisation of Vehicle Regulations (WP.29) Task Force on Vehicular Communications (TF VC). 5GAA actively monitors the activities to provide input where relevant, to shape the future regulatory and technical frameworks.

Scan the QR code to read the publication.

Enabling **C-V2X deployment**

Overview of the top key highlights in relation to deployment in each region

HARMAN works with Qualcomm to drive automotive innovation forward with new 'Ready Connect 5G TCU for Connected Cars'

Cohda's roadside unit MK6 gets FCC certified for C-V2X in the US

Applied Information and Wavetronix partner together to safeguard unprotected left turns

US FCC adopts 5.9 GHz band rules allowing C-V2X equipment to support roadway safety communications technologies

Updated US DOT Deployment Plan for Lifesaving V2X Technologies

Applied Information, Haas Alert, and Audi Unveil C-V2X intersection technology for traffic signal communication in US

Mercedes teams up with Haas Alert's safety cloud for beta testing of emergency vehicle alerts

DENSO Announces 'MobiQ' for the Automotive Aftermarket

Europe & Middle East

Pirelli and Bosch cooperate on 'intelligent tyre' technology

Verizon and Audi Build 5G Test Track in Germany

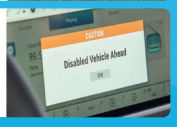
Keysight, Ettifos, and Autotalks make first 3GPP Release-16 sidelink radio interoperability connection

Deutsche Telekom and Volkswagen drive progress in automated port logistics with 5G and edge computing

Volvo Cars' industry-first connected safety technology alerts drivers of accidents ahead

Rohde & Schwarz first to test 5G eCall interoperability of Quectel's 5G module with its wideband radio communication

Stellantis, Volkswagen: cross-brand V2V communication unveiled at CES 2024



Asia-Pacific

NEXCO Central Japan launches first road-vehicle cooperative demonstration for autonomous driving on expressways

Honda and SoftBank Corp. test cellular V2X technology to prevent traffic accidents

NIO launches large-scale 5G-powered unmanned vehicle transport at Xinqiao No. 2 Plant

China launches 20-City Pilot (2024-2026) for Intelligent and Connected Vehicles with vehicle-road-cloud integration

China implements 2024 versions of C-NCAP, C-ICAP, and C-GCAP to enhance vehicle safety, intelligence, and sustainability

China issues first mandatory national standards for vehicle cybersecurity, software updates, and data storage aligned with UN regulations

Huawei hosts global launch of 5G-A Pioneers Programme, reaching consensus with six pioneering global operators

BMW's 5 Series to integrate V2X technology starting January 2025

India's Telecommunication Engineering Centre (TEC) establishes a task force to advance ITS in India

Monotch and Cohda join New Zealand road worker safety V2X trial

Engaging with policymakers and local ecosystems

Asia

China

With significant contributions from its Chinese members and counterparts, the 5GAA WG6 China sub-group updated the reports on the V2X State of Play in China 1.0 (now 2.0) to reinforce overall comprehension of the Internet of Vehicles (IoV) ecosystem, including policies and regulations, standardisation, and pilot and demonstration areas.

On the regulatory front, Chinese government agencies have introduced a range of policies and strategic frameworks to support the advancement of connected mobility and intelligent transportation. The Ministry of Transport (MOT) and the Ministry of Science and Technology (MOST) have jointly issued the 'Medium- and Long-term Development Plan Outline for Science and Technology Innovation in the Transportation Sector (2021-2035),' which provides a structured and systematic approach to transportation technology innovation for the next five to 15 years. Additionally, the Ministry of Industry and Information Technology (MIIT) has published key policy documents such as the 'National V2X Industry Standard System Construction Guide', 'V2X Industry Development Action Plan', 'Medium- and Long-term Development Plan of the Automobile Industry', and the 'Notice on Implementing Pilot Applications of Intelligent and Connected Vehicles for Vehicle-Road-Cloud Integration'. These regulatory efforts collectively contribute to the development and large-scale application of C-V2X technology in China.

In the domain of C-V2X and Intelligent and Connected Vehicles (ICV), China has implemented various initiatives, including seven national pilot zones, 17 national-level demonstration areas, and 16 smart city infrastructure and ICV pilot cities across the country. Furthermore, 20 cities were selected as pilot sites for vehicle-road-cloud integration, further advancing the ecosystem for intelligent mobility. These pilot programmes focus on leveraging connectivity to enhance transportation efficiency and safety, with applications in such areas as collaborative warning systems, cooperative driving assistance, and automated driving coordination.

5GAA reinforced its presence in China with a high-level visit at the end of 2024 involving a tour by 13 Platinum and Gold members to three different cities. Looking ahead, 5GAA is preparing for the Shanghai Meeting Week in October 2025, hosted by the China Academy of Information and Communications Technology (CAICT).

Japan

In 2024, during its Tokyo Meeting Week, 5GAA hosted a workshop on 'Enabling new services with next-generation ITS in Japan'. The workshop served as a platform for local stakeholders and global industry players to collaborate and discuss the future of ITS in Japan, leveraging the recently published Frequency Reorganisation Plan, and its potential implications and opportunities.

Following the issue of this Plan, the Ministry of Internal Affairs and Communications (MIC) reconvened the Next-Generation ITS Study Group,

which produced a report highlighting key considerations, including the development of a 5.9 GHz V2X system, a tangible migration plan for incumbent systems, and the digital infrastructure needed for Level 4 automated driving, to which 5GAA and its members positively contributed. Based on the report's findings, the study group will continue discussions on the 5.9 GHz assignment plan, technical details, and migration strategies.

In June, the Automated Driving Infrastructure Group was established to bring together several government entities to discuss infrastructure for automated driving. Since its formation, V2I experiments have been conducted on Japanese highways, and results were shared with 5GAA during its Tokyo Meeting Week in Q1 2024.

Since then, 5GAA has been collaborating with the ITS Info-Communications Forum, which is expected to play a crucial role in the technical considerations of the 5.9 GHz assignment plan in Japan. 5GAA has strengthened its partnership with the Forum and is currently working on providing input on several use cases, bringing together experts from both WG6 Japan and WG1. Additionally, 5GAA delivered a presentation on global ITS trends at the Forum's internal event, the Mobility and Safety Communications (MSC) seminar, held in Tokyo in December.

India

In recent years, V2X-related activities in India have been steadily increasing. In view of the troubling 2023 road accident statistics in India (1,264 incidents and 462 deaths every day, with highway accidents contributing to more than 60% of fatalities), the Ministry of Road Transport and Highways intends to use technologies such as 5G and C-V2X to bring these numbers down. In 2024, WG6-India was established to address the Indian government's growing interest in V2X - which includes an official report on ITS recommending the inclusion of V2X in the Bharat NCAP.

In response to these developments, WG6-India was established in 2023. The sub-group is providing guidance on V2X deployment to Indian authorities and stakeholders by leveraging 5GAA's global expertise. It will also monitor Standard Operating Procedures (SOPs) and key use cases, and identify gaps in standardisation and specific use cases relevant to India, considering the country's unique traffic conditions.

Since its formation, the group has established strong communication channels with the Indian government and relevant organisations, such as ITS India. 5GAA is also actively participating in the recently established government Task Force for ITS. In June, members of WG6-India had the opportunity to gather in person in Bengaluru for a one-day meeting to familiarise themselves with 5GAA's work items, discuss the goals of WG6-India, and engage with external stakeholders.

South Korea

In 2024, the Korean Ministry of Science and ICT published the final spectrum regulation, allocating the 5855-5875 MHz band for LTE-V2X. The regulation took effect in June 2024. The 5875-5925 MHz range has been reserved for further study, with 5G NR V2X being a strong candidate for future use. Dedicated Short-Range Communications (DSRCs) are thus expected to be phased out by June 2027.

To support this initiative and standardise C-ITS services across the nation, ITS Korea developed new standards for direct communication services, which were →↘↖↘↑↓↑↑↙ in June 2024. The Korea NCAP (KNCAP) is also progressively integrating V2X technology. According to 2024 protocols, in 2025, KNCAP will integrate V2X communications devices to the ranking system.Based on these updates, Korea NCAP is expected to be revised
to align with the new standards.

Following the spectrum decision, the Korea Expressway Corporation launched the first LTE-V2X installation project in the country, connecting the cities of Daejeon and Sejong. The project covers a 90-km stretch, including roads, expressways, and urban routes. Phase two of the project, which will include a tunnel, is expected to begin in March 2025. The initiative is a key step in advancing South Korea's commitment to a connected and smart mobility future.

Europe

In 2024, 5GAA actively engaged with European policymakers to push advances in ITS, digital infrastructure, and spectrum policies that support the large-scale deployment of Connected and Automated Mobility (CAM). As a key industry voice in the ITS Advisory Group, 5GAA worked to ensure that the ITS Work Programme (2024-2028) reflects a harmonised, technology-neutral approach to Cooperative ITS (C-ITS) and Safety-Related Traffic Information (SRTI) services across Europe.

5GAA advocated for an updated SRTI framework that enhances interoperability in the connected vehicle ecosystem, addressing critical challenges such as event-triggering definitions, cloud infrastructure development, and the need for European Access Points for traffic data.

5GAA also contributed to shaping the European Commission's policy on digital infrastructure, underscoring the importance of integrating automotive industry requirements into broader connectivity initiatives. Key priorities included the deployment of 5G-V2X Direct Communications for automated driving, expanding mobile network coverage to rural and underserved areas, and enabling seamless integration between Terrestrial and Non-Terrestrial Networks (TN/NTN) to ensure continuous connectivity.

Recognising the critical role of spectrum management, 5GAA remained actively engaged with the European Conference of Postal and Telecommunications Administrations (CEPT). Under its 5G-V2X-EU work item, we closely monitored and contributed to discussions on revising the ITS regulatory framework to allow 20 MHz channels and clarify technical conditions for coexisting with applications in adjacent bands.

5GAA also called for improved coordination between CEF Transport and CEF Digital funding programmes, and proposed a dedicated metric within the EU's Digital Economy and Society Index (DESI) dashboard to track LTE/5G coverage along Europe's road networks. We advocated for maintaining a structured industry consultation process for spectrum allocation while ensuring alignment with international standardisation efforts.

Sustainability remained a core focus, with 5GAA supporting the Commission's efforts to integrate electronic communication networks and digital solutions into the EU's green investment framework. We highlighted the potential of CAM to optimise road usage, reduce emissions, and improve mobility solutions, particularly in rural areas.

Through its cross-industry expertise, 5GAA reinforced its role as a trusted advisor to the European Commission and Member State authorities and stakeholders on connected mobility matters.

United States

In August 2024, US DOT released its final V2X Deployment Plan, to which 5GAA made significant contributions. The plan outlines US DOT's vision and specific milestones for deploying V2X technology.

Later in the year, US FCC published its Final Report and Order establishing rules allowing C-V2X to operate in the 5895-5925 MHz band. This decision comes nearly four years after the initial Report and Order in 2020 and marks the culmination of a process that began with 5GAA's original petition for an FCC waiver in November 2018. The Order permits devices that have already been authorised under previously obtained C-V2X waivers to continue to operate. Moving forward, 5GAA will continue to support its members and V2X deployers with resources needed to operate in the 5.9 GHz band and will advocate for additional spectrum based on results of 5GAA studies on the spectrum needs of C-V2X network-based (V2N) communications.

In 2024, 5GAA provided comments to the US Industry and Security Bureau's advanced and proposed notices of proposed rulemaking on securing the information and communications technology services supply chain in connected vehicles, providing extensive technological clarifications throughout the consultation process.

Looking ahead, 5GAA will continue to engage with the US legislative branch, with a special focus on maintaining and celebrating champions of C-V2X and

educating House Representatives on the benefits of connected transportation for safety, mobility and equity.

Finally, 5GAA will continue to support a maturing V2X ecosystem in the US by actively engaging with US partners, such as ITS America, and state and local level agencies to support first day deployments in several US States. 5GAA will work to pave the way for advanced C-V2X deployment with its technological expertise, go-to-market strategies, standardisation support, and regulatory and policy advocacy.

Communicating internally and externally

Communication and positioning of 5GAA

Over the past eight years, 5GAA has raised awareness of the industry's need for C-V2X technology, positioning it as the optimal solution to navigate global challenges in mobility and connectivity, while enhancing road safety and enabling smarter transportation.

We do this through a combination of organising internal events and demonstrations for members, participating in external events, and keeping both members and the rest of the world up to date on the Association and industry's progress deploying C-V2X technology in the market.

Events to Raise 5GAA's Profile

A feature of 5GAA's outreach includes attending and often actively participating in high-profile events representing our members' diverse industries, technologies, and interests. Major communications actions and profile-raising events in 2024:

ITS WC Congress – Dubai, United Arab Emirates

5GAA played an important role in the ITS World Congress 2024 held in Dubai, United Arab Emirates, participating in four special interest sessions that delved into the intricacies of C-V2X technology. Maxime Flament, the Chief Technology Officer (CTO) of 5GAA, covered several key topics in his discussions. He addressed sustainable transportation and connected mobility, highlighted the advancements in Physical and Digital Infrastructure (PDI) and communication as enablers for CCAM with ERTICO, an ITS industry platform, and discussed progress on space satellite technology for ADAS with the European Space Agency (ESA). Additionally, he participated in a session on 5G driving mobility, together with and organised by 5GAA member companies.

Mobile World Congress – Barcelona, Spain

At the 2024 Mobile World Congress in Barcelona, 5GAA made a notable impact by participating alongside top executives from global tech companies, government representatives, and emerging businesses in various discussions, from the 'Enablement for Connected Vehicles' session covering new use cases and tech trends, to the 'Satellite and Non-Terrestrial Networks Summit' with ESA, and the 'Global 5G Alliances Summit' hosted by the GSMA APAC 5G Industry Community. We set up an informative booth to provide insights into 5GAA's activities and the benefits of membership.

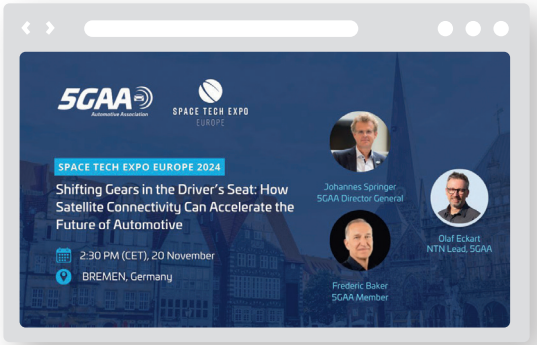
Consumer Electronics Show (CES) – Las Vegas, United States

Ahead of the global tech event CES 2024, 5GAA developed a brochure to spotlight our members' activities. This document provided a comprehensive overview of the diverse initiatives and contributions made by our community within the realm of connectivity. Beyond individual achievements, the brochure strategically underscored the substantial footprint of 5GAA at CES, emphasising our collective impact on the event. 5GAA CTO Maxime Flament participated in a panel discussion, entitled 'Connectivity in Cars: Navigating the Future'. He discussed how manufacturers are collaborating to unlock satellite-based connectivity, which enhances vehicle capabilities and services.

Speaking Slots

In 2024, 5GAA earned more recognition as an influential player in the field of 5G technology associated with the automotive industry by securing **52 global speaking slots**, underlining its pivotal role in shaping the conversation around the intersection of telecommunications and automotive innovation.

As we continue to drive discussions and initiatives, 5GAA and its members remain at the forefront of developments, fostering collaboration and advances in the dynamic 5G-connected landscape.



5GAA as a Key Partner for Cross-industry Discussions

Gearing Towards Advanced V2X Use Cases: The Impact of ETSI Release-2 Standards Workshop – Malaga, Spain

In September, 5GAA co-hosted the 4th ETSI C-V2X Plugtests™ event with DEKRA, supported by the European Commission and European Free Trade Association (EFTA). Vendors tested the interoperability of their OBUs, RSUs, and Public Key Infrastructure (PKIs) using ETSI TC ITS Release-2 standards. During the event, 5GAA held a workshop to discuss the impact of these standards and showcase advances in 5G-V2X Direct and security aspects, highlighting our role in advancing connected vehicle technology.

5GAA Delegation Visit to China

In 2024, 5GAA reinforced its presence in China with a delegation visit that included a tour of three cities and participation in the 31st China SAE Congress & Exhibition (SAECCE). The objectives were to understand the Chinese V2X roadmap, re-engage with MoU partners and Chinese members, and prepare for ecosystem engagement in Q4 2025.

At the SAECCE 5GAA's Vice Chair Tim Leinmüller presented on the topic 'Pioneering Digital Transformation in the Automotive Industry'. The delegation also met with 5GAA's Chinese MoU partners, including the IMT-2020 5G Promotion Group, to discuss technical topics such as the C-shift policy for V2X, the Vehicle-Infrastructure-Cloud Integrated Systems (VICIS), and the 5GAA Roadmap from a Chinese perspective. The meetings sought to solidify cooperation content and plans for the future.

5GAA at 5G Open Roads Demos

In November, 5GAA was invited to the 5G Open Roads demos at the Institut Mines-Télécom (IMT) in Saclay, France. 5GAA's CTO Maxime Flament presented the new version of our roadmap, highlighting the future of connected and automated vehicle technologies.

Notable Meetings Hosted

5GAA also organised or co-hosted several high-level activities and face-to-face meetings to delve into key challenges and opportunities in connected and automated mobility. Notable examples included:

- A workshop dedicated to Enabling New Services with Next-Generation ITS in Japan. This workshop explored the potential implications/opportunities in response to the release of Japan's Frequency Reorganisation Plan by the Ministry of Internal Affairs and Communications, assigning the 5.9 GHz spectrum to V2X for next-generation ITS.
- Live car showcases to demonstrate the latest innovations in the C-V2X technology family, to help achieve 'Vision Zero' for all road users. The demonstrations illustrated the potential of 5G-V2X in enabling new use cases integrated across multiple automakers, service providers, and mobile network operators.
- A conference titled 'Scaling Up Connected Mobility: What's Next for Germany and Europe?' brought together important institutional stakeholders and industry representatives. With the launch of Germany's Mobility Data Act and the finalisation of the EU's ITS Work Programme (2024–2028), concrete steps are being taken to prepare both industry and society for the future of transport and mobility. 5GAA was proud to facilitate this timely discussion on the road ahead.

GROWING 5GAA ONLINE PRESENCE BY 31 DECEMBER 2024

24,199
followers on Twitter and LinkedIn combined
(journalists, industry experts, broader ecosystem, and policymakers)
↗ **8% more compared to December 2023**

108,000
unique visits to 5GAA website
↗ **72% more compared to December 2023**

17
news items

17
publications

527,283
organic impressions on social media

3
5GAA online events

Global media coverage

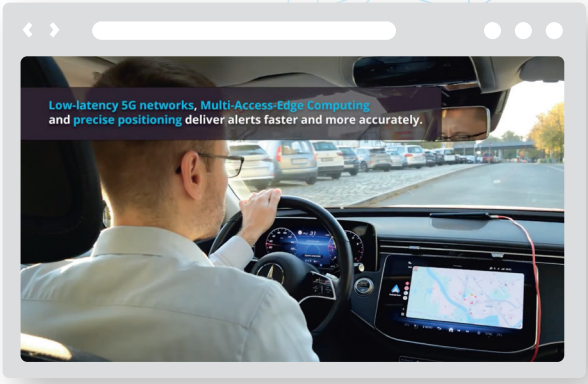
Interviews with leading 5GAA figures in major media outlets explored the intersection of connectivity and automotive innovation, showcasing our growing importance as the voice of connected mobility worldwide.
Throughout the year, 5GAA's Chairman Christoph Voigt, Director General Johannes Springer, CTO Maxime Flament, and Executive Director Americas John F. Kwant shared insights on the future of C-V2X deployment worldwide, emphasising the technological forces propelling the automotive industry forward and potential safety benefits for pedestrians and cyclists. A successful partnership with Telecom TV, starting with the 5GAA Meeting Week in Berlin (21 - 24 October 2024), resulted in the creation of several high-profile video interviews with 5GAA members and representatives.

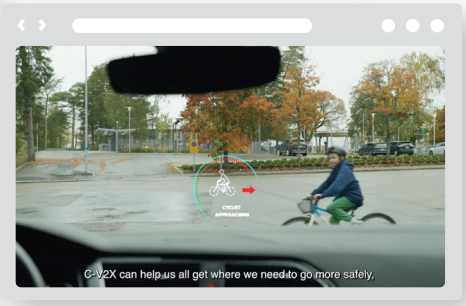
Gallery of media relations highlights

In 2024, 5GAA organised two press tours. At the MWC Barcelona trade show, 20 journalists joined 5GAA to tour members' exhibits and explore their latest market innovations. The stands visited included Deutsche Telekom, HARMAN, Vodafone, Qualcomm, Keysight, Rohde & Schwarz, and more, showcasing the collaborative and innovative spirit of 5GAA within the dynamic connectivity ecosystem. The Berlin 5GAA Live Demonstrations also provided an opportunity to introduce high-level journalists to 5G-V2X Direct technology for the first time, and resulted in favourable media coverage.

Promoting C-V2X Technology Benefits

Scan the QR code to watch the videos.





Internal Communication

While external communications are key to 5GAA's outreach, building awareness of our achievements outside the stakeholder community, effective internal communications are equally important to the success of the Association. Seamless internal collaboration fosters a sense of unity and cultivates a shared vision among the members.

In 2024, 5GAA's communications team(s) continued to ensure that members' news and relevant industry developments were communicated in a timely and effective manner.

Newsletters

In 2024, we introduced in-person Quarterly Report meetings in addition to our regular internal newsletters, further strengthening engagement with our members. **Six newsletters** were shared over the year with more than **1,700 subscribers**, all representing 5GAA member companies. These updates reported on recent achievements and highlighted upcoming milestones and activities relevant to the association.

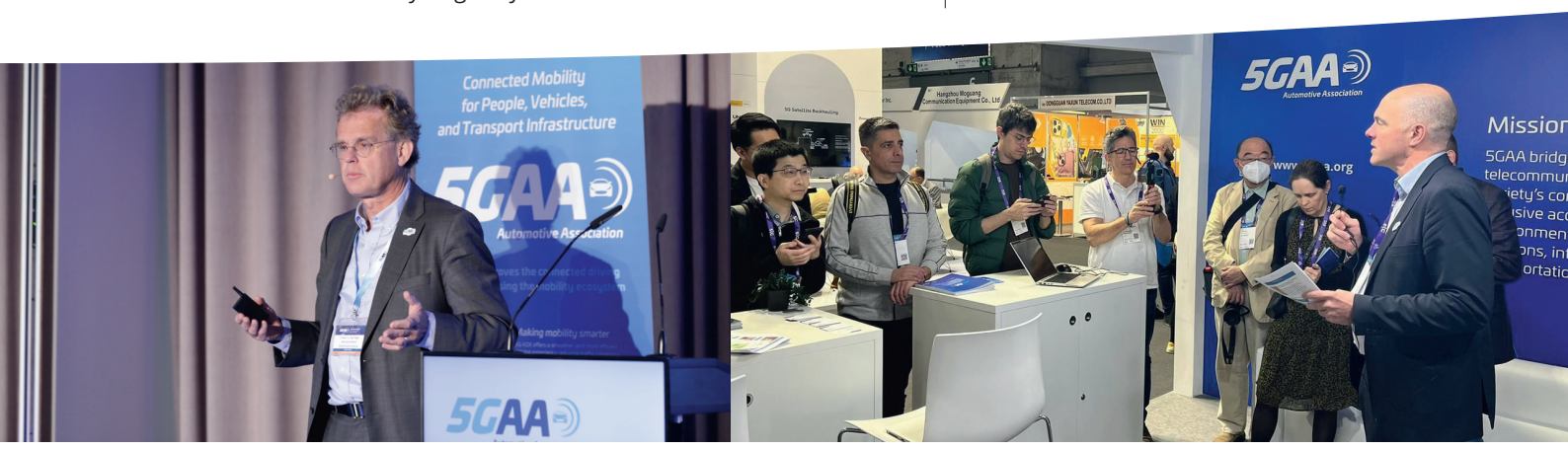
Celebrating Our Members

In 2024, 5GAA decided to look for new ways to better appreciate our members, giving them special recognition in several categories:

- **5GAA Outstanding Contributor:** Recognises delegates who have significantly contributed to one or more of 5GAA's work items or activities. Eligibility: All members except work item leads.
- **5GAA Outstanding Lead:** Recognises delegates who have successfully led one or more work items or activities. Eligibility: All work item leads.
- **5GAA Outstanding Liaison:** Recognises delegates who have provided 5GAA inputs/results to other organisations. Eligibility: All members.
- **5GAA Champion:** Recognises strong advocates of 5GAA within and outside the community. Eligibility: All members.

Community-Building Sessions

5GAA also likes to treat the extended community or ecosystem of stakeholders in connected mobility as part of the family, especially in communicating technological advances that require greater awareness as a condition for wider uptake. As such, the team organised outreach and engagement through three Community-Building Sessions, which hosted a total of 33 presentations.



Who we are, **how** we work

5GAA is comprised of members, an Executive Committee, Board, General Assembly, and Working Groups that together ensure the successful governance and operation of the Association. We also partner with many other organisations working on connected mobility.

5GAA: a global cross-industry association

10 of the top 15 OEMs

8 of the top 10 MNOs

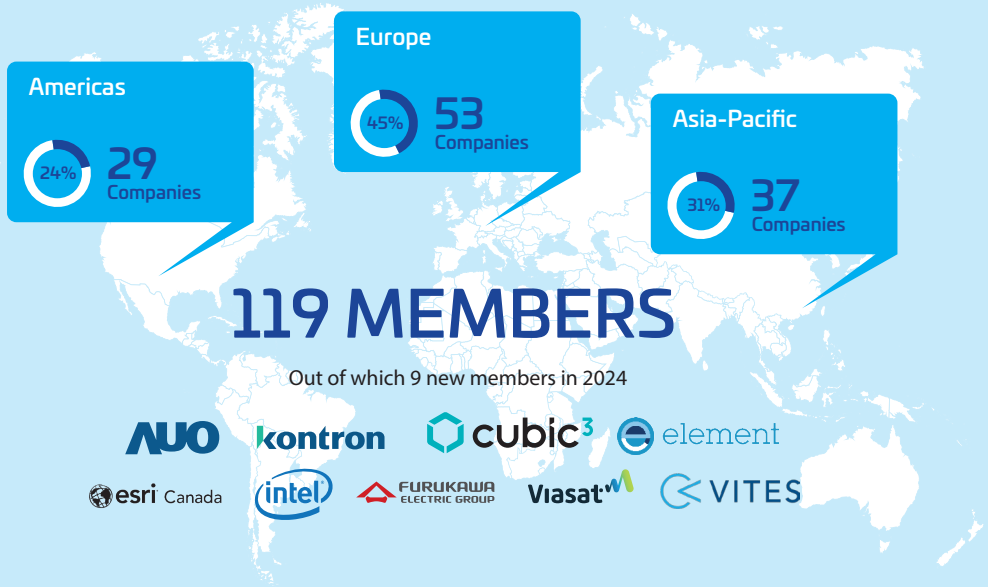
2 top smartphone vendors

Sept. 2016
In September 2016, **8 companies** teamed up to create 5GAA to help develop, test, and promote 5G standards.

2025
Today, 5GAA unites **+110 members** from around the world working together on all aspects of C-V2X.

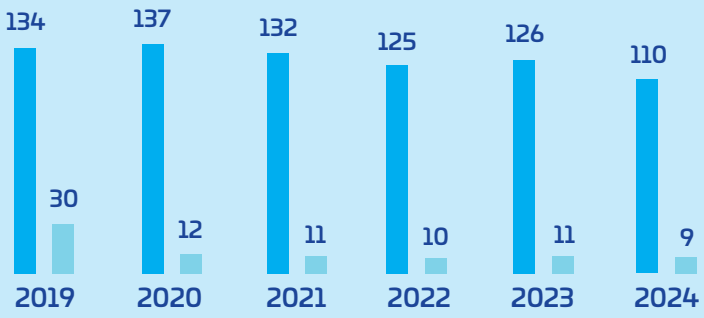
5GAA membership evolution in 2024

Regional split

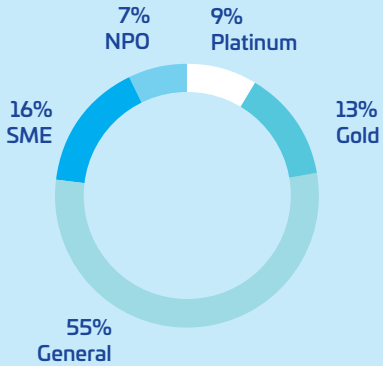


Membership overview

Member companies (119 total)



Members by category



* This overview reflects membership on December 31st, 2024.

Structure and Governance

GENERAL ASSEMBLY

BOARD

CHAIRMAN
Christoph Voigt

VICE CHAIR
Tim Leinmüller

- 5GAA Board supervises and advises the Executive Committee in all material respects, in particular regarding strategic considerations.
- The Board is composed of up to 18 members (up to 12 Platinium and 6 Gold Members), elected by the General Assembly every year.
- As of 1 January 2025, 1 platinum seat is vacant.

AT&T		BMW GROUP	BOSCH ★	DENSO ★	T ★	ERICSSON	Ford
Usman Z. Chaudhary Arnold Liu	Christoph Voigt Jörg Plechinger	Joachim Göthel Georg Schmitt	Andreas Schaller Frank Hofmann	Tim Leinmüller Lutz-Peter Breyer	Benjamin Bastians David Cohen	Friedhelm Ramme Thomas Nylander	Ivan Vukovic Todd Konet

HUAWEI	JLR ★		NOKIA	Qualcomm	SAMSUNG ★	STELLANTIS ★	verizon	vodafone
Yingpei Lin Chan Zhou	Collin Lee Clara Gutierrez Echeverria	Rainer Krumrein Osman Aydin	Berthold Panzner Stephan Miller	Jim Misener Vince Park	Suman A. Sehra Amine Taleb	Antonio Fernandez Nick Russell	Thomas J. Fox Jyoti Sharma	Luke Ibbetson Tony Sammut

EXECUTIVE COMMITTEE AND CTO

Executive Committee is the legal representative body of the association and is responsible for the day-to-day management of the 5GAA.

The Executive Committee reports to the Board.

DIRECTOR GENERAL
Johannes Springer*
Christof Schmidt

SECRETARY
Markus Dillinger

TREASURER
Thomas Kraeker

CTO**
Maxime Flament

* At the end of 2024, Director-General Johannes Springer announced his retirement, which officially took effect at the end of March 2025.
** non-statutory member of EXEC

WORKING GROUPS

WG1	WG2	WG3	WG4	WG5	WG6	WG7
Use Cases and Technical Requirements	System Architecture ans Solution Development	Evaluation, Testbeds and Pilots	Standards and Spectrum	Business Models and Go-To-Market Stategies	Regulatory and Public Affairs **US (2019)** **EU (2019)** **Japan (2020)** **China (2021)** **Korea (2021)** **India (2024)**	Security and Privacy

Partners

In addition to its internal activities, 5GAA invests a considerable amount of time in working with different partners to explain and promote the benefits of C-V2X technologies.

Ecosystem Partners - formal collaboration

Ecosystem Partners - informal collaboration

MoUs Signed in 2024

Automotive Edge Computing Consortium (AECC)

In August 2024, 5GAA signed a cooperation agreement with AECC. The cooperation scope focuses on open Application Programming Interfaces (APIs), joint proofs of concept and integrated Quality of Service (QoS) for different multi-slice service operations. With this agreement, 5GAA broadens its network of partner organisations in the United States and once again looks forward to working on joint activities and projects.

OmniAir Consortium

5GAA signed a Memorandum of Understanding (cooperation agreement) with OmniAir in September 2024. The cooperation scope includes cyber-security, aftermarket safety devices, application testing, and also the possibility of co-organising a plugfest. The cooperation also foresees coordination on tolling using C-V2X and roadmaps for the industry. With this agreement, 5GAA shows its engagement with certification partners and the advantages of greater collaboration with organisations across the entire ecosystem.

China Institute of Communications (CIC)

Later in the year, 5GAA signed a cooperation agreement with CIC to coordinate technical, testing and deployment activities. Starting from December 2024, the cooperation scope includes technical discussions, academic exchanges, the promotion of relevant standardisation work, and enhanced interactions within the C-V2X industry ecosystem in order to foster innovation and further developments. With this agreement, 5GAA broadens its network of partner organisations in China and looks forward to working on joint activities.

ITS India Forum

5GAA signed a cooperation agreement with ITS India Forum in December 2024. The cooperation scope includes connected mobility use cases for India, but also standardisation developments in the country, V2X reference architecture, and the topic of tolling. The cooperation also foresees coordination regarding a future 5GAA face-to-face Meeting Week in India. With this agreement, 5GAA opens its network of partner organisations to India for fruitful collaborations and activities going forward.

5GAA MEMBERS - DECEMBER 2024

The 5G Automotive Association (5GAA) is a global, cross-industry organisation of companies from the automotive, technology, and telecommunications industries (ICT), working together to develop end-to-end solutions for future mobility and transportation services. Created in September 2016, 5GAA has rapidly expanded to include key players with a global footprint in the automotive, technology and telecommunications industries. This includes automotive manufacturers, tier-1 suppliers, chipset/communication system providers, mobile operators and infrastructure vendors.

FOLLOW US

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