

Emerging Asset Value Engine

Eave Whitepaper

John Whitton

July 2021

Abstract

Eave efficient multi-chain trading and capital deployment

As at June 25th, 2021 the Decentralized Exchange (DEX) Market has a \$3.3 Billion daily trading volume and is capturing market share from the Centralized Exchange Market which has a daily trading volume of \$119 Billion. Ethereum[2] is still the dominant decentralized platform. However, we are seeing the emergence of low cost trading chains capturing market share. Using 24 hour volume, 13 of the top 20 DEX's are either multi-chain or running on emerging chains such as Binance Smart Chain[4] and Huobi EcoChain[5]. Whilst this is great for the ecosystem as a whole it is also fragmenting liquidity across disparate pools within protocols and blockchains and siloed liquidity on each blockchain.

Eave is a multi-chain AMM protocol with aggregation, capital management and yield optimization capabilities. Eave has three core components Eave Protocol, Eave Platform and Eave Capital Manager.

The protocol is a robust AMM and lending protocol which can be deployed on multiple chains.

The platform is built on Polkadot and offers economic security, fast finality, scalability, low gas fees and a complete developer toolkit for DeFi protocol developers and DApp developers.

The Capital Manager component consists of a suite of three sub-components. The Aggregator offers multi-pool, multi-platform aggregation capabilities. The Capital Optimizer incorporates lending and borrowing capabilities across liquidity pools and platforms to provide capital efficient liquidity provisioning. The Yield Optimizer automates the discovery and provisioning of capital to the DeFi portfolio providing the highest yield.

Contents

1	Overview	3
1.1	Problem and Opportunity	4
1.2	Solution - What makes Eave Different?	4
1.3	Eave Benefits	6
2	Eave Protocol Functionality (KANGA)	7
2.1	Use Case Overview	7
2.2	Teleporting Assets	7
2.3	Foundational Swap	8
2.4	Eave Protocol Swap with Pouch	9
2.5	Eave Aggregator Split Swap	10
2.6	Consolidated Asset Pools	11
2.7	Capital Optimizer Flow	12
2.8	Yield Optimizer Flow	13
3	Eave Implementation	14
3.1	KANGA - Key Functionality	15
3.2	Yield Engine - Strategies	16
3.3	Capital Optimizer - Key Metrics	17
4	Future Work	19
4.1	Traction and Release Strategy	21
4.1.1	KANGA MultiChain Rollout	22
	List of Figures	23
	References	24

1 Overview

With the emergence of decentralized finance, a diverse financial ecosystem has been created using blockchain technology. We are now seeing rapid innovation in the space specifically around improving the efficiency of capital deployment and exchange. Recent improvements include scenario specific bonding curves for more effective trades, aggregation layers to facilitate better price discovery and trade execution also automated yield strategies to increase returns on deployed capital.

Eave enables the efficient exchange and provisioning of capital both within and across multiple chains. It provides a complete solution by combining three distinct components a protocol, platform and aggregation engine.

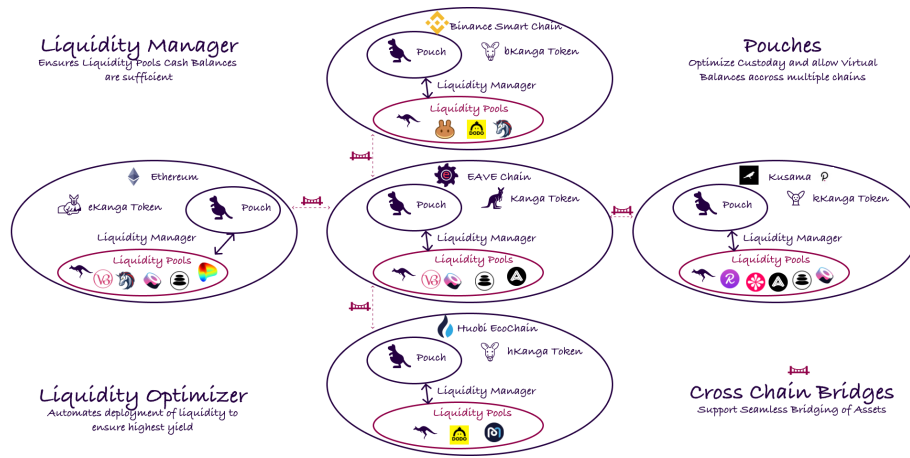


Figure 1: EAVE Protocol

1.1 Problem and Opportunity

Eave is focusing on reducing the inefficiencies in the following areas:

- **Gas fees** are often high and may involve multiple fees across liquidity pools for a single trade.
- **Slippage** can be high when there is not enough liquidity available to a pool or an inefficient bonding curve is used for the trade.
- **Capital Efficiency** can be improved by reducing the amount of capital required to be locked within a pool to facilitate trades.
- **Greater Liquidity** can be provided by leveraging liquidity across multiple protocols and platforms when executing a trade.
- **Token Holder Rewards** can be increased by increasing the fees earned through different channels such as a portion of the trading protocol fees, gas fees and allowing the token to be used as collateral in lending protocols.

1.2 Solution - What makes Eave Different?

Eave is a complete multi-protocol multi-chain capital management solution

Eave's solution is focused on efficient aggregation and interoperability between trading protocols and multiple block chains. Eave goes beyond improving gas on traditional chains and improving liquidity within a protocol and even beyond using price discovery and aggregation to offer more efficient trades. Eave enables the dynamic seamless movement of capital to the most efficient trading platforms on the fly as needed.

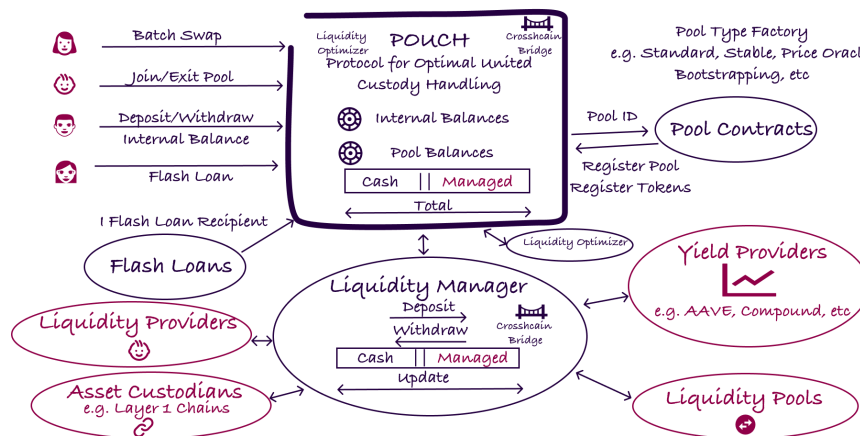


Figure 2: EAVE Protocol

Let's review the above problems and see how a multi-layer solution adds value to each:

Eave Protocol is a multi-chain solution that can be deployed standalone on multiple blockchains. It provides efficient trades within each individual chain. Features include the ability to have scenario specific bonding curves to reduce slippage. The separation of bonding curve logic and liquidity management using Pouch the Protocol for Optimized Unified Custody Handling. Pouch also provides gas optimization using virtual balances and integrates with Eave's Asset Teleporter and capital management.

Eave platform is complete platform for DeFi developers and enables low gas fees, economic security, prevention of front running and multi-chain bridging. It is built on Polkadot and leverages XCMP functionality for it's foundational offering to on-board assets from all parachains. Eave's xSDK (cross SDK) has both EVM and WASM support allowing developers to port their existing solidity and vyper protocol as well as developing in rust and ink.

Eave Aggregation allows price discovery, optimized order execution which can leverage multiple liquidity pools to provide the best execution price for a single trade. It also has multi-path order execution which dynamically determines whether a more efficient trade can be realized by including intermediate token swaps for lower slippage.

Eave's Capital Optimizer enables seamless multi-chain liquidity and more efficient use of capital. It does this by enabling asset custodians with excess capital to provide this capital as needed to liquidity pools thus enabling them to more efficiently utilize their capital.

Eave's Yield Optimizer automates the discovery of optimal yield for liquidity providers and dynamically moves their assets to the highest yield liquidity pools. It can be deployed with Eave Protocol for a chain specific solution or integrated with Eave Platform and Eave's Capital Manager to provide a complete multi-chain multi-asset solution.

1.3 Eave Benefits

Following are the benefits Eave provides for each user type.

Traders and Arbitragers: In addition to holding and swapping tokens, holders can combine multiple trades in a batch swap, provide liquidity by joining or exiting a pool, decide whether to leave their tokens in the POUCH as an internal balance or withdraw the assets back to the native token and create flash loans for arbitraging opportunities.

Token Holders drive the governance of the platform and get the ability to stake their tokens for a share of the protocol fees.

Asset Custodians: are any entity which manages assets. These include Layer 1 blockchains, parachains, DeFi protocols, centralized exchanges and traditional financial institutions. All of these custodians can increase liquidity for their assets (tokens). They can also increase liquidity for their platform, either by bridging to POUCH or moving forward implementing Eave Protocol on their platform.

Liquidity providers invest across multiple platforms easily and efficiently.

Yield providers such as DeFi protocols like AAVE[18] can use their managed assets to provide liquidity. This reduces the amount of assets needed to be held in pools and increases their yield by augmenting their existing fees with trading fees from the liquidity pools. Yield can be further increased by using more advanced yield strategies to improve yield similar to the strategies that YEARN [20] introduced.

AMM's can leverage Eave's Pouch functionality for token management and integrate with the Capital Management functionality to increase their available liquidity and returns.

DeFi Developers can leverage the EAVE Platform and xSDK to rapidly innovate on a secure, cost effective, fast and open platform.

2 Eave Protocol Functionality (KANGA)

2.1 Use Case Overview

Eave Protocol is a multi-chain DeFi Protocol, as such it may be launched standalone on multiple chains. In the examples below we have named the protocol **KANGA** (Kernel for Aggregating Networked Growth Assets). This is to highlight the separation of the platform from the protocol. Let's go through the various use cases to see how Eave's Protocol, Platform and Aggregation improve both capital efficiency, trade value and usability.

2.2 Teleporting Assets

The asset teleporter allows the teleporting of Assets between chains. It leverages multi-chain bridges and the POUCH protocol to provide a portal between various chains. It can be leveraged in the following scenarios:

- **Traders** depositing or cashing out funds across platforms.
- **Layer 1 Platforms** providing liquidity across multiple platforms.
- **Cash Optimizer** dynamically moving funds between liquidity protocols and other DeFi protocols across platforms.
- **Yield Optimizer** dynamically moving liquidity between platforms to ensure the most efficient use of capital and highest yield for liquidity providers.

2.3 Foundational Swap

The EAVE Foundational Protocol has already been built and is currently in testing. It's inspiration comes from Uniswap V2 and Acala. It offers the traditional AMM capabilities of Order routing as do many of the protocols which have been inspired by Uniswap, Sushiswap, PancakeSwap Viper and others. Here we look at a swap of polkaBTC (pBTC) TO True USD on the EAVE Protocol.

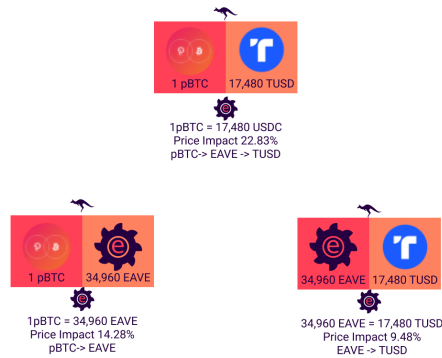


Figure 3: Foundational Swap

In this example the following occurred

- The Smart Order Router determined the most cost effective execution path from pBTC to TUSD was via EAVE we call this multiswap where intermediary tokens are introduced to provide the most effective trade execution.
- This single swap actually involves multiple trades as each liquidity pool has it's own token factory. We will see how this can be improved when we introduce POUCH. For this trade the swaps, which each occur gas fees are
 1. pBTC - PolkaBTC Deposited
 2. EAVE - EAVE token withdrawn
 3. LPT-pBTC-EAVE - The pBTC-EAVE liquidity pool token updated to reflect the update balances
 4. EAVE - EAVE Token Deposited
 5. EAVE - TUSD token withdrawn
 6. LPT-EAVE-TUSD - The EAVE-TUSD liquidity pool token updated to reflect the update balances

In this scenario, without aggregation, the user has a choice of multiple exchanges on multiple platforms and they must login to each exchange and check each platform within the exchange to discover the best price. Also in this scenario the assets are different representations of the same underlying Assets (Bitcoin and US Dollars) but are not fungible between platforms or between token implementations. Here our trader, after logging in to five separate exchanges would choose to execute on Uniswap Ethereum as it had the most liquidity and the best price.



Figure 4: Simple Swap User chooses a Exchange

2.4 Eave Protocol Swap with Pouch

If we introduce Pouch we now immediately save multiple calls to different Liquidity Pool contracts as balances for all pools are now managed within the Pouch. This reduces the number of calls from 6 to 5.

However if the trader is for example a high volume trader or arbitrageur they can take advantage of the Pouch's ability to store virtual balances of their tokens. And at a later time may "cash out" their tokens to the Layer 1 native token. In this scenario this dramatically improves the gas needed as we are now doing just one interaction with the pouch contract instead of 5 (previously 6) interactions with native and liquidity pool tokens.

Here the following updates all occur within Pouch reducing gas fees

1. pBTC - The users virtual balance of polkaBTC is reduced
2. LPT-pBTC-EAVE - The pBTC-EAVE liquidity pool balance is updated in Pouch to reflect the update balances
3. TUSD - The users virtual balance of TUSD is increased
4. LPT-EAVE-TUSD - The EAVE-TUSD liquidity pool token updated to reflect the update balances

2.5 Eave Aggregator Split Swap

So far we have covered a simple swap, a multi-swap and the use of Pouch. Here we look at how we can split a swap amongst multiple pools to reduce the slippage in each pool. Note in this example we must use both the same tokens and the same platform to ensure that the user receives exactly the tokens requested.

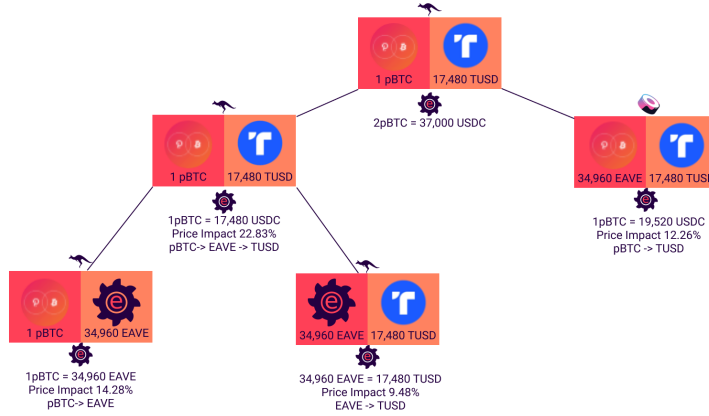


Figure 5: Split Swap Multi-protocol

If we now introduce the Asset Teleporter then we can then aggregate and split over multiple chains and protocols. In the example below we aggregate over the Eave and Acala platform and the Kanga and Acala protocols to reduce the slippage for the user. In this example the Aggregator may be able to leverage virtual balances in the Eave Pouch if available, otherwise it will need to factor in the increased gas costs for multi-chain swaps when calculating the most efficient trade.

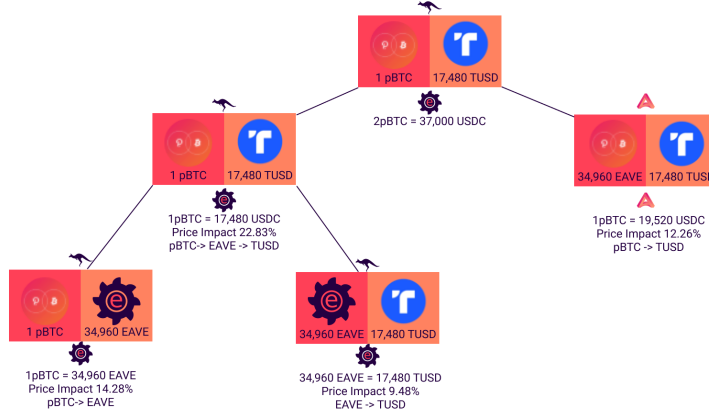


Figure 6: Split Swap Multi-chain

2.6 Consolidated Asset Pools

Consolidated Asset Pools offer a new type of asset class, taken semi-fungible tokens representing the same underlying asset and consolidating them into a single Pool. The trader may then choose to use this basket of assets liquidity pool token rather than taking the individual tokens. This basket token may then be traded directly or used for collateral in other protocols, such as lending protocols.

With the combination of POUCH being able to store virtual balances for underlying assets and Asset Teleporter functionality we now can consolidate assets from multiple chains into the same basket. Greatly enhancing the liquidity and diversity of offerings on the platform.

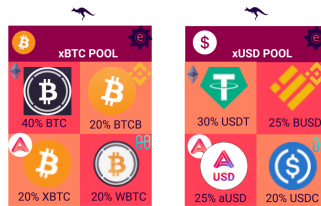


Figure 7: Consolidated Asset Pools

2.7 Capital Optimizer Flow

Protocol for Optimal United Custody Handling (POUCH) provides enhanced liquidity, better yields and gas efficiency.

The Capital Optimizer manages amount of cash required in liquidity pools and deploys under utilized capital to other DeFi protocols including multi-platform liquidity pools and lending and borrowing protocols. It does this dynamically.

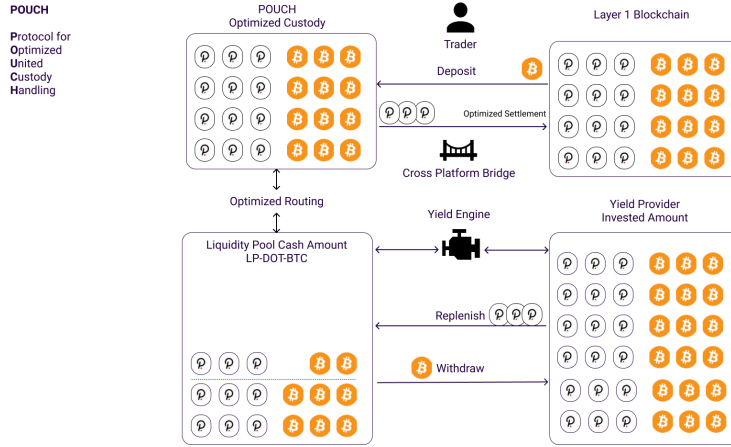


Figure 8: Pouch Sample Trade Flow

The POUCH holds all balances of the Liquidity Pools for the protocol. It allows for a single interface point with all liquidity pools and abstracts away the underlying implementation resulting in a gas efficient platform and agnostic interface for the exchange of tokens.

Routing and Settlement: off-chain swap routing enables the discovery of the best value for swaps via the Optimized Ledger. This includes all Kanga protocol Liquidity Pools and may be augmented with on-chain components for realizing discovery fees.

A sample trade flow is as follows:

1. Trader approves the Optimized Ledger to work as a proxy
2. Trader requests to swap one BTC for some DOT
3. The BTC is deposited into the Optimal Ledger (note: this optionally uses the Cross Platform Bridge if the assets come from another layer 1 platform)

4. Optimal Routing selects the most efficient swap route from multiple liquidity pools and executes the trade
5. The trader receives the DOT and then can either leave the DOT on the Optimal ledger or withdraw it using Optimal settlement (once again, if the funds are native to another layer 1 platform the Cross Platform Bridge will be used)

2.8 Yield Optimizer Flow

The yield optimizer automates the discovery of the best yield and updates the deployment of capital to the highest yield liquidity pool or DeFi Protocol. Leveraging the Asset Teleporter it can support protocols across multiple platforms.

The yield optimizer connects Liquidity Providers to Yield Providers. Yield Providers *invest* in a liquidity pool. However, rather than sending all the invested tokens to the liquidity pool, only the minimum amount needed for transactions are sent. The role of the yield optimizer is to monitor the balance of the liquidity pools and replenish and re-balance them as needed.

The Yield Optimizer flow is as follows:

1. The Yield Provider (e.g. AAVE or Honza) "invests" a number of tokens into a liquidity pool.
2. The Liquidity Pool maintains a minimum threshold needed for trading, which is called the Optimal Liquidity Amount. The remaining "investment" tokens remain in the Yield Provider enhancing the yield for the Liquidity Pool.
3. When the number of tokens for any token in the pool drops below the Optimal Liquidity Amount, a re-balance is triggered (optionally using the cross platform bridge if needed).

Note: In the above scenario, BTC was traded for DOT thus triggering DOT to drop below its Optimal Liquidity Amount. Hence, DOT is replenished by the Yield Provider and BTC is withdrawn to balance the Liquidity Pool and continues to earn yield on the surplus BTC.

3 Eave Implementation

The Eave Protocol provides efficient trades within each individual chain. The protocol is inspired by Uniswap, Balancer, Acala, Curve, Shell Protocol and DodoEx for AMM functionality, Sushiswap for Reward incentives and YEARN yield strategies for it's yield optimization. Efficient use of capital and liquidity optimization is inspired by Uniswap v3 and Balancer V2, Aave.

The Eave Aggregation Value Engine allows optimized custody and settlement, price discovery and seamless multi-chain liquidity. The multi-protocol aggregation capabilities are inspired by 1inch and Paraswap. Multi-chain support inspiration by Sushiswap, Acala, Moonbeam and compound cash.

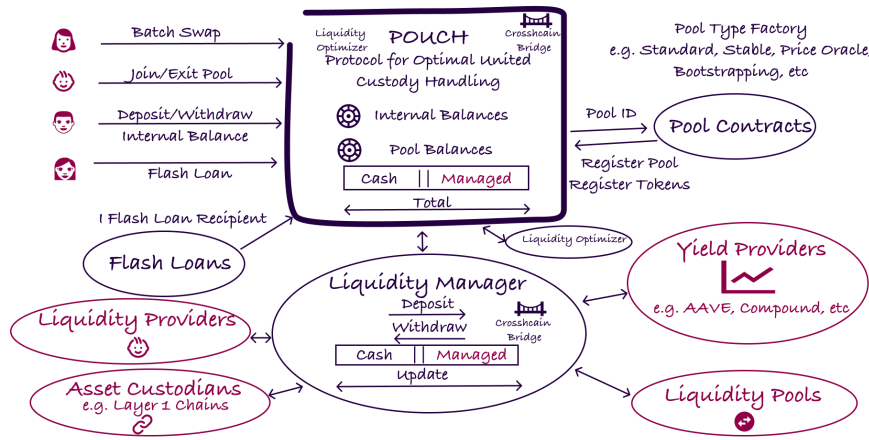


Figure 9: EAVE Protocol

3.1 KANGA - Key Functionality

1. **Native Token Balances** are the balances of the underlying Layer 1 token used when providing liquidity.
2. **Virtual Balances** are a representation of native tokens within the Pouch enabling efficient gas costs.
3. **Pool Contracts** are the contracts which manage the bonding curves for the pools and enable scenario specific bonding curves to be implemented at the Pool Level. They are used in conjunction with the Pouch which manages the token balances.
4. **Liquidity Pool Tokens** representing the liquidity pool balances. They have the ability to work with the Capital Optimizer to record cash and managed balances for the liquidity pools.
5. **Positional Tokens** are non-fungible tokens representing a position or settlement contract.
6. **Pouch** is implemented once per platform. It stores consolidates and manages all liquidity pool tokens in a single contract enabling reduced gas fees and swapping of virtual balances.
7. **Aggregation Order Router** used when executing a trade. It reviews all pools and calculates the most efficient trade. This may include splitting the trade across multiple pools to reduce slippage or introducing intermediate tokens into the order execution to ensure the most cost effective execution route.
8. **Consolidated Asset Pools** are multi-token Pools whose liquidity can be used to represent semi-fungible assets.
9. **Cash Out** allows a user to optionally cash out their tokens to the underlying native token. Deposits will always check a users virtual balances before using the native token to reduce gas fees.
10. **Capital Optimizer** enables a liquidity pool to manage a portion of their cash balances with other yield providers including other DeFi Protocols, liquidity pools and even multi-platform protocols. This optimizes the use of capital and increases yield for liquidity providers by investing capital that would otherwise lay dormant in other yield returning protocols.
11. **Yield Optimizer** enables a liquidity provider to choose a yield strategy to dynamically reallocate their capital to ensure the greatest return on their capital.
12. **Asset Teleporter** enables token balances including native tokens, virtual balances and liquidity pool tokens to be ported across to other protocols using cross chain bridging. Thus opening up new capabilities for the use of capital across multiple chains.

3.2 Yield Engine - Strategies

Yield strategies similar to those introduced by Yearn[20] and implemented in protocols such as sushi swap[14] can be added to the yield engine and increase yield for Asset Custodians. Features of V2 yVaults include:

Up to 20 strategies per yield engine: will increase the flexibility to manage capital efficiently during different market scenarios. Each strategy has a capital cap. This is useful to avoid over allocating funds to a strategy which cannot increase APY anymore.

Strategist and Guardian are the new Controllers: The Strategy creator (strategist) and a Guardian oversee strategy performance and are empowered to take action to improve capital management or act on critical situations.

Automated vault housekeeping (Keep3r network): harvest() and earn() calls are now automated through the Keep3r bots network. These 2 function calls are used to purchase new underlying collateral by selling the farmed tokens while moving the profits back to the vault and later into strategies. The keep3r network takes the heavy lifting of doing these calls and running with the gas costs in exchange for keep3r tokens. This approach unloads humans from these housekeeping tasks. **Note:** keep3r network[19] will be implemented as needed on emerging blockchains.

Bouncers and Guest lists: Yearn has created a unique development process for new vaults. All vaults are launched as Test Vaults (tyvToken) to start with. Test vaults have a cap and therefore their strategies do as well. Also, the Bouncer has a guest list of wallets which can interact by depositing and withdrawing funds in the Test Vaults. This approach prevents uninformed users from potentially losing funds in a not production ready product. Kanga Protocol will use test vaults before leveraging the strategy in yield engines.

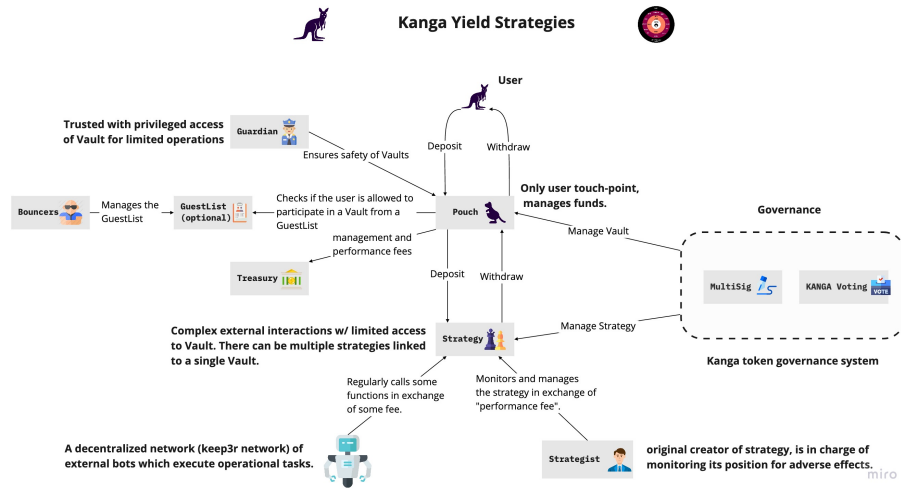


Figure 10: Yield Engine Strategies using Yearn Vaults

3.3 Capital Optimizer - Key Metrics

Below is an overview of the key metrics for the Capital Optimizer

Pod slippage Threshold: This is the maximum tolerated slippage by Traders. For example uniswap and sushiswap application interface currently have a default slippage amount of 0.1% and 0.5% respectively which can be overwritten by the user. The slippage amount can be derived from the pools bonding curve

Maximum Trade Percentage: The maximum trade percentage is based on a percentage of the pool. It can never be more than 100% as you cannot trade more tokens than exist in the pool. Using the Slippage Threshold we can calculate the max trade percentage.

Cash Calculation: This is the Minimum amount of cash required to ensure that the slippage threshold is not exceeded. This can be calculated using the slippage threshold as the max trade amount percentage

For example if we have a max slippage threshold of 2% then we may need to maintain a minimum cash amount of 20% of the total liquidity pool.

Managed Commitment This is the managed commitment that the Pool agrees to reserve for topping up Liquidity Balances

Protocol Fee Calculation: Protocol fees are distributed amongst all Pools based on there Liquidity Percentages Tracked By Liquidity Pool Tokens (LPT). Managed Tokens are incorporated into the liquidity percentage for the

pool and receive a percentage of the protocol fees.

Re-balancing Gas Fees: are the gas fees incurred when re-balancing liquidity, note this may be improved using batch settlement leveraging sparse merkle chains or zk-rollups.

Yield Optimization Fees: are the fees charged to liquidity providers when their portfolio is re-balanced by the yield optimizer using automated yield strategies.

4 Future Work

The vision for the Eave Exchange is a multi-platform, multi-asset DEX. This will be accomplished in a phased roll out. The first phase is the launch on Binance Smart Chain[4]. This will give access to all assets on the Binance Smart Chain and optimized swap and yield functionality.

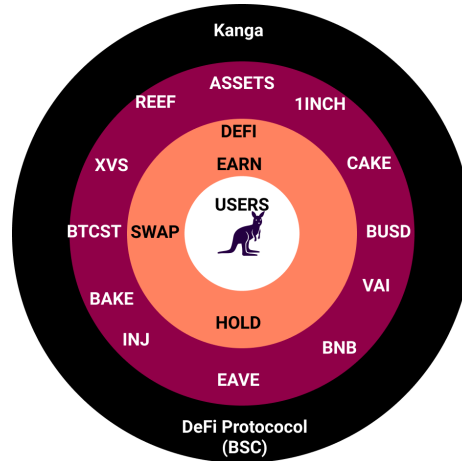


Figure 11: Eave Exchange on Binance Smart Chain

The following phases include adding additional platforms such as Polkadot[6] and Huobi Eco Chain[5] and additional functionality. These may be done in parallel.

Additional Eave Protocol functionality includes multiple bonding curves, governance, an NFT marketplace, Price Oracles and Limit Orders.

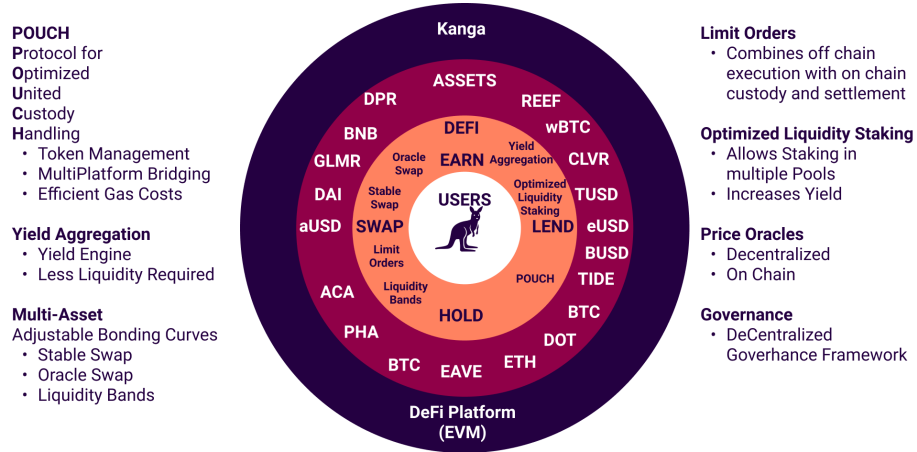


Figure 12: Eave complete protocol

The additional Platform functionality includes Cross Platform Bridges which connect the systems together. Also, a Polkadot parachain has been prototyped and is being tested as a settlement layer. This would enable a settlement hub on its own dedicated trading chain and support a broad ecosystem.

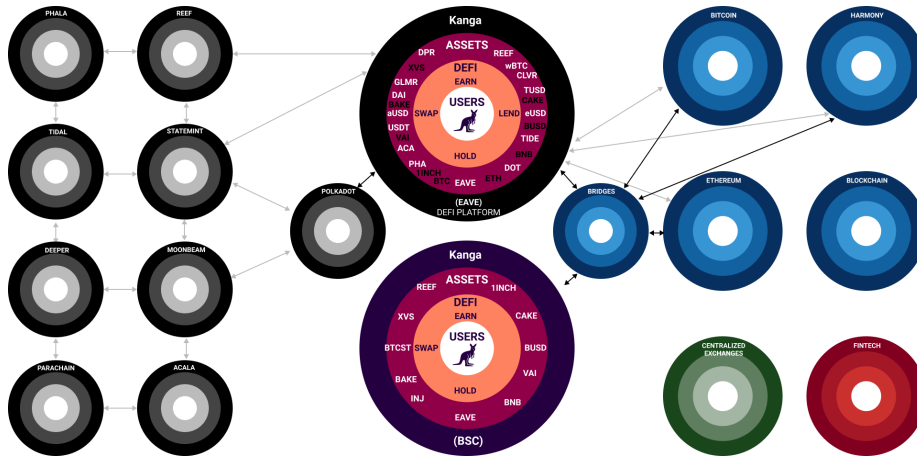


Figure 13: Eave Exchange future Protocol enhancements

4.1 Traction and Release Strategy

Eave first launched it's Steam parachain on the Rococo Testnet on April 5th, 2021 [7] and has since been focused on it's developer SDK which supports EVM and WASM, bridging functionality and Eave foundational protocol offering Exchange, Lending, Borrowing and Staking Functionality.

EAVE has deployed it's AQUA Testnet and Steam Parachain which it is using to test cross chain settlement as well as it's Digital Asset Marketplace. It's planned launch on Kusama is next followed by it's deployment on Polkadot.

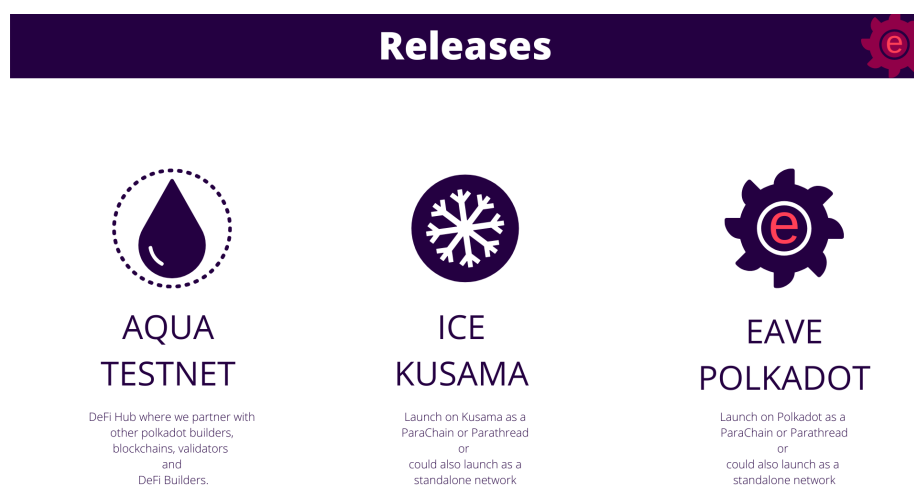


Figure 14: EAVE Feature Roll out

Following are the next targeted features being worked on which will be rolled out incrementally.

- DeFi Protocol - POUCH
- Limit Orders (Order Book)
- Platform Bridges - Binance, Ethereum, Cosmos, Harmony
- Multi-Asset Support
- Protocol Onboarding - DeFi Protocols
- Optional - SuperChain on Polkadot

As you will notice above some of these features may depend upon partnerships. Partnerships and Ecosystem growth are a strong focus with a significant amount of Tokens being dedicated to Ecosystem Growth via grants. This

is combined with EVM compatibility, a robust developer toolkit, integration framework and open standards to ensure a developer friendly platform.

EAVE has built an EVM compatible blockchain which has been deployed as a standalone IDE, a standalone Testnet and a parachain. This includes full support for development standards such as ORML and ERC to enable a rich, cost effective development environment as we become a DeFi Hub.

We are now dogfooding our own IDE and development tools as we create our liquidity pool framework. The result will be liquidity pools can be deployed on other platforms and leveraged by other AMM developers. These liquidity pools can then integrate with yield engines to enhance return for liquidity providers and leverage EAVE Optimized Custodial and Settlement (OCS) to ensure greater liquidity.

As an aggregator and exchange of digital assets, we plan to work across the complete Polkadot ecosystem, blockchain community as a whole and centralized digital asset providers. Key focus areas include working with other blockchains to enhance their liquidity on their own chain via our liquidity pools and open up cross chain liquidity through our Integration Framework and Optimized Custodial Settlement. Working with DeFi projects to enable them to more easily build AMM's on multiple platforms using our liquidity pool standards.

4.1.1 KANGA MultiChain Rollout

Eave Protocol (KANGA) initial (foundational) offering including Exchange, Lending, Borrowing and Staking Functionality has been developed and deployed on the Eave Platform and is currently undergoing functionality testing and code audit preparation. The protocols vision is to be multi-platform and we believe the emergence of low cost trading platforms including Polkadot[6] and Kusama parachains[8], Binance Smart Chain, Huobi EcoChain, Harmony and Polygon are ideal for platforms for Eave Protocol.

Our initial launch targets include Polkadot's Kusama which [6] has begun rolling out it's Parachain [8] and Parathread offerings. Polkadots Valuation of \$15 Billion has been steadily increasing, and growing more rapidly than Ethereum and other layer 1 platforms. Eave foundational protocol offering Exchange, Lending, Borrowing and Staking Functionality and has been deployed on the EAVE Platform and is currently undergoing functionality testing and preparing for code audits. Binance Smart Chain which has captured approximately 20% of the DEX daily trading volume and it's Decentralized Finance (DeFi) ecosystem is growing rapidly.

List of Figures

1	EAVE Protocol	3
2	EAVE Protocol	4
3	Foundational Swap	8
4	Simple Swap User chooses a Exchange	9
5	Split Swap Multi-protocol	10
6	Split Swap Multi-chain	11
7	Consolidated Asset Pools	11
8	Pouch Sample Trade Flow	12
9	EAVE Protocol	14
10	Yield Engine Strategies using Yearn Vaults	17
11	Eave Exchange on Binance Smart Chain	19
12	Eave complete protocol	20
13	Eave Exchange future Protocol enhancements	20
14	EAVE Feature Roll out	21

References

- [1] Satoshi Nakamoto, 2008. *Bitcoin: A Peer-to-Peer Electronic Cash System* <https://bitcoin.org/bitcoin.pdf>
- [2] Vitalik Buterin, 2013 *Ethereum Whitepaper* <https://ethereum.org/en/whitepaper/>
- [3] Vitalik Buterin, 2013 *ETHEREUM VIRTUAL MACHINE (EVM)* <https://ethereum.org/en/developers/docs/evm/>
- [4] Binance. 2020. *Binance Smart Chain. A Parallel Binance Chain to Enable Smart Contracts* <https://github.com/binance-chain/whitepaper/blob/master/WHITEPAPER.md>
- [5] Huobi. 2020. *Huobi ECO Chain – Heco* [HuobiECOChain\T1\textendashHeco](https://github.com/HuobiECOChain/T1/textendashHeco)
- [6] Gavin Wood. 2018. *POLKADOT: VISION FOR A HETEROGENEOUS MULTI-CHAIN FRAMEWORK*. <https://polkadot.network/PolkaDotPaper.pdf>
- [7] John Whitton. 2021. *Include Steam parachain for Rococo* <https://github.com/polkadot-js/apps/pull/5025>
- [8] Polkadot Wiki. 2020. *Parachains*. <https://wiki.polkadot.network/docs/en/learn-parachains>
- [9] Hayden Adams, Noah Zinsmeister, Dan Robinson. 2020. *Uniswap v2 Core*. <https://uniswap.org/whitepaper.pdf>
- [10] Fernando Martinelli, Nikolai Mushegian. 2019. *A non-custodial portfolio manager, liquidity provider, and price sensor*. <https://balancer.finance/whitepaper/>
- [11] Fernando Martinelli, 2021 *Introducing Balancer V2: Generalized AMMs* <https://medium.com/balancer-protocol/balancer-v2-generalizing-amms-16343c4563ff>
- [12] Michael Egorov. 2019. *StableSwap - efficient mechanism for Stablecoin*. <https://www.curve.fi/stableswap-paper.pdf>
- [13] DODO Team, 2020. *A Next-Generation On-Chain Liquidity Provider Powered by Pro-active Market Maker Algorithm*. <https://dodoex.github.io/docs/docs/whitepaper/>
- [14] SushiSwap, 2020. *SushiSwap Staking SushiBar (xSushi)*. <https://docs.sushi.com/>
- [15] Mdex, 2021. *MDEx Economic Whitepaper* <https://mdex.medium.com/mdex-economic-whitepaper-1bdc882e20c9>

- [16] PancakeSwap, 2020 <https://docs.pancakeswap.finance/> <https://docs.pancakeswap.finance/>
- [17] Stanislav Kozlovski, 2021. *Balancer V2 — A One-Stop-Shop* <https://medium.com/balancer-protocol/balancer-v2-a-one-stop-shop-6af1678003f7>
- [18] AAVE Protocol, 2020. *AAVE Protocol Whitepaper*. https://github.com/aave/aave-protocol/blob/master/docs/Aave_Protocol_Whitepaper_v1_0.pdf
- [19] keep3r.network, 2020. *Keepers* <https://docs.keep3r.network/keepers>
- [20] yearn.finance, 2020 *V2 yVaults* <https://docs.yearn.finance/products/yvaults/v2-yvaults>
- [21] Kenneth White, 2020. *Shell Protocol*. https://github.com/cowri/shell-solidity-v1/blob/master/Shell_White_Paper_v1.0.pdf
- [22] saddle.finance, 2021. *About Saddle* <https://docs.saddle.finance/>
- [23] Hayden Adams, Noah Zinsmeister, Moody Salem, River Keefer, Dan Robinson, 2021. *Uniswap v3 Core* <https://uniswap.org/whitepaper-v3.pdf>
- [24] Balancer, 2020. *Liquidity Bootstrapping Pool* <https://docs.balancer.finance/guides/smart-pool-templates-gui/liquidity-bootstrapping-pool>
- [25] Joe Petrowski, 2020. *Polkadot Governance* <https://polkadot.network/polkadot-governance/>
- [26] Sunshine Protocol, 2020. *Sunshine Governance* <https://sunshine-protocol.github.io/sunshine-bounty/intro.html>
- [27] NucleiStudio, 2020. *Governance OS* <https://github.com/NucleiStudio/governance-os>
- [28] Sunshine Protocol, 2020. *Sunshine Governance* <https://sunshine-protocol.github.io/sunshine-bounty/intro.html>
- [29] Polkadot, 2019. *A Walkthrough of Polkadot's Governance*. <https://medium.com/polkadot-network/a-walkthrough-of-polkadots-governance-486555a056e0>
- [30] Polkadot Wiki, 2020. *Governance*. <https://wiki.polkadot.network/docs/en/learn-governance>
- [31] Gavin Wood, 2019. *Kusama Rollout and Governance, 2019*. <https://polkadot.network/kusama-rollout-and-governance/>
- [32] Polkadot Wiki, 2020. *Treasury* <https://wiki.polkadot.network/docs/en/learn-treasury>

- [33] Acala Wiki, 2020, *Governance Overview*. <https://wiki.acala.network/maintain/governance-guides/governance-overview>
- [34] Alex Evans, Guillermo Angeris, Tarun Chitra, 2021. *Optimal Fees for Geometric Mean Market Makers* <https://stanford.edu/~guillea/papers/g3m-optimal-fee.pdf>
- [35] SushiSwap, 2020. *Sushibar - Staking* <https://docs.sushi.com/products/the-sushibar>
- [36] Uniswap Org 2020. *Introducing UNI*. <https://uniswap.org/blog/uni/>
- [37] Sushi 2020. *Current Governance Model* <https://docs.sushi.com/governance/current-governance-mdoel>
- [38] Sushi, 2020. *CProposals & Voting* <https://docs.sushi.com/governance/proposals-and-voting>
- [39] Andre Cronje, 2021. *Sushinomics : introducing oSushi* <https://forum.sushi.com/t/sushinomics-introducing-osushi/4055>
- [40] Stanislav Kozlovski, 2021 *Balancer V2 — A One-Stop-Shop - Subsection Governance* <https://medium.com/balancer-protocol/balancer-v2-a-one-stop-shop-6af1678003f7>
- [41] Susi, 2020. *Sushibar - What is xSUSHI?* <https://docs.sushi.com/products/the-sushibar>
- [42] Sushi, 2020. *BentoBox - What is BentoBox?* <https://docs.sushi.com/products/bentobox>
- [43] Sushi, 2021. *Kashi Lending - What is Kashi?* <https://docs.sushi.com/products/kashi-lending>
- [44] Lido, 2020. *Lido: Ethereum Liquid Staking* <https://lido.fi/static/Lido:Ethereum-Liquid-Staking.pdf>
- [45] Lido, 2021. *How To: Liquidity mining with SushiSwap Onsen* <https://blog.lido.fi/liquidity-mining-with-sushiswap-onsen/>
- [46] Acala, 2020. *Liquid DOT - Staking Liquidity Protocol* <https://wiki.acala.network/learn/basics/liquid-dot>
- [47] Sushi, 2021. *Yield Farming* <https://docs.sushi.com/products/yield-farming>
- [48] Substrate Developer Hub, 2020. *Off-Chain Workers*. <https://substrate.dev/docs/en/knowledgebase/learn-substrate/off-chain-workers>
- [49] Steve Ellis, Ari Juels and Sergey Nazarov, 2017. *ChainLink A Decentralized Oracle Network*. <https://link.smartcontract.com/whitepaper>

- [50] Sawit Trisirisatayawong, 2020. *Band Protocol White Paper*. <https://github.com/bandprotocol/bandchain/wiki/Terminology>
- [51] Bryan Chen, 2020. *Introducing the Open Oracle Gateway for Polkadot*. <https://medium.com/polkadot-network/introducing-the-open-oracle-gateway-for-polkadot-1cf2e1b71c92>
- [52] ACALA, 2020. *Open Oracle Gateway*. <https://wiki.acala.network/learn/basics/oracle>
- [53] Chris Williams, 2020. *Compound User Liquidated for \$49 Million, Price Oracle Blamed*. <https://cryptobriefing.com/compound-user-liquidated-49-million-price-oracle-blamed/>
- [54] Scott Chipolina, 2020. *Oracle Exploit Sees \$89 Million Liquidated on Compound*. <https://decrypt.co/49657/oracle-exploit-sees-100-million-liquidated-on-compound>
- [55] Vitalik Buterin, 2018. *Improving front running resistance of $x*y=k$ market makers*. <https://ethresear.ch/t/improving-front-running-resistance-of-x-y-k-market-makers/1281>
- [56] Anton Bukov, Mikhail Melnik, 2020. *Mooniswap white paper*. <https://mooniswap.exchange/docs/MooniswapWhitePaper-v1.0.pdf>
- [57] Uniswap org docs, 2020. *Core Concepts: Oracle*. <https://uniswap.org/docs/v2/core-concepts/oracles/>
- [58] Joe Petrowski, 2020. *Polkadot Governance* <https://polkadot.network/polkadot-governance/>
- [59] thegostep, 2020. *Flashbots: Frontrunning the MEV crisis* <https://ethresear.ch/t/flashbots-frontrunning-the-mev-crisis/8251>
- [60] Philip Daian, Steven Goldfeder, Tyler Kell, Yunqi Li, Xueyuan Zhao, Iddo Bentov, Lorenz Breidenbach, Ari Juels, 2019. *Flash Boys 2.0: Frontrunning, Transaction Reordering, and Consensus Instability in Decentralized Exchanges* <https://arxiv.org/pdf/1904.05234.pdf>