



10 Things to Know About Blockchain for the Transportation Industry

1. What is Blockchain?

Many types of blockchains exist. In general, blockchains are a form of distributed ledger technology, where transaction data is shared by the nodes (computers) on a network to which transactions are recorded and validated. Validation may be done by a consensus mechanism performed by the network or otherwise. A block is a part of a blockchain, which records a set of transactions. Once a block is filled, a hash of the contents is created and stored in the subsequent block. This makes the data in each block immutable. Each time a block gets completed, it is stored on each node in the network.

2. What Are the Different Types of Blockchains?

There are three main types of blockchain platforms—public, private and consortium. Organizations use these platforms based on their specific needs.

- Public Blockchains, are a decentralized framework that allows anyone to add themselves to the network, read transactions, transfer assets and participate in the consensus process, typically without any special permission.
- Private Blockchains are centralized frameworks that are permissioned, allowing only a pre-approved set of members to read and send transactions and participate in the consensus process.
- Consortium Blockchains are a hybrid of the public and private blockchain platforms. They leverage the decentralized nature of public blockchains and the permissioned capability of private blockchains. As with any consortium, the entire network, along with validation rules and policies, is defined and governed by members/nodes. They can control every aspect of the blockchain, including validation of transactions, addition of nodes, managing node privileges, smart contracts, deployment of chain codes, etc.

3. What are Crypto Currencies and Tokens?

A cryptocurrency is a digital currency that uses cryptography for security and for which transactions are typically recorded to a blockchain. Tokens can be a currency but can be programmed to include additional functionality, such as ownership of title, voting rights, distribution rights, and other functionality. Recordation of ownership of currencies and tokens occurs via a blockchain. Typically this is implemented using public key/private key encryption. The “keys” are long strings of numbers and letters linked through the mathematical encryption algorithm that was used to create them. The public key (comparable to a bank account number) serves as the address which is disclosed to others and to which others may send currencies and tokens. The private key (comparable to an ATM PIN) is meant to be a guarded secret, and only used to authorize transfers or transmissions associated with the currencies or tokens. Crypto currencies and tokens can be bought and sold (or traded) via exchanges and can be transferred in a peer-to-peer manner. Transfers can occur via a software “wallet,” which is associated with a user or device, has a unique alphanumeric identifier and can transfer and receive crypto currencies and tokens.

4. What are Smart Contracts?

Smart contracts are essentially self-executing contracts with the operational terms of the agreement between buyer and seller being directly written into and executed by lines of code. The code and the agreements contained therein can exist across a distributed, decentralized blockchain network. Using a scripting language or other techniques, a smart contract can include logic-based programs run on top of a blockchain. A smart contract can receive data from various sources and programmatically implement a series of if-then rules that are performed at least in part by computers without the need for third-party human interaction.

5. What is the Internet of Things (IoT)?

The IoT is a network of sensor-enabled devices that can collect data, communicate via the internet or other networks and, if programmed to do so, execute transactions or take other actions based on a predetermined set of conditions. As examples, car, trucks and cargo can be sensor-enabled to collect and transmit data.

6. How are Auto Makers Using Blockchain?

So much is in the works. Here are some examples.

- **Toyota** — [announced](#) in May 2017 that it is exploring blockchain and distributed ledger technology (BC/DL) for use in the development of a new mobility ecosystem that could accelerate development of autonomous driving technology. It is working in at least three areas of the new mobility ecosystem: driving/testing data sharing, car/ride share transactions and usage-based insurance.

> *Driving/Testing Data Sharing:* Blockchain technology may allow companies and individuals to securely share and monetize their driving information and access the data contributed by others in a secure marketplace. Modern vehicles are increasingly aware of their environment through onboard sensors and are increasingly connected to the cloud, roadway infrastructure and other vehicles, all of which are generating massive amounts of valuable data. BC/DL may create an opportunity to share driving and autonomous testing data in an environment that preserves ownership of the data by the creator.

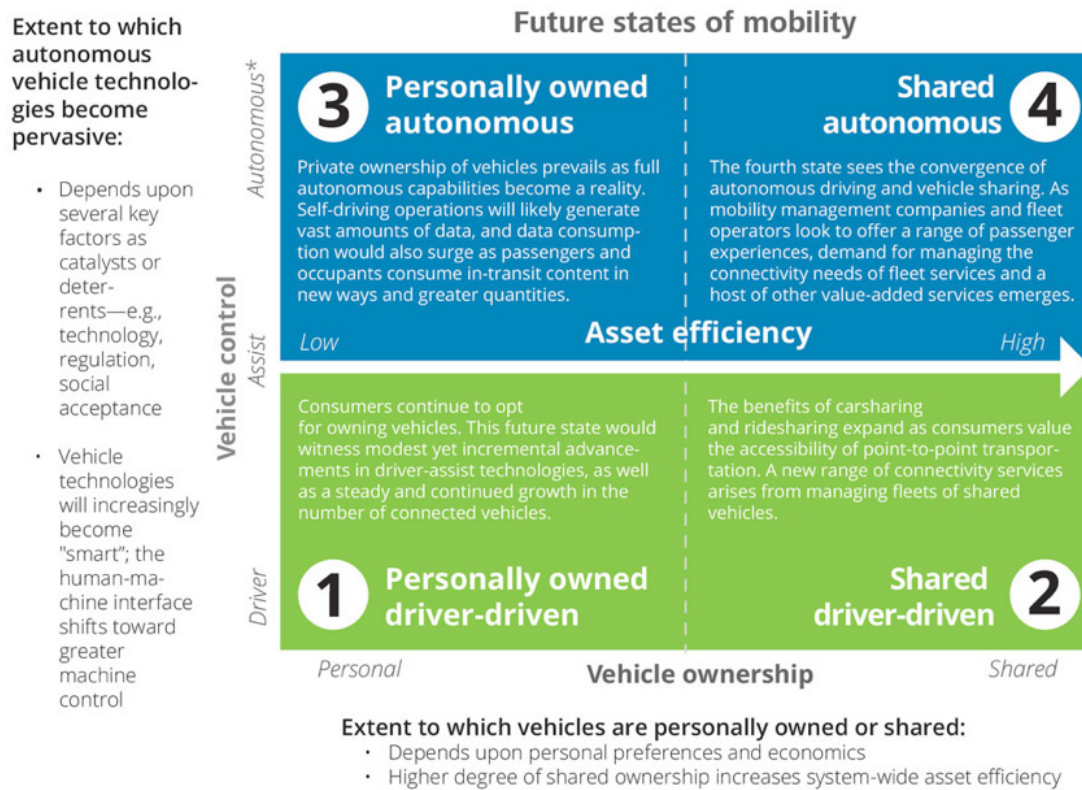
- > *Car/Ride Share Transactions*: Tools based on BC/DL have the potential to empower vehicle owners to monetize their asset by selling rides, cargo space or even the use of the vehicle itself. The blockchain can store data about the vehicle's usage and information about vehicle owners, drivers and passengers. This profile information can help validate a "smart contract" between two parties plus manage payment of services between them without need of a financial intermediary, thereby saving transaction surcharges. The system may also provide connectivity to vehicle functions for remote locking/unlocking doors and engine startup/shut off.
- > *Usage-Based Insurance*: The blockchain can also be used for vehicle owners to save money on their insurance rates. By allowing the vehicle's sensors to collect driving data and store it in a blockchain, vehicle owners may be eligible to further lower their insurance costs by giving their insurance companies increased transparency to reduce fraud plus granting them access to driving data to measure safe driving habits.
- **Porsche** — has [announced](#) that it is the first automobile manufacturer to implement and successfully test blockchain in a car. The applications tested include locking and unlocking the vehicle via an app, temporary access authorizations and new business models based on encrypted data logging. This could be developed further, for example, to improve autonomous driving functions. According to Porsche:
 - > the services developed on the foundation of blockchain are fast and very secure. The car becomes part of the blockchain, making a direct offline connection possible – that is, without diversion through a server. Taking 1.6 seconds, the process of opening and closing the car via an app is up to six times faster than before. In addition, efficient cryptographic encryption takes place. This process ensures that all activities are documented in the blockchain in a way that prevents them from being modified, and can be viewed using an app. For example, access authorizations can be distributed digitally and securely and can be monitored by the vehicle owner at any time. Access also works remotely.
 - > the technology makes it possible to assign temporary access authorizations for the vehicle – in a secure and efficient manner. A protected connection to vehicle data and functionalities can be established using blockchain. At the same time, it protects all communication between participants. Third-party providers can be integrated without the need for additional hardware, simply by using "smart contracts."
 - > new blockchain-based business models are enabled. The system could create an extremely fast and secure network for electric car charging station availability and payment. Further into the future, it may also prove essential to self-driving cars. Information from a self-driving Porsche on road conditions, could be uploaded and distributed across the blockchain. From there, other vehicles' software connected to the system could access and analyze the information to provide a warning to traffic congestion or inclement weather.

> IBM [announced](#) is working with ZF Friedrichshafen AG and UBS to develop the first blockchain-based automotive transaction platform for mobility services. This shared ledger technology will enable secure and transparent in-vehicle payments, so that motorists can pay for tolls, parking, car sharing and eBattery charging on the go and receive payments for car sharing. An important part of achieving this vision is the development of a reliable, autonomous agent that will enable cars to respond to their environment, navigate routes and perform diagnostic checks without human input. How cool will it be when your autonomous car can drive to Starbucks, order your favorite coffee drink on its way, pay for it with its ewallet, pick it up at the drive-through and deliver it to you?

7. What is a Mobility Ecosystem?

The following image depicts the future state of mobility according to a Deloitte report:

Figure 1. The future states of mobility



*Fully autonomous drive means that the vehicle's central processing unit has full responsibility for controlling its operation and is inherently different from the most advanced form of driver assist. It is demarcated in the figure above with a clear dividing line (an "equator").

Source: Deloitte analysis.

Photo Attribution: Deloitte University Press, dupress.deloitte.com

The emergence of these four future states catalyzes a new mobility ecosystem that is connected, seamless, efficient, and intermodal. Value in this new ecosystem is derived from consumer-centric data, systems, and services-oriented business models.

The pillars of a decentralized mobility platform include the convergence of the internet, blockchain, energy systems, on-board sensors, ewallets and mobility/logistics to create a new transaction layer. This is referred to as an open decentral mobility platform and enables cars to autonomously communicate and transact with a number of entities.

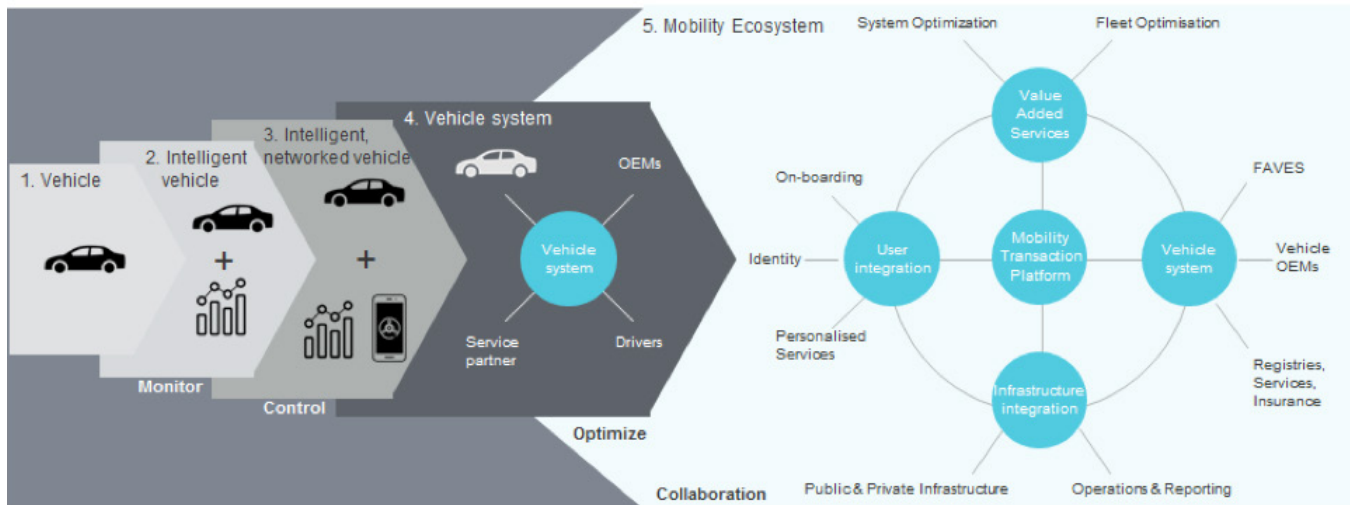


Photo Attribution: World Economic Forum, weforum.org

8. How is Blockchain being used in Supply Chains?

Many supply chains will be transformed by blockchain technology. Transportation, as part of those supply chains, is no exception. Walmart is testing blockchain technology for its supply chain. Maersk the world’s largest shipping company, working with IBM, has recently completed a test of managing the company’s cargos using blockchain.

According to Morgan Stanley, blockchain has the potential to join autonomous trucks, drones, and the ‘uberization’ of freight as a key disruptive technology that can bring operating and cost efficiency to supply chains. It noted there are numerous potential uses, particularly in areas related to security, automation, and supply-chain visibility. It added that at a basic level, the secure, transparent and automated nature of blockchain technology can allow for smooth, speedy and secure execution of contracts across the supply chain thereby eliminating physical documentation and manual involvement by automating contract execution and delivery from initiation through payment (through smart contracts).”

9. How is Blockchain being used in the Transportation Industry?

The following is an overview of some aspects of the transportation industry that are anticipated to be affected by blockchain (according to the [Blockchain In Transport Alliance](#)).

Transportation Applications of Blockchain

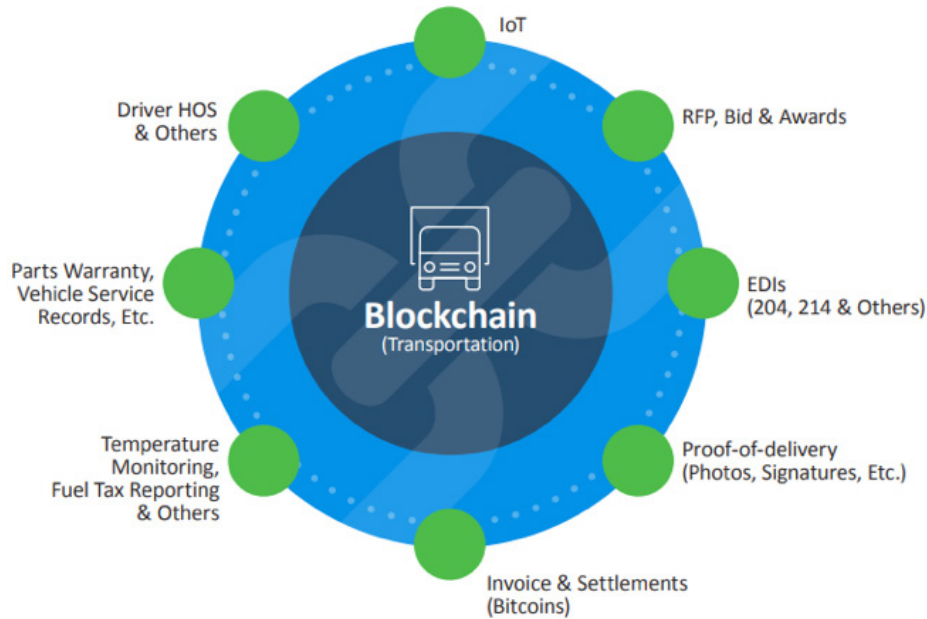


Photo Attribution: TMW Systems, supplychain247.com

According to a recent [article](#) proponents of blockchain technology have identified a wide variety of potential applications that would benefit the providers and commercial users of transportation and logistics services, such as:

Foiling Imposter Carriers. Shippers sometimes fall victim to schemes whereby a fraudster masquerades as a legitimate carrier. For instance, the criminal intercepts information about a high-value load, arrives at the point of origin ahead of the legitimate carrier, obtains possession of the load with forged documents, and readily vanishes to fence the goods. However, blockchain may permit the shipper to identify a given carrier as an imposter if the carrier lacks the proper credentialing record created through blockchain technology.

Accelerating Load Tenders. A shipper or freight broker having control of a load could tag the load with an RFID chip containing points of origin and destination, rate, or other criteria. The RFID chip would be connected to a network such that carrier software could automatically search and bid on the transportation of the load based on predetermined rules. The load tender and acceptance would happen without human intervention.

Track and Trace. A pallet or other load tagged with an RFID chip could be tracked and traced via blockchain technology as that particular load moved through various locations having access to the internet, creating a detailed record of the load's pedigree and chain of custody. Having this data is particularly beneficial for those involved in the transportation of pharmaceuticals or food products—even more so when a product recall need arises.

Expediting Payment. Shippers and carriers could enter smart contracts where the rules provide that payment is automatically made when a given load arrives at destination under various conditions. For instance, carriers may no longer need to devote substantial resources to billing and collection efforts if the network itself (rather than a third party) validates the blockchain such that payment is made automatically. This might also mean that certain carriers would no longer need to factor receivables.

Minimizing Claims. The same application of blockchain to track and trace cargo could be used to minimize claims. For instance, whether the load or the truck itself is tagged, a blockchain record will develop showing the time of pick-up and delivery, thereby creating unalterable evidence as to whether a given load was delivered timely or not.

Leveling the Playing Field. Many of the examples above illustrate how blockchain technology will benefit smaller carriers with limited resources by providing them faster payment, more expeditious claims handling, more and easier bid opportunities, and the like. By empowering smaller carriers, blockchain technology promises to make the transportation

Similarly, the combination of IoT and Blockchain can be used to ensure safe delivery of perishable food products by controlling and documenting the temperature throughout the transportation process. It also can be used to automate order fulfillment, invoicing and settlements using smart contracts.

In terms of telematics, it would enable manufacturers to add more sensors to help service centers securely capture and store engine diagnostics data and other vehicle performance information. This can be used with machine-learning algorithms to determine when a vehicle will require maintenance.

This is just the tip of the iceberg. Many more applications will emerge.

Additional References

Noteworthy Organizations

[Blockchain In Transport Alliance](#) a forum for the development of blockchain standards and education for the freight industry whose goal is to bring together leading companies in the freight technology industries that have a vested interest in the development of blockchain technology.

TMW (a Trimble Company) - Blockchain Engineering Standards for Transportation & Logistics ([BEST-L](#)) invites blockchain architects, developers, DevOps, network administrators and technical gurus, to collaborate and establish open engineering standards for transportation and logistics industry.

[Vinchain](#) - is creating a worldwide decentralized database of vehicle information that is 100% transparent, reliable, and accessible by everyone. This database is blockchain based to guarantee that the information in it has not been faked, changed, or deleted. Information is captured from country registries, insurance and leasing companies, different partnered services, private registers, paid APIs, and certified members. Information is also captured directly from the vehicle, so the data is live and updated in real time.

Articles

[Blockchain in logistics and transportation: Transformation ahead](#)

[Blockchain for transportation](#)

Morgan Stanley - “Just as internet has transformed our lives with email, e-commerce, or smartphone apps, we believe blockchain as an infrastructure technology can power future disruptive technologies through distributive ledgers, smart contracts, tokens or identity management.”



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