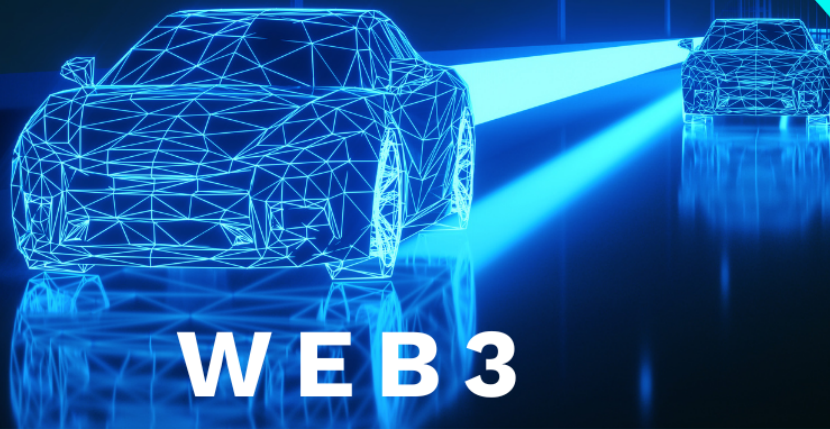




Building the  
**Web3 Economy**



**WEB3**

# **VEHICLE IDENTITY**

**BUSINESS WHITE PAPER**

**MOBI VID0001/WP/2021 Version 2.2**

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**JANUARY 2021**

**Vehicle Identity (VID) | Working Group**

*July 2019 (V1.0)  
January 2021 (V2.0)*

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# INTRODUCTION

This standard was issued by MOBI and its members. MOBI is a nonprofit alliance of many of the world's largest vehicle manufacturers, startups, governments/transit agencies, NGOs, financial institutions, e-mobility providers, consultancies, suppliers, logistics providers, and more working to create standards and build the Web3 digital infrastructure for connected ecosystems and IoT commerce.

MOBI is creating standards for trusted self-sovereign data and identities (e.g. vehicles, people, businesses, things), verifiable credentials, and cross-industry interoperability, with the goal of making transportation more efficient, equitable, decentralized, and circular, all while preserving the data privacy of users and providers alike. MOBI is technology and ledger agnostic. The work of preparing standards is carried out through MOBI Working Groups. Each member of the consortium interested in a subject for which a Working Group has been established has the right to be represented and participate in that Working Group.

The procedures used to develop this document and those intended for its further maintenance are described in the working group charter. In particular, the different approval criteria needed for the different types of MOBI documents should be noted. Approvals of MOBI Steering Committee and Board of Directors are obtained upon the final document release. Attention is drawn to the possibility that some of the elements of this document may be the subject of intellectual property rights. In accordance with MOBI IPLR policy, a 60-day review period is provided to the MOBI community to disclose any and all IP matters pertaining to this standard. MOBI shall not be held responsible for identifying any or all such rights. Details of any IP rights identified during the development of the document will be in the Introduction upon public release of this standard.

Any trade name used in this document is provided for the convenience of users and does not constitute an endorsement. The Working Group responsible for this document is the Vehicle Identity (VID) I Working Group. Sincere thanks and appreciation are extended to those who contributed their unique insights to the VID I Business White Paper.

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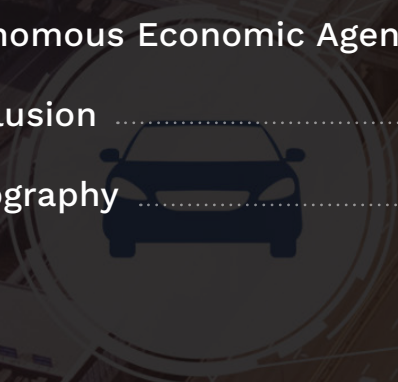
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## EXECUTIVE SUMMARY

*A new type of vehicle identifier will ignite the next digital revolution in mobility.*

Blockchain and distributed ledger technologies (DLT), when combined with in-vehicle artificial intelligence (AI) and two-way vehicle-to-anything (V2X) connections, will enable the digital transformation of the mobility industry and ignite the biggest change in mobility economics since the assembly line. The foundation of all this is a digital identity for vehicles based on decentralized identifiers (DIDs). DIDs are a cornerstone of next-generation web services that are designed to work without the centralized registries or certificate authorities that secure the identities of entities and devices on today's internet.<sup>1</sup>

*MOBI's Vehicle Identity creates a vehicle's "digital twin", enabling the efficiencies and economies of the digital world to be ported to the world of physical mobility.*

This is particularly important for applications where Internet of Things (IoT) devices communicate directly in ad-hoc, local networks at the "edge." Edge computing is an emerging technology that optimizes decentralized networks by placing nodes and processing data as close as possible to its source or use. Vehicles and smartphones are the two most important products that share this need for a DID to enable roaming in edge networks.<sup>2</sup> The Mobility Open Blockchain Initiative (MOBI) Vehicle Identity (VID) defines a DID for the vehicle to create a vehicle's digital twin as a crucial building block for mobility and transportation ecosystems of the future. Whereas AI and V2X enable the vehicle to become increasingly autonomous, the MOBI VID permits the vehicle to become an economic agent, transacting with infrastructure, other vehicles, and various transportation services.

*VID offers efficiencies and new business opportunities across the full span of the mobility value chain.*

We call this the "New Economy of Movement," a multi-trillion dollar digital transaction ecosystem of vehicles, infrastructure, and mobility prosumers (individuals who both consume and produce mobility data or services). The MOBI VID blockchain-based standards are the keys that enable this digital economy. MOBI VID supports multi-stakeholder and interoperable transportation ecosystems to increase transparency, coordination, and automation between providers and consumers, creating greener, safer, and more affordable mobility options.

*Additional standards covering mobility use cases will build on the MOBI VID.*

The MOBI VID is a necessary, but not sufficient, condition for the digital transformation of global transportation ecosystems. Many additional DLT/blockchain-based standards will be needed in addition to the VID. MOBI working groups (WGs) have released or will soon release standards covering:

- » Vehicle Identity (VID) I — defines the digital "birth of a vehicle" at production with factory specifications.
- » VID II — defines business requirements and reference implementation for vehicle registration, usage, and maintenance use cases.

<sup>1</sup>"Decentralized Identifiers (DIDs) v1.0 Core Architecture, Data Model, and Representations," W3C Working Draft, 27 December 2020 <https://www.w3.org/TR/did-core/>.

<sup>2</sup>"CBAN successfully demonstrates first of its core services and signs MoU with MOBI," CBAN Press Release, Singapore, 04 November 2020, <https://www.cban.net/post/cban-successfully-demonstrates-first-of-its-core-services-and-signs-mou-with-mobi>.

- » Usage-Based Insurance (UBI) — defines technical specifications for pay as you go insurance/mobility.
- » Electric Vehicle Grid Integration (EVGI) — supports the increasing adoption of EVs by creating interoperable systems for governments, utilities, and the mobility industry.
- » Connected Mobility Data Marketplace (CMDM) — supports a blockchain-based data marketplace for all stakeholders of the mobility and transportation ecosystem.
- » Finance, Securitization, and Smart Contract (FSSC) — supports credit on blockchain, securitization, tokenization of mobility assets, and fractional ownership.
- » Supply Chain (SC) — supports operational efficiencies, parts tracking, carbon tracking, and ethical sourcing in the automotive supply chain.

Future WGs are expected to focus on sustainability, logistics, and V2X payments

This paper provides a high-level introduction to the MOBI VID. Those seeking a deeper technical understanding can access the VID technical specifications and reference implementation architecture standards.

## LIST OF ACRONYMS

ADAS	:	Advanced Driving Assistance Systems
DID	:	Decentralized Identifier
DLT	:	Distributed Ledger Technology
GPS	:	Global Positioning System
P2P	:	Peer-to-Peer
VIN	:	Vehicle Identification Number
V2I	:	Vehicle-to-Infrastructure
V2X	:	Vehicle-to-Everything



## GLOSSARY OF TERMS

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This section contains the definitions of all technical and specific terms used throughout this document.

**Advanced Driver Assistance Systems (ADAS):** Advanced driver-assistance systems are technologies that assist drivers with the safe operation of a vehicle.

**Agent:** An Agent is a software component that is able to control an entity's digital wallet (to an extent that is typically defined by the entity) and the communication to other agents in order to send or obtain information stored in the digital wallet. The agent software can be deployed on an edge device or server that is run by the entity itself or a service provider on behalf of that entity.

**Blockchain:** A blockchain is a growing list of records, called blocks, that are linked using cryptography. Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data (generally represented as a cryptographically secure tree structure such as a Merkle tree).

**Distributed Ledger Technology (DLT):** Distributed Ledger Technology enables consensus about the state of replicated, shared, and synchronized digital data geographically spread across multiple sites, countries, or institutions. A peer-to-peer network is required as well as consensus algorithms to ensure replication across nodes is undertaken. Blockchains are the most well-known example, though general practical byzantine fault-tolerant systems fall under this category as well.

**Global Positioning System (GPS):** GPS is a U.S.-owned utility that provides users with positioning, navigation, and timing (PNT) services.

**Peer-to-Peer (P2P):** A peer-to-peer service is a decentralized platform whereby two individuals interact directly with each other, without intermediation by a third party. Instead, the buyer and the seller transact directly with each other via the P2P service. The P2P platform may provide services such as search, screening, rating, payment processing, or escrow. (Source: Investopedia, 2021)

**Vehicle Identification Number (VIN):** A unique code, including a serial number, used by the automotive industry to identify individual motor vehicles, towed vehicles, motorcycles, scooters, and mopeds, as defined in ISO 3779.



## OBJECTIVE OF THIS DOCUMENT

The objectives of this document are to:

- » Introduce the concept of self-sovereign vehicle identity.
- » Explain how blockchain technology and the VID can benefit the automotive industry in general.
- » Explore the possible use case for MOBI VID in Asset Visibility, Vehicle to Grid, Usage Based Insurance, etc.

## MOBI VID STANDARDS

*MOBI's "Vehicle Birth Certificate" encompasses information relevant to a vehicle's value and capabilities when it leaves the assembly line.*

A vehicle's identity, similar to a human's identity, begins at birth. The "Vehicle Birth Certificate" signifies the vehicle's birth at a factory and is the first "link" in the full lifecycle of the vehicle. In July 2019, the VID I working group released its first technical specifications standard focused on the vehicle birth certificate. Subsequent standards will build on this and complete the full lifecycle of the MOBI VID, exploring use cases such as registration, transfer of ownership, maintenance, and end of vehicle life.

*MOBI VID extends the physical VIN to the digital world and immutably links the physical vehicle to its digital records.*

The MOBI VID is the digital identity of a unique vehicle that provides a necessary bridge to the physical asset. It permits vehicle owners, users, and the transportation IoT ecosystem to trust and verify the vehicle's identity. MOBI VID extends the efficiency and economy of the digital realm to the physical vehicle in the IoT ecosystem because it is a DID that can be used to prove existence, manage access control, confirm ownership history, and track events in the life of a vehicle. As a result, the MOBI VID becomes the string that ties together the master records for the vehicle's history and usage data.

*MOBI VID is machine readable, allowing efficient data sharing, V2X transactions, and automated provision of new mobility services.*

Blockchain and DLT enable broader and more efficient collaboration in business ecosystems. Stakeholders with relevant read and/or write permissions will be able to interact with the data stored on the tamper-evident decentralized ledger. Figure 1 illustrates the use cases that revolve around MOBI VID for the transportation ecosystem in the New Economy of Movement. MOBI VID elevates the current best alternative, the VIN, in the following four areas:

- » The VIN serves as a unique physical identifier for the vehicle. When integrated with the MOBI VID, other systems/data of record (i.e. ownership, vehicle history, etc.) are trusted and traceable back to the physical vehicle. MOBI VID enables the VIN to become a trust anchor and a building block for other use cases.
- » The MOBI VID allows for scalable distributed and decentralized transportation ecosystems with permissioned access, controlled coordination, and inputs from stakeholders.

- » The DLT/blockchain-based vehicle identity is both digital and standardized, making it machine-readable. This is essential for V2X communication, as well as future extension into settlements and payments.
- » MOBI VID and its associated metadata are verifiable and tamper evident, therefore reducing the risk of fraud and protecting data integrity.



**Figure 1.** Potential use cases/applications enabled by Web3 implementation of MOBI VID

*Increased asset visibility, an trust anchor for vehicle services, data provenance, and autonomous vehicle transactions are some of the MOBI VID benefits.*

New transportation use cases enabled by the MOBI VID benefit from four broad features of DLT/blockchain ecosystems. These features are listed below and are plotted against time horizon and scale in Figure 2:

- » **Asset Visibility** — Improved asset visibility reduces information asymmetries and frictional costs across the entire transportation services value chain.
- » **Anchor for Additional Use Cases** — MOBI VID creates the trust anchor for the next generation of connected mobility use cases which are increasingly decentralized.

- » **Data Provenance** — The trust anchor secures V2X transactions and data exchange at the edge.
- » **Autonomous Economic Agents** — Trusted data, trips, and transactions generated at the edge, along with embedded profit functions, turn connected vehicles into autonomous economic agents in the New Economy of Movement.

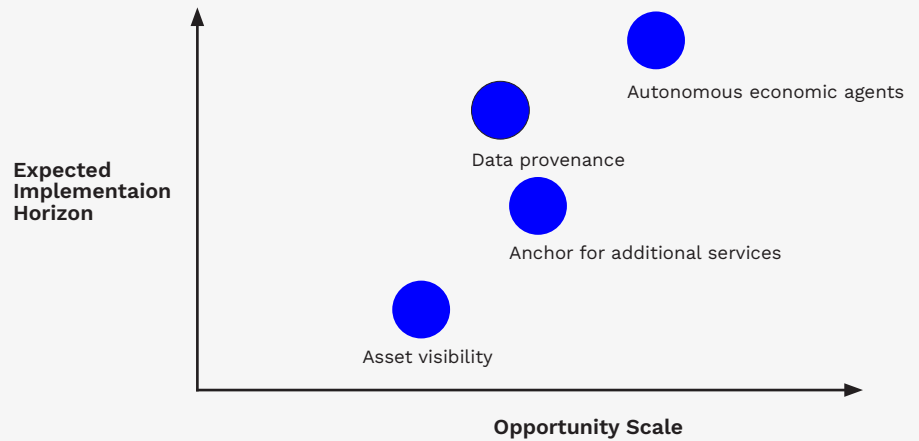
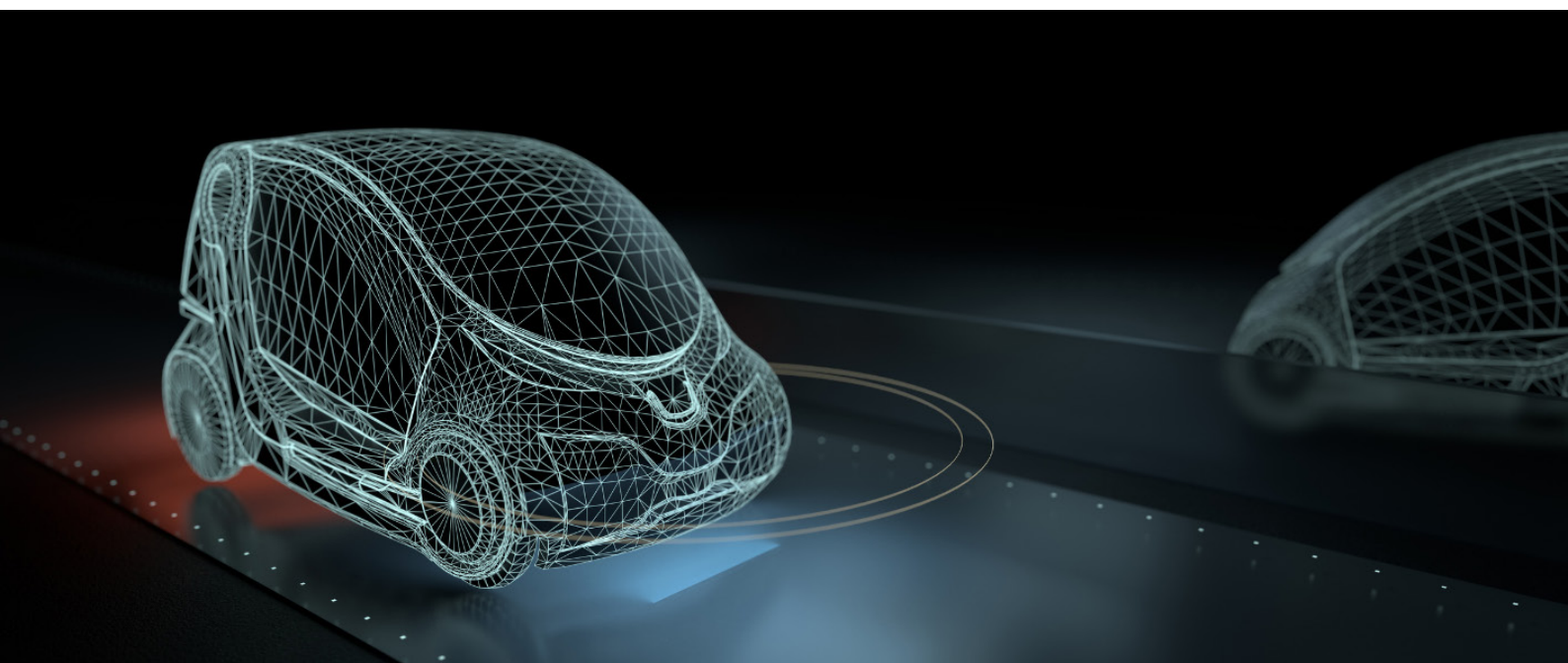


Figure 2. MOBI VID Benefits Horizon

*MOBI VID business uses span a range of time horizons and value.*

This paper explores these four features of DLT/blockchain ecosystems in more detail below. The decentralized nature of DLT/blockchain requires collaboration, standards adoption, and ecosystem implementation to create impactful outcomes for the stakeholders. While early, it is already clear that DLT/blockchain-based vehicle identity can bring enormous value to transportation stakeholders.



## ASSET VISIBILITY

*Improved asset visibility and data provenance will reduce the information asymmetries that create market inefficiencies for both new and used vehicles.*

Current industry vehicle identity mechanisms, such as physical VINs, are highly manual and insufficient. To go beyond the VIN, third parties have developed proprietary databases, with both public and private records, that contain vehicle history in digital form. But these siloed and isolated systems often include repetitive or incorrect data and are not interoperable. This results in redundancy and high frictional costs for reconciliation, verification, registration, and transfer of vehicle titles.

The static and physical nature of the VIN enables fraudulent identity switching between similar vehicles. A DLT/blockchain-based VIN that is immutable, traceable, updatable, and linkable to usage records from various stakeholders is resistant to fraud since it is unlikely that all the data can be changed or erased unnoticed.

Asset visibility is crucial while transporting and storing vehicles. Shipping a vehicle from a factory to a dealership can take weeks, even months, depending on the origin and destination. An efficient tracking and tracing of vehicle's custody can reduce administrative overhead to process shipments thereby reducing time to transport or inventory the vehicles.

*MOBI VID will increase transparency and reduce frictional costs at every step in the manufacturing, distribution, and mobility services value chains.*

From manufacture through distribution, sale, and daily vehicle use, the MOBI VID will increase transparency thereby reducing paperwork, lead times, and various administrative costs. Combined with the traceability offered by decentralized ledger technology, MOBI VID will allow stakeholders to participate in a shared ledger for vehicle information — a “single source of truth” — enabling automated contracting, execution, and settlement across the business ecosystem.

MOBI VID extends the benefits of better asset visibility to the mobility services industry as well. A tamper-evident record of vehicle identity, starting with the vehicle's birth, has the potential to reduce fraud (cost of erroneous information) and auditing cost (cost of trust) for mobility service providers and consumers. These efficiencies may reduce the market power of platform transportation network companies and enable new peer to peer (P2P) business models.

Visibility of vehicle history and use also improve the efficiency and fairness of vehicle resale markets. According to the National Highway Traffic Safety Administration, more than 450,000 vehicles are sold each year with false odometer readings resulting in more than 1 billion USD in losses annually.<sup>3</sup> The transparent and verifiable vehicle records enabled by DLT/blockchain can help prevent fraudulent and false information and reduce such losses.

<sup>3</sup>“Odometer Fraud,” National Highway Traffic Safety Administration, accessed June 18, 2019, <https://www.nhtsa.gov/equipment/odometer-fraud.core-services-and-signs-mou-with-mobi>.

*Odometer fraud is a global problem that digital ledgers and digital twins can help solve.*

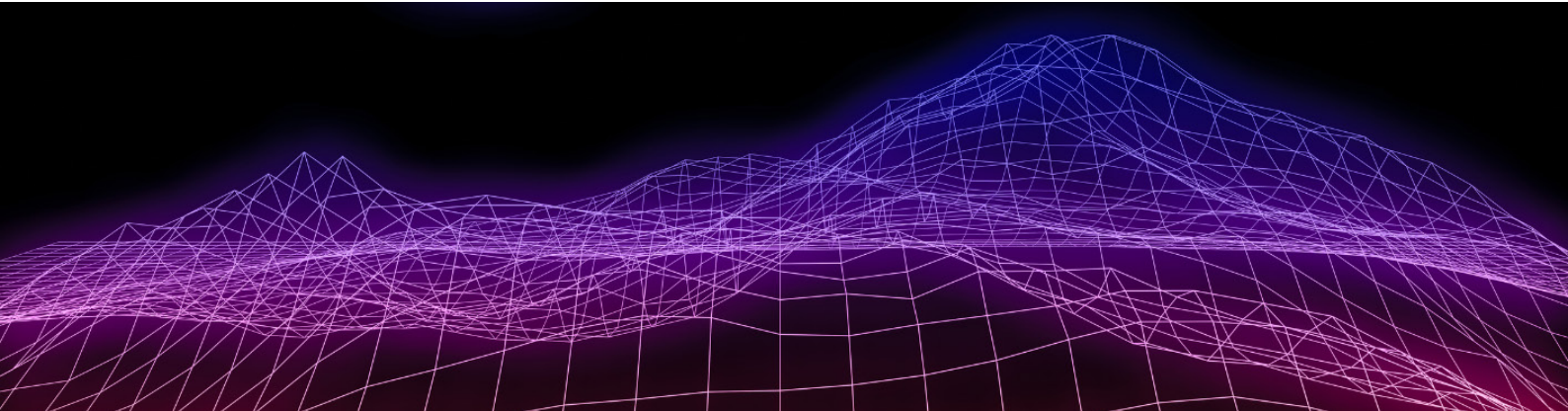
In a report, recently issued by the European Parliament,<sup>4</sup> blockchain is identified and highlighted as a solution to odometer tampering. Besides the occasional transmissions and recordings of odometer reading to blockchain, another way to validate the mileage is the comparison of multiple sources of odometer data, such as Global Positioning System (GPS) mileage tracking and the odometer itself. Linking such data to the corresponding MOBI VID, with the appropriate certifications, will significantly reduce the “lemons” problem and associated economic losses due to information asymmetries in the used vehicle marketplace.

*DLT enabled supply chain track, trace, and provenance promise to make recalls, warranties, maintenance, and repairs more efficient.*

Parts trace and track will be key for warranty and recall management, resulting in more efficient, accurate, and safer mobility. The impact of recalls on businesses include not only short-term costs associated with operational replacements, which in 2016 grew to 22 billion USD,<sup>5</sup> but also long-term effects of loss of consumer trust in the brand and reduced residual values. According to one study, the vehicles affected by Takata airbags saw a greater decline in residual values than vehicles not under the airbag recall.<sup>6</sup> While manufacturers have substantially improved the reporting of parts internally, industry-wide shared parts tracking, as part of a consortium effort that incorporates both quality and authenticity data, has the potential to reduce recalls and warranty claims and increase consumer trust.

*MOBI VID opens new opportunities to finance and manage commercial and dealer fleet operations.*

Another benefit of the MOBI VID is more transparent information on used vehicles and a fairer, more efficient, secondary market. DLT/blockchain-based birth certificates overlaid by data from IoT devices, parts, and history of events on each of these devices will create a digital twin of a vehicle with a live snapshot of its condition and state. This provides more accurate estimates of residual values and resale value. The asset visibility that MOBI VID provides is especially applicable for asset-based operators such as dealers, resellers, car auctions, fleet managers, banks, and others. The VID also opens up the possibility for simplified and faster digital escrows for vehicle ownership transfers that today are often avoided due to high costs.



<sup>4</sup>“Odometer Tampering: Measures to Prevent It,” Research for TRAN Committee, European Parliament, accessed July 15, 2019, [https://www.europarl.europa.eu/RegData/etudes/STUD/2017/602012/IPOL\\_STU\(2017\)602012\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2017/602012/IPOL_STU(2017)602012_EN.pdf).

<sup>5</sup>Anisa Jibrell, “Automotive Recall Bill Grew 26% to \$22billion in 2016, Study Says,” Automotive News, January 30, 2018, <https://www.autonews.com/article/20180130/RETAIL05/180139974/auto-recall-bill-grew-26-to-22-billion-in-2016-study-says>

<sup>6</sup>“Takata Airbag Recall Effect on Used Pricing,” Auto Remarketing, April 3, 2015, <https://www.autoremarketing.com/trends/takata-airbag-recall-effect-on-used-pricing>.

## ANCHOR FOR ADDITIONAL USE CASES

*The combination of MOBI VID and trusted location creates a “trusted trip,” opening up new opportunities for pay per use mobility, smart cities, and infrastructure finance.*

The MOBI VID functions as an anchor for additional use cases. These use cases span from birth to end of life for a vehicle. The VID can be overlaid with visibility to infrastructure (i.e. roads, toll booths, electrical grid), vastly expanding its usefulness and value to adjacent ecosystems. Combining MOBI’s VID with trusted location data results in a “trusted trip” that gives rise to many new mobility services and infrastructure monetization opportunities.

Cities, transit agencies, and other urban infrastructure owners can use the trusted trip data to charge for road use based on the vehicle weight as well as traffic conditions (congestion pricing), fuel used (pollution and carbon pricing), and any other important factors. Marginal cost pricing for infrastructure is a huge opportunity for the public sector to monetize their 25 trillion USD of road and transportation assets that cannot be monetized without DLT/blockchain vehicle identity and payments. In the process, the public sector will gain powerful new tools to influence mobility behaviors and sustainable new sources for infrastructure finance.

*MOBI’s Electric Vehicle standard builds on VID to enable new opportunities to monetize EVs and charging infrastructure.*

Vehicle to infrastructure (V2I) transactions also include electric vehicles to grid transactions. Using MOBI VID, EVs can not only connect to charging stations by validating their identity but also pay for the charging, offer battery storage to the grid, and provide energy use data to aid in the management of grid demand. The MOBI EVGI DLT/blockchain-based Technical Specifications Standard released in October 2020 addresses use cases like tokenized carbon credits, vehicle to grid storage, and other ancillary V2I services for EVs.

*MOBI’s Usage Based Insurance standard builds on the VID to promote new insurance policies which offer better value for customers, reduce carrier risk, and promote safer driving.*

This same tracking, payment, and settlement used in V2I transactions can be used by insurers to provide contextual, usage-based insurance (UBI), a market that is estimated to hit 107 billion USD by 2024.<sup>7</sup> UBI aims to empower insurance companies to develop insurance schemes based on driving behavior data captured from on-vehicle telematics. This technology redefines insurance to a per user per vehicle model. Because the MOBI VID can “talk” to telematics, its human driver, and infrastructure, an integrated, usage-based, risk underwriting model is possible.

*Revenues from new mobility services, including vehicle payments, are expected to exceed 1T USD per year sometime in the next decade.*

According to McKinsey, “consumer mobility behavior is changing, leading to up to one out of ten cars sold in 2030 potentially being a shared vehicle and the subsequent rise of a market for fit-for-purpose mobility solutions.”<sup>8</sup> Accenture estimates that revenues from mobility services will hit ~1.35 trillion USD — with profits reaching as much as 248 billion USD.<sup>9</sup>

<sup>7</sup>Global Market Insights. 2018. “Usage-based Insurance Market to hit \$107bn by 2024: Global Market Insights, Inc.,” <https://www.globenewswire.com/news-release/2018/12/03/1660531/0/en/Usage-based-Insurance-Market-to-hit-107bn-by-2024-Global-Market-Insights-Inc.html>

<sup>8</sup>Von Paul Gao, Hans-Werner Kaas, Detlev Mohr, and Dominik Wee, “Automotive Revolution – Perspective Towards 2030,” McKinsey & Company, January 2016, <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/disruptive-trends-that-will-transform-the-auto-industry/de-de>.

<sup>9</sup>“Mobility as a Service,” Accenture, Accessed June 18, 2019, [https://www.accenture.com/\\_acnmedia/PDF-71/Accenture-Mobility-Service.pdf](https://www.accenture.com/_acnmedia/PDF-71/Accenture-Mobility-Service.pdf)

The next wave of convergence in mobility is sharing the same vehicle for different services. Without a trusted digital identifier like the MOBI VID, coordination of multi-use assets and utilization at scale is not feasible. In a case like P2P rideshare, for example, vehicle owners and users may not be able to transact without third party intermediaries unless decentralized vehicle and user identity management is in place. New governance models will allow asset owners to dynamically reconfigure usage rights without third party oversight. However, a new array of third party service providers and its associated ecosystem will become enabled for access to routine maintenance and cleaning needs as they arise.

*MOBI VID supports a new generation of connected mobility services which are increasingly decentralized with transactions executed locally at the edge and which require new tools for trust, cooperation, and coordination.*

A striking feature of these new mobility services is the convergence of technology and strategic interest from telecoms, insurers, energy generators, utilities, smart cities, tech companies, cloud providers, transportation network companies, infrastructure owners, and, of course, legacy players in the mobility value chain such as suppliers, manufacturers, and transit agencies. The new services require a level of cooperation and coordination between these industries that is unprecedented because each will need the sub-services of the others. For example, transportation network companies will need insurers for competitive UBI policies, UBI relies on OEM vehicle telematics, telematics relies on telecom carriers, etc.

Figure 3 illustrates this convergence for stakeholders and use cases in the New Economy of Movement enabled by the MOBI VID.

*Additional MOBI standards, created by other MOBI Working Groups, build on the VID to support additional emerging mobility businesses.*

“Coopetition,” the mixture of cooperation and competition, needed to succeed in future mobility services is a hallmark of DLT business ecosystems that enable diverse industries and stakeholders to share core data, services, business processes, methodologies, and standards. To this end, additional MOBI working groups are creating DLT/blockchain-based standards for Insurance, Data Exchange, Electric Vehicle Grid Integration, Supply Chain, and Finance and Securitization. Additional working groups are planned for the near future.

DIGITAL VEHICLE USE CASES	SALE & REGISTRATION	VEHICLE FINANCE	PARTS & RECALLS / MAINTENANCE & ACCIDENTS	ALERTS & MESSAGING	ODOMETER & TRUSTED TRIP	FLEET MGMT	VEHICLE WALLET & PAYMENT	CO2 FOOTPRINT ETHICAL SOURCING	ROAD USAGE CHARGE (RUC)	USAGE-BASED INS./MOBILITY	P2P MOBILITY	LOGISTIC / DELIVERY SERVICES	V2X NEGOTIATION
PARTS SUPPLIERS			✓	✓	✓	✓		✓				✓	
OEMS	✓	✓	✓	✓			✓	✓		✓	✓	✓	✓
DEALERS	✓	✓	✓	✓	✓								
FINANCIAL SERVICES	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	
VEHICLE REGISTRIES	✓	✓	✓		✓	✓	✓	✓		✓			
OWNERS / RENTERS	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	
FLEETS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
INFRASTRUCTURE OWNERS					✓		✓	✓	✓			✓	✓
INSURERS	✓		✓		✓	✓	✓			✓	✓	✓	✓
MOBILITY SER. PROVIDERS (TNC)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
SHIPPERS			✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
TELECOMS				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Figure 3. MOBI VID Stakeholder Use Case Matrix

## DATA PROVENANCE

*MOBI VID supports monetization of the massive bi-directional data flows from connected vehicles.*

A connected vehicle is projected to upload twenty-five gigabytes of data per hour, according to McKinsey's research.<sup>10</sup> There is a cost to basing business decisions on erroneous data, as well as data visibility gaps. On average, across the board, poor data quality amounted to 15 million USD annual financial costs in 2019.<sup>11</sup> Provenance, or proof of origin, of vehicle data is essential to coordinate multimodal mobility, share vehicles, and pay for infrastructure use. Direct business cases include fraud prevention, data quality for data science (garbage in, garbage out), and Advanced Driver-Assistance Systems (ADAS). Indirect business cases include secondary data markets. McKinsey predicted that the entire market for monetizing vehicle data could be worth as much as 750 billion USD by 2030.<sup>12</sup> Thirty-two of forty-four car brands currently offer some form of vehicle-to-vehicle (V2V) communication devices in their vehicles, illustrating that data collection is already commonplace for the automotive industry. DLT-enabled vehicle identities can validate requests and ensure there is trust in the communications between vehicles.

With the importance of data, data accuracy, provenance, integrity, and security, the MOBI Connected Mobility Data Marketplace Working Group launched in October 2019 to ensure collaboration and standardization for connected networks.

## AUTONOMOUS ECONOMIC AGENTS

*Embedded profit functions and MOBI VID turn connected vehicles into autonomous economic agents, revolutionizing the provision of mobility services, optimizing road use, and creating new usage based sources of finance for public infrastructure.*

The combination of MOBI VID, trusted location, and the ability to accept and conduct payments will ultimately transform vehicles into autonomous economic agents. These vehicles will have embedded vehicle wallets to store their DIDs, other credentials, permissions, and means of payment. The means of payment for these wallets will not be cash or traditional bank transactions as high frictional costs will be prohibitive. Instead, V2X payments will utilize a programmable digital currency of the type now being developed by both private sector DLT/blockchain protocol companies (e.g. Ether and Tether) and central banks (e.g. digital Euro and digital Yuan). Vehicles will use these capabilities to transact with other vehicles and infrastructure, and to coordinate services in shared and multimodal environments. They will be able to autonomously maximize profits for services and data offered, and minimize costs for resources, services, and data they consume.

*MOBI VID enables coordination between increasingly autonomous vehicles that enhances safety and efficiency beyond what is possible without sharing data about intention, condition and location.*

With the arrival of autonomous driving, vehicles will share their intended movements, in real time, in local ad hoc networks at the edge. Coordinating movement utilizing vehicle DIDs will deliver huge gains in efficiency and safety. Dynamic

<sup>10</sup>“What is Driving the Connected Car,” McKinsey & Company, September 1, 2014, <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/whats-driving-the-connected-car>

<sup>11</sup>Susan Moore, “How to Stop Data Quality Undermining Your Business,” Gartner, January 18, 2019, <https://www.gartner.com/smarterwithgartner/how-to-stop-data-quality-undermining-your-business/>

<sup>12</sup>eff Plungis, “Who Owns the Data Your Car Collects,” Consumer Reports, May 2, 2018, <https://www.consumerreports.org/automotive-technology/who-owns-the-data-your-car-collects/>

platooning allows highway trucks to draft closer. Sharing situational awareness of obstacles and threats permits urban vehicles to minimize their infrastructure footprint. It allows them to collectively plan paths and maneuvers that avoid collisions or conflicts. This interoperability permits higher speed, efficiency, and coordinated actions which are impossible without advance knowledge of all the local vehicle actions. Coordinated autonomy has the potential to significantly increase throughput on a given road footprint.

## CONCLUSION

*Blockchain mobility is attracting powerful new entrants from adjacent industries. Startups have raised hundreds of millions of dollars in VC funding. Blockchain mobility will exhibit strong network economics with late entrants facing high barriers.*

*New mobility businesses built in VID span value chains from sustainable resource extraction to end-of-life disposal, from vehicle manufacture to end user mobility services, from insurance to telecoms, and from privately owned vehicles to public infrastructure.*

*A “New Economy of Movement” will be built on the VID and related DLT standards by competitors who recognize that new mobility opportunities require collaboration to create infrastructure for an emerging decentralized mobility ecosystem.*

The transportation ecosystem is evolving rapidly with technology companies entering the race for mobility services, rideshare, and connected and autonomous vehicles. To stay competitive, existing ecosystem stakeholders are actively looking for innovative solutions to accelerate their digital transformation to improve efficiency and security, all while elevating the customer experience and reducing environmental impacts.

Blockchain and DLT have the potential to accelerate these transformations through supply chain efficiency, trace and track, vehicle data integrity and provenance, secure autonomous economic transactions, streamlined mobility as a service (MaaS), coordinated multimodal transit, marginal cost pricing for infrastructure, usage-based mobility/insurance, and much more. At the heart of all this is a decentralized vehicle identity. The MOBI VID will enable exciting new use cases for the transportation ecosystem beyond what is possible with existing technologies.

MOBI VID business cases for better mobility span fleet operations, sale of vehicles, mobility services, ecosystem services (i.e. insurance, predictive maintenance), data markets, smart cities, traffic management, and more. MOBI VID also enables optimization of supply chain elements such as sustainable and ethical sourcing, liability and accountability for recalls, supply chain transparency, fraud prevention, and data analytics with new insights into parts and systems performance.

Trusted identity is essential for vehicle communication. Without a trusted identity, electric vehicles cannot communicate with the grid, autonomous vehicles cannot communicate with infrastructure and each other, smart cities are without good tools to manage mobility, and marginal cost pricing for road use, congestion, and pollution is not possible. In short, a new kind of vehicle identifier is needed for connected, smart vehicles to allow them to join and transact within multiple dynamic edge ecosystems while roaming. Decentralized Identifiers like MOBI VID are designed to enable interactions of connected vehicles, without reliance on centralized registries or certificate authorities, within multi-party, multi-use mobility services in the New Economy of Movement.

For the MOBI VID to be useful, a certain scale is needed. We call this the “minimum viable ecosystem,” the point where DLT/blockchain applications begin to exhibit increasing returns. As is the case with most new and revolutionary

technologies, scale is the hard problem, not the technology itself. While the Web 2.0 model revolved around platform plays, the emerging Web 3.0 model revolves around infrastructure plays within a minimum viable community. This is the *raison d'être* for MOBI.

*MOBI VID on a shared digital ledger is a foundational step towards a greener, safer, and more efficient mobility future.*

The MOBI VID, trusted and used at scale, will unlock a new transaction economy for consumers, businesses, vehicles, and infrastructure, turning mobility products into services while digitizing much of the transportation experience. Shared ledger technology for vehicle identities is a crucial building block for these new mobility ecosystems. MOBI VID Standards accelerate industry adoption and power future mobility ecosystems that are faster, more efficient, secure, affordable, and greener than possible today.



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