

GSENetwork

Sharing Economy Reimagined with Blockchain

2018.8

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All contributions will be applied towards the Foundation's objects, including without limitation promoting the research, design and development of, and advocacy for the application of blockchain technology to the sharing economy in order to enable blockchain technology to deeply and positively influence human life, promote environmental protection, and create a recognized token which can serve global users.

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Chapter 1: Introduction

1.1 The Status Quo

With the advent of Web 2.0, social trends and consumption behavior have changed drastically. It prompted a new wave of community-sharing driven by business-to-consumer (B2C), business-to-business (B2B) and peer-to-peer (P2P) needs in the pursuit of new and better experiences.

However, problems have also surfaced with the rapid growth of the sharing economy, limiting its full potential. The key challenges that needs to be urgently addressed that are hindering the growth of the global sharing economy are high intermediary costs, a trust gap, a monopolistic and fragmented landscape and the lack of risk mitigation.

GSENetwork aims to tap on the huge potential of the sharing economy and champion the growth and transformation of the global sharing economy to create an interdependent network of users and providers.

1.2 Our Mission

Our mission is to create a decentralized global sharing economy network for the sharing economy based on blockchain technology.

By focusing on the global sharing economy as our launch pad, we aim to build a decentralized global sharing economy network with trust woven into its core, forming a web of interdependent decentralized marketplaces on blockchain, transforming the sharing economy to its next generation, offering greater accessibility and equitability to its users.

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Chapter 2: Problems and Potentials

2.1 Problems of the Current Sharing Economy

With the exponential increase in the rate of adoption of the Internet over the past two decades, it became a platform that facilitated the genesis and rise of the sharing economy. Driven by a shift of emerging trends, the quest for new experiences, economic benefits, increased environmental and social awareness, the sharing economy has seen phenomenal growth.

For advocates of decentralization, the sharing economy is utopia made real - peers transact directly with peers, avoiding governmental or corporate intermediaries. It has proven a boon to regular income earners, allowing them to profit from under-utilized assets like extra apartment space or spare bikes and cars. It has also transformed the employment market, opening up avenues for micro-entrepreneurs to better utilize their skills, resources and services (for example being an instructor on Udemy or being a part-time on-demand taxi driver). Overall, the sharing economy has been widely beneficial to it's participants, offering additional income, providing them with more flexibility and autonomy in the manners in which they choose to work whilst enabling better coordination of underutilized assets in the economy.

However, as the sharing economy continues to grow in scale, so have the associated challenges and obstacles. The urgent goal is to fix the key issues that have hindered the growth of the sharing economy.

<u>High intermediary fees</u>
At its core, the sharing economy encourages the efficient utilization of resources to build social capital. The current structure of the sharing economy business model is made up of centralized platforms which gather and package resources to cater to consumers and providers, charging both parties high intermediary fees for this service. For instance, Uber now charges drivers an astounding 20 percent and consumers 10 percent of the ride charges for every completed ride and Airbnb generally charges hosts a 3 percent service fee and guests a service fee of up to 20 percent. In addition, the increment of these fees are also at the discretion of these intermediaries.

<u>Trust Gap</u>
Not even the unicorns of the sharing economy have escaped controversies that threatened trust in their users, the platforms and the products (rides and rentals). Uber has made headlines over drivers' dissatisfaction and Airbnb has had to deal with a myriad of complaints as well.

A survey done by a travel blog Asher & Lyric showed that in 2016, Airbnb recorded nearly 80 million stays, out of which 3 to 7 percent of them became guest horror stories such as last minute cancellations by hosts, mismatched expectations, scams and fake listings or reviews.

In fact, Goldman Sachs Research's report "Blockchain: Putting Theory into Practice" has stated that the adoption of P2P lodging sites like Airbnb are being hindered by concerns about safety and security (guests) and property damage (hosts) and they have cited Blockchain technology as a solution to these problems. It is evident that the key underlying challenge is ascertaining that the two transacting parties are acting in good faith.

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Monopolistic and fragmented landscape

When a company has conquered a significant market share, the lack of industry competition may lead to complacency and a self-beneficial strategy which creates a disconnect between the brand and their consumers.

In addition, the first-generation sharing economy landscape is largely fragmented with a lack of transparency. There are a variety of platforms that share the same product offerings but a user would have to visit each of them individually to assess the most suitable deals. For instance, booking the same hotel room may yield different prices on Expedia and Hotelbooking.com.

On top of that, a user is required to register a new account for every platform he visits. This means every platform will own a set of the user's data and would have the potential to misuse the data without the knowledge of the user.

Lack of risk mitigation

In the event of disputes between the provider or user, the intermediary should have a mediator role to play. Yet often, the process to get assistance is not straightforward. Other factors such as human bias, discrimination and poor judgement may come into play that could cloud a central arbitration process.

2.2 Unleashing the Potentials of the Sharing Economy

PWC forecasted the global revenue of the sharing economy to hit $350 billion by 2025, expecting factors like trust, convenience and a sense of community to push the adoption of the sharing economy. Juniper Research identified 3 industries in the sharing economy that they have termed as "ripe for disruption", forecasted significant growth specifically in shared transport, shared space and shared logistics.

In 2016, The Yano Research Institute estimated that transactions on Japan's sharing platforms would grow from 29 billion yen ($260 million) to around 60 billion yen ($540 million) by 2020 (Takeo, 2017). In China, the government promotes sharing to "improve efficiencies in resource usage" and "[make] people more affluent": its Sharing Economy Research Institute suggests the market value of China's sharing activity will grow at 40 percent per year and account for 10 percent of GDP by 2020 (Yan, 2017). In essence, the 3 main factors that will continue to drive the advancement and evolution of the sharing economy are:

- Increased participation rates in the sharing economy resulting in increased demand and supply
- Rise of integrated communications and transaction platforms such as WeChat Pay and Alipay to enable greater user convenience
- Deeper penetration of Internet of Things to make the sharing economy more user-friendly and efficient

Our team strongly believes that the sharing economy is a powerful economic sector that will continue to exhibit exponential growth and it has contributed some of the most impactful innovations that have enhanced the consumer experience greatly since its advent in the last decade.

Hence, there is an urgent need to disrupt this first-generation sharing economy by plugging the gaps to pave the way for the second-generation sharing economy.

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Chapter 3: The Decentralized Sharing Economy Network

3.1 Using Blockchain Technology as the Enabler

Blockchain facilitates the secure exchange of value in a decentralized manner, removing the need for a central intermediary. The unique proposition of blockchain technology is its ability to run software applications (smart contracts) in a secure and decentralized peer-to-peer network that is not controlled by a central party. Fundamentally, blockchain-based applications are able to govern, allocate and coordinate resources and activities, as well as facilitate interactions of all participants without central arbitration.

These features are perfectly aligned with our vision for the sharing economy - a decentralized structure which encourages usage of the platform through distribution of rewards. By removing the intermediary, the externality value produced will be redistributed to those who contributed to its value creation. We believe that a decentralized sharing economy will truly bring out the concept of a true sharing economy, facilitating the creation of more innovative and community-driven applications, while rewarding bona fide participants.

3.2 The Evolution of the Sharing Economy

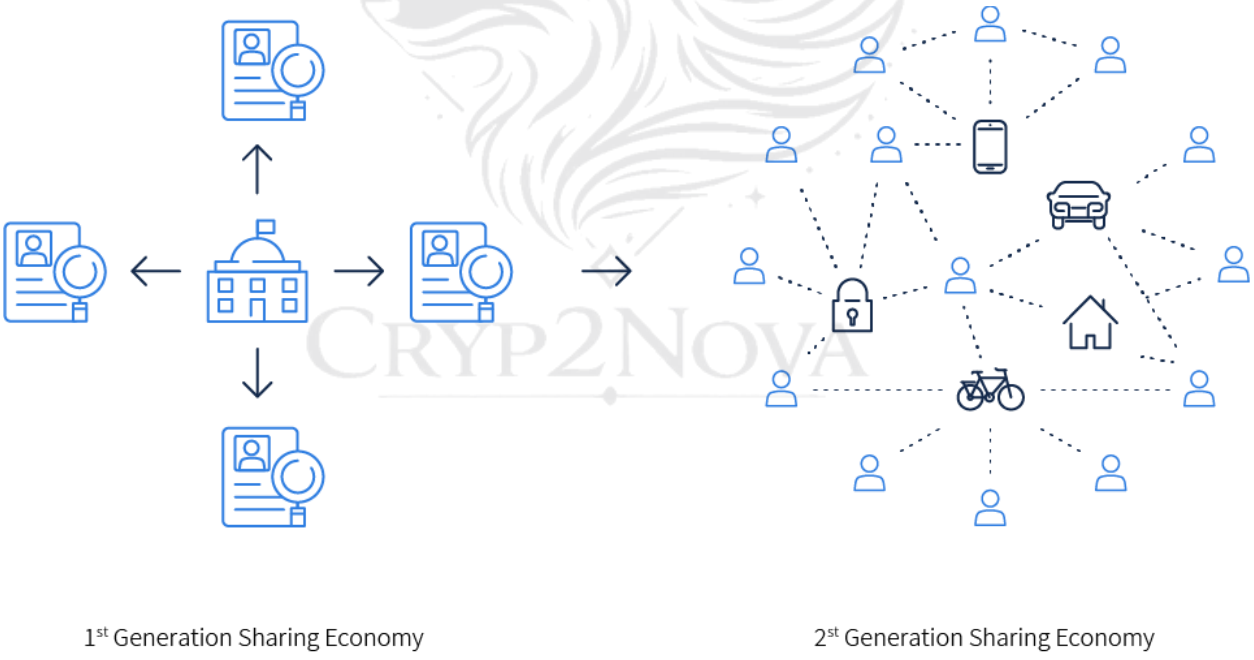


Diagram 1: *The evolution of Sharing Economy*

The sharing economy is entering the next phase of growth. The first generation sharing economy formed many new behaviors and benefits to providers and consumers alike - lowering costs of ownership, greater access to assets and services and opportunities for untapped markets.

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The next-generation sharing economy that GSENetwork is sculpting can be outlined using a three-pillar approach:

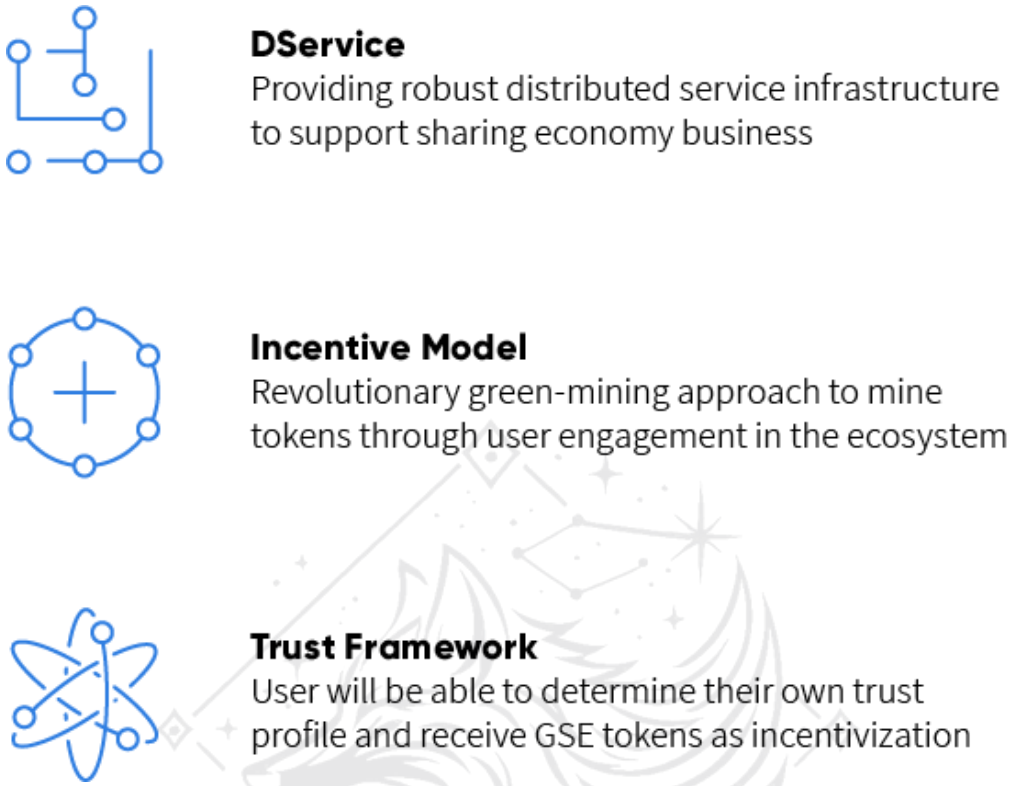


Diagram 2: *Three - Pillar Infrastructure to enable the 2nd Generation Sharing Economy*

1. Decentralized Service (DService) Platform

We aim to be the key enabler of sharing economy businesses on the blockchain by providing a robust distributed service infrastructure for them to build on.

Enabled by a DPoS Consensus Mechanism; DService's core components will be implemented as distributed systems in the following areas:

1. Order Dispatching System
2. Anti-Fraud System
3. Multi-dimensional User Profile Rating System
4. Transparent Pricing System

By doing so, the sharing economies DApp built on our network can then focus on their core businesses and GSENetwork will provide robust distributed infrastructure to support them.

Decentralized App (DApp)

The DService platform will facilitate developers to create their own decentralized app (DApp); which will allow participants to create their own listings, browse through the product offerings and services available as well as to make or accept payment. In essence, the DService platform permits a DApp ecosystem to allow enterprises, third-party providers, users as well as mobile applications to interact and transact on.

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2. Incentive Model

Through a revolutionary green-mining approach – transacting equates to mining, GSENetwork aims to redistribute the externalities created by the ecosystem back to the ecosystem contributors. To build GSENetwork, we intend to forge strategic partnerships with sharing economy players of all sizes, to increase participation through integration of the sharing economy marketplace onto blockchain.

GSENetwork has forged a strategic partnership with ofo, the world's largest bike-sharing platform to introduce a revolutionary token distribution mechanism - Green-Mining on a global scale. Having extensive global presence across 21 countries, ofo is a suitable launchpad for us to integrate this model into real-world application, bringing blockchain closer to the everyday user. As part of this partnership, we piloted the "Ride & Earn" Green-Mining campaign in Singapore to reward ofo users with GSE.

Using the "Ride & Earn" campaign as a case study, GSENetwork redistributed the externalities created by the ecosystem back to its contributors - in this case, the ofo users. When users receive incentives in the form of GSE tokens through their green mining activities as they ride, they will in turn be motivated to increase their participation rate and be more engaged in the global sharing economy. Concurrently, the user base will increase, thus scaling the GSENetwork ecosystem.

The implementation of the incentive model would result in the effective scalability of GSENetwork, due to the following reasons:

1. GSENetwork rewards participants with GSE tokens when they "transact and share" instead of having to "owning" an asset. This will ultimately scale the global sharing economy, truly encouraging sharing behaviours.
2. Rewarding participants would increase participation rates, encouraging transactions within the global sharing economy. This will bring about an exponential scaling of network effect that would add value to the GSENetwork ecosystem.

With our revolutionary incentive model, GSENetwork is well-poised to be the blockchain platform for the future global sharing economy.

3. Trust Framework

The incentive and tokenomics of the GSENetwork are set to increase user interactions, allowing GSENetwork to document more user activities and behavior to create a holistic trust profile of each individual user, forming the framework for the interdependency of the network and the users. With a clearly structured tokenomics model, GSENetwork would return the locus of control to the user to determine the quality and quantity of data provided to the network, and in return, receive the respective incentivization.

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Chapter 4: Decentralized Service (DService)

4.1 Introduction to DService

With the introduction of smart contracts, blockchain technology have evolved from simple transaction ledgers to computation platforms. Blockchain veteran Fred Ehrsam once drawn this analogy: if Bitcoin is a calculator, Ethereum is a computer. Today, blockchain is now able to handle the vast range of highly complex interactions with applications. Smart contracts allow us to do more than send and receive tokens. On-chain applications can make conditional decisions based upon on-chain data. Within the GSENetwork, high-performance customizable smart contracts are deployed to enable various functions within the community.

This chapter introduces GSENetwork's technical architecture to illustrate how the decentralized sharing economy network contributes to multiple shared economic models with **Diagram 3** showing the GSENetwork technology stack. GSENetwork can be divided into 3 layers - the mainchain layer, DService layer and application layer.

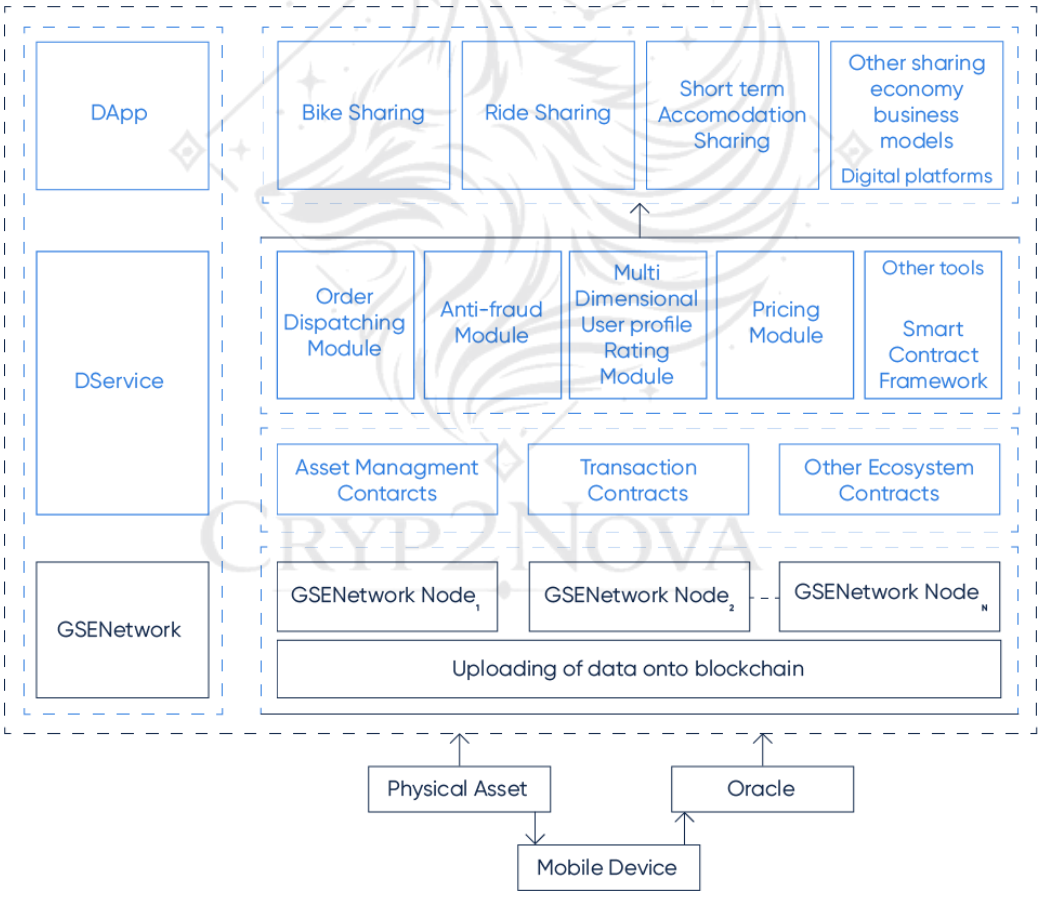


Diagram 3: *GSENetwork Technical Architecture*

Amongst them, the mainchain layer is the cornerstone of the decentralized trust framework. The GSENetwork blockchain is maintained by thousands of nodes in the network. All nodes can store and

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process user information autonomously under the premise of decentralized node control, and reach a consensus on the consistency of processing results. The mainchain layer also provides a smart contract system. With the help of a smart contract mechanism, the blockchain system can flexibly process data in the network to meet specific business needs.

The DService layer is equivalent to the "middleware" between the blockchain and the upper-layer applications. DService consists of several basic smart contracts running on blockchain nodes and provides a variety of smart contract templates for higher level applications. Developers can have the flexibility to develop based on these templates without being concerned about the implementation details of smart contracts. User data from the upper-layer application is passed to the smart contract through DService, which is then processed by numerous nodes in the blockchain network.

The DService layer would be equipped with four types of modules to cater to the seamless onboarding of businesses:

1. Order Dispatching Module
2. Anti-Fraud Module
3. Multi-dimensional User Profile Rating Module
4. Pricing Module

With this infrastructure in place, higher level applications would be more equipped to deal with flexible and complex business logic. In the subsequent stages, DService would provide richer features and greater compatibility for the sharing economy.

The application layer would have a variety of shared economic applications, such as bike-sharing, ridesharing and shared accommodation. With the increasing functionalities of GSENetwork, it would be able to attract the future participation of more products to create a complete shared economic ecosystem.

Further elaborations would be in the subsequent sub-chapters.

4.2 Mainchain Layer

4.2.1 Introduction

Blockchain is a peer-to-peer distributed ledger technology based on cryptographic algorithm to ensure the secure transfer of value and information. It guarantees the traceability and tamper resistance of data based on hash chain and timestamp mechanism. Consensus-based algorithms ensure data consistency among nodes. Based on the above characteristics, the blockchain technically tackles the security problem brought by the trust-based centralized model, and becomes the foundation of the construction of the decentralized trust framework.

In GSENetwork, the blockchain will provide secure data logging. In the blockchain, signed by an external user and broadcast to the entire blockchain network, the instructions processed by all nodes are called transactions. In this system, data from applications such as shared bicycles and homestays are encapsulated into transactions, processed by nodes in the network, and recorded in all nodes of the entire network. For the data records stored in the node, its security can be guaranteed in two ways. Firstly, the data structure and consensus algorithm of the blockchain itself can guarantee the immutability of the

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data. Secondly, the numerous nodes in the network ensures that there is no single point of failure; hence data records will never be lost even if some nodes are damaged.

GSENetwork would need to accommodate as many participating nodes as possible so as to increase the security level of the data records. GSENetwork intends to adopt public chain technology. In the public chain, any number of nodes can participate in the recording and processing of data. In combination with economic incentives, GSENetwork has the potential to attract thousands of nodes to participate in the maintenance of the blockchain, creating a highly secure data logging mechanism.

All nodes in the network would be required to process transactions and agree on the consistency of the processing results. Therefore, as the number of blockchain nodes increases, the time consumed by transaction processing and network resources may increase. In addition, for applications such as ridesharing and bike-sharing, the frequency of transactions entering the blockchain network would significantly increase during peak hours. Therefore, improving the efficiency of transaction processes of the blockchain would be a key factor in the promotion of GSENetwork. Based on this, GSENetwork intends to adopt the Delegated Proof of Stake (DPoS) mechanism as the basis for processing and consensus on transactions. Compared with the traditional consensus mechanisms such as PoW and PBFT, DPoS would be able to maintain high transaction processing efficiency even when there is a large number of nodes. As DPoS is one of the core technologies of GSENetwork, it would be further discussed in-depth in the following chapters.

In the future, the GSENetwork blockchain would adopt the sidechain technology. At that time, through interactions, affiliated blockchains known as “sidechains” would occur. Each side chain has varying technical characteristics and would carry different types of applications. Transactions from an app will be sent to a specific sidechain and each sidechain would process the transactions in parallel, thereby improving the speed of transaction processing.

Another crucial feature provided by the GSENetwork blockchain is the "smart contract" mechanism. A smart contract is a user-defined program that can be deployed on all blockchain nodes and has the ability to host different applications and be bound to specific accounts. When the transaction recipient is marked as the bound account, it triggers the program and the data carried by the transaction would be processed in accordance to the user-defined logic. The nodes on the blockchain would agree on the results of the operation to ensure consistent results. Since the same set of data would be processed by thousands of nodes in the network, the results of the smart contract will be extremely credible. Smart contracts extend the use of blockchains, enabling blockchains to support more applications. In the development of GSENetwork, several smart contracts have been built as the foundation. Such smart contracts can be combined into various basic service modules to form the basis for the operation of DService. Application developers are also able to develop new smart contracts based on specific business needs.

In order to achieve on-chain and off-chain data collaboration, GSENetwork would introduce the Oracle mechanism. The Oracle mechanism is a unique facility adopted for the interaction between smart contracts and real world applications. On one hand, it collects external data through tools such as IoT devices and GPS satellites. On the other hand, it encapsulates the collected data into transactions and handles them through specific smart contracts. As a subsidiary module of the blockchain, the Oracle mechanism is able to expand the data sources bridge communications between channels of data sources and turns into a bridge for communicating the blockchain and real world applications.

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4.2.2 DPoS Consensus Algorithm

The consensus mechanism is the core concept in blockchain technology, including Practical Byzantine Fault Tolerance Algorithm (PBFT), Proof of Work (PoW), Proof-of-Stake (PoS), Delegated Proof of Stake (DPoS) and other algorithms and their variants; of which, DPoS is considered to be a relatively robust, secure, highly distributed, flexible and efficient consensus algorithm.

PoW requires extensive computing power and time to reach consensus and block confirmation; whereas PoS staking mechanism has been criticized because it gives unfair advantage to those with marginally more tokens to mine a new block.

Adopting the DPoS consensus mechanism; GSENetwork is able to mitigate these issues through voting processes; where token holders are able to vote for the chosen "validators" of transactions; these "validators" are referred to as Delegates. Under this consensus mechanism, all GSE token holders are able to exert a certain degree of impact in the future of the network. As such, the adoption of DPoS mechanism encourages greater community participation and involvement. The voting power of token holders are directly proportional to their vested tokens; and they can vote for a list of potential delegates. The delegates shortlisted through community voting will be evaluated by the Foundation, and ultimately appointed at the Foundation's discretion. This election process ensures that only reliable nodes will be involved in the consensus process, thereby ensuring the efficiency and vitality of the network.

Listed below is the block generation process detailed.

1. *Registration of potential delegates*: The nodes in the network that want to become block producers are called delegates and their collections are recorded as$\{N_1,N_2,...N_i\dots\}$, the special transaction record sent are recorded as T_{N_i} , indicating that the node N_i has sent the transaction T registered as a candidate representative, and locked a certain amount of tokens recorded as C_{N_i} in the smart contract (with the minimum amount of restrictions), as a credit endorsement to promote and attract votes from other holders. In general, the more tokens are locked, the more one can demonstrate his willingness to secure the network, because the disruption of consensus and security of the network will cut off its locked tokens proportionally.

2. *Generate a delegate set*: All the holders in the network are recorded as H. After H votes for delegates $\{N_1,N_2,...N_i\dots\}$, they are labelled as H_{i_j}, indicating the Jth holder who voted to the ith delegate. The tokens $C_{H_{i_j}}$ are locked to the corresponding delegates, and the total amount of tokens in which the holder is locked to the delegate N_i is recorded as C_{H_i}, and the delegate account N_i is finally locked in the smart contract $\boldsymbol{S}$. $C_{Ni_{total}}$is thereby calculated as: $C_{Ni_{total}} = C_{H_i} + C_{N_i}$.

Finally, by comparing the number of locked tokens $C_{Ni_{total}}$ corresponding to all the delegates, the pre r (the number of r is set according to the specific business logic and requirements) delegates are selected as the representative set of the participating consensus as $\{D_1, D_2 \dots D_r\}$.

3. *Block validation*: Delegates set $\{D_1, D_2 \dots D_r\}$ validate blocks in the agreed order, each delegates $D_i$can only validate block within a specified period $[t_i, t_{i+1}]$,, and blocks proposed at other time are invalid. If one delegate doesn't successfully validate blocks in predetermined period, this delegate will be skipped. For example, when D_i doesn't validate block within $[t_i, t_{i+1}]$, but D_{i+1} validates $block_{i+1}$ in $[t_{i+1}, t_{i+2}]$, then the blockchain will be $\{\dots block_{i-2} \leftarrow block_{i-1} \leftarrow block_{i+1}\}$. If a block was missed and no blocks were

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produced in the past 24 hours, they will be removed from the delegates set, and will be penalized until they are once again re-elected as a delegate. In this way, the stability of blockchain can be guaranteed, and the influence caused by unreliable delegates can be minimized.

Since the DPoS consensus is a cooperative generation block rather than a competitive generation block, the blockchain would not fork under normal circumstances. If the blockchain has forks, the forked chain with more delegates would extend faster than the forked chain with fewer delegates, because the former will encounter fewer missing blocks, so the longest chain represents the consensus amongst the majority of the delegates. However; as the delegates are ultimately decided by the Foundation, we predict that the chances of an unplanned fork happening would be very low.

4. *Delegate-confirmed transaction*: Other delegates would verify the block produced by the first delegate and add it to the next block. In the blockchain, it would be assumed that less than one-third of the nodes are malicious. If there exists more than two-thirds of different delegate behind a block, it would be considered that the block is confirmed by the majority, resulting in the transaction being deemed irreversible. For instance, if there are a total of 21 delegates, and there are 15 different proposed blocks after the first, it would be irreversible.

4.3 DService Layer

Above the blockchain layer is the Decentralized Service (DService) Layer, which is the "middleware" between the application layer and the blockchain layer. The DService Layer consists of a number of smart contracts running on the blockchain nodes and faces the upper-level applications, providing many foundational smart contract templates for the application. Developers can flexibly develop based on these templates. According to the smart contract template provided by DService, it can be defined into 5 modules: foundational contract module, order dispatch module, anti-fraud module, multi-dimensional user profile rating system, and pricing module. The foundational contract module mainly includes Asset Management Contract and Transaction Management Contracts.

4.3.1 Foundational Contract Module

The foundational contract module is the basis for DService to provide services to users and is a necessary component for all other modules to implement functions. The foundational contract module utilizes the smart contract template provided by DService, and it mainly includes Asset Management Contracts and Transaction Management Contracts.

Asset management contracts primarily deal with operations related to asset registration and revocation. When a user registers an asset on GSENetwork, the Asset Management Contract would be invoked to register the asset, and the user would be required to stake an amount of GSE. Inversely, when there is a cancellation of a booked asset, the Asset Management Contract would proceed to deregister the asset.

The transaction contract facilitates the transaction between two contracting parties by managing and monitoring the process. If a breach of contract occurs, the transaction contract would automatically deduct the credit of the defaulting party (the credit rating of the user account is based on the information from behavior credit and credit rating) and the deposit. If there is no breach of contract, the transaction contract would automatically increase the credit rating of both parties and transaction is completed.

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4.3.2 Multi-Dimensional User Profile Rating System

The multi-dimensional user profile rating system provides user credit references for other modules, denoted as $User_{profile}(User_{data}, alg_{profile})$, $User_{data} = \{Tra, Eva, \dots\}$. The objective is to determine the user's credit status based on the user interaction information such as the immutable transaction information Tra and the evaluation information Eva recorded on the blockchain. The module only provides a template for obtaining transaction data, the specific data mining algorithm $alg_{profile}$ and the user transaction information $User_{data}$ that needs to be queried is customizable based on the user requirements.

The factors in the algorithm that DiDi, Uber and other ridesharing companies use to evaluate the credit status of both driver and passenger is mainly based on their misbehaviors such as order cancellations. In the homesharing model such as Airbnb, the credit rating is evaluated mainly by mining the evaluation information of both parties. In the shared IoT system such as ofo, the credit status of the equipment is evaluated by mining the user's evaluation of the equipment, whether the equipment is damaged, etc.

4.3.3 Order Dispatch Module

The dispatch module provides the application with dynamic matching transaction services, denoted as $Order(creditt_x, credit_y, O, alg_{order})$, where $credit_{x,y} = User_{profile}(\dots)$. The core is to match the transaction based on the credit $credit_{x,y}$, and the specific application scenarios O of the two parties. This module guarantees that under the same conditions, users with higher credit ratings will be given the priority to obtain services, so as to encourage users to maintain a good credit rating, namely $Order_{Score} \propto credit_{x,y}$. The module only provides a template for obtaining user credits from the Target User Profiling and the Credit Rating module. The priority order corresponding to the specific rating and the rule O of the specific application scenario can be customized according to the user requirements.

The dispatch module is currently mainly applicable for ride sharing services such as DiDi, Uber, Grab, etc. The specific variable rules that the software needs to consider include rules that preferentially selects drivers in closer in proximity to the passengers' pick up points and judging the feasibility of a carpooling destination based on the drivers' current location and passengers' destinations.

4.3.4 Anti-Fraud Module

The anti-fraud module provides stability and security for the application and is documented as Security(). It exists to identify fake users and the false information released according to the credits of the two parties and the specific transaction information S, to feedback to the target user profile and credit rating module to perfect the user mapping. The module provides a template for obtaining user credits from the Target User Profiling and Credit Rating Module, a template for obtaining transaction data, and a template for feedback information. This allows users to create user and information identification filters according to their needs to reject dealing with fake users.

In all shared economic systems, a credit threshold can be set. When the credit score of the user is lower than the threshold, the user is deemed as a fake user, and the service would be denied. In DiDi, Uber and other ridesharing system, it is possible to preliminarily judge whether the information published by the user is authentic. It can refuse to respond to the fake messages by comparing the ride request initiated by the user as well as the corresponding location.

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4.3.5 Pricing Module

The pricing module provides a dynamic price adjustment service for the app, denoted price({old_price}, {price_parameter}, alg_price). Its objective is to allow users to set the price adjustment rule alg_price to achieve smart pricing and asset binding. The module provides the template for quoting a transaction contract and a set of templates for price setting conditions. The specific price setting alg_price can be designed by the user according to their needs. When the two parties transact, the transaction processing contract calls the relevant module in the pricing module to obtain the price information of the corresponding asset.

In a home-sharing service such as Airbnb, users can design a series of dynamic price rules based on factors such as the low and peak rental seasons and rental durations. In a transportation-related shared economy system, users can design a set of dynamic price rules based on information such as traffic conditions and travel time.

4.4 Application Layer

Above the DService layer is the Application layer, which carries a variety of shared economic applications, such as ofo bike-sharing applications, DiDi, Uber and other ridesharing and home-sharing services such as Airbnb. These applications can be ported and expanded with the help of modules provided by the DService layer.

Take the ridesharing system as an example. When a user submits their vehicle information in the system, the Asset Management Contract is called to register the vehicle as an asset and the user would have to stake an amount of GSE tokens. The user is then recognized as the asset owner in the blockchain.

The transaction is initiated when a passenger enters the departure point and the destination. The system calls the anti-fraud module to review the passenger's user information and the order information issued by the passenger to determine whether to provide services. In the case of normal service provision, the system calls the dispatcher to provide the vehicle owner for the passenger with dynamic matching. At the beginning, according to the starting point and destination of the order, as well as the passenger profile obtained by the user profile and credit scoring module, the order is ranked; then the passenger is searched among a certain range of vehicle owners. The range can be set according to the specific scene, and request from the user profiling and credit scoring module to obtain the credit status of the owner. Under the same conditions, users with higher order scores are more likely to receive the service, while owners with higher credits are more likely to earn high-scoring orders.

After the owner receive the order, both sides will reach a trade consensus. The system will call pricing module automatically to obtain the corresponding price of the asset. At the same time, the transaction contract is called to process the transaction. According to the behavior of both parties, the transaction contract can automatically handle the credit evaluation and the deposit of both parties. During the operation of the system, the user profile and credit scoring module pushes the transaction information onto the blockchain to profile the user and analyze the corresponding credit status. Upon the completion of the transaction, GSENetwork will grant a certain amount of GSE reward. The reward is based on the "Green-Mining" mechanism rules as well as the contribution of the user to the overall external system workload during this period of time (system usage and information uploading).

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Chapter 5: Incentive Model

5.1 Getting Incentives Right

Through a revolutionary green-mining approach – transacting equates to mining, GSENetwork wishes to redistribute the externalities created by the ecosystem back to the ecosystem contributors. Users will be incentivized to participate in the network which will grow GSENetwork. GSENetwork has leveraged on our strategic partnership with ofo as the pilot platform to trial the incentive model.

5.2 Incentives in Sharing Economy

Both GSENetwork and partner platforms would share directly or indirectly incurred costs since both would benefit from user transactions on GSENetwork.

GSENetwork benefits from more trust in circulation when there are increased user transactions and varied platforms from externalities which is illustrated as follows.

The sharing economy is realized by platforms in the likes of ofo, Uber and Airbnb. The key to the business models of these platforms is to internalize the externality generated by all participating entities, such as riders, drivers, travelers and hosts. The externality refers to the behavior of individuals that will bring about consequences (positive or negative) to the system and such externality is neither priced nor traded.

The externalities are absorbed by the online platforms, which is referred to as the 'internalization of externality'. The platforms gain additional revenue from the externalities and all participants do not get a share out of it. In addition, the platforms may want to utilize such revenue to incentivise users. However, as reflected in the current market, it is very complicated to execute in a systematic and optimized way.

Implementing blockchain technology would address the issue. The bike-sharing platform as a launch pad is an excellent real-world application for the mechanism. Relying on the decentralized recording function and issuance of token, the externality of consumers' contribution to the bike-sharing platform can be distributed in the network to achieve the optimal overall equilibrium.

The externalities will be covered in the following sub-chapters:

- Membership Externality
- Usage Externality
- Information Externality

5.2.1 Membership Externality

The increase in the number of members will bring platforms additional resources, which is not paid to the creators but absorbed by the platform as higher pricing power. This would explain why there is only one dominant player in most sharing verticals since all resources tend to gravitate towards the lead player.

Referring to the ride-sharing platforms as an example, the increase in the number of members benefits the platform. More members would enable easier pairing between providers and users. Consumers would

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choose the ridesharing platform and travel accommodation platforms with most availability. Advertisers would gravitate towards platforms with the most users, and the popular platforms would be able to justify higher advertising fees with wider reach and higher effectiveness.

The externality from increased membership is rather exponential than linear with the number of membership itself. However, not all parties on the platform enjoy such benefits.

5.2.2 Usage Externality

Higher frequency of transactions would have two major positive externalities to the platform. A higher utilization rate implies a higher circulation speed of resources amongst all participants, which aligns with the core objective of the sharing economy. Users will find it easier to find bikes, rides, rooms and drivers would find it easier to have passengers, likewise for homeowners offering short-stay rental. The usage externality from increased frequency of transactions and thus increased utilization of the platform is evident.

5.2.3 Information Externality

The third type of contribution deserving incentive is information (data) externality. Apart from revenue itself, users and transactions contribute to platforms with data as well. The data includes demand patterns, reviews, photos, population distribution, tide-effects, etc. These data are of great value to the platforms for data mining for deeper business insights.

In fact, data has become the core asset of any kind of organizations, especially with the help of advanced data mining technology like machine learning. Organizations are enabled to make better decisions by all means with the control of data. In addition, platforms can cultivate and grow new business lines with the advantage of such insights.

However, the benefit of such positive externalities is again not shared with other participants, especially those who contribute such data.

5.3 Design of Green-Mining as an Incentive

For every transaction created in the network, the externality created will be shared between 4 parties - the user, the foundation, suppliers and GSE holders. In order to stimulate the growth of GSENetwork,the externality distributed to the foundation will be distributed back to users, suppliers and GSE holders.

Take bike-sharing as a specific example in sharing economies, we call the incentive scheme as “Green-Mining” to achieve wider understanding of the new concept since ‘mining’ has become a popular term in the trend of blockchain and cryptocurrencies.

In the concept of Green-Mining, users will be rewarded with tokens after they take rides. The design of Green-Mining should adhere to the following guidelines:

- The design must have the ability to quantify sharing activities and the ability to translate them into workloads through a clear approach;
- The collection of workload data has to have a minimal impact on user behavior, requiring low user perception in the process and cannot be too time-consuming;

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- The workload data must be associated with behavior subjects, possess an anti-counterfeiting mechanism, and also support verification;

Among these conditions, the first condition is the requirements of the mechanism design, and the two latter conditions are to be ensured through technical means.

We will further elaborate on the production and distribution of GSE, via Green-Mining, in chapter 7.

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Chapter 6: Trust Framework

6.1 Introduction of Trust and Why it is Important

Trust is a valued commodity, or a social currency that can facilitate transactions in the sharing economy. Intermediaries in the first-generation sharing economy perceive authentic profiles as the gateway to transactions on their platforms.

If every individual's digital footprint and social media profile are unique, each user should have ownership of their personal digital data. With the aid of blockchain technology, such records will be permanent and traceable, forming the basis of trust between user and provider.

6.2 Principles of the Trust Model and Types of Trust

The GSENetwork defines trust using a two core elements to ascertain the authenticity of the user profile - *Existential Trust* and *Behavioral Trust*.

Existential Trust
The GSENetwork adopts Internet of Things (IoT) devices utilizing GPS, fingerprint scanners, accelerometers and other IoT indicators to validate the authenticity of the user's identity. Each logged and authenticated interaction point would contribute to the user's trust value.

Essentially,Existential Trust provides information about a participant's existence. A participant in the GSENetwork with high Existential Trust may still exhibit bad behaviors, but he/she is still likely to truly exist, accounting for his/her Existential Trust score.

There is no cap in supply of Existential Trust since a participant can have large Existential Trust approximating to infinity, correlating to actual human behavior - the longer a person lives, the higher the number of accumulated interactions with other individuals or objects over a lifespan.

Existential Trust would decay over time. Once a participant stops interacting with other identities in the network, the identity would gradually cease to exist. Thus, it is necessary to introduce the concept of accelerating decay of Existential Trust, noting that objects would have a slower speed of decay compared to humans.

Behavioral Trust
GSENetwork would be able to correlate the user's online activities, frequency and interaction with assets, people and platforms the user has interacted with to determine the value of their behavioral trust.

A high Behavioral Trust implies a high likelihood that a target is has produced accountable and ethical actions, and a low Behavioral Trust could be a result of less than satisfactory interactions or transactions in the past.

Behavioral Trust is an built-in pseudo-credit system of GSENetwork. Since not all IoT devices can record and upload information about users' behavior, Behavioral Trust will have to differ from Existential Trust. Ideally, Existential Trust would be awarded for every interaction by participants. However, due to the

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limitation of IoT devices, only specific interactions will be awarded Behavioral Trust. Thus we term it a pseudo-credit system. Before we are able to adequately equip Behavioral Trust-enabled IoT devices with the right technology to record accurate information GSENetwork requires, we will closely observe the true effectiveness of Behavioral Trust and compare it against GSE Trust Score or other third party credit scores which will be mentioned in later chapters.

Taking the assumption that there are sufficient Behavioral Trust-enabled IoT devices, several guidelines should be followed:

- The total distribution of Behavioral Trust should follow normal distribution, or a bell curve distribution. This complies with distribution in reality where the majority of users are ethical and have accountable actions. The supply of trust on both the individual at a micro level and population at a macro level, would be governed by normal distribution and therefore have diminishing marginal reward. This should be adjusted automatically and dynamically based on factors affecting the entire network such as monthly active users and total monthly transactions.
- Behavioral Trust would also decay over time based on the logic that when a participant stops interacting with other parties or assets, the system is not able to record information, hence losing information about it and not that trustworthy as before.

A decentralized trust framework means that users will own the data that they provide to the network and be able to have control over the data that is shared. Users would be able to affect their own trust value through their actions and be in control how they are shared and utilized.

6.3 Recording of Trust onto Blockchain

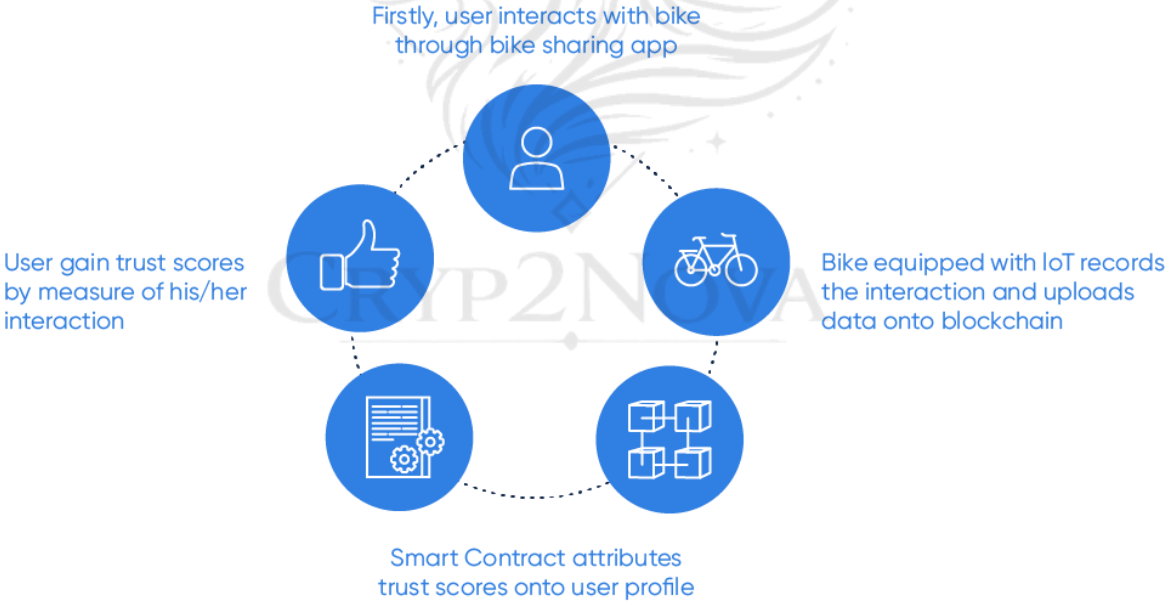


Diagram 4: *Illustration of trust system*

Trust is an attribute for every ID, and is not a separate token. It cannot be transferred to another user, and it would decay over time if it is not maintained. IoT devices will record each activity and interaction with physical assets on blockchain by first determining if the transaction is valid. If it is valid, the transaction data will be uploaded onto the blockchain. The uploading of the transaction data would pass through a

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decentralized oracle in the GSENetwork before completion. The smart contracts attribute trust scores onto the user's profile through the network algorithms, and the trust smart contract rules are determined via decentralized voting system of the GSENetwork community.

6.4 Trust Generation Rules

This section will elaborate on the Trust Generation rules and guidelines mentioned in the previous section.

Existential Trust will be awarded to participants for every interaction. Specifically, lower trust identities would benefit, that is to say, gain a bigger increase in Existential Trust than high trust identities.

Some may wonder the 'Singular Point' for the entire GSENetwork since the trust has to start somewhere in a decentralized way. To solve this, all human users will be granted an initial trust which will decay over time. By supplying 'genesis trust' to each users, trust recognition is realized with the help of all users.

Two explanatory graphs of such mechanism on Existential Trust can be seen below. Once again, we use our strategic partner, ofo, to illustrate the case.

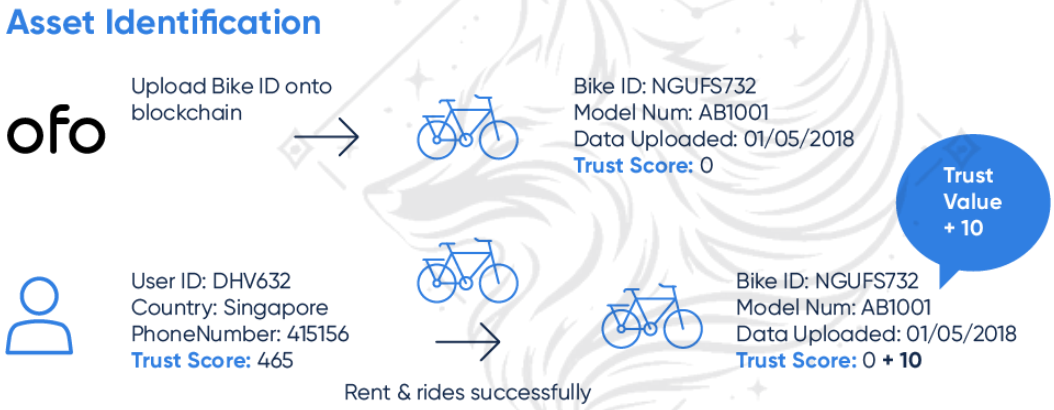


Diagram 5: *Asset Identification*

A rider rides an ofo bike with 0 trust score. The rider with trust score of 465, will attribute the bike with an addition of 10 trust score.

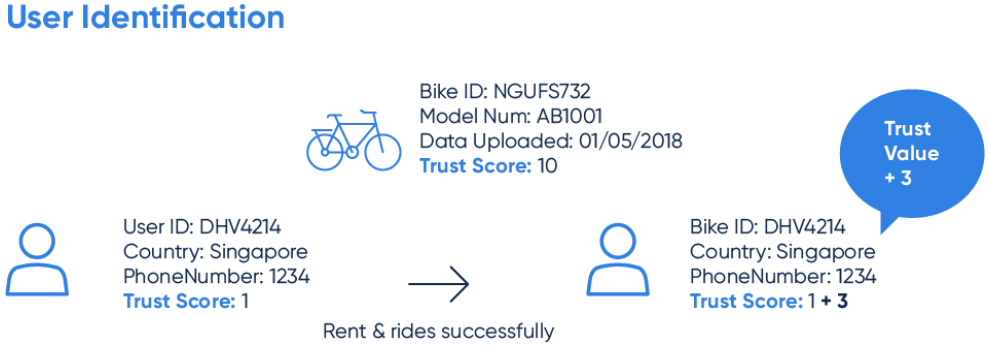


Diagram 6: *User Identification*

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A rider with a trust score of 1, rides a bike with a trust score of 10. The rider will gain trust score after interaction with the bike.

There would be possible changes in Behavioral Trust when IoT devices record new and additional behavioral data. In a fundamental sense, good behavior would be rewarded with Behavioral Trust.

6.5 IoT Device Governance

IoT devices are a crucial entity in GSENetwork; they act as oracles to convert real world interactions to the digital world, carrying trust information with them. A single IoT device may act as node on the chain if it possesses the required computation power, storage capacity and transmitting bandwidth.

In cases where an IoT device fails to meet the minimum requirement of a node, Shadow Nodes will be utilized. One Shadow Node can correspond to one or many IoT devices. The IoT devices serve as a data collector, or Oracle for the Shadow Node. The Shadow Node could be a PC, a server, depending on the requirement of its device governance. A Shadow Node shall have full / core capabilities of operating on blockchain, especially ‘mining’.

As data collection from IoT devices may be prone to fraud and misuse; GSENetwork will require each Shadow Node to put a stake proportionate to the number of IoT devices it controls as deposit.

GSENetwork blockchain will provide mechanism for dispute on stakes. Should there be any dispute on fraud or data integrity collected by IoT and uploaded by Shadow Nodes, network members will be able to raise dispute against the Node. If the fraud is proven to be true by voting or other means, the stake deposit will be confiscated.

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6.6 Trust Score

With proper control and approval, a user's behavior can be analyzed and any party can generate a Trust Score for reference. This should be a composite score based on both Existential Trust and Behavioral Trust while there could also be specialized focus depending on the application of the Trust Score.

It would help to promote the adoption of the score if the publicized rules for calculation are transparent and open sourced. However, having a black box for calculating such scores will not be a critical barrier for the adoption, as long as the entity publicizing it is able to verify its reputation and credibility.

A fundamental objective of Phase 3.0, full suite of access control will be provided to users to reach the optimal balance between user privacy and data acquiring.

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Chapter 7: Tokenomics

7.1 GSE Token

The token of GSENetwork is referred to as GSE. The system will produce a certain amount of token in every fixed period of time. This process is accompanied by two categories of behavior in the system: first, the users' participation in the Green Mining of the sharing economy, and the other is nodes' participation in the accounting. In each certain period, the produced token will be distributed to these two categories of users based on certain proportion.

7.2 Production Rate of GSE

The rate at which the system produces GSE in any fixed period will decline over time, in accordance with the following formula:

$$S_{step} = S_{init} * c_{atten}^{-int((T_{cur}-T_{init})/T_{atten})} * F(\vec{C}, T_{cur})$$

S_{step}: the total number of GSE generated in each period
S_{init}: the number of GSE generated in each period during the Genesis stage
T_{cur}: the current time
T_{init}: the time of genesis
T_{atten} :the period of decline of generation of tokens
c_{atten}: the decline factor of GSE
$F(\vec{C}, T_{cur})$: function of work based on member in sharing economy, such as bike-sharing
$int()$: stands for integer-valued function and its meaning is that for each period of time passed, the number of GSE generated in each unit time will decline according to a certain rule.

The number of GSE produced according to the formula above will be distributed among the contributors of the sharing economy and accounting nodes. Before the main chain of GSENetwork is released online, third party main chain will be used for accounting. Given that the transaction rate will hardly meet the needs of huge number of transactions in the sharing economy, the accounting period will lag behind the generation of workload in Green-Mining before the main chain is released online, therefore the system will pre-produce a certain amount of tokens based on the production intervals of the third party main chain and distribute them, and instant distribution will be adopted after the main chain is released.

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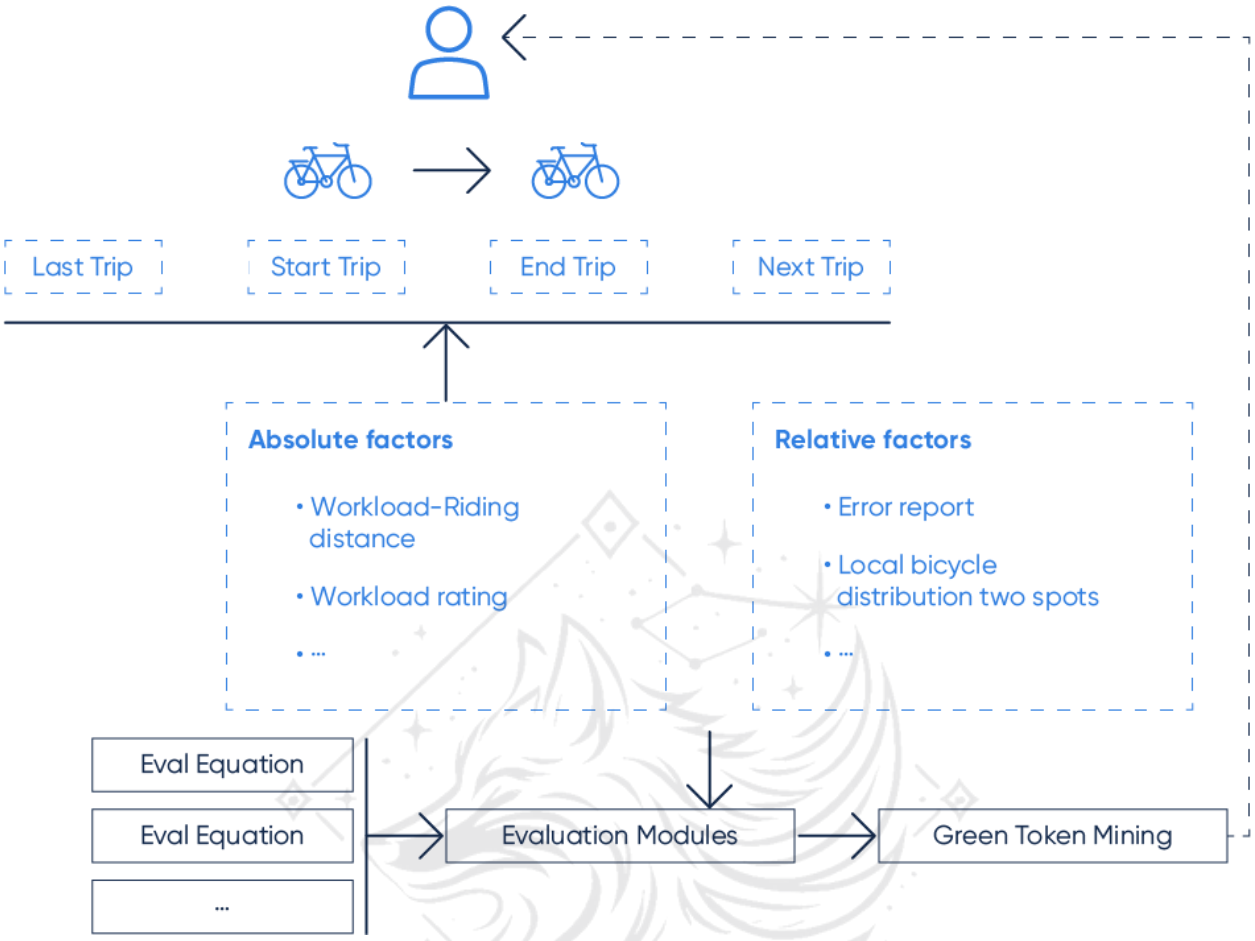


Diagram 7: *GSE production algorithm for bike sharing*

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7.3 Distribution of GSE based on workload

The measurement standard of users' engagement in the sharing economy, which could be referred to as Proof-of-Labor, labor contribution will be expressed as $\overrightarrow{L_i}(t), 1 \preceq i \preceq N_t$, among them N_t is the total number of users engaged in riding in period t. From a quantification perspective, on one hand, the feedback for users' contribution to the sharing economy by using the service and making payments should be manifested. On the other hand, the feedback for the positive influence on sharing economy brought by users' other non-payment engagements should also be manifested. Therefore $S_{step} = S_w + S_r$, S_w is the feedback reward.

The total mark for an individual user's contribution to Green-Mining:

$$V(\overrightarrow{L_i(t)}) = W(\overrightarrow{Lw_i(t)}) + C(\overrightarrow{Lr_i(t)})$$

Among them, $W(\overrightarrow{Lw_i(t)})$is the total amount of labor in the current period; $C(\overrightarrow{Lr_i(t)})$is the weight of specific behaviors.

Based on the definitions mentioned above, the rewards for a particular user mainly depends on the ratio of a user's workload to the riding workload in each period of time and the rewards for feedback mainly depends on the workload evaluation conducted by external system. The latter will be adjusted according to the proportion in the whole system.

7.4 Features of GSE Token

GSE is designed to be used solely on GSENetwork as a unit of exchange for all services on GSENetwork, as well as providing the economic incentives which will be consumed to encourage participants to contribute and maintain the ecosystem on GSENetwork. GSE is an integral and indispensable part of GSENetwork, because in the absence of GSE, there would be no common unit of exchange to pay for these costs, thus rendering the ecosystem on GSENetwork unsustainable. GSE is a non-refundable functional utility token. GSE does not in any way represent any shareholding, participation, right, title, or interest in the Foundation, its affiliates, or any other company, enterprise or undertaking, nor will GSE entitle token holders to any promise of fees, revenue, profits or investment returns, and are not intended to constitute securities in Singapore or any relevant jurisdiction.

GSE may only be utilised on GSENetwork, and ownership of GSE carries no rights, express or implied, other than the right to use GSE as a means to enable usage of and interaction with GSENetwork. In particular, you understand and accept that GSE:

- is non-refundable and cannot be exchanged for cash (or its equivalent value in any other assets) or any payment obligation by the Foundation or any affiliate;
- does not represent or confer on the token holder any right of any form with respect to the Foundation (or any of its affiliates) or its revenues or assets, including without limitation any right to receive
- is not intended to be a representation of money (including electronic money), security, commodity, bond, debt instrument or any other kind of financial instrument or investment;

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- is not a loan to the Foundation or any of its affiliates, is not intended to represent a debt owed by the Foundation or any of its affiliates, and there is no expectation of profit; and
- does not provide the token holder with any ownership or other interest in the Foundation or any of its affiliates.

The contributions in the token sale will be held by the Distributor (or its affiliate) after the token sale, and contributors will have no economic or legal right over or beneficial interest in these contributions or the assets of that entity after the token sale. To the extent a secondary market or exchange place for GSE does develop, it would be run and operated wholly independently of the Foundation, the Distributor. The sale of GSE and GSENetwork. Neither the Foundation nor the Distributor will create such secondary markets nor will either entity act as an exchange for GSE.

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Chapter 8: Roadmap

GSENetwork will adopt a ground-up approach to build our platform. A strong user base with a stable value of exchange, will be the building blocks for a strong foundation for the GSENetwork. In this section, we will set out timeline for GSENetwork technical developments.

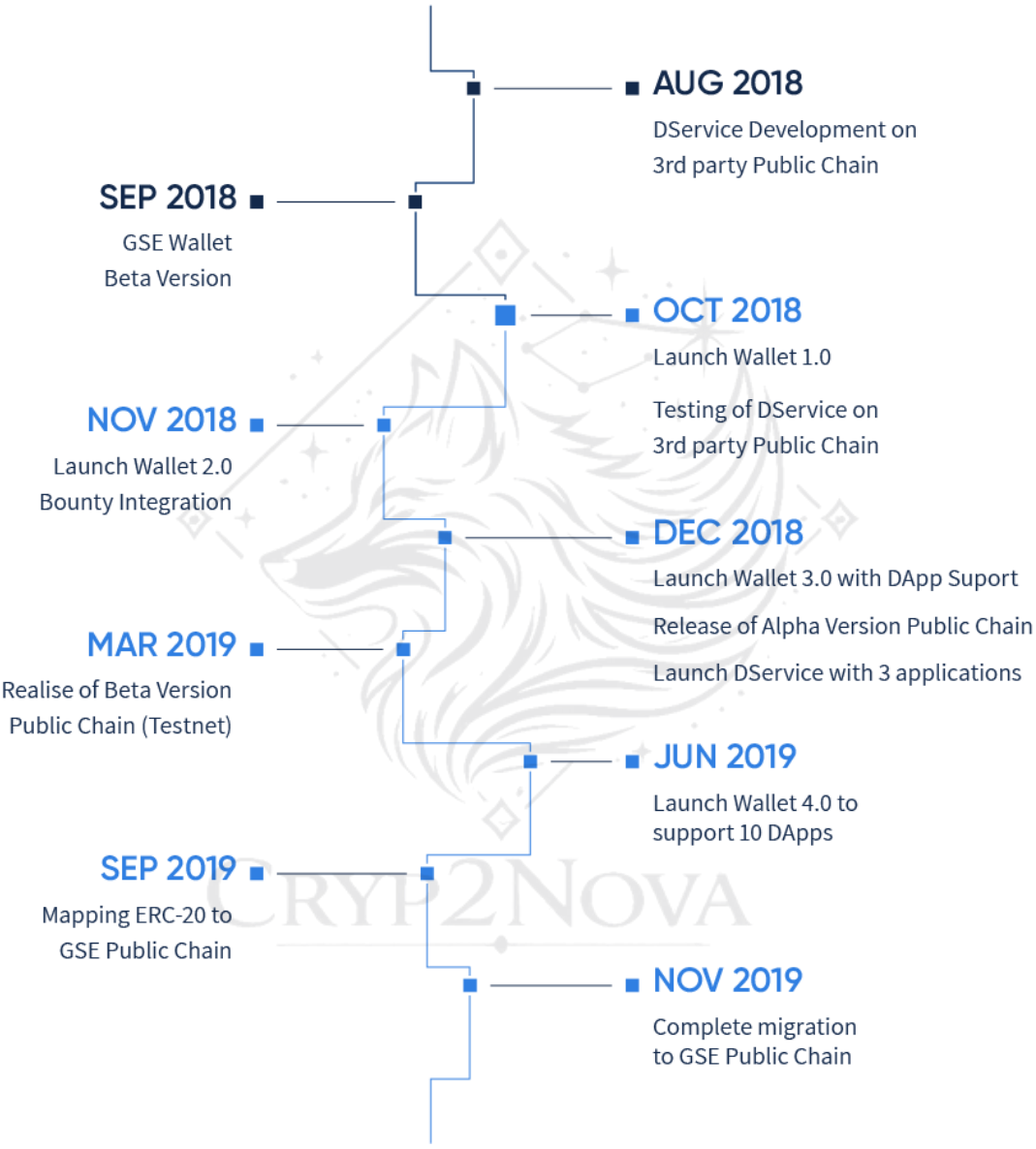
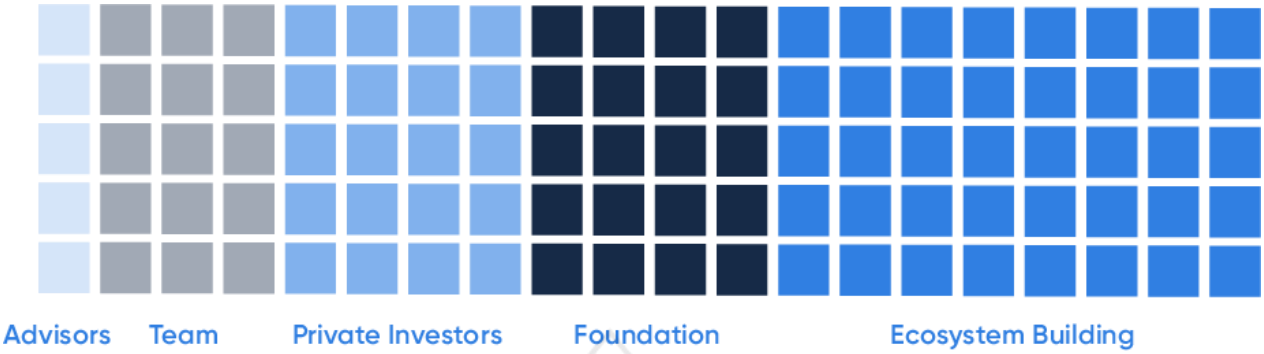


Diagram 8: *GSENetwork Roadmap Overview*

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Chapter 9: Token Distribution

The entire volume of GSE shall be 100 billion, with 0.0001GSE as the minimum unit, as follows:



- 40 percent of GSE will be set aside towards ecosystem building such as green-mining, strategic partnerships, ecosystem incentives, etc
- 20 percent of GSE will be allocated to the Foundation in order to provide support for community operations
- 20 percent of GSE will be released to private investors
- 15 percent of GSE will be allocated to the team
- 5 percent of GSE will be allocated to the advisors

Diagram 9: *Percentage distribution of Token Distribution*

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Chapter 10: Risk

You acknowledge and agree that there are numerous risks associated with purchasing GSE, holding GSE, and using GSE for participation in GSENetwork .

10.1 Uncertain Regulations and Enforcement Actions

The regulatory status of GSE and distributed ledger technology is unclear or unsettled in many jurisdictions. It is impossible to predict how, when or whether regulatory agencies may apply existing regulations or create new regulations with respect to such technology and its applications, including GSE and/or GSENetwork. Regulatory actions could negatively impact GSE and/or GSENetwork in various ways. The Foundation (or its affiliates) may cease operations in a jurisdiction in the event that regulatory actions, or changes to law or regulation, make it illegal to operate in such jurisdiction, or commercially undesirable to obtain the necessary regulatory approval(s) to operate in such jurisdiction.

After consulting with a wide range of legal advisors and continuous analysis of the development and legal structure of tokens, a cautious approach will be applied towards the sale of GSE. Therefore, for the sale of GSE, the sale strategy may be adjusted in order to avoid relevant legal risks as much as possible.

10.2 Competitors

It is possible that alternative networks could be established that utilize the same or similar code and protocol underlying GSE and/or GSENetwork and attempt to recreate similar facilities. GSENetwork may be required to compete with these alternative networks, which could negatively impact GSE and/or GSENetwork .

10.3 Loss of Talent

The development of GSENetwork depends on the continued cooperation of the existing technical team and expert consultants, who are highly knowledgeable and experienced in their respective sectors. The loss of any member may adversely affect GSENetwork or its future development.

10.4 Failure to Develop

There is the risk that the development of GSENetwork will not be executed or implemented as planned, for a variety of reasons, including without limitation the event of a decline in the prices of any digital asset, token or GSE, unforeseen technical difficulties, and shortage of development funds for activities.

10.5 Security Weaknesses

Hackers or other malicious groups or organizations may attempt to interfere with GSE and/or GSENetwork in a variety of ways, including, but not limited to, malware attacks, denial of service attacks, consensus-based attacks, Sybil attacks, smurfing and spoofing. Furthermore, there is a risk that a third party or a member of the Foundation or its affiliates may intentionally or unintentionally introduce weaknesses into the core infrastructure of GSE and/or GSENetwork , which could negatively affect GSE and/or GSENetwork .

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10.6 Other Risks

In addition to the aforementioned risks, there are other risks (as more particularly set out in the Terms and Conditions) associated with your purchase, holding and use of GSE, including those that the Foundation cannot anticipate. Such risks may further materialise as unanticipated variations or combinations of the aforementioned risks. You should conduct full due diligence on the Foundation, its affiliates and the GSENetwork team, as well as understand the overall framework and vision for GSENetwork prior to purchasing GSE.

Please visit https://www.gse.network or send an e-mail to info@gse.network for more information.

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