

Bunicorn

Phuc Nguyen
phuc@buni.finance

Maxwell Nguyen
maxwell@buni.finance

Updated May 2021

Abstract

The Auto Market Making (AMM) concept initially introduced by Bancor (2017) & Uniswap (2018) has been proven viable allowing fully on-chain autonomous market-maker and gained exponential adoption in combination with liquidity mining. The evolution has been continued with several proposals to improve many aspects of AMM including reducing the impermanent loss [1], avoiding MEV (miner extracted value) [2], and improving capital efficiency [3].

Bunicorn combines Balancer's approach [4] of self-balancing weighted portfolio with Kyber's DMM [3] for similar assets to make a DEX that offer 2 kind of liquidity pools in 1 seamless gamified user interface: flexible weighted pools with a customizable number of assets, and amplified pools with high capital efficiency & minimal slippage for stablecoins. We also introduce a new yield farming model that vest the mining reward for a period of time by wrapping these time-locked fungible tokens into NFT collectibles. While most of the mentioned platforms were built on top of Ethereum, Bunicorn's first version is built on Binance Smart Chain (BSC) instead to inherit its lightning speed & lower gas fee.

1. Introduction

DeFi products have gained a lot of traction recently and that really changed the world of financial activities. One of the most notable contributions to this growth is the evolution of decentralized exchanges (DEX) in the past 4 years. The first several approaches were simulating a centralized exchange with off-chain relay and on-chain settlement such as the orderbook-style introduced by 0x.org. Kyber took a slightly different approach by having smart contract-based reserve aggregation that allows large liquidity providers (LP) to connect and advertise prices for specific trade pairs. As a countermeasure, these concepts usually have some (centralized) control mechanisms such as the whitelisting of the LPs or having Oracles to feed prices to the smart contracts.

A market maker is usually a firm who actively and continuously quotes two-sided markets, providing bids and offers along with the market size of each in an effort to keep that financial market liquid. Although market making has a risk of holding an asset because they may see a decline in the value after it has been purchased from a seller and before it's sold to a buyer, they

earn profit by charging the aforementioned spread on the asset they cover. In a volatile or low liquidity market, this risk becomes higher so the spread is widened at both sides. Many exchanges utilize a system of market makers competing against each other to set the best bid & offer to win the new orders coming in.

However, market making for on-chain orderbook is very expensive as adding or removing an order both take a gas fee, even if these orders are never executed. As a consequence, most decentralized exchanges back then usually had very high spreads, so the price is less competitive compared to centralized exchanges. To address this problem, there is an approach for an autonomous market making a pair by having a portfolio that any trade must maintain a constant proportion of value in each asset of the portfolio when expressed in the same currency. This idea was first introduced by V. Buterin [5] 4 years ago, generalized by Alan Lu [6] and adopted to a viable product by Uniswap.

This brand new way of automated market making (AMM) adjusts pricing deterministically for one asset against another based solely on their balance in the pool, and completely on-chain via smart-contracts. Even though the value of the pool remains constant theoretically, it will gradually increase because of the swapping fee earned after each trade. This model also opened another door for liquidity providers to passively contribute their assets to the AMM pools and earn income from these swapping fees. When adding liquidity to the pool, an user gets back a fair share of their contribution represented as an amount of LP token. The amount of LP token in possession of a user represents his stake at the pool, and can be used to withdraw their assets out of the pool respectively.

To stimulate liquidity providers to lock up their value to the Defi platform, the project often gives them a reward besides the usual returns. These rewards are usually native tokens or the governance tokens of the Defi platform itself. For the AMM pools in particular, you can stake the LP tokens received after contributing your assets to the pool into different farming pools to earn extra reward. This process in which you put your assets to work to generate returns is called Yield Farming. Being a yield farmer means that you are actively looking for the best strategy to maximize your profit from your initial funds. Such a strategy requires you to adjust your position from week to week, finding the pool that is offering the best annual returns (APY) at the given time. Usually, the percentage of returns is directly proportional to the risk of the pool. However, like with any other investment your strategy needs to be crafted around handling the risks.

Liquidity mining is a result of yield farming. The process involves getting tokens as a bonus besides the usual returns. With the highly remunerative earning from the liquidity mining farms, AMM has gained exponential growth from retail users. We can name a few among the best such as Uniswap, Pancakeswap, Curve, Balancer, Kyber's DMM, Mooniswap... While all of them feature a similar AMM mechanism by defining a determined formula for adjusting the price automatically, each of them has different trade-offs and benefits. Because none of them is perfect, so users have to wisely choose which works best for them based on their taste of risk & expected income.

2. Observation & Motivation

AMM

One of the biggest issues with liquidity providers is the risk of impermanent loss. It happens when you provide liquidity to a liquidity pool, and the price of your deposited assets changes compared to when you deposited them. The bigger this change is, the more you are exposed to impermanent loss. In this case, the loss means less dollar value at the time of withdrawal than at the time of deposit.

Pools that contain assets that remain in a relatively small price range will be less exposed to impermanent loss. Stablecoins or different wrapped versions of a coin, for example, will stay in a relatively contained price range. In this case, there's a smaller risk of impermanent loss for liquidity providers (LPs). However, most of the famous AMM such as Uniswap, Pancakeswap or Sushiswap only offer liquidity pools with only 2 tokens at 50:50 ratio. The first token is usually ETH or BNB while the second one is usually a more volatile ERC20/BEP20 token. That means LPs are exposed to the risk of impermanent loss with half of their portfolio, and sometimes, the returns they get from trading fee & liquidity mining is not enough to compensate for the declined value in impermanent loss. As a simple rule, the more volatile the assets are in the pool, the more likely it is that you can be exposed to impermanent loss.

There is another issue with the AMM which is the price slippage. It's the difference between your intended price and where your trade is executed. This problem becomes more severe when you want to swap between stablecoins because their price is meant to be stable. Imagine that you eventually need to cash out your profit from other Defi-platforms to stablecoins, let's say from DAI to USDC, but you wouldn't want to suffer the high slippage in Uniswap or Pancakeswap.

It's required to provide enormous funds to keep a meaningful liquidity for a stablecoin pair pool. On the other hand, the returns will be very small, perhaps several percent APY. This leads to another issue of capital efficiency where a pool with smaller TVL can provide better liquidity (lower slippage) and gain more returns for LPs. In relation to this capital optimization, most AMMs only offer a fixed fee model regardless of the market volatility.

Looking at all the aforementioned concerns, Bunicorn made an effort to combine the best solutions of existing AMM platforms into a single seamless UI that addresses all of the problems above. In particular, we adopted Balancer [4] for normal tokens in combination with Kyber's DMM approach [3] for stablecoins. Actually, Curve [8] solved the issue of low slippage for stablecoins long before Kyber DMM. However, Kyber's DMM protocol does offer a higher level of flexibility in terms of both the inventory curve for similar assets and a dynamic fee model for optimized earnings.

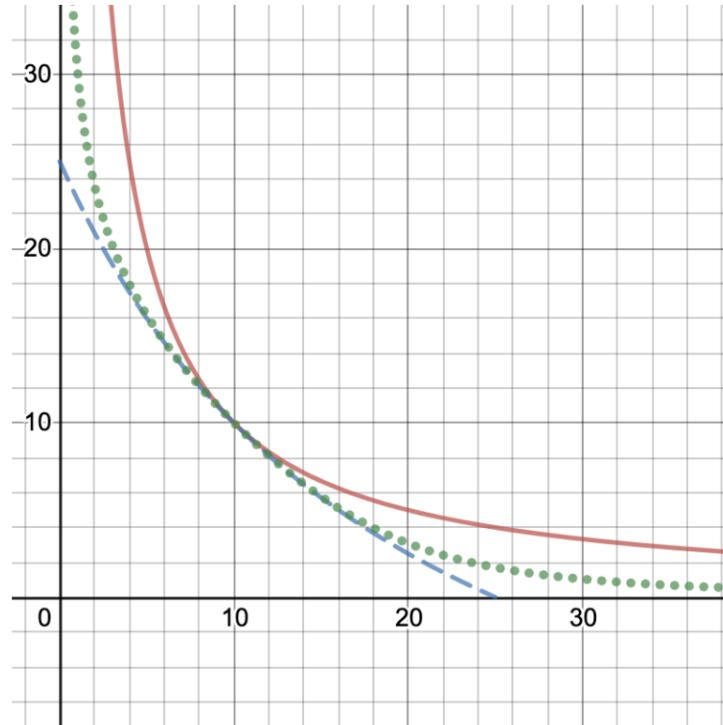


Figure 0. Inventory curves of Uniswap (red), Curve (green) and Dynamic pricing curve (blue)

Balancer offers flexible pools that can have up to 8 tokens with any weights instead of just 50:50 pairs. Therefore, LPs can choose the most suitable pool that matches their taste of risk to reduce the impermanent loss. For instance, they can choose a pool with only 25% of which is a high volatile token while 3 out of 4 other tokens are in their long-term portfolio. And of course, they can also load up their assets into our stablecoin pools with almost no risk of impermanent loss & high capital efficiency.

Last but not least, most of the AMMs mentioned above are built on top of the Ethereum network whose gas price has skyrocketed recently. At the time being (May 2021), the standard gas price is around 440 gwei while it was only ~25 gwei one year ago. The average transfer in ETH now ranges from \$25 to \$456. This gas war and the proof of work consensus of ETH lead to even another race of the front-running miners who constantly bid a higher gas price to extract value from arbitrage opportunities of AMM pools. More generally, this technique is called MEV (miner extracted value) where miners/market makers can take advantage of their place as arbiters in how blocks are packaged to “front-run” profitable trades. Flashbots [9] shows the total amount of extracted MEV from 2020 now has exceeded \$521.7M. Some EIP proposals [10] attempted to fix this problem of ETH but they also received a lot of discontent from the mining industry.

We also observed that the Binance Smart Chain has recently built up a thrilling community and massive market adoption. BSC-powered Defi projects such as Pancake swap have recorded explosions of volume and TVL (total locked value). It surpassed the giant Uniswap volume since Feb 2021. There are some trials to build stablecoin pools to BSC such as Smoothies [11] and

Ellipsis [12] with low slippage. Yet, they are not popular enough, and there is no AMM in BSC that offers both flexible pools and stablecoin pools in one platform.

Yield Farming

There is one issue with most of the liquidity mining: users tend to dump their tokens they get from the mining pool immediately because that's not something they bought but something they are given. Also, a high APY yield farming program also comes along with a high inflation rate of the tokenomic. We have been observing this for quite a long time and wanted to propose a solution that can lock-up these farming rewards out of circulation while still providing value to yield farmers.

We have seen an increasing interest in NFT (non fungible token) recently with a lot of NFT marketplaces and projects. However, most of the use cases for NFT were just representations of digital contents such as artworks, musics, videos or game items. However, if we consider NFT as a vehicle for containing information in general, the possible use cases for it are huge. For example Genesis Shards [13] has wrapped pre-IDO tokens and created a secondary market for these NFT and turns illiquid tokens into liquidable assets.

By combining both these ideas, we introduced a new liquidity mining model such that instead of distributing the farming reward directly to the users, these tokens are wrapped into NFT collectibles. Users can then claim back the actual tokens after a vesting period. In the meantime, they can also trade these NFT in other well known marketplaces and make them liquidable.

3. Background

The implementation of Uniswap only works for the portfolio so called liquidity pool with 2 tokens where we keep the product of balances of tokens in the liquidity pool constant:

$$xy = \text{const}$$

Where

- x is the balance of token x in the pool;
- y is the balance of token y in the pool;

Balancer has generalized this invariant to any number of tokens with any weights by applying this same invariant-based approach described by Michael Zargham [7] et al. They define a function, called Value function, which constrains the pool's weights and balances as below.

$$\prod_i x_i^{w_i} = \text{const}$$

Where

- i ranges over the tokens in the pool;

- x_i is the balance of the token in the pool;
- w_i is the normalized weight of the token, such that the sum of all normalized weights is 1;

By making this Value function constant, we can define an invariant surface as illustrated in Figure 1 below.

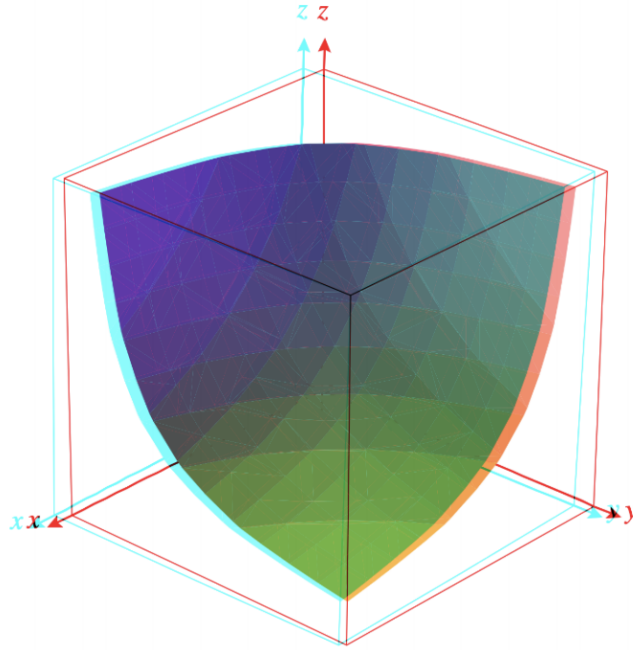


Figure 1. The invariant surface of a Balancer's pool

Bunicorn also adopted this brilliant idea of Balancer and its implementation to bring it to the BSC blockchain & ecosystem. To further explain this approach, we'll see the trading formulae proved by Balancer [4] below:

Spot Price

Each pair of tokens in a pool has a spot price defined entirely by the weights and balances of just that pair of tokens. The spot price between any two tokens, SP_i^o , is the the ratio of the token balances normalized by their weight:

$$SP_i^o = \frac{\frac{B_i}{W_i}}{\frac{B_o}{W_o}}$$

Where

- B_i is the balance of token i , the token being sold by the trader which is going into the pool.
- B_o is the balance of token O , the token being bought by the trader which is going out of the pool.
- W_i is the weight of token i
- W_o is the weight of token o

Effective Price

It is important to bear in mind that SP_i^o is the spot price, which is the theoretical price for infinitesimal trades, which would incur no slippage. In reality, the effective price for any trade depends on the amount being traded, which always causes a price change. If we denote A_o as the amount of token being bought by the trader and A_i as the amount of token being sold by the trader, then we can define the Effective Price EP_i^o as:

$$EP_i^o = \frac{A_i}{A_o}$$

And as mentioned above, EP tends to SP when traded amounts tend to 0:

$$SP_i^o = \lim_{A_o, A_i \rightarrow 0} EP_i^o$$

Trading Formulas

Calculating the trade outcomes for any given liquidity pool is easy if we consider that the Value Function must remain invariant, i.e. must have the same value before and after any trade.

In reality, it will increase as a result of trading fees applied after a trade state transition.

Out-Given-In

When a user sends tokens i to get tokens O , all other token balances remain the same. Therefore, if we define A_i and A_o as the amount of tokens i and O exchanged, we can calculate the amount A_o a user gets when sending A_i . Knowing the value function after the trade should be the same as before the trade, we can write:

$$A_o = B_o \left(1 - \left(\frac{B_i}{B_i + A_i} \right)^{\frac{W_i}{W_o}} \right)$$

In-Given-Out

It is also very useful for traders to know how much they need to send of the input token A_i to get a desired amount of output token A_o . We can calculate the amount as a function of similarly as follows:

$$A_i = B_i \left(\left(\frac{B_o}{B_o + A_o} \right)^{\frac{W_o}{W_i}} - 1 \right)$$

In-Given-Price

For practical purposes, traders intending to use our contract for arbitrage will like to know what amount of tokens i , A_i , they will have to send to the contract to change the current spot price

SP_i^o to another desired one $SP_i'^o$. The desired spot price will usually be the external market price and, so long as the contract spot price differs from that of the external market, any arbitrageur can profit by trading with the contract and bringing the contract price closer to that of the external market.

The amount of tokens i , A_i , a user needs to trade against tokens so that the current spot price changes from SP_i^o to $SP_i'^o$ is:

$$A_i = B_i \left(\left(\frac{SP_i'^o}{SP_i^o} \right)^{\frac{W_o}{W_o + W_i}} - 1 \right)$$

Liquidity Providing Formulas

Pools can aggregate the liquidity provided by several different users. In order for them to be able to freely deposit and withdraw assets from the pool, the protocol has the concept of pool tokens.

Pool tokens represent ownership of the assets contained in the pool. The outstanding supply of pool tokens is directly proportional to the Value Function of the pool.

If a deposit of assets increases the pool Value Function by 10%, then the outstanding supply of pool tokens also increases by 10%. This happens because the depositor is issued 10% of new pool tokens in return for the deposit.

There are two ways in which one can deposit assets to the pool in return for pool tokens or redeem pool tokens in return for pool assets:

- All-asset deposit/withdrawal
- Single-asset deposit/withdrawal

All-Asset Deposit/Withdrawal

To receive P_{issued} pool tokens given an existing total supply of P_{supply} where B_k is the token balance of token k before the deposit, one needs to deposit D_k tokens k for each of the tokens in the pool:

$$D_k = \left(\frac{P_{supply} + P_{issued}}{P_{supply}} - 1 \right) B_k$$

Similarly, by redeeming $P_{redeemed}$ pool tokens given an existing total supply of P_{supply} where B_k is the token balance of token k before withdrawal, one withdraws from the pool an A_k amount of token k for each of the tokens in the pool:

$$A_k = \left(1 - \frac{P_{supply} - P_{redeemed}}{P_{supply}} \right) B_k$$

Single-Asset Deposit/Withdrawal

When a user wants to provide liquidity to a pool because they find its distribution of assets interesting, they may likely not have all of the assets in the right proportions required for a weighted-asset deposit.

Bunicorn allows anyone to get pool tokens from a shared pool by depositing a single asset to it, provided that the pool contains that asset.

Depositing a single asset A to a shared pool is equivalent to depositing all pool assets proportionally and then selling more of asset A to get back all the other tokens deposited. This way a depositor would end up spending only asset A , since the amounts of the other tokens deposited would be returned through the trades.

The Dynamic Market-Making Pricing Curves

Dynamic pricing curves of DMM try to improve capital efficiency of the Uniswap model. The curves are still a constant product, but of virtual balances instead of real balances. Thanks to the virtual balances, which are amplified significantly from real balances, the DMM pools can

achieve moderate spread and slippage rates compared to the Uniswap model given the same capital.

We define liquidity providers' initial contribution to the pool as x_o and y_o , and $x_o y_o = k$.

Then we introduce what is known as the amplification factor a and $a > 1$. As its name suggests, it amplifies the real balances to virtual balances. Hence, we can define virtual balances $x'_o = x_o a$ and $y'_o = y_o a$.

The pool with programmable pricing curve model will maintain a constant product of these virtual balances by using the new inventory function:

$$x' y' = k'$$

If we have $P_o = \frac{x_o}{y_o}$ is the spot price on real balances, when the price will be calculated using

virtual balances instead of real balances, this comes at the expense of the price range no longer being unbounded, but being restricted between a fixed price range from

$$P_{min} = P_o \left(\frac{a-1}{a}\right)^2 \text{ to } P_{min} = P_o \left(\frac{a}{a-1}\right)^2$$

This limited price range allows us to have lower spread and slippage.

The inventory curves of Uniswap, Curve and programmable pricing curve are visualized in Figure 0 above.

4. Results

We have successfully implemented our decentralized exchange with the following features at launch initially on Binance Smart Chain network:

- Flexible AMM pools with a customizable number of assets and weights within a pool. This simulates a real index fund in real life. It also mitigates the risk of impermanent loss when exposing too much capital to a high volatile token in traditional 50:50 pools.
- Amplified pools that allow swapping between stablecoin pairs with lower slippage and higher capital efficiency.
- Smart order routing that automatically splits your swap across several pools for optimized price.
- Dynamic fees adjusted based on the underlying volatility to maximize returns for liquidity providers and encourage trading volume in a sideways market.
- No third-party or centralized oracle risks.
- Liquidity providers can also join multi-token pools with a single asset.
- New innovative liquidity mining model that vests the earned reward and wraps them into NFT collectibles.

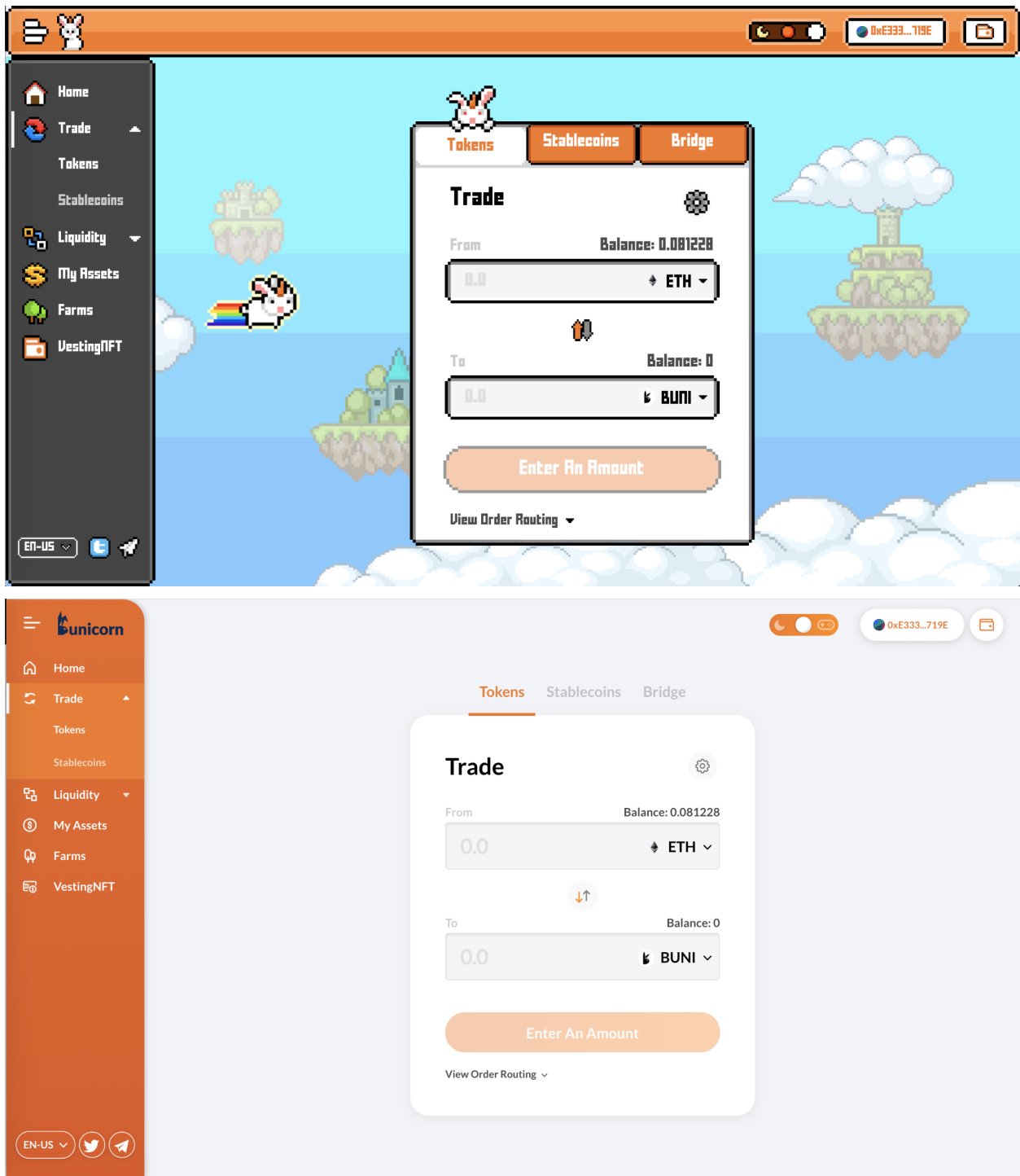


Figure 2. Bunicorn UI

So firstly we innovated our AMM model so that it optimizes profit for the liquidity provider & reduces the risk of impermanent loss with flexible number tokens per pool, different weight & stable-coin only pools. This will be the main boost for TVL & yield farming. In Particular, the

stablecoin pools are amplified ~100x, so that \$1M pool can provide the same liquidity capacity when comparing the slippage/pricing curve of the \$100M pool in Uniswap/Pancakeswap.

Because of the vesting schedule, the rewards will not be in circulating supply really soon. Thus, it's easier for us to design higher APR plans. This is also the only way to mint new NFT collectibles in our platform, the more you stake, the better its rarity, higher price.

NFT collectible marketplace

We will rank the rarity of the NFT collectibles based on the amount of underlying assets wrapped in that token. For instance, a \$1M worth of BUNI token will make it Ultra Rare or Super Rare. Apart from that, we will also add unique designs of Bunny characters to these NFT collectibles similar to what Crypto Kitty or Polkamon has done so far.

The difference between the NFT in our platform compared to other platforms is that it contains actual time-locked tokens similar to a bond. In other words, it contains speculative value. If someone cannot wait until the vesting period to be finished, he can sell his NFT at a discount. Besides, he can also collect and resell his Super Rare asset at a price much bigger than the underlying BUNI value in other NFT markets. Therefore, we have reached 2 goals for this feature: separating BUNI from the circulating supply but still making them liquidable in the form of NFT assets.

We are working on our own NFT marketplace for users to exchange and auction their NFT to be released in the next phase.

5. Tokenomic

Token information

- Token name: Bunicorn Token
- Token symbol: BUNI
- Total supply: 1,000,000,000 BUNI
- Initial circulating supply: 10,333,333 BUNI

Bunicorn Token is a BEP-20 token in Binance Smart Chain network.

Based on Binance Smart Chain achieves ~3 second block time with a Proof-of-Stake consensus algorithm, the liquidity mining phase will be done after two years with 200,000,000 BUNI. The rest of the supply will be minted with regard to the release schedule in the tokenomic section below.

Token Utility

The BUNI token is a utility token intended to perform several functions, mostly protocol ownership and can be added in the future.

- **Revenue share:** BUNI holders can stake their tokens to earn a portion of the revenue generated from the platform services such as swapping fee.
- **Governance:** BUNI holders can use their tokens to vote on governance proposals regarding changes and upgrades to the protocol.

Token Allocation

Type	Allocation	Lock Period
Team	5.9%	1 month cliff, then linear vesting over 2 years
Private Round	7.5%	Linear vesting over 1 year starting from TGE
IDO	0.67%	50% at TGE, 50% after 1 month
Marketing & Listing	3.5%	20% at launch, then quarterly over 1 year
Operation Reserve	14%	Fully locked for 3 months, then unlock over 2 years
Liquidity Mining	20%	Unlock over 2 years
Ecosystem	24%	Locked for 1 month, then unlock over 48 months
Foundation	24.43%	Locked for 3 months, then unlock over 48 months

Token Sale

Round	Token price	Quantity	Raising	Fully diluted market cap
Private	\$0.02	75,000,000 BUNI	\$1,500,000	\$20,000,000
Public	\$0.03	6,666,666 BUNI	\$200,000	\$30,000,000

6. Roadmap

- **7/2021 - Launching**
 - Balancer AMM style pools for BEP20 tokens.
 - Kyber's DMM Style Pools for stablecoins.
 - Incentivized liquidity bootstrapping program.
 - Yield farming with vesting rewards on NFT collectibles.
- **Q3/2021 - Acceleration Phase**
 - NFT marketplace.
 - Mobile application for DEX.
 - Exchange listings.
- **Q4/2021 - Moon Phase**
 - NFT game for BUNI NFTs.
 - Governance.
 - Token Burning.
- **2022 - Mars Phase**
 - Synthetic Swap.
 - Derivatives.
 - PolkaFoundry & ETH Layer 2 bridges.

References

- [1] <https://dodoex.github.io/docs/docs>.
- [2] <https://mooniswap.exchange/docs/MooniswapWhitePaper-v1.0.pdf>
- [3] <https://files.kyber.network/DMM-Feb21.pdf>
- [4] <https://balancer.fi/whitepaper.pdf>
- [5] https://www.reddit.com/r/ethereum/comments/55m04x/lets_run_onchain_decentralized_exchanges_the_way/
- [6] <https://blog.gnosis.pm/building-a-decentralized-exchange-in-ethereum-eea4e7452d6e>
- [7] <https://arxiv.org/pdf/1807.00955.pdf>
- [8] <https://curve.fi/files/stableswap-paper.pdf>
- [9] <https://explore.flashbots.net/>
- [10] <https://github.com/ethereum/EIPs/blob/master/EIPS/eip-1559.md>
- [11] <https://smoothy.finance>
- [12] <https://ellipsis.finance/>
- [13] <https://www.genshards.com/>