NIBIRU

Nibiru - Litepaper

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Introduction

Nibiru is a sovereign proof-of-stake blockchain, open-source platform, and member of a family of interconnected blockchains that comprise the Cosmos Ecosystem. A core blockchain scaling challenge is meeting transaction demand without becoming prohibitively expensive for retail traders. The promise of a multi-chain future has drawn interest towards Cosmos as an infinitely scalable solution to this problem. However, Cosmos currently lacks tools for investing with complex financial positions.

Nibiru is the first decentralized platform that unifies leveraged derivatives trading, spot trading, staking, and bonded liquidity provisions into a seamless user experience. Nibiru enables traders on over 40 blockchains to trade with leverage using a suite of composable, standalone protocols:

1. **Nibiru Perps**: A perpetual futures exchange where users can take leveraged exposure and trade on a plethora of assets — completely on-chain, completely non-custodially, and with minimal gas fees.

2. **Nibiru AMM**: An automated market maker for multichain assets, giving users access to swaps, pools, and bonded liquidity gauges.

3. **Nibiru Stablecoin (NUSD)**: A two-token economic model, where NIBI is the staking and utility token for the protocol and NUSD is a capital-efficient, partially collateralized stablecoin for the protocol.

4. **Nibiru Options**: A platform to provide traders with further instruments for arbitrage, hedging, and speculative trading.

Nibiru is built with the Cosmos-SDK and communicates with other chains using the Inter-Blockchain Communication (IBC) protocol. As the natural next step, Nibiru will upgrade to allow for CosmWasm smart contract deployment, enabling the broader community to evolve and develop new tools and asset classes.

1. Nibiru Perps

Perpetual futures contracts were first proposed by Robert Shiller in 1992 but did not reach popularity until 2016 when they were introduced to cryptocurrency markets by the BitMEX team. Perps are the most popular financial instrument in the modern day crypto markets. Their trading volume across major exchanges reaches trillions of notional USD value each year.

While most perps exchanges are designed with off-chain order books, there is no canonical exchange design as of yet. Perp implementations can differ greatly from exchange to exchange. The Nibiru blockchain powers a decentralized and fully on-chain perpetual futures exchange called **Nibiru Perps**. There are several open problems Nibiru seeks to address with this exchange:

- **Minimize latency during periods of high volatility**: Design a liquidation engine that minimizes latency by liquidating positions based on the index price rather than the mark price during periods of volatility.
- **Minimize the imbalance in open interest**: Formulate the correct AMM model to minimize the imbalance between long and short open interest.
- **Increase the number of unique traders on the platform** Enable traders, besides arbitrageurs and bots and minimize the insurance fund from taking the other side of the trades.
- **Reduce the bleeding of the ecosystem fund**: One of the top priorities on the Nibiru Perps protocol it to keep the funding rates of the listed perps at parity to all other perpetual futures exchanges while monitoring the opportunity for arbitrageurs.

What are perps?

A perpetual futures contract, or perp, is a standardized agreement to buy or sell an underlying asset at a predetermined price at some point in the future. Perps are a special types of futures contracts that don't have an expiry date. The derivative value of a perp position is represented by its **mark price**, and the value of the underlying is represented by its **index price**. Positions are long or short depending on the price movements of the corresponding asset.
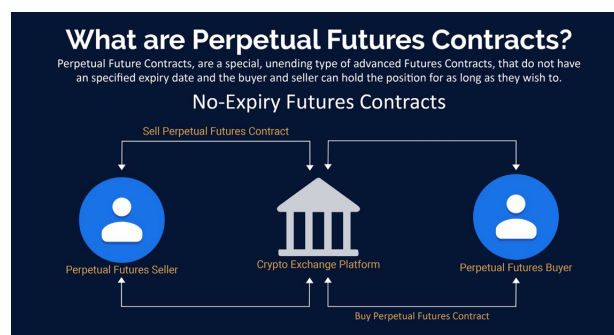
A description of perps can be found at Blockchain Simplified

Perp positions remain effective until either the trader closes their position or the position goes underwater. This allows traders to speculate on the future price without having to own the underlying asset. And by using leverage, traders can get exposure to the underlying with only part of the total value in collateral or margin.

Virtual Pools

Positions on Nibiru Perps are priced using virtual liquidity pools with no real assets stored inside. In this model, assets are priced using the constant product model pioneered by Uniswap. Tokens are sent to a clearing house, which stores the collateral in a vault, and where virtual pools are leveraged for price discovery of the derivatives. This allows for the use of leverage trading and removes the need for liquidity providers, or makers.

Virtual pools enable Nibiru to have **clear pricing rules.** Each futures contract specifies the base asset's quantity delivered for a single contract. For instance, OSMO/USDC, UMEE/USDC and ATOM/USDC futures contracts represent only one unit of its respective base asset, similar to spot markets.

Funding Payments

Funding payments are used to incentivize traders to take long/short positions. A time-weighted average price from the virtual pool is taken to compute the mark price. The index price is derived from an oracle. Funding payments are calculated and exchanged between traders hourly on Nibiru.

Perpetual Ecosystem Fund

To protect the perp protocol against unexpected events, Nibiru Protocol stores half of the revenue generated from trading fees in a fund called the PerpEF. This ecosystem fund steps in to cover the negative value from a bankrupt position that was not liquidated in time and to pay funding payments that could correct the skew between the long/short positions.

Liquidations

When using leverage on positions, traders naturally become exposed to liquidation risks. For example, when the underlying value of a trader's perp declines, the derivative asset will approach the value of its margin, putting the exchange at risk. To prevent the position from falling below the value of the margin that backs it, the protocol will proactively liquidate the position. Liquidations are triggered by **liquidations bots** that earn a small percentage of the remaining position.

Opening Positions

When opening a position, tokens are deposited and locked as **margin**. Under the hood, these tokens are stored with the **clearing house**, which uses the virtual pools for price discovery, converting the deposit into virtual assets.

These virtual assets change the reserves of their corresponding pool, determining the price of the derivative (position) while enabling the use of leverage. The protocol controls the funding payments in NUSD, actively monitoring the liquidation and the management of the Ecosystem Fund.

Perp: NIBI Token

Holders who stake their NIBI tokens can vote on or propose new ideas to improve the perps protocol. A small percentage of the protocol's NIBI inflation feeds into the Ecosystem Fund. NIBI stakers vote on, among others, exchange improvements, parameter alterations, new feature implementations, chain updates, and alterations to reward mechanisms.

Perp VIP Trading Program

Holders who stake their NIBI tokens can vote on and/or propose new ideas to develop the perps protocol. 10% of staked NIBI feeds into the ecosystem fund. The NIBI token acts as a backstop mechanism. In the event that Perp EF is unable to cover unexpected losses, the protocol will mint new NIBI tokens, immediately selling the new tokens for collateral to keep the system solvent.

NIBI holders will have the ability to vote on exchange improvements, parameter alterations, new feature implementations, chain updates, and inflationary reward mechanisms. NIBI stakers enjoy a trading fee discount proportional to the amount staked.

What are the risks?

Naturally, risks are inherent with any novel project being built. Nibiru's ecosystem is built to promote the robust decentralization, permissionless creation of perps. As a result, community members can start trading without the supervision of a central authority, meaning the safety of having a facilitating party will not exist to the same degree. That being said, new market proposals will require governance approval for listing and a listing fee in NIBI tokens.

The permissionless state of market creation can drive the protocol to in-solvency in a black swan event. To mitigate against the risk of one market spilling over to others, Nibiru requires each new pair to establish an insurance fund before trading can commence.

2. Automated Market Maker (AMM)

Nibiru AMM will use the generalized constant product function with multiple assets and differing token weights. The AMM is a constant value function, enforcing that the product of the asset balances raised to the asset weight in the pool should always remain constant. Within the below formula, t represents the number of assets in the pool, $\mathcal{Q}_n$ is the quantity of the asset, and $\mathcal{W}_n$ is the asset weight.

$$\prod_{n=1}^{t} \mathcal{Q}_n^{\mathcal{W}_n} = k$$

Nibiru takes the values in and computes *k*: the objective is to keep *k* constant by only changing the asset balances while maintaining the asset weights as constant. Each pair of tokens in the pool has a price that is dependent on the balance $\mathcal{B}$ and weight $\mathcal{W}$ for that specific pair.

Formally, the instantaneous spot price that the swap executes at is computed as the ratio of the token balances normalized by the token weight:

$$\text{Spot Price}_i^o = \frac{\mathcal{B}_i/\mathcal{W}_i}{\mathcal{B}_o/\mathcal{W}_o}$$
$$\mathcal{B}_i = \text{amount of token in}$$
$$\mathcal{W}_i = \text{weight of token in}$$
$$\mathcal{B}_o = \text{amount of token out}$$
$$\mathcal{W}_i = \text{weight of token out}$$

If liquidity providers don't modify the asset reserves, then k remains constant and the price changes solely based on trades since the asset weights also remain constant. This ensures that the price of the asset bought increases while the price of the asset sold decreases. The arbitrage opportunities guarantee that the prices offered by the pools move in conjunction with the rest of the market.

Stableswaps

Given the proliferation of stablecoins about to reach the Cosmos ecosystem, the Nibiru AMM will support stableswap pools based on Curve's Stableswap invariant.

$$An^n \sum_{i=1}^n x_i + D = ADn^n + \frac{D^{n+1}}{n^n \prod_{i=1}^n x_i}$$
$$A = \text{amplification coefficient}$$
$$D = \sum_{i=1}^n x_i = \text{sum of coins}$$

3. NUSD: The Nibiru Stablecoin

Nibiru implements a fractional-algorithmic stablecoin, NUSD, analogous to the one introduced by <u>Frax Finance</u>. NUSD has an elastic supply that adjusts based on market demand and NIBI helps bolster the stability of NUSD. This gives NUSD a greater capacity to scale through smaller required provisions for external collateral.

NUSD's creation and annihilation mechanism is dependent on the prices obtained from the chain's price feed. As a result, arbitrage opportunities arise when the price of NUSD falls from its peg given the ability for traders to profit from

secondary markets.

Nibiru aims more toward a fully decentralized model in which anyone can mint or burn NUSD, which can always be exchanged for an equivalent value in NIBI and collateral on the trading app. The first token Nibiru will accept as collateral is USDC.

Minting and burning: Users mint NUSD by placing NIBI and any accepted form of collateral into the system. In return, the protocol mints and gives an equivalent value in NUSD back to the user minus a small transaction fee. Similarly, an NUSD holder can **burn NUSD** in exchange for equivalent value of NIBI and collateral.

Collateral Ratio

The **collateral ratio (CR)** is defined as the proportion of NUSD's value that is transacted as collateral during mints and burns of NUSD. For example, if the collateral ratio is 70% and a user wants to mint 100 NUSD, 70 NUSD worth of collateral and 30 NUSD worth of NIBI are required. Similarly, if the user instead wants to burn 100 NUSD, the user would instead receive the same amount NIBI and collateral. At genesis, the protocol will start out with a CR of 100%. As users interact with the protocol, the CR will fluctuate based on the demand for NIBI and NUSD.

Nibiru's collateral ratio changes in response to the price of NUSD on the open market. A decline in the collateral ratio supports protocol expansion in periods of growth, while an increase in collateral during price downturns helps to curate system trust. If the price of NUSD goes too far below its peg (in a pre-determined threshold), the collateral ratio is automatically increased. If NUSD goes far enough above its peg, the collateral ratio is decreased.

Liquidity Ratio

Nibiru adjusts the Collateral Ratio based on changes in liquidity, measuring NIBI liquidity against the total supply of NUSD. We define the **liquidity ratio (LR)** as follows:

$$\texttt{LiquidityRatio} = \frac{\texttt{marketCap}_{\text{NIBI}}}{\texttt{marketCap}_{\text{NUSD}}}$$

In order to honor the CR under all market conditions, NIBI liquidity increase in proportion to increases in the supply of NUSD. During sustained periods of net negative liquidity ratio change, the market signals that more collateral should back the system. This collateral within the system dampens the reflexive downward spirals that are more likely to occur in systems entirely reliant upon endogenous collateral.

More NUSD can be redeemed with an increasingly smaller percentage impact on NIBI supply. As a result, the system can absorb more NIBI sell pressure from NUSD redemptions being sold without risking the potential for negative feedback spirals. The worst-case scenario for NUSD is if NUSD holders can drain all the collateral from the system through redemptions, leaving the remaining holders with insufficiently collateralized NUSD. This situation is only possible if NIBI has a CR that contradicts the true amount of collateral in its reserves. The CR is not designed to rapidly fluctuate so there will not be extended opportunities in which the CR vastly exceeds the actual percentage of collateral in the system.

Nibiru deploys a stability mechanism where changes in the NUSD supply and NIBI liquidity adapt to market volatility. The stability mechanism controls the amount of collateral backing the system. During prolonged periods of net liquidity ratio change, the market expresses its confidence in NIBI as a backstop, signaling to the protocol that the CR should be lower to better facilitate scaling.

Appendix and Future Work

Automated Treasury Management (ATM)

NUSD will implement a series of Automated Treasury Managements (ATM), to deploy the whitelisted exogenous collateral from NUSD minting into various strategies, while maximizing the core stability mechanism, formalizing the accounting of the balance sheet, and defining how much NIBI can be bought / burned with profits above that CR.

The ATM framework would enable the deployment of the NUSD into an arbitrarily large set of strategies to generate revenue, upgrade the system, and enable partnerships – all without undermining the price stability of NUSD.

Investor ATM

Investor ATM will deploy NUSD whitelisted collateral to yield aggregators and money markets. The ATM will allocate funds into strategies that have a time delay for withdrawals. As a result, it will never have to lower the CR, allowing it to pull out collateral, if needed, for NUSD redemptions

AMM ATM

AMM ATM will deploy idle and newly minted NUSD into the NIBI-NUSD pool. NUSD will utilize this DEX ATM to earn revenue and increase NUSD liquidity as well as strengthen its peg. Nibiru protocol will create the NIBI-NUSD pool, setting the pool parameters. The ATM would build incentive structure to maximize the LP rewards

Lending ATM

Lending ATM would allow for the borrowing of over-collateralized NUSD into money markets, giving the ATM the ability to increase/decrease NUSD interest rates through minting and burning. This ATM would control the NUSD adoption by offering highly competitive borrowing rates

Liquidation ATM

Liquidation ATM would allow for the deployment of NUSD to capture the yield (liquidation penalty) associated with the liquidation occurring within the perp and the lending protocols integrated on Nibiru.

The modularity introduced through ATMs allows NUSD to be quickly adapt to market conditions which may arise. Nibiru protocol will invest any excess collateral with its ATM strategies to increase the stability and

adoption of NUSD. Eventually NUSD will utilize a basket of stablecoins to maximize the decentralization ratio, with the extent to how much decentralized stablecoin system is dependent upon centralized components.

MEV Resistance

Nibiru plans to implement a form of encryption called threshold cryptography to tackle maximum extractable value (MEV). According to MEV Explore, over $635 million of value has been extracted away by miners on Ethereum. MEV extraction punishes retail users in favor of the miners, who have more privileged access to the blockchain, creating an unfair environment.

On Nibiru, transactions will be encrypted to hide trade details before it hits the mempool, preventing the validators from figuring out which transactions to prioritize. Fee details will not be encrypted. Validators can only see the details of the transactions after transactions are finalized and executed.

Pricefeed

Both the Perps and Stablecoin modules will require a price feed oracle to operate smoothly. For the Stablecoin, a price feed for the NIBI token and NUSD stablecoin are required to allow the two to accurately adjust in a dynamic fashion. For the Perps, a price feed is required for every base asset listed on the Perps Exchange. For example, the BTC:USDC perps contract will require a BTC price feed in order to calculate the difference between the mark price and the index price, implying the associated funding rate.