

BACK TO THE FUTURE:

Cubic's Top 5 most popular blog posts from 2021





BACK TO THE FUTURE

If our Top 5 blog posts are anything to go by, 2021 was all about the future. We've rounded up five of the posts that had the most engagement in 2021, across our website and social channels. Autonomous vehicles continue to capture the imagination but, as our no.1 post in 2021 points out, many automakers now acknowledge that developing the technology is more complex than originally thought.

What factors will play a role in delivering a self-driving future? **Road to 2030: the future of Autonomous Vehicles** (AVs) takes a look at the five levels of vehicle autonomy – and how players like Google, Ford and Tesla measure up.

2021 also saw a sharp focus on the technologies that will enable sustainable automotive and transport solutions. From the next generation of electric vehicles and fleets, through mobility as a service (MaaS), the future of car ownership and transport is changing as we speak. Posts like **Future of Transport: What is Mobility as a Service?** explored the technologies and systems that are transforming how we get from A to B.

The past year also showed that there's a clear interest in unlocking the opportunities presented by connected vehicles in a world where 5G and Cellular Vehicle-to-Everything (C-V2X) expand beyond the "possible" and into the "here and now." These are the technologies that underpin the revolution taking place in the automotive sector and give a real sense of where the opportunities lie for carmakers.

The last 10 years have seen significant changes in the automotive industry, but nothing compared to what the next decade will bring. What does the future hold for in-vehicle software architecture? How will connected software solutions impact future mobility? How will leading OEMs use technology to pivot into a more sustainable future? At Cubic Telecom, we're looking forward to playing our part in shaping 2022.

For now, enjoy our look-back on 2021!





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1. Road to 2030: the Future of Autonomous Vehicles (AVs)

Over the past decade, the pursuit of self-driving cars has excited public imagination and inspired unprecedented collaboration between carmakers and tech innovators. So how much closer are we to integrating autonomous vehicles (AVs) into our transportation systems? Forecasts predict that one in 10 vehicles will be fully automated globally by 2030, but until difficult challenges can be fully resolved, the industry can only speculate. In reality, many pieces of a very complicated puzzle need to fall into place before autonomous vehicles become a normal sight on the roads.

Ambitious real-world testing and intriguing vehicle projects continue to build hype around AVs, but many automakers now acknowledge that developing the technology is more complex than they originally thought. Still, optimism for Alpowered self-driving technology (enabled by 5G) is growing, as advancements in partially-autonomous cars offer a more realistic vision of what the next decade may look like. With the potential to transform everything from our mobility behaviours to how future smart cities are designed, what factors will play a role in delivering a selfdriving future?





LEVELS OF VEHICLE AUTONOMY

There is a guiding framework of standards for measuring AV capabilities, with five levels of vehicle autonomy as defined by the Society of Automotive Engineers (SAE). They range from 0 (human control) to 5 (full autonomous). Tesla's Autopilot technology is considered Level 2, where the vehicle can manage functions like steering and acceleration but still requires a driver to be ready to take over. Google's self-driving car project Waymo operates at Level 4 autonomy, with driverless cars already shuttling passengers around Phoenix for the past several years. At the Mcity Test Facility run by the University of Michigan, carmakers like Ford are testing the limits of autonomous technologies in a fake city the size of 24 football fields. In this controlled test environment, researchers are gaining valuable insights on how connected and autonomous vehicles can operate under realistic conditions.



3

Conditional Automation

Driver is a necessity, but is not required to monitor the environment. The driver must be ready to take control of the vehicle at all times with notice.



High Automation

4

The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.



5

Full Automation

The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle.

TECHNOLOGY FOR SAFER MOBILITY

One of the key drivers of the autonomous vehicle market is the promise of a safer journey for drivers, passengers and pedestrians. According to the U.S. National Highway Traffic Safety Administration, 9 out of 10 crashes are due to human error. If the technology can catch up with the promise, AVs have the potential to eliminate most traffic accidents – but first they'll need to rely on a self-driving system that can perceive the road better than the best human driver. What's clear is that data will be key to unlocking the potential of AVs. Today's connected cars can generate up to 25 GB of data per hour. In the future, autonomous cars are likely to generate more than 300 TB of data per year.

The continuing evolution of safety technologies is setting the foundation for developing intelligent software-defined automated systems capable of navigating roads with little to no human intervention. Many of today's modern vehicles are equipped with advanced driver-assistance systems (ADAS) that use sensor technologies like radar and lidar to detect objects – getting more sophisticated with each generation. The emergence of 5G technologies for enabling Artificial Intelligence (AI) and analytical capabilities in selfdriving cars will be crucial to the success of AV adoption.





INDUSTRY COLLABORATION AND POLICY MATTERS

Developing the car of the future and the systems architecture to support it will require intense long-term collaboration between tech innovators, automakers, telecoms, government agencies and many others. While competition is driving the scene forward, the challenges involved are too complex and too expensive for any one party to go it alone. Exciting progress is being made, particularly in China where private-public support for autonomous vehicle technologies is incredibly high. China's ride-hailing service Didi, for instance, plans to roll out over one million robotaxis on its platform by 2030, while new rules around AV development are fuelling a boom in the commercialisation of autonomous cars.

The framework for self-driving car technology will depend on regulatory developments from policy makers, which is proving to be a complicated hurdle in the pursuit of making AVs mainstream and commercially viable. As responsibility for accidents shifts away from drivers and regulations around AI grow more complex, complicated questions will have to be addressed.

Despite the massive obstacles ahead, consumers are ready for driverless cars. While industry players and experts agree that AVs have the potential to truly transform mobility, understanding what needs to happen before widespread commercial adoption becomes a reality is much harder to forecast. To accelerate the future of the automotive industry over the coming decade, multi-layered challenges will need to be resolved by next-generation tech innovations. With Cubic Telecom's connected software and analytics solutions, innovation for tomorrow's landscape of connected, electric and autonomous cars will help drive intelligence across the mobility sphere.have to be addressed.



'CAR OF THE FUTURE' INDUSTRY TRENDS

2. 'CAR OF THE FUTURE' INDUSTRY TRENDS

Dramatic changes underway across the automotive landscape—centred on rapidly evolving business models, next-gen autonomous technologies, electrification and an industry-wide push towards sustainability and the zerocarbon car—will usher in a transformative decade that will redefine our perception of the mobility experience. All converging players in this ecosystem including OEMs, tech innovators, government regulators and consumers will play a vital part in how these changes unfold, and which components become widely adopted.

These were some of the overarching themes at last week's virtual Reuters Events: Car of the Future conference, which brought together some of the industry's most influential voices to share their insights and strategies on the path forward. Here is a roundup of trends on the horizon:





OEMs DIGITAL TRANSFORMATION

The convergence of connected cars, autonomous driving platforms, shared and electric mobility are disrupting the industry faster than ever—but will it be a revolution or evolution? With the onset of software-defined digitalisation impacting the entire automotive value chain, the challenge for OEMs is to avoid the trap of moving too slow, or worse, being left behind as new players enter the space and fill market gaps. According to Henrik Green (Volvo), OEMs must build products that will fit in this new world while anticipating the solutions needed for tomorrow. As a new set of expectations are defined by consumers, reducing complexity will be key to delivering connected vehicles as the new standard

AN ELECTRIFIED FUTURE

As EV sales continue to grow—particularly in booming markets like Europe and China, which boasts 44% of all the EVs in the world (more than 4.5 million)—calls to prepare EVs for the mainstream are growing louder. But challenges remain for mass market adoption, mainly due to the lack of sophisticated charging infrastructures and public awareness, with some drivers still holding the impression that EVs are more expensive than their gas guzzling counterparts. Fabrice Cambolive (SVP, Renault) expects plug-in hybrid vehicles to be a major part of the transition, particularly for winning over new customers. According to research firm, JD Power, most electric vehicle drivers vow to never return to combustion engines, with 82% considering purchasing another EV in the future. "Once you go EV, you don't go back" has indeed become a familiar anthem that is resonating across the industry.

DATA MONETISATION TRENDS

The big data market in the automotive industry is expected to reach \$7.84 billion globally by 2025—extracting value from this data has become a priority for all involved. Barry Napier (CEO, Cubic Telecom) put a spotlight on how OEMs can monetise connected vehicle data successfully to pull ahead in a field of growing competitors. By 2030, about 95% of new vehicles sold globally will be connected—that marks an increase from around 50% today. This will open up untapped opportunities for OEMs to make strategic decisions that ultimately put user-centric services and applications at the centre of their business models.

THE ROAD TO FULL AUTOMATION

Ever since sci-fi writers began giving creative licence to what a fully autonomous future might look like, there has been a constant question of 'when?' Today, the technologies are already in place and major investment is flowing—the autonomous vehicle market is projected to surpass \$65 billion by 2027. Sajjad Khan (Mercedes-Benz AG) notes that the way to approach autonomy is to start on the highways. In fact, self-driving trucks are making the most progress today towards commercial deployment. This autonomous wave sweeping the logistics industry may offer the best glimpse yet of what's to come.

Industry challenges remain on the road to developing tomorrow's vehicle. Safety, data privacy and cyber security will be a top priority, as will the integration of 5G technologies. Key to its success will be the cooperation of private and public sector players, and a stronger push from government actors to begin laying out regulatory structures that will encourage more investment and build consumer confidence.



NEXT:

HOW WILL SHARED MOBILITY TRENDS CHANGE THE FUTURE OF CAR OWNERSHIP?



3. HOW WILL SHARED MOBILITY TRENDS CHANGE THE FUTURE OF CAR OWNERSHIP?

For many, the freedom and flexibility a car provides is sacrosanct. This is perhaps most evident in the U.S. where 91.3% of households have access to at least one vehicle. But will traditional car ownership as we know it be a thing of the past – disrupted by emerging mobility trends and changing consumer behaviours? While few expect the public's reliance on personal vehicles to fade anytime soon, significant cultural and economic shifts – pandemic-related and otherwise – may offer a glimpse of what's to come.

DEMAND FOR ALTERNATIVE MOBILITY SOLUTIONS

It's hard to imagine life without cars – our relationship with them has been going strong for the past century. But in some ways and for some people, owning a vehicle today is making less and less sense. Foremost is the reality that city streets are already clogged to capacity, stretching our urban centres to the limit. There are an estimated 1.4 billion vehicles in operation worldwide and over 70 million more vehicles coming to market each year. By 2050, two out of every three people are likely to be living in cities or other urban centres, the UN estimates. To move forward towards sustainability and keep our cities liveable, Mobility-as-a-Service (MaaS) solutions will be needed to improve transportation efficiencies in all corners of the globe.

Consumer attitudes and preferences towards mobility are evolving based on access to in-vehicle technologies, convenience, cost, and other influencing factors. In today's mobility ecosystem, there are more viable alternatives to car ownership than ever before. With a rise of Netflix-style car subscription models – alongside the advent of car sharing, ride-hailing and self-driving vehicles – unique and enhanced mobility solutions may pave the way for a new era of 'access over ownership'. For automotive manufacturers who must now navigate this sharing economy with agility, there is an opportunity to create new user-centric experiences as on-demand services shift the marketplace.

FUTURE OF CAR OWNERSHIP

NEXT:

It's impossible to predict how future mobility trends will reshape the concept of traditionally-owned vehicles, but transformative change is rarely linear and will come in waves. As disruptive technologies get more sophisticated and our transport needs evolve, tomorrow's automotive landscape will shift from a product-focused model to one that is service-focused.

According to a pre-pandemic survey from 2019, nearly half (48%) of respondents said they would consider giving up car ownership if autonomous mobility solutions, such as self-driving buses or taxis, were available. While 96% of car owners said they think they will own a car in the future, the growing adoption of shared mobility services provide an opportunity to complement, rather than replace, privately-owned vehicles over the coming decades. Considering that the typical car is parked and idle 95% of its lifetime, it becomes clear just how inefficient automobiles are and why they must be better utilised. In the future, connected, sustainable and autonomous technologies could transform vehicles into revenue-generating robotaxis, serving a multitude of riders 24/7 while creating profit for vehicle owners.

> **HOW WILL SHARED MOBILITY TRENDS CHANGE THE FUTURE OF CAR OWNERSHIP?**

4. FUTURE OF TRANSPORT: WHAT IS MOBILITY AS A SERVICE (MAAS)?

Today's transportation systems are undergoing a paradigm shift that will reshape and reimagine how we get from point A to B.

Dubbed the 'Netflix of transportation', Mobility as a Service (MaaS) is a unified platform that efficiently services all your travel needs, door-to-door, in one simpleto-use application. Unlike Netflix's library of movies & series, MaaS provides users with an all-encompassing bundle of on-demand transit options like Uber-style ride-sharing, "pop-up" bus services and micro-mobility modes like e-scooter and bike sharing. The point of MaaS is to get you from first mile to last in a way that is most efficient and convenient – you are always at the centre of this hyper-connected and collaborative universe.

Think of MaaS as a superorganism in an all-in-one ecosystem, where various data-driven modes of transportation and mobility work cooperatively in unison for the sole benefit of the user. MaaS enables frictionless journey planning on both public and private transportation, with additional technology providers filling the gaps. Cubic Telecom's software solutions, for instance, can provide route optimisation based on traffic

patterns for a seamless journey. Open communication and data-sharing between all MaaS actors will ultimately be key to its success.

Innovative mobility services are needed now more than ever. By 2050, "two out of every three people are likely to be living in cities or other urban centres" the UN estimates. With population centres outstretched – coupled with outdated systems and deteriorating infrastructure – improving public transport becomes a central tenet of MaaS. Better utilisation of private vehicles, fleets, and existing transport infrastructure will all need to be considered. The very notion of turning your private car into a money-making Airbnb-like asset is already making waves across automotive circles, with unique revenue models still being explored.

MAKING SENSE OF MAAS

MaaS is not a monolith and will take many forms. As a digital platform accessed straight from a smartphone, it allows users to plan, pay and move frictionless through their journey using real-time data. With pay-as-you-go or a monthly Netflix-style subscription with unlimited multimodal transit, it works to optimise journey planning and improve speed, cost and overall efficiency. By 2030, it's expected that revenues from mobility services will reach almost \$1.2 trillion, with potential benefits impacting everything from road congestion (we spend a big chunk of our lives sitting in traffic) to improving sustainability and mitigating our impact on the environment. Efforts to conceptualise MaaS depend on where you are and who you're asking. It is widely understood – at least at the onset – that MaaS will evolve differently across a wide spectrum of cityscapes and regions—but always acting as a unifying system for the betterment of users travel options. As digital technologies embed themselves all around us, MaaS players like Cubic Telecom can enable next-gen communications – between vehicles, pedestrians, infrastructure and more – for tomorrow's smart cities. MaaS aims to answer the needs of its locality, fuelled by the ethos that getting from point A to B should be easy, seamless and cost-effective, everywhere and all the time.

MaaS is about co-habitation and co-existence of converging players in software, big data, Internet of Things (IoT), connectivity, autonomous vehicles, electrification and intelligent communications. This multi-layered, multi-actor platform – from both the public and private spheres – can only flourish if everyone moves together with a common purpose. With MaaS, the only metric of any worth is consumer satisfaction, as user mobility habits will ultimately drive the scene forward.

THE DIGITAL ROAD AHEAD

There is no clear roadmap for how MaaS will unfold but once it arrives en masse, it will forever change the way we think about movement – both of people and of goods. MaaS will disrupt entire industries, but it will also help reinvent them and generate exciting new business models. How will OEMs leverage their industry expertise to build and dominate this ecosystem, moving from manufacturers to service providers? What will we even think of private car ownership in the coming decades as we move towards shared mobility? With attitudes shifting, issues like sustainable urban transport are taking centre stage. Most significantly, MaaS will usher in a new era to help you get where you want, when you want and how you want.

Integration of these new or enhanced mobility services will come in cascades, requiring cooperation and collaboration to ensure the benefit of all and not some. MaaS cannot survive in an environment that's not fully and completely user-centric. We don't know what this ecosystem will look like yet, or all its potential benefits and challenges, but it is inevitable that all roads lead to MaaS. Cubic's global software technologies are already playing an integral role in helping unify this ecosystem for today and tomorrow.

NEXT:

PLANNING FOR TOMORROW'S MOBILITY WITH 5G AND CELLULAR VEHICLE-TO-EVERYTHING (C-V2X)

5. PLANNING FOR TOMORROW'S MOBILITY WITH 5G AND CELLULAR VEHICLE-TO-EVERYTHING (C-V2X)

Speculation around what the future of automotive tech will look like has been examined at length for the past decade. Today, next-generation vehicle technologies are giving us a clearer glimpse of what to expect in the decades ahead. With the number of connected cars on the roads forecasted to reach 76 million by 2023, there are growing opportunities to design intelligent mobility systems that are safer, greener and more efficient across the globe.

The momentum to innovate the transport industry is increasingly being driven by Cellular Vehicle-to-Everything (C-V2X) and 5G technologies. Several key components that fall under the C-V2X umbrella include:

- Vehicle-to-Vehicle (V2V)
- Vehicle-to-Infrastructure (V2I)
- Vehicle-to-Pedestrian (V2P)
- Vehicle-to-Network (V2N)

It is a future where cars talk to each other, to their surroundings, and to anything else that will listen. Accurate real-time communication to and from the vehicle is key to unlocking mobility's full potential.

ROLLING OUT V2X-EQUIPPED VEHICLES

It is still early days for the application-level testing and deployment of C-V2X technologies, but real-world progress is underway. Industry analysts estimate that there were about 0.7 million cars on the roads featuring V2X capabilities in 2020. Forecasts expect this number to grow to over 35 million by 2025. The deployment of 5G will be vital to any future advancement of C-V2X.

China has taken the lead in adopting C-V2X services, which are expected to be included in about half of new cars manufactured in the country by 2025. Ford, for example, is conducting ongoing tests of its C-V2X features on public roads in select Chinese cities, providing real-time traffic alerts notifying drivers of possible delays or road emergencies on their journey. Other exciting C-V2X use cases in regions like Europe and U.S. are demonstrating capabilities that will drive the future of intelligent transport.

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CONNECTED CARS OF THE FUTURE

While connected car tech isn't new, it is certainly evolving quickly to enable C-V2X. Certain features have been toyed with over the years. For example, car phones were arguably the first iteration of scaled vehicle connectivity, in that they were the first live link from the car to the outside world. OnStar was one of the first major iterations of commercialised vehicle connectivity. Interestingly, both were effectively made obsolete by smartphones.

Today's rapid digitalisation of the automotive sector is again moving innovation forward. Disruptive brands like Tesla have forced carmakers to leverage the success of leaders in the cloud computing space. These partnerships signify an acknowledgement by traditional automotive companies that they cannot exist in a vacuum if they want to stay relevant. Automakers may have been slower to adopt, but now that they're fully onboard, the industry will see massive acceleration in the connectivity space.

PLANNING FOR THE ROAD AHEAD

Self-driving vehicles will generate vast amounts of data that will help improve road safety and make driving more collaborative. In the future, drivers will work together on the roads to create a more efficient transport ecosystem. Developing the infrastructure to support C-V2X communications will be a challenge, but absolutely vital for improving mobility systems. Before a smarter transport system can be realised, infrastructure will have to be as intelligent as the vehicles on the road. Cubic Telecom's global connected software solutions future-proof digital transformation in the automotive industry — key to enabling the success and adoption of C-V2X technologies for today and tomorrow.

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