Klaytn

Token Economics & Governance Paper v1.0

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1. Introduction

Public blockchain platforms are maintained through the token model, and the said model greatly influences the direction of growth. As blockchain typically has no central governing authority, it is incredibly important that the individuals maintaining and developing the blockchain stay motivated to secure the continued existence of the blockchain. However, it is unreasonable to expect that participants will participate in the securing of the blockchain solely out of altruistic motives and not in pursuit of financial gains. Therefore, an incentive system to motivate the participants within the blockchain ecosystem is necessary to maintain and develop the network.

In blockchain, governance structure dictates change. As available technologies constantly expand and market demands change, so too should blockchain platforms change and keep pace with such external developments. Unlike the usual products that are developed and maintained by one company or a central governing body, a public blockchain is not well suited to allow any governing entity to make unilateral decisions and to implement them. For example, even if the core developers make the decision to update the software, miners may choose to not apply it. Thus, in order for a blockchain network to implement timely changes, it needs a governance process that collects opinions of all of the participants in the ecosystem and that decides based on such collected opinions. A stable governance structure must be in place for a blockchain to make the proper adjustments in response to external changes.

This document describes the token model and governance system of Klaytn. Klaytn is an enterprise-and-service-oriented blockchain platform that strives to provide a user-friendly blockchain experience for millions of users. Specifically, this document will outline what design principles have been used to create the current features of Klaytn and discuss how these features may change in the future. The information provided in this document will be verified with the relevant data and certain aspects may be changed after sufficient verification and consideration.

2. Design Principles

Designing the token economy and governance structure of a blockchain platform is a complicated task. First, the token economy and governance structures are tested in controlled conditions that do not perfectly mirror reality, so not every variable can be prepared for. Also, even though the blockchain industry is arguably in its early days, it is noteworthy that we have yet to see a successful system. In other words, it is difficult to tell whether specific structures or rules will function smoothly in reality. Considering all these factors, we determined that setting up guiding principles for Klaytn is more reasonable than creating detailed rules that may need to change depending on external factors. This process allows quick response to external changes while sticking to Klaytn's principles and aligning our direction with those of our participants.

Klaytn's token model and governance was designed to address three large areas which include economic growth and distribution, general decision making and design, and platform security and governance. The specific design principles behind each area are as follows:

- **Economic Growth and Distribution**
  - **Growth as a Fundamental Metric:** For a blockchain platform to be sustainable and to provide great value to many users, simply maintaining the network is insufficient; there must also be the growth of the platform's ecosystem. As such, Klaytn[1] will identify the entities that contribute to this growth and provide compensation and support commensurate with each participant's level of contribution.
  - **Service-Centric Growth:** To achieve the level of growth outlined above, Klaytn will focus on service providers. Reliable service providers must exist for mass adoption and longevity of the blockchain. Klaytn will reward the service providers for the growth they bring to the protocol, and aim to create a governance structure where these service providers become important parties on the network.
  - **Sustainable Growth:** A blockchain platform must maintain continuous growth. An ecosystem can only last if it constantly improves to keep up with the developing changes in the industry. But such improvement efforts incur costs. In order to keep Klaytn sustainable, part of the new KLAY that is issued will be used to pay for development or maintenance fees.

- **Platform Security and Governance**
  - **Economic Security Realized with Trusted Entities:** To put simply, economic security is enhanced by increasing the cost of carrying out attacks—such as double spending and other malicious events. The cost of attacking must be greater than the anticipated utility (profit) the attacker can gain. To address this, Klaytn has chosen entities that are trusted in real life as the block creators and maintainers. Compared to anonymous entities, these trusted entities are likely find attacking the network economically unreasonable due to the opportunity cost of losing credibility in real life.
  - **Gradual Decentralization:** Klaytn strives for decentralization, so no individual can control the platform. Decentralization must occur not only in the governance process, but also as the blocks are being created. Klaytn will create various mechanisms to make this possible, but because we need time to adapt to the market as well as to

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[1] Denotes the Klaytn Platform.

test and improve many different ideas repeatedly at a rapid pace, decentralization will be achieved gradually as we pass through the initial platform stabilization period.

- **General Decision Making and Design**
  - **Simplicity:** Klaytn will strive to structure all features as simply as possible. This will make quick optimization and modification possible in the future, and the simplicity will help everyone involved easily understand the features.
  - **Experiments & Optimization by Data:** How high should inflation be? What actions need what types of rewards? Questions like these are difficult to answer without testing and verification. Klaytn will analyze data (that have been obtained and managed in a transparent manner from the blockchain), quickly achieve platform optimization by testing different hypotheses, and share these results transparently through technical reports.

3. Klaytn Token Economics

3.1. Klaytn Incentive Mechanism

Klaytn's incentive mechanism will be used to accomplish the following goals.

- Sufficient economic security and ability to maintain the network over the long-term.
- Assistance to entities that promote economic activities

In a traditional public blockchain, incentives have only been used to maintain the network and for economic security. To maintain the blockchain, someone must continuously save block data, and process a new transaction. Because of this, existing blockchains like Bitcoin and Ethereum give block rewards to the miners who handle block creation. Additionally, incentives are deeply connected to economic security. Simply put, economic security is proportional to the cost necessary to conduct an attack on a blockchain. This cost usually becomes higher as the potential profit for block creators in the block creation process increases.

Incentives are necessary to secure a high level of economic security and for good maintenance of the network. However, the cryptocurrency must maintain or appreciate in value for the system to operate with high stability. If the cryptocurrency's value suddenly falls, the economic security and stability of the network may fall proportionally.

The stability or appreciation of the value of KLAY heavily relies on its utility. This utility comes from having considerable number of people using KLAY, which can happen when excellent service providers actively provide services on Klaytn.

3.2. Financial Sources of Incentives

Klaytn plans to reach its incentive goals through newly issued KLAY and transaction fees.

3.2.1. Minting

KLAY is the native currency of Klaytn and can be used for transaction fee payment, KLAY staking, as a medium for exchange, et cetera. Initially 10 billion tokens will be issued and additional KLAY will be issued through subsequent new block creations. For the initial year after the launch of the mainnet, the inflation rate will be kept at approximately 3% per year, which translates to approximately 9.6 new KLAY being issued for each new block. By default, the inflation rate will reflect the economic growth of Klaytn, and while we aim for lower values when possible, the exact value will be decided through governance structures.

3.2.2. Transaction Fee

As explained above, Klaytn has decided on a transaction fee policy to maximize the platform's service-oriented, user-oriented, and enterprise-friendly nature. The transaction fee policy was determined considering our intended direction as listed below. We have decided on a fixed transaction model with a set amount of KLAY for each op-code.

- Improve user experience
  - Minimize complicated or unnecessary user action during transaction fee payment to improve ease of use for those unfamiliar with blockchain. For example, actions such as directly entering the gas price should be minimized. Additionally, transaction fee variability must be minimized so the user can comfortably use Klaytn.
- Improve the operation process for service providers
  - Klaytn will maintain low transaction fees to lessen the burden for service providers.
  - Through Enterprise Proxy, service providers can pay for customer transaction fees. A system that can accurately predict the fees must exist for service providers to enjoy ease of operations.
- Protection from network attacks
  - Data storage and computation on the blockchain come with costs. If no transaction fee exists, attackers may send meaningless transactions to paralyze the blockchain. To prevent this, our transactions incur reasonable costs to act as hurdles against such meaningless transactions.

In other words, unlike Ethereum, the gas price will be fixed by default. This fixed transaction fee model will normally follow the pricing convention of 1 gasUsed = 25 ston(10^{-9} KLAY). As illustrated above, Klaytn aims to have predictable, low fees, but in special circumstances, such as when we are under DDOS or spam attacks, we may change to a different transaction fee system following governance processes to improve the security of the platform and the services on the platform.

3.2.3. Block Reward Distribution

For each block, the block reward (the sum total of the KLAY issued and transaction fees incurred during block creation) will be distributed as follows (specific percentages and categories subject to change—current percentages and categories reflect projected values for the initial stage after mainnet launch):

- Core Cell Operator Reward: 34%
- Proof of Contribution: 54%
- Klaytn Improvement Reserve: 12%

A closer look into the information on incentives follows in the next few paragraphs.

3.3. Core Cell Operator Incentives and Penalty

Core Cell Operators ('CCOs') form the block creation and maintenance body of Klaytn and process the consensus algorithm. In the early stages of the platform, the members of Klaytn Governance Council, Klaytn's decision making body, will act as CCOs. To perform this role, CCOs must secure enough hardware resources to form the network.

Klaytn will continuously compensate CCOs with a certain amount of KLAY as they provide the resources necessary to Klaytn and promote smooth block creation operations. The magnitude of the reward will depend on each CCO's level of contribution to the platform. Contribution in this context means actions such as creating blocks, providing resources for platform operations, and staking KLAY, which enhances the stability of the platform.

3.3.1. Incentives

To become a CCO, an individual must stake at least 5 million KLAY. CCOs can stake their own KLAY or stake the KLAY of a third party in proxy. Each CCO receives one smart contract. Through this smart contract, a CCO can stake and unstake KLAY. However, unstaking has a one-week delay on withdrawals[2]. Staking results are calculated and reflected on the protocol every 86,400 blocks.

The platform will calculate the Gini coefficient of the amount of KLAY each CCO has staked, and the results will be reflected on each CCO's probability of being chosen as the block proposer. The Gini coefficient is an index used to represent the level of inequality. If the division of wealth is perfectly equal, the Gini coefficient will be 0, and if the division is perfectly unequal, the Gini coefficient will be 1. Where G represents the Gini coefficient, the adjusted value of staked KLAY for each CCO is as follows.

$$Adjusted\ staking\ amount\ =\ (CCO's\ staking\ amount)^{1/1+G}$$

Using the Gini coefficient, the newly adjusted stake value will be reflected in the probability of each CCO being chosen as the block proposer. The Gini coefficient has been incorporated to prevent any one body from holding monopoly on Klaytn.

During each block creation, an algorithm will select a few members of the CCO to form a block creation committee. The committee is a subgroup comprised of members of the Governance Council and is chosen randomly for each block. The committee will consist of one block proposer and multiple validators. The block proposer will propose the block and the validators will check the validity of the block. Once 2/3 of the validators agree that there is no issue, the block will be created. The block proposer will earn the predetermined ratio of the block reward, which is set at 34% for the initial stage but subject to subsequent changes. The information on the block proposer and validators will be saved in the block header.

3.3.2. Penalty

As Klaytn uses a BFT (Byzantine Fault Tolerant) based consensus algorithm, nothing-at-stake attacks or long-range attacks are unlikely to occur. However, failures such as different chains being created on the same block height or block proposers not creating blocks can occur. These failures can seriously threaten Klaytn, but these actions can be prevented by increasing the opportunity cost. The specific parameters of each penalty will be decided upon sufficient testing, verification through data, and discussions. Currently, the basic policy is as follows.

CCOs will face penalties if either of the following two types of failures occur. For the smooth operations of the platform, new penalty policies may be included or removed through the governance process.

Safety Failure Issues
- If a CCO creates more than one block in the same block height: disqualified from being a CCO.
    - If the block proposer has created more than one block with their signature.
    - If a validator has COMMIT to more than two blocks.

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[2] This was decided to prevent any one CCO from harming the network and immediately withdrawing KLAY afterwards.

- If a CCO intentionally excludes a transaction (censorship): disqualified from being a CCO.

Liveness Failure Issues

- If the CCO chosen as the block proposer has not created blocks.
  - If the block proposer has not created blocks for a period, it will be unable to participate in the consensus process for a certain number of future blocks.
  - If the situation outlined above continues to occur, the proposer will be disqualified from being a CCO.
- If a block committee member does not validate a block created by the block proposer.
  - If the committee member has not participated in the block creation process for a period, it will be unable to participate in the consensus process for a certain number of future blocks.
  - If the situation outlined above continues to occur, the member will be disqualified from being a CCO.
- If the block proposer intentionally creates an invalid block.
  - If the proposer has created invalid blocks for a set amount of time, it will be unable to participate in the consensus process for a certain number of future blocks.
  - If the situation as outlined above continues to occur, the proposer will be disqualified from being a CCO.

3.4. Proof of Contribution

3.4.1. Background

Klaytn's token economy operates and develops through the activities of Klaytn's economic entities. The growth of the token economy will help improve the stability of the platform and help the ecosystem last. Therefore, Klaytn has created an incentive system to foster the economic entities' activities in order to help maintain and strengthen the economic growth of Klaytn.

3.4.2. General Concept

The Proof of Contribution system aims to assess the contribution level of all economic entities and provide rewards that correspond to each entity's level of contribution. To make this possible, the contribution level for platform growth will first be measured before rewards are given out. To maintain a fair system, the contribution level will be measured based on the data recorded on the blockchain. As various types of data are accumulated, the reward system will gradually become more elaborate and optimized. Specific incentive scheme or policy may change through General Governance Process depending on future conditions and strategic direction of Klaytn.

3.4.3. Initial Implementation

Users can only join the platform after service onboarding begins. Therefore, we will focus on assessing and rewarding service contributions during the early operation period of the platform. The incentive system will be constantly financed by a certain percentage of block rewards. The percentage is set to 54% in the initial stage, but the rate is subject to change.

3.4.4. Plan

The metrics for service contribution assessment will be diversified over time to improve our assessment model. Furthermore, we are considering to include not only service providers but also users as recipients of key rewards for Proof of Contribution. However, as there is no blockchain or service that has achieved mass adoption yet, analyzing user behavior that contributes to blockchain platform is a tall task. As such, during early operations of the Klaytn mainnet, user behavior will be

analyzed to define a user's contribution to the platform and to formulate a method of quantitatively assessing such contribution. Additionally, we will launch a website that will act as the main channel for receiving applications for Proof of Contribution and for posting assessment results proof of rewards.

3.5. Klaytn Improvement Reserve

3.5.1. Background

As technology continues to improve and the needs of users change over time, our platform must have the ability to quickly adapt to any new circumstance that arises. To respond to such changes, we must not only work on services, but also undergo various activities to maintain Klaytn's ecosystem. For instance, research and development for better technology, or projects that contribute to the overall growth of the ecosystem may be part of these activities.

These activities are necessary for Klaytn to progress continuously. Therefore, the Klaytn Improvement Reserve (KIR) will be managed on the platform for the investment and research on the Klaytn ecosystem.

3.5.2. General Concept

The spending necessary to set up the ecosystem can be categorized as following.

- Platform: Support for infrastructure, research and development, and the creation of a durable protocol
- Tools: Create a better development environment to enhance developer experience
- Community: Create programs to encourage participation in Klaytn's ecosystem (community events, meetups, hackathons, etc.)
- Others

KIR proposals can be created by any participant in Klaytn's ecosystem. KIR spending proposals will be processed per KIR Governance Process.

3.5.3. Initial Implementation

KIR will be allocated a certain percentage of the block reward (12% for the initial stage and subject to subsequent changes), and various proposals will be sent and executed through the Klaytn Finance Commission[3]. Refer to the KIR governance section for more information on the procedure. Once a spending proposal has passed, KLAY will be distributed periodically, from a predetermined total amount, based on the project's level of progress. This process may change based on the project size but is planned to be processed monthly.

3.5.4. Plan

As the platform stabilizes in the future, Klaytn House of Representatives[4] and Klaytn Finance Commission may elect to automate certain processes of funding new projects. In addition, since all budget expenditure information will be disclosed in a transparent manner, a website will be created to share budget allocation and project progress information. Users will be able to vote through the Klaytn House of Representatives on this website.

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[3] Klaytn Finance Commission is a part of the Klaytn Governance Council and has voting rights on matters such as the Klaytn Improvement Reserve.

[4] This is a space where all Klaytn users conduct a primary evaluation for Klaytn Improvement Reserve proposals.

4. Klaytn Governance

Simply put, governance is the process with which an organization or a community reaches an agreement on specific problems or ideas and subsequently makes decisions. Therefore, the governing body, topics, and processes of governance must be selected with careful consideration of external conditions and the platform structure.

4.1. Governing Body

For service-oriented blockchain platforms like Klaytn, the ideal governance system is one that allows all members of the platform to participate and make good decisions swiftly. However, this ideal model is difficult to implement in a perfectly decentralized environment. Klaytn addresses this issue by forming a governance structure composed of elected contributors who share the core principles of Kalytn platform.

The bodies that participate in decision making must be able to come to the best possible decision for the development of the platform through solid understanding of blockchain technology and with high interest in the platform. Currently, however, the average blockchain user may lack the knowledge or interest in blockchain that is necessary to participate in Klaytn's decision making process.

For example, Ethereum's DAO has recorded a low voter participation rate (less than 10%). Low participation makes it hard to claim that any of the decisions represent the entire platform and present the future direction a platform must take.

Because of this issue, blockchain developers and communities insist a token-based voting system (with votes given proportionally to the amount of tokens held) should be implemented rather than an identity-based voting system, but this brings the issue of power being concentrated in the hands of those who only care for short-term financial gains.

We believe making platform contributors the main components of the governance structure fits the goals of Klaytn. Platform contributors are either service providers or those who have helped the development of the service in different ways (e.g., platform ecosystem contribution), whose interests are aligned with the long-term progress of the platform, and are relatively knowledgeable about the platform. Platform contributors are likely to make decisions that are beneficial for the platform's long-term growth, and these forward-looking decisions will bring greater benefits to everyone who uses the platform while also increasing the overall platform value.

4.1.1. Klaytn Governance Council

The Klaytn Governance Council is a council that has the right to decide various governance matters. To secure its reliability, the early members of the Governance Council will be limited to trusted organizations. This decision has been made so that the protocol can be quickly improved in the platform development and stabilization stage. However, as the platform develops in the future, more participants will be able to join the governance process. The Klaytn Governance Council will be composed of the Governance Council members and the Governance Council chairman.

4.1.2. Klaytn Finance Commission

The Finance Commission votes on Klaytn's financial issues and is composed of Finance Commission members. The commission members are those among the Governance Council that have the right to vote on financial issues. These issues include financial proposal introduction and approval as well as KIR expense approval.

4.1.3. Klaytn Governance Council Chairman

The Klaytn Governance Council chairman is the entity that leads Klaytn's governance. The chairman is chosen from members of the financial commission. During the development phase following Klaytn's launch, the Governance Council members will take turns acting as chairman. After the development phase has passed, the selection process may change through the general governance process. The chairman has the responsibility to review the proposals passed during his or her term, and has the obligation to appoint advisors. For his or her activities, the chairman will be compensated with special activity payments as well as with additional votes. The chairman also has the right to take emergency measures in case of an emergency. Emergencies are matters such as platform freezing and large-scale KLAY theft.

4.2. Other Participants

4.2.1. Advisors

The advisory board is a body that advises the Klaytn Governance Council to reach the best governance decision. The advisory board is composed of experts from three different fields. These fields are technology, economy, and governance. The advisory board will be appointed by the Klaytn Governance Council chairman. The chairman will invite experts from each field and select at least one advisor for each category. The advisors will submit their statement of opinions on proposals introduced to the Governance Council or the financial commission. Advisors have the obligation to explain the details of their statements to the Klaytn Governance Council. As compensation, the advisory board will receive a special activity payment.

4.2.2. House of Representatives

The Klaytn House of Representative is a system that evaluates different proposals through the votes of all users. All Klaytn users are able to submit their proposal to the House of Representatives. The proposals submitted to the House will have their suitability determined by the votes of Klaytn users. Once the proposal accumulates sufficient number of votes, the proposal will automatically be registered as a KIR agenda. Note that the House of Representatives will not be set up immediately after Klaytn's launch, but gradually over the initial two years.

4.3. Governance Topics

The main topics that can be decided through the governance structure include the following three areas, and proposals that require additional decision making may be introduced in a regular meeting or temporary meeting for review. The Klaytn Governance Council must make decisions that are best for the growth of Klaytn.

- **Technology**
  - Matters related to the technical update of the platform. Here the issues on the blockchain's basic structure (e.g., Account Structure), new features (e.g., L2 solution), or software update schedule are included.

- **Economy**
  - The additional issuance of KLAY and its distribution structure, change in transaction fees, changes in Proof of Contribution service evaluation methods, Klaytn Improvement Reserve spending approval, and more issues are included in this category.
- **Governing Rule**
  - The governance subjects and processes, as well as the rules for the responsibilities and rights of governing bodies, are included in this category.

4.4. Governance Process

Klaytn principally aims for the governance process to occur within the protocol (on-chain). Through this process, the votes will be recorded on the blockchain, and the results will be carried out following the vote. As the platform grows, more matters will be handled through on-chain governance.

4.4.1. General Governance Process

The governance process is operated in the following order: proposal introduction, statement of opinion submitted by advisors, voting by council members, and various follow-up procedures depending on the result of the vote.

Those who have the right to introduce proposals can make sure each proposal is voted on by introducing it. Once the proposal is introduced, the advisors must conduct expert analysis on the proposal and submit a statement of opinion with their results.

The Klaytn Governance Council members have the right to vote on the introduced proposal and will reference the advisors' statement of opinion to vote on what they believe to be the best option. If the number of votes passes the threshold, the proposal will pass; if not, the proposal will be dismissed. The follow-up measures for an approved proposal will be led by the chairman, and the chairman has the responsibility to carry out all proposals that have been passed by the council within his or her term. Specific proposal votes and follow-up measures follow the procedures outlined below.

- **Core Update**
  - These are proposals that suggest updates to Klaytn's core code. The vote takes place online. However, even if the code update is passed, software update must take place on a set date for this code to be implemented. As such, the software update will also be proposed, and if it is passed, the core update will take place on the set schedule of update.

- **Parameter Change**
  - This concerns proposals that will be applied on the blockchain without any code updates. Currently, matters such as gas price, block reward amount, block reward distribution ratio, voting period, number of committee members, and more can be decided without code updates. The proposer may initiate the voting process, and the vote will take place on-chain during a predetermined voting period. Each voter's choice will be saved in the block header, and the vote will automatically be closed once the voting period is over. Once the same length of time as the voting period passes after the vote, the decision will be automatically implemented to the platform. Therefore, no specific follow-up procedure is necessary.

- **Standard Proposal**
  - This concerns proposals that request the approval of new standards for Klaytn, and the vote takes place online. As there is nothing to be changed in the platform, an approved proposal will only see an official announcement that Klaytn has officially approved a standard change.

4.4.2. Klaytn Improvement Reserve Governance Process

Unlike usual governance processes, the KIR governance process takes a series of steps composed of introduction of a proposal, spending approval, and follow-up procedures to implement an approved proposal.

KIR's proposal introduction methods are the following two.
1. The financial commission can introduce a new proposal.
2. A proposal passed by the House of Representatives is automatically introduced as a new proposal.

The KIR's final spending proposal will be determined through the votes of the Klaytn Financial Commision members. The goal is to automatically implement approved proposals on-chain as soon as it is passed, but in the early days following Klaytn's launch, this process may be handled manually.

4.4.3. Voting Right

Each of the Klaytn Governance Council members can cast one vote. This was decided as it is important to make sure one body cannot hold monopolistic power over Klaytn. However, the number of votes each council member has may increase later on depending on their level of contribution to the platform and governance contribution as well as on their amount of staked KLAY. Each Governance Council member will have their number of votes determined using the following formula. The maximum value that can be given by the following formula is capped at two, and thus each Governance Council member's number of votes will be a real number between one and two.

$$1 + \alpha * f(governance\ contribution) + (1 - \alpha) * g(staking\ amount)$$

governance contribution may be calculated using the number of new proposals introduced and whether the proposals were passed, voting participation rate for all proposals, and whether the member had served as the chairman.

4.5. Governance Roadmap

The bodies participating in governance must act in consideration of Klaytn's long-term benefits rather than just for their personal interests, and they must actively participate in the voting process. Additionally, all participants that contribute to the network as Klaytn Governance Council members must secure computing resources that are greater than the platform requirements and stake a set amount KLAY of their own or from third parties. For the smooth operations in development and stabilization of the platform, Klaytn. Pte. Ltd. will take many roles in governance related matters in the initial development phase. In the future, however, other bodies will gradually take greater roles in the decision-making process, and they will have the right to participate independently.

- **Development Phase**
  - The initial development phase after the mainnet launch must quickly see parameter adjustments, new feature developments, etc. For this to be possible, many issues will be decided through gathering the opinions of the Klaytn Governance Council members, service providers, and community members. To secure initial stabilization, Klaytn. Pte. Ltd. may assist in the decision-making process. Additionally, all decided matters will be transparently shared with the public.

- **Stabilization Phase**
  - The Klaytn Governance Council has voting rights on most proposals. For special matters such as those concerning platform development, the opinion of Klaytn. Pte. Ltd. may be taken into consideration. For specific topics with the possibility of conflict of interest (rewards for CCOs, etc.), separate entities such as foundations may advise the council.

- **Decentralization Phase**
  - Following the stabilization period, to gather additional opinions, more service providers and other bodies may additionally be brought into the decision-making process.

APPENDIX

Appendix A. Klay Unit

The names of the units in Klay are as follows.

- peb is the smallest currency unit.
- ston is a word used as a substitute for Gpeb and is created for convenience.
- 1 KLAY is 10^18 peb.

Unit	peb value	peb
peb	1 peb	1
kpeb	10^3 peb	1,000
Mpeb	10^6 peb	1,000,000
Gpeb	10^9 peb	1,000,000,000
ston	10^9 peb	1,000,000,000
uKLAY	10^12 peb	1,000,000,000,000
mKLAY	10^15 peb	1,000,000,000,000,000
KLAY	10^18 peb	1,000,000,000,000,000,000
kKLAY	10^21 peb	1,000,000,000,000,000,000,000
MKLAY	10^24 peb	1,000,000,000,000,000,000,000,000
GKLAY	10^27 peb	1,000,000,000,000,000,000,000,000,000
TKLAY	10^30 peb	1,000,000,000,000,000,000,000,000,000,000

Appendix B. Design Principles and Implementations

The following table shows how the principles above have been planned and implemented in different parts of Klaytn.

Category	Design Principles	Our Implementation at Klaytn
Economic Growth and Distribution	Growth as a Fundamental Metric	- Proof of Contribution - Klaytn Improvement Reserve
	Service-Centric	- Proof of Contribution (To be) Service providers as governing bodies - Transaction fee
	Sustainability	Klaytn Improvement Reserve
Platform Governance and Security	Economic Security Realized with Trusted Entities	- Consensus: penalty - Consensus by trusted entities - Consensus: staking adjustment by Gini coefficient
	Gradual Decentralization	- Governance: voting right - Consensus: staking adjustment by Gini coefficient (To be) Governance by phases
General Decision Making and Design	Experiments & Optimization by Data	(To be released) Technology report (To be released) Decision making based on data
	Simplicity	All implementations and policies

Table 1: Summary of how each design principle is implemented

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