ECONOMY WHITEPAPER

2022/7

Crust Economic Model & Asset System

1. Overview

As a decentralized cloud system, Crust serves as a distributed network that is public and open to everyone to participate freely. This system was incubated by the Decentralized Cloud Foundation, and it will eventually be self-governed by the community after the growth period. In this system, whether it is a cloud service provider or demander, or various interested parties who maintain the system, they can freely enter and exit under the premise of following the system agreement. Crust's economic model can maintains the interests of all parties and guarantee the development of the entire Crust system.

2. Economic Design Goal

The goal of Crust economic design is to keep the interests of all participants increase in the same direction as the value growth of the Crust system. On the one hand, it is essential to protect the rights and benefits of all participants; on the other hand, it is also necessary to maintain the stability of the Crust system. That is, each participant will contribute to the Crust system while pursuing their interests.

To achieve the goal of Crust economic design, we will consider from the blow several aspects:

How to ensure the security of the Crust protocol

How to keep the sustainable development of the Crust system

How to protect the interests of participants

How to manage the interests of the participants and the value of the Crust system in the same direction

Before describing the design of the Crust economic model, let us first analyze the model of the existing distributed system:

Bitcoin, as one of the earliest blockchain protocols, uses native tokens to incentivize nodes to verify transactions, and also applies PoW consensus to coordinate competition between nodes. In Bitcoin's economic model, early block rewards act as the primary way to protect the interests of nodes. After the block reward decreased in the later period, the fee income has become the essential method to guarantee the node's interest. There are two commonly accepted functions of Bitcoin: value storage and circulation payment. Regarding value storage, users expect to hold or increase the value of tokens, so they pay more attention to the security and deflation policies of the Bitcoin network protocol; regarding circulation payment, users employ the peer-to-peer value transmission function of the Bitcoin network, which is similar to the fiat currency payment function, so they pay more attention to Bitcoin transaction fees and value volatility. On the premise of without changing the existing bitcoin economic model, value storage defends the interests of users. In this kind of user-led network, transactions will not happen so much; so in the long run, it is difficult to retain the operation of the node while ensuring network security. This will affect the sustainable development of the entire system.

Ethereum is the largest smart contract platform, and its native token is used to pay for computing services. Similar to Bitcoin, after the block reward reduced, service fees may become the primary way to preserve the interests of nodes. The difference is that there are more users involved in circulating payment in the Ethereum network, and its monetary policy is not fixed yet and is now an inflation policy. The planned ETH2.0 system changes

the consensus of Ethereum to PoS and is designed to protect the node's interests with sustainable inflation. However, inflation will affect the value of the token and its economic model will try to balance this relationship as much as possible.

After studying the models of other distributed projects, Crust proposed the Crust economic model and asset system according to its characteristics.

3. Crust Participants

There are multiple parties in the entire Crust system, and they have different needs. According to the way each role participates, we divide them into validators, candidates, guarantors, and users. The users mentioned in this article mainly refer to users involved in storage and computing resources. At Layer 2 there will be other different user roles, such as a token market maker.

3.1 Merchants

Merchants are nodes in the network that provide storage resources and storage retrieval services. Merchants can provide users with storage resources and services through the storage trading market and obtain profits.

3.2 Validators

The validators are nodes that generate blocks and includes blocks in a package in the Crust network to maintain the entire blockchain network. According to the GPoS (Guaranteed Proof of Stake) consensus of the Crust network, the validator nodes need to stay online and have sufficient storage resources and workload as a guarantee to staking the corresponding amount of CRU tokens (the native tokens in the Crust network described in detail in the next chapter). So the validator node is also a node that provides storage resources. The validator nodes participating in the network can obtain the rewards for the packaged blocks individually and share the reward of each cycle of the blockchain, but also needs to bear the risk of being slashed. The validator can also be a merchant that it is can obtain profits by selling storage resources on the storage trading market.

3.3 Candidates

The candidates are nodes that compete in the Crust network to become a validator but does not qualify for verification. Like the validator node, the candidate also needs to stay online and possess storage resources and workload as a guarantee to staking the corresponding amount of CRU tokens. The difference from the validator node is that the candidate node does not participate in the generation of the block, and cannot receive the exclusive reward for the block generation. Candidate nodes can obtain the reward share of each cycle of the blockchain, and at the same time, they can also be a merchant to sell storage resources on the storage trading market to obtain revenue. Candidates and validators are not fixed, their identities may change every cycle, which mainly based on the staking number of tokens at the end of each cycle.

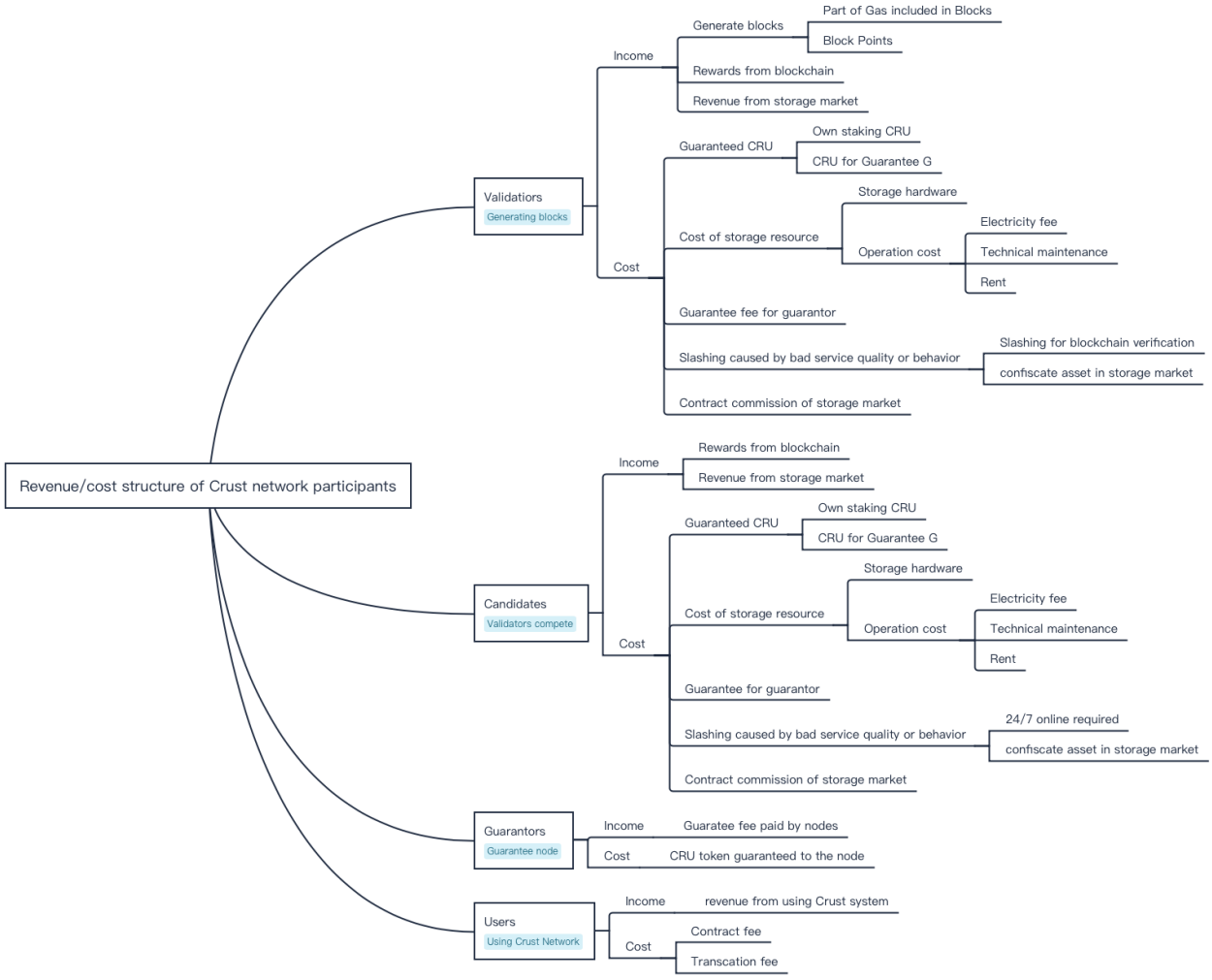
3.3 Guarantors

The guarantor is an account provided by any one or more nodes in the Crust network. Accounts with CRU tokens can become guarantors, and their CRUs can be used as guaranty assets. The guarantor can obtain guarantee income from the node, and shall also bear the penalty risk of its guaranteed nodes in proportion.

3.4 Users

Users apply Crust network resources, mainly refer to those who involved in storage and computing resources, and who can also use CRU tokens or other token assets supported in the Crust network to purchase resource services.

The revenue/cost structure of each participant is as follows:



4. Crust Token

The native token CRU in the Crust network is a utility token representing the value of the entire network, similar to ETH in the Ethereum or DOT in the Polkadot.

4.1 Token Functions

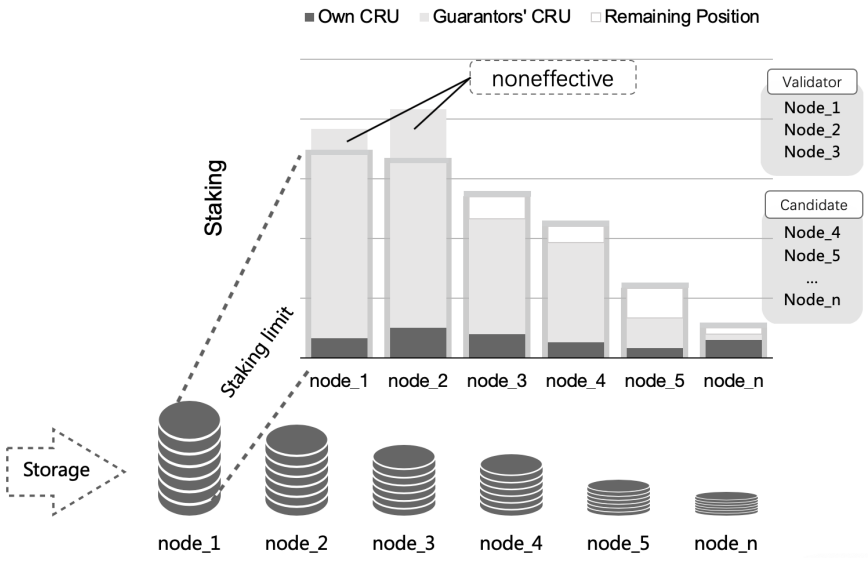
In the Crust network, the CRU token mainly has the following functions:

1. Staking to maintain the GPoS consensus of the Crust network
2. Used to guarantee the selected nodes
3. Serving as collateral for providing resourse service
4. Serving as a transaction fee for using the network
5. Used to purchase resource services
6. Used for election and voting of on-chain governance mechanism, and vote on proposals

The blockchain consensus in the Crust network is GPoS consensus, which is called Guaranteed Proof of Stake. GPoS is a kind of PoS consensus mixed with PoW. The mechanism combines PoW resource fairness and the high performance of the PoS chain. Similar to the existing PoS project, the node needs to use the CRU token for staking to compete for the right to generate blocks. The difference is that the node also needs to have storage resources or workload as a guarantee. Only with the guarantee amount can the corresponding number of CRUs be effectively staked. Under this mechanism, two types of assets, storage resources, and CRU tokens are required to become a node, combining the advantages of a resource-based (such as Bitcoin) and a token-based (such as Cosmos) consensus mechanism can more effectively ensure the security of the network. If you want to attack the Crust network consensus, in addition to having a large proportion of CRU tokens, you also need to be able to control a sufficient amount of storage resources. This design will make the difficulty of the attack particularly high.

Nodes can also allow other guarantors to stake CRU as a guarantee under the premise of having a storage resource and workload guarantee. That is, the staking CRU on the node can be own or from other guarantors. When the guarantor applies the CRU to guarantee a node, the number of the guaranteed CRU and the CRU staked and owned by node runner will add up into the total staking CRU on the node. When the total amount of Staking exceeds the guaranteed amount of the node, only the amount of Staking within the amount shall be deemed as the effective amount. When the total amount of Staking of a node is less than the guaranteed amount of the node, the total amount of Staking shall be the effective amount. To attract guarantees, nodes will pay for the guarantee. And the guarantee fee rate is set by the node runner. On the one hand, the guarantor chooses a certain ratio of income he is willing to accept when guaranteeing the node. On the other hand, the guarantor also needs to bear the corresponding rate of risk as the node being punished. If the node is penalized by the system for triggering the penalty mechanism, a certain part of the guarantor's staking will be deducted according to the agreed guaranteed ratio. Under this mechanism, the guarantor will tend to choose to stake on the nodes with good faith and service quality. Finally, it will become the market to determine a balance between guaranteed income and penalty.

The operation of GPoS consensus is shown in the following figure:



As a network protocol for storing underlying data, Crust provides the function of trading storage resources. CRU tokens are used as collateral in this trading market to protect the order of the trading market.

Similar to other blockchain projects, the CRU token will not only be used as a transaction fee for using the network, similar to Gas in Ethereum but also directly used to purchase resource services in the network.

The governance mechanism of the Crust system will allow the use of CRU tokens to conduct parliamentary elections on the chain and take a vote on proposals.

4.2 Generation and Burning

There are two ways to generate CRU tokens: one is generated at one time when the main network is initiated; the other is generated as blocks are produced.

The number of genesis blocks as Crust initiated main network: 20,000,000 CRU

Mainly used in the following aspects:

5,000,000 CRU Community development (25%)

2,000,000 CRU Used for Crust ecological construction (10%)

5,000,000 CRU Transfer to a professional investment institution (25%)

4,000,000 CRU Reward the technical team (20%)

4,000,000 CRU Foundation reservation (20%)

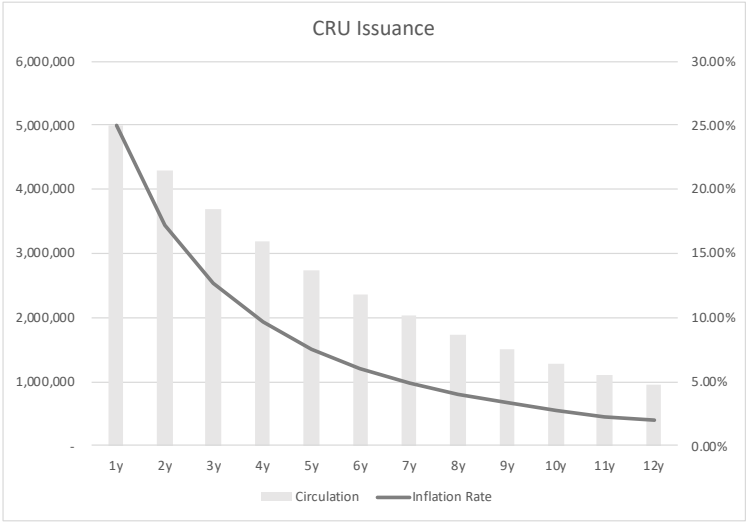
The tokens generated by the block have rewards every cycle, and the points can also be redeemed for rewards. The rewards are mainly for participating nodes in the network to maintain the security of the network protocol. And encourage participation in the network at an early stage. The total distribution method is as follows:

First Year 5,000,000 CRU

From the second year onwards, it will be reduced by 12% each year, and will not decrease until the inflation rate of the whole network reaches 2.8%. The specific data is as follows:

Chart:

Time	Issuance	Inflation Rate
1y	5,000,000	25.00%
2y	4,400,000	17.60%
3y	3,872,000	13.17%
4y	3,407,360	10.24%
5y	2,998,477	8.17%
6y	2,638,660	6.65%
7y	2,322,020	5.49%
8y	2,043,378	4.58%
9y	1,798,173	3.85%
10y	1,582,392	3.26%



If the service quality of the node is unstable or node is found with malicious behavior, it will face the confiscation of the staked CRU. Some of the confiscated tokens will be directly burned, and some will be placed in the Treasury account as a reserve. Some of the fees

incurred by transactions in the network will be directly burned, and the rest will be allocated to the nodes that generate blocks.

4.3 Token Values

CRU is a utility token of the Crust network, its value depends on the Crust network. Its value was correlated with the size of the Crust network, and demand for CRU increased as the Crust network was used by a large number of users. There are two main ways for CRU to capture network value. One is to lock or occupy when it is used, thus reducing the total amount of circulation. For example, deposit for storage and retrieval services, payment for purchase of storage services, voting for governance on the chain, Staking in the consensus mechanism, and so on; The other is that it will be burned when used, thus reducing the total amount of token, such as some transaction fees.

5. Economic Model

The main problem solved by the Crust economic model is to reasonably distribute the interests of various parties under the premise of ensuring the security of the network protocol. The economic model can incentivize various participants to join the network, but also make the system stronger, safer, and more valuable. And can maintain the sustainable development of the system by using CRU as the value bearing and value circulation.

5.1 GPoS Consensus Design

Besides maintaining network security, the design of GPoS also seeks to optimize the workload under PoW as much as possible to match the actual market demand, so that the workload becomes meaningful (Meaningful Proof of Work). When CRU is used as staking to maintain the GPoS consensus of Crust network, nodes need to have storage resource guarantees to obtain a staking quota. We define this quota as storage power. There is a conversion rate X between the storage resource/workload and the storage power, that is, how many units of storage power a unit of storage resource/workload can generate. $\boldsymbol{\beta}$ is the weight for storage resource； $1+\boldsymbol{\alpha}$ is weight for meanful data. The design of X is devided into two phases in the system. In phase 1, The formula is:

$$X = \mathrm{Z} \times \beta + M \times (1 + \alpha) \times \beta$$

*X: storage power

*M: meaningful storage data (TB)

*Z: remaining storage resource (TB)

Meaningful storage data M means the data comes from users by order in storage market. Remaining storage resource means storage spaces other than meaningful data. It should be noted that in the calculation storage power of meaningful data, the **α** coefficient needs to be delayed for three months to take effect.

When the Crust network starts, we define $\boldsymbol{\beta}$=1; Weight $1+\boldsymbol{\alpha}$ has relation with file copies in crust network, we define the initial $\boldsymbol{\alpha}$ mapping table as follow:

file copies	1+α	Initial α
1--8	1.1	0.1
9--16	2	1
17--24	4	3
25--32	8	7
33-40	10	9
41-48	15	14
49-55	20	19
56-65	50	49
66-74	80	79
75-83	100	99
84--92	120	119
93-100	150	149
101-115	160	159
116-127	170	169
128-142	180	179
143-157	190	189
158-200	200	199

**If the number of copies in the network reach 200, the extra copies will not be valid*

After the Crust Network launching, $\boldsymbol{\alpha}$ will have a halving annually, finaly will be adjusted by the on-chain governance in the further.

Considering that the number of copies of each file is not the same, the storage power of each node is calculated as:

$$X = \mathrm{Z} \times \beta + \sum_{i=0}^{n} \left[(1 + \alpha_i) \times \mathrm{M_i} \beta \right]$$

For nodes, improving meaningful data storage can increase storage power,after three months. So that will incentivize nodes to make storage as meaningful as possible.

With Crust network growth, when the total staking quota reaches a specific ratio of the total CRU issuance, it will go to phase 2. In phase 2:

$$X = \mathrm{R} \times \frac{V}{\sum_{i=0}^{n}(V_i)} \times Amount_{cru}$$

*X: storage power

*R: conversion factor

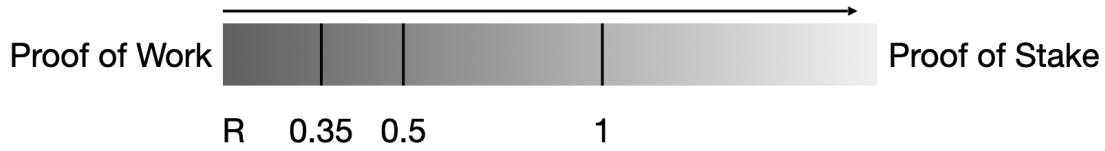
*V: storage power of node in the first stage formula

*Z: remaining storage resource (TB)

*n: amount of nodes

*Amount_cru: The total number of CRU tokens in the whole network

The R factor represents the upper limit of CRUs that staked in the system can be effective. When the factor is low, the economic characteristics of GPoS consensus will be closer to the PoW consensus. At this time, the security of the network is mainly guaranteed by storage resources, and the distribution of benefits will flow to these nodes; When the R factor is high, the economic characteristics of the GPoS consensus approach PoS. The security of the network is mainly guaranteed by the staked CRU tokens in the network, and more of the benefits will be allocated to the account holding CRUs. As shown below:



We set initial R = 0.35, base on this setting, the total staking quota accounts for 35% of the entire network's CRU. Factor R is a variable, it will vary according to the effective staking rate of the entire network. When the effective staking rate of the entire network is greater than or equal to 33%, R maintains the intial setting value. When the effective staking rate of the entire network is less than 33%, the R factor will become bigger. The specific formula is as follows:

$$R=0.35;\ \text{当 Sr>33\%}$$

$$R=\frac{0.33}{Sr}-0.65;\ \text{当 Sr=<33\%}$$

*Sr:effective staking rate of the entire network

*R: conversion factor

After analyzing the staking ratio of existing PoS projects, the generally accepted safety coefficient is about 0.35 ~ 0.66. That is, the locked tokens in the PoS system account for 35% to 66% of the total. In actual projects, the staking ratio range can be 0.15 ~ 0.85. It is determined by the stage of the project and the staking yield. The following table shows the staking situation of cosmos and tezos projects:

Projects	Staking Ratio	Inflation Rate	Consensus
cosmos	73%	7%	BPoS
tezos	78%	5%	LPoS

The conversion ratio setting only specifies how many CRUs the entire network can stake. The number of CRUs participating in staking is related to the yield of participation. From the data of the Cosmos and Tezos projects in the above table, it can be seen that in the early stage of the projects, when the functionality of the token was not exerted, users tended to stake the token in the system to earn dividends. When the yield is 6% ~ 8%, the staking ratio can account for about 75%. In the Crust system, when the price of the token is low, the node runners will not blindly expand the storage resources, which is similar to all PoW projects; when the value of the token is recognized, it will bring a price increase, and the staking ratio will decrease accordingly. Node expansion of storage resources to increase the CRU staking limit will not directly bring benefits back, this will weaken the node's willingness to expand. If the value of the token is due to the development of the storage market, the node's revenue in the storage market will drive it to increase storage resources. This design allows the supply of resources to change according to market demand, rather than simply relying on the increase in token prices.

After passing through the block reward period, the inflation rate of the token in the Crust network will remain at 2.8%, a stable perpetual Inflation rate. The specific design is described above. The inflation rate has a strong relationship with the staking rate of the entire network. For the Staking rate, our expected short-term target is 60%-80%, about 30%-60% in the medium and long term. Because the security of the network will decrease rapidly after being lower than 30%, when the effective staking rate of the whole network is lower than 30%, there will be a income compensation to staking.

Compensation for inflation rate ：

$$\left(1-\frac{\mathrm{Sr}}{0.3}\right)\times 0.08$$

The average rate of return for effective staking excluding hardware cost is:

$$\mathrm{r}=\frac{\mathrm{In}+\left(1-\frac{\mathrm{Sr}}{0.3}\right)\times 0.08}{\mathrm{Sr}}$$

*Sr: effective staking rate of the entire network

*In: designed inflation

*r: the average rate of return for staking

The rate of return for long term is as follows:

Due to the uncertainty of the level of network participation in the early stages, the income compensation mechanism will be postponed for a few years, and the specific time will be decided by the council.

In the Crust system, the CRU staked at the node can come from the node itself or can be by the guarantor. We further analyze the return on investment of participating in the network as a node runner or guarantor:

We define the ROI (Return On Investment) of the validators as:

$$ROI=\frac{Rv+Re+Rs-Fg-Fs}{C\_node+Cm+Vcru}$$

*C_node: The hardware cost invested for the node to participate in the network

*C_m: Hardware maintenance cost for the node

*V_cru: CRU value of node own staking

*R_v: Block generation reward (which includes transaction fees and block points included in the block)

*R_e: Reward distribution of each cycle of blockchain

*R_s: Storage Market Revenue

*F_g: The guarantee fee paid by the node to the guarantor

*F_s: The cost of the node being confiscated

Compared with the validators, the candidates do not have the job of generating blocks, so it does not have to bear the penalty risk of generating blocks and enjoy the R_v income. The asset cost categories invested by the node runners include hardware equipment, power costs, labor costs, site costs, and CRU token assets; revenue includes CRU tokens and the various types of assets that can be independently determined in the trading market, which are mainly divided into fiat currency-denominated assets and CRU token assets. Since

storage resources have independent trading markets, their ROI can be separately calculated as:

$$ROI = \frac{Rs}{C_{\_node} + Cm}$$

Compared with the existing cloud storage vendors, the ROI of storage resources will ultimately be determined by the market. Considering that the storage market is not perfect early in the system, R_s should be small. Therefore, the Crust system has designed a higher R_e to protect the node's revenue, and R_e will gradually decrease as the system grows. After R_e is reduced to a stable ratio, the node has an independent ROI calculation through the staked CRU token, where the validator is:

$$ROI = \frac{Rv + Re - Fg - Fs}{Vg + Vcru}$$

*V_g: CRU value guaranteed by the guarantor for the node

The candidate's ROI is:

$$ROI = \frac{Re - Fg}{Vg + Vcru}$$

The staking ROI between the validator and the candidate is closely related to the average staking rate r of the entire network. Because the inflation of the system accounts for a large proportion of the node's revenue. When the proportion of handling fees and income in the trading market increases, the ROI can be significantly improved.

If do not consider the cost of being confiscated, the guarantor's ROI is:

$$ROI = \frac{Fg}{Vg}$$

As the guarantor 's investment with CRU tokens, the income is also CRU tokens. When the asset variety is the same and the investment return rate is measured in CRU tokens, the rate of return will be determined by the market. The rate of return can refer to that of the entrusted voters in the Cosmos and Tezos projects.

5.2 Gas Fee Composition

In the blockchain network, the typical resources and the corresponding fees are designed as follows:

Limited block size, it charges gas fees by calculating the number of bytes occupied by each transaction;

The limited generation time of the block, the time consumed by different transactions can be obtained by calculation or performance test;

On-chain storage resources usually have two modes of one-time payment and leasing. The one-time payment occurs during processing transaction and it evaluates this fee during development. The leasing model also considers the length of time that a transaction occupies on the chain, and will clear the corresponding state after the timeout.

In the design of the Crust system, the gas fee is composed of the following parts:

Total gas fee = basic fee + (byte fee + weight fee) × (1 + dynamic adjustment rate) + tip

The basic fee is the fee to be paid for each transaction; byte cost = cost per byte × number of bytes. The system will give an initial cost configuration, which can be updated as

the system upgrades. The dynamic adjustment rate is a rate adjusted according to the proportion of block resource usage. When the utilization rate of network resources is high, transaction fees will increase; when the utilization rate of network resources is low, transaction fees will be reduced. Tipping is a fee determined by the sender of the transaction. When the network is particularly congested, tips can be added to give priority to packaging transactions.

The basic fee will be directly burned, and other fees will be paid to the nodes that package the block. The basic cost of burning will allow the tokens in the system to enter deflation.

The work report generated by the MPoW mechanism in the Crust network is submitted to the network as a special type of transaction. We allow nodes to lock CRU to obtain the fee reduction for this type of special transaction.

In addition, the clearer described in Section 6.1.2 below can also lock CRU to obtain service fee compensation for the settlement of storage order.

5.3 Penalty Mechanism

The staking module of Crust Network has a slashing mechanism for validators. The network will check validators at the end of each cycle, When it detects that the validator is offline or attacked the network maliciously, the punishment mechanism will be triggered and the slash amount will be calculated. Penalties include the effective staking token deduction and the removal of the verifier's identity.

The amount of assets slashed as a result of a dropped line is the maximum slash ratio occurring in a cycle multiplied by the number of CRU token for validator's staking. Formula X of slash ratio is:

$$x = \mathrm{Min}\{\frac{3 \times \mathrm{Max}\left[k - \left(\frac{n}{10} + 1\right), 0\right]}{n}, 1\} \times 0.07$$

*k: Number of offline validator nodes

*n: Total number of validators

The slashed assets will be transferred to Treasury account. If they are not returned to the validator through the appeal within a certain period of time, the system will burn these assets by default. As a guarantor, when the validator of the guarantee is slashed, the guarantee amount of the guarantor will be slashed accordingly.

6. Trading Market

The first phase of Crust will complete the storage resource market, allowing storage resource providers and storage resource users to trade in this market, and will further introduce the computing resource market in the future.

6.1 Storage Resource Market

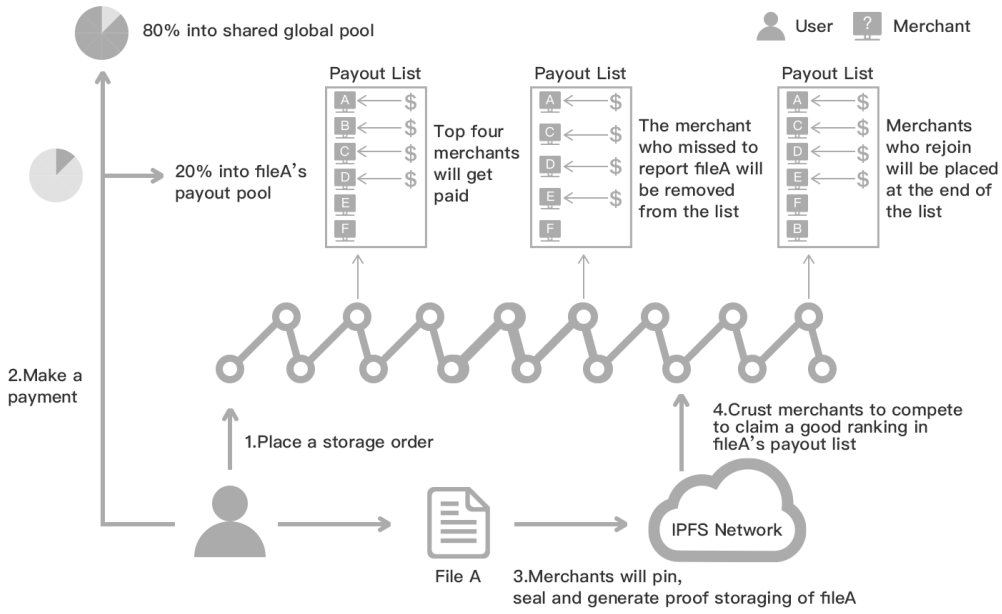
There are two kinds of service in storage market: file storage service and file retrieval service. In the storage resource market, storage resource providers serve as merchants in the Crust network, including validators and candidates; storage resource users are users with data storage and retrieval demands, including users of Web2 centralized cloud storage, and users with big data storage need in the Web3 ecosystem decentralized network.

To meet storage service requirements, resource providers need to be online 24/7. We have designed corresponding mechanisms in the network access protocols for validators and candidates and put forward further requirements for merchants being online in the storage market.

6.1.1 File Storage Service

In the Crust network, when users want to store files, they need to pay the fees calculated according to the system's pricing formula, and at the same time broadcast storage orders to the entire network. The order contains the basic information of the file, and will be submitted to the blockchain. The basic information includes the file hash, the size of the file, etc. After the merchants in the network receive the broadcast order information, they can search for the corresponding file in the IPFS network, download it and save it on the merchant's node server. When a merchant submits the storage proof of the saved file to the blockchain, the user's storage order becomes effective. In order to ensure that a merchant can search for the files, users need to upload the files.

After the user's storage order comes into effect, the user's payment to the network is divided into two parts, 80% of which is paid to the reward pool of the entire network for distribution to nodes that provide CRU token staking; 20% is paid to the reward pool of the stored file, which is used to distribute to the merchants who provide the storage proof of the file. The distribution rules for the 80% reward pool are as same as the node staking reward rules; the part used for distribution to the storage merchants will be distributed according to the order of the merchants. The storage market process and principle are as follows:



The queuing order of merchants is based on the time when the merchant submits the file storage proof, that is, whoever submits the proof first has priority. In each spot check period, if a merchant cannot submit a storage proof, it will be kicked out of the queue immediately. When it submits the proof again, it will be placed at the back of the queue according to the principle of time priority.

The reward for distribution to merchants will only be distributed to a certain number of merchants in the queue. The default initial number of distributors in the Crust network is 4, and users can choose to increase the number. The maximum number is 10. Since merchants who cannot submit storage proofs will be kicked out of the queue, the system ensures that rewards are distributed to high-quality storage merchants through this screening mechanism.

When a merchant stores multiple files, each file will be allocated rewards on a periodic basis. When the merchant submits a claim request, the rewards will be transferred to the merchant's account; when the merchant has not claimed it, the rewards will always accumulate in its distribution pool. Storage merchants also need to provide collatoral, which is the CRU mortgaged by the merchant, and the minimum value is 10cru. The amount of the collatoral must be greater than 10 times of the rewards distribution pool before the system will continue to distribute rewards to it, otherwise the system will distribute the rewards to the next merchant in the merchant queue, but it does not affect the merchant's queuing order, this is, when the merchant makes up the collatoral in the next distribution cycle, it can still receive rewards in the order in which it is located.

The files stored locally by storage merchants are divided into two categories. The first category is the documents that can obtain the reward distribution; the second category is the documents that cannot be rewarded in the order in which the storage proof is submitted. The second type of file can become the first type of file at any time because of the advance of its sorting.

10% of the user's payment to the network will be sent to the market revenue pool account, and 8% of this payment can be reduced proportionally based on the number of CSM tokens locked by the user, 2% of this payment can be allocated to the merchant in proportion to the number of CSM tokens locked by the merchant

The pricing formula for the storage market:

Storage cost = basic fee + dynamic adjustment rate A* on-chain state weighting fee + dynamic adjustment rate B × byte weighting fee × file size + tips

Basic fee: The basic cost of a file order,determined by the throughput of the storage market. If the throughput is bad, the basic fee will rise; otherwise, the the basic fee will fall.

Dynamic adjustment rate A: a coefficients that are dynamically adjusted based on on-chain state usage.

On-chain state weighting fee: Fees charged based on on-chain state usage.

Dynamic adjustment rate B: a coefficient dynamically adjusted according to the storage space usage in the network.

Byte weight fee: weight fee charged according to the number of bytes of the file.

Tips: The additional fees that users are willing to pay to increase their willingness to accept orders by merchants

The dynamic adjustment rate mechanism is a coefficient adjusted according to the storage resource usage of the entire network, and the initial value is 1. The storage resource utilization rate of the entire network is the ratio of the capacity of paid order files to the total verifiable capacity of the entire network,

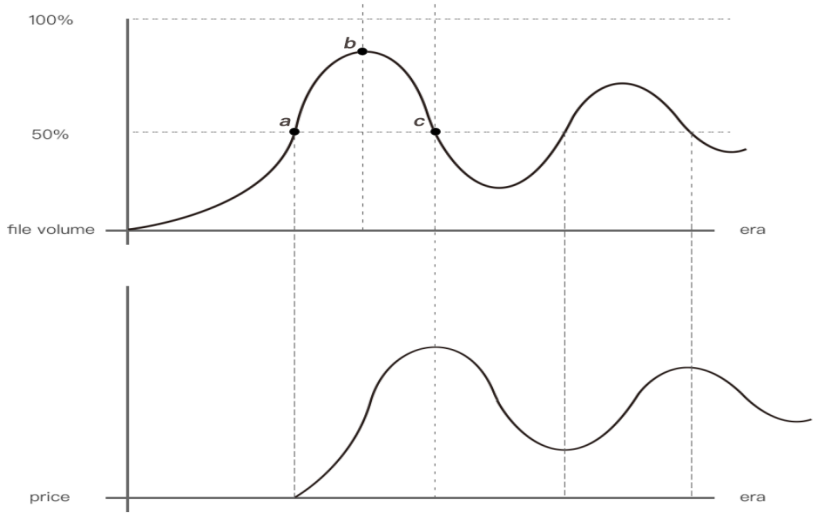
When resource utilization rate>=50%, every 600 blocks(about 1 hour), if there is a storage order, the dynamic adjustment rate B*1.003.

When the resource utilization rate is less than 50%, every 600 blocks, if there is a storage order, the dynamic adjustment rate B*0.997.

When the on-chain state utilization rate >=50%, every 600 blocks, if there is a storage order, the dynamic adjustment rate A*1.003.

When the on-chain state utilization rate is less than 50%, every 600 blocks, if there is a storage order, the dynamic adjustment rate A*0.997.

Under this dynamic adjustment rate mechanism, the relationship between the storage resource utilization rate of the entire network and the file order price is as follows: (assuming that basic fees and tips are not considered)



The upper part of the chart represents the utilization rate of storage resources across the network, and the lower part of the chart represents the price of the order. At point a, when the file storage of the entire network accounts for 50% of the resources, the dynamic adjustment rate begins to increase exponentially, and the price begins to rise; when it reaches point b, because the price is too high, it limits the user's demand for use. The file storage capacity of the whole network begins to decline, but the price will still rise at this time; when it reaches point c, the data storage capacity of the whole network accounts for less than 50% of the resources, the dynamic adjustment rate begins to decrease in a negative direction, and the price begins to decrease . Through multiple cycles, the resource utilization rate of the system will fluctuate around 50%, and the price will oscillate within a price range acceptable to the market. The mechanism of on-chain state is similar.

6.1.2 File Order Renew and Settlement

After the user places an order and stores the file in Crust network, the file has an expiration date. If the user don't want the file to expire after that, user need to renew the file. Crust network has designed a renewal pool. Users can pre-charge CRU l to this renewal pool. At any time, other agents in the network (including users themselves) can use the funds in the renewal pool to renew files. When the file is still valid, there is no benefit from the agent's operation to renew the order. When the filet expires, the agent will receive the agent income when operating the renewal order.

After the user places an order and stores the file, the first 4 merchants who submit the storage proof can continue to obtain order revenue, and this revenue needs to be claimed before it can be collected by the merchant. The order selttement mechanism is a mechanism designed by Crust Network to better manage the file order system. Any Crust user can act as a clearer to settle unsettled orders in the network. When the settled order is an order that has expired, the clearer will receive the agent settlement income. The clearer can lock CRU to obtain the fee reduction for settlement transction.

6.1.3 File Retrieval Service

As a storage network, Crust does not only provide the function to store files, but also provide accessibility to that file in the most expedient manner possible. Therefore, another important function in the Crust network is the file retrieval service. The Crust network has an additional incentive as described in the technical whitepaper, to encourage merchants to provide retrieval services to users. In the current system design, such retrieval services are free. By providing retrieval services proactively, Merchants can get higher credit, and thus obtain data more effectly, which can increase its effective staking quota amount and receive more rewards distributed by the network.

6.2 Computing Resources Market

Crust Network will support the decentralized cloud computing in the future. Unlike the storage market, computing resource services generally do not support long-term staking assets, but users directly pay for computing services in the form of gas fees. The design of this trading market will be updated in subsequent versions.

6.3 Token Trading Market

To better serve all participants in the Crust network, a decentralized token trading market is provided in the Crust network. In this token trading market, multiple types of tokens can be exchanged with CRU. Because Crust is developed based on the Substrate framework of Polkadot ecology and will be connected to the Polkadot network in a parallel chain, it can easily accept the exchange of other types of tokens and CRU in the ecology.

In the above, we mentioned that the participating users in the storage market include Web2 centralized cloud storage users and users in the Web3 ecosystem who have decentralized big data storage demands. Traditional Web2 users as consumers will prefer to use currency with stable value to purchase storage services, such as stable coins; Web3 ecological users can also easily use their project tokens to purchase storage services. The nodes that provide storage resources can also choose the assets they are willing to accept to price the service. When the assets paid by the user are different from the assets accepted by the node, the token trading market can provide real-time token transactions and only need to pay a certain fee.

7. On-Chain Governance

Crust uses Substrate technology to build an on-chain governance mechanism. The main applications related to the economy are the processing of funds in the Treasury account, as well as possible future proposals for system improvements. When the network is running, nodes may be confiscated for some reason. This operation may be misjudged

because of the imperfect network. We hope to correct such an error through a channel. The voting function of on-chain governance allows CRU token holders to participate in the construction of the network. The on-chain governance mechanism is still under development.

8. References

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