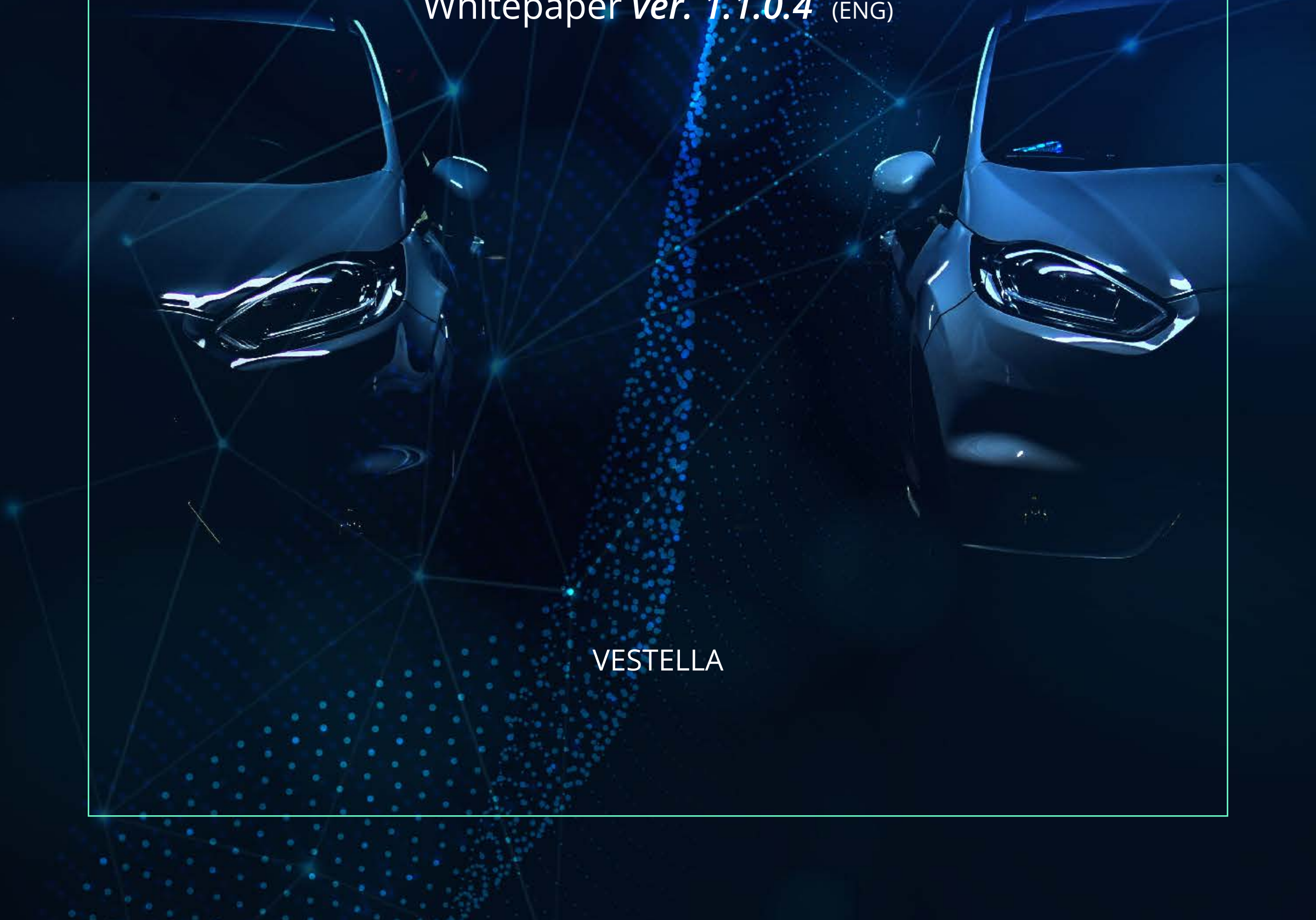
DATA MARKET PLATFORM FOR

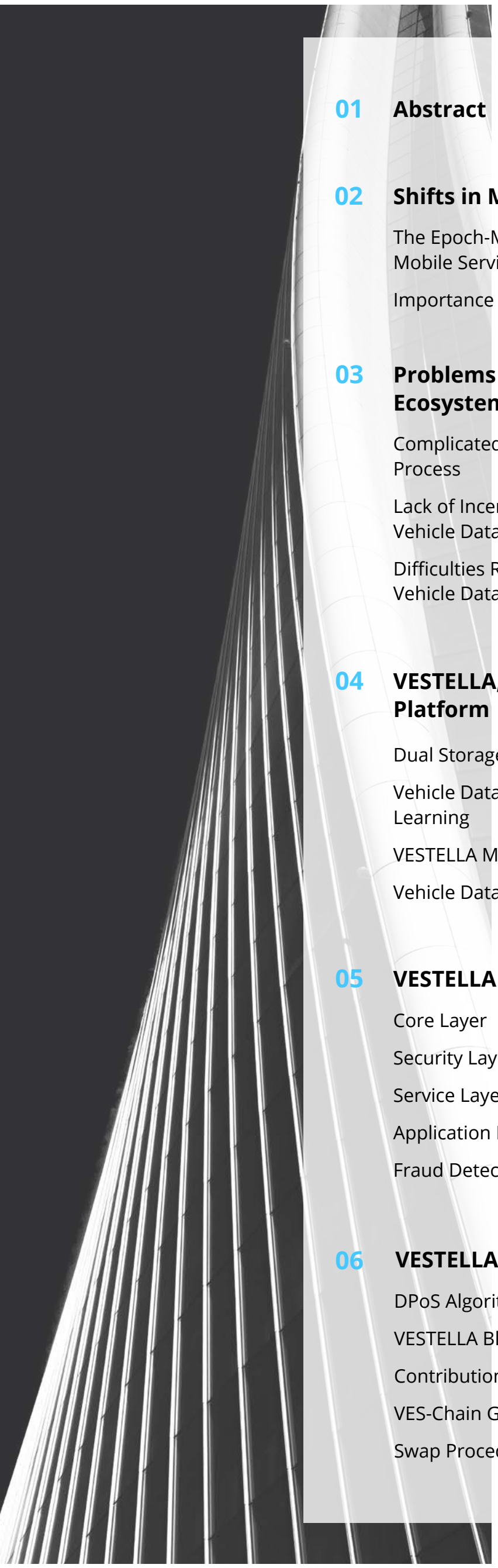
FUTURE MOBILITY

VESTELLA

Whitepaper ***ver. 1.1.0.4*** (ENG)



VESTELLA



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01 Abstract

VESTELLA is a vehicle data market platform using Blockchain technology.

Autonomous driving and mobility service are key businesses of the future, and not only the key players of the automobile industry such as vehicle manufacturers or mega-suppliers, but also large IT enterprises are entering the field. Thanks to massive input of human resources and capital, the two businesses have both made eye-opening progress, and the human race are now one step closer to the mobility of the future.

With the rise of autonomous driving and mobility service, the importance of vehicle data also received attention, as actual data of human drivers had to be analyzed and reflected to seek a safe driving pattern similar to those of humans, and V2X data were used as the basis of optimization to enhance efficiency of mobility services.

However, the inefficient distribution of vehicle data has caused delays in the actualization of a new ‘mobility’, as the collection process of vehicle data is complex, and even when collected, the incentive in providing own data to others is insufficient. The lack of appropriate market for vehicle data transaction is also a good reason of such delays.

VESTELLA overcomes the limitations of vehicle data industry by combining own technologies with Blockchain. It creates the ecosystem in which vehicle data are efficiently distributed by simplifying data extraction and collection process, providing cryptocurrency as the incentive for provision of data, and establishing trustless decentralized market platform. In addition, VESTELLA establishes an environment that allows VES Coin that acquired by rewards to be used in vehicle management, insurance design, maintenance, etc.

Through convergence with blockchain, VESTELLA will overcome the transitional limitations and creates an unidentifiable vehicle data ecosystem which ensures the rights of data subjects.
It is also a decentralized data market platform where vehicle data is freely traded, and will also develop symbiotically with various DApps in the new future mobility ecosystem.

02 Shifts in Mobility

The mobility market is growing steadily. With the steady increase in V2X technology, more than 10 new mobility business models are emerging annually, and the number of existing mobility companies transforming into multinational corporation is increasing. The mobility market is facing the greatest transformation as the acceptance of a variety of car-sharing methods has been increased, personal car ownership has been reduced, and service providers have grown significantly. Consumer demand for new mobility in Eastern Europe has also become a motivating factor for car-sharing and ride hailing service providers to expand their business into Europe. It is creating explosive synergy in conjunction with various support from European countries, especially France, Germany, and British, increasing user-based services, and increasing social network populations. The global partnership of major mobility companies, the expansion of strategic investment, and above all the consolidation and integration of global companies to increase market size are driving the current mobility market into the future. The changes in the mobility industry can be summarized by the following two aspects.

The Epoch-Making Development of Mobile Services

The identity of vehicle is shifting from “vehicle ownership” to “mobility [1] services consumption”. Vehicles produced to lead a better life reached saturation around lar cities, but ironically, the quality of life dropped due to increased traffic congestion and environmental pollution. As a solution, the concept of MaaS (Mobility as a Service) and TaaS(Transportation-as-a-Service) was introduced. MaaS means that an individual does not own a vehicle, but consumes only a service called mobility.[2] When consumer consumes vehicle transportation services as objects of sharing rather than owning a car, the overall cost of society may decrease and the benefits may increase.

MaaS is completed with autonomous driving technology. Autonomous technology is needed to efficiently supply mobility services and reduce operating costs. For consumers, mobility services with autonomous technology will be more affordable and more convenient than existing services such as taxis and buses.[3] As a result of these changes, ride-sharing services such as Uber and Lyft and the mobility services such as Toyota's E-Palette project are all aimed at converging with autonomous technology.[4] With autonomous driving technology, vehicles are transformed into efficient mobility services that transport to a new platform and a second living space, and it will also improve urban traffic.

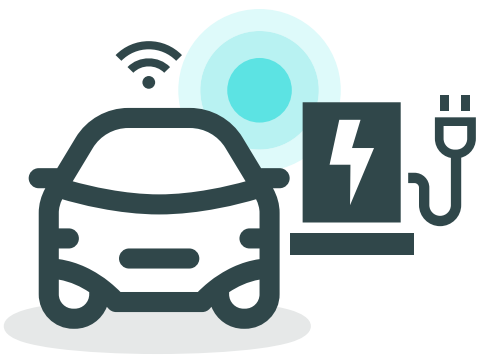
As we step into the era of the 4th Industrial Revolution, the formation of hyperconnective and hyperconvergent industry ecosystem has enabled large enterprises including existing key players of automobile industry and representative IT companies to devoted tremendous capital and human resource to develop autonomous driving vehicles. Leading countries in the field such as the U.S. and Germany have prepared legal framework for the realization of autonomous driving vehicles and are procuring test infrastructure, and autonomous driving technology is now facing entry into Level 4 of SAE Automation Level, ‘High Automation’.[5]

Importance of Vehicle Data

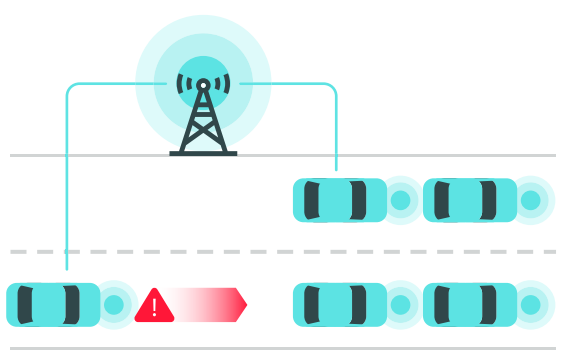
The function of an autonomous driving vehicle, which is one of the key elements of the future mobility era, consists of recognition, decision, and control.[6] Autonomous driving system works by first recognizing external driving conditions, based on which it establishes driving strategy and controls the vehicle accordingly. The system uses machine learning to make 'decisions' based on driving conditions recognized by various sensors, that is, the system studies as much driving conditions and decisions as possible to make optimal decisions in any circumstances. A large amount of learning data is required in order to actually implement autonomous vehicle by improving the adequacy of judgment and the stability of autonomous driving. The mainstay of the learning data is the actual driving record that humans performed in various environments.

V2X data acquired through communication between vehicles and objects can contribute to the overall improvement of urban traffic. According to the World Economic Forum (WEF) study, simply increase the number of autonomous vehicles does not unconditionally solve the problem of road congestion, but leads to inefficiency.[7] A policy approach to the infrastructure is also needed to maximize the pure function of autonomous vehicle. V2X data such as vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I), and vehicle-to-pedestrian (V2P) can be used as appropriate grounds for policy determination.

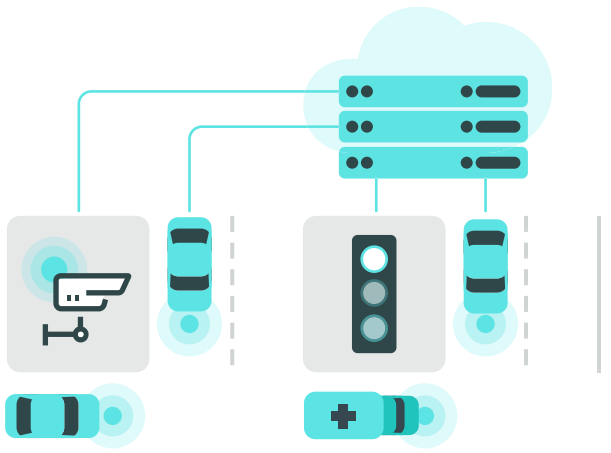
Vehicle data will become more important in the future when authentic MaaS combined with autonomous driving technology. Human intervention will also be needed less and less in optimizing multiple vehicles in the constantly changing urban traffic conditions. In addition, vehicle data, such as the ADID of Android and the IDFA of iOS, can be the main basis for marketing, and consumers may have a greater choice as products that utilize the data are developed. In particular, as access to vehicle data increases, not only will large companies that are currently driving mobility innovation have the opportunity to participate as players in the comprehensive automotive industry, but start-ups will as well.



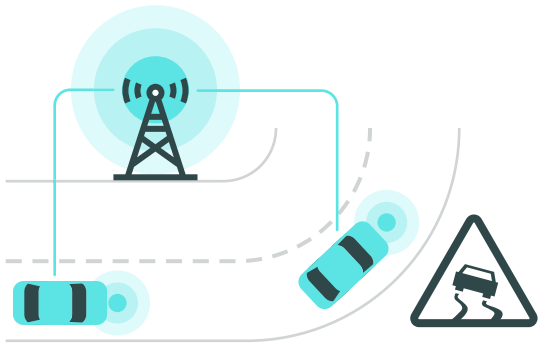
Discover Parking and Charging



Traffic Flow Control/Queue Warning



Cloud-based Sensor Sharing



Road Hazard Warning 1km Ahead

03 Problems of Vehicle Data Ecosystem

However, despite the growing importance of vehicle data, inefficient data distribution process has delayed the development of the industry, as it is difficult to acquire and accumulate data in terms of both quality and quantity. Eventually, the players of automobile industry were given no choice but to establish a small-sized, limited data pool through self-led tests, or to buy data of unreliable quality at high prices. Three causes can be named responsible for such phenomenon in the vehicle data industry.

Complicated Vehicle Data Collection Process

Data consumers refer to developers of autonomous driving technology or mobility service providers, while data providers refer to vehicle owners (corporation) and a real person. While individual vehicle owners or corporations owning multiple vehicles constantly generate vehicle data, the true values of data are not realized due to lack of appropriate method of collection and relevant knowledge. In addition, in the procedure of processing sensitive data such as personal information or location information of a driver of a vehicle, problems such as disclosure of personal information and hacking may occur. As a result, technically valuable data such as the condition of the vehicle and driving information are not properly collected, and the utilization is also difficult.

Lack of Incentives for Provision of Vehicle Data

The problem also involves collection process, and means that the incentive for vehicle owner to collect and provide data despite inconvenience is insufficient. According to a survey on of vehicle-related enterprises, 84% of executives responded, ‘raising awareness on monetization of vehicle data is important’.[8] Therefore, vehicle owners’ recognition of monetizability of vehicle data provision and collection should take place in order for high quality data, in terms of both quantity and quality, to be provided.

Difficulties Regarding Formation of Vehicle Data-Exclusive Market

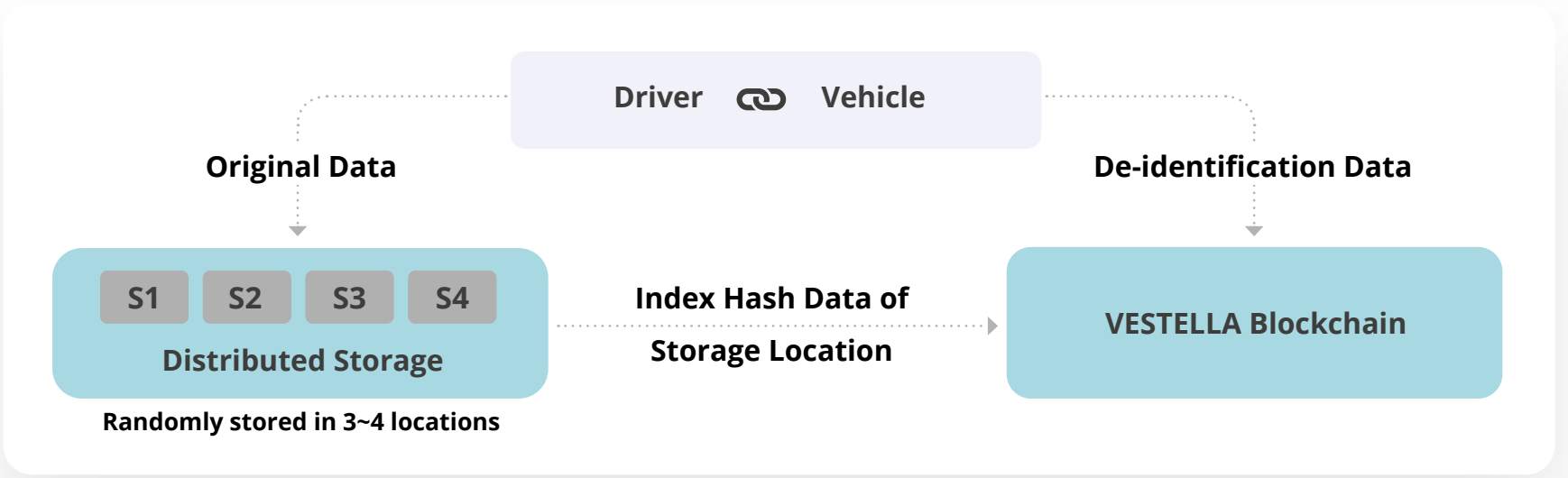
The current society lacks the market which should exist as the point of contact for coexistence and mutual development of mobility service providers and autonomous driving technology developers. If such market is not formed on its own, it should be artificially established in order for data trade to take place. However, if a third party with vehicle data lead the establishment of data market as a middleman, agency costs incurring between providers and consumers result in inefficiency of the market.[9]

04 VESTELLA, Vehicle Data Market Platform

VESTELLA is a data market platform using blockchain to provide groundbreaking solutions to problems of vehicle data ecosystem. First, VESTELLA resolves the complexity of vehicle data collection to simplify data accumulation through own technologies and devices. Then, VESTELLA uses its own blockchain to create a data market platform that provides a reward system for data provision and efficient market that does not request trust cost. Through this, more corporations and individuals will be given the opportunity to enter a new market, and VESTELLA will function as a long-term sustainable vehicle data platform.

Dual Storage

VESTELLA platform receives and stores vehicle data produced by data providers. The original data is then stored off-chain in a distributed data storage and the index hash, which contains the original data and the data provider's information, is recorded on-chain in the VES-Chian. While not much data are produced by individual vehicles, when the number of providers increase, the amount of data to be stored becomes enormous. Considering the benefits and implications of decentralization, it would be ideal to record all data on Blockchain or store via P2P remote distributed storage, but such methods are in fact quite inefficient for market platforms which require swift transaction. VESTELLA platform maintains user convenience and secures data credibility at the same time by storing original data in distributed data storage while only recording index hash on blockchain.



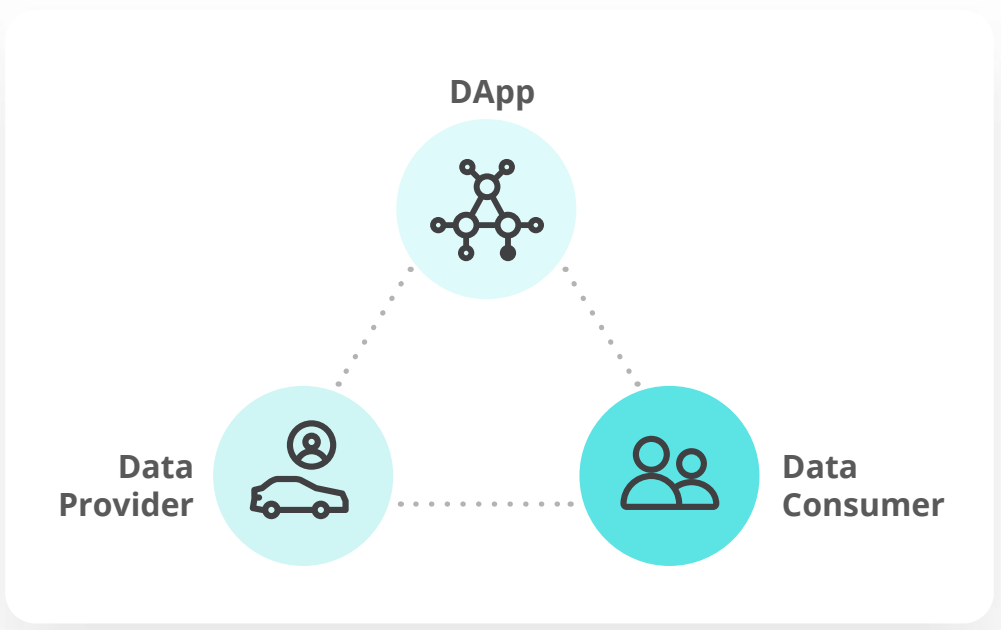
Vehicle Data Verification Using Machine Learning

Currently, the most important consideration in the vehicle data collection, storage, and solution development is whether the data can be relied upon. The data received via the OBD-II device is not 100% reliable because of the risk of hacking during the transmission and manipulation of the data itself. It is also possible to continuously generate the same driving data by storing the data sequentially from the moment the engine is turned on until the moment the operation is finished, and then repeating it through the simulator. VESTELLA uses machine learning to solve this problem. VESTELLA AI analyzes the entered driving data to determine whether 1) repetitive patterns have been found, 2) traces of simulator usage have been found, and 3) situations in which the vehicle is physically unable to travel. Through this process, real data and fake data are categorized then send to distributed storage and abusing data storage respectively. VESTELLA is also

responsible for warning and freezing accounts of users who are seeking unfair rewards by continuously sending abusing data.

VESTELLA Market Participant

VESTELLA platform consists of organic relations between data provider, data consumer and DApp operator. Each subject voluntarily acts as the constituent of VESTELLA market ecosystem, contributing to the efficient operation of the platform.



1) Data Provider

Data providers, who provide data to VESTELLA refer to vehicle owners. Key providers include corporations with multiple vehicles such as large transportation companies, car-sharing or car rental businesses, and individuals with vehicles registered under one's name. Providers are in charge of collecting, transmitting and recording data using VESTELLA device, and their data ownership and right to control data are perfectly guaranteed as they can set the type and scope of data to sell, and as they can track all data sold. Providers are given VESTELLA Coin (VES) in reward for providing data.

2) DApp

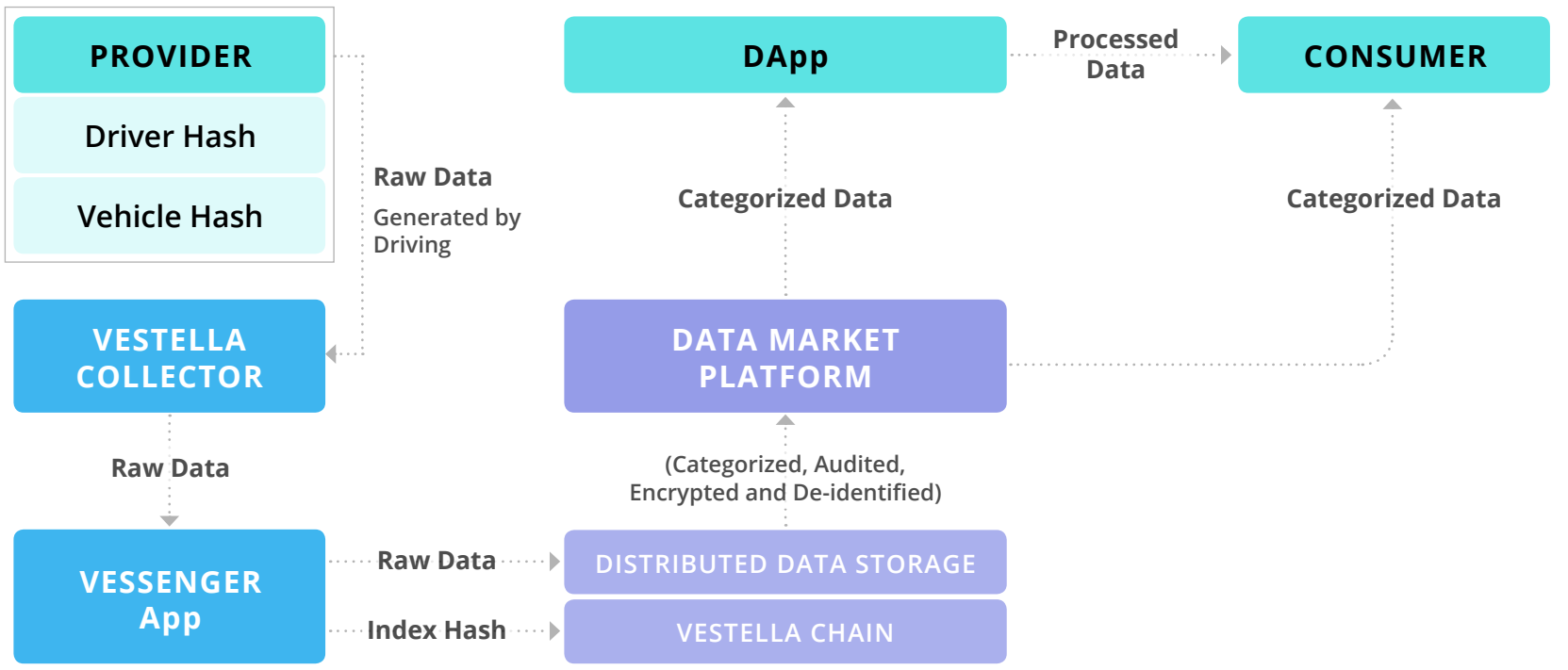
Various DApps in VESTELLA are 'Prosumers' in the sense that they purchase data, and that they sell processed data or data-based services. Creator of added value for data, DApps are essential for the long-term growth of VESTELLA platform, and at the same time the catalyst in the invigoration of data and various tokens issued by the VESTELLA platform. Companies wishing to develop DApp should have more than a certain amount of VES coins. The token holding amount required for Dapp development is adjusted on a specific period of time, taking into account the overall token distribution.

3) Data Consumer

Key consumers of VESTELLA are corporations related to autonomous vehicles and mobility services, which include vehicle manufacturers, mega-suppliers, technology developers or startups. The pool may also include insurance companies seeking to minimize risks, or marketing companies aiming to utilize data providers for targeted advertising. Data consumers can purchase data categorized by VESTELLA platform by searching keywords, or may purchase and utilize big data or products processed by various DApps such as VESTELLA Data Lab.

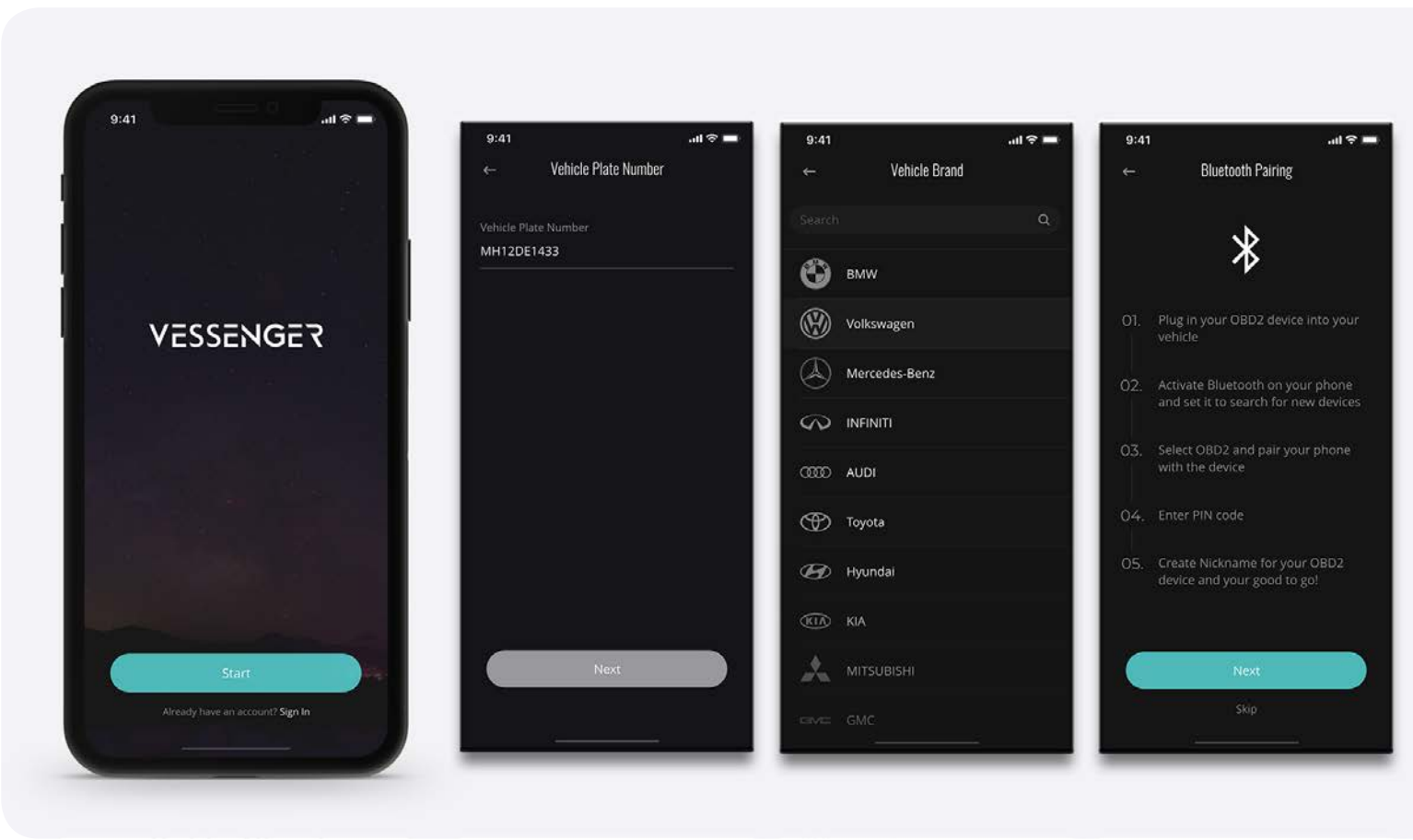
Vehicle Data Flow

The overall process of vehicle data creation and trade at VESTELLA Market Platform is as follows.



1) Preparation

Vehicle owner installs device certified by VESTELLA (Data Collector) on the vehicle, and VESTELLA app (VESSENGER) on smartphone. The owner (or driver) and the vehicle receive an encrypted ID of the VES-Chain via entering subscription and identification information, and the owner determines the type and range of data to provide.

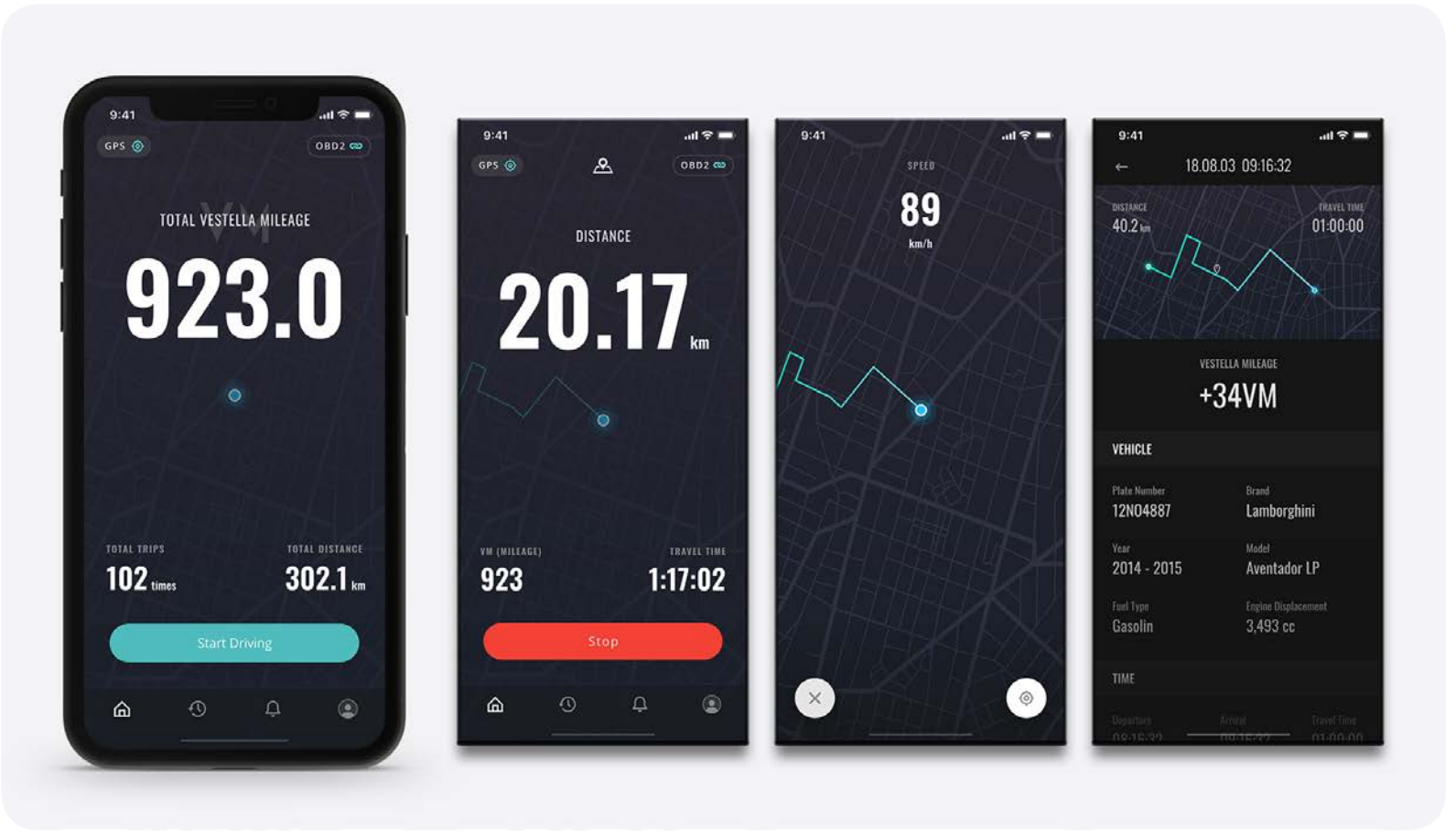


2) Driving

The status data, driver behavior data, and driving data that are generated from an actual driving are extracted in real time by the VESTELLA certified communication device.

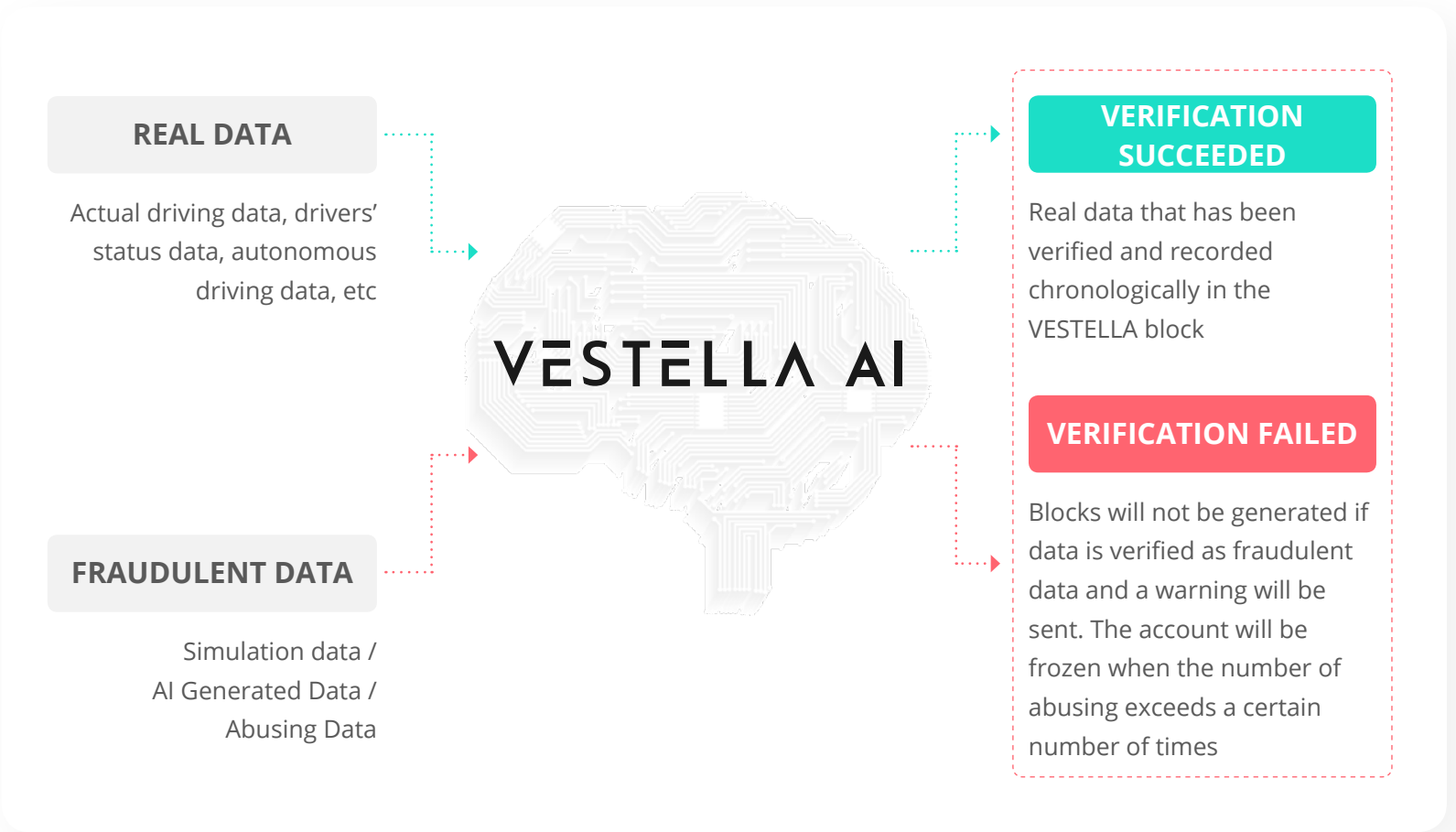
3) Transmission

Vehicle data generated during driving is transmitted to the VESSENGER app or VESTELLA authentication server via the communication device. The driver can check the driving record of the vehicle in real time through the application.



4) Verification

The Big Data Infrastructure module classifies the received data by category, and deep learning-based VESTELLA AI analyzes the pattern of the received data to verify the authenticity and gives Pass / Fail value. Once the data are shown as Pass, the data provider will be able to receive VESTELLA Coin (VES). If the data are shown as Fail, VESTELLA Token will not be given, and the TXID and the account will be frozen when abusing is repeated more than a certain period.



5) Record

Once verification is complete, the data will be divided into two types according to authenticity. Data that is found to be counterfeit by AI verification is recorded in the abusing data storage and will be completely deleted after a certain period of time. Real data is replicated into two or three copies and moved to the distributed storages. The location of each storage, Hash of the driver, and the Hash of the vehicle are recorded in transaction form in the VESTELLA blockchain.

6) Transaction Stage

Mobility data recorded in transaction form in the VESTELLA blockchain is classified according to each keyword and registered as a commodity in VESTELLA market. Data consumers can easily purchase the data they want by using category search algorithm, and pay with VES.

7) Processing and Re-selling stage

Various DApps including but not limited to VESTELLA Data Research Lab can perform data processing according to given purpose by purchasing data. DApps can use the processed data for their own services or re-sell the data which allows re-selling in a price set that added extra value.

05 VESTELLA Architecture

VESTELLA Architecture consists of four layers, with varied technologies handling vehicle data, including big data management, personal information protection, and AI verification, converged.

APPLICATION Layer	Target Marketing Platform (Web)	Fleet Management Solution (Web)	Data Market Platform (Web)	Data Research Lab: for Administration
	Vehicle Monitoring App (Mobile)	VESTELLA Wallet App (Mobile)	Public API/SDK: for DApp, external service	
SERVICE Layer	Vehicle Information Service	Mileage Management Service	Data Exchange Management Service	Transaction Management Service
SECURITY Layer	Data Audit Module: AI based data review	Security and Privacy Module: Encryptions and de-identification	Authentications and Data Access Control	
CORE Layer	Collector Module (H/W Device)	Blockchain Module: Blockchain Coin & Node Management System	Big Data Infra Module: Distributed Data Storage Management System	

Core Layer

1) Collector Module

VESTELLA Data Collector (tentatively named), a hardware sensor device for vehicle data developed and provided by VESTELLA, and external providers' sensor devices with **VESTELLA Data Collector Protocol** certification are included. **VESTELLA Data Collector**, a small IoT device, is attached to a vehicle and automates vehicle data collection through OBD (On-Board Diagnostics) II standard interface. As V2X infrastructure is extended and global standard is established, we will continuously extend the functions of VESTELLA Data Collector and data collection scope of VESTELLA Data Collector Protocol.

2) Blockchain Module

It is the management module of VESTELLA Platform's underlying blockchain. It secures the persistency of transparent recording of transaction between vehicle data provider and buyer and data traceability. It maintains the chain-like connection link and prevents data forgery in distributed storage environment.

3) Big Data Infra Module

It is a module that uses a distributed data storage infrastructure to store and manage large vehicle data. Due to excessive overhead to record, maintain, store, and transmit large amounts of vehicle data generated over a long period of time within a block, only the transaction records and reference materials of the data are stored in the block, and the vehicle information is stored in the distributed In the data storage.

Security Layer

1) Data Audit Module

It is a security module which checks coherence and integrity of data collected through **VESTELLA Data Collector** and inspects anomaly of time-series data through various machine learning techniques. When there is any attempt to illegally acquiring incentives without providing actual driving data or erroneous datum generated by device malfunction or failure, this module primarily conducts preliminary data authentication and security operation through data corruption prevention AI algorithm.

2) Security and Privacy Module

This module reinforces the security of blockchain node and network and conducts de-identification process. Based on SHA-2 (Secure Hash Algorithm), it encrypts or replaces major data regarding personal information in the hash form. While extracting useful information from mass data pattern through differential privacy technology, it obstructs personal information exposure with methods including noise injection.

3) Authentication and Data Access Control Module

This module provides authentication system for various stakeholders who try to access to data and defines the scope of accessible data according to each user's access authority. VESTELLA controls authentication and access through this module, to allow each user collect, store, and export data in differentiated manner according to individual access authority even when multiple users simultaneously access to data.

Service Layer

1) Vehicle Information Service

Vehicle information service refines vehicle information stored in distributed storage into a form available for the external applications. It processes the raw data of the vehicle and transmits useful data to the driver based on the standpoint of safe driving and economic driving. It provides standardized interfaces for a variety of automotive applications available to the driver.

2) Mileage Management Service

A service module that manages the VESTELLA mileage (VM) that is given to the data provider corresponding to the pre-collected data until the mainnet launch. After the mainnet release, pre-collected data is recorded in the VESTELLA blockchain, and the service module evaluates the contribution of the data provider based on the VM and pays reward.

3) Data Exchange Management Service

It is a service to support various behaviors related to transactions of vehicle data. It is closely linked with data market platform and handles functions including data search, sorting, selection, and purchase.

4) Transaction Management Service

It tests integrity of aspects related to transaction of vehicle data, including provision, purchase, and sales of data, and provides transparent ledger recording and safe transaction management system.

Application Layer

1) Data Market Platform (WEB)

Comprehensive marketplace in which actual vehicle data consumers including companies, laboratories, and institutes can search vehicle data, and selectively purchase only the demanded data, is provided on the web.

2) Target Marketing Platform (WEB)

It is a web platform on which data consumer organizations can provide information regarding customer convenience to vehicle holders and launch various promotion campaigns. On this platform, the company launching a campaign can conduct marketing with accurately selected targets, which are expected to show excellent promotion efficacy, and quantitatively evaluate the efficacy. Vehicle holder may receive or block the marketing through VESTELLA App and driver who receives the marketing are rewarded with the cryptocurrency in the ecosystem.

3) Fleet Management Solution (WEB)

Incorporated enterprises which traditionally has to manage many vehicles and car sharing service companies whose demand on vehicle is recently rapidly growing need to control vehicles' location, driving status, and need for inspection in real-time. VESTELLA Fleet Management Solution supports corporate activities through providing comprehensive and immediate vehicle management system to not only individual users but also corporate users.

4) Vehicle Monitoring App (APP)

It is a mobile application which provides information useful for checking driving habit and vehicle status, based on real-time information regarding the vehicle and past driving information. It includes features which allow vehicle holder check data validity before sending driving data to the core layer and actually help the user's driving activities.

5) VESTELLA Wallet App (APP)

VESTELLA provides both iOS and Android versions of electronic wallet with which the user may immediately check the holding amount of VES and conduct transfer and payment to connected services. This wallet application could be converged with vehicle monitoring app after going through stabilization stage in the future. The application will be extended by adding various optional services related to VESTELLA ecosystem.

6) Data Research Lab

Data Research Lab includes application for system administrator which can check integrity of entire VESTELLA Platform system and conduct health check for the system is included. In order to prove

that the platform is operated transparently, externally verifiable and publicly open operation status is provided in the dashboard format, and the researchers are granted with access to some of public data, to allow various data-based researches.

7) Public API / SDK

For various DApps and external services based on VESTELLA Platform, public API and SDK are provided. Providing public interface which allows various derived services facilitates the participation of external developers and establishes structure for persistent extension of VESTELLA ecosystem.

8) VESSENGER (APP)

VESTELLA's MVP (Minimum Viable Product) is responsible for the management of collected vehicle data and paid VES tokens. In conjunction with a service that can initially use VES tokens, it provides convenience to users even before the official platform launch.

Fraud Detection System

In the VESTELLA ecosystem, there can be fraudulent attempts to provide large amounts of abnormal driving data in order to obtain reward. Since even a small number of fraudulent data can lose trust in the entire data, there is a monitoring system across all layers in the VESTELLA platform. The main modules responsible for fraud detection for each layer are as follows.

1) Fraud Prevention

Core Layer : Collector Module

When VESTELLA Data Collector Protocol authentication is performed, the security of hardware sensor equipment is strengthened to prevent illegal actions such as input of false vehicle signals or input of simulation data as driving data in advance.

2) Fraud Identification

Security Layer : Data Audit Module

The Data Audit module uses machine learning to analyze time series data to detect errors in raw data collected in a primary way. Statistical techniques such as rule base and matching algorithm are used for abnormal data such as data which is physically impossible such as distance travelled per hour or connection relationship of GPS coordinates.

3) Fraud Detection

Service Layer : Transaction Management Module

If the fraud identification step is focused on detecting errors in the data itself, the fraud detection step tracks malicious users and blocks their attempts. By using the machine learning technique, malicious user's attempts are automatically identified. Also, when a detected user exchanges data with VES, the data is excluded from the rewarding payment. The coin that has already been paid will be processed for withdrawal or invalidation.

4) Fraud Investigation

Application Layer: Data Research Lab

No matter how accurate and sophisticated algorithms and protective measures have been established, it is hard to know how malicious users will abuse in the future. Therefore, VESTELLA Data Research Lab can transparently disclose driving and transaction data through blockchain, so that various external researchers as well as the data security department in VESTELLA can develop fraud detection algorithms directly, and provide a window to report and supplementing fraudulent cases.

06 VESTELLA Blockchain (VES-Chain)

The main goals of VESTELLA platform are stable collecting and sorting of data, systematic processing and management of big data, and reasonable exchange and rewarding. To achieve this goal, VES-Chain adopts a new DPoS agreement protocol that utilizes driving and builds a Permissioned Blockchain structure in which various DApps using data can be developed.

DPoS Algorithm Converged with Driving

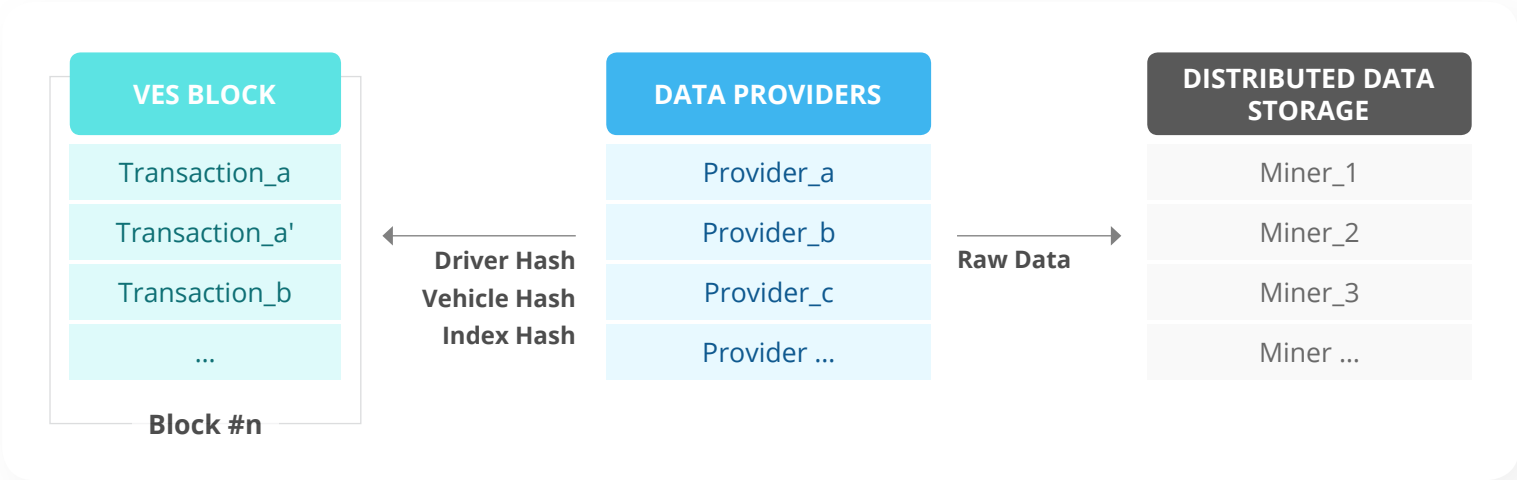
Basic agreement algorithm of VES-Chain is based on DPoS (Delegated Proof-of-Stake) method. In order to deal with a large amount of data transactions, the transaction speed is the key; therefore, a DPoS consensus algorithm that guarantees a stable speed is needed. Mining authority is delegated to authenticated organizations including complete vehicle and vehicle component manufacturers, technology developer, service provider, and government institute. Miners are obliged to maintain a full node to secure the stability of VES-Chain and to provide distributed data storages with more than a certain amount of capacity. The initial number of miners consists of 10 people, but if the platform grows later, it can be increased through the voting process.

VESTELLA Block (VES Block)

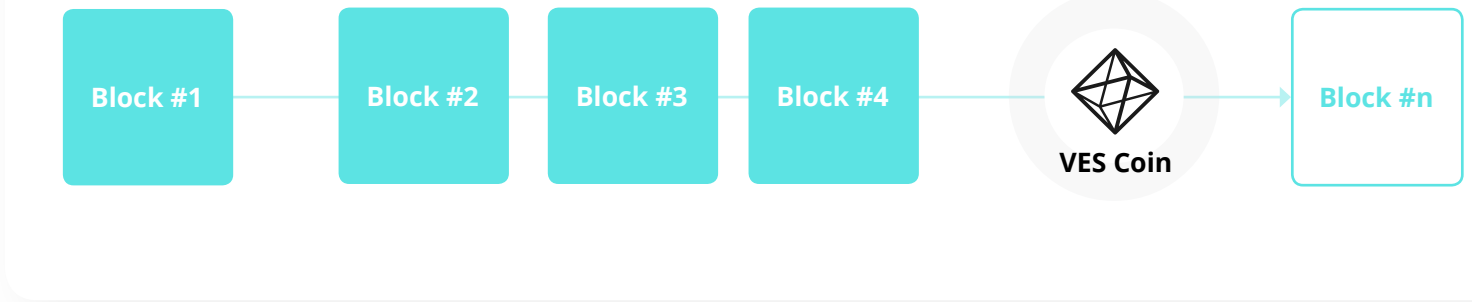
The cycle for VES block generation is determined based on the data generated by driving and the time the transaction history fills the block, and the mining difficulty is adjusted by VES-Chain. The unique has of each driver and vehicle is matched to form a TXID. Through such way, each datum could be stored in blocks by corresponding smart contracts and the quantity of data to be processed by a smartphone could be significantly reduced. Separately storing actual vehicle information and vehicle use information is suitable for sharing service in which the owner and user of the asset continuously changes. As unique data are not mixed even when an individual drives multiple vehicles or multiple individuals drive a single vehicle, data consumer can selectively collect and utilize data.

The generation of the VES block consists of the following steps:

1) Driver hash, vehicle hash, and data reference hash are sent to the VES-Chain.
2) Transmitted hashes are recorded in the new VES block in transaction form.



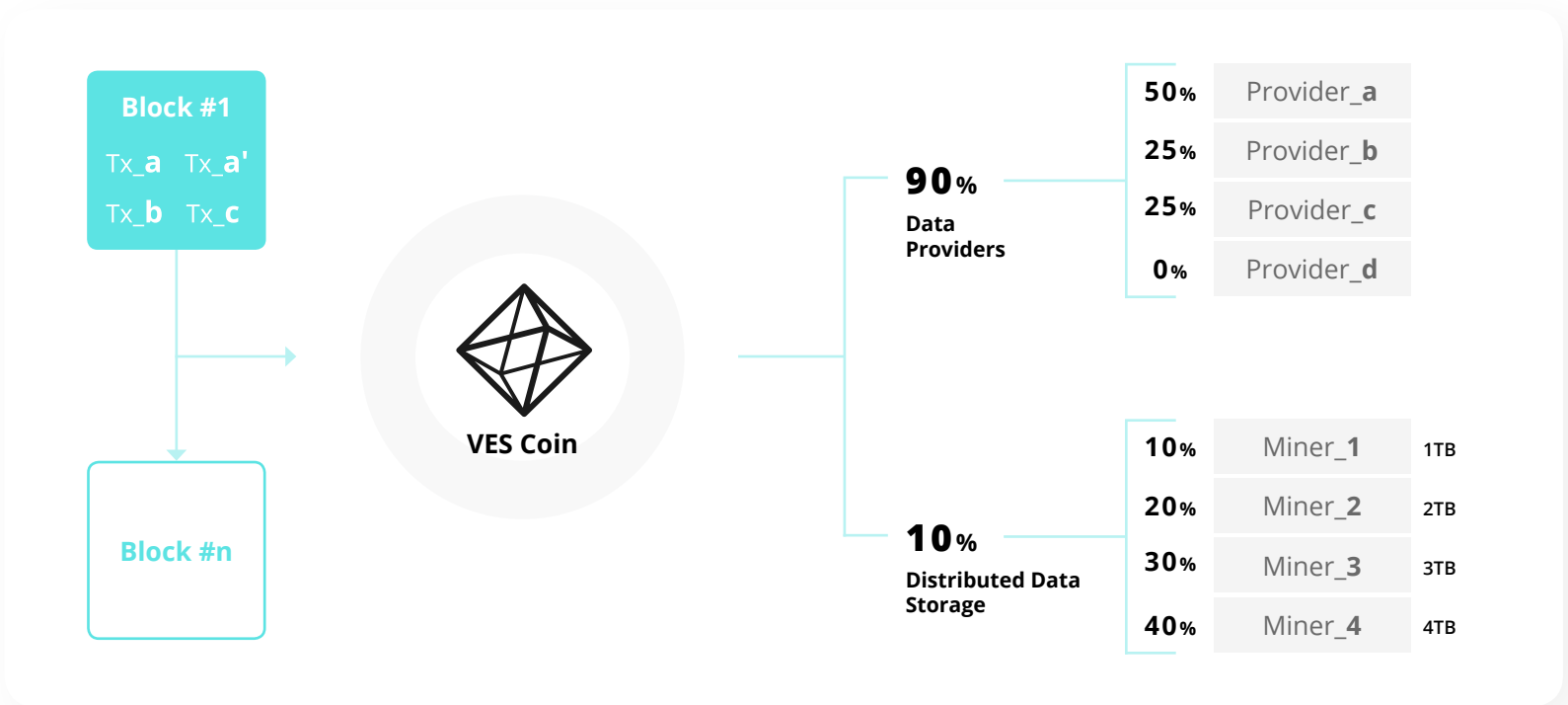
3) When the transaction capacity of the new block is full, it is connected to the preceding block and the VES coin is issued.



4) Start recording on the new block.

Contribution Assessment and Reward

Participants contributing to maintenance of VES-Chain are granted with corresponding rewards in VESTELLA Coin (VES), in accordance with the level of contribution.



1) Data Provider

90% of the VES Coins issued by block mining are distributed to the data providers. The “contribution to data provision” is evaluated based on the amount of index hash filling VES block. When a block is filled up by index hash history, data providers are granted with VES in accordance with their share in the entire provided index hash in the block.

2) Miner (Witness: VES-Chain Miner)

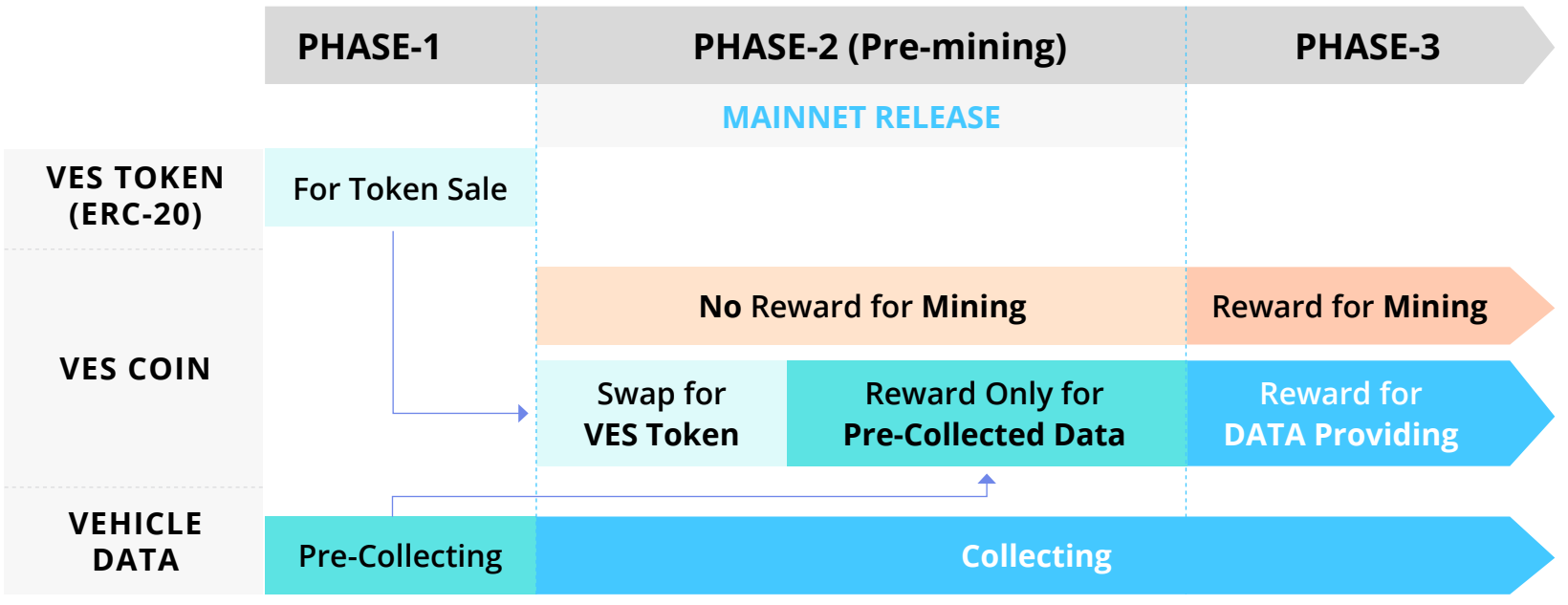
Miners generate blocks in which index hashes are recorded and maintains the stability of VES-Chain by operating full nodes. Also, miners are obliged to operate distributed data storage with a certain space or more and a certain amount of VES Coins. Miners are rewarded with 10% of VES Coin issued during block mining, as the reward for operation of full nodes and storages.

VES-Chain Governance

As VES-Chain is developed to break down the centralization of data, its governance is done by a number of miners. The miner can comment on the update of the VES-Chain as an adviser. The comprehensive comment of the miners suggests the overall update direction of the VESTELLA platform, but it is not mandatory. Since VES-Chain is developed developed as a permission blockchain that is easy to update the source code of the blockchain, it can become a more efficient platform if the miners comment actively. It is expected that the miners will make efforts for the desired operation of the platform in the sense that it is mandatory to hold more than a certain amount of VES Coins.

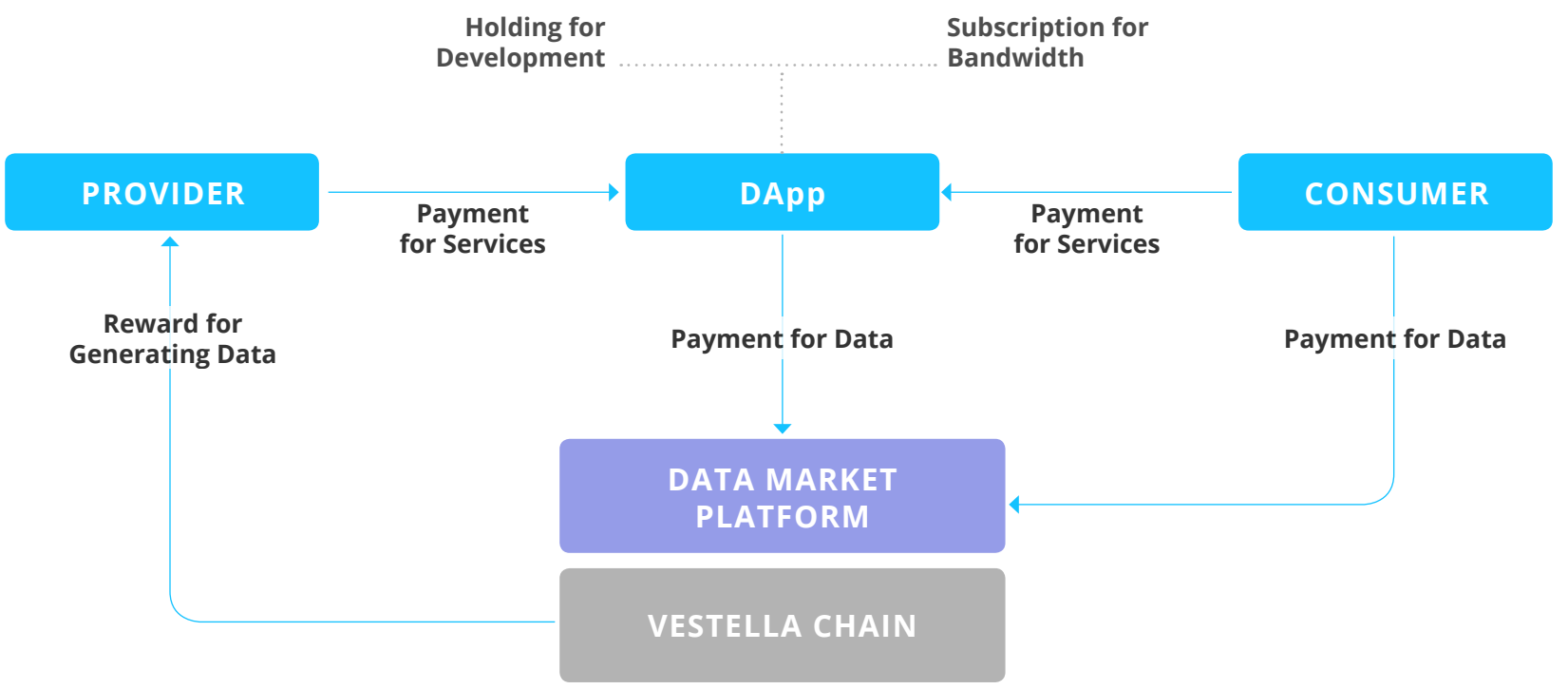
Swap Procedure After Mainnet Release

Prior to the release of the VES-Chain Mainnet, VESTELLA Token is issued based on Ethereum's ERC-20. In the case of vehicle data, a distributed data storage is operated at the pre-mining level to receive data. After the mainnet is released, a 1:1 swap is performed with VES-Chain's VES Coin based on a snapshot of VES Token. In addition, miners will not receive their rewards until all the pre-data is input completely into the blocks after the genesis block.



07 Tokeneconomy

The tokeneconomy of VESTELLA ecosystem is the top priority on the stability of data transactions. This is because data transactions using VESTELLA Coins are sufficiently stable and predictable to provide reasonable reward and fulfill the functions of the fair data market. Also, securing stability is a precondition for VESTELLA platform to become a credible data market in the long term. The basic flow of coins between the participants of VESTELLA Market Platform are as follows in the figure below.



VESTELLA Coin (VES)

VES Coins are issued via DPoS consensus protocol at VESTELLA platform's mainnet, and there is no restriction in issue amount. Before the development of VES-Chain, VESTELLA's mainnet, VESTELLA Token which conforms to Ethereum's ERC-20 Standard will partially replace the role of the Coin. VES Coins are utilized in calculating the hash difficulty of VES block and amount of reward, and are used as the medium for economic activities taking place in VESTELLA platform. The frequency and application of VES Coins will expand as the platform is further invigorated, from buying/selling driving data to creating and distributing targeted ads, and paying / exchanging services or products.

DApp

DApp is the most important economic entity that encompasses the supply and demand of the VESTELLA token economy. Companies wishing to develop DAPPs on VES-Chains should hold more than a certain amount of VES Coins. The required amount depends on the amount of VES Coin issuance and distribution at the time of development. As DApp grows, the volume of transactions will increase, and faster transaction processing will be required. In this case, DApp can increase the bandwidth by paying VES Coin to the network.

Purchasing as much bandwidth as you need in a subscription way allows for more comfortable VES-Chain transactions during the subscription period. The VES Coin used for subscription will be burnt and used as a means of adjusting supply.

Data Provider

Data providers in the VESTELLA platform can gain complete data control, VES coin acquisition, and good quality service. We will actively develop events and partnerships that will give VESTELLA devices a free or low-cost sale for the active inflow of initial data providers.
As personal driving data become digitized, it recognizes the explicit grounds for a better mobility experience and realizes profit by providing and selling only desired data. The membership level, which is determined by the amount of VES Coins you have, allows you to use the services offered by various DAPPs and partner companies at a discounted price. Initial data providers will be made up of partnerships such as large transportation companies, but as the platform grows, it is expected to gradually expand to individual drivers.

Data Consumer

From data consumers' aspects, using VES Coin to purchase data may be inefficient. However, the VESTELLA platform can be the only data market that meets these conditions, as there is no platform to guarantee the rights of individuals and to purchase reliable data in sufficient quantities. While the initial VESTELLA platform may lack the amount of data, an active partnership will increase the number of data providers and build a rich data pool. Then the data consumer can benefit from the entry cost of using the VES coin by purchasing data from the VESTELLA platform.

08 VESTELLA DApps

VES-Chain is a platform blockchain which promotes the development of various DApps. The higher the utilization of vehicle data, the greater the vehicle industry develops and the more sustainable the VESTELLA platform will be. As a participant in the vehicle data market platform, VESTELLA will set the development of Data Research Lab which manages big data as top priority. Other categories of DApp to be developed are as follows.

Service Provider DApps

VESTELLA Coin, collected through driving, can be used as a means of transaction for various services. Anyone in possession of VESTELLA Coin can use it to enjoy services registered on DApp including shopping, delivery, relocation, flight tickets, travel, and fuel.

VESTELLA expends the use of the VESTELLA Coin by partnering with various service providers at the beginning of the release. Early partnerships can be actively concluded in that service providers can increase customers and VESTELLA users can access services at a lower cost. Subsequently, service providers are included as DApps and become the long-term growth engines of the VESTELLA platform.

Automotive Management DApps

While autonomous driving relied on its first stage, 'recognition of external driving environment', it is expected that the development of driving record-based algorithm for the second stage, 'establishment of determination and driving strategy' will become more active from now on. In order to guarantee stability similar to the level of men-driven vehicles, an actual data on internal and external information of men-driven vehicle should be reflected. Should VESTELLA provide such information, DApps can launch products or services required for the advancement of autonomous vehicle technology.

This type of DApp focuses on domestic and international companies that develop solutions for autonomous driving technologies. In particular, SMEs that have difficulty in acquiring their own experimental data can purchase VESTELLA DAPP at reasonable prices to create added value. Companies that need up-to-date data to simulate their own algorithms can also save money in the long run by registering as DApp rather than simply purchasing data repeatedly.

Fleet Management DApps

DApps dealing with advanced data for organic management of multiple vehicles are connected P2P with drivers. The DApp can be used in the development of group learning for autonomous vehicles and connected car service. Also, VESTELLA-FL, a data-utilizing information system concurrently manages corporate vehicles to provide information real-time by period. Service costs can be charged to commercial transport businesses and corporate vehicle owners.

For corporations and transportation companies with multiple vehicles, fuel costs and insurance are the biggest costs. Fleet Management DApp can analyze collected data to propose an efficient method of operation or process data to provide evidence for insurance savings. DMP companies that analyze, process, and sell data from rental or sharing services in a form that can be used for marketing purposes can also be DApps in this field.

Electric Vehicle Management DApps

VESTELLA data network DApp for electric vehicles which provide information on battery and recharging post. The DApp enables automatic payment with VESTELLA Coin for purchasing electric vehicle-related products or recharging batteries.

Early electric vehicle DApps utilizes V2X data collected by VESTELLA. It provides consumers with the location of the charging stations while driving, the location of the charging space while in the station, the available charging times, as well a function to reserve the charging space. On the other hand, if a company that operates a charging station registers with DApp, it can acquire initial customers, and then purchase the data necessary for business expansion. On the other hand, if a company that operates charging stations is registered as a DApp, it can acquire early customers, and purchase the data that is necessary for business expansion.

All businesses related to vehicle services can actualize their services in VESTELLA platform in the form of DApps. Aside from DApps described in the White Paper, new DApps can always be developed using VESTELLA's open source, through which the businesses can launch own tokens, services and products to contribute to the expansion of VESTELLA platform.

09 Token Sale Information

Token Name

VES
ERC-20 based Utility Token

Total Supply

15,000,000,000 VES

Number of Tokens for Sale

50% of Total Amount

Hard Cap

7,500,000,000 VES

Acceptable Currencies

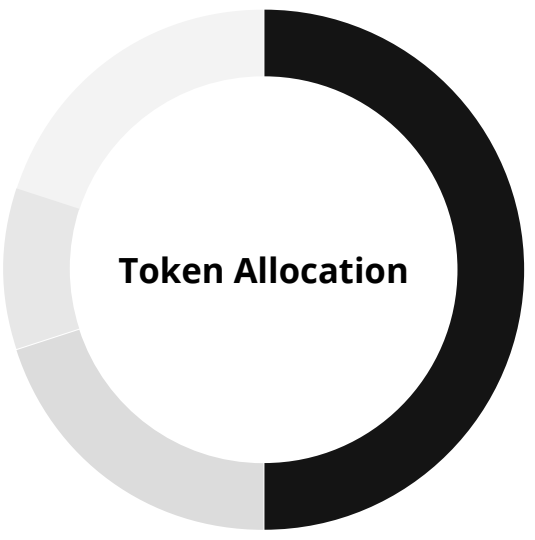
ETH

Lock-up Period

24 months (Team, Partners, Advisors)
12 months (Private Round, Only for Bonus)
3 months (Pre-Round, Only for Bonus)

NOTE: VESTELLA does not sell tokens to the buyers of Chinese and American nationality.

Token Distribution



- TOKEN SALE **50%**
- ADVISOR/TEAM/PARTNER **20%**
- MARKETING/PROMOTION **10%**
- R&D/MANUFACTURE **20%**

- OPERATION **20%**
- MARKETING **10%**
- PARTNERSHIP/DAPPS **20%**
- RESERVE **20%**
- STRATEGY **10%**
- DEVELOPMENT **20%**

10 Future of Vehicle Data - VESTELLA

VESTELLA was developed to meet current needs, and makes advancements for future sustainability. The vision of VESTELLA, the vehicle data market platform, is to help the industry and the lives of the individual develop in the desirable direction by establishing a rational and efficient ecosystem.

Conquering Transitional Limitations of Mobility Industry

Through own technology, VESTELLA overcomes the transitional limitations of vehicle data ecosystem and provides a desirable direction for mobility innovation. Through VESTELLA's endless efforts for a better data ecosystem the actualization of autonomous vehicles is hastened, development of various mobility services become easier, and ultimately the lives of the people are completely changed due to the convergence and commercialization of autonomous driving and mobility services.

Decentralization of Data Ensuring All Rights

VESTELLA achieves decentralization of vehicle data through convergence with blockchain, breaking down the original structure in which the majority of data is monopolized and monetized by the minority, lowering entry barrier into the industry and establishing data control. By enhancing accessibility to trustable, high quality data and providing appropriate compensation for provision of data, VESTELLA seeks to establish a fair and rational mobility ecosystem.

Symbiotic Development for the Future

In the era of new "mobility", VESTELLA has become an essential platform. The importance of mobility data will become more significant in the future, and relevant laws and institutions will be refined. In the future industry, where all interests are complexly intertwined, an efficient market platform in which all authorities are guaranteed but trust costs are eliminated is required. As a value neutral market, and at the same time a fair participant of the mobility industry, VESTELLA will seek symbiotic development with other various DApps.

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- Blockchain Technology & Cloud Computing Expert

13 Partners

14 Roadmap

PHASE/01
Q3. 2018

- Initiation of VESTELLA Mining Device Production
- Initiation of the Development of the Open Source Platform “VESTELLA”

PHASE/02
Q4. 2018

- Token Sale Begins (ERC-20)
- Alpha Test of VESTELLA MVP Application (VESSENGER)
- Partnership with DApp Service Suppliers
- Partnership with B2B Service Suppliers

PHASE/03
Q1. 2019

- Main Sale (ERC-20)
- Token Distribution (ERC-20)
- Collecting Driving Data of Corporate Vehicle
- Connection with Control Solution for Corporate Vehicle

PHASE/04
Q2. 2019

- Beta Test of VESTELLA Application
- Collecting Individual Driving Data
- Partnership with Cryptocurrency Payment Solution
- Pilot Project Begins

PHASE/05
Q3. 2019

- Fundraising for Decentralized Data Lab
- Partnership with Car Manufacture Companies
- Partnership with Gas Stations
- Partnership with Car Repair Shops
- Partnership with Car Sharing Companies
- VESTELLA MAINNET Construction
- Token Swap (VES Token - VES Coin)

PHASE/06
Q4. 2019

- Launch of VESTELLA Fleet Management (Control System for Corporate Trucks)
- Strengthening Existing Partnerships
- Sequential Launch of VESTELLA DApps

PHASE/07
IN. 2020

- Actual Trade of Mobility Data
- Opening of Decentralized Data Lab
- Development of Autonomous Driving Modules Based on VESTELLA Mobility Data
- Project GO Live
- Launch of VESTELLA Data API / SDK

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