MVL Mass Vehicle Ledger
WHITEPAPER

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0. Abstract

Over the past century, the vehicle industry has grown substantially. It has created many jobs in various fields such as the logistics, distribution, car repair and used-car trade scene. With the rise of technology, the vehicle industry is expected to continue its expansion. For example, we have in recent years seen the introduction of self-driving vehicles and eco-friendly electric vehicles. But the mix of the traditional and IT-savvy vehicle market only focuses on a portion of the vehicle industry. It fails to connect different sectors of this industry together.

Despite the growth and developments of the vehicle industry, old problems still remain. For example, cab drivers with discourteous service[1], unreliable mechanic shops[2], a lack of consistency and transparency on used-cars by dealers[3], and accidents caused by reckless driving[4]. Unfortunately, new technology still struggles to address these problems effectively. What's worse is that it brings nuisance to the market, like the increase in customer price due to commissions collected by transport-related online platforms.

In the past five years, we have been in the global IT-based mobility market partnering with car rental companies and the transportation business as a transportation booking system. We are familiar with problems that plague the vehicle industry and we came to understand that the struggles in the vehicle industry can be solved by connecting all the services in a single ecosystem. To do this, we will converge vehicle-related industries and the blockchain technology.

Mass Vehicle Ledger Ecosystem (MVL Ecosystem, pronounced as "em-buh l" Ecosystem) is a new blockchain-based ecosystem created for use in the vehicle industry. Participants of the ecosystem are expected to be individuals familiar with the vehicle industry – for example, car owners, motor vehicle manufacturers/retailers, motor vehicle repair and/or modification service providers, motor vehicle insurance companies - and their participation in the ecosystem will allow them to upload core data relating to a specific car, including information regarding traffic accidents or repairs, into the blockchain.

Participants who provide data related to a car will receive MVL Points (MVP), which are an element of a reward system used to encourage contribution to the ecosystem. Participants of different roles can participate by providing accurate and transparent data related to vehicle management, driving, repair, transportation service and so on. Therefore, blockchain data will be used by used-car dealers, self-driving car makers, insurance companies and more. MVP can be used for marketing purposes, as points will show how well businesses are doing; or can be exchanged to MVL Coin (MVL).

MVL Coins can be traded for MVL Points (and vice versa) or used to trade with other participants in the ecosystem. This also means that contributors will earn MVL Coins if their data is sold by providing data to others.

Finally, MVP and MVL will be used for the blockchain's agreement protocol (mining). We have improved the existing agreement process that mainly credits those with expensive mining tools (proof of work) and large capital (proof of stake)[5]. We are practising a distributed economy, or deconomy[6], where safe drivers, friendly chauffeurs, honest mechanics and other diligent data providers are fairly rewarded.

1. Introduction

In 2015, around 1.2 billion cars are driven worldwide a day [7], a 2015-data by statista shows. Cars have become essential in our modern day life. An estimated hundred million new cars[8] are purchased each year, which triggers boost in related markets, such as the car parts and used-car markets. The vehicle market is also growing with technology which explains the many ride-sharing, cab-hailing and delivery apps. The car industry will continue to create more jobs and come up with more innovative ideas like self-driving and eco-friendly vehicles.

What problems do we face in the wake of the rapid growth of the vehicle industry?

We have all encountered unpleasant cab experiences. Many of us were surprised by the expensive quotation provided by car mechanic shops. It's worse because we have no way of knowing how well they did their job. We also know how you feel when you want to sell your car that you took such good care of, only to find the price is lower than what you think you deserve. We've all been there. We know your pain. Technology has flooded our lives, but it's not quite there yet, is it? Below we will discuss the problems we want to address.

Building trust in the traditional used-car trade industry has always been difficult. A car owner has no way of proving that his or her car has been highly maintained and get a good price. On the other hand, the potential buyer has no way of checking if the repair history is accurate. This is where the dealers come in to minimize risk that comes from the lack of transparency, but they are not a foolproof solution and risks still exist as dealers may not always provide transparent data of a car.

These problems are equally applicable to businesses. For instance, when car rental companies want to sell their fleet of vehicles, they are not able to prove that their cars have been maintained in good condition. As a result, a car's value is determined by its usage and mileage, and well-used rental cars may fetch a lower price even if it has been well maintained. They also have to compensate for the flaws inflicted by the previous owners because they can't prove otherwise.

Chauffeured ride providers and taxi companies face problems concerned with service quality and customer satisfaction. Due to various economic issues, drivers have to operate for a long period of time with low pay and they will try to get as many customers as they can which leads to careless driving and poor quality service. The return of each order is low, leading to a lack of motivation to provide safe and good service. Of course, customers will not want to tip them. This vicious cycle goes on and on.

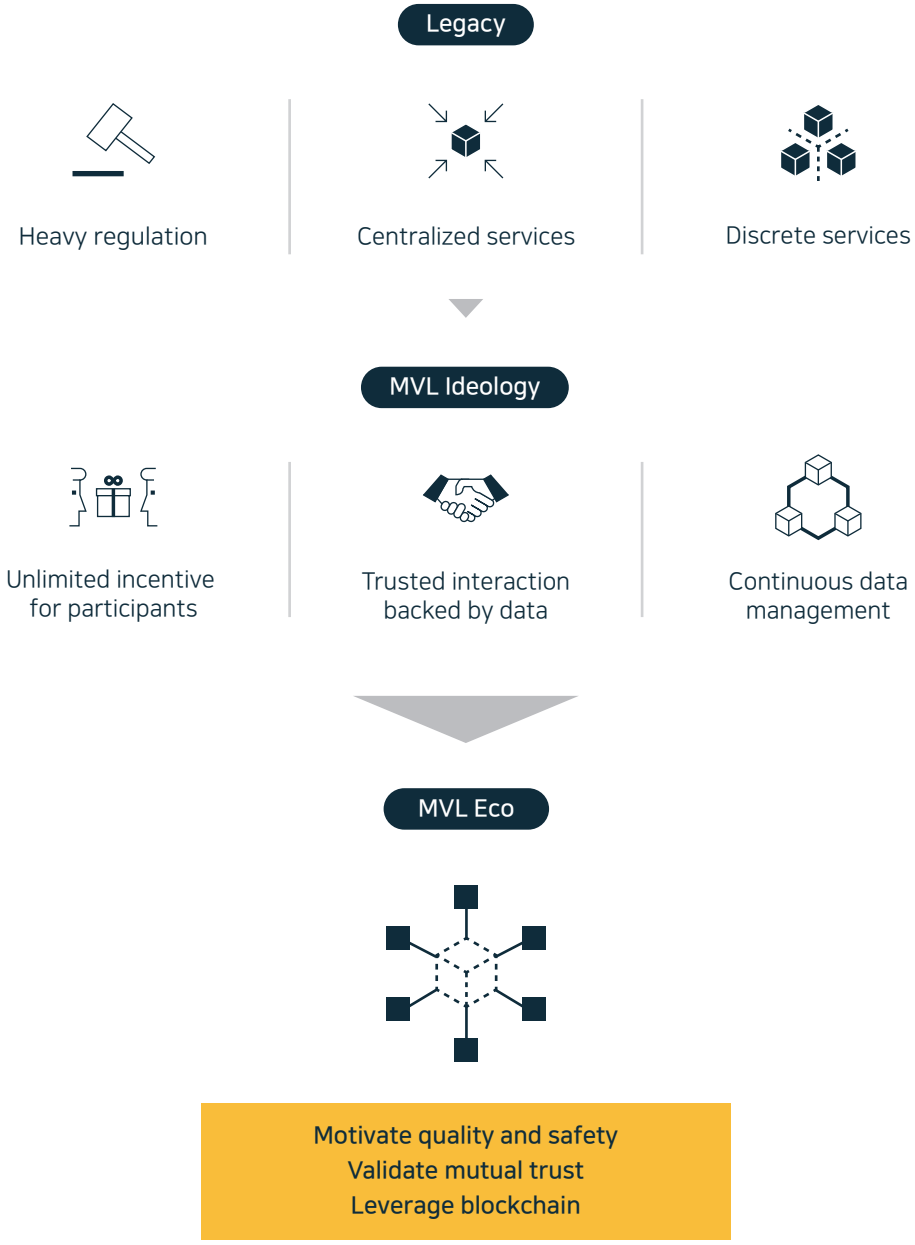
Many problems still exist on the individual level. No matter how small your fault is in an accident, you'll be charged high insurance and even if you drive safely, the insurance fee stays high. Also, the government has been executing campaigns to reduce traffic death rate for decades, but still it is on the top of their agenda, indicating that this is an ongoing problem.

There are many IT services related to repair, insurance, carpool and cabs that help address these issues[9]. These tools have connected suppliers and customers, but commissions occur to prompt higher customer price. Also, users have too many different apps to go about their business. What's worse is that these centralized services that store data in their own servers do not bring balance to the market. This is because when an app garners high daily users, it is only the makers who gain high return. These platforms do not radically lift the living standards of its participants. Also, these ride services are triggering dispute with the traditional cab services. It can do better to bring social change.

By analyzing each service, we can figure out fundamental problems.

Vehicle-related services are tangled up in the vehicle market because problems such as inefficient data management were not properly addressed. How can we figure this out?

Most existing services only connect two participants in their own centralized platform, like driver and customer, mechanic and customer and so on. Each platform solves their own problems and there is no overall system that connects different platforms to solve bigger problems. But the vehicle-related markets in reality are connected because they all commonly need vehicles to operate. These markets can create an ecosystem. If we find the common enemy of these existing services, we can trace a solution. Let's look at a big picture to find the fundamental problems.



First of all, the vehicle scene is regulation based, not incentive based. For instance, while safe driving benefits the society, those who practice safe driving are not acknowledged. Only penalties exist for drunk driving and speeding. There is no ac-

tual motivation for people to drive properly because all you need to do is not get caught. Government penalty brings order to individuals on the road, but too much cost is poured into punishing those who do not heed the laws in place. Campaigns aren't effective. We need to bring a different program that will encourage a change. So since the MVL system collects transparent data, it is a natural way of encouraging safe driving.

Secondly, each service is centralized. For example, in the context of IT-based ride hailing mobile applications, although it is the drivers and users who fuel the services' growth, those who receive the benefits and returns of such growth are the investors, shareholders and founders. The dedication of the drivers and customers are not properly rewarded. This does not meet the full meaning of shared economy. The more this takes place, the less motivated the participants will be to participate.

Next, the separate service models are disconnected. Let's take a look at different ride sharing app all over the world – China's Didi, United States' Uber, Lyft and South Korea's Kakao T provide the same service, but operate on separate platforms. An Uber user from the States needs to download the Kakao T application in order to book a ride in Korea. This is the case for other vehicle-related services, like repair and car wash. Due to this disconnection, data is stored separately and points or coupons are not usually usable across the various platforms.

We want to find solutions by connecting various car-related services.

So what do we have to do to solve these problems? During the past five years, we have been in the global mobility market, providing rides across the border between Hong Kong and Shenzhen as a transportation booking service. We also provided rides for the 2018 Olympics Winter Games at Pyeongchang and more. We know the pain that exists in the vehicle industry and as such, we hope to solve the unsolvable by connecting all vehicle related companies into a single ecosystem.

To connect companies, individuals and drivers in vehicle market, we need to store the entire history of a vehicle. All vehicle services, like repair and chauffeured rides, can interact with each other and provide data that keeps track of a vehicle's changing status. For this to happen effectively, we need to converge the vehicle ecosystem with the blockchain technology.

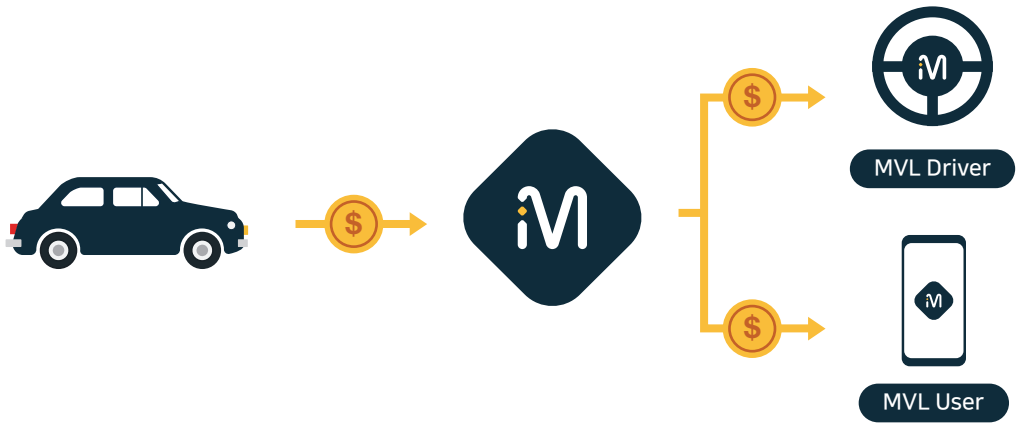
2. MVL Ecosystem : Integrated Blockchain-based Mobility Ecosystem

2.1. What's the MVL Ecosystem?

Gathering the data of a vehicle's lifetime is a great motive that brings separate car services into a single incentive-based ecosystem. Separate centralized services have their own server where data is managed independently and their focus were not to collect a vehicle's lifetime data effectively[11]. To elaborate, repair services only collect data relating to repairs, and GPS services only gather driving and navigational data. Also, not all the data could be proven to be accurate, unable to gain trust from the market. Data gathered by mobile applications falls into the ownership of the makers and the contributor were not given access to it.

MVL Ecosystem will tackle these problems by gathering all data in one centralized database and utilising blockchain technology. With the MVL Ecosystem, we can maintain records of all activities relating to a particular vehicle for the entire duration of its "lifetime" and ensure that such records are kept free from corruption. Only the owner will have the authority over his or her data stored on the decentralized blockchain. In the past, a limited number of centralized services monopolized data, but now the power of who owns the information is distributed evenly to the people. Various participants in the vehicle market can continue to add trustworthy data and be connected in one ecosystem.

Legacy



MVL Ecosystem

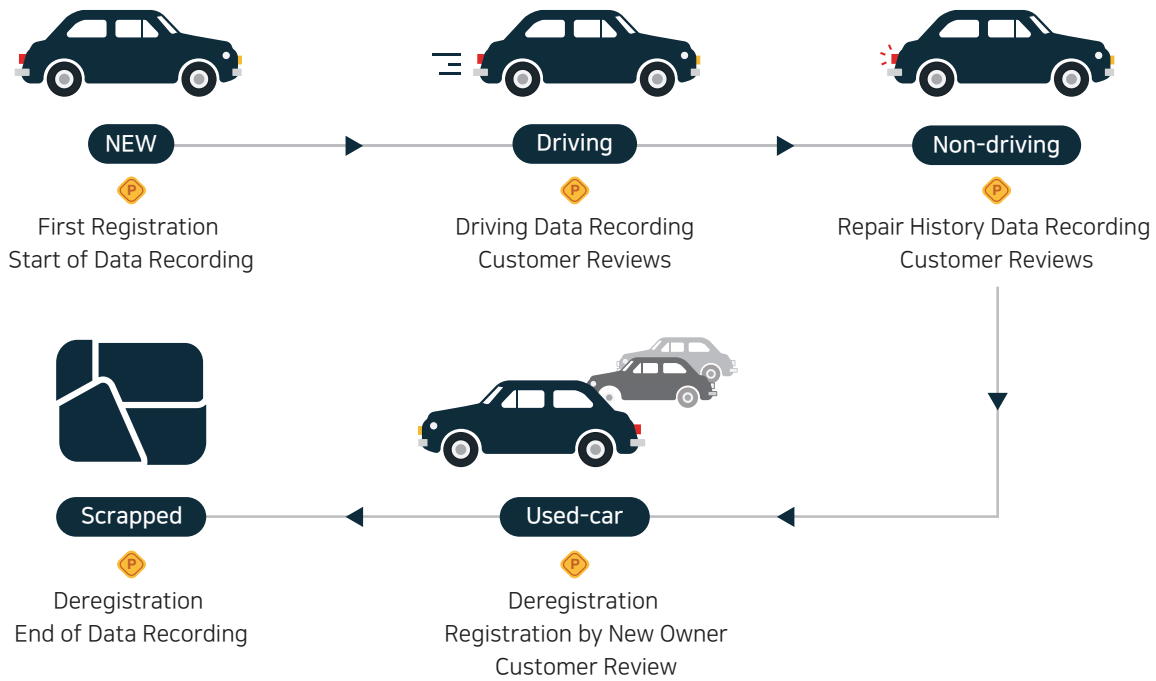
Through the reward system, participants will receive MVL Points (MVP) in exchange for accurate and active data collecting. Those who play their role and put in different types of data to earn MVP, which they can use to promote how well their business is doing or exchange it to MVL Coin (MVL). MVL can be traded with other participants in exchange for goods and services such as gas, repairs, or car rental. All sellers of car-related goods and services will be appropriately licensed/approved to sell such products and any such sale will occur within national boundaries. Now people no longer have to rely on used-car dealers to get a good price. They have accurate data in their hands to prove a used car's value. Now, people can earn MVP if self-driving car makers or insurance companies purchase their vehicle data through MVL Ecosystem.

Lastly, the ecosystem uses MVL Points (MVP), which can be mainly earned by active participation, and MVL Coin (MVL), which can be earned through the provision of goods and services within the MVL Ecosystem, to prove validity of the data on the blockchain (agreement protocol). This solves the existing problems caused by existing agreement protocol of POW and POS method, as this means that those who work hard will be fairly rewarded and trusted. Participants will be motivated to fuel the growth of this MVL Ecosystem and receive rewards doing so. MVL changes the old ways where only the investors and makers see the highest returns. We want to create a world where participants who persevere can share wealth and see the distributed economy system.

MVL Ecosystem will motivate its participants with an effective reward system of MVL Points. The MVL Ecosystem will have a system that allows participants to evaluate each other to promote reliable data collecting.

2.2. MVL Ecosystem's Scope

The MVL Ecosystem can be used by car makers, transportation operators, used-car dealers, rental car companies, insurance firms, car owners, car providers, passengers and other related parties, and different rules apply to different participants.



First, in the new car phase, a newly manufactured vehicle is handed over to an individual or a business owner. When data on the new vehicle is entered into the MVL Ecosystem, it will be the first time the car will interact with other participants in the MVL Ecosystem.

In the driving phase, participants drive their cars for personal use or business (e.g. driving a cab). The car owner and driver (whether they are individuals or companies) and the passenger will be the participants in this phase.

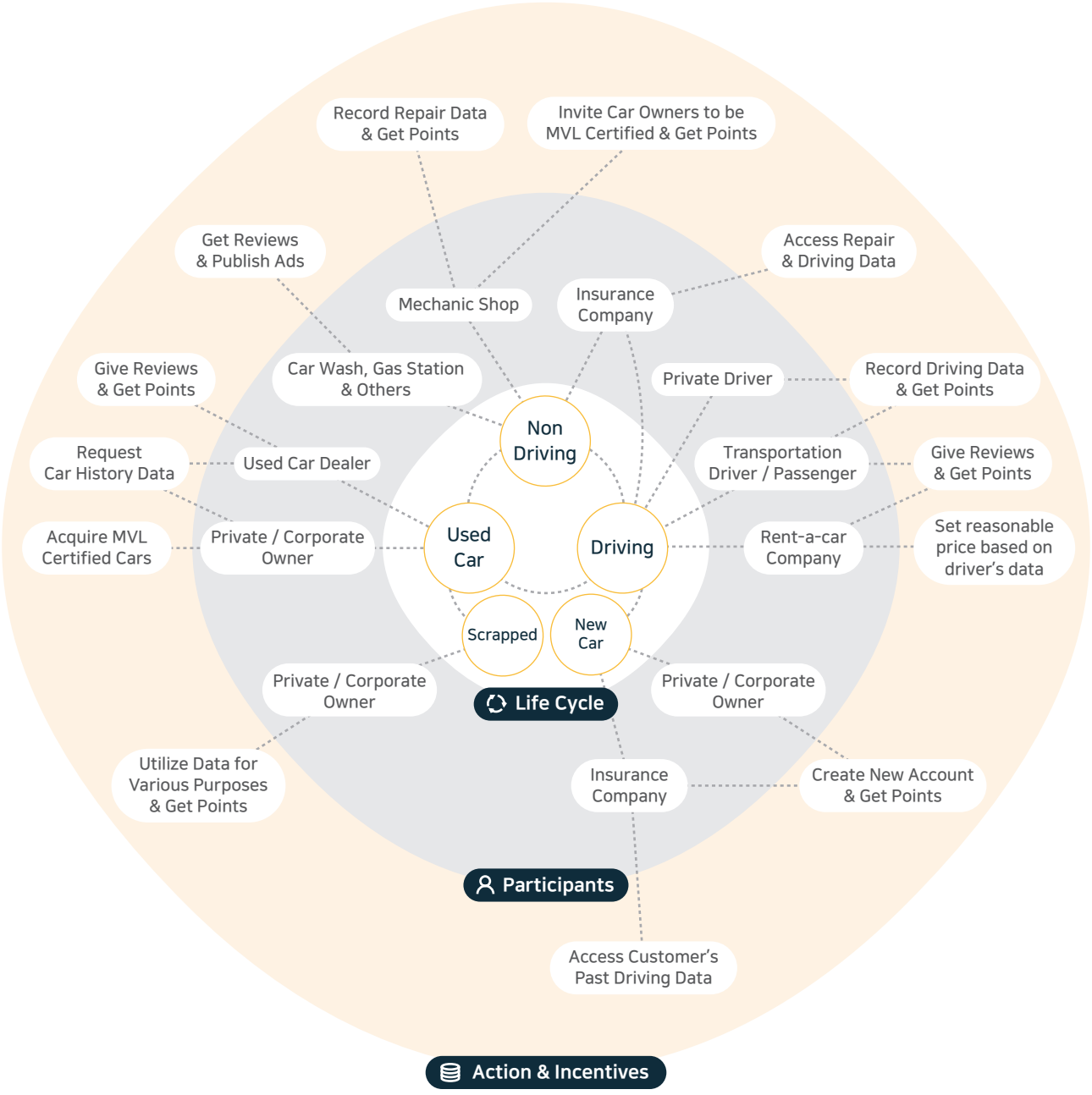
In the non-driving phase, a vehicle is evaluated, fixed and maintained. Here, other participants like the insurance company and mechanic shop who are neither the owners nor driver of the vehicle become involved. These participants upload data to the MVL Ecosystem that is important in assessing the value of a vehicle. Gas stations or car washers can also contribute

data to the MVL Ecosystem in this phase.

The fourth phase is the used-car trade phase, where the owner of a car changes as a car is bought and sold. The ownership of a vehicle can switch from a company, such as a car rental company, to a private individual. The MVL Ecosystem seeks to ensure the car is accurately priced based on the data uploaded to the MVL Ecosystem in the new car, driving and non-driving phases.

The final phase contemplates many transactions occurring among individuals and businesses alike. After a vehicle finds new owners, the vehicle goes through the driving, non-driving and used-car trade phases again until it is eventually scrapped.

2.3. MVL Incentive System



MVL Ecosystem provides customized incentive programs for different participants that contribute data to the MVL Ecosystem. With this incentive program, MVL seeks to solve various problems faced by sharing the transparent data collected.

2.3.1. New Car Phase- Beginning of Blocks (Open Trust)

This is where the ownership of a vehicle is finalized for the first time through car and insurance registration. In the MVL Ecosystem, participants that add a car's serial number and owner's account information on the blockchain will receive MVL Points (MVP). Car sellers or dealers who encourage these acts will also be rewarded by referral codes where the new participant inserts the code of the person that encouraged them to join.

2.3.2. Driving Phase - Continuous Recording on Blocks (Revolutionary Change)

The driving phase is the most essential part of the MVL Ecosystem. The vehicle's data will be properly managed as accurate and consistent data regarding incidents such as an accident will be recorded. The ecosystem will reward those who drive safely. To get their rewards, participants have to add data while using the MVL wallet application connected to the car. This will encourage safe driving because the app will continuously track the movements of the car.

This incentive system will be available for taxi, carpool or car-sharing vehicles, and drivers will receive rewards for safe driving and good service. If reviews are given by customers, who will be rewarded for doing so, drivers will get an incentive which will boost the service quality.

If a driver borrows a car from car rental companies and adds data related to the movements of that car, he or she will receive rewards too. If the car quality is well maintained, the company will also get rewards.

Also, through data collected on the MVL wallet app, participants will know their driving behavior so the right insurance rate will be applied to them. In other words, all participants related to a driving vehicle will be rewarded, while the government effort to promote safe driving is accomplished.

2.3.3. Non-driving Phase - Discrete Recording on Blocks (Basis of Trust)

The non-driving phase is where many different participants are expected to input and upload data to the MCL Ecosystem. From a simple vehicle evaluation to vehicle accident repair, this phase involves many activities. Data collected in this phrase is crucial to assessing the value of a vehicle.

For example, mechanic shops may ask for an unfair price or put records that are inaccurate. To prevent this, MVL Ecosystem seeks to rewards those who input concrete data and provide good service. When the customer takes his or her first mechanic shop's data to the second mechanic shop to get it evaluated, the first shop will be rewarded for inserting good data, but penalized if the data is not exact. This thorough evaluation system will take place because the MVL Ecosystem wants to be sure. If the damage scope of an accident quoted by a mechanic shop is way bigger than what the big data analysis projects, participants and the MVL Ecosystem will be alerted.

Participants will be able to use MVL Coin (MVL) to get fuel, car wash, vehicle parts and more.

2.3.4. Trade Phase - Change of Ownership (New Contributors)

During this phase, the ownership of a vehicle changes. The used car trade market is as big as the first-hand car sales market. But a downside of the used car trade market is that the seller is unable to prove that his or her car has been well

maintained and the buyer may have a hard time trusting the previously recorded data. Used-car dealers have stepped in to fill the gap created by the lack of information and credibility, but this is not an ideal solution for the problem because we still do not know if the information is accurate. In the MVL Ecosystem, trustworthy, accurate and reliable data previously uploaded can be shared between sellers and buyers to allow them to agree upon a fair price. This does not mean used-car dealers will lose their jobs, as they will receive rewards by encouraging new participants to join the MVL Ecosystem, recommending well-maintained MVL certified rides to buyers and help register vehicles for data gathering. Those who encourage others will be acknowledged by referral codes.

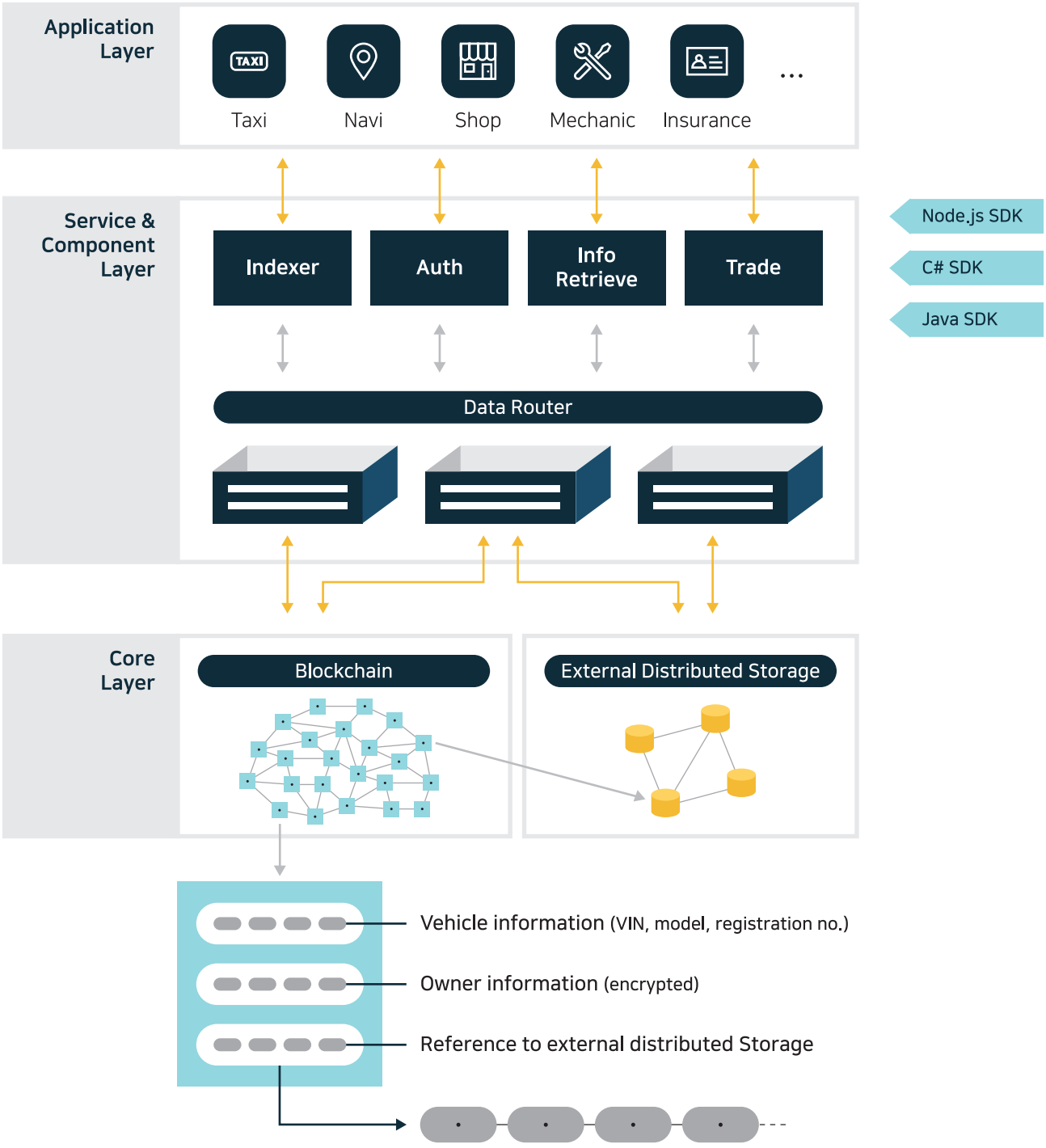
2.3.5. Scrapped Phase - End of Blocks (Infinite Incentive)

A vehicle will repeat going through the driving, non-driving and trade phases until the vehicle is unable to operate any longer and must then be scrapped. In this scrapping phase, the government, car owner and vehicle-scrapping company will be involved and the final data for that particular vehicle being scrapped will be recorded. The vehicle will lose all of its vitality and no more data will be inserted into a block. Existing data will then be used for research and analysis in the self-driving industry and more. The profit earned by selling the data will be returned to the related participants.

3. MVL Coin (MVL) Technology Part

3.1. Structure of the MVL Ecosystem

The MVL Ecosystem consists of three layers: Core, Service & Component and Application.



3.1.1. Core Layer (Blockchain Layer)

In the core layer, all data collected during a vehicle's lifetime will be uploaded and stored in an external distributed storage. This external distributed storage is a required for more storage space. Driving, accident and repair data are important data which can be used when purchasing used-cars or handling car insurance. These types of data will be stored in

the blockchain so it will be free from distortion and/or damage caused by server error. Basic data of MVL's blockchain will be operated based on Ethereum in the beginning but we will transfer the data to our independent blockchain for storage once we have created our mainnet.

Also, data that takes up lots of space and are not as frequently used will also be stored in the external distributed storage to boost efficiency of the blockchain network. Examples of such data include photos uploaded by the mechanic, data relating to steering or the increase in speed rate during driving will be stored in the external distributed storage, not the blockchain network.

In this core layer, the data will be encrypted and will be accessible only if the person who contributed that piece of data gives permission to do so.

3.1.2. Service & Component Layer

The Service & Component Layer acts as a window that allows MVL developers and third parties to access to the data in the Core Layer so they can create decentralized application programs, or "DApps". Services in the MVL Ecosystem will be able to connect to the MVL blockchain only through this Service & Component Layer. When the MVL's blockchain network is ready after the release of the ecosystem, the heavy weight on the blockchain, such as fast transaction and categorizing core data, will be soothed. Moreover, in this layer, API[12] will be provided in the form of SDK[13] so many services, or DApps, can be developed on top of the MVL Ecosystem.

3.1.3. Application Layer

This is where MVL data is used to create various services. All sorts of DApps will be operated here using the SDKs provided in the Service & Component Layer. Therefore, the data collected by these DApps will pass through the Service & Component Layer. The MVL team will make various services and help other developers or services by providing SDK for major languages. This SDK will be used by third party developers to access vehicle data and use it to spur the growth of the MVL Ecosystem.

3.2. Basic Blockchain and Data Storage

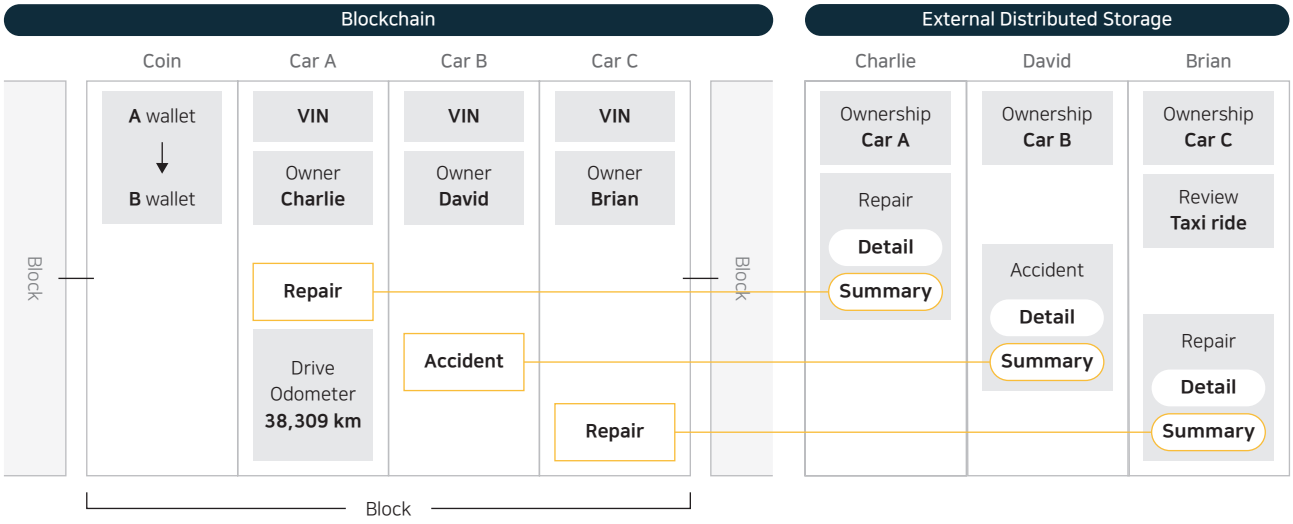
MVL will take two steps to create the blockchain network for data storage. In the first step, we will use the Ethereum[14] network to store MVL data on the blockchain. But as the MVL Ecosystem is too large for the Ethereum network to fully manage and so, we will work towards developing our independent blockchain network.

The second is the mainnet step where miners get rewarded and get commission for agreeing and verifying data on the blockchain. Here, participants get profit. We will create a mobility ecosystem where large volume and interaction can be handled quickly by improving transaction speed and block production cycle.

We will also operate an external data storage for those that get in the way of the blockchain efficiency. We will use distributed storage that is free of damage due to central server error. We will use external distributed storage solution like the InterPlanetary File System (IPFS), after improving its protocol and features.

3.3. Data Type in MVL Ecosystem

The MVL Ecosystem keeps track of all vehicle data. We will distinguish between core data types that are crucial to vehicle management, and data that is relatively less essential – this will allow us to increase the blockchain's efficiency. Core data will be added in the blockchain, while the supplementary data will be stored in the external distributed data storage.



3.3.1. Data Managed on the Blockchain

A vehicle's major lifetime data, trade information in the ecosystem and wallet data are all stored on the main blockchain network.

3.3.1.1. Major Data of a Vehicle

Major vehicle data will be stored on the blockchain. Such data includes Vehicle Identification Number (VIN)[15], owner account information, summary data of driving, and accident and repair history.

In the MVL Ecosystem, a vehicle is distinguished by VIN, a distinctive number given to each vehicle by the car manufacturer which is akin to an individual's passport number. All lifetime data and owner account information of a particular vehicle will be linked to the VIN of that vehicle and recorded on the blockchain. Personal data will be stored separately. If the vehicle is sold, the linked owner account will be switched to the new owner's account.

After the new owner is registered onto the MVL Ecosystem, all the core data collected while driving will be added to the blockchain. This data includes driver info, driving data collected by OBD(On-board Diagnostics)[16], accident data and repair history data.

Repair or accident data will be uploaded by participants other than the vehicle owner to ensure transparency and reliability of data. To accomplish reliable data gathering, MVL Ecosystem will use AI-based repair evaluation and mutual verification system.

Also, repair history data typically includes many supporting documents, videos and photos which take up too much space on the blockchain. To maximize efficiency of the blockchain, only the summary of the data will be inserted here, while detailed data, including the supporting documents, videos and photos, will be stored in the external distributed storage. Summarized data will exclude sensitive information like the driver or owner's personal information. Encrypted hash refer-

ences will be used so users will know how to find detailed data of the summarized version after the data owner has given authorization.

3.3.1.2. Trade Data

All data related to trade in the ecosystem using the MVL Coin will be stored on the blockchain. When the owner of a car has changed, it will be reflected here. Also, when participants use MVL Coins (MVL) to buy vehicle parts, get gas or a get a car wash service, the transaction will be recorded on the blockchain. The movement of coins between different accounts will be stored, while the details, like the personal info of the account owners, will be stored separately. The owner has to authorize access so others can see the transaction details on the distributed storage.

3.3.2. External Distributed Storage

Data like personal information or those that require more storage space will be stored on the external distributed storage. These can be divided into vehicle-related data and MVL Ecosystem data.

3.3.2.1. Vehicle-related Data

There are various forms of vehicle-related data. Here are some of the following:

1. Driving data that plot the starting and end points of each journey
   · Driving data does not include personal information. Data here includes GPS[17], speed rate and steering data collected by navigation systems, CAN (Controller Area Network)[18] or OBD (On-board Diagnostics) installed in the vehicle and mobile phone connected to the car.
2. Sensor data and/or videos of an accident
   · Accident data will be detected and stored when a situation exceeds a certain threshold, like a sudden friction.
3. Documents and photos inserted by mechanics
   · Repair history data will be inserted by the mechanic. If other participants are related to the accident or repair, data will be linked to their account.

These data details how a car's condition changes. They are stored separately to avoid overloading the blockchain.

Vehicle data can be divided into private and public data – Public data, such as driving, accident and repair history data will be given to the new owner of a used car from the old owner. But private data, such as the previous owner's personal information, will not be. MVL Ecosystem will be strict about who owns what type of vehicle data and who has access to them.

3.3.2.2. Ecosystem-related Data

Any transaction data related to a vehicle or MVL Coin will be stored on the blockchain, while the related participant's personal information, job and other detailed info will be stored in the external distributed storage. Also, data that is necessary to maintain order in the MVL Ecosystem, such as the number of MVL Points, partnering company list, will be added on the external distributed storage.

3.4. MVL Data Ownership

There are two types of data ownership – Data that is stored on the blockchain can be publicly accessed, while data on the distributed storage is private and accessible only by the owner and other third parties authorized access by the owner. Publicly accessible data will include summarized data of vehicles and repair data, and will not include personal data. Private data will be encrypted on the external distributed storage, with hash references of such private data stored on the block-

chain. When the owner of a car changes, the ownership of the data, excluding all personal information, will be given to the new owner.

3.4.1. Ownership of the Data on the Blockchain

Data directly related to the vehicle, such as owner's account information and the summarized data of accidents and repair history, is publicly accessible on the blockchain. Anyone can see this data and use it. Data here will help participants obtain basic information regarding the vehicle, however if they want more detailed information, they will have to obtain authorization from the data owner to access the external distributed storage.

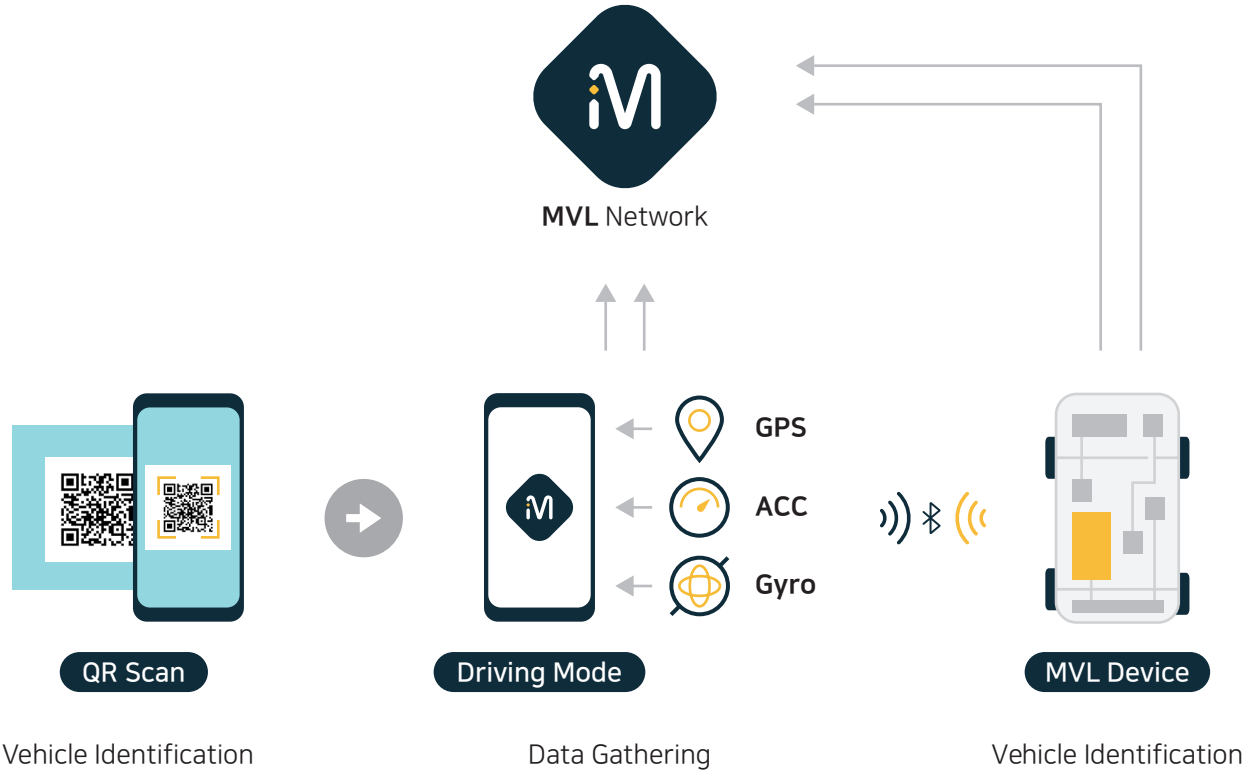
3.4.2. Ownership of the Data on the External Distributed Storage

Data stored on the external distributed storage will be under the exclusive ownership of the car owner or driver. Data under such exclusive ownership includes data that are uploaded while the data owner interacts with the MVL Ecosystem. Examples of such data include detailed driving data of any vehicle, repair history data or accident details that are encrypted.

Account owner basically owns his or her data related to a car even after the ride is sold to another owner. The new owner will also own the past data of his or her car inserted by the previous owner. But the previous owner will not have access to the newly inserted data after the car finds a new owner. Driving data will be owned by the person who is driving. This data may be personal so it won't be given to the new owner even after a car is sold.

3.5. Data Collecting

The MVL Ecosystem aims to continuously collect trustworthy vehicle data using the MVL Points reward program to incentivize participants. As the MVL Ecosystem aims to allow participants to add data easily and to prevent any type of abuse, it will work towards developing an automatic data collecting program and mutual verification system, which will be



upgraded from time to time.

3.5.1. Registering Data of Existing Vehicle

For the ecosystem to grow, existing vehicles have to join the platform. So MVL-certified participants will be rewarded for inviting vehicles and its owners to join MVL. The vehicle's residual value will be added on the blockchain and the vehicle's data can now be added to the ecosystem. This process will allow the ecosystem to grow quickly and create value.

3.5.2. Data Collecting in the Driving and Non-driving Phase

To continuously gather data on the blockchain, we need to utilize more than one device. IoT-based scanners or RFID tags are typically used to collect data for logistics, distribution and delivery. But they are a hassle for the users as they are not familiar with such things. Therefore, MVL wants to minimize efforts and make data collecting automatic. The MVL's data collective device will continue to be upgraded and make data collecting an everyday activity.

3.5.2.1. Step 1: Data Collecting Using Smartphones

In the MVL mobile decentralized application, there will be a wallet and navigation function to collect data of the vehicle's status. Trading and vehicle management data keeping functionalities will also be available. In this app, there will be a QR code scanning feature that allows participant to register a vehicle's identifiable info. Using the mobile phone's GPS and other sensor, user will be able to collect a vehicle's driving data. This app, slated to be launched with MVL Ecosystem opening, will be used to get rewards. This will be discussed later.

3.5.2.2. Step 2: Data Collecting Using CAN or OBD Network

ECU (Engine Control Unit)[19] controls a vehicle and uses CAN (Controller Area Network) to tell a car's current status or how it has changed. MVL uses such networks to collect data and select what is valuable to the ecosystem's participants. This technology calls for wireless communication, for example BLE, with the driver's MVL app. Using the app, participants can verify other participants and vehicles and collect data while driving.

3.5.2.3 Step 3: Data Collecting Device Installed in Vehicles

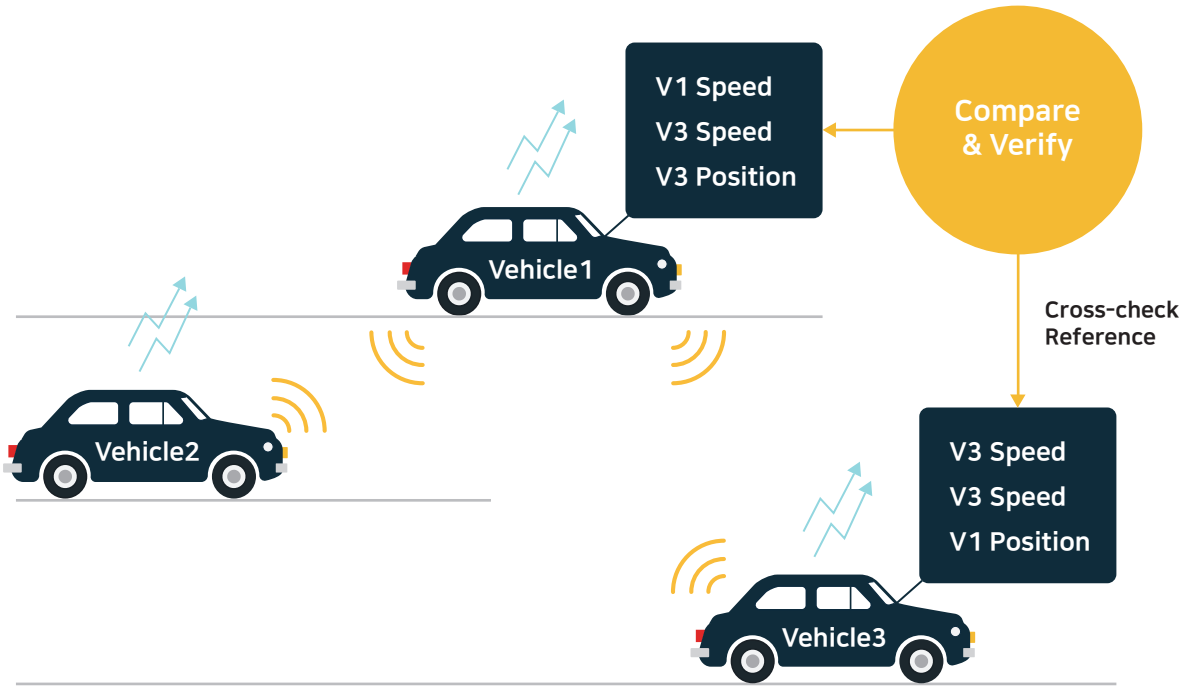
When more participants enter this ecosystem and the MVL Ecosystem is able to develop and grow, MVL hopes to eventually be able to cooperate with car makers and integrate data collecting devices to vehicles, as this will allow participants to collect data easily. MVL is currently in talks with car manufacturers of cars which are equipped with internet access and trying to bring about innovative solutions.

3.5.3. Ways to Prevent Abuse

To collect valuable data, active and consistent participation is the key. More the reason why we have to find solutions to avoid abuse and malicious acts. This can tarnish the quality of data and trust among participants in the ecosystem. MVL promotes verification process so the data are accurate as follows.

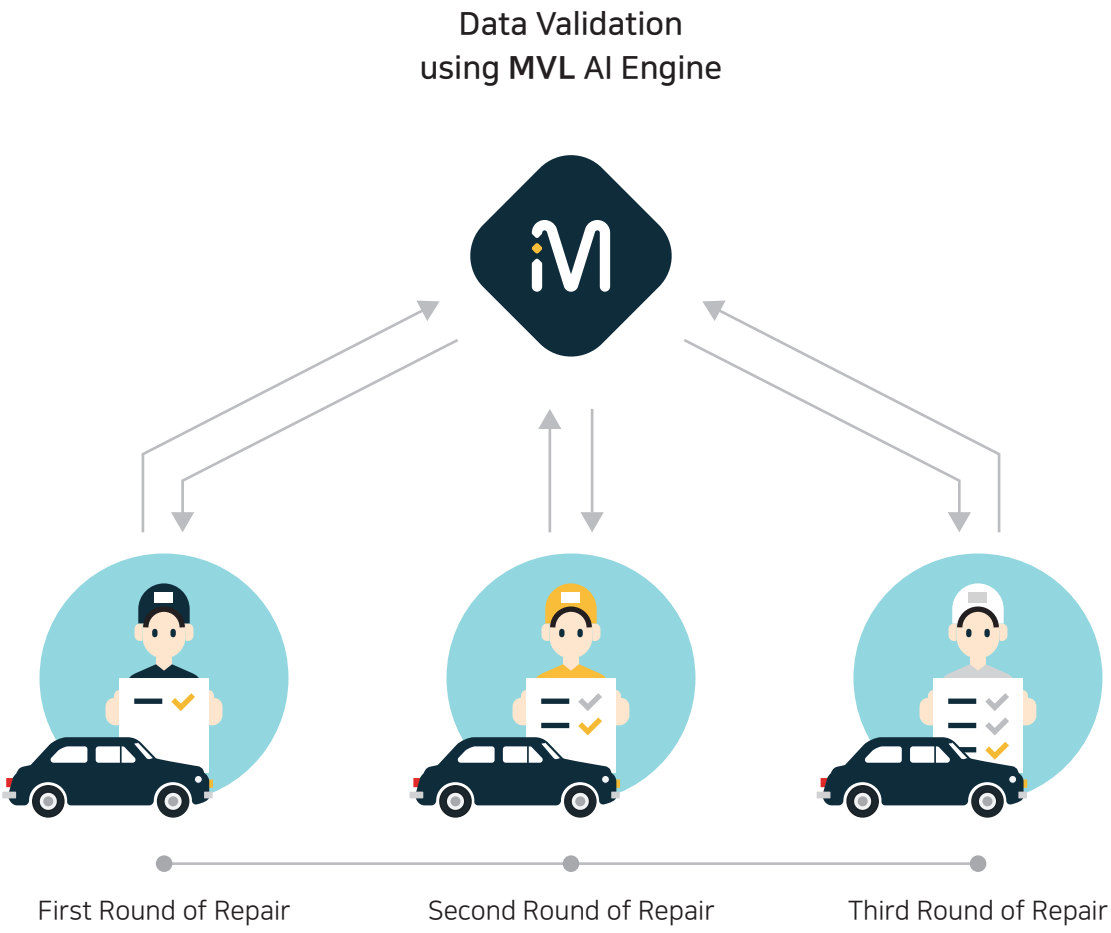
3.5.3.1. Mutual Verification of Driving Record

Data of nearby vehicles will be compared to check if the data is collected from a driving vehicle with GPS or vehicle-to-vehicle network. This way we will know how the data is being collected. Only verified data will be stored in the MVL Ecosystem. As more participants join this ecosystem, more reciprocally verified data will be gathered and participants who try to misuse the system will lose their grip in the ecosystem.



Driving Data Validation

3.5.3.2. Mutual Repair History Data Verification



When the mechanic inserts data regarding maintenance and repair, it will be evaluated by other mechanic shops in the ecosystem. When a mechanic works on a vehicle, he or she can look up its past records to double check whether it was

fixed properly or not.

When it has been verified that the current and previous mechanic have put in accurate data and provided good service, they will both be rewarded. If the next mechanic finds out the previous one was not honest by checking the record inserted by the first mechanic, a penalty will be given. If the previous repair results and cost of repairs differ significantly from MVL AI Engine's estimated range, the third MVL certified mechanic shop will step in for further evaluation.

3.6. MVL Platform's Core Components

Here, we will discuss the core component provided at the Service & Component Layer for various applications. Core components or other SDK and API are being used to make DApps in the ecosystem.

3.6.1. MVL Account and Authority

MVL Ecosystem gives one account to one individual. One account can have multiple authorized users including the user, owner and driver of the car. Corporate accounts for transportation operator and mechanic shops will needs to be certified. One company gets one account. Individual accounts will go through a different verification process from a corporate account. These different forms of accounts will carry out different roles and will allow access to different data.

3.6.1.1. User

All participants will have the authority as a user. Users will be able to give reviews to various vehicle services in the MVL Ecosystem and get MVP Points. User's personal information will be encrypted. Personal information will be accessible only if the data owner allows it.

3.6.1.2. Owner

If the user verifies the ownership of his or her car, the user will also have authority as an owner. The user owns the data collected such as driving, repair and accident data, for as long as he or she owns the vehicle. When the vehicle is sold to another owner, the ownership will be passed on. However, the previous owner will still have access to the data he or she has gathered and get a share of the profit if the data is sold.

3.6.1.3. Driver

If a user has a driving license, he or she will have authority as a driver. Drivers can use their own vehicle or the vehicles owned by others. Drivers can be employed by rental car companies. All data recorded during driving or repairing the vehicle which are uploaded on the MVL Ecosystem will be rewarded.

This does not mean that drivers will receive unlimited MVP for driving – There will be limited time for driving that will be counted for rewards. Contributing data through driving will be the most basic activity in the ecosystem and major participation.

Information of the owners, private or business, will be stored using asymmetric encryption system and can only be authorized to be read with granted access from the owners.

3.6.1.4. Mechanic

The mechanic shop account owner maintains, evaluates or fixes vehicles in exchange for money. Mechanic shops who

are verified as required by local law will be able to create an account in the MVL Ecosystem and participants will be able to add new data of what repairs were made, review the past repairs made on the vehicle and get rewarded for doing so.

3.6.1.5. Other Participants

Other participants include used-car dealers, car wash companies, gas station and so on. MVL intends to create more accounts for different vehicle-related participants down the road.

3.6.2. Request System for Authority and Data

In the MVL Ecosystem, publicly accessible information of participants and vehicle will be limited. Repair history or the owner information can be accessed only during a trade or sale of the vehicle and only with the consent of the owner.

Participants will be able to make a public request to see confidential data, subject to the data owner's approval. For example, participant A can request for the record history of a car owned by participant B. Participant B will receive a request via a mobile app, or in other form, and he or she will use a private key to grant access to the data. The data will be temporarily accessible only to the authorized user.

3.6.3. Ecosystem Data Index Server

Hash reference of data will be stored on the blockchain. MVL Ecosystem has a separate index so people can see open data from the blockchain and external distributed storage. Server of this index is accessible and easily searchable through decentralized application using MVL API. For example, participants can use this to search used cars of certain conditions or find taxis at a particular location. An index server is not only used as storage but also allows mechanics to maximize use of data. This server will be an open source and DApp developers can use the data to create their own index server.

4. Economic Model of MVL Ecosystem

4.1. MVL Coin (MVL) and MVL Point (MVP)

MVL Coin

· Transferrable
· Available for trade in MVL Ecosystem

MVL Point

· Not transferrable
· Not available for trade in MVL
· Only used for exchange to coin

* Before MVL-developed mainnet is ready, the Ecosystem will temporarily issue MVL Token that follows widely-used Ethereum-based Token Standard (ERC20)

MVL Ecosystem issues MVL Coin (MVL) to reward blockchain miners who manage and record vehicle data. It is also used to interact with other MVL participants. MVL Coin can be used to trade goods and services in the MVL Ecosystem. Participants can pay for a car-sharing service, purchase vehicle parts, pay for repairs or gas or even buy a new vehicle. All sellers of car-related goods and services will be appropriately licensed/approved to sell such products and any such sale will occur within national boundaries.

Before the MVL-developed mainnet is ready, the MVL Ecosystem will temporarily issue MVL Token that follows widely-used Ethereum-based Token Standard (ERC20)[20]. It is designed to be used seamlessly to trade on the ecosystem. Once the MVL-developed mainnet and MVL-made blockchain is ready, the MVL Tokens given to early users can then be exchanged to MVL Coins.

Before the MVL mainnet and blockchain network are ready, the only way to get MVL Coin is to purchase MVL Token from the coin exchange market. After the MVL mainnet and blockchain network are ready later on, participants can also earn MVL Coins through the mining system and contributing to the blockchain network. Businesses in the MVL Ecosystem can also get MVL Coins by providing services, and car owners can get MVL Coins by allowing other participants to access his or her data. Participants may also earn MVP by active contributions of data to the MVL Ecosystem, which may subsequently be exchanged for MVL Coins.

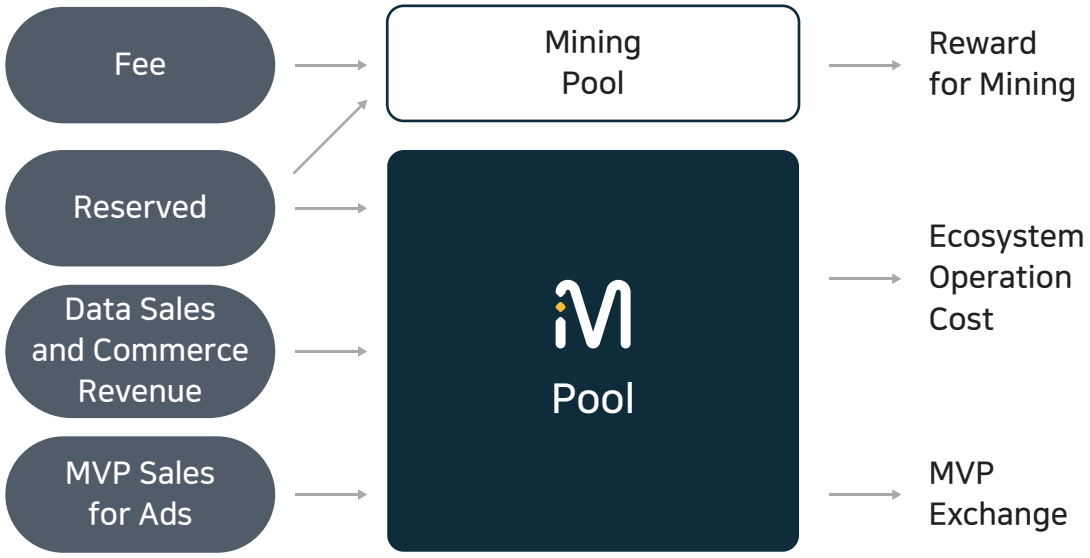
All participants will get accounts and MVPs, which shows how much they have dedicated to the platform. Participants who have different roles will follow MVL regulations, aimed at encouraging behavior that solves problems in the vehicle market, while doing their daily operations as always and earning points.

MVL Points act as a barometer that show how much they have done well and how influential they are in the ecosystem. If a service provider delivers good service and get positive remarks, it will get points. Points can be purchased by using coins up to a point to promote business. Promoting in this ecosystem will accurately target vehicle-related businesses and customers. Of

course, MVL will create an environment where there is a limit to how much a business can be promoted using coins. This way, ultimately hard work, good service and consistency will be the main indicator of how well a business is doing in an ecosystem.

MVL Coins, which can be bought in the market or exchanged with MVP, can be transferred from one owner to another. But MVP can only be gained by using MVL Coins or contributing to the ecosystem. MVP cannot be transferred to another user.

4.2. MVL Pool : Reward System for MVL Ecosystem Participants



The MVL Ecosystem shares profits with those who contribute to the MVL Ecosystem's growth – The more you contribute, the more you will be earn.

In the MVL Ecosystem, MVL Pool will be created. This will be used to reward miners that verify transactions on the blockchain. Mining Pool will be created on the MVL mainnet and miners will receive MVL Coins. MVL is NOT providing an arrangement where the token holder's tokens are collected and/or pooled, where such pooled tokens are then returned/distributed back to the token holders. MVL contemplates each individual miner conducting mining activities separately and on his own account, to build its mainnet and to compensate individual miners with the transaction fee generated in the ecosystem. In the beginning, reserved tokens may be used as the fee may not be enough. There is no collection/pooling from existing token holders and MVL does not manage any mining operations on behalf of the miners.

Commission triggered by transactions of the ecosystem participants, such as service usage, product purchase, driving data sales and other business models of the ecosystem, will be assigned to the MVL Pool. Profit created by MVP purchase with MVL Coins in a bid to promote a business will also be allocated in this pool. This pool be used for those who wants to change MVL Points to MVL Coins. A part of it will also be used to operate and expand this ecosystem.

Such an ecosystem will bring benefits to all participants, miners and MVL Coin owners in the MVL Ecosystem. Transactions will be recorded on the blockchain so the details of profit will be transparent.

In the early stage of the ecosystem, the reward for miners and participants may be low. So we need to give them a reason to become active in the ecosystem from the start. MVL Ecosystem will inject 16 percent of the total MVL Coin in the MVL Pool

over ten years. The more coins there are in the pool, the more coins people will get for points. Therefore, we will inject more coins from the 16 percent cap in the pool in the earlier stages and fewer coins down the road. This is to help the early users to kick off interaction in the ecosystem. Over a decade, the people will sustain transaction boosting profit which will help the MVL Pool grow and the coins to gain high value.

MVL aims to have a steady economy system from the start. Other blockchain based platforms, like Steemit[21], issue more coins and causes inflation[22]. But MVL issues a fixed number of coins to reserve the value of coin.

4.3. MVP Exchange

MVP will be exchanged to MVL Coins based on the total amount of coins in the MVL Pool. See the formula below. Some 40 percent of the pool will be used when participants want to exchange points to coins and the exchange rate will be calculated based on how much coins are in the MVL Pool. If the ecosystem grows, the value of the coins and the overall profit will increase giving high returns. So we believe participants will keep points for a longer period of time and actively interact in the ecosystem.

$$L = \frac{P_{Ri}}{\sum P_R} \times L_P \times \min(0.7, 1 - R_{PR})$$

$$R_{PR} = f(\frac{\sum P}{\sum P_R}, N_U, P_B)$$

where,

$\sum P$: Total points hold by all participants

$\sum P_R$: Total requested points for exchange

L_P : Reserved MVL in the pool for exchange

P_{Ri} : Requested points of individual participant for exchange

R_{PR} : Required MVL reserve ratio in the pool for exchange

N_U : Number of participants

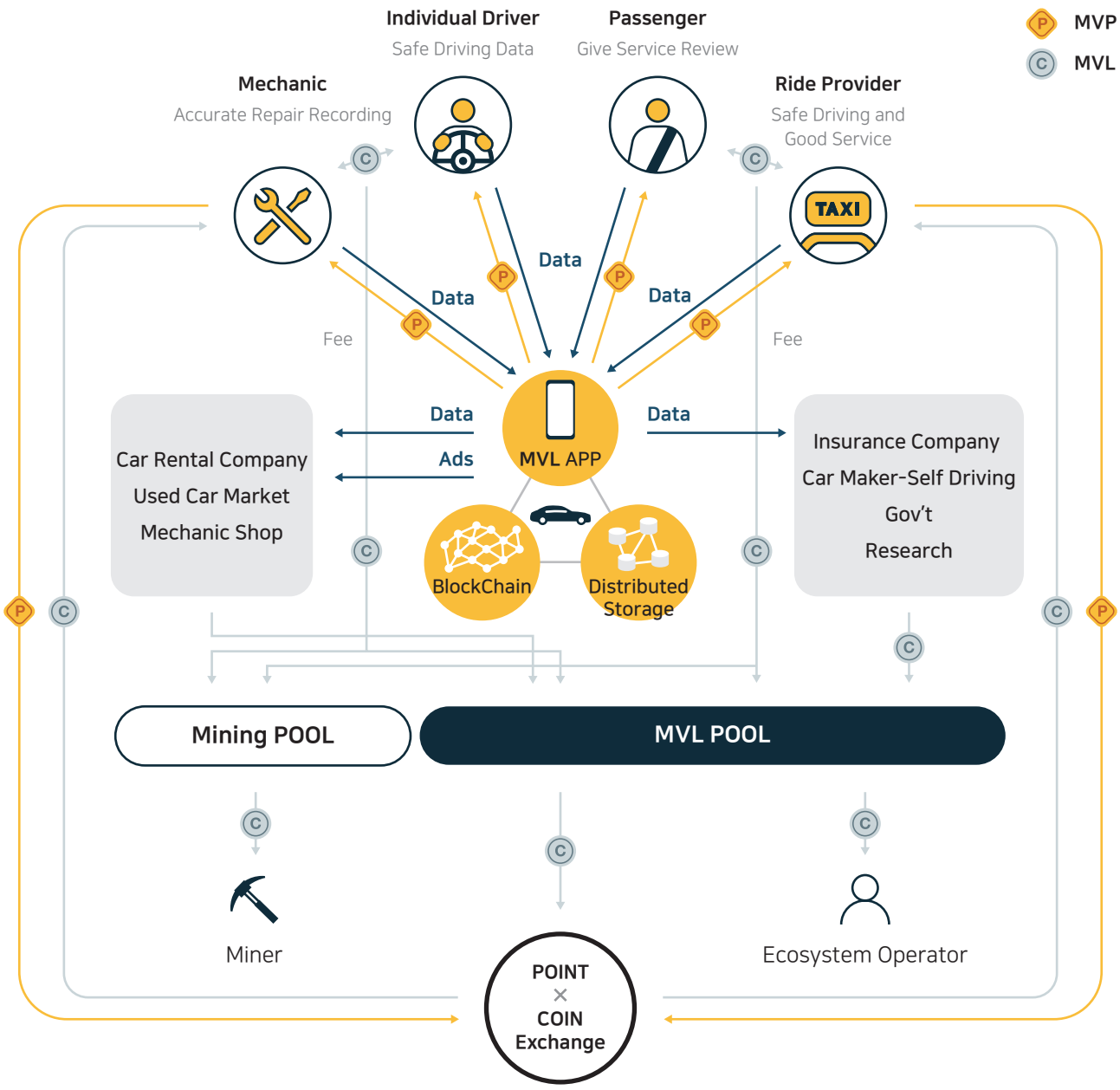
P_B : Points that will be terminated

4.4. Sales of MVP Points

Participants can use MVL Coins, whether they are purchased from the coin exchange market or earned by other means, to exchange them for MVL Points. MVL Points can be used to show how well a service in the MVL Ecosystem is doing so businesses can attract more customers through this ecosystem. Therefore, it is a good way of attracting potential customers or clients in the mobility industry.

MVL Ecosystem adapts the logarithm function for an exchange function from MVL Coins to MVL Points so that first time buyers can purchase a sufficient amount of MVL Points with MVL Coins for promotional purposes. But as the total number of MVPs increases, participants will need to use more and more MVL Coins to purchase the same number of MVL Points. We want to allow hard workers to get the most credit. Business owners need a good balance of actual hard work and capital to effectively promote themselves.

4.5. Issues to Consider for the Ecosystem Economic Model



The aforementioned point and reward system may undergo changes down the line in order to improve the system to promote fairness and trustworthy data collecting. The regulations that we are considering are as follows – When a participant wants to exchange MVL Coins for MVL Points, it will take a month so the MVL Ecosystem can maintain economical order. We are afraid that there will be people who want to buy MVL Points only to sell them immediately for a higher profit. In order to prevent this, a system that allows participants to exchange their MVL Points to MVL Coins at a certain time (such as once a month) is set. This way, people will not be able to abuse the point-coin exchange rate. Also, participants who are retiring from the MVL Ecosystem can make immediate exchange for one-time use only. Points will be taken away from those who put in bad data or provide bad service. Also, we may set a threshold level of points each participants can own and a system that helps control this is continuously being developed.

For better data management, we might have a master node and external distributed storages to store different types of data. We may also take votes when we want to make changes in the ecosystem to allow participants to feel as though they are

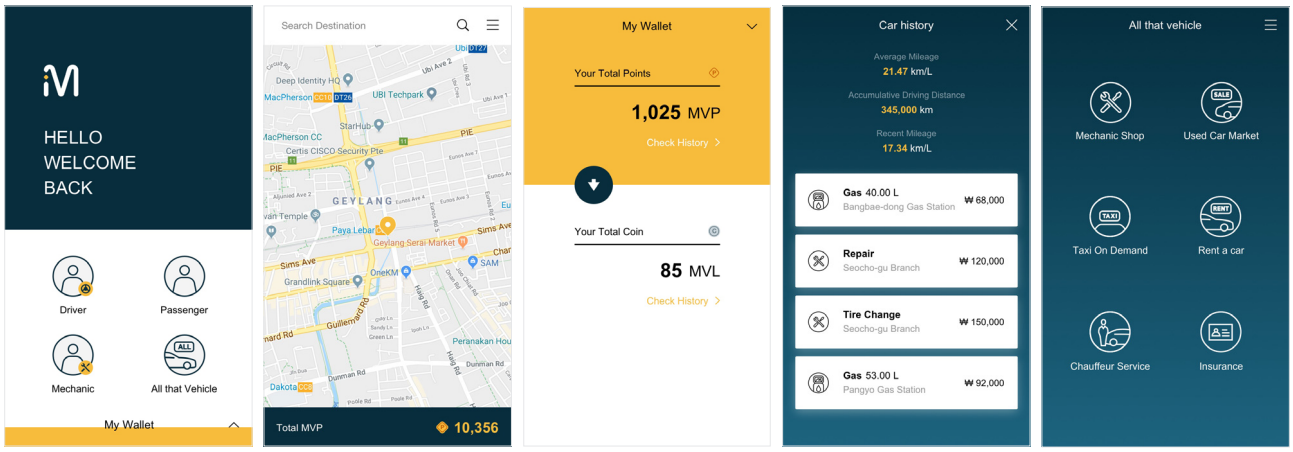
more involved and improve any issues that may occur. All in all, we want all participants to get fair return through good governance.

Regulations and policies will be set after we get feedback from the participants during our test period of the MVL Ecosystem. An MVL Ecosystem guide will be ready when our own independent blockchain network is ready.

5. MVL Ecosystem Application Case Studies

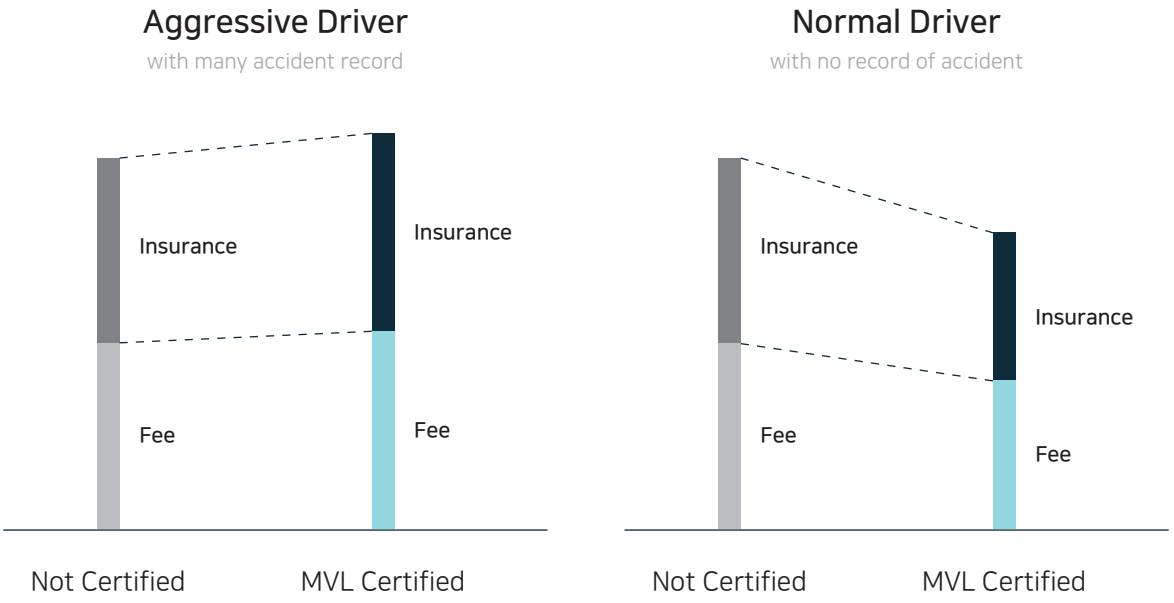
5.1. MVL Integrated Wallet Solution

Participants can get a MVL wallet to keep coins and exchange them. They will be able to connect with navigation, vehicle management, repair, fuel and taxi services and make payments through the app where participants will have access to the MVL wallet. This app will be introduced in the early stages before the MVL mainnet is ready. We will use it to test how well driving data, vehicle registration and other contributions can take place. When the mainnet is ready, it will be connected to the OBD hardware device for more accurate driving data collecting. While the app helps provide data, we will not be 100% sure if the participant is actually driving. However, with the OBD device, data will only be collected if the vehicle is moving.



5.2. Rental Car Service Platform

When customers rent a car, they are asked some questions and made to sign a contract based on past statistic reports. Practically, a customer's actual driving records do not matter as reckless drivers and safe drivers typically pay the same amount. In other words, safe drivers are paying more than they should for those who are reckless. There is no current data system that can set fair quotation based on people's driving records.



With the MVL Ecosystem, participants can use their driving data to demonstrate their driving history and rental car companies can take these records and data into consideration and provide a customized price, which we believe will boost overall customer satisfaction and encourage more people to rent cars more regularly.

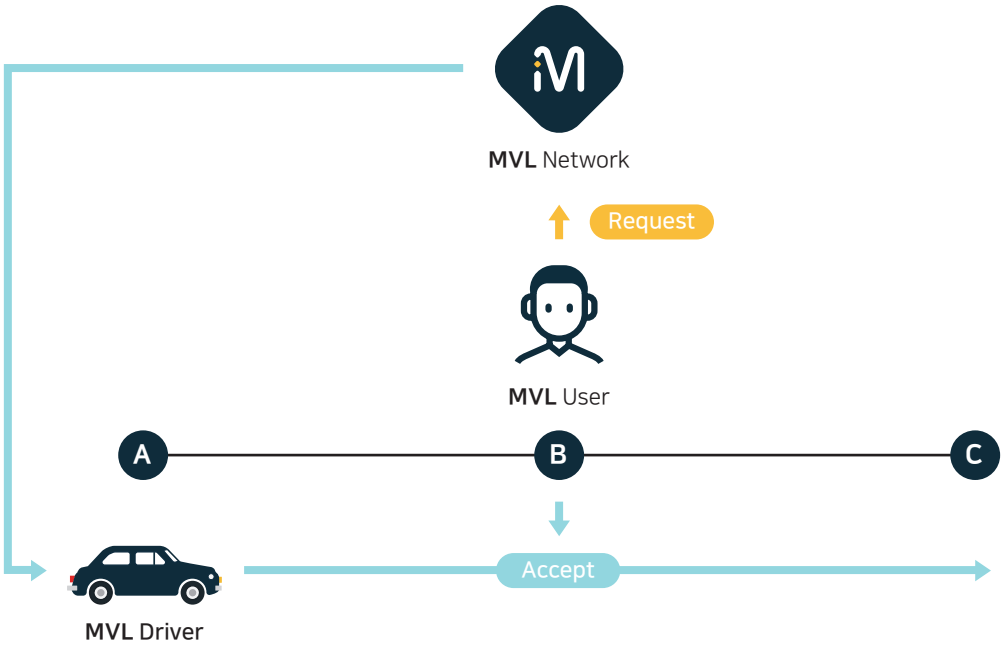
Customers can also get rewards for leaving reviews and driving the vehicle while companies will also receive MVL Points for providing good services. These rewards can be used pay for rental car leasing and spurring revenue for the company.

5.3. On-demand Rides, Cab, Chauffeured Rides and Chauffeur Hiring Service

Current platforms that connect customers to on-demand chauffeured rides or cabs or just chauffeurs earn a commission. Drivers usually have get no direct rewards for driving safely and drivers get paid the same amount as those who provide a less satisfying service. At the moment, reviews are only for references. No direct incentive is given to the service provider and the customer.

MVL connects with existing platforms and boost trust among their participants and motivate good behavior, such as safe driving and car maintenance, through fair rewarding system and accurate data collecting. On top of that, customers, drivers and the company gets incentive for leaving and getting positive reviews.

5.4. Car Sharing Platform



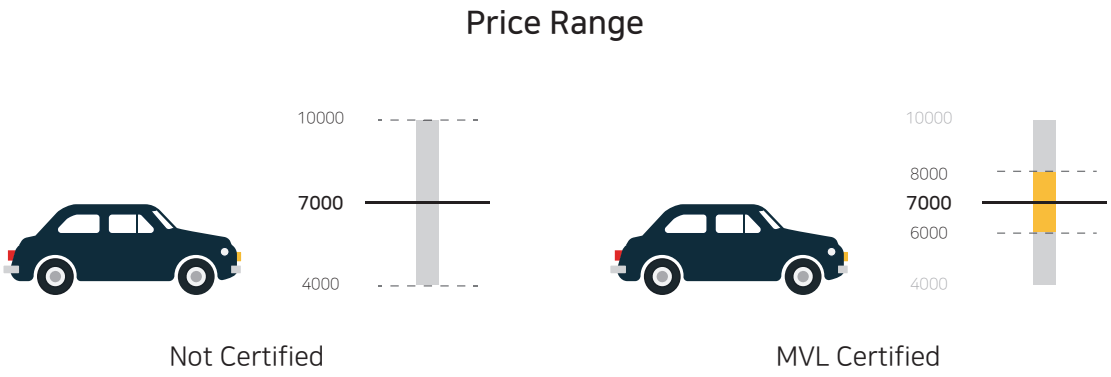
More Koreans are starting to prefer renting cars than purchasing them. Typically, people pay a deposit that accounts for 20-30 percent of the car price, on top of a monthly fee which recurs for a duration of one to four years. In MVL Ecosystem, long term rental car users can sub-lease the car when they don't use it. The data in the ecosystem can match two users whose driving records are similar, allowing a person to sub-lease their car to someone with similar driving habits.

Car sharing with rental cars will encourage more interaction because it will bring extra income for the participants by having more people participate in a single activity. Drivers will get incentives through the customer's payment or reviews and record-

ing driving data. Customers will be able to earn rewards for writing accurate reviews and use it to exchange for coins.

5.5. Used Car Trade Service Platform

MVL calls for accurate data collecting and reducing unnecessary cost. This is shown especially in the used car trade industry. Today, obtaining reliable information on a used car's repair history is close to impossible and we have no way of knowing how its previous owner treated the car. This is why the seller will never be able to fully guarantee good quality and be confident when setting a price, giving the buyer the opportunity to negotiate the price.



In MVL Ecosystem, a valuation of a car is backed by the data recorded by participants. Buyers will be able to see repair history and previous owners' driving behavior, subject to authorization from the data owner. MVL verifies vehicles so that people can accurately compare vehicles to buy and reduce unnecessary insurance fees. Participants will, of course, be rewarded when successful trades occur.

5.6. Car Repair Platform

Data recorded by mechanic shops in the MVL Ecosystem plays an important role in verifying a vehicle. Rewards will be given to mechanic shops and mechanics that upload accurate data and guarantee good quality work that meets a strict standard. Due to high competition, mechanic shops practice dishonest practices but the ecosystem encourages accurate data recording. MVL cuts off unhealthy competition and prohibited practices by encouraging accurate review system.

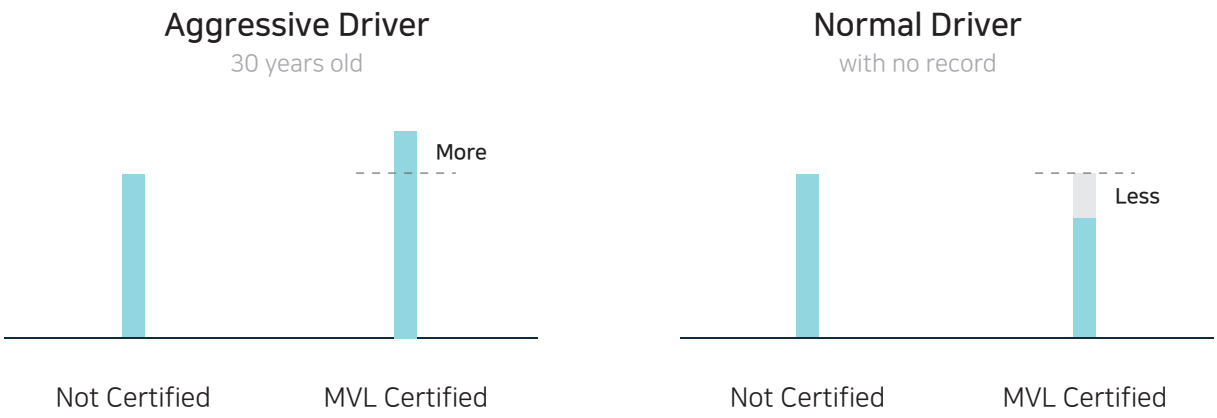
5.7. Dynamic Insurance Service

People who purchase vehicles need insurance. There is no data that shows how frequently accidents have occurred and how severe the accidents were and as such, a customized and reasonable insurance rate is impossible to calculate. As a result, despite being a good driver, individuals tend to pay insurance premiums based on a fixed rate the insurance company has set.

With the MVL Ecosystem, participants can upload driving data which can be analyzed to set a customised insurance rate. By adding more data down the road, the insurance rate can always be revised and fine-tuned. By knowing one's driving behavior, peripheral and supplemental insurance products and discounts can also be recommended.

The effective setting of insurance rate may seem like a loss for the insurance company because people who drive safely will

pay less insurance. But accurate data keeping will prevent people from requesting for too much insurance claim because the rate of accidents will decrease.



5.8. Big Data Service

MVL Ecosystem locks participants into the ecosystem and encourage their level of interaction, while building a rich database. Database can be used internally and externally –

· Internally : The database can be used internally by rental car providers, used car trading, mechanic shops and insurance companies. For example, analysis of driver's behavior and comparison of accident data shows how valuable a vehicle is in the used car market. They can also be used for exact quoting for car repair. In the rental car business, a good price can be given to safe drivers after checking their driving history. Also, insurance companies do not have to deal with people who bills excessive insurance in cases of accidents or repairs.
· Externally : Externally, data can be used for research. Driving data will be helpful for self-driving studies. Driving data and other traffic information can also be used to build government policies. Also, insurance company can use data to compare insurance rates.

Big data can be traded directly among participating individuals, companies and other third parties. Big data dealers will handle data requesting and trading system, manage and process data to create new value to boost revenue. Buyers do not necessarily have to be a participant of the ecosystem.

Profit earned from data sales will be injected to the MVL Pool and will be returned to the contributors. This will create a cycle where people hand in good data and use them, ultimately increasing the value of the MVL Ecosystem.

6. Growth Plan

6.1. MVL Ecosystem Growth Plan

Without the contribution of its participants, the MVL Ecosystem will not grow. As such, we intend to launch a mobile application so participants can insert data and manage their MVL Points in the early testing stages until the MVL's mainnet is made. When the blockchain is ready, participants will be able to use MVL Points and MVL Coins to interact with more services in the MVL Ecosystem. The MVL Ecosystem can also interact with third-party platforms and allow development of various DApps.

More people and services will be able to grow with the MVL Ecosystem and the value created will be shared among each other.

6.2. Mainnet

MVL Ecosystem will hold a large size of a vehicle's lifetime data and requests to see it. We need good resources to handle management and transactions. We believe that Ethereum will not be able to keep up with it all and the ecosystem will slow down at some point.

MVL's developer team is revving up for a mainnet in a bid to develop a more optimized environment. After the MVL token is issued and the early MVL Ecosystem has been tested, MVL intends to develop its own mainnet in First half of 2019. MVL will have its own blockchain network which has a mining system that will keep data safe and allows mutual verification between the nodes to validate each block.

Miners will be rewarded with MVL Coins. The mining method will allow hard workers to be fairly rewarded. We want to avoid the disadvantages of the method of PoW, which calls for many resources such as using a large amount of energy and requiring specific machinery, and PoS, a system which allows those with many coins to have more power and get more rewards than others. We want to do this by using both MVL Points and MVL Coins. We will use devices and tools, like mobile apps, to create a better user experience and facilitate the input of data and earning of rewards.

MVL is NOT providing an arrangement where the token holder's tokens are collected and/or pooled, where such pooled tokens are then returned/distributed back to the token holders. MVL contemplates each individual miner conducting mining activities separately and on his own account, to build its mainnet and to compensate individual miners with the transaction fee generated in the ecosystem. In the beginning, reserved tokens may be used as the fee may not be enough. There is no collection/pooling from existing token holders and MVL does not manage any mining operations on behalf of the miners.

$$R = f(P_{MVL}, P_{MVP}, T)$$

$$where,$$

$$R : \text{Personal return possibility}$$

$$P_{MVL} : \text{Personally owned MVL}$$

$$P_{MVP} : \text{Personally owned MVP}$$

$$T : \text{Continuous contribution time}$$

6.3. Makers of the Ecosystem

After the mainnet is ready to go-live, participants and services that make DApps will be notified. Data of the MVL will be put to good use and new services will be made with the help of the in-house developers and their API and SDK. For example, if MVL is connected to a used-car trading company, MVL participants will have access to a larger data of customer base and vehicles outside of the ecosystem. MVL developers will also introduce case studies for all sorts of connection with rental car companies and chauffeured ride providers.

6.4. Timeline

Kicking off with the token issuance event, MVL will follow the timeline below to trigger interactions and dedication from the participants:

2018

- **March - April**
  - Initial Coin Offering
- **3Q**
  - Introduce MVL application with the functions
    - 1. Wallet
    - 2. Map + Navigation
- **4Q**
  - MVL Application update
    - Car management record
  - Test point and stake-based mining

2019

- **1Q**
  - Introduce Mainnet of MVL
  - Conversion process from Token to Coin
  - Introduce Point to Coin exchange function on application
  - MVL Application Update
    - A. Mining system official launch
  - Introduce OBD device v1.0
- **2Q**
  - Introduce MVL API and SDK
  - Introduce MVL payment
    - A. Introduce early connected services
    - B. MVL application update (Payment for Car repair, Gas station and others)
- **3Q**
  - Launch Rent a car/Chauffeur service platform
- **4Q**
  - Enhance car management record function from basic to full function including public data access
  - Introduce hardware for navigation and data sharing

2020

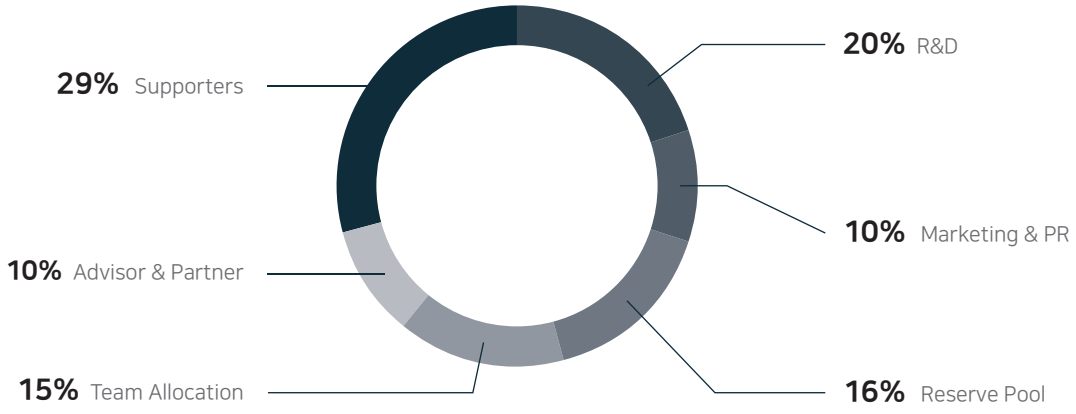
- **2Q**
  - Launch Used car trading platform
- **3Q**
  - Invite car makers to MVL platform

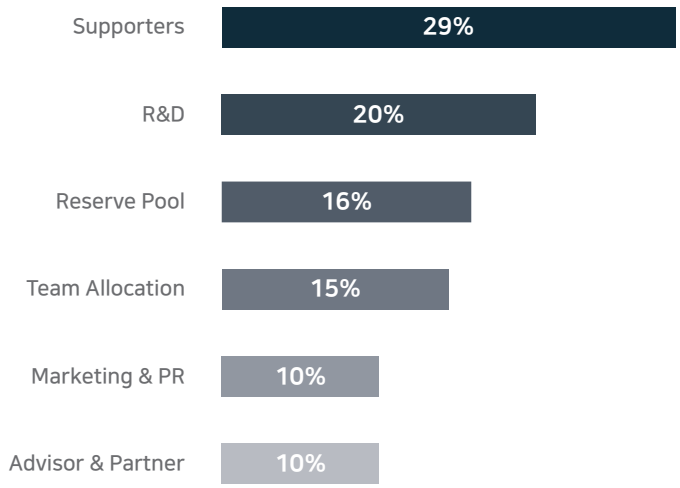
7. Conclusion

MVL is an experimental ecosystem. Using the blockchain, we will connect vehicle-related services and solves various problems that currently exist in the mobility industry. The current vehicle market is not incentive-based. Each service is centralized and disconnected from each other. The MVL Ecosystem, on the other hand, connects vehicles, rewards participants, shares profit with decentralized services and integrates vehicle-related services and business. The MVL Ecosystem does not only connect vehicle-related services but also motorcycles, bicycle, walking and public transportation. In the long run, futuristic mobility, like drone taxi, self-driving vehicles and electric vehicles will also be added to the ecosystem. In this ecosystem, all participants will have ownership of their data and grow with the ecosystem.

8. Token Issue Event

Tokens are issued to encourage participants to submit accurate data of driving, repairs, registration and other vehicle-related information, using Ethereum. A total of 30 billion MVL tokens will be issued. There will be a private, pre-sale and main sale that allows participants to purchase and get various awards accordingly. The exchange rate of each coin will be announced before the token is issued via our official communication channels. A total of 29 percent will be given to those who participate in this token issue event. Once the MVL mainnet is ready, 16 percent of the total issued MVL Coins will be injected into MVL Pool for point to coin exchange over a time span of 10 years. A part of the coins will also be used for partnership with vehicle services, marketing and promotion, development of MVL's own blockchain, maintenance, DApp support and more. Coins will also be reserved for MVL teammates who have been in the company for the past six years and other investors and advisers.





*The graph above shows how the tokens will be distributed. But the whole number of tokens and proportion is opened to change, if necessary.

We will announce through :
Website : mvlchain.io
Medium : medium.com/@mvlchain
Twitter : twitter.com/mvlchain
Telegram_en : t.me/mvlchain_en
Telegram_kr : t.me/mvlchain_kr

9. Team Profile

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· Founder of easi6

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