



Token Design Specification v0.5
06 December 2019

Note to the reader: This document is not meant to be a standalone description of The Centrifuge Operating System. If you do not have any prior understanding of Centrifuge, please consider starting with [The Centrifuge Protocol Paper](#) and our [Blog](#).

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1. Introduction

1.1. Our Vision

The Financial Supply Chain¹ is disconnected. Participants barely communicate, and when they do, it is often through rent-seeking third parties. The vision of Centrifuge is to bring those counterparties closer together by creating a *Global Business Graph*: a worldwide network of buyer-supplier relationships together with relevant stakeholders of the supply chain. By joining and using Centrifuge, all participants can contribute to the *Global Business Graph*; which, when fully utilized, will enable a new generation of applications for Decentralized Finance.

Centrifuge changes the way the financial supply chain operates. It connects businesses globally by enabling them to exchange financial documents - such as invoices, purchase orders, and company data - in a private, secure, and verifiable way; while providing an unalterable and single source of truth for all involved parties. We open up silos and enable any business, no matter how big, to transact on a global network while maintaining ownership of their data.

The value proposition of the Centrifuge Protocol is the ability to utilize these features to access new types of financial services built on top of Centrifuge, such as instant financing of real-world assets,² like receivables, music royalties,³ or real estate⁴ - with open access on both sides. Anyone can join and use Centrifuge. Ultimately, the *Global Business Graph* will enable applications such as deep-tier finance⁵, allowing the entire financial supply chain to benefit from the financial strength of large buyers. Our vision is to change the rules of global trade to foster economic opportunity everywhere.

1.2. The Centrifuge Approach

The Centrifuge Protocol currently implements a hybrid structure; combining a peer to peer (P2P) network for private document and data exchange directly between users, with smart contracts based on the public Ethereum blockchain.

¹ As opposed to the flows of goods or services within the *physical* supply chain, the *Financial Supply Chain* in our context means the parallel and reverse flow of information, data, and money.

² [Centrifuge Tinlake: Adding Real-World Assets to MCD](#)

³ [Centrifuge Tinlake and Paperchain join forces to accelerate music streaming revenues](#)

⁴ [Tinlake goes live with more than \\$180k in financing](#)

⁵ The transfer of liquidity access from large corporations down to its suppliers. [Deep Tier Financing: Supply Chain Finance for the Global 200 Million](#)

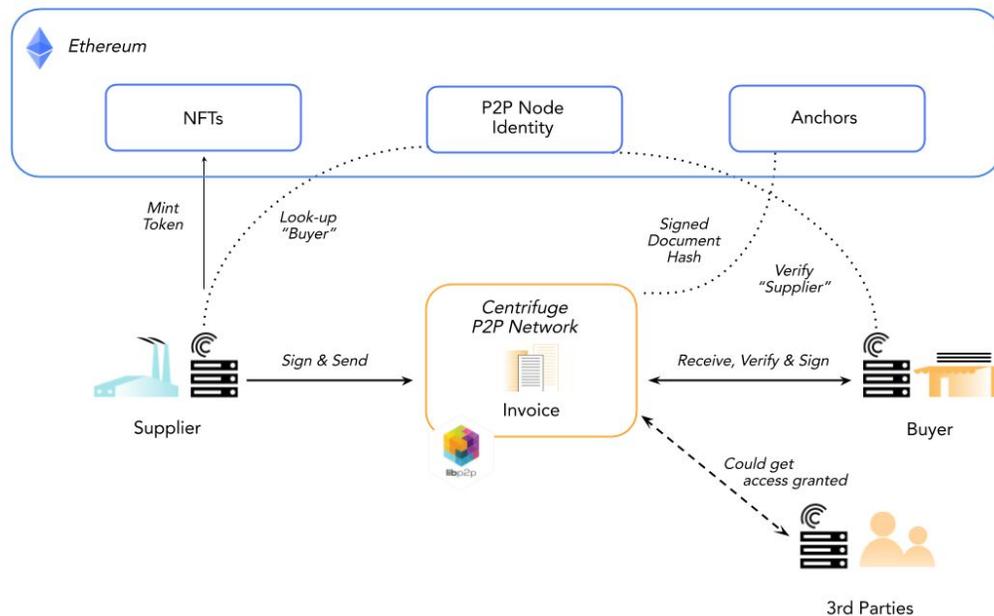


Figure 1 - Centrifuge as it exists today

Centrifuge is building its own, Substrate-based⁶ blockchain, Centrifuge Chain, to optimize specifically for the transactions required by the Centrifuge Protocol. This achieves a much more efficient execution of these transactions and allows for targeted use-cases like privacy-preserving NFTs.⁷ We are building Centrifuge Chain to hold the shared truth of off-chain assets with an initial bridge to Ethereum, and are looking forward to a future of many, connected blockchains.⁸

Through this structure, Centrifuge provides users with the features of digital identity, immutable and auditable data ownership, and the ability to create and transfer standard business documents. These features together enable a new type of financial business document: combining standards for non-fungible tokens (NFTs) with private off-chain business data to create unique, tradable assets we call Business NFTs.⁹

In the world of the Financial Supply Chain, most documents already have a digital representation today. However, the problems of duplication, verification of document authenticity, or tracking of ownership are very real challenges. Through their tokenization as Business NFTs, the assignment of the documents to other parties - knowing who should receive the money when an invoice finally gets paid - becomes possible. As a result, any existing lending platform that supports NFTs as assets can be used to gain liquidity for unpaid invoices.

⁶ [Substrate](#) is a framework created by Parity to create custom blockchains.

⁷ [Centrifuge Privacy Preserving NFTs](#)

⁸ A more detailed explanation of the Centrifuge Protocol architecture can be found in our [Developer Documentation](#).

⁹ [Financial Business Documents As Tokens On Decentralized Networks](#); Combining standards for non-fungible-tokens with private off-chain business data to create unique tradable assets on decentralized networks.

Payment obligations can easily turn into tradable assets on exchanges. This allows Centrifuge users to access liquidity for previously illiquid assets in a completely decentralized way.

2. The Centrifuge Token Model

The Centrifuge Token Model powers the Centrifuge Protocol, providing the framework needed to run the platform without reliance on a centralized third party, including Centrifuge, and to accelerate its utility. To accomplish this, Centrifuge leverages the cryptoeconomic primitives of a native token called “Radial,” a Proof-of-Stake consensus algorithm that employs Radial to stake value, and an on-chain governance mechanism that empowers Radial holders to guide the development of Centrifuge. As a result, business documents become *unstoppable* through their digital representation as non-fungible tokens (NFTs)¹⁰: documents have long-term verifiability, censorship resistance, and independence from centralized storage and processing.¹¹ All users retain full sovereignty over their data, and are able to share information with specific business partners or applications of their choosing.

For performing the critical functions of the network, delegation of services, and governance, users of Centrifuge have incentives to participate in the network. As a result, the users of Centrifuge are empowered to operate, control, and gain value from the platform.

2.1. The Prime Objective

The objective of the Centrifuge Token Model is to support and secure the use of Centrifuge without relying on a centralized third party. To accomplish this objective, the platform requires staking for, and incentivizes a distributed network of Validators for the Centrifuge Proof of Stake (PoS) Chain to:

- Mint blocks: Perform immediate, secure validation of transactions.¹²
- Perform public clock-keeping and anchoring of the state of the off-chain document exchange to Centrifuge Chain

Half of the total supply of Radial will be used to directly incentivize the prime objective, in the form of rewards to Validators and other entities that perform work for the Centrifuge network.

As a result of the objectives of the Centrifuge Token Model, Radial will be principally a staking token¹³ - used to stake value as a security margin for the right to perform critical network functions. Additionally, a core objective of the Token Model will be to provide a governance

¹⁰ [Ethereum standard for non-fungible tokens \(NFTs\)](#)

¹¹ The reader will note two types of tokens being used: the native network token, Radial, and NFTs which represent individual, unique business documents.

¹² Transactions may include the anchoring of document state, creation of a Business Identity, minting of an NFT, and other high-frequency, public interactions with Centrifuge.

¹³ Examples of staking tokens include Cosmos Atoms, Polkadot Dots, Livepeer LPT, and Tezos tez. Also referred to as “work tokens,” the defining feature being that tokens are bonded for a defined period of time which gives the stake holder the right to do work on the platform to be eligible to receive rewards and/or charge fees.

structure that allows users of Centrifuge to make decisions about its development as well as network parameters.¹⁴

The utility of Centrifuge drives businesses, networks, and services to use the platform.¹⁵ The token model, captured in Radial, secures Centrifuge OS and incentivizes a distributed network of agents. The Radial token model creates an additional incentive on top of fees¹⁶ for entities to perform critical network functions, and to perform them early on. The more utility and participation in the network, the stronger the desire to participate in governance of the platform by the businesses, networks, and services who use Centrifuge as well as the entities that perform critical network functions. These entities and personas are not mutually exclusive.

2.2. Entities and Interactions

Centrifuge consists of a peer-to-peer (P2P) network that exchanges private data between users, who participate directly by running an Operating Node.¹⁷ The state and result of modifications of those P2P messages is then anchored to Centrifuge Chain by Validators. Radial holders that do not wish to run Validators themselves may optionally delegate their stake towards other Validators. Centrifuge Chain is implemented within an open and decentralized setup.

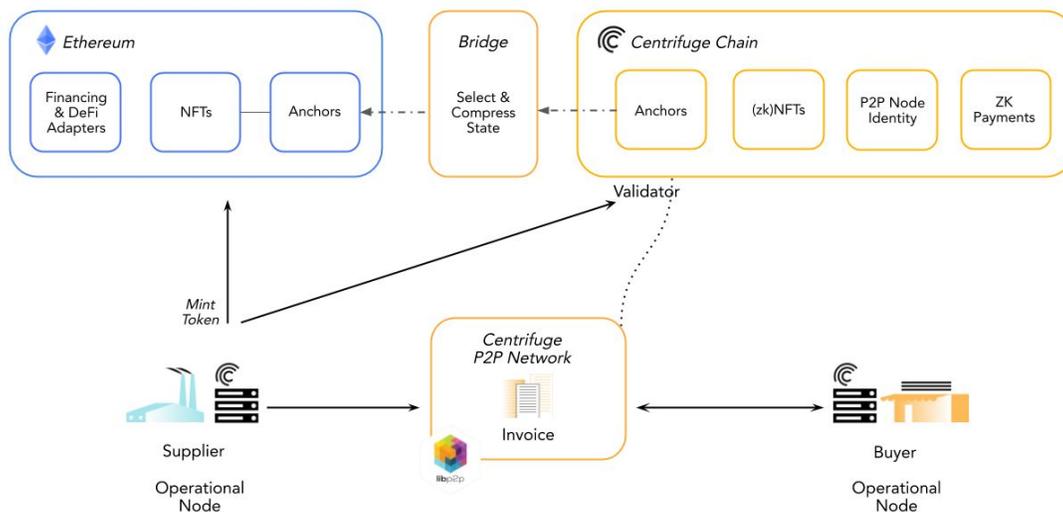


Figure 2 - General Interactions of Entities and Personas Using Centrifuge

¹⁴ Examples of tokens used in governance include the Zeppelin ZEP vouching proposal, Decred tickets purchased with DCR, Dfinity proposals purchased with DFINITIES, and Aragon upgrade proposals voted on by ANT holders.

¹⁵ Importantly, there is no additional token-based incentive used to drive businesses to use the platform.

¹⁶ The incentives are in the form of rewards in the Radial token and serve to bootstrap the network. These rewards are distinct and separate from fees that workers charge users.

¹⁷ A more detailed explanation can be found in The Centrifuge Protocol Paper.

| Entity | Main Function | Run a Node | Stake Radial | Receive Rewards | Receive Fees ¹⁸ |
|--------------------------|---|------------|--------------|-----------------|----------------------------|
| Operational Nodes | Send, receive, and validate their own off-chain, private business documents within the P2P network | ✓ | | | Pay Fees |
| Validators | Securely validate transactions, propose blocks, and anchor the state of the off-chain documents to Centrifuge Chain | ✓ | ✓ | ✓ | ✓ |
| Delegators | Radial holders who delegate their tokens to Validators, and thereby curate Validators, to be eligible for rewards | | ✓ | ✓ | |

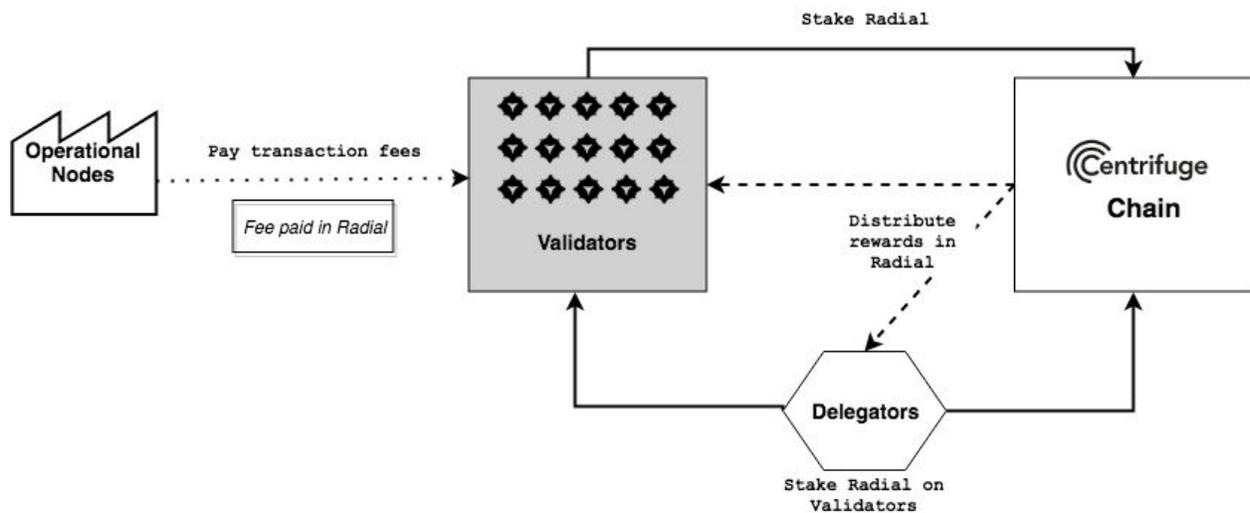


Figure 3 - Token Flow Between Entities

¹⁸ Initially, fees will be paid in Radial. Requirements for the token to be used for fees are detailed in section 3.1.3

3. Centrifuge Architecture

Centrifuge will use a Proof-of-Stake consensus mechanism to allocate the rights of transaction validation and block creation of Centrifuge Chain to Validators. Initially, this mechanism will comprise the standard Substrate module: the nominated-proof-of-stake (NPoS) Validator selection algorithm, BABE for block production, and GRANDPA for finality.¹⁹

3.1. Centrifuge Chain

The main purpose of Centrifuge Chain is to provide the public, immutable ledger that holds the anchors of P2P message document state, NFTs representing any off-chain/P2P document, and Centrifuge user's identities. The Substrate Runtime logic will define how entities can participate as Validators. First, Validators will be selected to participate in a set number of block-proposal rounds comprising an Era. The NPoS selection algorithm will support N number of active Validators each Era, selecting those Validators with the largest stake.²⁰ Blocks will be committed to Centrifuge Chain using BABE to determine the Validator to produce the new block on the chain that has been finalized by GRANDPA. BABE randomly assigns one Validator from the set of N active Validators to propose the block. The block is finalized when a $\frac{2}{3}$ majority (by weight) of the set of N active Validators attest to the chain containing that block. Any user can monitor this public chain for transactions being included in blocks, which means new document anchors being published, NFTs being minted, or identities being created or modified.

3.1.1. Validators

Validators must stake a minimum number of Radial tokens for the opportunity to propose blocks on Centrifuge Chain. The Runtime logic will select N Validators with the most bonded stake at the start of each selection-round (an "Era"). For each block in a given Era, one Validator will be randomly assigned to propose it. In return for this work, Validators are eligible for block rewards in Radial and additionally can charge a transaction fee to users.

Radial holders who do not wish to perform this work themselves may optionally delegate their stake towards Validators in order to participate in the block rewards collected by Validators. Validators will have the opportunity to attract bonded stake from Delegators by offering a favorable share of rewards to Delegators. After the Validator takes their share, block rewards will be distributed to Delegators in proportion to their relative stake. Misbehavior²¹ will be punished by way of slashing; and those Validators and Delegators forfeit their bonded stake.

¹⁹ Governance could decide to modify or upgrade the consensus mechanism. More detail on how this works in Polkadot can be found [here](#).

²⁰ This includes both the stake of the Validator itself and stake Delegated towards this Validator.

²¹ Misbehavior includes deliberate attacks, running modified software, severe bugs in the code, and unresponsiveness, to name just a few slashing conditions.

3.1.2. Network Rewards

Centrifuge will leverage rewards, distributed in Radial, to incentivize early participation of Validators as well as to fund the continued development of the Centrifuge Protocol. At the end of each Era, rewards will be generated according to the Runtime logic²² and distributed to those staked Validators and Delegators who have participated in that Era. The Validator rewards incentivize work to support and secure the use of Centrifuge.²³

Network Rewards will be inflationary until the limit of Radial network reward supply is reached – after which no further Radial will be created and incentives will persist in the form of fees only. The largest benefit to the network will come from incentivizing early participation of Validators by distributing a larger proportion of the rewards early on. An indication of how this may be implemented can be found in *Figure 4*. Network Rewards will be distributed in Radial in order to reward Validators with the increased ability to do work on the platform, increased ability to govern the development of the Protocol, as well as an incentive to continue performing work.

3.1.3. Network Fees

In exchange for doing work, Validators can charge fees to users of Centrifuge. Validators will be able to charge this fee on a per transaction basis similar to gas on other blockchains. At the launch of the network, fees will be minimal,²⁴ and Validators will be primarily motivated through rewards. Over time, Validators will move away from incentivisation through rewards to being primarily incentivized through fees and eventually will be entirely incentivized through fees. Validators would likely use these fees to pay for their operation costs long-term. *Figure 4* below demonstrates how the fees in the network (shown as “Network Fee”) may adjust over time in relation to the Network Reward.

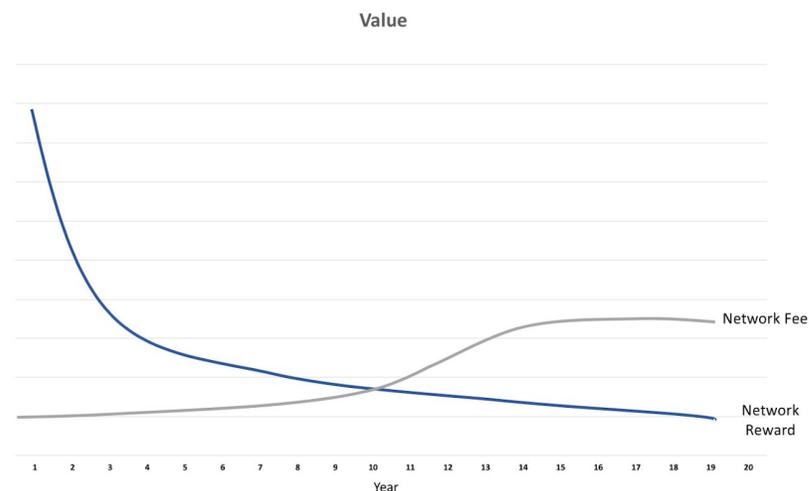


Figure 4 - The Potential Effect of Network Rewards on Fees

²² Initially, the standard Runtime logic will be used to increase minted rewards until a “target bonded” percentage of tokens is reached. This does not exclude the possibility of changes to this model through Governance.

²³ In the future, rewards may also be used to incentivize other types of work for the Centrifuge Network.

²⁴ The fee will not start at 0 in order to prevent spam and to allow users to easily transition into using network fees.

4. Network Security

The Token Model is designed to incentivize a distributed and secure network of Validators with no central point of control or failure.

4.1. Radial

The bonded stake of Validators will serve as a security deposit to prevent misbehavior such as performing work incorrectly and/or gaming rewards, for which these entities forfeit their stake. Network fees incentivize Validators to perform the desired work, and serve to prevent attacks on the network. By requiring a fee for each transaction, it will make flooding the platform with transactions costly; and thus Centrifuge Chain will be less vulnerable to an attack.

At this point, it is still being explored how the bridge to Ethereum will be handled within Centrifuge, as most transactions can occur on Centrifuge Chain initially. However, it will be important to bridge Centrifuge Chain state to Ethereum in order to make NFTs and other information available to the ecosystem of DApps on Ethereum.

4.2. Attack Vectors, Considerations, And Remediations

4.2.1. Validators

- Validator proposes bad/wrong blocks
 - Slash stake. Next validator will propose another block.
- General security notes
 - Block withholding.
- Syndicate building (early validators have most Radial to stake - will get most rewards later on)
 - Is quite possible and no mitigation in place here other than making sure to onboard initial validators judiciously by distributing tokens widely and to “good parties”. Initial token distribution mechanisms will be critically important.

5. Token Supply Distribution

The following section is a rough draft of a potential token supply distribution. The entities discussed and their percentage allocations are not definitive and subject to change substantially in the final distribution.

The Radial Token Generation Event (TGE) will be executed by the Centrifuge Network Foundation. The initial distribution will create 40% of the total supply of Radial, which will be distributed to the relevant addresses as detailed below. Half of the total supply of Radial will be created as Network Rewards and 10% will be created and allocated to the Centrifuge Development Fund as an ongoing supply of tokens until the limit of Radial token supply is reached.

5.1. Initial Distribution 40%

Initial Contributors 20%

This allocation will be used for the compensation of the initial contributors to the Centrifuge Protocol: the founders, the Centrifuge development team, advisers, and investors.

Centrifuge Network Foundation 20%

This allocation will be used to bootstrap and build the Centrifuge network. The use of funds can include payment for development of Centrifuge, incentives for the community to support the growth of the network, raising funds in the future, and to serve as a means to distribute the token across a wide range of users (token distribution mechanisms). This can include, for example, running a Centrifuge node, providing additional incentives for users to join the network, grants to run Validator nodes, or incentives for DApps to build on Centrifuge.

5.2. After the Token Generation Event 60%

Centrifuge Development Fund 10%

The purpose of this pool of funds is to support and finance the continued, long-term development of the Centrifuge Protocol, in control of token holders. In its ideal form, this fund will exist as a DAO.²⁵ The use of funds can include bounties for development and projects leveraging the Centrifuge Protocol.

Network and Global Graph Rewards 50%

Half of the total supply of Radial will be reserved as incentives for Validators and entities that perform work for the Centrifuge network.²⁶ Network Rewards will incentivize Validators to perform work and Delegators to perform the work of curating Validators and providing value at stake. These rewards will encourage early participation and serve to support and secure the use of the Centrifuge Protocol.

²⁵ This is not definitive and is heavily dependent on our ongoing governance research and advances in DAO structures and governance mechanisms.

²⁶ Rewards may also be used to incentivize other critical work for the network in the future.