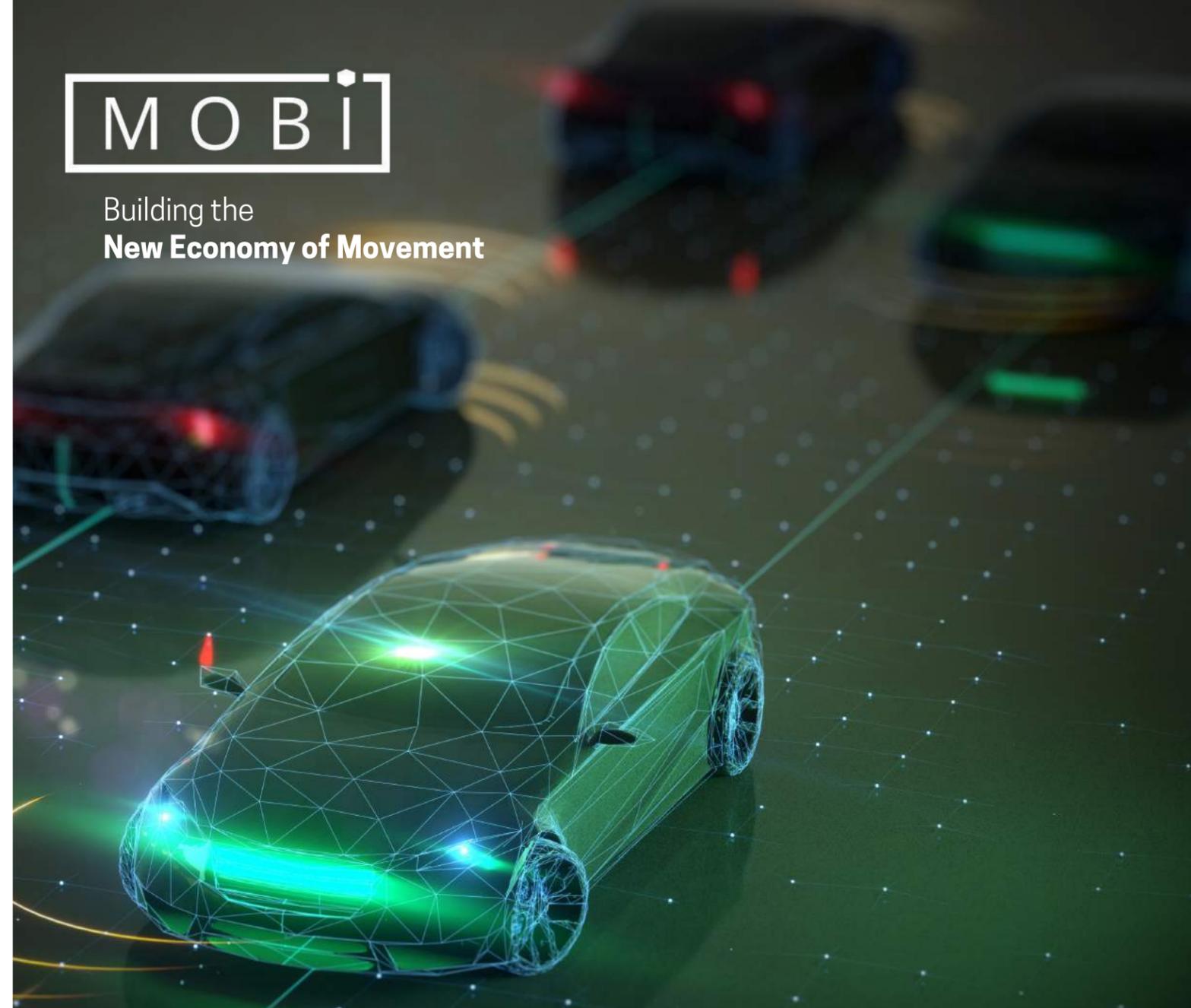




Building the  
**New Economy of Movement**



JANUARY 2021

# **VEHICLE IDENTITY II**

## **USE CASES AND BUSINESS REQUIREMENTS**

### **Use Cases**

#### **Vehicle Registration and Maintenance**

**MOBI VID0002/UC/2021**  
**Version 1.0**

# INTRODUCTION

**The Mobility Open Blockchain Initiative Vehicle Identity Working Group is a global and multi-stakeholder project working to co-design blockchain- and distributed ledger technologies-based standards for connected mobility ecosystems. The project engages stakeholders across the mobility value chain, including original equipment manufacturers, mobility industry service providers, technology companies, governmental and non-governmental entities. This report is based on numerous discussions, workshops, and research. Opinions expressed herein do not necessarily reflect the views of individual members.**

**Sincere thanks are extended to those who contributed their unique insights to this report.**

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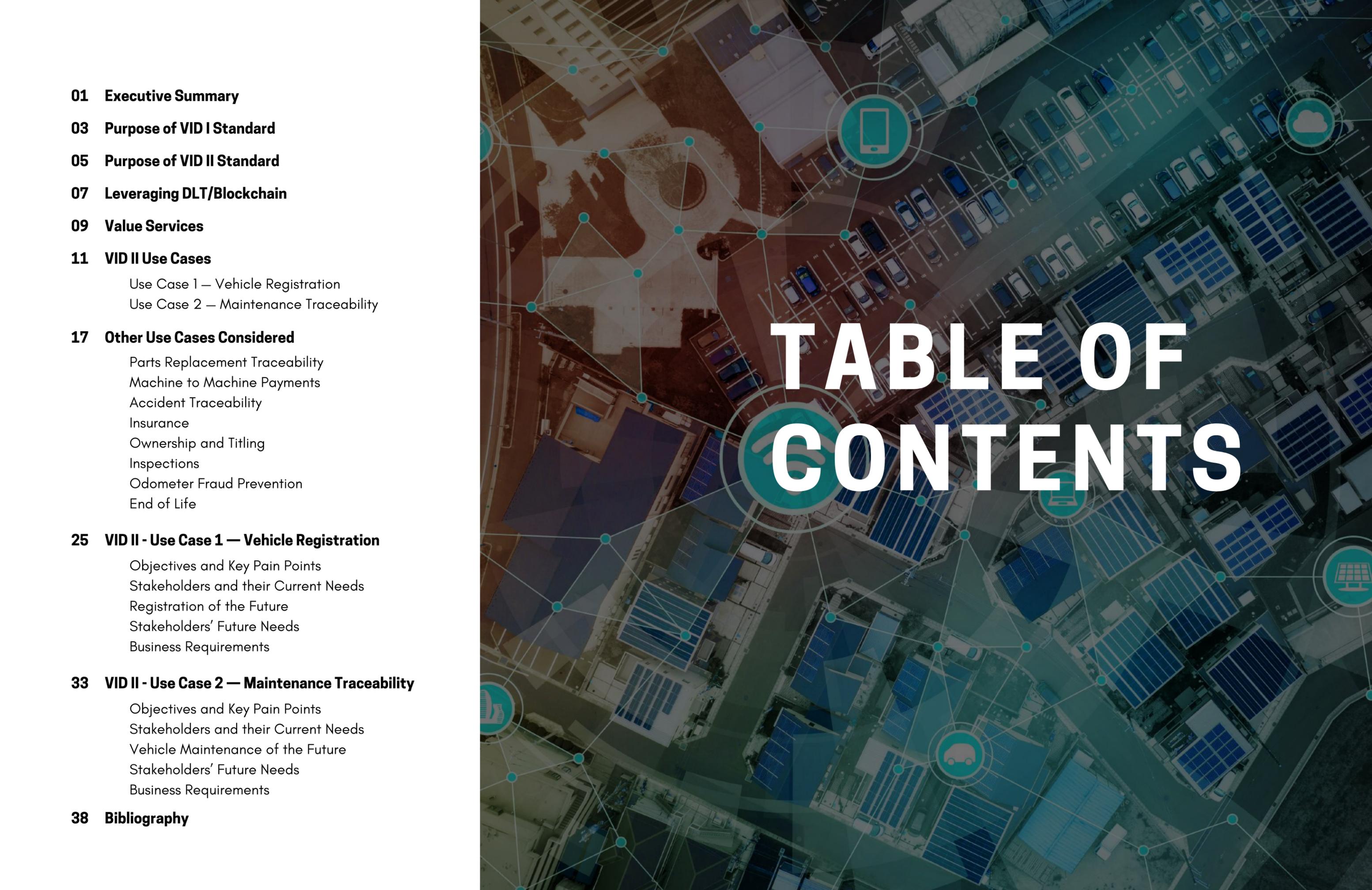
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# Executive Summary

Vehicle identity compatible with digital ledger and blockchain technology is a crucial building block for innovation in future mobility ecosystems.

MOBI VID applications span across vertical industry use cases, with vehicle registration and maintenance traceability being most immediate.

Blockchain and distributed ledger technologies (DLT) enable the digital transformation of the mobility industry. The foundation of all DLT and blockchain-based activity is the compatible vehicle identity. Using shared ledger technologies for vehicle identities is a crucial building block for new mobility, transportation and Internet of Things (IoT) ecosystems of the future. These ecosystems will disrupt the automotive and mobility sectors while changing the way business is conducted. Vehicle Identity (VID) is a tool that enables these ecosystems. VID supports dynamically defined multi-stakeholder, interoperable, mobility ecosystems, yielding increased transparency, coordination, and automation between the stakeholders. While the VID I standard focused on standardizing data related to the birth of the vehicle and created the Vehicle Birth Certificate (VBC), VID II extends that to data related to lifetime events and transfer of ownership.

DLT/Blockchain use cases that depend on a secure digital vehicle identity span from vehicle payments, supply chain and automotive financing to autonomous vehicle data marketplaces and many more. This document introduces a business review for the VID II use cases to accompany the technical standards created by the group. It describes current practices, key pain points, and stakeholder needs. The vehicle identity working group decided to focus on two use cases – vehicle registration and maintenance traceability.

Vehicle identity leverages traditional vehicle identification numbers and verifiable credentials on immutable ledger across the vehicle and service network.

In July 2019, Mobility Open Blockchain Initiative (MOBI) released a business white paper and a technical specifications as VID I standards. It consisted of a decentralized identifier (DID) tied with the vehicle's vehicle identity number (VIN) as an identifier at birth. VID can be used to identify the manufacturer of the vehicle, model, type, and year of manufacturer. VID augments and elevates the use of the current VIN, in the following areas:

- The vehicle receives a globally universal and immutable identifier that is compatible with implementing use cases on blockchain for which vanity identifiers do not scale.
- The VID is globally identifiable across multiple entities, in order to participate in a multi-party network to create use cases such as parts provenance.
- Since VID follows the World Wide Web Consortium standard (W3C), it is machine readable and therefore usable across multiple blockchain platforms.
- While the VID of a vehicle doesn't change, its attributes change over time.

A trusted ledger that verifies vehicle attributes is a critical piece for the industry adoption of vehicle identities.

Without a wide adoption of VID, the industry cannot scale implementations to reduce or remove the pain points in use cases described in subsequent sections. It is imperative that the VID can be created by anybody without a need for sophisticated application and then associate attributes about the vehicle. At the same time, those attributes must be verifiable since confidential information is not stored in the DID associated with the VID. This standard and VID II do not define who should provide the verification and play the role of the verifiable data registry and is beyond the scope. Perhaps, there will be a different standard to operate as a verifiable data registry. At minimum, the registry will leverage a decentralized public ledger to store VIDs in order to provide proof of the vehicle's existence in the network.



**At minimum, the registry will leverage a decentralized public ledger to store VIDs in order to provide proof of the vehicle's existence in the network.**

Vehicle's digital identity begins with a vehicle birth certificate, which is a subset of a vehicle's overall identity.

VID compatible with DLT/Blockchain technology will usher in innovative use cases as well as improve existing ones. Most importantly, VID allows cross-company collaboration to solve specific industry problems that remained difficult to address before the existence of blockchain technology. The foundation and requirement of use cases is an interoperable vehicle identity which leverages DLT/Blockchain technologies, DIDs, and Verifiable Credentials (VCs) for vehicle identities. The VBC envisioned in VID I is a data structure of strings and integers that records information about a particular vehicle at its creation.

Since a digital vehicle's life cycle begins with the VBC and it represents a subset of the vehicle's overall digital identity along with individual parts it contains, the working group decided to make a strategic shift.

Focusing on leading vehicle identity use cases, the VID-2 standard is a logical extension of the vehicle birth certificate.

In this phase of VID development the team focused on deployment of the VBC and this new digital vehicle identity for a variety of use cases leveraging blockchain.

VID II standard is divided into two deliverables:

- MOBI VID0002/UC/2021 - Describes vehicle identity use cases prioritized by the working group members, maps stakeholders needs, and identifies high level requirements.
- MOBI VID0004/RI/2021 - Describes reference architecture and technical specification to meet the requirements.

MOBI and the working group intend to add more use cases in future versions of both documents.



# PURPOSE of VID II STANDARD

# LEVERAGING DLT/BLOCKCHAIN

Blockchain technology has ushered in the concept of “coopetition” in which competing entities collaborate to alleviate common business problems by building a network operated by mutually agreeable common protocol, workflow, and data standards. Trust is outsourced to a decentralized ledger that operates within the boundaries defined by the network participants instead of a siloed enterprise infrastructure. Transactions are pushed to a decentralized ledger using cryptographically secure and fault tolerant consensus mechanisms. Augmented by off-n and on-chain governance, competing entities are thus assured that the ledger is immutable.

Standardized vehicle identity beyond VIN is necessary to utilize the DLT/Blockchain as a ledger to register events related to vehicle’s registration, maintenance, parts traceability, and more.

The ledger continuously records the state of assets as a stream of incoming transactions. The network autonomously agrees on the state of transactions added to the ledger.

Due to antitrust laws, these competing companies are not allowed to see the details of each other’s transactions. Hence, the details of these transactions are stored off chain and viewable only by the entities with appropriate permissions. The off-chain storage does have a way to link the asset detail to transaction in the ledger.

Beyond the VID standard, a community owned and managed mobility network is needed for stakeholders to share confidential information with each other.

Once the companies have agreed upon the state of ledger, they can actively participate in applications built for specific use cases. Original Equipment Manufacturers (OEMs) can share supplier’s reputations, threat intelligence, provenance of parts, etc. without disclosing confidential information to other entities. For the entities to agree on the state of the ledger, they first have to agree on how assets are assigned an identity before their state is added to the ledger as transactions.

MOBI and the working group members anticipate that the use cases mentioned in subsequent sections will be developed using some flavor of vehicle identity.

# VALUE SERVICES

The MOBI VID unlocks a range of new services including asset visibility, data provenance and autonomous economic agents.

The MOBI VID will unlock a range of new services labeled here as “Value Services,” which are as following:

- Asset Visibility
- Anchor for Additional Services
- Data Provenance
- Autonomous Economic Agents

Asset visibility allows provenance of vehicles and their safety components when they change “hands.” The vehicles provenance is recorded from the time a vehicle leaves a factory floor to when it is transported by multiple entities, to the time it reaches a dealer and sold to an owner. Current VIN-based vehicle identity provided by third parties is inadequate and incompatible with developing multi-party collaborative systems on a decentralized network. Assets in decentralized networks are identified with a set of keys and addresses and not with a VIN. These types of assets, however, can be associated with the VID. Being able to build asset visibility on collaborative multi-party systems unlocks many innovative use cases such as immutable odometer readings, maintenance statuses accessible to multiple parties, cross-border registrations, and more.

The intent of MOBI VID is not to replace VIN, but to augment it with digital certificates anchored to DLT/Blockchain technology.

While the main benefit for “asset visibility” is transparency, the other benefit is coordination. The MOBI VID will function as an anchor for additional services, using it to track, add to an asset, and enable transactions involving the asset—specifically, reflecting “real status,” setting permission levels, accepting payments, and adding business logic. In new mobility ecosystems this level of coordination is paramount.

Universal identification of vehicles and key components allow data about a vehicle to be compatible with systems everywhere regardless of language, and jurisdictions. VID adopted across the industry will also allow vehicles to interact with other vehicles (V2V), infrastructure (V2I) and eventually, vehicle-to-everything (V2X) environments.

The VID standard enables vehicles to autonomously transact with other entities in a shared mobility ecosystem.

The combination of VID and the ability to accept and conduct payments will transform vehicles into autonomous economic agents with far-reaching consequences. V2V transactions include negotiating right-of-way or platooning. V2I transactions include electric vehicles to grid payments and toll-roads. Vehicles can request and receive payments for their usage in shared and autonomous environments and much more.

# VEHICLE IDENTITY II USE CASES

The use cases for which business requirements and reference implementations are described leverage distributed ledger and blockchain technologies to achieve innovation and efficiency gains in vehicle registration and maintenance traceability. It is assumed that such systems use DLT/Blockchain infrastructure (including appropriate governance) as a root of trust for all stakeholders. Figure 1 below illustrates how at a high level both use cases apply DLT/Blockchain as a trust anchor.

The VID II working group recommends two use cases as a starting point – vehicle registration and maintenance traceability.

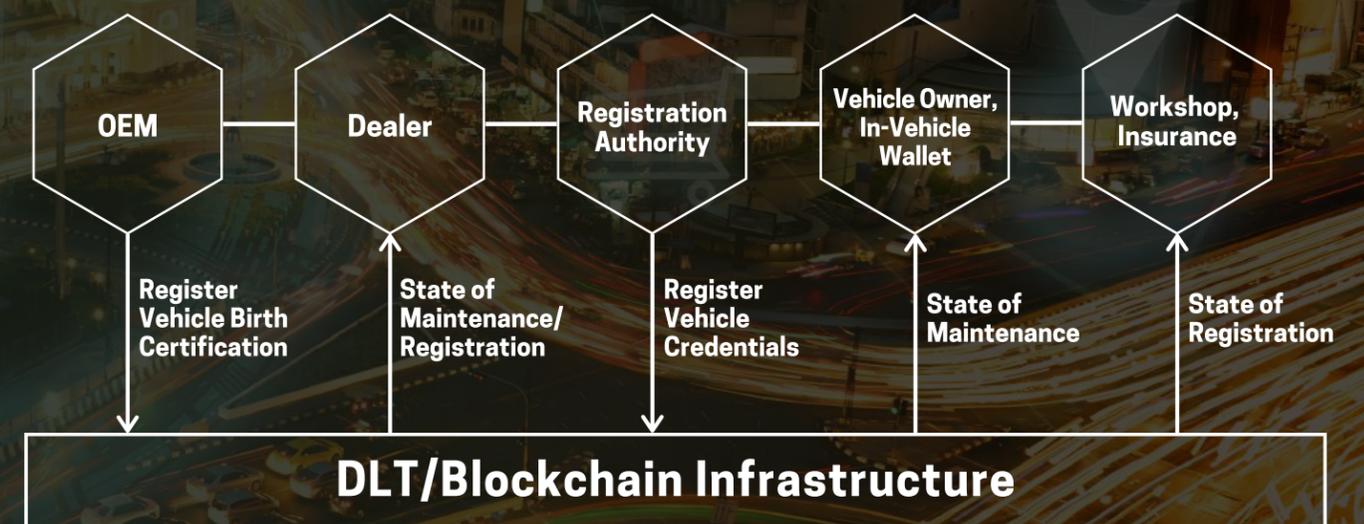


Figure 1 — Illustration of use of DLT/Blockchain infrastructure as a root of trust for stakeholders in vehicle registration and maintenance use cases.

# Vehicle Identity II Use Cases

## Use Case 1 — Vehicle Registration

The VID working group recommended two use cases - vehicle registration and maintenance traceability with limited scope described later.

At minimum, the vehicle registration use case involves the identity of the vehicle, current owner, and the past owner.

Vehicle registration connects new and used vehicles to a person or entity. Registration does not necessarily establish the ownership of the vehicle, which is accomplished through the titling process. Both titling and registration are established and regulated by laws of a jurisdictional government entity. In the United States (US), each state's department of motor vehicles registers a vehicle to a person or entity. In the European Union (EU), member countries and states or provinces maintain the registration. By registering, a vehicle receives a license plate (authority) in order to operate on public roadways. For the purposes of this document, we will assume the title holder (owner) of the vehicle and the name under whom the vehicle is registered and operated are the same.

The owner or operator of the vehicle has to carry a paper document (i.e., the vehicle registration) at all times. When associating a vehicle with an owner or operator through the registration and titling process, the government entity connects the vehicle's identity (VIN number) to a person's, or other entity's identity (i.e., date of birth, address, national identity). The registration is then used by third-party service providers such as insurance, taxation authorities, maintenance vendors, tolling agencies, law enforcement agencies, etc., for their own purposes.

When the owner of the vehicle moves (triggered by address change or number of days domiciled in the jurisdiction) to a different jurisdiction or when the vehicle is sold to another owner in a different jurisdiction then the vehicle must receive a new registration. In order to make this process as seamless as possible, many EU member states and provinces have been working for the past several years to integrate their systems,

The Vehicle Identity is designed to be globally unique which allows multiple agencies to have visibility of a vehicle's change of ownership and registration across jurisdictions.

create national vehicle registries (similar to the National Motor Vehicle Title Information System or NMVTIS in the US) to not only approve or reject registration requests, but also to provide consumers with a more reliable vehicle history.<sup>1</sup>

Where national vehicle registries are not available or where there are no national mandates to create one, it is incumbent upon the states or provinces to allocate resources and initiate integrations with other states and provinces.<sup>2</sup> To fill this void, numerous commercial entities exist that harvest data from multiple sources such as insurance companies, state and provincial entities and dealerships to provide the vehicle history to consumers.

The objective of this use case is to verify registration of a vehicle using VID as a global identifier without integrating with registration authorities. A VID that is compatible with blockchain technology can be a catalyst to virtually connect silos of vehicle registration systems between states or provinces in different countries.

1. "Understanding an NMVTIS Vehicle History Report," US Department of Justice, Office of Justice Programs, [https://vehiclehistory.bja.ojp.gov/nmvtis\\_understandingvhr](https://vehiclehistory.bja.ojp.gov/nmvtis_understandingvhr), Accessed September 10, 2020.

2. "REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL - simplifying the transfer of motor vehicles registered in another Member State within the Single Market," European Commission, Brussels, April 04, 2012.

# Vehicle Identity II Use Cases

## Use Case 2 — Maintenance Traceability

The Vehicle Identity would also be a part of the maintenance process at dealerships and repair workshops allowing owners to verify services performed and the provenance of parts replaced or repaired in the process.

The maintenance traceability use case at minimum involves the identity of the vehicle, the repair service provider, and the vehicle owner.

The global automotive repair and maintenance service market is estimated to reach USD 810.30 Billion by 2026, according to a new report by Reports and Data.<sup>3</sup> The North America region is projected to grow at a rate of 5.8% during the forecast period with the largest share of 32.50% in 2018. Moreover, an increase in sales of used cars in many regions, especially in emerging economies, as well as technological advancements pertaining to vehicle safety, are also fueling market growth. Based on statistics, increase in average age of vehicle due to technological advancements and the average miles driven per vehicle are also significant factors stimulating market growth.

The objective of this use case is for the stakeholder to verify if a vehicle has received service(s) from one or more repair service provider(s) during its life cycle and more easily obtain reliable maintenance records. In the future, the working group will include the stakeholder's ability to verify and trace parts replaced or repaired during the maintenance or repair process. The successful implementation of the use case will allow the stakeholders to verify if factory or other recommended maintenance was performed, if the proper parts were used, at the work performed by certified repair centers, etc. Such traceability will provide the stakeholders the ability to assess warranty claims, establish accurate resale value, quantify insurance claims risks, and verify emissions and other required inspections. This will also allow virtual consolidation of information silos across a range of stakeholders interested in a vehicle.

3. "Automotive Repair & Maintenance Service Market By Parts (Tires, Wear and tear parts, Collision body, Batteries, Others), By Applications, By Technology (Microcomputers, Aluminum, Wi-Fi), By Service type And Segment Forecasts," 2016-2026, Reports and Data, <https://www.reportsanddata.com/report-detail/automotive-repair-and-maintenance-service-market>, Accessed December 16, 2020.

# OTHER USE CASES CONSIDERED

MOBI VID II working group members considered several use cases and each one of them will create value services. These use cases included a broad range of pain points that the industry, regulatory agencies, service providers, and the consumers face, as shown in Figure 2.

The working group will develop business requirements and reference implementation for other use cases moving forward.



Figure 2 — DLT/Blockchain compatible globally unique vehicle identity allows innovation and efficiency gains in a variety of use cases concerning vehicles.

# Parts Replacement Traceability

The VID is the foundation for a digital car pass which may contain verified part replacement connected to the vehicle identity.

Parts replacement is part of maintenance and repair services. Parts are replaced to repair damage or as part of ongoing maintenance when they wear out (e.g., batteries, brakes, tires, etc.) It is possible that the vehicle's owner, repair shop or service provider may use non-standard parts or perform unintended mechanical changes to the vehicle or important components that were not intended by the parts provider or OEM. For these reasons and more, visibility into parts replacement and service maintenance is necessary for the following reasons:

- If a vehicle is affected by a recall, the OEM will mail a notification to the last owner of record and indicate the vehicle and the affected parts being recalled.
- If a vehicle has been modified in such a way as to void the warranty provided by the OEM.
- The installation of certain aftermarket parts will also not be covered under warranty or may have a significant impact on a vehicle's resale value (e.g., certain features such as aftermarket engine and performance equipment or software, etc).
- Mechanical breakdown insurance and extended warranties may be an option for aftermarket warranty coverage, but these too have restrictions for modifications or the inclusion of certain parts.

Without a digital vehicle identity, vehicle-based wallets will not function to facilitate vehicle to vehicle and vehicle to infrastructure payments.

Machine-to-machine payment is becoming more feasible than ever with electronic wallet applications and commitments from OEMs to include wallets in new vehicles. With cryptocurrencies and stable tokens gaining traction in the market, micropayments to pay for services consumed by vehicles is a reality. Vehicles can receive and transfer payments for repair services, pay for tolls, buy information with V2V and V2I type connectivities, and much more. One of the key requirements of vehicle-initiated payments is that the payee must verify who is receiving the payment and if it has received such payment. In that context, the identity of vehicles and associated wallets becomes essential to complete such payment transactions.

# Machine to Machine Payments



# Accident Traceability

Information about accidents and maintenance activities on vehicles are important parameters to reduce buyer-seller information asymmetry.

Two primary reasons why a vehicle loses value due to accidents are: (1) the severity of the accident the vehicle was involved in is usually unknown, and (2) the quality of repairs is unknown. It is difficult to determine if the car has truly been returned to its pre-accident state. Visibility into the accident history will not only increase resale value, it will encourage owners to maintain vehicles properly, use OEM parts and authorized service providers since not doing so will impact resale value. Such visibility will also allow dealerships, fleet owners, and used car buyers to accurately assess a vehicle's value.

There is potentially a market for "sweetening lemons". If a vehicle has been in an accident and that information is now visible to the concerned stakeholders, there might be a way to claw back some of that lost value, hence sweetening the lemon. A dealer could certify that a vehicle has been properly fixed and is as good as new.

# Insurance

The vehicle identity will allow insurance providers to seamlessly verify maintenance services performed, parts replaced and serviced. It will provide information on parts that came with the vehicle to direct owners to the appropriate workshop.

The insurance industry will greatly benefit from persistently managed relationships between a vehicle identity and subsequent parts identification. This will allow actuarial teams new insights into pricing insurance policies given records of types and quality of parts replaced during the repair process. Vehicle identification and digital registration held in vehicle wallets will potentially allow insurance companies to issue policies for shared vehicles and micro or usage-based insurance payments instead of monthly policies. Having accurate records for the entire lifecycle of a vehicle including the manufacturing, vehicle sales, claims, repair and maintenance will allow for much more individualized pricing per vehicle without having to collect the data from an individual.



## Ownership and Titling

An immutable and chronological record of a vehicle's title data eliminates the potential for title fraud, providing assurance to the potential customer and the state that the true value of the vehicle can be ascertained. This use case is closely tied to the vehicle registration since in most jurisdictions vehicle registration and titling are performed by the same entity. In the US, most state titling systems are paper-based and siloed. Blockchain can provide a future-proofed, modern solution to these problems by enabling states to securely exchange data with one another, while being assured that the potential for fraudulent activity related to ownership, odometer and other title information has been dramatically reduced or eliminated.

[Vehicle registration augmented with digital vehicle identity will enable easy on-line verification of vehicle ownership.](#)



## Inspections

Blockchain technology combined with vehicle identity provides an immutable record of inspections, shows the condition of vehicles at repair shops and provides an accurate and immutable record of physical and mechanical issues and repairs over time. Proof of inspection performed and whether the maintenance met specifications and other metrics such as paint thickness, and diagnostic or fault codes can be verified by third parties.

[Concerned stakeholders can easily verify required emissions, safety, and other inspections performed on vehicles.](#)

Odometer reading is often used as a predictor of a vehicle's market value. Mileage or odometer tampering has always been a problem for the automotive industry, especially when vehicles are bought and sold across international

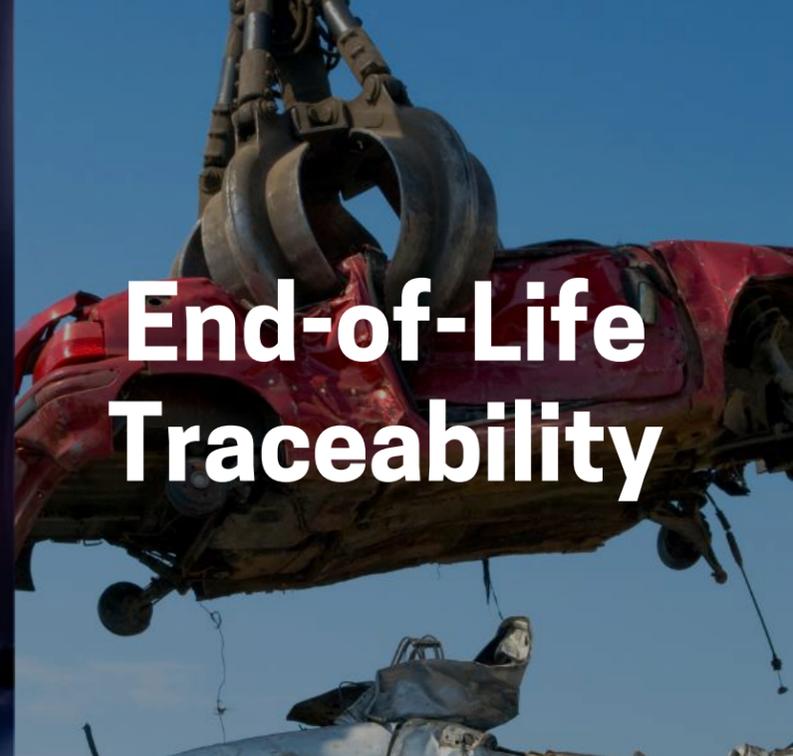


## Odometer Fraud Prevention

borders. Widespread practice of odometer tampering creates a negative impact on the used vehicle market. A public ledger of mileage record tied with digital identity can deter such malpractice.

Several companies such as BMW and Bosch have developed applications to utilize blockchain to anchor odometer readings. Even the European Parliament agrees that blockchain technology may represent another potential solution to be applied to combat odometer tampering, allowing for a more transparent access to odometer figures and tackling two sensitive issues: privacy of data and frequency of data recordings.

[Odometer tampering is a significant deterrent in after market and private sales of vehicles. Mileage readings tied to VID anchored to open immutable ledgers have potential to increase trust in vehicles sold in used car markets.](#)

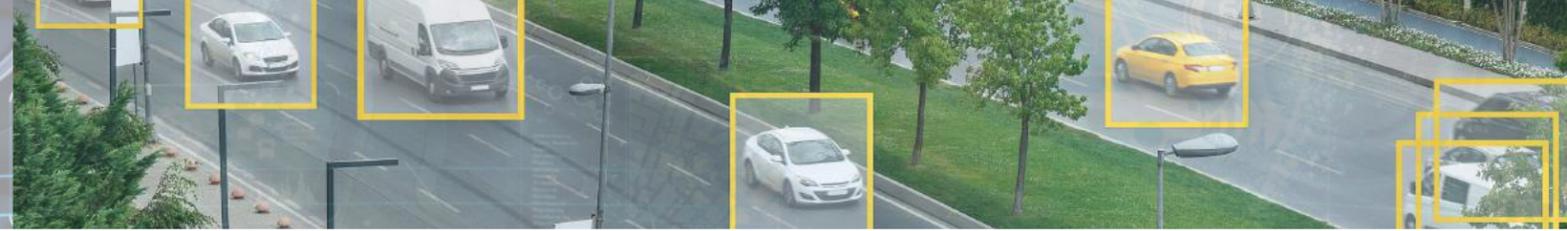


## End-of-Life Traceability

Vehicle end of life traceability is key to ensure that original parts (especially safety related) in the vehicle are properly scrapped, recycled, or shelved. In that context, it is important that parts identification in the vehicle are logged as such so that the IDs are not added to counterfeit parts. With this use case, dealers and repair shops will be able to query counterfeit parts and OEMs will be able to ensure they are not liable for unwarranted claims.

[VID and parts traceability can improve safety by reducing parts fraud at the end of vehicle life.](#)

# VID II-UC1 — Vehicle Registration



## Objectives and Key Pain Points

OEMs will create vehicle birth certificates, which are then passed on to dealerships and owners during the purchase and registration process.

Creating a more efficient virtual registry of registrations that transcends jurisdictions using globally unique VID will reduce the cumbersome process of granting, denying, and cancelling registrations across jurisdictions. Doing so will also reduce fraud related to registration “cleaning” sometimes referred to as “title-washing” when vehicle registrations are transferred from one jurisdiction to another to remove unwanted “brands” such as salvage or flood damage that impact resale value. Such a system will greatly reduce the cost to consumers to obtain the vehicle's history since the time it left the factory floor. These VIDs would be provided by the OEM as a part of creating the vehicle birth certificate, which is passed on to dealerships and then to vehicle owners.

The vehicle identity provides a clean and transparent history through the lifecycle of a car.

Buying and selling used vehicles is fraught with imbalance of information between the buyer and the seller. Since a vehicle with a 'clean' and transparent history holds more value than an equivalent vehicle without, sellers have incentives not to disclose information about defects, major repairs, recalls, etc. Since a vehicle's unique digital identity will be assigned as part of the birth certificate by the OEMs, such recalls and even major repairs will be visible to the buyers down the line. However, such a system must be conscious about the trade off between attributes publicly shared and accessible and privacy concerns of the vehicle owners. Alternatively, vehicle owners can be incentivized to disclose their maintenance history so as to increase resale value through such transparency.

It is important to note that this document and the subsequent technical specification document does not consider the following:

- Replace or modify existing rules by the states and provinces with regards to granting, denying, and cancellation of registrations.
- Replace or modify how vehicle history is collected by insurance companies, states and provinces.
- Replace or modify definitions of vehicle history.

The objective of this use case review and the subsequent technical specification document is for the stakeholders to enhance and augment the existing registration such that the stakeholders can extract value propositions by leveraging unique properties of blockchain.



# VID II-UC1 — Vehicle Registration

## Stakeholders and Their Current Needs

### Vehicle Owners

Consumers of this use case are individuals or companies that own and operate vehicles. They may also be lessor or lessee of the vehicles. In many countries, vehicles may be registered to individuals or companies that do not necessarily own the vehicles. They purchase new or used vehicles. They may move to different jurisdictions where they have to re-register the vehicles. They may purchase vehicles already registered in a different jurisdiction. These events necessitate the consumers to apply for registration, within a certain number of days, at their corresponding vehicle registration authority.

Consumers have to provide to a vehicle registration authority one or more documents pertaining to proof of ownership of the vehicle, environmental compliance certificate, odometer readings and VIN. Registration requirements may be unique for different classifications of vehicles such as commercial trucks, personal vehicles, for hire and rental passenger vehicles.

### Fleet Owners

Commercial entities with private fleet, rental service owners, ride-share providers and drivers.

### Vehicle registration authorities (VRA)

The agency that regulates, and to some extent, that enforces local and federal laws with regards to registration and titling of vehicles. They register vehicles, issue license plates, revoke registration, and ensure vehicles are compliant with local and federal safety and emissions regulations. VRAs also maintain titles or ownership information of vehicles. VRAs maintain the history of VINs associated with owners along with vehicle history.

### Insurance Companies

Insuring vehicles requires the registration to be up to date. Insurance companies have information about claims made on the vehicle during crashes, service maintenance and repair events, and claims of total loss from theft, accident or natural disaster. Insurance companies also keep track of odometer readings against the VIN and the owner.

### Dealerships

Buying a vehicle from a dealership usually means that they will handle some of the registration process on behalf of the buyers. Dealerships are often authorized by VRAs to transfer titles and issue temporary registration to buyers until a permanent registration is obtained from the VRA. Dealerships also must keep a record of the assignment of VIN to a buyer associated with the temporary registration and in some states or provinces must comply with know-your-customer legislation to prevent fraud.

### Banks and Captive Finance Companies

If a bank or captive finance company (a lender owned by an OEM, e.g., Toyota Financial Services, etc.) has a lien on, or leases a vehicle, then its name will appear on the title. However, this does not affect the registration of the vehicle. Banks however do keep track of the change of title in the event the lien is removed after full payment or if the vehicle is stolen, totaled in an accident or damaged beyond repair in a natural disaster.

### OEMs

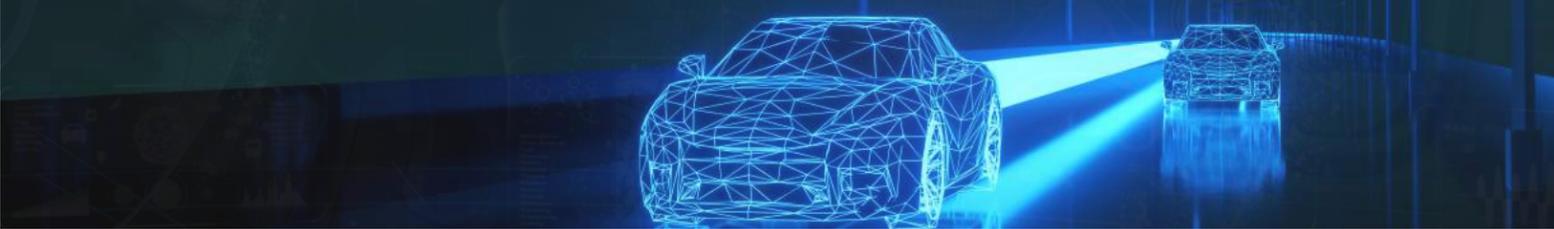
Vehicle manufacturers assign VINs to vehicles according to Society of Automotive Engineers (SAE) standards (e.g., SAE - J272.). OEMs are the initial owners of the vehicles after manufacture. The first ownership transfer occurs (for most vehicles) between the OEM and a franchised dealership which holds a contractual relationship with the OEM permitting the sale of its vehicles.

### Franchised Dealership and Independent Service Providers and Other Repair Shops

These entities service vehicles at the request of the vehicle owners or, in the case of franchised dealerships, in accordance with required maintenance intervals and warranty or recall repairs. In cases where insurance is involved, then they submit detailed reports on the service performed to the insurance company. In these transactions, VINs and owner or operator identification are used to identify and record the services performed.

### Rideshare Providers

These entities provide mobility-as-a-service without necessarily owning vehicles as assets. They recruit vehicles owned by other entities and individuals to provide mobility services, e.g., Uber and Lyft. These entities must verify if a vehicle being offered for the service is properly registered.



## Registration of the Future

Current verification of a vehicle's registration is a manual and cumbersome process. With MOBI VID, creation and transfer of a vehicle's registration will be less cumbersome and easy to verify. In the future, in-vehicle digital wallets will store its identity and present credentials to anybody servicing or using it.

Manual and paperwork intensive registration of new and used vehicles is inefficient. We envision a future when registration does not require owners to walk into VRAs, and the agencies can issue, transfer or revoke registrations using seamless data transfer between agencies, entities and individuals. At this point, the only verifiable connection between a vehicle and its owner is a piece of paper and perhaps a digital copy that resides in a centralized database at VRAs. There should be an electronic or digital twin of such a relationship that can be accessed and verified digitally and from which stakeholders can quickly confirm the existence of such a relationship as part of a variety of existing and future applications.

## Stakeholders' Future Needs

### Vehicle Owners

Consumers can electronically register a vehicle after they've bought it from a dealership or another consumer. The registration can be triggered by the dealership electronically on behalf of the consumer. In case of a private transaction, both consumers can complete the transfer of registration. Digital wallets will play a pivotal role in storing and proving the vehicle's identity. The digital wallet can then sign off insurance renewals, safety and emissions inspections, and easily connect other personal devices to the vehicle's components. Any stakeholder requesting verification of the registration can verify credentials in the wallet in which the trust comes from an anchor on a ledger or an issuer DID on a ledger.

### OEMs

OEMs assign VID and VIN for vehicles. Vehicle manufacturers assign VINs to vehicles according to Society of Automotive Engineers (SAE) standards (e.g., SAE - J272.). OEMs are the initial owners of vehicles after manufacture. We envision that OEMs will also assign initial VID and VBCs.

### Vehicle Registration Authorities

Whenever a stakeholder needs to digitally verify the ownership of a vehicle, then VRAs provide such verification electronically. The VRA should be able to transfer the registration from one stakeholder to another without shredding and printing a new registration, as is now done in many countries. Renewing a registration should be as easy as executing a simple digital signature and receiving a digital payment from the consumer or other vehicle owner and operator entities.<sup>4</sup>

### Fleet Owners

Owners and operators of vehicle fleets can electronically register multiple vehicles after purchase or lease. The registration can be triggered by the dealership or lessor on behalf of the fleet owner or operator. Digital wallets will efficiently store and provide the identity of multiple vehicle identities, insurance policies, safety and emissions inspections, and other requirements. Any stakeholder requesting verification of such credentials in the wallet will leverage the trust that comes from digital vehicle identity anchors or an issuers DID on a ledger.

### Dealerships

Vehicle identities are passed on to their franchised dealerships by the OEMs. Since in some jurisdictions dealerships assist the new vehicle owners with the registration process, dealers play a role in providing verification of those identities.

### Vehicles

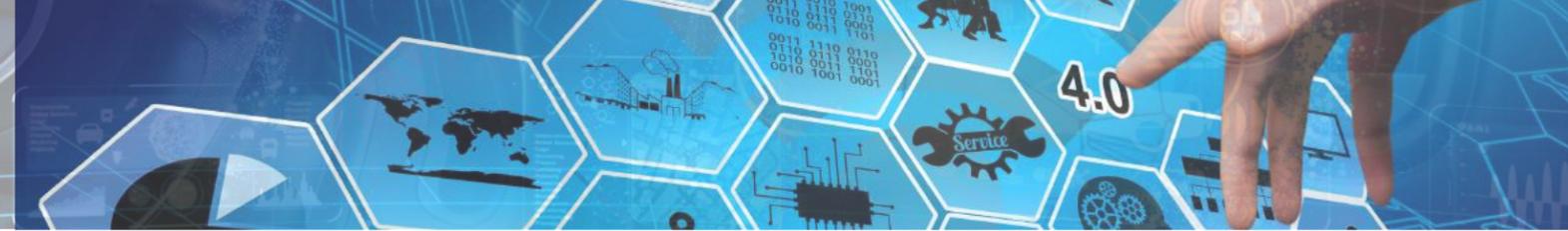
Vehicles in the future will have an embedded wallet with the registration certificates.

### Banks and Captive Finance Companies

These institutions can continue to work with VIN to issue traditional auto loans. They can also use VIDs to build innovative financing models for use cases such as fractional ownership.

4. Adam Norris, "GoChain — Vehicle Registration & Licensing," Medium Corporation, <https://medium.com/gochain/gochain-vehicle-registration-licensing-on-blockchain-8e80b0676447>, July 16, 2019.

# VID II-UC1 — Vehicle Registration



## Insurance Companies

These institutions can continue to work with VIN to issue traditional auto insurance. Insurance companies can issue usage-based or per trip insurance by using digital wallets of vehicles and their owners and operators. For other entities that need to verify a policy tied to a registration, vehicle owners can do so using digital wallets that connect to the underlying ledger and are signed by the insurance companies.

## Franchised Dealership and Independent Service Providers and Other Repair Shops

These entities will need to verify if the vehicle is properly registered by interacting with the vehicle and owner's wallets.

Banks, insurance companies, and maintenance providers will continue to use VIN until there are enough value propositions for them to use VIDs.

## Business Requirements

### VID II-UC1-BR1

A vehicle owner shall be able to electronically register a vehicle after purchase from a dealership or another consumer. In case of a private transaction, both consumers shall be able to complete the transfer of registration without the need to physically visit a VRA (or similar entity) or send paper documents via mail.

### VID II-UC1-BR2

A vehicle owner's digital wallet shall be tied to a government provided identity, the vehicle's previous registration, its VIN, VID, and new registration.

### VID II-UC1-BR3

A vehicle owner or operator shall be able to prove registration to outside third parties such as insurance, law enforcement, and maintenance service providers without producing personal information.

### VID II-UC1-BR4

A VRA shall be able to digitally verify if the vehicle is legally registered.

### VID II-UC1-BR5

A VRA shall be able to digitally transfer the registration from one vehicle owner to another.

### VID II-UC1-BR6

A VRA shall be able to digitally renew or revoke the registration of a vehicle(s) at the vehicle owner's request. It is recognized that in the future, more than one individual or entity may have an ownership stake in the same vehicle.

### VID II-UC1-BR7

OEM shall be able to create a VID for each vehicle using VIN, vehicle birth certificate, and other verifiable information and provide such information downstream to other stakeholders.

### VID II-UC1-BR8

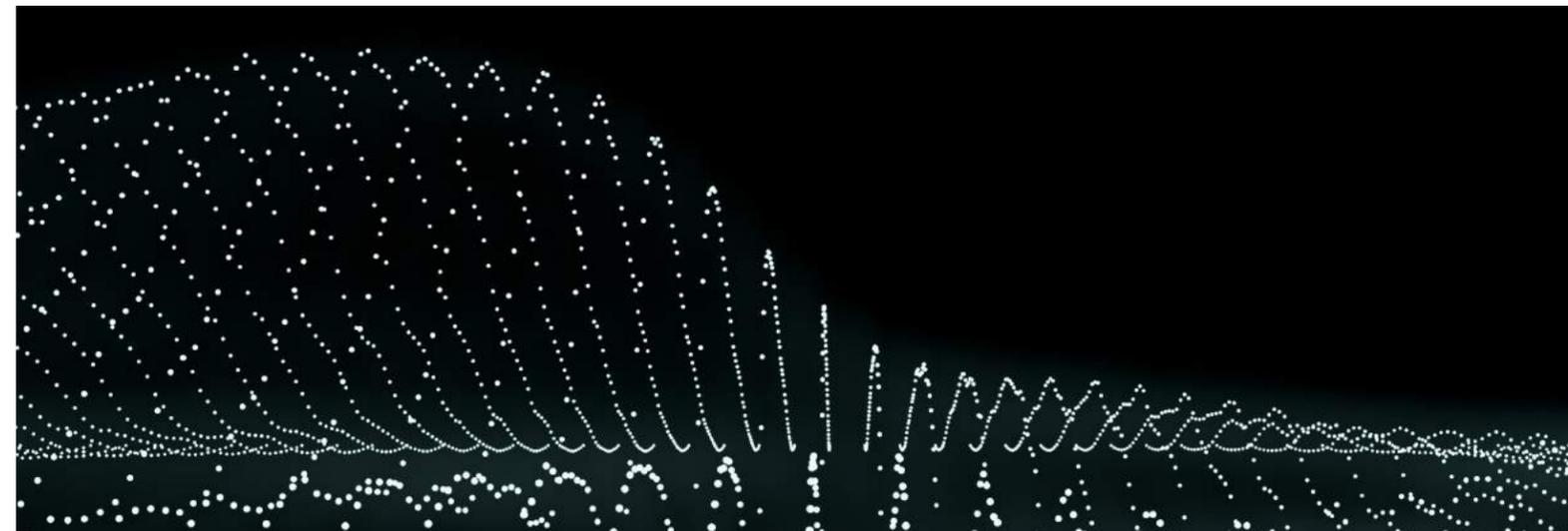
VID assigned by the OEM shall be persistent enough to prove existence, manage access control, confirm product definition and ownership history, and track events in the life of a vehicle.

### VID II-UC1-BR9

Insurance companies, banks, and other third party service providers shall be able to digitally verify the ownership of a vehicle using the vehicle's digital wallet, blockchain, or combination of available sources.

### VID II-UC1-BR10

VID shall be robust enough for other vehicles and infrastructure in the V2X environment to verify the identity of the communicating vehicle.





## Objectives and Key Pain Points

Proper and timely maintenance of vehicles impacts warranty claims, insurance, and resale value. There is an information asymmetry between vehicle owners, repair service providers, OEMs, and other third party service providers. The objective of this use case is to reduce the information asymmetry and the resulting disbenefits for all the stakeholders involved. At minimum, the scope of this use case is to provide information to the vehicle's stakeholders concerning the maintenance records by the way of VID pertaining to where and when such services were performed. As described in the earlier part of this document, the working group will, in the future, consider the ability to verify and transmit details of maintenance services provided, including identification of parts replaced or repaired.

Using digital vehicle identity and maintenance activities anchored on DLT/Blockchain infrastructure, users can verify where and when maintenance or repair was performed on a vehicle.

It is important to note that this document and the subsequent technical specification document does not consider the following:

- Replace or modify existing rules by which states and provinces grant, deny, and revoke licenses to operate repair service facilities.
- Replace or modify how the vehicle's maintenance history is utilized by the OEMs, dealerships, insurance companies, states, and provinces.
- Replace or modify how the repair services perform maintenance at their locations.

## Stakeholders and their Current Needs

### Vehicle Owners

The owners are required to provide as much verifiable information about repairs performed on their vehicles to other parties interested in the vehicle. However, very few owners keep a record of such services performed. That is why many buyers and lien-holders rely on multi-point inspection reports provided by repair services prior to purchase.

### Fleet Owners

Same as Vehicle Owners. In some jurisdictions, fleet owners are required to periodically report maintenance and inspection status of their fleet vehicles to authorities.

### Vehicle Registration Authorities

Government authorities that perform safety checks and other inspections and may require emissions checks as part of renewing a vehicle's registration.

### OEMs

Settling warranty claims is cumbersome because OEMs have to verify if the vehicles have been repaired at certified repair centers and if OEM parts were used to replace faulty ones.

### Dealerships

Dealerships keep electronic records of maintenance services performed on vehicles, records of parts exchanged or removed due to recalls, and normal repairs.

### Franchised Dealership, Independent Service Providers, and Other Repair Shops

Repair Shops provide electronic records of repair services performed on vehicles. Some repair providers can provide maintenance history to the vehicle's owners but not to others.

# VID II-UC2 — Maintenance Traceability

## Vehicle Maintenance of the Future

Maintenance traceability is a critical step in reducing recall costs for OEMs and parts suppliers.

We envision a future in which anybody wanting to verify a vehicle's maintenance record shall be able to do so with ease. Such maintenance traceability can be performed without going through multiple and siloed systems. This will also allow OEMs and dealerships to quickly respond to parts recalls and settle warranty claims. The resale value of vehicles can be quantified more objectively than currently practiced, which will positively impact current business models of buying and selling used vehicles.

VID-enabled maintenance records provide end-to-end lineage of trustable vehicle information.

Importantly, when vehicles are bought and sold privately, buyers can, with full confidence, get the history of repairs due to accidents and other causes. This is a form of insurance for the buyer, to have information certified by all the service providers that have worked on the vehicle. It's also a guarantee for the seller that they can resell their vehicle at a fair price.<sup>5</sup>

In this version, the use case review is limited to certifying if the repair shop performed service or not and providing maintenance records. Being able to verify replacement, and repairs of individual parts is out of scope.

5. Julien Jimenez, "Use Case of Blockchain Technology - Car Maintenance Book," WorldLine, <https://worldline.com/content/dam/worldline/documents/publications/briefing/expert-itw-car-maintenance-en.pdf>, Accessed October 21, 2020.

## Stakeholders' Future Needs

Vehicle and Fleet Owners

Manage and take ownership of the vehicle's identity by managing in-vehicle and mobile wallets. While vehicle owners will have access to maintenance information, they will also have the responsibility to make sure maintenance records about their vehicle are correct.

The owners have a cryptographic key that only they can use and which unlocks access to the vehicle data. If they like, they can give access to (or even sell) part of their data to an insurance company for a customized quote, or to a future buyer if they resell their vehicle.

OEMs and Dealerships

OEMs may send a request to verify maintenance schedules, status, and history from the repair services. At present the scope is limited to if the repair shop performed a service or not on the vehicle and receiving maintenance record.

Franchised Dealership, Independent Service Providers, and Other Repair Shops

Repair service providers will need to automatically respond to requests from OEMs, insurance companies, and vehicle owners for a certification that the shop did perform repairs on a vehicle and transmit the maintenance record.

Insurance Companies

Insurance providers have an interest in knowing which repair shop provided the maintenance or repair service. Some insurance companies have established networks of preferred repair shops.

## Business Requirements

- VID II-UC1-BR1** A vehicle owner shall be able to electronically verify to a repair service that the vehicle is indeed registered to the owner.
- VID II-UC1-BR2** A vehicle owner shall be able to tie their wallet to the vehicle's wallet so that the repair shop can obtain permission to perform repair services on the vehicle.
- VID II-UC1-BR3** A vehicle owner shall be able to provide a link or an electronic source to buyers, insurance companies, and DMVs for them to verify if in fact maintenance was performed at the repair shop.
- VID II-UC1-BR4** OEM shall be able to obtain from a repair shop a verification that it performed service on a vehicle in question.
- VID II-UC1-BR5** Repair shop shall be able to provide verification that it did perform a repair service on a vehicle in question.
- VID II-UC1-BR6** Repair shop shall be able to transmit maintenance records along with the service verification request.

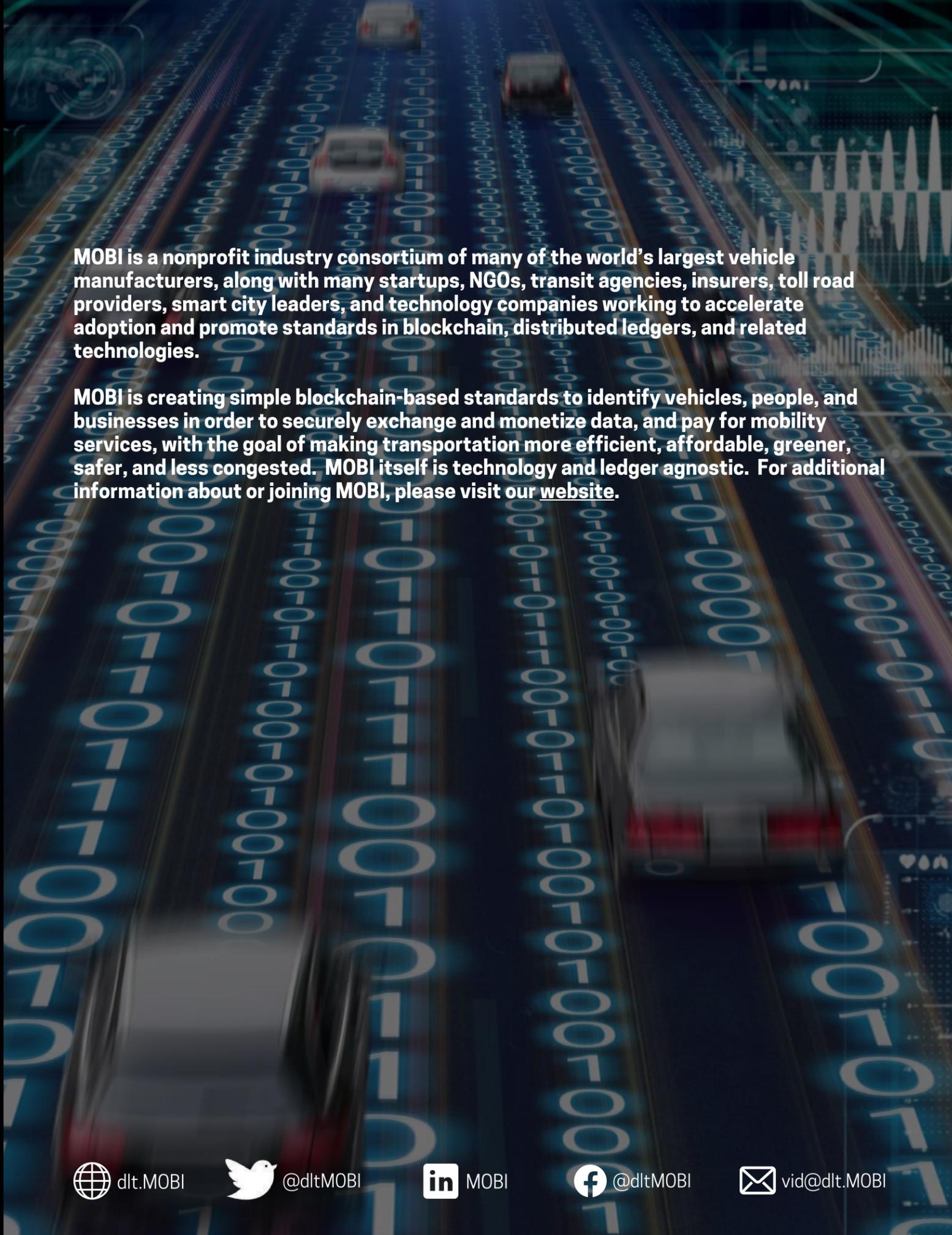
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**MOBI is a nonprofit industry consortium of many of the world's largest vehicle manufacturers, along with many startups, NGOs, transit agencies, insurers, toll road providers, smart city leaders, and technology companies working to accelerate adoption and promote standards in blockchain, distributed ledgers, and related technologies.**

**MOBI is creating simple blockchain-based standards to identify vehicles, people, and businesses in order to securely exchange and monetize data, and pay for mobility services, with the goal of making transportation more efficient, affordable, greener, safer, and less congested. MOBI itself is technology and ledger agnostic. For additional information about or joining MOBI, please visit our [website](#).**



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