NERVE

White Paper

Table of Contents

Abstract

NerveNetwork is a decentralized digital asset service network and a blockchain cross-chain interaction protocol based on NULS microservice framework and developed with NULS ChainBox. It aims to break the Isolated value island of the blockchain, establish a network that is suitable for multichain assets to interacte , and provide all the necessary underlying support for the Defi application ecosystem. Let every digital asset holder enjoys truly secure, free and transparent Defi application services.

1. Background

Bitcoin has grown to trillions of market value, surpassing the market value of many countries' sovereign currencies. In the inevitable process of the development history of blockchain, various public chains are also emerging one after another. There are more and more public chains, but each blockchain is an independent closed loop, of which the application can only be used with the chain assets. Assets on the chain have become isolated value islands, and some breakthrough Defi scenarios can't give full play to their value due to the limitation of the local token on the chain, thus the blockchain, an emerging industry, can't gather strength to make further breakthroughs.

People's pursuit of freedom has never stopped and the DeFi applications allow humans for the first time to fully enjoy the asset services that everyone should have. NerveNetwork aims to realize this vision, creating a value world of multi-asset interaction and discussing the universal cross-chain protocol for value exchange with various communities to provide better support for the birth of large-scale Defi applications, and gathering industry strength to make continuous breakthroughs

on DeFi to achieve the goal of serving all mankind.

2. The objetive of NerveNetwork

Developing a general cross-chain interaction protocol. Through the standard protocol conversion layer of NerveNetwork, we can match the general interface standard for development, access more mainstream digital assets, and form a general cross-chain interaction protocol. By following the general interface standard to develop a module and through the verification and upgrading of virtual bank and consensus node, you can load the cross-chain interaction protocol of NerveNetwork.

Providing a new intelligent lightning network for mainstream digital assets such as BTC. Bitcoin has a long confirmation time and a high transfer fee. Through NerveNetwork, you can initiate a fast transaction with low handling fee , and it can realize second level confirmation on NerveNetwork. Most mainstream digital assets such as BTC do not have smart contracts, thus decentralized mortgage lending, decentralized exchange and other Defi applications cannot be directly implemented in their chains. While more application scenarios or ecosystem can be easily realized

through NerveNetwork.

Opening the blockchain closed-loop of mainstream digital assets and enabling quick transfer to each blockchain of the NULS ecosystem. Any blockchain is like a local area network (LAN). The assets on the chain can only circulate in the closed-loop. NULS is an infrastructure for building the blockchain and the blockchain built through NULS modules can realize asset circulation, with the only need to configure cross-chain modules. The goal of NerveNetwork is to connect LANs of other network with different structure types, such as BTC/ETH, etc.

The multi-asset, open and transparent value interaction platform provides the underlying support for the Defi application ecosystem. We store digital assets such as BTC into centralized platforms, such as exchanges, centralized financial wallets, etc., and then they can arbitrarily misappropriate your assets. These platforms are black boxes that cannot ensure the safety of your assets. While in NerveNetwork, you can build an asset trading platform, where all data is open and transparent. Your assets are controlled by multiple signatures through cross-chain virtual banks to

ensure the security of assets.

3. What is NerveNetwork

NerveNetwork is a decentralized network of digital asset services and a blockchain cross-chain interaction protocol based on NULS microservice framework and developed with NULS ChainBox. It aims to break the isolated value island of the blockchain, establish a cross-chain asset interaction network, and provide all the necessary underlying support for the Defi application ecology. Let every digital asset holder enjoys the real security, freedom, and transparency of the Defi application services.

Through the NerveNetwork cross-chain interaction protocol, only a small amount of development is needed through the standard interface, and then the blockchain with different structures can be transformed into a set of common asset types that can be identified by the cross-chain modules in the NULS ecosystem. In this way, we can achieve the asset interaction inside and outside of the NULS ecosystem, and provide rich Defi scenarios for mainstream digital assets such as BTC.

4. Technical Design of NerveNetwork

(1) The bottom layer of blockchain

NerveNetwork is built based on the NULS ChainBox development framework, . ChainBox is a tool to build a blockchain quickly. It encapsulates six underlying modules of ledger, account, transaction, block, consensus, and network and shields complex blockchain technologies such as distributed data storage, peer-to-peer transmission, consensus mechanism, and encryption algorithm. Developers can use it to build a basic chain in minutes, or develop business modules according to the standard communication protocol and then form a new application chain driven by ChainBox.

Account	Network	Ledger	Block	Transaction	CrossChain	POCBFT Consensus	Interface protocol

Based on ChainBox, NerveNetwork has made the following optimization and expansion:

1. Adding the cross-chain module;

2. Replacing the consensus module POC in ChainBox with the

consensus module POCBFT;

3. Adding a protocol conversion module for communication with other blockchains.

NULS modular architecture based on microservice can lower the development threshold of blockchain and reduce the development and time cost of building the blockchain. Through the NULS cross-chain protocol, all the NULS ecological assets can be docked. In addition, NerveNetwork supports communication with other heterogeneous blockchains, thereby achieving extension of NULS ecosystem and self-value.

4. The NerveNetwork AMM and order book modules have been added to the NerveNetwork's underlying to support the decentralized AMM protocol and to match trading orders. This function also provides layer-2 network asset management and functional applications for NerveNetwork's crosschain assets.

(2) Consensus algorithm

NerveNetwork's consensus algorithm is implemented based on the POC (proof of credit) algorithm of NULS. POC is a safe, reasonable and fair consensus mechanism, which has

the advantages of DPOS and POS and achieves a good balance in decentralization and efficiency. NerveNetwork is a decentralized digital asset service network, which needs to provide the underlying support for massive applications and services in the future. There are very high requirements for performance and stability. Therefore, based on the POC consensus algorithm, NerveNetwork has designed an efficient and stable consensus algorithm POCBFT. POCBFT adds PBFT mechanism based on POC to realize the final confirmation of blocks and reduce the block time interval to the second level, which can enhances the user experience. Block confirmation is transaction confirmation, so the transaction will not be rolled back.
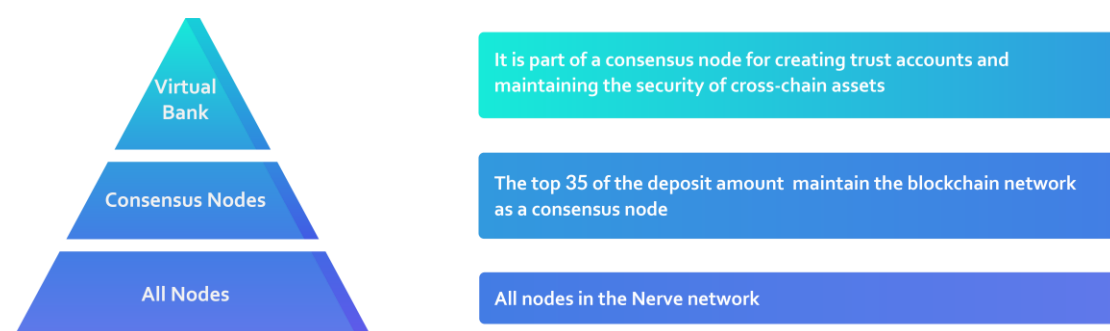
NerveNetwork consists of three layers:

1. Virtual bank: the virtual bank is responsible for the maintenance of cross-chain assets, including creating and

managing multiple accounts or smart contracts in parallel chains, creating and broadcasting asset transferred out transactions, etc. The virtual bank is selected from the consensus nodes, and the 15 consensus nodes with the largest amount of deposit will be selected by default. The reward weight of a virtual bank is twice that of a common consensus nodes.

2. Consensus node: the consensus node is responsible for the maintenance of the blockchain. Consensus node can be created with deposit, which can' be less than 200,000 NVT and is not capped. The number of consensus nodes is fixed to 35, and the top 35 nodes by deposit are selected to maintain the entire Nerve network.

3. Common node: other nodes are responsible for transaction collection, block and transaction verification and providing services for applications, etc.

(3) Price feeding mechanism

Each consensus node must provide accurate price feeding procedures for the average price of multiple exchanges, Oracles or quotation agencies, similar to the index. The data provided to the system by the price feeding procedures

provided by the distributed consensus node to judge the weight is called the price feeding index.

The feeding index changes every day, and the change result is written into the block.

1. Eliminating 2 lowest and 2 highest feeding prices;

2. The average price of all remaining consensus nodes is submitted to the system as the weight basis.

Pledge and mortgage mining tokens according to accessed tokens , and distribute the weight according to the corresponding market value.
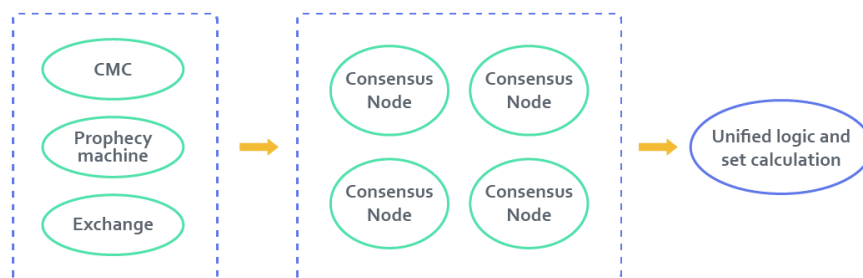
(4) Cross-chain interaction
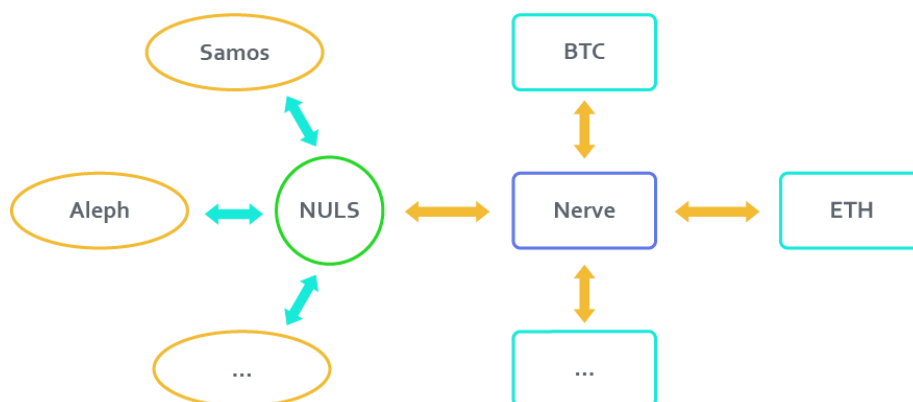
**NerveNetwork's cross-chain interaction is divided into two parts**

- NULS cross-chain ecological docking: realize the interaction of all blockchains in the NULS ecosystem based on the general NULS cross-chain protocol.

- For independent public chains such as Bitcoin, Ethereum and Binance chain, NerveNetwork defines a set of interface protocols, which can facilitate the interaction of different blockchains. The cross-chain interface protocol includes the following aspects:

  - address mapping

  - creating multi-signature addresses/creating smart contracts

  - transaction verification

  - transaction assembly

  - transaction broadcast

  - signature verification

  - additional signature

The architecture of cross-chain interaction protocol is designed as follows:

Every time a blockchain is docked, it needs to implement a set of interface protocol components for data interaction between

the two chains.

A certain number of virtual banks are selected from the consensus nodes to create and manage multi-signature addresses (smart contracts). Virtual banks are responsible for the verification of assets transfer in and execution of asset transfer out.
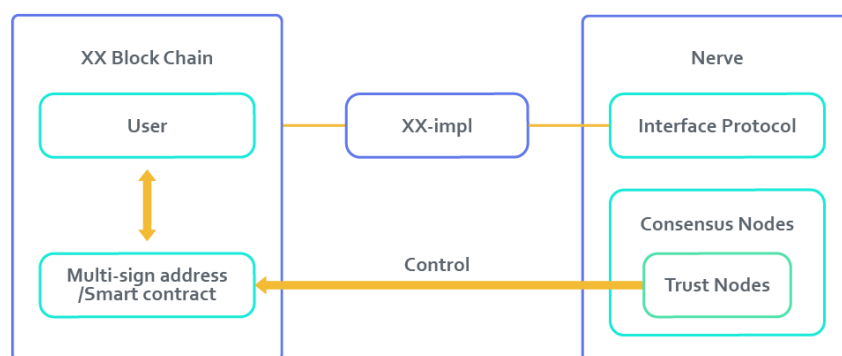

Taking BTC as an example, the cross-chain interaction process is as follows:

Transfer in cross-chain assets (deposit):

The user transfers BTC to the multi-signature account of the Bitcoin chain managed by the virtual bank, and fill in the remarks with his/her NerveNetwork address of Nerve-ADDR. The virtual bank of NerveNetwork monitors the transaction of the Bitcoin network, verifies the confirmation number, prevents the fork rollback attack, assembles a coin-creating transaction to the user's mapping address of Nerve-ADDR, and signs the transaction. Then it will broadcast the transaction, collect 66%

signatures from the virtual bank, pack the transaction into the block, and then update the ledger. After that, the user has BTC assets in the NerveNetwork ecosystem. The actual BTC assets on Bitcoin network are guaranteed not to be used by the virtual bank.
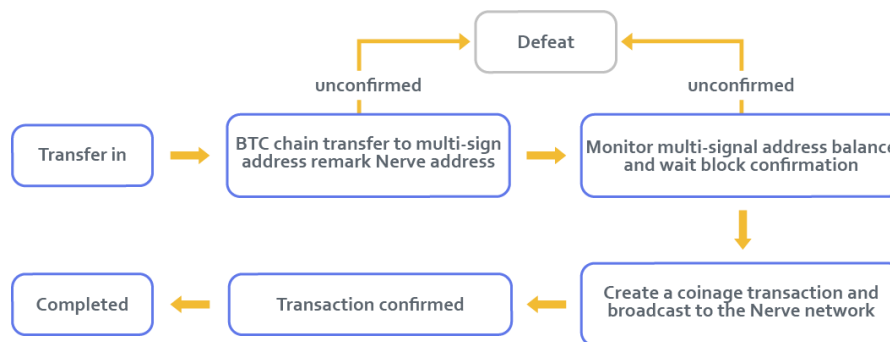
Transfer out cross-chain assets (withdrawal):

The user assembles the transfer-out transaction, with the target address of Bitcoin address of BTC-ADDR, signs and broadcasts the transaction. Once the consensus node receives the transaction, it will validate the transaction signature and pack the transaction into the block after approving. After the block is confirmed, each node assembles the multi-signature transaction, and broadcasts it to the Nerve network. When the number of signatures is sufficient, the transaction will be broadcast to the Bitcoin main network, and BTC will be transferred to the BTC-ADDR from the Bitcoin multi-signature account. After that, the transaction is

completed.
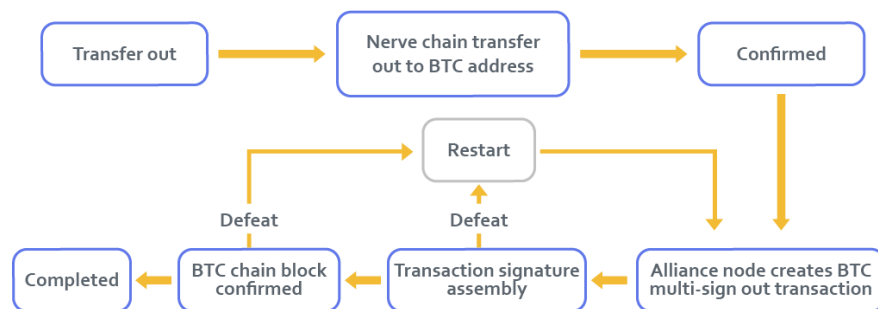
5. Application protocol module

AMM module

NerveNetwork supports two protocols, AMM Swap and Stable Swap. AMM protocol applies the k=x*y algorithm as its core mechanism. StableSwap enables multichain assets to be exchanged between different network with absolutely none slippage, which provides a great solution for various crosschain demands.

NerveNetwork order-book module

NerveNetwork use its order-book to match corresponding system trading orders. Through NerveNetwork, developers can create their own DEX and other related applications.

Staking module

Staking module enables developers to create a Staking pool in

the most efficient manner possible. A developer just need to configure some corresponding parameters.

StableSwap module

StableSwap module allows developers to create liquidity pools for the multichain assets, thus enabling user to swap the same assets across multi-chains with 0 slippage and transaction fee.

6. Economic model of NerveNetwork

NerveNetwork is a built-in original asset in the network, with the cap of 2.1 billion NVT. The initial supply of NVT is 1.1 billion, where 1 billion are generated through node consensus.

(1) Initial distribution (1.1 billion)

Early development: 200 million (airdrop: 10 million, 0.48%) 9.5%

It is used for community construction and promotion in the early stage, as well as the recruitment of virtual banks. 10 million of them are airdropped to the corresponding address according to the proportion of NULS held.

Cornerstone Investment: 300 million, 14.3%

It is used for the participation of institutions and partners, bringing more resources and institutional partners to the

NerveNetwork and NULS ecosystem, and promoting the development of the NerveNetwork project.

NerveNetwork Foundation: 600 million, 28.6%

It is used for the team development and phase I and phase II R&D for NerveNetwork, as well as the long-term development fund support of the project to ensure the sustainable development of the NerveNetwork project.

200 million of them are permanently staked in virtual bank nodes to ensure the safe operation of assets on the network and chain.

And 400 million are gradually unlocked monthly one year later after the launch of the MainNet and unlocked finishing in 20 months.

(2) node consensus output (1 billion)

• Staking consensus:

Any asset in the NerveNetwork can participate in the Staking, including the assets transferred from other chains. In the future, all valuable digital assets, such as BTC and ETH, can participate in the Staking after they are transferred to the NerveNetwork chain, and get consensus

rewards.

• **Create nodes:**

To create a consensus node, you need to lock the deposit, which has the same effect as the other assets' Staking. The way of Staking is to lock the asset in a Staking pool. The user has only the ownership of the asset and no operation right and the operation right can only be restored after cancelling the Staking. When an asset is being staked, you can choose flexible or time-fixed staking, flexible staking means you can cancel the staking at any time and unlock related assets.

• **Weight coefficient:**

NerveNetwork has designed an incentive system with different weights for different assets and different ways of Staking.

• **Consensus reward:**

  - Initial daily total reward: 86400

  - Block reward decrements time: 100 days

  - Block decay coefficient: 0.822%

  - Cap: when the total amount reaches 2.1 billion, it will no longer produce new tokens, which is expected to take about 100 years.

A weight can be calculated for each staking of each account, with which the number of rewards for that staking can be calculated. The weight is calculated according to the amount of Staking and the weight coefficient.

• **Weight calculation**

The weight coefficient _weightcoefficient_ is equal to 1 by default and increases in the following cases:

1. In the calculation of NULS and NerveNetwork, the weight coefficient is multiplied by 2;

2. In the calculation of the deposit of virtual bank, the weight coefficient is multiplied by 4;

3. In the calculation of consensus nodes of the non-virtual bank, the weight coefficient is multiplied by 3;

4. For the time-fixed staking, weight coefficient varies from the time, as shown in the following table:

Duration	weight coefficient
Three months	1.2
Half a year	1.5
One year	2
Two years	2.5
Three years	3

Five years	4
Ten years	5

5. When any two of the above three conditions are satisfied at the same time, it can be superposed;

6. Calculation formula:

$$Weight = nulxAmount \times \sqrt{weightCoefficient}$$

7. Example of weight calculation:

a) When an account creates a consensus node and pays a deposit of 200000 NVT, the weight of this account is $200000 \times \sqrt{1 \times 2 \times 1.5}$, equal to 346000;

b) After account becomes a virtual bank, the weight of this account is $200000 \times \sqrt{1 \times 2 \times 2}$, equal to 400000;

c) if an account is transferred into 5 BTC, and one BTC is equal to 3500 NVT according to the exchange ratio of the current day's feeding system. The account stakes the 5 BTC with the locking time of 5 years, then the weight of this account is $5 \times 3500 \times \sqrt{1 \times 4}$, equal to 350000;

d) if an account is transferred into 1000 NULS, one NULS is equal to 12 NVT according to the exchange ratio of the current day's feeding system. The account stakes the 1000 NULS with the locking time of half a

year, then the weight of the account is

$1000 \times 12 \times \sqrt{1 \times 2 \times 1.5}$, equal to 20760;

• Reward calculation

Description of parameters used in the reward calculation

formula:

Field	Type	Remark
Weight	Long	Weight of a certain staking
Total Weight	Long	Sum of weight of all accounts
Height	Long	Current block height
Credit	Double	Credit value of the node

Description of constants used in the reward calculation

formula:

Key figure	Description
86400	Number of blocks per day
8640000	Number of blocks in a reward decay period (100 days)
0.00822	Decreasing proportion

• Calculation formula of the Staking reward (daily

reward)

$$Reward = \frac{\text{Weight} \times 86400 \times (1 - 0.00822)^{(height \div 8640000)}}{TotalWeight}$$

• Calculation formula of node reward (reward for producing a block)

$$Reward = \frac{\max(0, \text{credit}) \times \text{Weight} \times (1 - 0.00822)^{(height \div 8640000)}}{TotalWeight}$$

• **Virtual bank:**

The top 15 with the largest deposit will become virtual banks, which have twice the rewards of blocking. Moreover, these 15 virtual banks will protect cross-chain asset security through multiple signatures. Virtual banks are also the core of the entire NerveNetwork project and the entire value interaction platform. It is necessary to increase PAX, USDT and other stable assets as a deposit to become a virtual bank at a proper time.

• **Usage of NerveNetwork:**

1. Paying for cross-chain settlement;

2. Voting rights of NerveNetwork project and of the on-chain governance tool;

3. Handling fees for on-chain transactions;

4. Deposit for creating a node;

5. Participating in the staking to get rewards;

6. Repurchase and destroy the transaction fees of the decentralized exchange;

7. Destroy the fees for creating transactions pairs in the decentralized exchange;

8. Destroy the fees for creating assets in the decentralized exchange;

9. Other application scenarios of the NerveNetwork ecosystem.

7. Team

Founder

Berzeck,one of NTC members;System engineering bachelor graduated from Engineering Military School,La Paz -Bolivia; General Manager at ARXEN SRL(Official distributor of Pulzar ERP);Former National Director for Information System Division in PROESA(A national commercial);Nearly 20 years of experience in system development and team management ,He has extensive experience in using modular methods and microservices. He has led and completed the design and development of modular refactoring and microservice architecture for the underlying core of NULS 2.0.

Core Team

NTC （NULS Technical Community) is the core technical community. NTC members have an in-depth understanding of the NULS architecture and products, and they enjoy the flexibility and creativity of self-government and community support. The NerveNetwork project was founded by the member of the NTC and received full support from the community. NerveNetwork was developed and provided incubation support by NTC. It would build a multi-chain interworking blockchain network for the NULS and NerveNetwork ecosystems.

8. NerveNetwork open-source community

NerveNetwork is a community-driven, global open-source blockchain project, the prosperity of NerveNetwork is determined by its ecosystem diversity. The NerveNetwork project will continue to establish an open-source community, meawhile providing services that are decentralized, safe, harmonious, transparent, and achievable for the community