YGGDRASH

Trust-based Multidimensional Blockchains
& Internet re-designed by blockchains

White paper (ver 0.22.2)

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* If you have any questions, please contact info@yggdrash.io.

Introduction

The future we think…

Our future will become ever more complex, and more transactions and data will be created. As it has been and always will be, data management is one of the most important tools to navigate this complexity.
What will happen if we maintain the current system where we keep all the data in one place and manage all the points that are linked to each other? It means all the risks are concentrated in one place. If people keep choosing central points where all their personal data is stored in order to use services and to maintain their lives, is this the right decision or the best choice?
What if such a central point stops to operate? Or what if people or centralized organizations use our valuable information for the wrong reasons? Will we still be able to trust the system after all? It is questionable whether we should continue to trust current centralized systems in which the safety and integrity of our data is not guaranteed.

Even if we cannot transfer all of the internet, which is a sea of information, into the blockchain world, we shall address the necessity of this blockchain platform as a first step heading toward the future.
All blockchains have their own governance. While blockchains such as Bitcoin and Ethereum are different, each has its own goal and direction and presents different solutions.

YGGDRASH acknowledges such difference in thinking and is pursuing a platform which will enable different methods to solve these issues together.

The ideology of blockchain has changed. There are still difficulties in how each blockchain project resolves issues and problems in reality. Users who use the network are concentrated on one blockchain, so all transaction data is concentrated in one block, causing negative effects on applications in the real world. This might cause another centralization of the decentralized information of networks, showing the limits of blockchain performance. If too many people try to register in a block at the same time, a bottleneck will occur which is an essential task for the P2P network to tackle, no matter how fast the speed of a blockchain connection is made.

Many blockchain projects are still trying to resolve these problems. The YGGDRASH project will contribute to solve them and subsequently make the blockchain ecosystem much healthier. Our future will become more complex, and more transaction and data will be created. As it has been and always will be, the data management is one of the most important factors.

Team YGGDRASH

1. Summary

1.1 Why another blockchain?

1.1.1 Transaction processing performance, abusive, self-interest driven competition between block verification nodes, and sync speed of blockchain

What is transaction speed (TPS) / throughput, in other words, transaction processing performance? Basically, it is a measure of how many transactions can be processed per unit of time. Many major blockchains today are experiencing difficulties due to the dramatic increase in the number of transactions and size of DApp data. In case of existing centralized platforms, this issue can be solved by increasing the number of servers along with data traffic increase. However, the recently introduced blockchains have inherent limitations. The computations necessary to complete each transaction in the current decentralized DB environment and P2P network resources with different processing performance slow down the overall network. In addition, the consensus process between nodes makes this problem even worse and more complex.

Inseparably related to the processing performance of a blockchain are the block validation nodes: in other words, the economic incentive for miners. Bitcoin, the first generation of blockchains, believed that it could create a transparent and stable ecosystem through the voluntary participation of miners by rewarding them based on mathematical proofs and game theory, such as proof of work (POW). Due to explosive growth in the number of transactions, however, the consensus process is governed by abusive and self-interest driven block verifiers. They line up transactions and DApp data based on profitability, resulting in higher cost for the blockchain environment. Even though such transactions can yield high value for the verifiers, using lower fees slows transactions down or leaves them not executed permanently. This is the reality of the blockchain environment today.

What is not discussed significantly in the blockchain ecosystem until now is the matter of increased block size and sync speed. Since the structure of a blockchain connects a block with another block, the size of all blocks increases and block sync speed decreases along with the increase in transaction volumes as time goes by. Since 2012, the average size of a block in a blockchain and the time for the block to sync have doubled every year. As of February 2018, the total data of Bitcoin is 150 GB and the block sync takes 14 days on average. This issue hinders the participation of common people in the blockchain ecosystem and brings a negative result in which the nature of decentralization turns into the centralized blockchain. As such, most of the major blockchain projects today struggle to solve issues of blockchain capacity and sync speed in order to apply blockchain to the real world in business, such as embedding blockchain technology into IoT devices.

1.1.2 The current situation of Bitcoin

When Bitcoin, the first generation of blockchain, was introduced for the first time, the main reasons why it received tremendous attention were because of its vision to offer decentralization-based security, fast remittance, and 'near zero commission fee'. Unfortunately the reality ended up being not exactly ‘fast’ for remittances. This goal became almost impossible due to transaction delays and unauthorized transactions. Fees per transaction have exceeded $ 55 on average over the last three months. As a result, paying for goods and small transactions became impractical. Why do these problems occur?

Most of the public blockchain projects failed to address the following issues:
1) processing speed of a decentralized DB
2) designing economic incentives for nodes created/shared by a decentralized DB.

The following figures clearly show the current situation Bitcoin faces;

“51 minutes"
Average time it takes to complete a single Bitcoin transaction during the past 30 days (BlockchainInfo.com)

“55 dollar"
Average transaction fee per 1 Bitcoin over the last 3 months (blockchain.info/charts)

“214,817”
Number of transactions floating now in the Bitcoin network now without being included in the block (blockchain.info/charts)

“150 GB & 14 days”
Current size of total blocks in Bitcoin and time required to sync (bc.daniel.net.nz)

“30.14 Terawatt”
The amount of electricity consumed by the Bitcoin network during 1 year is 30.15TW.
This is exceeding the total power consumption of Ireland (25TW a year)
(Digiconomist, a media outlet specialized in cryptocurrencies)

1.1.3 The current situation of Ethereum

Ethereum, the second generation of blockchains, is a platform to operate various DApps using smart contracts, SNS, and e-voting. It also functions as a cryptocurrency. However, Ethereum also has the following issues: 1) limited scalability because all DApp data is recorded and processed in the single blockchain of Ethereum, 2) limitation of the economic incentives similar to those of Bitcoin.

The following describes the current limitations of Ethereum;

“Crypto Kitty"
On November 28 2017, due to the popularity of Crypto Kitty, a DApp on Ethereum, in which a virtual cat can be sold and purchased using Ethereum, the number of transactions in the Ethereum network increased by 6 times in a day, which resulted in network paralysis.

“Ethereum Gas(fee) issue”
Ethereum is designed for users of the network to pay gas fees for Turing-Completeness and security reasons. It is a commission policy that users used in traditionally centralized services (The EOS token policy sounds more reasonable here for example).

“Issue of fee payment in case of interlocking between DApps"
When numerous DApps launch on the Ethereum platform, these DApps operate as one service through interlocking (when the independent commission policy is executed by each DApp). Users should pay commissions every time to each unknown DApp (of course, as soon as all the services are commercialized, most DApps will be integrated to create a better structured platform).

“In case DApps are not executed or won’t be executed permanently”
On the Ethereum platform, a person who pays a fee is a user but the person who executes the relevant service is a verifier. Verifiers are preferentially validating relatively profitable DApps, whereas low margin DApps are rarely or may never be implemented.

“Attacker costs and user costs”
It creates costs in both cases because it is difficult to distinguish attackers and users under the same fee policy. The dilemma is that the costs should be low for users and high for attackers.

“650 GB & 8 days”
Total size of the current blocks in Ethereum and time required for block sync (bc.daniel.net.nz).

We believe YGGDRASH project could solve problems listed above with current blockchain projects carry.

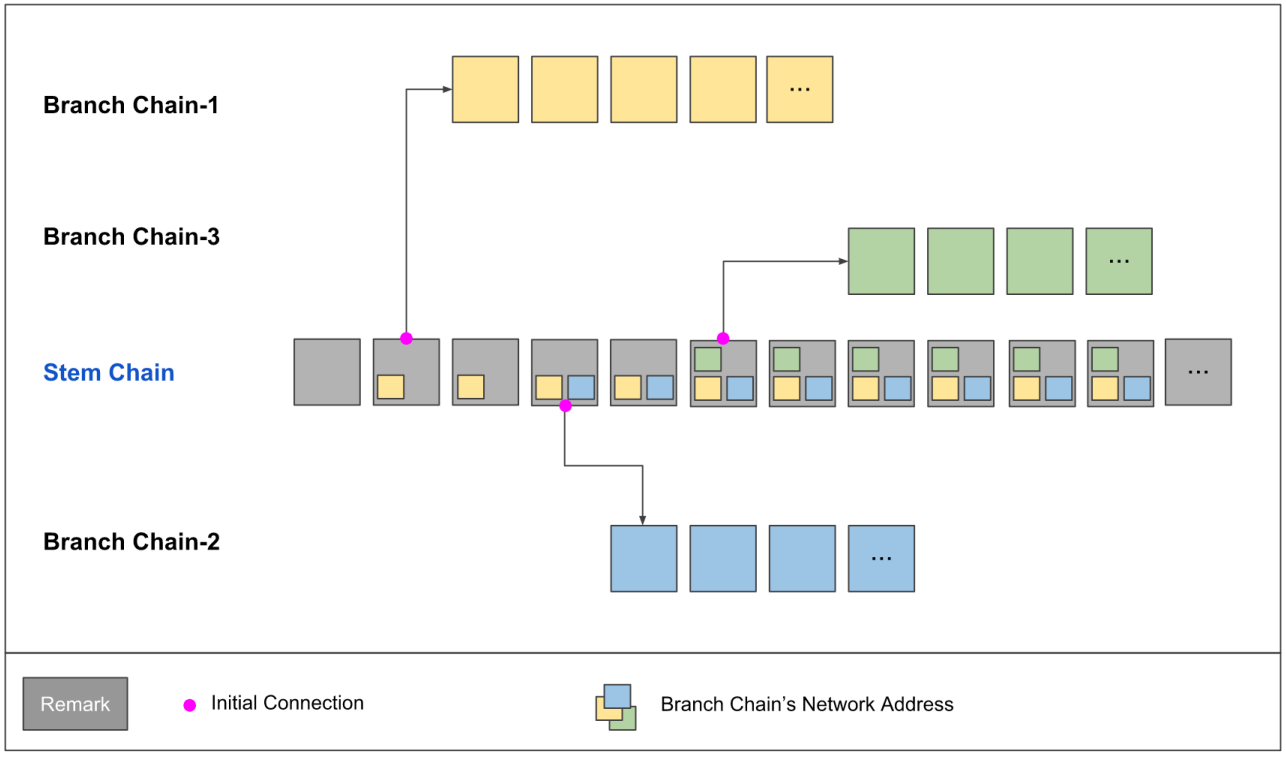
2. YGGDRASH

YGGDRASH aka a world tree, is a channel connecting all blockchains. The purpose of the YGGDRASH project is to connect all blockchains using a trust-based multi-dimensional blockchain. It hopes to redesign all services on the internet into a blockchain platform.

> ***Origin of YGGDRASH (Yggdrash)***
>
> *Yggdrash = Yggdrasil + Hash*
>
> *Yggdrasil is an immense mythical tree that connects wells of the world and locations from the underground and to the heaven: "hash" stands for hashed values used in blockchain transactions and networks.*

2.1 Elements of YGGDRASH

YGGDRASH consists of a Stem Chain and Branch Chains; the Stem Chain provides the blockchain ecosystem wherein all Branch Chains communicate with each other and are fused.



2.1.1 Stem Chain

The Stem Chain is the main blockchain which is the root of the YGGDRASH ecosystem. It is also an aggregate and a blockchain containing information of all Branch Chains. The Stem Chain is optimized for transaction processing scalability and expandability by storing only minimum information such as the address of each Branch Chain. In addition, it connects each Branch Chain by referring the address of each Branch Chain and is able to manage the full life-cycle (creation / modification / destruction) of each chain.

2.1.2 Branch Chain

A Branch Chain is a DApp and an independent blockchain at the same time. Since the Branch Chain itself is a blockchain, it can naturally select the agreed and desired algorithm and form its own blockchain governance. A Branch Chain eventually reaches the level of DAO (Decentralized Autonomous Organization).

A Branch Chain should not be confused with a Side Chain. This is a very important concept. Existing channels between blockchains should be connected by artificial technology like Atomic Swaps. YGGDRASH however can naturally refer/connect other Branch Chains at the same time once the Branch Chain is connected with the Stem Chain, which can create an environment where properties between chains are easily transacted. In addition, since a Branch Chain is operated as a independent blockchain, it is not influenced by overloading and failure of transactions of other Branch Chains.

YEED is the internal token/cryptocurrency used in the YGGDRASH project. You can find more details about YEED in the later sections of this whitepaper.

The types of Branch Chains are as follows;

1. Immunity Branch Chain
Branch Chain used in the YGGDRASH platform; it doesn't consume YEED and is not eliminated from the list.

2. Mutable Branch Chain
Branch Chain created by users; it consumes YEED at regular intervals.

3. Instant Branch Chain
Branch Chain created by users; it does not consume YEED but exists only for a certain period of time (it can be created only by users who have a certain level of trust).

4. Test / Private Branch Chain
Branch Chain not connected to YGGDRASH; it is used for test and private purposes (The Stem Chain does not need to be aware of this chain; it is shared by limited users who know the information of this branch or owner of this chain).

2.1.3 Important Branch Chains

1) Internal Currency Chain: YEED

Why does the real world we live in require currency? We think that the main purpose of money is a means of transaction, but money is one of the most powerful tools to control and govern society. YEED, the currency of the YGGDRASH ecosystem, is one of the tools used to maintain our network while it also works as a means of transaction. However, the biggest reason of its existence is to connect and maintain a large number of blockchain networks connected to the YGGDRASH network.

In general, if a new blockchain is created, it is not automatically registered to the Stem Chain of YGGDRASH. YEED is used to connect the blockchain to the main network of YGGDRASH, and YEED will be gradually consumed over time.

The new Branch Chain in the YGGDRASH network can have tremendous opportunities in which the blockchain resources and service partners can be found and easily connected.

2) Reputation Score Evaluation Chain: Sacred Water

Why should users in a blockchain and cryptocurrency system pay a network fee? The reasons to charge network fees in most blockchains are as follows;

1. To compensate miners who create blocks and maintain the network. Since the number of blocks are limited, the miners prefer transaction requests paying higher fees in the block.

2. To prevent malicious users such as hackers from attacking the network. If the network fee is zero, malicious users will cause an infinite number of transactions to paralyze the network or create meaningless information to register in the block

YGGDRASH measures reputation scores and reliability based on resources, such as time, the resource anyone has and can spend the same amount of, to benefit legitimate users and to limit malicious users. The more time and beneficial activities you contribute to the network of YGGDRASH, the higher your reputation score becomes and the greater the benefits you can get. One of them is a lower fee.

Users with a high reputation score don’t have to pay any fees when using our network. It is the same mechanism that customers with high credit scores benefit from when they don’t have to pay fees while using certain services of a bank.

There are many other benefits that can be provided to users with high reputation scores, other than free of charge services. For example, users with top ratings are given a higher share of newly issued YEED. As such, a policy that compensates beneficial contributions in the network is made possible.

In the real world we live in, can reputation be traded as a resource? It is difficult to assign someone’s high reputational score to other people. For example, a person with a certain reputational level might transfer his score to others and lower his or her own score. It is the duty of the YGGDRASH community to develop and

improve ways how to execute these kinds of policies. To earn a reputation score in YGGDRASH ecosystem, users should contribute to and invest time on the YGGDRASH network. When users accumulate trust or reputation in order to adversely affect the network, they are detected by other network participants or surveillance systems, reducing their scores. In addition, all options are possible such as eliminating benefits like fee waivers, resources in YGGDRASH, and the right to build trust by designing the policy accordingly. The most important asset in YGGDRASH is not YEED but trust score which can benefit many others in the network. YGGDRASH will distribute more benefits and privileges to many participants who want to create a healthy ecosystem, and will create a blockchain ecosystem to grow together.

3) Reputation Score Creation Chain: Sacred Water Fountain

The creation of a reputation score of network participants is conducted in the Reputation Score Creation Chain. It is the algorithm designed to increase the score when beneficial activities are detected in the YGGDRASH ecosystem. If the nodes are inactive, the score cannot be obtained or increased. At the same time, YGGDRASH will run a system to monitor and punish users who intend to obtain a reputation score maliciously.

2.2 Advantages of YGGDRASH

2.2.1 The smart contract data capacity issue is resolved

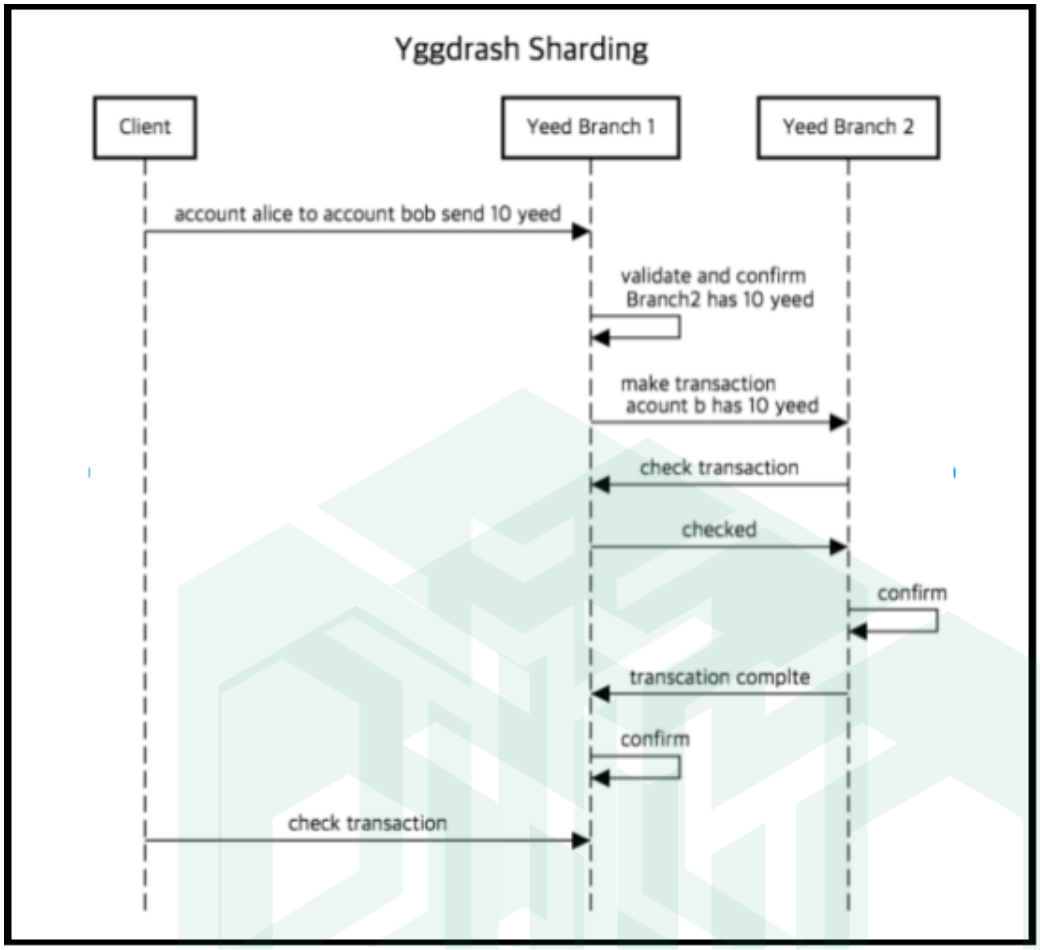
The smart contracts of Ethereum add value to the decentralized system of blockchains. Smart contracts contribute to the creation of a transparent and efficient blockchain ecosystem by allowing numerous transactions to follow an automated agreement that could not have been realized in the real world. However, it also faces the limit of capacity by loading numerous smart contracts into the blockchain.

In fact, if the issue of data capacity is not resolved in developing decentralized applications made of smart contracts, we cannot create the desired business applications. How can we resolve this critical issue? Our answer is that if only integral information of the smart contract is uploaded into the blockchain and the binary file is received through another path in the network, the limitations of data capacity with smart contracts can be resolved. In addition, the programming language of smart contracts will not be constrained, and the hurdles of development of smart contracts will become significantly lower.

2.2.2 Improvement of processing performance through blockchain network sharding

YGGDRASH allows network sharding using multi-dimensional blockchain features. First of all, Branch Chains that do sharding should have the same governance, and each branch must have the other Branch Chains' sharding information.

The following example shows sharding with two branches. The criteria to process sharding are assumed based on the account number of each branch chain (e.g. odd or even numbers).



In case of sharding with 2 Branch Chains as above, if moved from Yeed Branch 1 to Yeed Branch 1, only one trade occurs in general. However, if moved from Yeed Branch 1 to other branches, Yeed Branch 1 will have two confirmation processes taken by Yeed Branch 2 with the asset escrowed.

This can be described as follows;

> Sharding effect = same branch 50% + other branch (3) 50% = branch sharding count / 2

The example above shows sharding performed with two different Branch Chains. In case of sharding like in the example above, the sharding writing performance (transaction processing performance) is the same with one Branch Chain. However, the performance improves significantly when sharding is performed with more than 3 branches. The performance of a single Branch Chain of YGGDRASH is expected to be between 1,000 and 10,000 TPS, and blockchain network sharding can improve processing performance even further. Using our blockchain technology, business applications that require large amounts of transactions for micro-payments can be served effectively on the YGGDRASH platform.

2.2.3 Akashic system –improvement in node sync speed by applying BRA (Block Reassembling Algorithm)

Most blockchains that consist on the main net today provide a full node (wallet) that can be utilized. Various functions such as smart contracts can be executed on those networks. However, most cryptocurrency users are using cryptocurrency exchanges or light client node (wallet) services to trade cryptocurrencies and use smart contracts. This is because it is difficult to form a full node on their own. One of the biggest constraints is the time and economic inefficiency involved due to the need of all the blocks in the blockchain to be downloaded and synchronized.

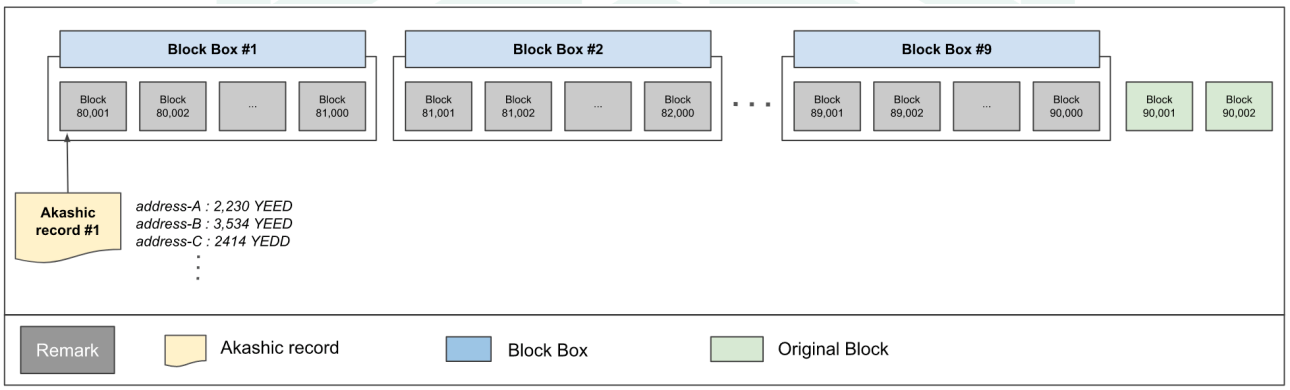
For example, the synchronization for Bitcoin takes about 14 days while that for Ethereum takes about 8 days (4.8 million blocks / as of January 2018).

Those who want to form a full node on a different blockchain platform do not synchronize from the Genesis block (the first block of its blockchain). By receiving a wallet where blocks are synchronized to a certain extent and shared over the internet through a P2P network, they can save time on synchronization. Still the nature of widely used P2P networks today (such as Torento etc.) might come with the risk of carrying viruses. One receives the wallet from available servers where reliability and integrity is not guaranteed.

YGGDRASH will realize an effective and stable block synchronization through the Block Reassembling Algorithm (BRA).

The Block Reassembling Algorithm consists of 3 components as follows;

- Akashic Record (AR): A set of values of all transactions before N blocks
- Block Box (BB): A set of blocks containing N blocks in one box
- Original Block (OR): Blocks of general blockchain



The Akashic Record is a set of data that stores the results of all transactions (the result value of transactions from all accounts) from a Genesis block to a block at a specific checkout point. A Block Box is a set of blocks containing several blocks in one box.

In order to realize the BRA, the result value of AR and BB is hashed and saved in the block according to the specified policy. The actual binary data of AR and BB is stored to the file sharing on the P2P network of YGGDRASH. When a node is synchronized using the BRA, the block data is downloaded in parallel from

YGGDRASH's file sharing on the P2P network, and then compared with the hash value of the BRA stored in the YGGDRASH block to guarantee integrity and security.

YGGDRASH proposes a method in which all network participants can easily participate in the network without losing the advantages of a blockchain network. The BRA can also be an option to synchronize a full block, depending on the users.

The following examples show how to increase the actual block sync speed by using the BRA;

- **Scenario**
  - Let's assume that there is a new node at a time when the current block number is 4,890,002

- **BRA operational policy**
  - AR (Akashic Record): The Akashic Record stores the result value per every 100,000 blocks
  - BB (Block Box): A Block Box is created for every 10,000 blocks

- **Result of BRA application**

- **YGGDRASH block sync speed**
  1 AR + 9 BB+ 2 REGIONAL BLOCK SYNC TIME = About 30 minutes

- **Block sync speed of other blockchains**
  4,890,002 BLOCK * BLOCK SYNC TIME = About 8 days

As you can see above, BRA is a technology that can minimize block sync rate and node resources as the size of a block increases. Ultimately, we believe that we are able to solve the issue of block size which current blockchains are striving to tackle. As a result, it is expected that blockchain technology can be applied to many business areas such as Internet of Things (with limited processing power and data storage) and other applications.

2.2.4 The File Sharing on the P2P Network - Solving the issue of storage capacity

The file sharing network of YGGDRASH registers smart contracts, Akashic records, block boxes, and chain resources. The application exists not only in the code, but it is operated with various types of resources that offer the service of the application.

YGGDRASH provides an option to overcome data limitation on the blockchain through the file sharing on the P2P network, which will enable a more diverse and varied blockchain services.

2.2.5 Interoperability is guaranteed on multi-dimensional blockchains

The reason why YGGDRASH is called a multi-dimensional blockchain is that it can connect blockchains with other blockchains created at a different time. In order to connect different blockchains, the time concept in a blockchain must be understood. Bitcoin creates one block every 10 minutes and Ethereum creates one block every 15 seconds.

How can those two different blockchains be connected? YGGDRASH solved this task by applying Akashic slice, the chain connection protocol. At the time when the data of different blockchains is exchanged, the result of the block of the node is stored as if shooting a snapshot of that exact moment. For example, let's suppose that a person is looking out through a window and a car is passing by. He can prove that the car passed the window by taking a photo of the car at that exact moment in time.

If other blockchain platforms can connect to the Stem Chain of YGGDRASH through the chain connection protocol designed by us, our network resources (YEED, Reputation, Different DApps) can be used in their blockchain platforms as well. Eventually, existing block chain platforms can be connected to YGGDRASH and operated like a Branch Chain if the governance issue is resolved.

2.2.6 Blockchain Starter & Smart Kit

YGGDRASH provides blockchain development toolkits for independent blockchain developers. Each toolkit is customized for blockchain development that satisfies the schedule, flexibility, applicability, and convenience of development depending on business requirement and strategy.

YGGDRASH would like to set aside a separate budget to fund an open source environment and the development of blockchain technology. This is one of incubation projects that YGGDRASH plans. The incentive will be paid depending on the contribution of each project participant. Anyone interested in or wanting to contribute to the blockchain technology development can participate and use this resource. The blockchain development toolkit is offered in two types;

1. Blockchain Starter Kit (Blockchain infrastructure development kit)
The blockchain infrastructure development kit modularizes the basic elements of a blockchain to help developers quickly apply blockchain technology to their businesses.

- Consensus Algorithm (PoW, PoS, PoI, etc.)
- Encryption Algorithms (ECDSA, Hash, etc.)
- Data Structures (Merkle tree, Patricia tree, etc.)
- Node / Wallet Configuration (Full node, Light node, Web node, etc.)
- Special Functions (Smart Contract, Zero-Knowledge Proof, etc.)

2. Blockchain Smart Kit

The Blockchain Smart kit will contribute to the development of new technologies to overcome limitations of blockchains such as sharding and lightning networks, and allow the blockchain technology to be attached to other business enabling technologies, such as Artificial Intelligence, Internet of Things, and Genetics.

The role of YGGDRASH is to grant an incentive to create such an environment. We wish that participants with passion and competency in the blockchain industry will become pioneers who can contribute to the world as others did.

- Scalability (Sidechain, Sharding, Lightning Network, etc.)
- Interoperability Technologies (Multidimensional Blockchains, Atomic Swap, etc.)
- Data Capacity Saving Technology (Akashic Record, Block Box, File sharing on P2P Network, etc.)
- 4th Industrial Revolution Technology (Big Data, IoT, AI, RT, etc.)

2.3 YGGDRASH Governance

2.3.1 Consensus Algorithm

Since the blockchain operates in random P2P network environment, it must resolve the issues of time lag in information arrival, system malfunctions and failures, and forgery of data. The consensus algorithm is designed to verify the legitimacy of blocks created by each node so that network participants can achieve a single result in the aforementioned environment, and share them across the entire network.

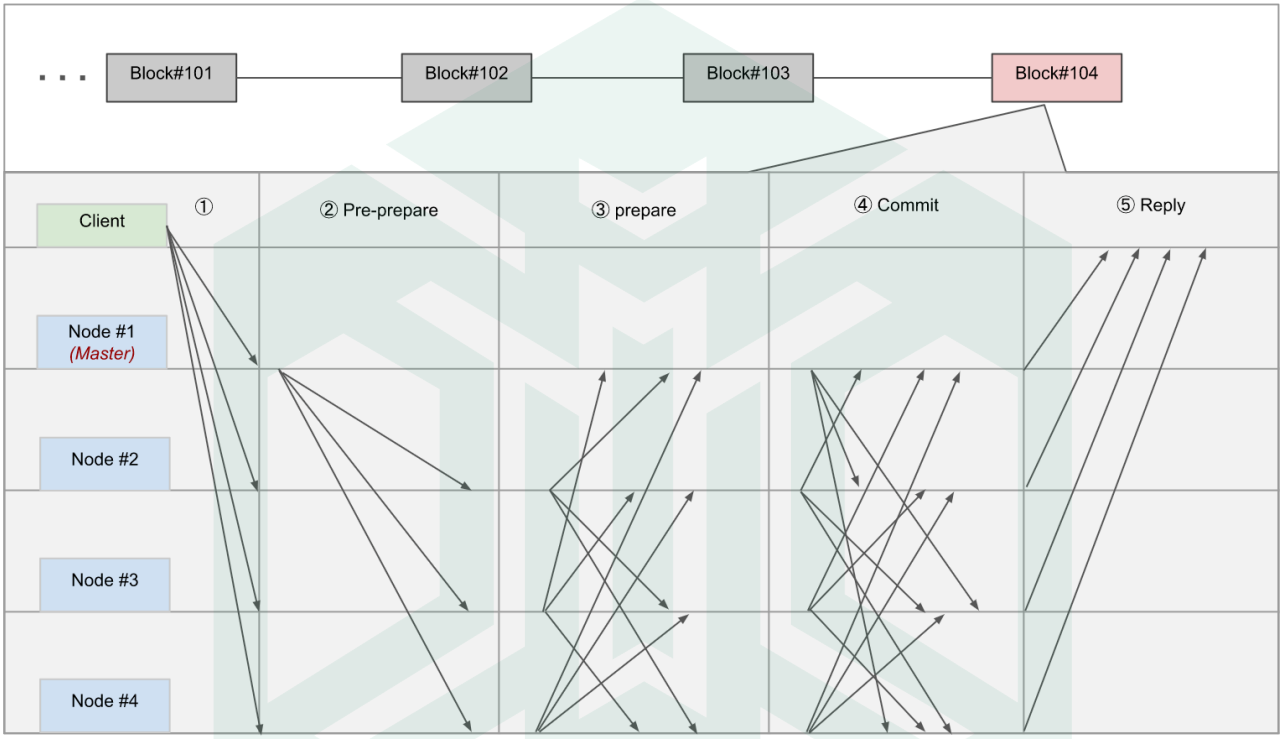
Bitcoin is a consensus algorithm based on the calculated amount of PoW (Proof of Work) which is the first to realize an electronic money system that anyone can participate in P2P network. However, by having a structure in which a block chain is branched, it is often the case that when a node using a short chain is converted into a long chain, the balance of the account is changed or the transaction itself vanishes. To prevent such a phenomenon, Bitcoin has a wallet that can set a limit, such as not being able to do the next transaction for about 6 blocks even when the transaction is confirmed. This is one of the reasons why it is difficult to introduce Bitcoin in financial institutions because of the uncertainty of finality (data completeness). In addition, the verification of the reliability of the distributed data takes longer than other algorithms due to the complex computations and many node consensus times. Thus, this makes it difficult to increase processing performance (response time and throughput), and above all, tasks that need to be processed in real time are basically unsuitable.

On the Ethereum platform, PoS (Proof of Stake) is being applied, and the one of the characteristics of this algorithm is that the node with more cryptocurrencies is given the priority to create new blocks. This is based on the premise that " a node that owns a large number of the currency will protect the reliability of the system to keep the value of the currency." The basic structure is no different from the PoW and is an improved model in terms of resource consumption or processing speed of the nodes since hash calculations are less difficult depending on the amount of currency owned. However, the uncertainty of the finality and performance ability are the remaining assignments to solve for both PoW and PoS.

YGGDRASH designed the DPoA (Delegated Proof of Authority) based on the PBFT(Practical Byzantine Fault Tolerance) to improve the performance issues of PoW and PoS.

First, let's learn about PBFT.
In PBFT, one of the participants on the node becomes the master node and it will send a block processing request to all nodes, including itself. The results of the request are aggregated and a number of values are used to determine the block. If N is the number of negative nodes, the number of nodes should be 3 N + 1, and the determination requires at least N + 1 node.

Below is the schematized steps of the PBFT block processing.



PBFT Processing Steps:

① A client broadcasts a request to all nodes

② Node#1 (Master) sequentially forwards the commands to other nodes

③ When each node receives the command in (2), it replies to all nodes including Node#1 (Master)

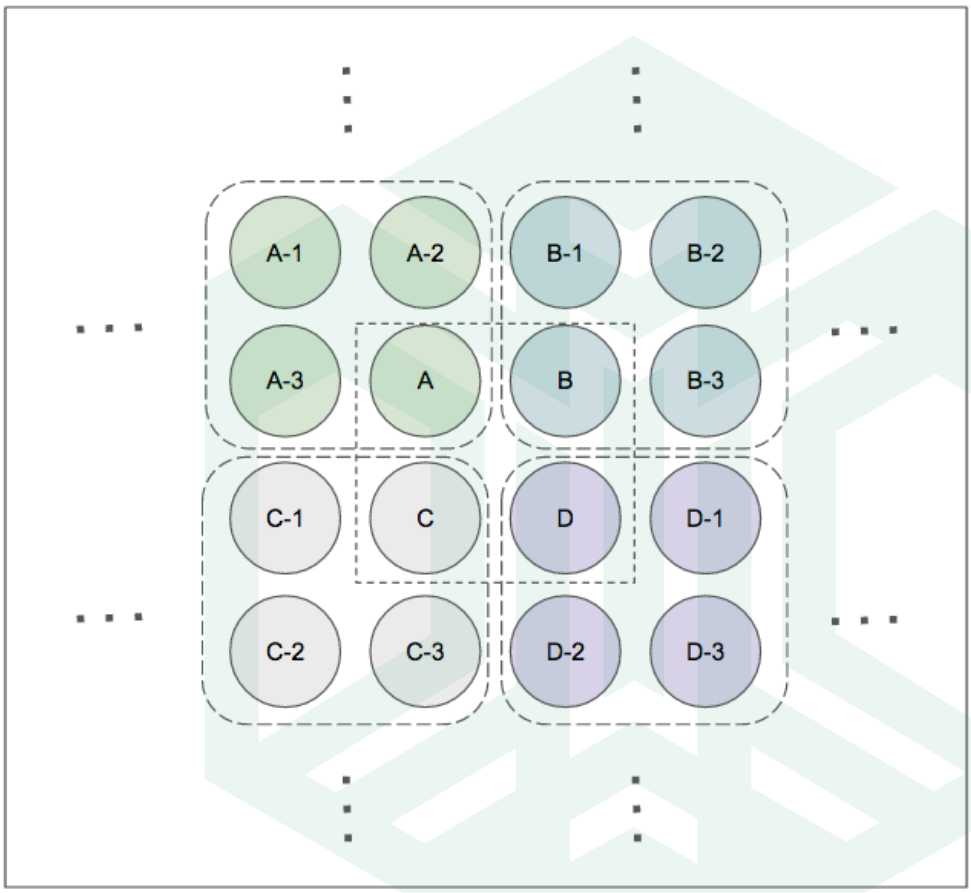
④ When each node receives more than a certain number (2N) of commands transmitted in (3), it transmits the received signal to all nodes including Node#1 (Master)

⑤ When each node receives more than a certain number (2N) of commands sent in (4), it executes the command, registers the block, and returns the reply to the client

Unlike PoW or PoS, PBFT uses the majority rule to make decisions resulting no branches from the blockchain. In other words, a confirmed block is unchangeable, and the finality is assured (not structured for blockchain branching). Moreover, in terms of performance, PBFT proves its superior algorithm since it does not repeat the calculation to meet a certain condition like PoW or PoS.

However, PBFT also has disadvantages. PoW, PoS can operate the blockchain even if only one node remains, but PBFT does not operate the blockchain until it meets a certain number of nodes. This means that a single failure point on the master node must be resolved. YGGDRASH was designed to solve this challenge through the tiering of nodes (Master nodes and Sub-nodes). By default, the block verification has been designed to generate blocks every 10 seconds according to algorithms (Round Robin method, Time Series method, etc.), which can be adjusted to the optimal time through the test net process.

Each master node delegates its representative authority to its sub-nodes in accordance with the YGGDRASH's Authority delegation policy. As a result, a single point of failure can be improved while maintaining a certain number of nodes.



The above diagram depicts the node operating configuration of YGGDRASH. Among the nodes, A-D alphabets are the master nodes, and alphabetic-numeric nodes are sub-nodes of corresponding master nodes. The block generation of the node develops randomly by an algorithm, and the structure has robust tolerance to malfunctions because the empowerment process executes immediately when there is any failure or delay in a certain node.
In addition, even if illegal use is attempted abusing a node's authority, the majority has to agree to it, and when the master node cheats and all the participants figure it out by monitoring the movements of the master node, they can decide to replace the master node by a majority vote.

The Delegated Proof of Authority (DPoA) is the consensus algorithm of YGGDRASH. A public blockchain must basically draw an agreement from a number of unspecified, unreliable nodes. Bitcoin is designed to certify blocks based on the "Proof of Work", and Ethereum is based on the

“Proof of Stake”. Since the anonymity is the fundamental share with all blockchains, it is difficult to measure the reliability of the account.
However, accounts of YGGDRASH can be made into another digital identity on the Internet or a blockchain by applying similar credibility of the real world.

YGGDRASH 1) wants to create a world of blockchains in which we can build trust in the world of unreliable blockchains. 2) The trust increases or decreases with the behavior of each node in the YGGDRASH’s branch chain - reliability assessment chain. 3) The master node of YGGDRASH is the node that has made the most contributions over a long time. The node with the highest reliability will be appointed by voting in the master node group after its reliability has been verified. 4) This gives each master node the most important ”authority” to propose, to revise, to decide on policies in the YGGDRASH network, and to verify the blocks in the stem chain.
YGGDRASH wants to create a Blockchain ecosystem by turning the unreliable environment into a reliable one, and short-term benefit seekers into long-term visionaries.

2.3.2 Governance of the Master Nodes

A master node is elected through the reputation evaluation chain of YGGDRASH when more than 3/4 of the master nodes are involved and the majority approves the node. The master node group can vote and decide on the operating policies of the YGGDRASH ecosystem, the reward and punishment policies for network participants, and YEED's monetary policy. In addition, a master node's authority can delegate, transfer, and dismiss a master node according to the 'authority delegation model'.
The master nodes of YGGDRASH will be distributed by each continent based on stability and security, and the number of master nodes will be calculated as the ideal number through the test net.

2.3.3 Incentive of Master Node

Due to the multi-dimensional Blockchain policy, the structure of YGGDRASH prevents the direct monetary rewards. However, the master nodes of YGGDRASH can receive benefits within the ecosystem such as imperishable Blockchain suggestions which do not consume any YEEDs, no transaction fees, and so on. The authority of YGGDRASH’s master node can be revoked immediately if it does not participate in block verification, violates the rules and acts, and shows malicious behaviors without a cause. In addition, if the representative node's cheating is reported and the report is recognized, the representative will be disabled and the reporter will receive a certain percentage of compensation depending on the report policy.

2.3.4 The Monetary Policy of the YGGDRASH currency (YEED)

YEED is the currency used inside YGGDRASH, and 10 billion YEEDs are issued in the beginning. Burning of YEED will occur for at least one year and the total volume will gradually decrease accordingly. YGGDRASH

differentiates the transaction fee according to the reputation scores of the network participants, and the account that has more reputation than the certain level is free from transaction fees.
The most important area for YEED usage is creating and maintaining a new branch chain. The vitality of the new branch chain is decided by the amount of YEED, which will be consumed gradually. As the YGGDRASH ecosystem develops and enriches, the value of YEED and the stem and branches of YGGDRASH grow together. Transaction fees from unreliable accounts are used as the budget for the YGGDRASH Incubating Fund, which further drives the ecosystem of YGGDRASH.

2.4 USE CASES

2.4.1 Decentralized Exchanges (DEX)

This is literally a "decentralized exchange". All deposits and withdrawals of cryptocurrencies are made solely in the blockchain of DEX. It is possible to trade cryptocurrencies directly in YGGDRASH's personal wallet. This wallet connects directly to the blockchain rather than the tokenized internal wallets provided by exchange platforms today. In a truly decentralized exchange, random manipulation and harmful activities such as blocking deposits and withdrawals are almost impossible. Since it benefits from the security of the blockchain, DEX are free from system hacking and leakage of personal information like we often see today with existing centralized exchanges.

DEX in YGGDRASH will become a game-changer in decentralized exchange platforms. Delays of transactions and hacking attempts will be prevented and reliability ensured.

2.4.2 DApp Store of Blockchain (DSB)

A Branch Chain of YGGDRASH is a service and a DApp at the same time. In the Ethereum platform, the issue of inefficiency of data storage has been on the rise. Users who want to execute DApp of A had to receive all DApp data of B, C, and D that have no relation to execute that of A.

On the other hand, YGGDRASH requires only downloading the Branch Chain which is related to the specific DApp. This is due to the fact that each DApp is an independent blockchain and service. It is comparable to the fact that you don’t have to download the complete movie library of a torrent website if you only want to download the Star Wars movie. YGGDRASH provides an environment like the App Store of Apple in which users can easily search and download the blockchain DApp they want. Can you imagine what the future will be like? This can be realized on the DApp Store platform of YGGDRASH.

2.4.3 Our daily life in the near future

The following is a situation imaginable in the near future: Peter sets a business meeting on his smartphone with a certain location and at a certain time. When he leaves the building, an unmanned vehicle is waiting for him. When he gets in the car, it drives him to the location via an optimal path. Upon arrival at the destination, he gets off the car and heads to the meeting.

How does YGGDRASH operate in this situation? As soon as the meeting schedule is set, YGGDRASH (or a DApp), which is installed on his smartphone, calls the nearest unmanned car. When the closest and most reputable unmanned vehicle is assigned, the car immediately arrives at the pick-up point and waits for Peter. The cost for the ride will be uploaded soon after Peter gets in the car and will be paid immediately upon arrival.

Right after the payment is made, the reputation of the unmanned car rises and the revenue from the payment is automatically distributed to the relevant account of the unmanned car branch chain. A person who wants to invest in the unmanned vehicle can invest by purchasing a token of a branch chain operating the unmanned vehicle. If Peter does not show up, the reputation score of Peter will be reduced and there will be a disadvantage in cost and time for calling an unmanned vehicle next time.

3. Summary of YGGDRASH

3.1 What makes YGGDRASH special?

YGGDRASH proposes the most practical and achievable ways to overcome some of the most important challenges of other blockchains;
1) inherently slow processing speed due to decentralization (though decentralized systems will mostly remain slower than centralized ones),
2) the issue of economic incentives that are forced to maintain the blockchain network by relying on a large number of non-specific validation nodes, and
3) the increased block sizes and slowed down block sync speed.

We propose the most practical and achievable ways to overcome those issues.

3.1.1 Independence and processing performance of each blockchain is guaranteed

1) Optimized performance of main chain processing
The Stem Chain of YGGDRASH serves as the path to connect all Branch Chains and realizes the optimization of processing performance and capacity as follows:

- **Lightening size of block data**

Data stored in the Stem Chain minimizes size of the data itself by storing only minimal information such as the address of each Branch Chain. This reduces the issue of data size that linearly increases over time.

• Optimization of consensus procedure and block generation

We will apply the DPOA (Delegated Proof of Authority) to consensus algorithm. This algorithm is designed based on the stability and reliability of users, and improves the processing speed by simplifying the consensus procedure / calculation / time and optimizing the number of participants.

2) Each blockchain (DApp) has its guarantees own independent network and governance

Each and every blockchain should not be subordinate to a certain higher ranked blockchain. It should be its own independent blockchain network, governance, data, cryptocurrency, and service. The data of other blockchains or DApps which is not required should not be possessed, and resources should not be used to maintain such data. In addition, the delay of processing data and transactions on other blockchains should not affect your service and network.

YGGDRASH solves the problem by introducing the concept of Stem Chain and Branch Chains. To summarize, it can provide services without delay in using the blockchain DApp with normal users because it consists of a separate blockchain as an independent Branch Chain depending on the nature and purpose of each service. This allows the creation of an ecosystem and environment where an active DApp is operated and serviced in any situation.

3) Various blockchain technology toolkits are provided for participants in YGGDRASH network

YGGDRASH provides processing performance for each Branch Chain and various technical services to blockchain business participants.

- Enhanced processing performance through blockchain network sharding
- Enhanced node sync speed through Block Reassembling Algorithm (BRA)
- Enhanced data storage through file sharing on a P2P network
- Enhanced smart contract data storage
- Convenient applications and enhanced efficiency of blockchain services through block chain Starter & Smart kits

3.1.2 Solving selfish mining competition and enabling trust or reputation based economic incentives

1) Solving selfish mining competition systems

A node (= miner) who is in charge of block consensus in the public blockchain is the most important factor for maintaining the blockchain network. However, the increasing number of transactions to be processed has resulted in selfish competitions among the nodes (= diggers) that intend to secure transactions with the highest fees.

YGGDRASH will solve the selfish competition problem by applying DPOA. The verifier of a YGGDRASH blockchain has the authority to determine the policies of our YGGDRASH network, rather than receiving incentives of cryptocurrency through PoW and PoS. Therefore, the verifier will conduct selfish mining for economic incentives but contribute to make our network much healthier and enriching.

2) Trust based economic incentive is guaranteed
In YGGDRASH, a separate branch chain, the Reputation Evaluation Branch Chain, evaluates the trust level or reputation score of each branch chain and user. This chain is designed to measure reputation scores based on equitable "time". This is a resource given in the same amount to anyone equally in order to ensure punishment for malicious users and to provide economic incentives such as fee exemption for good users.

3.1.3 Interoperability and scalability between block chains are guaranteed

YGGDRASH is a blockchain platform that can connect different blockchains which satisfy different business needs of users. The Stem Chain and Branch Chain serve those roles. The Stem Chain contains address information of all Branch Chains connected to the YGGDRASH network as if using domain services when we search on Google. In order to connect to other Branch Chains, the active Branch Chain selects the service of other Branch Chains needed to its business using the information contained in Stem Chain.

A true competition-free market in YGGDRASH will finally emerge once it is possible to ensure the independence of each blockchain and economic incentive by connecting to other blockchain businesses.

In the early stages, each blockchain should focus its time on making its own blockchain ecosystem and service as a Branch Chain. Subsequently, each blockchain will find opportunities with other blockchain services in our YGGDRASH ecosystem. Participants will eventually experience another level or type of business model that can be created through mutual connections.

The more of these fused services with various business players there will be, the more our network will be enriched. Users will be fascinated by our YGGDRASH blockchain ecosystem.

3.2 Incentives for different participants

YGGDRASH is designed to provide economic incentives to all participants in the blockchain ecosystem. It aims to create a transparent, fair, and reasonable blockchain ecosystem for all network participants, rather than to create a monopoly environment through someone with wealth and power.

3.2.1 Cryptocurrency developers

DApps and services can be developed and provided along with their own business logic without having to take into consideration transaction delays of other blockchains. Each Branch Chain can be connected in line with your business strategy. Also, development resources needed to separate chain connections, such as a

Atomic Swap, are no longer needed and various blockchain technologies and toolkits provided by YGGDRASH can be utilized.

3.2.2 Cryptocurrency miners

Branch chain miners: They can select reliable chains based on the chain reputation score information provided by YGGDRASH. Through that stable mining rewards can be guaranteed.

YGGDRASH ecosystem: YGGDRASH can create a stable network ecosystem as a whole, including Branch Chains due to the inflow of many miners who prefer stable rewards.

3.2.3 Cryptocurrency users (investors or service users)

They can select reliable blockchain services based on the information of the Reputation Evaluation Chain provided by YGGDRASH, and a stable investment rate for investors and stable service for users are provided. Also, users with high reputation scores can receive additional benefits such as fee exemption.

3.2.4 Cryptocurrency service providers

It is possible to implement one's own service more quickly and efficiently by using the blockchain Starter & Smart Kit provided by YGGDRASH. Also, service providers can create continuous, expandable, and various fused services by connecting rich blockchain services which are connected to the YGGDRASH ecosystem.

3.2.5 Cryptocurrency exchanges

By using the YGGDRASH trust evaluation information it is possible to recognize and prevent users from the damages on exchange platforms caused by problems of a specific chain or cryptocurrency. In addition, it is possible to minimize the development resources needed to list cryptocurrencies by using a standardized wallet module. This helps to maximize revenue of exchange platforms from listing and operating their platform.