Array

A Vampire-Resistant Liquidity Protocol
Whitepaper

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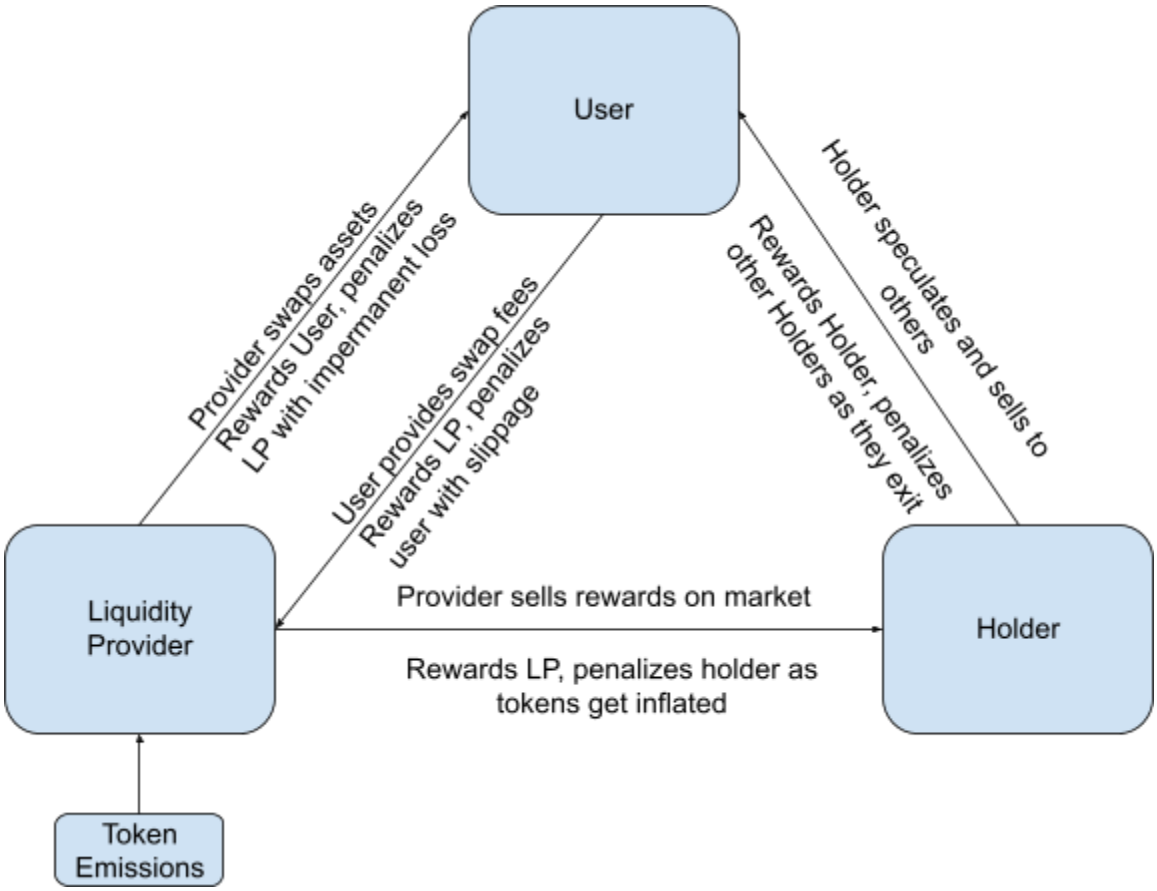
Abstract

Decentralized Finance (DeFi) on Ethereum is a burgeoning ecosystem. As the space has time to mature, it has shown that current models are inefficient when it comes to the nuances of closed economic systems. With current protocols, APYs are artificially inflated from the emissions of speculative governance tokens independent of profits generated. As the space matures, speculation alone cannot sustain a protocol. It has been shown that TVL follows profit, and as token emissions slow down, TVL wanes. Using this knowledge, we propose a new model which applies game theory, finance, economics, and data science to build a self-sustaining reward structure. Array is a vampire resistant liquidity protocol that incentivizes and locks the most profitable forms of liquidity into the arrayDAO.

Applying Game Theory to DeFi

The current *meta* of DeFi projects involves three adversarial players: the user, the liquidity provider, and the token holder. Each player's goal is profit, and in DeFi's current state, this profit penalizes other players. Historically, new protocol launches generate high APYs, which attract TVL, and then that TVL quickly dumps the token before moving on. This penalizes the two other players. It penalizes holders, who lose by selling the token at a loss, and the user, by not attracting enough volume to efficiently provide swaps in the case of an AMM. In game theory, this is known as a *n*-person game, and the described state is the Nash equilibrium[1].



The current DeFi adversarial model is shown in the above diagram.

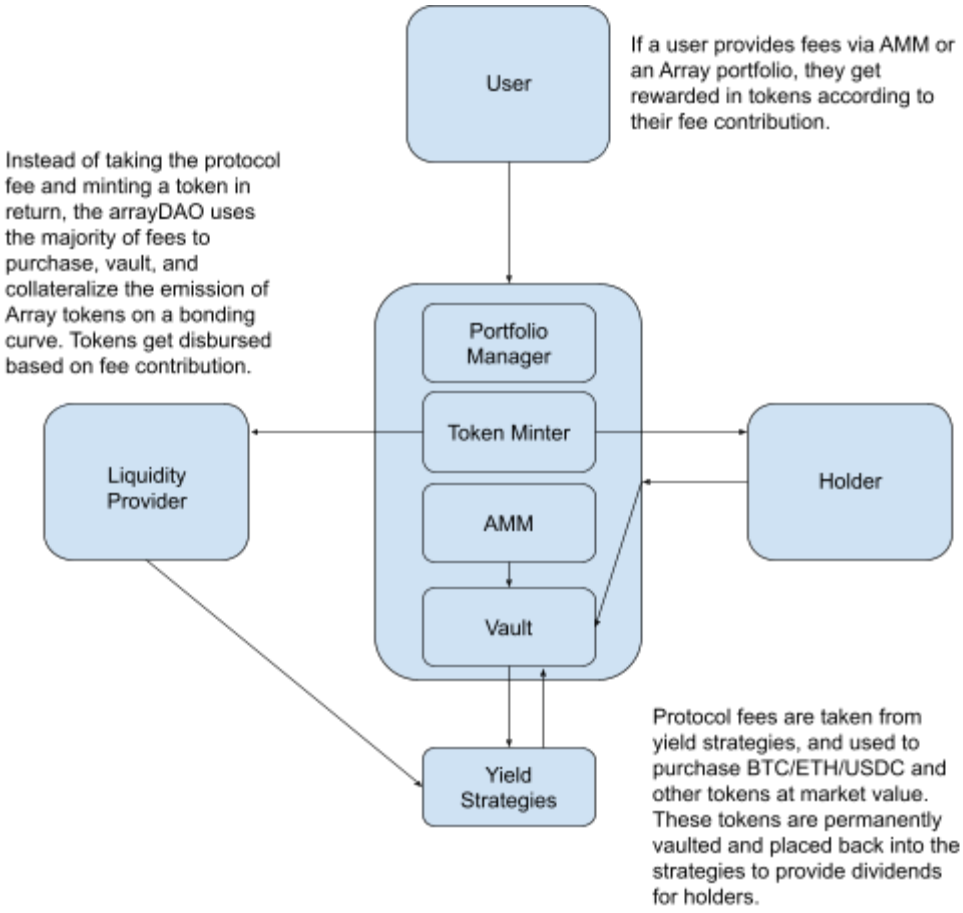
The above diagram can be abstracted into the following formula:

$$totalValueLocked \cdot (protocolYield - protocolFee) + protocolToken = userYields$$

In this equation, $totalValueLocked$ correlates directly with $protocolFee$, which creates variation in expected protocol return, and allows outliers. $protocolToken$ does not correlate to TVL or fees, which causes inflation problems, penalizing holders and incentivising sell pressure. This existing model does not work well at scale because of the adversarial nature, and is why we propose a DAO-based model, which we have named the arrayDAO.

Aligning adversarial incentives with the arrayDAO

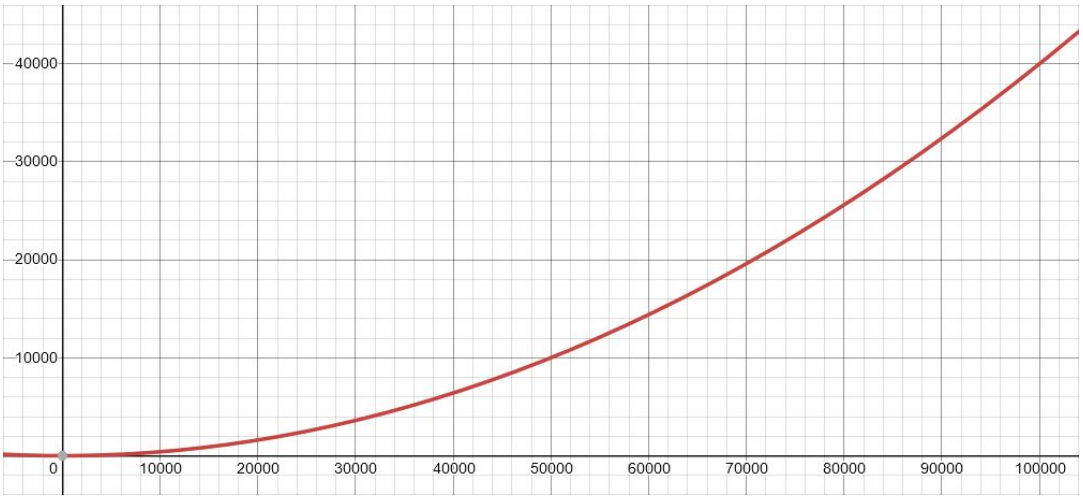
As outlined above, DeFi models penalize other players because of an adversarial structure. By applying the *von Neumann–Morgenstern* theory to provide a cooperative solution to solve the Nash equilibrium, a superadditive model is possible[2]. The “game” has been delegated to a DAO with the singular function of distributing tokens based on individual contributions to the protocol.



The above diagram depicts the arrayDAO basic contract structure.

Instead of simply minting on an emissions schedule, Array mints $protocolToken$ on a collateralized bonding curve, represented as:

$$tokenPrice = \frac{1}{250000} tokenSupply^2$$



The bonding curve formula, shown as a graph. X represents the total supply, and Y represents the collateral required to mint a new Array token at that price.

This creates a self-regulating asymptotic token emission schedule, creating more deflationary pressure as more Array tokens come into circulation, providing inherent value, and solving the LP token dumping problem. A collateralization rate $(cRate)$, set by the DAO, is deducted from $pFee$ and used to purchase Bitcoin, Ethereum, stablecoins, and other select tokens, which are then permanently vaulted as $pInvestment$. Additional tokens to be used as Array collateral can be voted on by the DAO. The $cRate$ directly correlates with the $bondedTokenRate$ emission rate to ensure a stable valuation. A simplified model is shown below. As tokens are collateralized using $cRate$, they are bonded according to the curve model described above.

$$(pInvestment + totalValueLocked) \cdot (pYield - (cRate + pFee)) + bondedTokenRate = userYields$$

With the arrayDAO model, there are several reasons why it is a better alternative to current DeFi platforms:

- Array encourages profitable TVL to contribute to the DAO by providing stable, long term rewards, backed by yield bearing BTC/ETH/USD/DeFi, as APY now scales with TVL, instead of the typical inverse model where a limited APY is divided between locked capital.

- Some historical TVL is retained as $pInvestment$, any protocol volume results in retained value. $cRate$ between assets can be voted on by the DAO to maximize value for Array holders. $pFee$ can also be used to buy APY boosting tokens and further increase APY for users.
- Token emissions can last forever with no risk of penalizing holders by inflation
- $pInvestment$ can be used to insure users in case of a protocol failure, and if the DAO completely fails, can be used to liquidate token holders by burning Array tokens for the underlying assets.
- As long as a $pFee$ is taken, users can receive tokens in return. This includes AMM traders as well, to rebate them on gas usage. This would be impossible for any other model due to inflation.

Distribution Flow of protocol profits and Array rewards

- All funds which flow through the DAO are taxed.
    - This tax is spent to market-buy BTC, ETH, and USDC, as well as a basket of strong DeFi tokens to act as collateral.
- This collateral is vaulted into interest-bearing farms. Staked Array tokens earn this interest.
- Tokens minted with the collateral are returned proportionally to the users who provided the collateral to mint it.

Variable Contributions: Vampire Strategies

As it stands now, many existing protocols operate under a “vampire strategy” model. In a vampire strategy, a protocol extracts value in such a way that is parasitic- commonly by depositing principal, earning interest and governance tokens, and selling the governance tokens on the open market for more of the principal asset. This strategy has been proven effective and has been rapidly iterated upon with the proliferation of DeFi protocols. However, there are cases that vampire strategies will eventually prove unsustainable long-term, as a vampire protocol needs a host to continue staying profitable. The Array protocol offers the traditional vampire strategy model, used to mint Array using the following formula:

$$userReturn = (\ vampireReturn) \ - \ (\ pFee \cdot vampireReturn)$$

In the vampire model, the arrayDAO still receives vaulted contributions, albeit at a lesser rate compared to the angel model. Because of this, providers will gravitate towards angel strategies as they offer higher Array APYs. The protocol rewards Lps more Array by contributing and locking up more tokens they farm into the DAO. Creating a supply sink and increasing the value of all the tokens within Arrays bonding curve allocation and the interest generated on the collateral reserves held within the DAO (compounding supply sink).

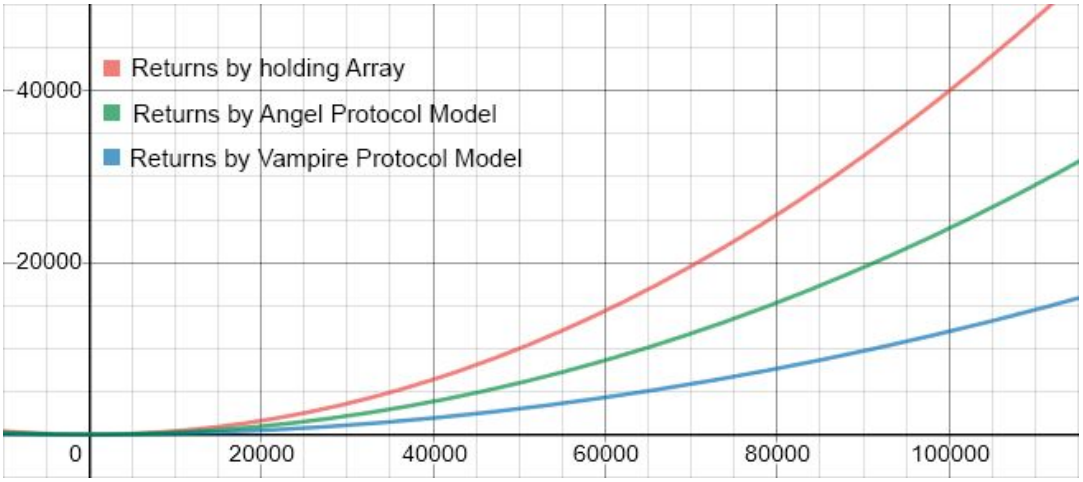
Variable Contributions: Angel Strategies

Angel strategies will allow Array liquidity providers to contribute a greater percentage of the protocol profits they generate to the DAO and operational treasury. This enables Array to grow the DAO at a faster rate whilst also increasing their share of the protocol rights. In addition to Array token distribution, rewards will be used to subsidize impermanent loss. Due to the fact

that Array tokens are collateralized, this averages out at a larger return over time compared to a traditional vampire strategy.

Maximizing Value

Overall, providing better returns for collaborative effort ends up aligning incentives to provide a superadditive effect, as mathematically proven by comparing collateralization rates of Array tokens following the three formulas.



The superadditive effect is apparent when viewing the Array bonding rates of the various protocol methods.

Array tokens can only be issued to lps and traders that generate protocol fees. Therefore, 100% of all Array tokens will be issued to collateral contributors (⅔ of protocol fees), the Array team will therefore not receive any Array tokens. This means that all the protocol fees that are issued to the Array team & development treasury (⅓ of protocol fees) could be used to buy back Array from the secondary market, to issue as payment to our contributors and vendors. In time, we plan to increase the buy back rate to 100%, establishing continuous and scaling buy pressure as protocol fees increase.

Scalability & Failsafe Functions

Token issuance is tied directly to profitability, which creates an infinitely scalable yield generator. Interest bearing token collateralization ensures a gradually rising value floor to combat the increasing supply generated by protocol profits. Inverse to existing DeFi protocols, more TVL actually *increases* return for Array token holders.

A large problem with cryptocurrency projects is that they are dependent on a bull market to sustain both profitability and solvency[3]. At sufficient TVL, this DAO model becomes self-sustaining, providing enough returns from collateral alone to survive bear markets until the next cryptocurrency market cycle begins.

Array token holders can burn their tokens, which transfers the protocol rights to the remaining Array tokens in circulation and unlocks the underlying collateral. This guarantees token value regardless if the protocol is still actively generating profits. If the project shuts down for any reason, the DAO can be liquidated by token holders trustlessly with a contract call.

Passive DeFi with the arrayDAO

By delegating the distribution of rewards to the DAO, the difficulties with balancing rewards becomes self-regulating, incentivizing TVL to move towards the most profitable vaults and pools. Due to the fact that the Array model produces superadditive APY results, profitable vaults stay profitable longer (by creating supply sinks for the tokens we farm and that are part of the bonding allocation). The Array DAO will provide pool and diversify risk efficiently by vault-hopping to provide the best risk adjusted returns for Array token holders and Vault LPs. These swaps can be performed completely internally, reducing value leakage and retaining DAO funds long-term.

Portfolio Management with Smart Contracts

Using the Array vaults and a rebalancer system, both tailored and user-created portfolios are possible. A user who wants to build their own Array would utilize internal liquidity pools provided by Array vaults to create an Array. Instead of going to decentralized exchanges and purchasing proportional assets by percentage which would induce slippage, internal liquidity provided by Vaults would be leveraged to create an internal pool. This internal pool would have a token representing the proportional share of underlying assets, which can be redeemed at any time by being released back into the liquidity pools.

Leveraging Locked Liquidity

The Array DAO leverages the collateral held within it to maximize the risk-adjusted return. The protocol acts as a liquidity sink for DeFi governance tokens that the DAO decides to include within its bonding curve allocation. The Array DAO uses a percentage of protocol fees to buy and vault DeFi governance tokens as collateral. A meta vault is a potential solution to further leverage locked assets for governance proposal votes. By allowing the DAO to redirect liquidity and utility to generate additional passive revenue streams for Array token holders.

Use Cases for Locked Liquidity

- Locked liquidity creates a collateralized and yielding price floor for Array tokens
- Locked liquidity provides foundational capital for Array Vaults and Liquidity Pools
- The Array AMM reduces slippage and gas fees by creating several direct liquidity rails for capital to enter and exiting both the Array and common DeFi ecosystems efficiently
- Locked liquidity creates non-forkable reserves to buy APY-boosting tokens to pair with existing LP deposits. To create a long term competitive strategic reserve of APY

boosting tokens (CRV, CEL). An APY edge over our competitors on the most secure and long-lasting alpha wells in the space.
- Locked liquidity could be used as venture capital investments
- Array leverages historical locked and foundational liquidity that will always remain in the DAO, which secures an important layer of base capital and profits for Array token holders
- Array token holders could vote to direct a percentage of all protocol profits entering the Array DAO into a “insured” custodial reserve.

Utilization will be determined by risk adjusted returns available and the utility Array token holders wish to attach to the token through DAO voting.

Array Smart Pools

Array can leverage both internal vaults and external yield farming protocols to diversify risk. In order to safely and effectively maximize initial user deposits, Smart Pools utilize an algorithm weighted heavily towards stability and minimal risk. This algorithm creates a score for each prospective vault and liquidity pool which is used to dynamically allocate resources. As funds enter a Smart Pool, they are deposited accordingly to an array of pools based on an index score. This score incorporates:

- Public audits
- Weeks of Engineering
- History of Critical Vulnerabilities
- Code Changes (time-weighted average)
- Time in Service
- Pool Collateralization (if applicable)
- 24 Hour Volume
- Historical & Current Pool Liquidity
- Centralization Risk
- APY
- Reward Token Value

Each pool is then set in a weighted array based on this health index to provide the theoretically safest DeFi investment at the highest rate of return, with the addition of earning Array tokens. These Smart Pools are *n*-dimensional, meaning theoretically any protocol with an index score can be incorporated into a custom portfolio created and deployed by the user.

Conclusion

Array is among the next generation of DeFi protocols by combining the best parts of the DAO model with incentivization based on game theory. Utilizing a combination of collateralization, dynamic emissions, and aligning incentives among DeFi participants, the Array model becomes not only a passive DeFi solution but a self-sustaining and infinitely scalable model for long-term growth. By providing incentives for not only users, but also partner protocols, collaboration results in superadditive results for the entire ecosystem as a whole.

References

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2. Neumann, Von John, and Oskar Morgenstern. Theory of Games and Economic Behavior. Princeton University Press, 2007.

3. Benedetti, Hugo E and Kostovetsky, Leonard, Digital Tulips? Returns to Investors in Initial Coin Offerings (May 20, 2018). Journal of Corporate Finance, Vol. 66, No. 101786, 2021, https://dx.doi.org/10.2139/ssrn.3182169.