

Version 1.1

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Abstract

CrowdSwap is a **cross-chain opportunity optimization and automation platform**. It aims to reach mass adoption in crypto for every human being and overcome actual problems that reside from a fast-growing business space like DeFi.

CrowdSwap concentrates on providing the best opportunities in the crypto space built on top of our best-price-routing and aggregation algorithm and fast and secure cross-chain feature.

CrowdSwap aims to decrease the barriers to profit from DeFi opportunities. With our automation and optimization approach users can easily take advantage of the best opportunities without the hassle of knowing every detail about the necessary steps to execute. CrowdSwap wraps all steps into a minimum number of transactions. You benefit from spending less time searching for best prices, cross-chain bridges, adding liquidity to the correct places. You can concentrate on the main topic. Your profit!

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1. Introduction

The crypto space has ever since allowed people to make life-changing gains. With decentralized finance (DeFi), the possibilities have increased significantly. Every new project on the launch platforms, e.g., Polkastarter, did amazingly well afterward, sometimes reaching valuations of 100x or even more. In a bull market, everybody wants to trade these tokens that are first available on the decentralized exchanges (DEXes), e.g., Uniswap.

Lately, the popularity of DeFi has created some problems. Network traffic exceeded former expectations. And especially Ethereum had to suffer from high transaction fees. These high transaction costs gave other network providers the chance to step in. With lower prices, they can catch up to Ethereum as the number 1 network. Different chains bring another dimension of complexity to the DeFi space. Now the amount of DEXes not only grows on Ethereum, but it also spreads across all kinds of networks. The majority of users cannot keep track of all DEXes anymore. Not to mention the overhead of transferring their coins and tokens across networks.

The future of DeFi is bright, and CrowdSwap believes in DeFi. The mentioned issues are to be solved to make DeFi a place of equality for every human being.

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2. Problems

2.1. High transaction fees

As already mentioned in the introduction, the transaction costs on the Ethereum network are far too high for an exchange of tokens. Compared to central counterparties in the crypto environment, the transaction costs here are extremely high, amounting to many times the pure exchange fees. In some cases, the transaction costs exceed the $100 mark, which often amounts to several percent of the exchange value. This has great impact on the overall costs of ownership of a token as CrowdSwap always takes ancillary costs into account. With small trading volume transaction cost can exceed he 1% mark easily while the additional liquidity fees on the exchange markets, on the other hand, are only 0.3%.

From the overwhelming acceptance for DeFi, its popularity creates a problem in the Ethereum network that nobody can solve overnight. One reason for the high cost and low transaction per second (TPS) is the proof-of-work approach. The EIP-1559 will weaken the miners' position, but it remains to be seen whether this will reduce transaction costs significantly. Recently the berlin hard-fork reduced the transaction costs slightly.

2.2. Complexity

The DeFi area is not that easy to access, especially for newcomers to the crypto sector. First of all, you need a so-called wallet, technically a network address protected from third parties utilizing a password and a seed phrase. The construct is already very technical and too complex for most users on their own.

Here, however, we will look at another type of complexity, which is already evident on a small scale but will probably pose even more significant challenges for providers, their products and users soon.

We are talking about the ever-increasing number of DEXes, which will expand to other networks in the future, as the example of Binance Smart Chain shows. At this point, we can only name a few networks that already have or will soon have their first DEXes: Ethereum, Binance SC, Polygon, Cardano, Polkadot, Stellar, Solana, Tron, Neo, IOTA, Avalanche, Elrond, Zilliqa, Kusama, Harmony, XDAI, etc. The amount of DEXes multiplied by networks unveils the following requirements:

1. Not all tokens are to be exchanged on all DEXes and networks.

Knowledge of the various cryptocurrencies is the basis for successfully performing exchanges in the DeFi area. Taking any cryptocurrency, a user needs to know where to exchange it. This information alone is not always easy to find.

2. The user needs a different wallet for each network.

If the user has found out which DEX swaps the token, this could be on a network on which the user does not have any collateral to exchange. First, the user has to create a wallet, buy tokens before exchanging is possible.

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3. The user must transfer its tokens to another network.

Suppose the user has a wallet on the target network, but the tokens needed for the exchange are in a wallet on another network. In that case, the user must transfer the cryptocurrency via a so-called network bridge first.

Users who already find it difficult to get started will abandon DeFi Space at this point at the latest and turn to the conventional central exchanges. The complexity also goes hand in hand with user-friendliness.

Many people interested in crypto have difficulties even entering the stage. The barrier to entry is due to the nature of moving from fiat money to cryptocurrencies. There are currently only two options:

1. registration and KYC on a central exchange;
2. purchase of cryptocurrencies via credit card or bank account;
3. deposit ATM fiat -> crypto is transported to the wallet.

Since option 3 is subject to extremely high fees, we will not cover this case. However, there are barriers with the other two as well, which we describe now.

Option 1 was the only option for most crypto users to get into crypto a few years ago. Broad interest in DeFi started in 2020. However, centralized exchanges like Binance and Coinbase among others, strongly oppose the decentralized approach of Blockchain. Besides, many also shy away from KYC procedures that require more and more identity features and insight into the financial situation.

Some countries have moved to block access to the central exchanges, thus preventing their citizens from this opportunity to enter the crypto scene. The ban of cryptocurrency exchanges is especially the case in countries where politically difficult circumstances prevail, and the national currency is often exposed to strong inflation.

Option 2 is to buy crypto by credit card or bank account through a so-called "fiat ramp on/off provider". These providers handle the sale of crypto usually quickly and transparently. However, there are also many scammers in this environment. The fees for such an exchange vary greatly.

CrowdSwap will rely on the "fiat ramp on/off provider" to enter DeFi. CrowdSwap will audit providers before a decision to integrate is confirmed to avoid the issues such as scams or overpriced fees. Criteria for inclusion in the CrowdSwap Ramp on/off program are:

1. fee structure
2. transactions processed/historical performance
3. publicity/perception
4. cryptocurrencies offered
5. ease of use of the solution

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6. integration effort

2.3. User-friendliness

The great success of Uniswap and the like is undoubtedly because of their users having been in the crypto environment for a long time and therefore gathered excellent knowledge about the technology. Some of the applications are very technical and leave beginners with many questions. For example, there is often no explanation of what a wallet is and how to obtain the first tokens. When you finally get some tokens after extensive research, you are actually supposed to perform conversions in the decimal range without being given any known auxiliary values.

Indeed, there are one or two solutions that are already a bit further along in this context, but the user-friendliness is by far not sufficient for global acceptance.

2.4. Transparency

Most DEXes focus on swapping from token A to token B based on their liquidity pools. CrowdSwap emphasizes transparency of the best route for the swap, the fee structure, and the swap side costs.

Only a consideration of all criteria will reveal the best price in the end. The concentration of one measure, on the other hand, obscures the overall cost. In section 3.1.1, we will go into more detail on the individual criteria. The next chapter describes the solutions and products CrowdSwap wants to address to solve these challenges and problems.

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3. Solutions and Products

All challenges set an essential course for the future and acceptance of DeFi. CrowdSwap is confident that these can be improved or solved with the following CrowdSwap products.

3.1. Best-Price-Search

The Search App searches for the **best price for a specific token pair in the complete DeFi Space**. The search takes place **cross-chain and is only limited by the integration of the different liquidity sources**. The best-price algorithm finds the best price for the token pair and considers all collateral costs. These costs are:

Fees of the Liquidity provider

Transaction costs of the execution of the smart contracts (swap).

Prices of the bridge transfer (network transfer).

In addition to the liquidity pools of the AMM DEXes, other sources will establish in the future. For now, the Search App uses the following liquidity sources in this order:

- Decentralized Orderbooks (DeBooks)
- DEXes (DEX)

In the following, the listed liquidity source will be referred to as (LS) for better readability. In particular, we refer to DEXes or DeBooks.

From all liquidity sources, the best results are analyzed and ranked according to the following criteria.

The best price per token, including all collateral costs, is presented to the user in ascending order. The determination of the price bases on the following formula:

For simplicity we assume that all liquidity sources like LPs or order books have some kind of fees. We assume that the price can be expressed in USD.

$$M = \frac{\mathrm{V}}{\mathrm{p} + \mathrm{F}}$$

V = Volume of trade/swap in USD (e.g. 500$)

P = price of token in USD (e.g. 0,97$)

F = fee of liquidity source based on token value (e.g. 0,03$)

M = number of resulting tokens (e.g. 500 tokens)

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The number of tokens M is determined from the exchange volume underlying the search. By default, this is set to $500 but can be changed in the settings. The number of tokens is equal to the quotient of exchange volume V and price added with fees.

To calculate the fee per token, all you need is this formula.

$F = p * f\%$

P = price of token

F = percentage of fees for the liquidity source

The final formula calculates the final price of the token including the fees of the liquidity source and the transactional costs.

$$P(all)t = \frac{\mathrm{M(p + F) + C}}{\mathrm{M}}$$

M = number of resulting tokens of the liquidity source

p = price of the resulting token (based on the volume in USD it is $\frac{V}{M}$)

F = fees per token (based on the fees of liquidity source)

C = additional transactional cost (see on-chain gas estimation of smart contracts)

The total cost price of a LS is calculated from the number of tokens M multiplied by the token price p, added by the fees F of the LS. The total is added by the cost C of the transactions for executing the smart contracts. Price per token is the result divided by the number of M.

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The search result display presents the user with a **clear ranking reduced to price** and shows the number of tokens the user will receivebased on the given volume. Furthermore, the user can open the price details to understand the pricing.

Many DEXes use different functions of their smart contracts to execute the same token swaps. Here, the internal routing is not always the same, resulting in higher transaction costs for the user. **CrowdSwap analyzes the smart contracts of the connected LS and always executes the swap via the most lucrative and shortest path**.

In addition to the price, the user also sees the percentage of ancillary costs in the swap volume. The overall price per token (including all ancillary costs) allows the user to quickly decide **which LS is the most efficient for the desired swap**.

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CrowdSwap determines the transaction costs by an empirical analysis of the on-chain data. Here, the mean values of all functions' gas consumption are determined and multiplied by the calculation's current gas costs.

$$T = \frac{1}{n}\sum_{i=1}^{n} x_i * G$$

G = current gas cost

The Swap Button allows the user to go directly to the CrowdSwap Swap App and execute the swap. The Swap Button is not active if the user does not own the needed requirements for trading. An inactive Swap button appears if there is no wallet connected or not enough tokens are available for the swap. The lack of information for successful exchange includes network-related idiosyncrasies, which can differ a lot.

The Wallet Manager enhances the Search App features for the user even more. If the Wallet Manager connects before searching for the Best-Price, the search includes the wallet's information. The Wallet Manager's information allows the best-price algorithm to prepare the search result more intelligently for the user. The user gets swap options displayed on top, which are directly executable based on the wallet's information.

Example:

Alice wants to swap ETH for 1INCH. She enters this token pair into the search app. The result shows a LS on Binance Smart Chain as the best price. Only in second place, she finds an option on the Ethereum network. How is it even possible to rank a non requested token pair (BNB-1INCH) like that? Based on the information from Alice's wallet, the Search App has found BNB tokens in the BSC wallet and subsequently suggests this swap as the best, as the total cost per token is currently the cheapest. These situations can occur if the LP on BSC has an advantage based on the swap direction or just because of the lower transactional costs.

Alice can also continue to swap her ETH for 1INCH by using the second option. However, she always keeps control over the best options in DeFi Space.

If there would have been a matching limit order in the DeBooks, this would have been part of the ranking, too.

3.1.1 Transparency

Most DEXes focus on swapping from token A to token B based on their liquidity pools. CrowdSwap emphasizes transparency of the best route for the swap, the fee structure, and the swap side costs.

The best route for the swap is not always the one that the DEXes suggest as the best price. Many transactions of arbitrage traders show that there are more optimal routes in certain

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market phases, which have the most significant advantages for the user (if not frontrun by other parties).

CrowdSwap transparently displays all routes of the compared DEXes. The best price algorithm ensures that the best route of each DEX is found. The goal is always to find the best price, including all additional costs. No other criteria, such as pool ratio, pool health, volume or TVL, plays a role. Our focus is exclusively on the price advantage of our users.

The fee structure is not always easy to understand. While the DEXes display the fees, they are usually shown in token form rather than US dollars. These numbers bring confusion as to the magnitude of the costs. For swaps over multiple LPs, the fees of 0.3%, for example, accrue numerous times. I.e., for a value of 1000$ over two LPs there is not 3$ but 6$ to be paid. It also happens that different pools charge different fees. In the new V3 of Uniswap the prices go from 0.05% - 1%, depending on the pool. CrowdSwap always displays the fees of the swap in US dollars to be compared to each other.

The **swap charges** are not displayed on most DEXes because it is a network problem and not one of the DEXes themselves. We agree with this only to the extent that it makes no difference on a DEX. However, if the user can choose, he would probably use the exchange platform with the lowest incidental costs.

Concerning the ancillary costs, we will only assume the transaction costs here. Considerable differences can arise due to different smart contracts. Furthermore, the tokens involved influence the gas costs and thus on the transaction costs. Optimizing smart contracts can therefore lead to significant savings. Providers are working on this with varying degrees of success.

However, it is not always the case that the DEX with the higher ancillary costs also always have a worse price after CrowdSwap representation. Sometimes the pure swap prices are so reasonable that even higher ancillary costs still achieve the best overall price. So we take all costs into account to make sure the user is paying the best price per token.

With the Search App, CrowdSwap shows maximum transparency when comparing the best routes of different LS. The prices of the DEXes have been created based on the best routes from a provider perspective. On-Chain data analysis provides the exact ancillary transaction costs based on historical gas costs for the swaps across the routes shown. If CrowdSwap finds a better route, it offers an additional entry in the search results.

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3.2. Swap

CrowdSwap offers the possibility of swapping. Built on search, the transition to the Swap app is fluid and transparent. The user can transfer a search result to the Swap UI to get multiple options to trade. Experienced users can, of course, jump right into the Swap UI.

The first option is a direct swap based on the information in the search result. CrowdSwap makes it particularly easy and transparent for the user. In latter option, the user does not have to worry about the exchange's technical challenges but can receive his traded tokens.

Based on best price routing (BPR), **CrowdSwap takes care of all actions to successfully execute the swap and save on ancillary costs where possible**. The BPR considers the users' tokens and wallets on the different networks and automatically performs transfers to other networks when necessary. These features increase user-friendliness and reduce complexity significantly.

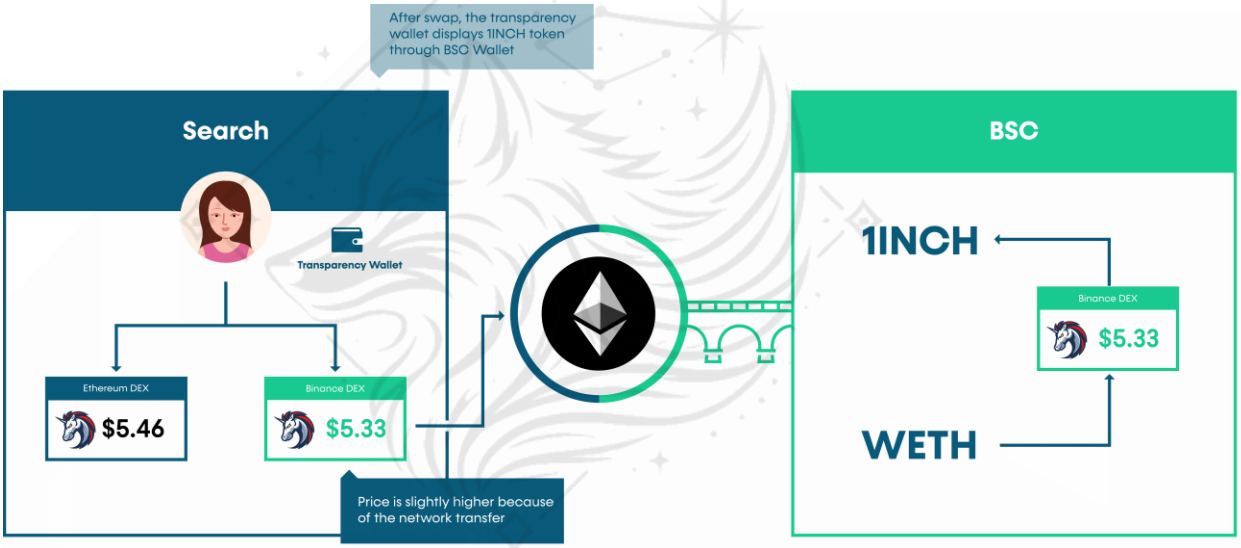


Figure 1: Cross-chain swap (ETH - BSC)

The second swap option is bulk swap. This option provides users with the ability not to exchange directly but to group to get better ancillary cost conditions.

[Prüfen, ob sich das Beispiel wirklich lohnen kann, wenn die Ausführung Cross-chain durchgeführt wird. Cross-chain Kosten näher beschreiben.]

Example:

Bob wants to buy 1INCH on Uniswap for $500. When confirming the transaction cost in Metamask, he can't believe what he sees. Bob shall pay $100 in transaction costs. He cancels the swap because he doesn't want to pay 20% of his trade volume in incidental expenses.In CrowdSwap, Bob can place his order in a pool, as shown in the search app. If the pool volume is large enough to reduce the transaction cost by at least 50%, the swap executes.

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In the future, CrowdSwap will introduce more intelligent and user-friendly options of swaps, which we call smart swaps and fall into the premium services area. Many strategies are known from the stock market trading and charting world that work well in the crypto world. We will introduce our users to options of trading in a simple way. Here, we will dispense with any terminology such as limit and stop orders or indicators such as EMA200, RSI, MAC, among others.! CrowdSwap presents the benefits of SmartSwaps through a transparent strategy dashboard.

For example, one possible option is to activate a strategy called "Accumulation". As the name suggests, this strategy accumulates tokens at particularly favourable prices.

3.3. Atomic token transfer (ATT)

DeFi is developing as a **cross-chain space** soon, as mentioned at the beginning. A token transfer from network A to network B brings some challenges that need to be solved. Let's make a real-world example for this:

Example:

Bob wants to exchange his ETH on Ethereum wallet for CAKE on the Binance Smart Chain (BSC) network. To do this, he first needs to transfer his ETH into a wrapped form on the BSC network. Before we discuss the existing solutions, we highlight the general vulnerabilities that arise in exchanging messages and tokens between networks and the technical challenges of a decentralized nature.

3.3.1. Token inflation

Each coin or token is attributed to an owner. This owner determines the metrics such as maximum number, minting and burning. When cryptocurrencies are transferred from one network, they leave one network to be reused in the other. However, in doing so, the token's original metrics must be respected. It (which is a synthetic copy of the originating one) retains its initial value in the destination network. This process requires ensuring that the token is burned on the source network. However, this is not enough. At the same time, the wrapped token must be created on the destination network. Critical here is the consensus across network boundaries that the transaction is valid and successful. In the event of an error, all actions must be reversed.

3.3.2. Ownership

Besides the validators' consensus, another problem in this transaction is the execution of "Burn" and "Mint". In many smart contracts, only the owner can execute these functions, which is essential for security reasons. If only the owner can perform this operation, then CrowdSwap requires a transfer token for network transfers. The transfer token (CROWD token) represents **option 1** of the ATT.

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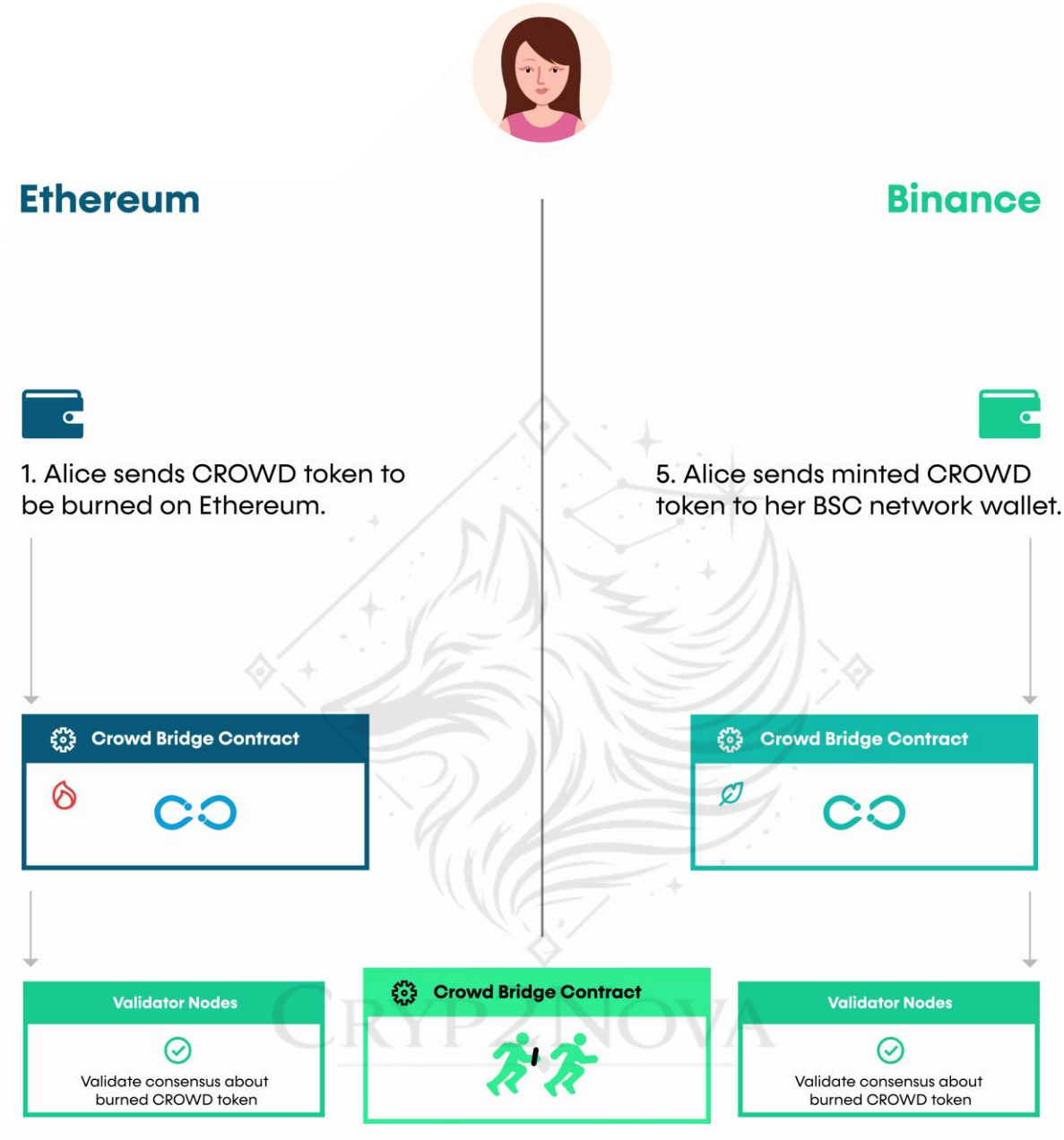


Figure 2: Crowd Token Bridge

As described above, tokens on a network are burned first. If there is consensus on this by validator nodes, relayer nodes mirror this information (amount of burned tokens is included) to the destination network. There the corresponding amount is minted. Consensus about and relay of the collateral generation complete the process, which is ensured by the validator and relay nodes. If the process breaks off at any point, the tokens are generated again on the source network (rollback).

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Another option is using smart contracts on both networks for the exchange, including freezing and releasing tokens. This solution works similarly to the one described above, but the tokens are not burned during the transfer. On the opposite side, wrapped tokens are created backed by real coins or tokens on their original public addresses.

Option 2 of CrowdSwaps ATT uses an existing solution, as in the case of BSC Bridge. Unlike option 1, CrowdSwap loses control over the transfer options. In the case of BSC Bridge, there is a limit on volumes per day and address. Even if the sums currently on BSC Bridge seem sufficient, they depend on liquidity or proof-of-assets. These limits result in two potential problems for CrowdSwap when using such bridges:

1. The popularity can decrease, and with it, the deposited liquidity in the proof-of-stake.

2. On other networks, the deposited liquidity may be smaller and thus critically affect the transfer volume. Who provides the liquidity here? Are the incentives high enough?

Option 3: Atomic swaps represent another option. The concept is not new and is called a peer-to-peer network (P2P). There are participants on each side of the network who agree together to swap their tokens. Hashed Timelock Contracts (HTLC)[1] ensure that no party can gain without sticking to the agreement.

Example:

Bob wants to transfer his ETH for BNB on the BSC network. Alice has BNB on the BSC network and wants to exchange it for ETH on the Ethereum network. Both will agree on the number of tokens for the exchange. Bob sends his ETH to an HTLC on the Ethereum network, Alice sends her BNB to an HTLC on the BSC network. Alice provides Bob with the public hash. Bob can now receive his BNB. By enabling Bob's HTLC, Alice now also gets the public hash and can receive her ETH. If Bob does not unlock within the time specified by the HTLC, both parties will get their money back.

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[1] https://en.bitcoin.it/wiki/Hash_Time_Locked_Contracts, https://www.arxiv-vanity.com/papers/1801.09515/

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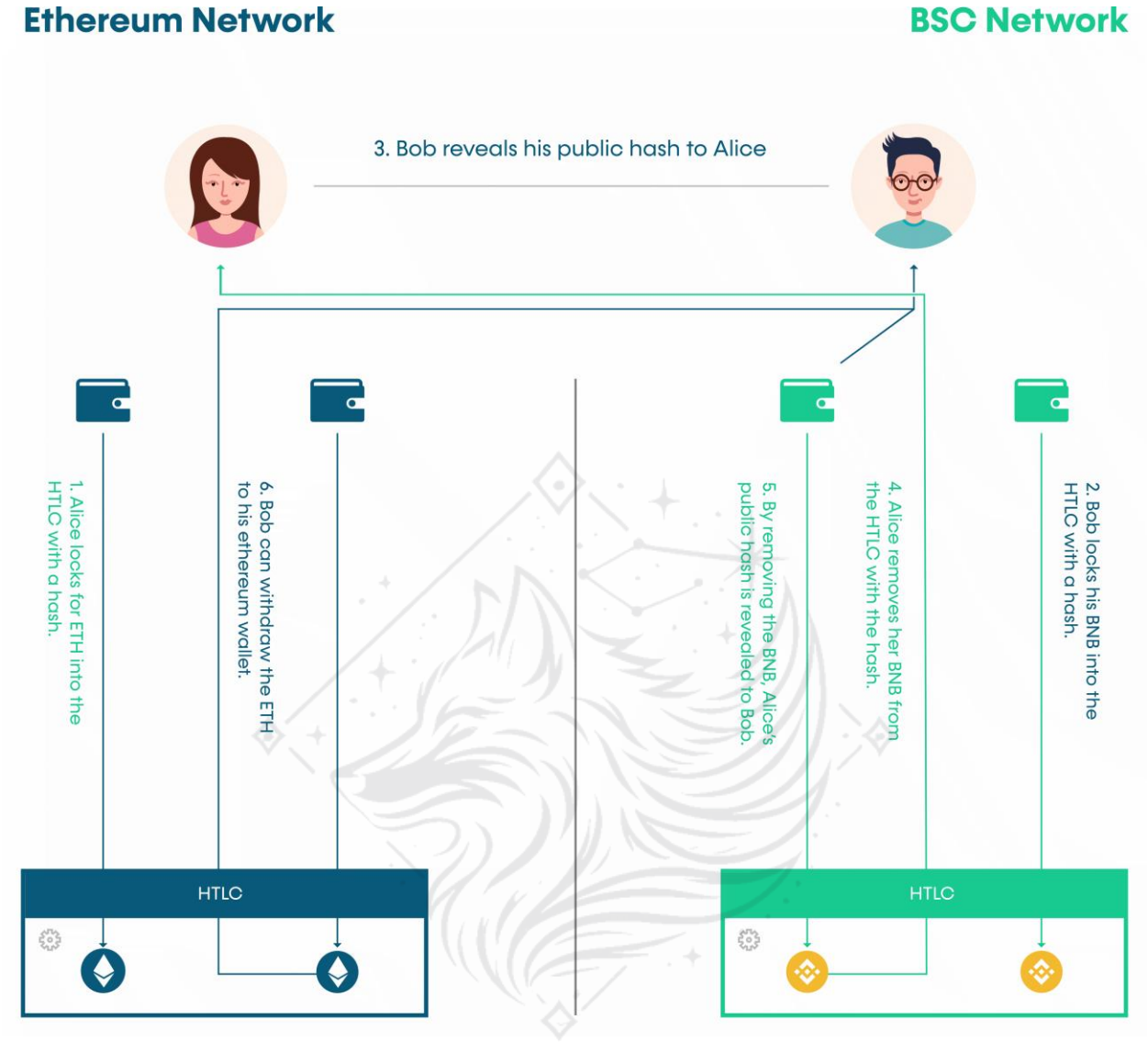


Figure 3: Atomic Swap (HTLC)

The concept can be extended to cross-chain LPs so that the network transfer can take place automatically. This concept creates marketplaces on various networks giving incentives with fees to provide liquidity for such a transfer. Atomic swap represents another option that does not require a consensus mechanism with independent players.

This concept can be used particularly well for the DeBook, if the coins of different chains are exchanged.

3.3.3. Duration

CrowdSwap's goal is to find the best price in the whole crypto universe and to be able to perform the swap easily and quickly.

While we can realize the best price finding and routing without significant effort, the exchange across network boundaries provides a new challenge that we have not yet considered. Namely time! In the dialogs of current DEXes, the information for a swap changes about every 5 seconds. In contrast, the scenarios described above for a transfer to another network can take several

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minutes. The time needed is partly due to the network's consensus mechanism and because the network providers want to limit the network swap. We assume that network providers will further reduce this duration in the future. However, CrowdSwap would like to go ahead here and show a way to overcome this hurdle.

Let's take the example from the beginning of the chapter.

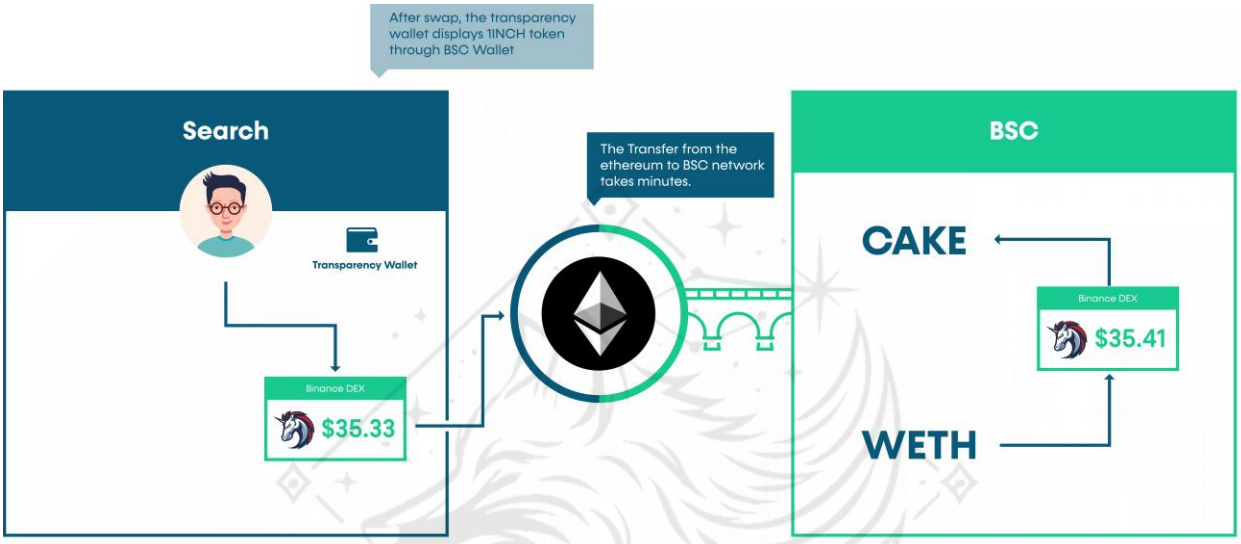


Figure 5: Reduction of Swap Duration

As already described, this attempt to perform a swap fails due to the duration of the transfer of tokens from Ethereum to BSC network. In the time it takes for the network transfer, the price has changed to Bob's disadvantage. We need a solution that significantly decreases the time it takes to deploy the tokens on the target network.

The solution must execute the swap option directly and simultaneously ensure that the collaterals involved remain accessible to the transaction owners and that no one involved can gain an advantage over the other party.

The user can execute the swap directly if he owns tokens on the target network. If this is not the case, a transfer must first take place. For this purpose, we make use of a tool known as liquidity pools (LPs). However, in our solution, the LP's pairs are not on one network.

Therefore, the process is bipartite, but also atomic following the findings from "Atomic Cross-Chain Swaps"[2] . . Mentioned solutions already ensure that the most important principal is met. **The transaction is not advantageous or disadvantageous for any party and is self-contained**. For a good user experience and automatic execution that doesn´t need any user interaction in the shortest amount of time, we need a different solution.

[2] Atomic Cross-chain swaps (Maurice Herlihy) https://arxiv.org/pdf/1801.09515.pdf

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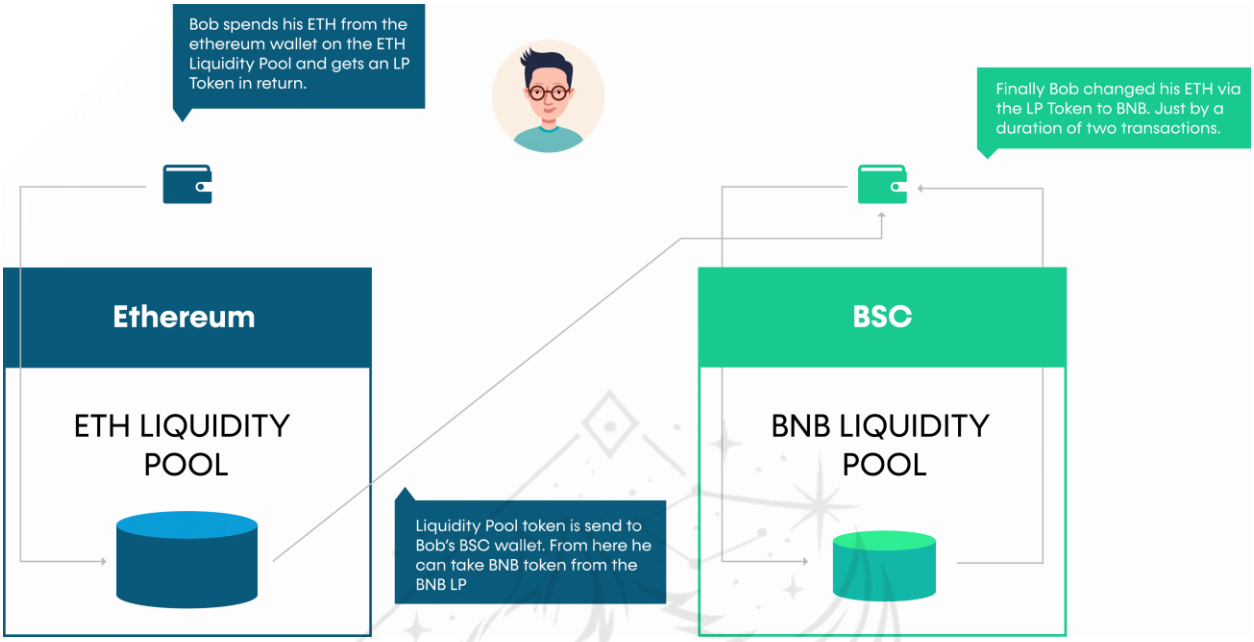


Figure 6: Token transfer between networks via Cross-Chain Liquidity Pools (CCLP)

For the definition of atomicity and the consideration of the different cases, we refer to the document "Atomic Cross-chain swaps"[3]. It describes the above points in detail and gives proof of their validity.

To enhance the situation of cross-chain swap, we integrate the CCLPs (Cross-chain liquidity pools)[4]. Based on the example figure 6, ETH and BNB can be provided separately. No need keep the relation of the tokens healthy cross-chain as that would not be achievable. Instead the prices are given through decentralized price oracles (e.g. DEXes, orderbooks)

Given the different options, CrowdSwap emphasizes the cross-chain swaps that can be executed in the shortest amount of time, giving the best user experience. All options might come into play for CrowdSwap prioritizing CCLP for our cross-chain solution.

3.4. Wallet Manager

Based on the solution shown for swapping tokens across network boundaries, the required wallet's question naturally arises. If we go back to Alice's example from ATT, then Alice needs cryptocurrencies on the BSC network to benefit from the lower overall price. For experts and advanced users, it is no problem to configure the BSC network in the wallet app and switch it before the swap. However, this group would certainly also appreciate an improved intelligence of the best price discovery and routing.

[3] Atomic Cross-chain swaps (Maurice Herlihy) https://arxiv.org/pdf/1801.09515.pdf

[4] Cross-chain liquidity procotol specification (Christian Mülder) Read the whitepaper: http://crowdswap.org/wp-content/uploads/2021/11/Whitepaper_CCLP_0.5.pdf

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We, therefore, envision an extension for existing wallets that allows CrowdSwap to access configured networks of all known wallets of a user. The result would return an optimal best price not only in search but also a simple cross-chain swap afterwards.

The Wallet Manager represents the tokens that exist across all networks. The search utilizes this information to determine the best price for a swap.

Furthermore, avoiding unnecessary cross-chain transfers, which would cause further costs for the user.

The Wallet Manager is easy to configure and does not require proof of identity. However, the user also has the option of using name services to organize the different wallets.

3.5. Best Price Routing (BPR)

Best Price Routing (BPR) provides the basis for a lucrative swap and is the core of CrowdSwap. Based on on-chain data, the BPR always finds the best price. The best price is always calculated with all ancillary costs, as CrowdSwap attaches great importance to transparency.

How does the BPR find the best price?

The on-chain data provide all the information it needs to find the best price. This data has the knowledge of the liquidity pools (LPs) of all connected DEXes. There are several ways to swap token DAI and UNI. The simplest solution would be to give DAI to the DAI-UNI pool and get UNI in return.

However, **the obvious is not always the best solution**. Other possibilities would be to swap across multiple LPs. The following examples have been frequently observed here in the past.

DAI -> ETH -> UNI

DAI -> USDT -> UNI

DAI -> USDC -> UNI

Why is that the case? And aren't there higher fees here?

To answer the 2nd question first. Yes! There are DEX fees associated with each pool. It is a concern for the DEXes and the LP-providers that swaps make heavy use of the LPs.

However, this is not the only reason. A route build of several pools might also be the cheapest and most stable. For this, one must know how LPs work. Here we refer to the Internet and the numerous sources on LPs and AMMs.

At this point, a small example should help. We assume that LPs always consist of 50% token A and 50% token B. For simplicity, let's take stablecoins DAI and USDC with an intrinsic value of 1 USD. When creating the LP, we need to deposit the same number of both tokens.

Preise: $DAI = \frac{1000\ USDC}{1000\ DAI} = 1\ USDC$

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Preise: $USDC = \frac{1000\ DAI}{1000\ USDC} = 1\ DAI$

If we now make a swap e.g., 10 DAI/USDC. Then we get 10 USDC for it. The pool has changed and now has the following quantities and prices:1010 DAI / 990 USDC

Price: $DAI = \frac{990\ USDC}{1010\ DAI} = 0{,}98\ USDC$
Price: $USDC = \frac{1010\ DAI}{990\ USDC} = 1{,}02\ DAI$

In addition to the quantities in the pool, the prices of the individual tokens also change. The behavior of price changes bases on the illiquidity of a pool. **This small example alone is the reason why an exchange via different routes can bring better results, even if this generates higher ancillary costs.**

However, our small example also provides the approach for the BPR. In our first swap, we still received 1 USDC for 1 DAI. However, in a second exchange, we would only receive 0.98 USDC. On the other hand, we now receive 1.02 DAI for our exchange of 1 USDC. We can take advantage of this added value in other DAI pools, since they probably still value DAI at 1USD. Thus, **the algorithm creates best price routings that guarantee users a more significant amount of tokens in the end**.

Finding the best routes is CrowdSwap´s most crucial task. We start on separated networks with ethereum and binance smart chain. The goal is to find the best routing across all available networks.

How does DeBook orders fit into BPR?

The BPR analyzes the DeBook based on the requested token pair. The best-possible order is added to the total result of the DEXes and ranked. The fees and ancillary transaction costs should be cheaper when executed on the same network as the DEXes. The more affordable additional costs affects the ranking.

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3.6. On-chain data analysis

The significant advantage of decentralized finance is that the transaction data is openly available to everyone. On-chain data delivers essential insights, which CrowdSwap also uses and needs for its various functions and features.

Especially for best price routing, the information on liquidity pools is the crucial basis. Advantages can be achieved via these when exchanging tokens, which would be pure coincidence without the knowledge of this data.

Furthermore, CrowdSwap collects data on general anonymous user behavior, which will impact the various offers in the future. We already plan on other use cases for CrowdSwap where on-chain data will extract an advantage for our users.

3.7. Governance

CROWD tokens are needed for the voting process and staking, among other things. Those who invest their tokens with CrowdSwap benefit from the revenues generated by the project and get to participate in the future of CrowdSwap.

The decentralized approach of the project is fundamental to CrowdSwap. Concentrating 20% of the voting rights on one address is not a decentralized approach. Therefore, CrowdSwap provides additional rules that we believe contribute to the decentralization of a DAO:

1. Voting rights of a staker are measured based on quadartic voting[5]
    a. I.e., if a staker has invested 5 million tokens, he will also benefit from at least 0,5% of the distribution from the sales of the project. However, he can only participate in the governance process with the square root value of the tokens owned.
2. The votes gain weight the more prolonged the tokens remain in the staking
    a. Each month that tokens remain longer in staking or in the voters wallet, they are added by a factor + 0.1. I.e. Every year the voting power of the owner doubles. This way, the voting power can exceed the square root value. And large volumes of CROWD tokens in the staking secure the project and stabilize the token price.
3. Inputs into the project and their total reconciliation
    a. Every staker can make suggestions for the improvement of the CrowdSwap project. If these are supported by more than 90% of the eligible voters absolutely (each address counts only once), the proposer receives a VIP rank, which increases the number of votes again. Depending on levels yet to be worked out. (double, triple). Furthermore, VIP users can use the comment function to describe the proposals of others in the spirit of the project.

[5] https://vitalik.ca/general/2019/12/07/quadratic.html

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The governance process is the process of voting on changes in the CrowdSwap project. The community takes over after the essential functions of the CrowdSwap DAO have been created. Any change (e.g., development, distribution of fees, use of liquidity reserves) is due to voting for all stakers.

The proposed changes are described similarly to the EIP (Ethereum Improvement Protocol) so that everyone eligible to vote can learn about the issue in advance. Only ballots received will count.

3.8. MEV Protection

What is MEV? And why do we need MEV Protection?[6]

There are sometimes extreme MEV situations in many arbitrage trades, which are usually intercepted by the miners or bots. These then become active themselves and use attacks, such as front- or back running, sandwich attacks, to profit from these lucrative transactions themselves.

To prevent this, CrowdSwap will exhaust all possibilities of prevention on the application side and seek support from projects and integrate their solutions to offer the best protection to our users.

The application design can already give some sort of MEV protection as long as the executing smart contract integrates a security mechanism that the MEV taker can ´t change or reorder before execution. This can be achieved by a mined transaction on a different chain. Based on this security mechanism, the MEV taker transaction would simply fail. No front-running would be possible.

With the system side integrations there will always be some kind of sharing the MEV with the miner that will lead to higher ancillary costs. But in some situations this approach might be suitable and comes with some advantages of gasless transactions, no slippage and no failed transactions.

MEV Protection will be integrated into CrowdSwap as a selectable option and will be available to all platform users.

3.9 Opportunities

The opportunities section is the central part of CrowdSwap. Taking all features in this chapter together and providing the user with the best opportunities in DeFi, finding the fastest, secure, and cheapest way from your assets to this opportunity is our vision.

DeFi is a vastly growing market with many participants that we use every day. In 2021 the number of players increased exponentially since more and more blockchains entered the stage. With these blockchains, decentralized exchanges and order books grew heavily like wallets providers and opportunities like yield farming, skating, lending and borrowing, liquidity providing, rebase reserve currency project, and many more.

[6] https://medium.com/flashbots/frontrunning-the-mev-crisis-40629a613752

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Cross-chain solutions are needed, and many different bridge solutions arose, increasing the number of players.

Since this is great for the market, it leaves the user with an unmanageable amount of possibilities and two questions:

1. How can I find the best opportunity?
2. How can I take this opportunity fast, secure, and lowest cost?

Manually, the user can´t manage to do this task anymore. It´s just impossible. Taking moderate numbers into account, the possibilities add up to 9.3B combinations. Software solutions are needed to provide the user with:

1. Options to find and filter the desired opportunities
2. Automatically find the best (fast, secure, and cheap) way to the opportunity
3. Guide the user through the multi-step process.

You will see screenshots that are very early stage. First, we want to provide you with what we will build for you and lay out the easy and transparent process.

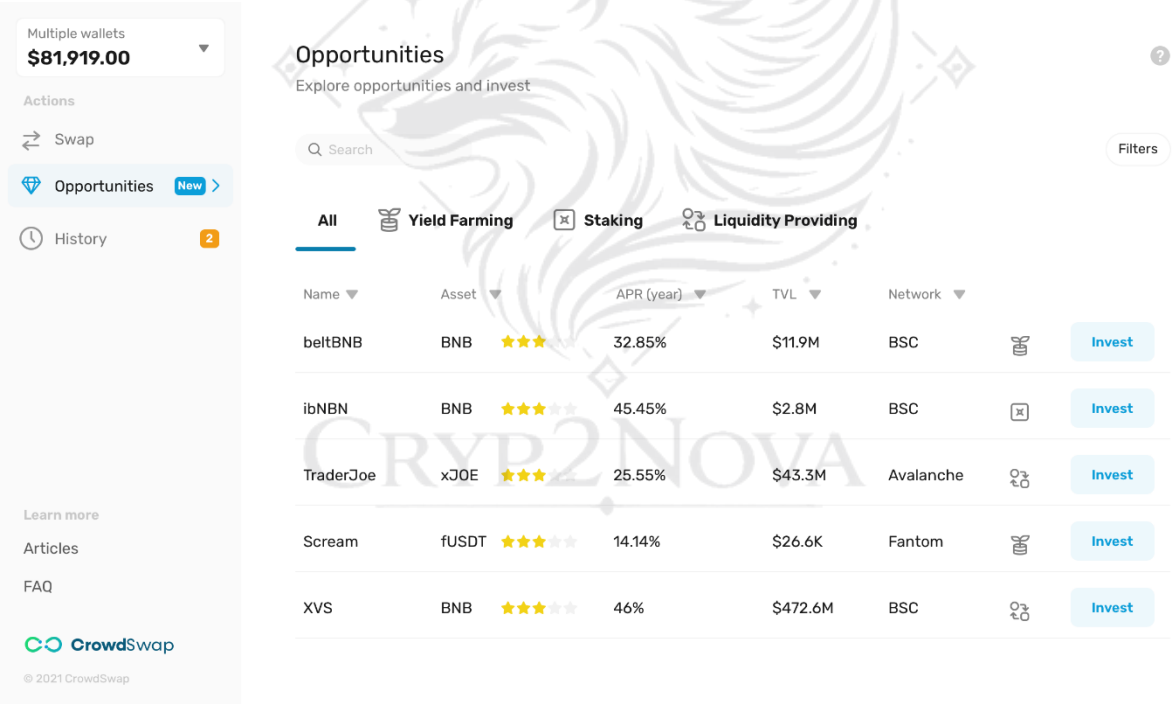


Figure 7: Opportunities page

On the app's main page, you will see the Opportunites menu that opens up the world of opportunities for you that you can filter for your desired ones. Different categories will be available and an "All" section where you will find the best yields.

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If you select your desired yield and click the "Invest"-button a dialog opens to show all of your options regarding the connected wallets. (In the top left corner, you can see the value of all related wallets. See wallet manager for more info on this)

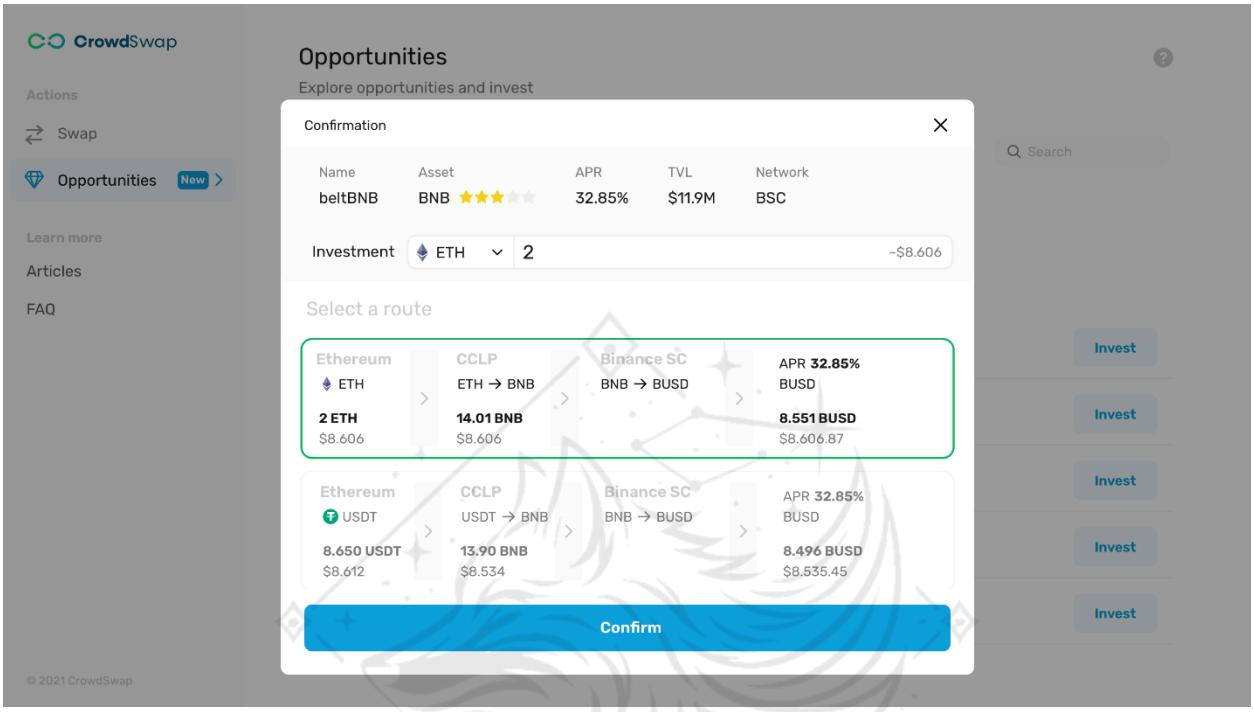


Figure 8: Routing dialog

In this example, we chose an opportunity on the BSC network with a stable coin yield of over 30%. The connected wallet only contained ETH and USDT as collateral, so these routes are available for you to choose from.

Since the value of the first route is higher (you will invest more into the opportunity), this is the best route based on your assets, and it is always preselected for execution. You can already see the different steps you have to take to get to your desired goal from the route information.

1. Make a cross-chain transfer
2. Swap BNB into BUSD
3. Transfer your BUSD into the yield opportunity

To change the amount of your investment in ETH, you can change to your intended amount of spending. For better transparency, we display the value in USD dollars. If you want to use the USDT route, you can select it, and the investment token changes to USDT. In the same way, you did with ETH; you can now change the USDT value.

If you click “confirm” we guide you through the process to get to your desired opportunity.

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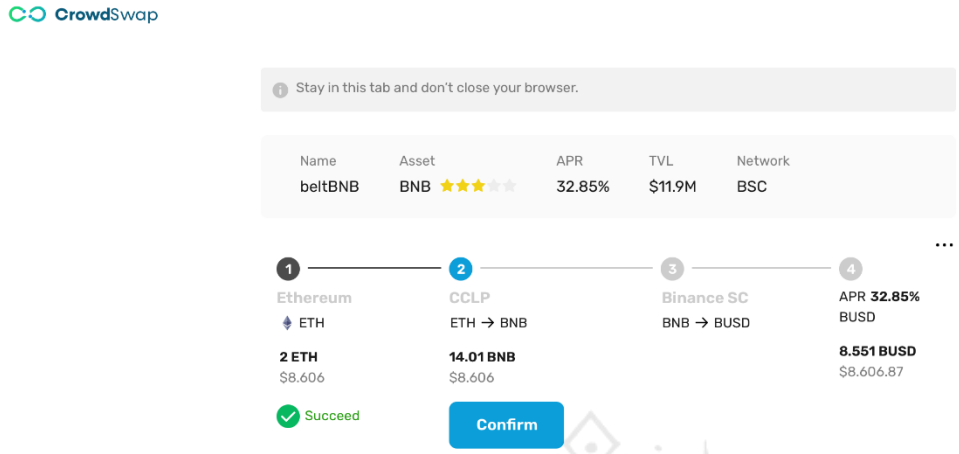


Figure 9: Process in starting state

The starting point is always any coin or token from your wallet. You have to confirm the cross-chain swap for the first transaction using our cross-chain liquidity protocol (CCLP) to get to the next step. If you click “Confirm” the process shows a “Pending” button.

In the background, your ETH is sent to the liquidity pool of our cross-chain solution that releases the appropriate amount of BNB tokens on the BSC network from our liquidity pool. The amount of BNB tokens released is calculated on the relation between ETH/BNB on a price basis using price oracles.

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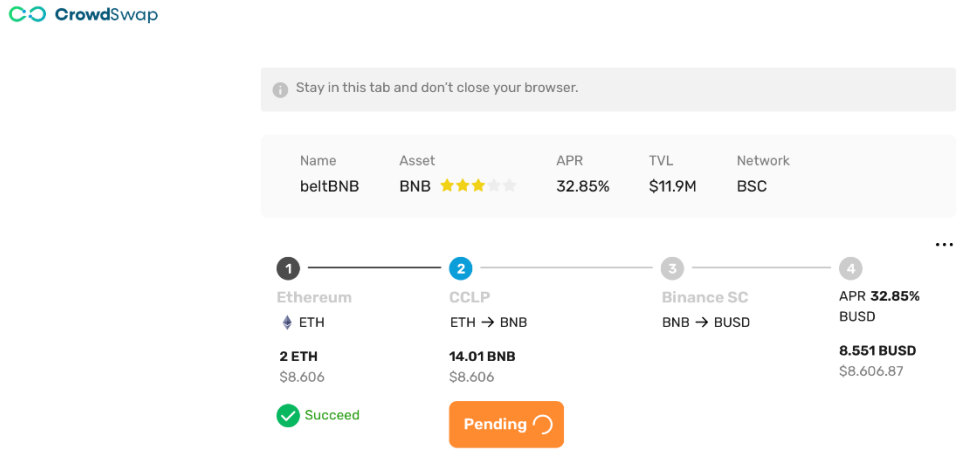


Figure 10: Process in pending state

The pending state shows up as long as the transaction is still running. You don´t have to do anything. If you need to interact, the dialog will show some progress.

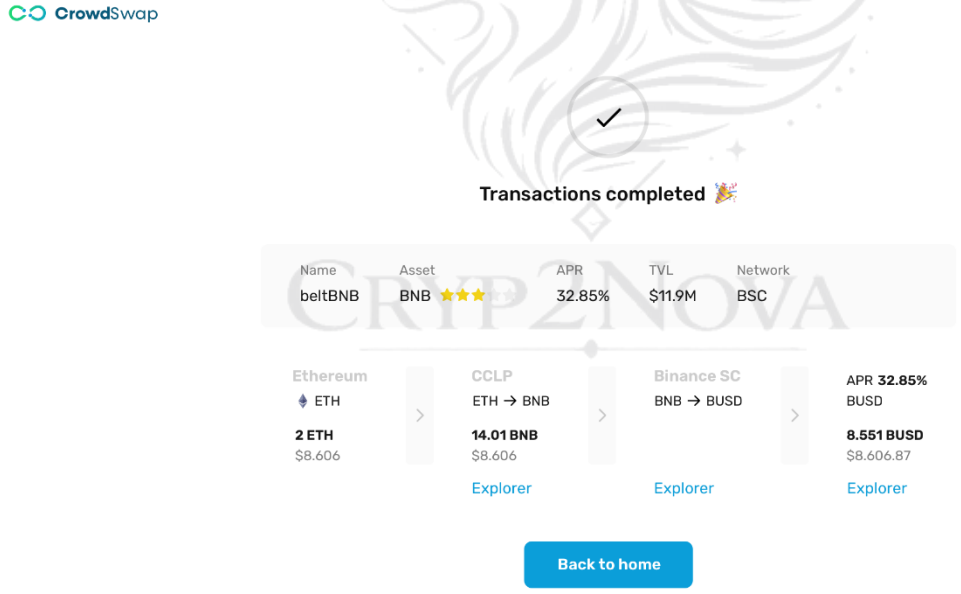


Figure 11: Process in finished state

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If a transaction has been finished, you see an “Explorer” Link with a status (not shown here.) For every transaction, you can jump to the blockchain explorer to look into the details. The process takes you to the next step until you confirm them all.

If your internet connection breaks for some reason, you can set up the process later again. But the circumstances will have changed. So if possible, don´t close this browser tab.

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4. Architecture

The products described above combine to form an overall architecture, which we outline in this chapter. It serves as an overview, and we refer you to the individual chapters on the different architecture areas.

The figure shows the composition of the various components, as they are described in the individual chapters. For example, the Search App is based on the BPR layer, which is also responsible for best price determination. The Wallet Manager provides essential information for finding the best price for the user's initial situation using BPR. If the user does not own any cryptocurrencies yet, we will guide him through the onboarding process with the ramp-on provider's support.

For the swap itself, it may be necessary to transfer tokens from one network to another. CrowdSwap uses the atomic token bridge to achieve this. We implement different solutions of bridged and atomic swaps here to prepare for future scenarios.

Decentralized orderbooks are the newer concept in the DeFi space and takes an important part in the architecture. When it comes to cross-chain swaps the DeBook makes things easier because the assets don´t have to be transferred into pegged token or burned and minted. The mechanism behind this approach is similar to option 3 from the Atomic token transfer in chapter 3.3. Atomic token transfer (ATT).

The architecture describes the components that are currently in the scope of the project. We add additional features successively, which have already been touched upon in the chapters, such as simplified trading models or the consideration of on-chain data analysis to enhance swapping optimization, usability and user experience.

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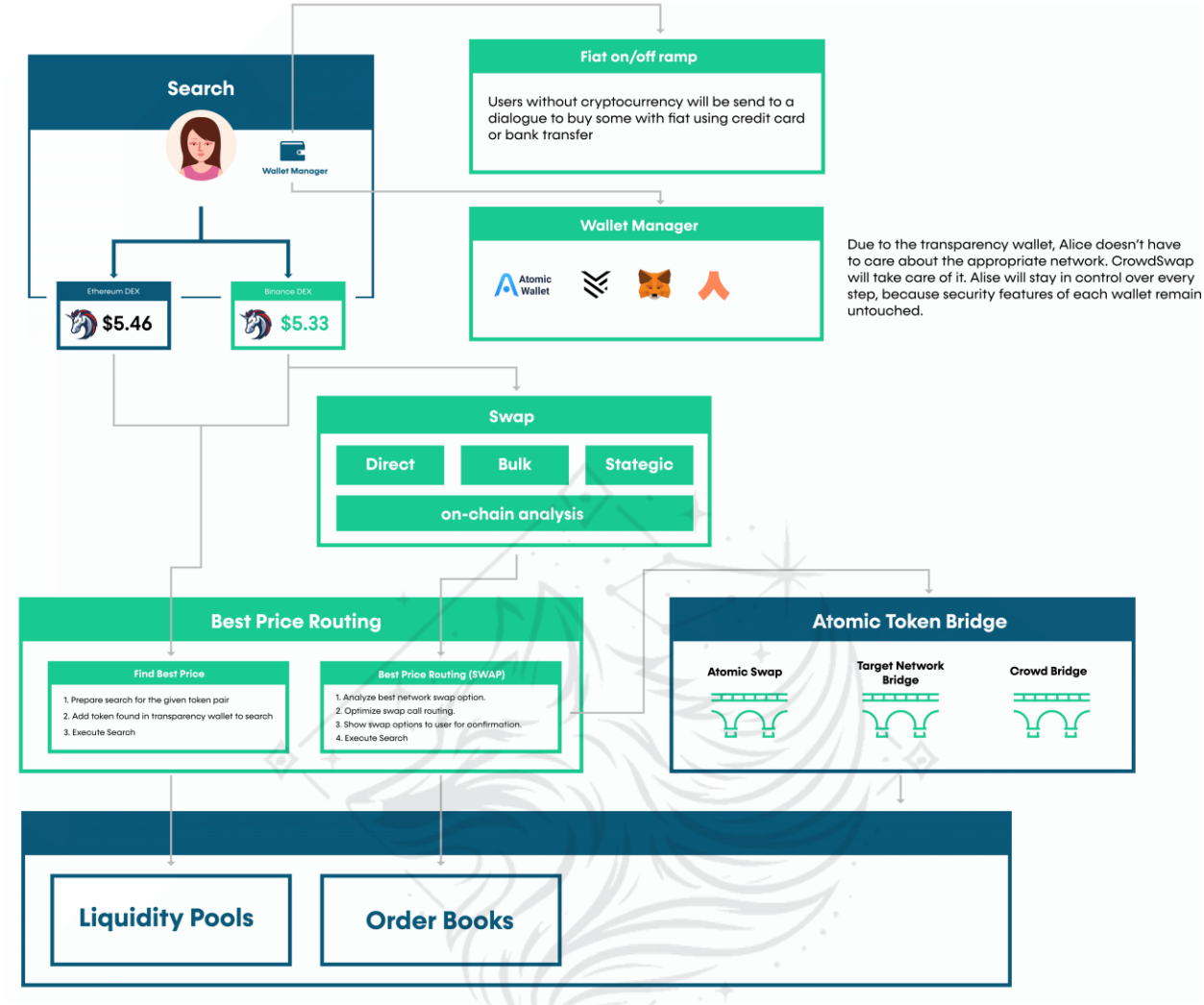


Figure 12: DeFi space architecture (lite)

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5. Business

CrowdSwap provides the simplified exchange of **tokens and coins at the current lowest price in the DeFi universe**. This service will impose a small brokerage fee on each user, assessed on the total volume of the exchange.

Furthermore, CrowdSwap offers a subscription plan that reduces the fees for each swap. This plan is exciting, especially for active users. Besides, CrowdSwap offers further premium services in the subscription, which are paid accordingly in Crowd Tokens.

CrowdSwap distributes fee profits to to the respective areas. See chapter 6.3 Token Revenue Distribution

CrowdSwap also acts as a liquidity provider in the market to establish optimal swap conditions. For the cross-network swaps, CROWD tokens or CCLPs that CrowdSwap must initially service to facilitate third-party entry.

With the DeBook CrowdSwap establishes a platform that other participants can trade on. This provides a small fee to the project on any trade.

CrowdSwap will use the opportunities of the DeFi market itself to optimize profit through its platform. The trading strategies used will later be integrated into CrowdSwap as premium services, offering users further trading opportunities.

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6. Tokenomics

Tokens are crucial to any project. At CrowdSwap, we have a fixed total supply of **1,000,000,000 CROWD tokens** that fund the CrowdSwap mission.

For the cross-chain transfer, we need liquidity in most cases (options 1 and 3 from 3.3. ATT). This liquidity will be provided mainly by third parties. At the start, CrowdSwap will use its own liquidity. The project's success requires investors who see CrowdSwap as a long-term investment. Due to the fees' distribution structure, **the CrowdSwap token is deflationary**, as every month, we burn a percentage of the fee income in CrowdSwap tokens. **For investors, this means further stability of your investment.**

Besides, **users can stake crowd tokens, for which the stakers receive a share of the profit** from the fees. Furthermore, the percentage of staked tokens is used in the Government process when CrowdSwaps asks all stakeholders to decide on voting, feature request, prioritization and changes. **We believe that the decision of many is always better than that of a few.**

Also, CrowdSwap offers value-added services that we outlined briefly in the Swap chapter of this whitepaper. More such services will also emerge in the Search App space. These premium services will be paid for via crowd tokens, offering everyone the opportunity to participate in these premium services at a low cost.

For stakeholders, the premium services are offered at a lower price and can be paid automatically from the staking revenues.

6.1 Token Distribution

In the description below, you find four different areas of distribution. The goal is the simplicity of distribution as well as creating enough incentives for traders.

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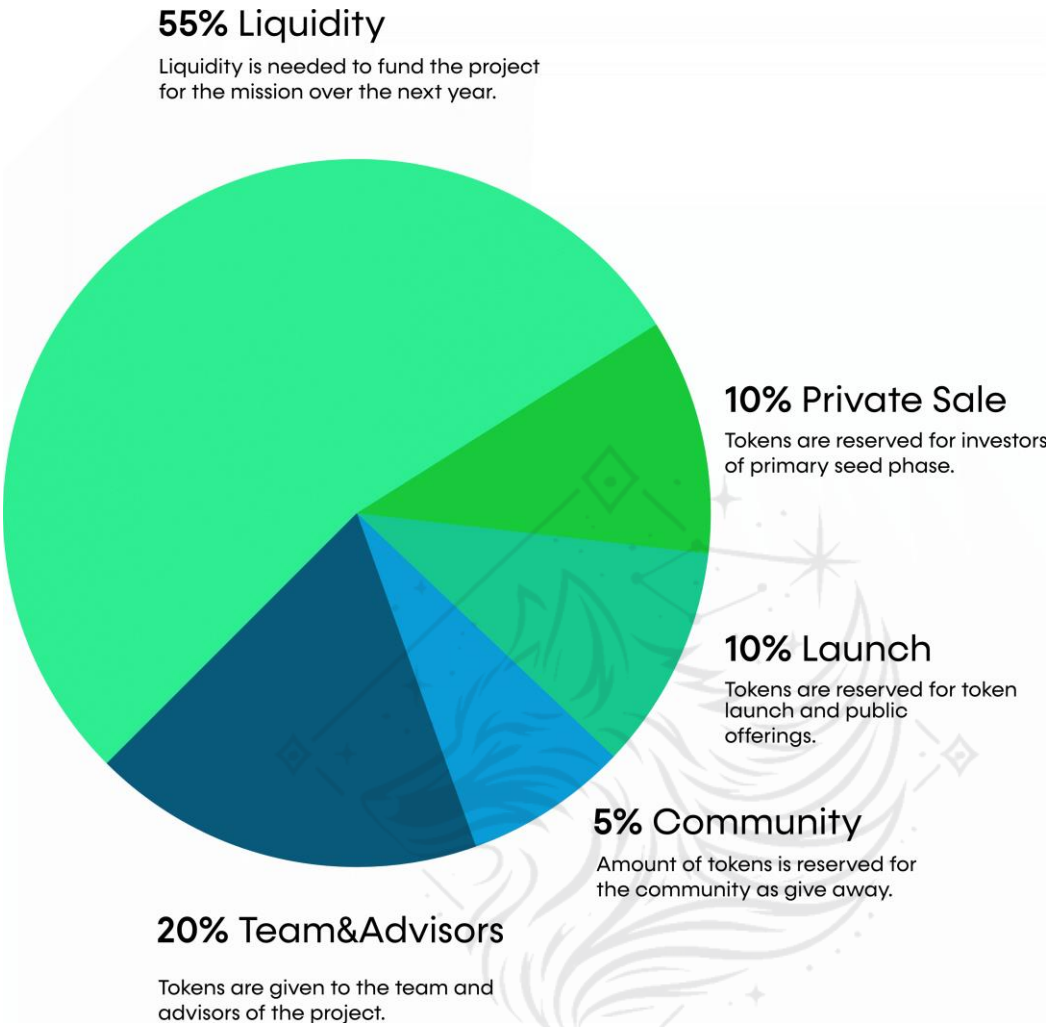


Figure 13: Token distribution

6.1.1 Liquidity

Every project needs liquidity to cope with the tasks at hand. The tokens in the liquidity area are used to pay for development, marketing and administration expenses and provide enough volume to grant liquidity on different platforms like DEX and DeBook.

Thereby, only 10,000,000 tokens will be released from this area at the beginning of the project to not directly put pressure on the token price after launch. The further release of the tokens takes place successively month by month. See 6.2 Free Float of CROWD token.

6.1.2 Launch

The CROWD token is brought to the market via a launchpad. A maximum of 10,000,000 tokens is available for this purpose. It is important to us that there is a large number of different owners. A launchpad is a great place to onboard many participants. Their concept of whitelisting allows many to buy a limited amount of tokens and thus supports our decentralized approach to develop CrowdSwap into a real DAO.

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6.1.3 Community

For the CrowdSwap community, we are holding back 5,000,000 tokens that will be released to our users on a schedule to be defined. The release of these tokens will start 6 months after the launch. Then the first 1,000,000 tokens will be available for allocation.

The way in which the tokens will be distributed has not yet been determined. We will hold a vote in the community on this. Possible options would be AirDrop, benefit sales, distribution to addresses according to volume and sales, etc.

6.1.4 Team & Advisors

The team and advisors receive 20% of all tokens. The founders have invested a lot of time and hard work in the project and the idea, so the share is justified based on the achievement of the goal. The founders and advisors are equal to the stakers once the DAO is completed. Even though the team and advisors will own more tokens, their influence on the project at the time governance has started is small because of the quadratic voting approach.

6.1.5 Private Sale

Investors take an important part in the early stages of a project. They not only provide needed liquidity, more often they support the project with services, reach and access to communities and their influencers, great knowledge, expertise and guidance. In the private sale investors can join the project and get their share of tokens at a discounted price.

6.2 Free Float of CROWD token

The CrowdSwap project will launch the CROWD token in the form of 1 billion units. However, this amount of tokens will not be available immediately after token launch. A smart contract will release the tokens over time. The following chart gives an overview of when the tokens from different areas will be available to the general market at the earliest.

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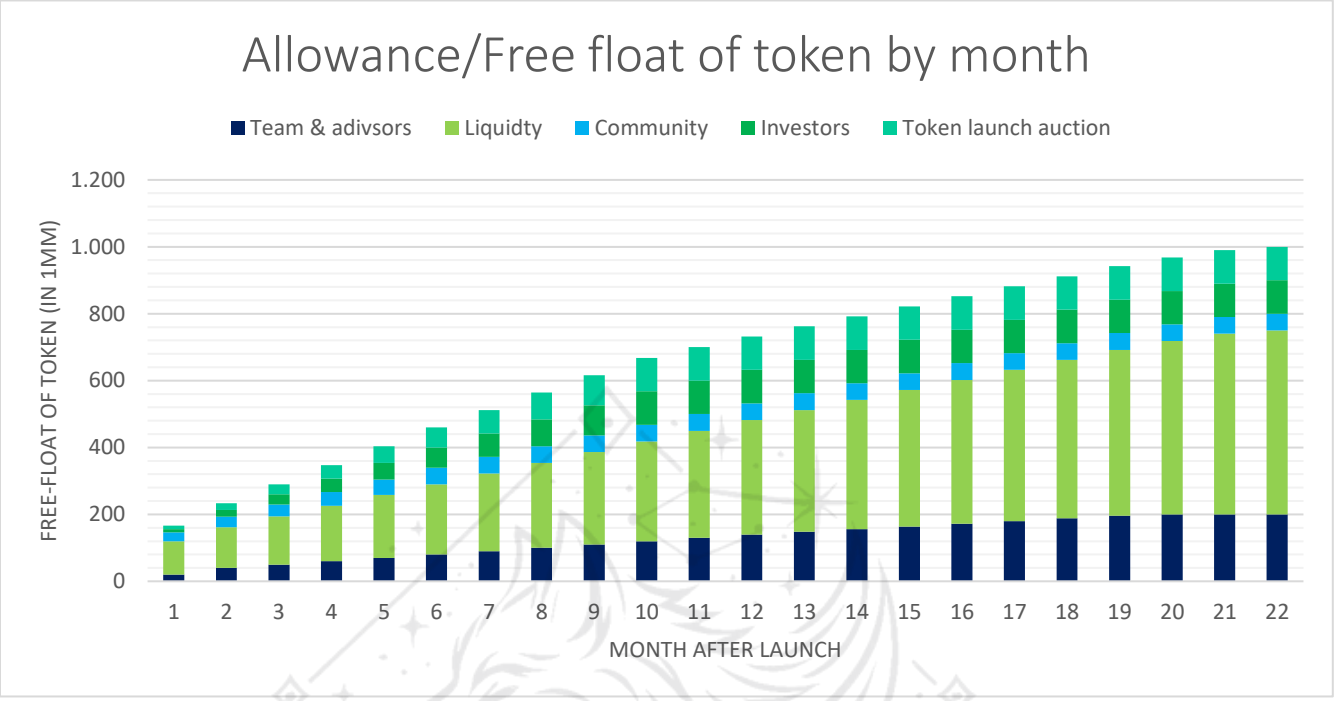


Figure 14:Free Float of token by month

It is vital to keep the free float amount of tokens stable after the launch. Not flooding the market with tokens means that there is no immediate inflation of the CROWD token. We assume that those market participants who receive CROWD Tokens through the token launch will sell them at a profit. Therefore, the number of free float tokens will remain stable for the time being and only increase slightly directly after launch.

6.3 Token Revenue Distribution

CrowdSwap itself earns from the fees for the swaps executed on the platform and distributes its revenue according to the following diagram:

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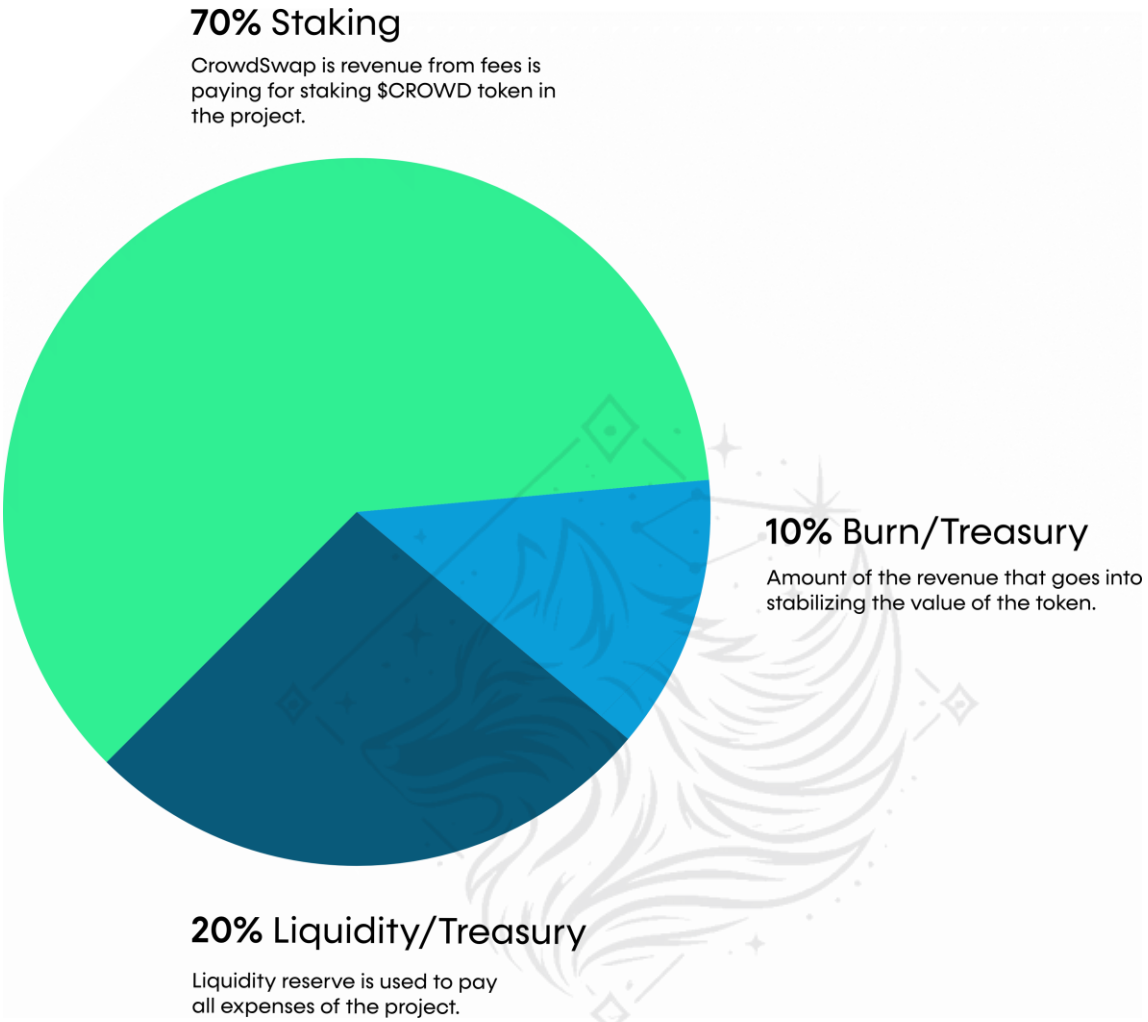


Figure 15: Revenue distribution

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6.3.1 Liquidity

20% of the income goes directly into the liquidity reserve of the project. From this, all activities related to development, marketing and administration are to be paid. If the operational expenses do not exceed the income, the surplus is used for treasury.

6.3.2 Burn/Treasury

With 10% of the revenue, the project will burn CROWD tokens and store the rest in the treasury. . Both have a value-enhancing effect that is intended to support price stability. Read about the treasury in chapter 6.3.4 Treasury.

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6.3.3 Staking

All stakers receive interest for providing liquidity, actually for holding the tokens. You can see this as a vote of confidence towards the project. The amount of interest is based on the income from CrowdSwap fees.

All stakers receive interest for providing CROWD tokens as a liquidity reserve. 70% of CrowdSwap's revenue is distributed to the Stakers proportionally. Since the distribution is automatic, the resulting interest can change very quickly.

The distribution takes the amount of all staked tokens as 100%. There is no upper limit for Staking!

Staking will only be available a few months after token launch. With the possibility of staking, the governance app will also be made public, which is an essential milestone for achieving the CrowdSwap DAO goal.

6.3.4 Treasury

Revenue made from fees will be stored into treasury from the LIQUIDITY and BURN percentages. The treasury will be used to give the CROWD token a minimum intrinsic value based on the underlying portfolio.

The treasury will consist of a basket of crypto currencies combining a good relation between growth and value/stability. For the moment the highest percentage would go into stablecoins, Bitcoin and Ethereum with a medium amount, a small amount into promising projects. The crypto currency held in treasury will be lend to generate yield.

This ensures that the worth of a CROWD token is always at minimum:

$$p = \frac{VT}{AT}$$

p = Price of token (intrinsic value)

VT = Value of treasury (total)

AT = amount of diluted token (total)

Usage of the treasury other than growing the intrinsic value of the CROWD token can only be opportunities for the project to invest into growth that increases the revenue, thereby supporting the treasury concept.

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7. Roadmap

–Done

- MVP CrowdSwap App
    - Ethereum, BSC and polygon DEXes
- Website Launch
- Whitepaper
- Best price routing
- Multi-chain support
- User experience
- Social media

Q4 - 2021

- Staking
- Community engagement
- SDK/API development
- Integrating new Chains/DEXes

Q1 - 2022

- Token launch
- Liquidity pools (CROWD-USDC)
- CCLP (cross-chain liquidity protocol)
- Security Audits
- MEV Protection
- Trading opportunities

Q2 – 2022

- Governance
- CCLP (Liquidity Providing)
- Integrate new DEXes

Q3 – 2022

- CCLP (Optimized Liquidity pools)
- Yield opportunities
- Integrate new DEXes

Q3 – 2022

- Integrate on-chain

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- Staking opportunities
- best price analysis and user-friendliness

Q4 – 2022

- LP opportunities
- Integrate on-chain

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