FeSwap Free Decentralized Exchange

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1 FeSwap Introduction

Cryptocurrency exchanges can be basically divided into two categories, namely, centralized order book exchanges (CEX) represented by Binance [1] and Huobi, and decentralized automated market maker exchanges (DEX) represented by Uniswap [2] and Curve.

The pricing mechanism of centralized exchanges and decentralized exchanges is different. The price of a centralized exchange is the marginal price, and the cryptocurrency is priced in real-time by the ups and downs of transactions that users conduct all the time. The advantage of the marginal price is that it is quick to respond and can keep up with the rapid changes in market information, while the disadvantage is that sometimes the CEX could be lack of liquidity and the price fluctuates greatly.

The price given by decentralized exchange is the average price. Every user is trading with the cryptocurrencies in the whole liquidity pool, so the trading price is the average price given by all the cryptocurrencies in the pool participating in the calculation of constant asset product formula $X * Y = K$ [3]. The advantage of the average price is that the price is stable and the liquidity is good, but the disadvantage is that the price can only change passively, and the large price change can only be driven by a large scale of transactions.

Due to the different pricing mechanisms of the two types of exchanges, prices among exchanges are often out of sync, thus providing arbitrageurs with many arbitrage opportunities. There are a large number of arbitrage transactions in decentralized exchanges, through which the prices of cryptocurrencies in two different kinds of exchanges are basically consistent

Both centralized and decentralized exchanges rely on charging various proportions of transaction fees to achieve profitability. As a kind of transaction friction, transaction fees could affect users' willingness to trade cryptocurrencies to some extent.

The FreeSwap decentralized exchange protocol [4] designed an automated market maker exchange protocol that does not charge transaction fees at all. The protocol sets up two one-way exchange sub-pools for each pair of trading assets, which results in that the asset prices inside the two sub-pools will deviate a little bit as the tradings happen. While some preset conditions are met, an internal asset swap will be triggered to smooth this price deviation. The automatic repair process of asset price deviation is

also an arbitrage process, which can make profits for the liquidity providers of the trading pool.

The fluctuation of digital asset exchange prices is inevitable and existing naturally. The FreeSwap protocol can lock in some part of the profit from these price fluctuations, which otherwise all be captured by arbitrageurs, and thereby providing completely free exchange services for trading users. By reducing trade friction, it is promising to attract more users to conduct exchanges in DEX, and in turn, make more profits for the liquidity providers.

FeSwap decentralized exchange specifically refines and implements the FreeSwap exchange protocol, and aims to provide users with a completely free decentralized digital asset exchange service.

2 FeSwap DEX implementation

FeSwap decentralized exchange reuses part of Uniswap's technical architecture and technical implementation. The exchange is mainly functioned through three smart contracts: $ExchangeRouter$, $PairFactory$, $SwapPair$.

$ExchangeRouter$ is the access point for users to add liquidity, remove liquidity, and exchange tokens.

$PairFactory$ mainly realizes the functions of exchange pair creation and exchange pair information management.

$SwapPair$ performs specific exchange functions, including add liquidity, move liquidity, mint/burn liquidity token, tokens exchange, price oracles, etc.

FeSwap also has many technical implementations different from UniSwap, which will be described in detail below.

2.1 Two sub-pools setup

FeSwap decentralized exchange adopts FreeSwap [4] AMM exchange protocol to determine the cryptocurrency exchange price and quantity according to the constant product formula [3].

Unlike Uniswap [2] and other exchanges, users do not need to pay transaction fees when trading in FeSwap. According to the constant product formula, for two types of assets with quantities A and B in the trading pool, the asset of type A with quantity a can be exchanged for the asset of type B with quantity b, which is:

$$b = \frac{a}{A+a}B \qquad (2.1.1)$$

FeSwap sets up two one-way exchange sub-pools for each pair of tokens. When the token prices of the two sub-pools deviate up to 1% on transaction processing, a certain amount of tokens are automatically swapped between the sub-pools to smooth the token price deviation.

FreeSwap exchange protocol has theoretically proven that this internal token swap is a win-win situation for the two one-way sub-pools, and further, both the sub-pools gain the maximum benefits from the internal swap. According to the formula of the FreeSwap protocol (2.4.1), two one-way sub-pools can be expressed as:

$$(N_{AA}|N_B) \,||\, (N_A|N_{BB}) \tag{2.1.2}$$

The internal automatic swap rules, also the price smooth rules and arbitrage rules between the two sub-pools, are defined by the Freeswap protocol formula (2.4.19) :

$$\begin{cases} \dfrac{N_{AA} * N_{BB}}{N_A * N_B} \geq \gamma \\[2ex] P^e_{A \to B} = \dfrac{N_B + N_{BB}}{N_A + N_{AA}} \\[2ex] L^e_A = \dfrac{N_{AA} * N_{BB} - N_A * N_B}{2 * (N_B + N_{BB})} \\[2ex] L^e_B = \dfrac{N_{AA} * N_{BB} - N_A * N_B}{2 * (N_A + N_{AA})} \end{cases} \tag{2.1.3}$$

Among the above formula, γ is the trigger condition of arbitrage operation, and FeSwap predefines $\gamma = 1\%$. $P^e_{A \to B}$ is the token price used for arbitrage exchange, and L^e_A and L^e_B is the number of tokens exchanged.

2.2 Swap pair creation

FeSwap imposes restrictions on the creation of token swap pairs in order to improve the quality of these swap pairs.

The creation authority of each token swap pair is controlled by a corresponding NFT token, and only the NFT owner has the right to create the swap pair, set or modify the receiver address of the profit coming from the liquidity provider service.

60% of the platform income making by the swap pair is controlled by the owner of the swap pair NFT, who can designate any recipient for the income, or choose to give up the income within a certain period of time.

2.3 Provide liquidity

When adding liquidity for the swap pool, users can adjust the proportion of liquidity provided to the two sub-pools, to decide whether to provide only one sub-pool or to provide both sub-pools at the same time, and also the different proportion of liquidity allocated to the two sub-pools.

Theoretically speaking, the income is a little bit higher to provide liquidity to the sub-pool with less liquidity, compared to provide liquidity to the sub-pool with more liquidity.

If the liquidity scale is large, you can provide liquidity to two sub-pools at the same time, if the liquidity is small, you can choose to just provide liquidity to the sub-pool with less liquidity. When the swap pair has just been created and the liquidity is first added, it is recommended that the liquidity allocation ratio of the two sub-pools be set to 50:50.

Do not create a swap pair with two stable coins. FeSwap conducts internal token swap and also arbitrage to smooth the price deviation of the two sub-pools periodically, this mechanism is not applicable to swap pairs with two stable coins.

Because some deflationary tokens burn a certain proportion of the amount transferred within the transaction, it is recommended not to create swap pairs containing such deflationary tokens. The internal swap of deflationary tokens can not ensure the token price consistency of the two sub-pools, and multiple times of token swaps could also accelerate the token deflation.

2.4 Distribution of exchange income

The automated market maker based on FreeSwap protocol can make profits equivalent to charge 2.488‰ of exchange fee while without charging any exchange fee at all.

11/12 or about 91.7% of the swap pair's earnings are shared by all liquidity providers in proportion to their respective shares of the liquidity they provide to the swap pair. FeSwap exchange platform and the swap pair owner share the other 1/12, approximately 8.3% of the earnings, with a distribution ratio of 40:60, namely FeSwap platform obtains 40% of 1/12, and the other 60% is paid to the receiving address set by the owner of the swap pair NFT.

The NFT owner can modify the swap income receiving address at any time, or set the address to zero to temporarily waive the income.

The trading income collected by FeSwap is mainly used to support the development and maintenance of the FeSwap exchange application, but FeSwap will waive this income within the first 3 months of FeSwap's online operation, in the hope of attracting more liquidity providers.

Exchange income is paid while a user provides or removes liquidity.

After multiple swap transactions, a very small amount of dust income may be generated in the swap pair, due to the reason of calculation accuracy during swap transactions. This dust income is not distributed but simply kept in the swap pair.

2.5 Remove liquidity

If having provided liquidity to two sub-pools, the user can either remove liquidity from any one of the sub-pools, or remove liquidity from both sub-pools at the same time.

2.6 Token exchange

When users conduct token exchange through the FeSwap exchange router, the router first calculates the token price deviation within the two sub-pools. If the price deviation reaches 1%, the router triggers the internal token swap, which is also an internal arbitrage, between the two sub-pools to smooth the price deviation.

For the user who triggers the internal arbitrage operation, he pays more gas fees than the normal transaction, but he also gets the best token swap price.

If some other contracts bypass the swap router and directly call the swap pair smart contract to conduct a token exchange, the internal arbitrage process will never be triggered. At this time, even if the price deviates above the threshold, the swap will still be processed at the deviated price.

Do not call the swap pair contract directly, unless you are very sure about your swap intention. If the operation is improper, you may suffer from some token loss.

2.7 Flash swap

Feswap supports flash swap, that is, users can first withdraw the required amount of trade-out tokens from the swap pair, and then return the corresponding number of the trade-in and/or trade-out tokens in the exact same swap transaction.

Flash swap can only be initiated by invoking swap pair contract directly, and it is not possible to initiate flash swap via the swap router contract.

Since the FeSwap swap pair is one-way swap pair, the flash swap can only withdraw the trade-out token, and cannot withdraw the trade-in token. Users need to carefully choose the swap pair to borrow the token needed.

Flash swap transaction can return the trade-in token and/or trade-out token. If the trade-out token is returned, the FeSwap swap pair will charge a flash swap fee of 0.3% to obtain some service income for the swap pair liquidity providers.

If the flash swap transaction returns trade-in tokens, FeSwap does not charge any swap fees. Flash swap usually involves a large swap amount of tokens, so while the trade-in token is returned, it will cause a big price slippage in the swap pair. This price slippage will be locked by the swap pair, and could trigger internal arbitrage in the subsequent swap transaction and generate benefits for the swap pair.

During the flash swap, the user needs to carefully choose the type and quantity of the tokens to be returned from their own interests. FeSwap supports the simultaneous return of trade-in and trade-out tokens. The difference is that there is no charge for returning trade-in tokens while a 0.3% swap fee is charged for returning trade-out tokens.

2.8 Token price oracle

FeSwap inherits Uniswap's time-weighted average price oracle mechanism.

However, since FeSwap adopts two one-way swap sub-pools, FeSwap token price oracle will output two token prices, and there will be a systematic deviation of less than 1% between these two prices.

If a third-party uses the price given by the FeSwap price oracle, it must use the average of the prices given by the two sub-pools of the swap pair. The single oracle price given by the one-way sub-pool will change in one direction, and is adjusted periodically by internal token exchange.

2.9 Blockchain network

The FeSwap free decentralized exchange will initially run on the Ethereum network, and while its running is stable, we will consider deploying it to some Ethereum layer-2 networks, and maybe some other specific blockchain networks such as Binance Smart Chain.

When deployed to other blockchain networks, a few operating parameters of the swap pair may be adjusted, but the core idea of providing users with free token exchange service will remain the same.

3 FeSwap governance

FeSwap heartfully embraces the tenet of decentralized governance of neutrality and trust minimization, so the governance framework will consider comprehensively all kinds of people who have made and will make contributions to the development of FeSwap.

FeSwap will issue FESW ERC20 tokens as the tool for the decentralized community governance, the total supply of FESW token is 1 billion. All FESW tokens are minted at the genesis and released gradually over the 5 years course:

- FESW Name: FeSwap DAO
- FESW Symbol: FESW
- FESW Total supply: 1,000,000,000
- FESW Inflation：   0

The target issuance members include all kinds of people who help FeSwap to set up, grow and strengthen:

- Swap pair creators
- Liquidity Providers
- FeSwap exchange users
- FeSwap community members
- FeSwap developers
- FeSwap market promoters

- FeSwap founders
- FeSwap open source technology providers

3.1 FESW allocation

FESW allocation rules are as follows:

- 1%: Vitalik Buterin. Thank him for his contribution to the creation of the Ethereum system, and grant him the right to participate in the FeSwap governance;
- 1%: Uniswap. FeSwap reuses part of UniSwap's open-source technology, thanks UniSwap for its technical contribution to FeSwap, and grant Uniswap the right to participate in FeSwap governance;
- 10%: FeSwap founders, with 5-year vesting:

Year	Release proportion	Release amount
Year 1	4%	40,000,000
Year 2	2%	20,000,000
Year 3	2%	20,000,000
Year 4	1%	10,000,000
Year 5	1%	10,000,000

- 20%: Project team, of which 16% with 5-year vesting, and 4% for strategic reserve:

Year	Release proportion	Release amount
Year 1	6%	60,000,000
Year 2	4%	40,000,000
Year 3	2%	20,000,000
Year 4	2%	20,000,000
Year 5	2%	20,000,000
Strategic reserve	4%	40,000,000

- 20%：to all bidders participating in the FeSwap Trading NFT auction, and to financial sponsors of the FeSwap project.
- 15%：FeSwap liquidity providers，distributed in 3 years:

Year	Distribution proportion	Distribution amount

Year	Distribution proportion	Distribution amount
Year 1	9%	90,000,000
Year 2	4%	40,000,000
Year 3	2%	20,000,000

- 15%：FeSwap exchange users，distributed in 3 years:

Year	Distribution proportion	Distribution amount
Year 1	9%	90,000,000
Year 2	4%	40,000,000
Year 3	2%	20,000,000

- 10%: to community members participating in community governance voting, distributed in 5 years. If the distribution is not completed in the previous year, roll into the next year:

Year	Distribution proportion	Distribution amount
Year 1	2%	20,000,000
Year 2	2%	20,000,000
Year 3	2%	20,000,000
Year 4	2%	20,000,000
Year 5	2%	20,000,000

- 8%: to FeSwap foundation, used to cultivate and improve FeSwap ecosystem, with 5 years vesting:

Year	Release proportion	Release amount
Year 1	2%	20,000,000
Year 2	2%	20,000,000
Year 3	2%	20,000,000
Year 4	1%	10,000,000
Year 5	1%	10,000,000

3.2 Community governance

Current governance voting statistics of UniSwap and etc. showed that the voting turnout is some low. The main reasons are estimated to be:

1. Users need to pay a certain voting cost to participate in community governance voting;
2. Most community proposals have no direct interest with users;
3. Users can still vote with their feet even if they don't participate in voting.

To attract community members to actively participate in voting for governance proposals and become more involved in community events, FeSwap will distribute 2% of FESW to all the voting participants every year.

To attract more liquidity providers, FeSwap will distribute 15% of the total amount of FESW tokens in a ratio of 9%, 4%, and 2% over 3 years with the yield farming mechanism.

To attract more exchange users, FeSwap will also distribute 15% of the total amount of FESW tokens in a ratio of 9%, 4%, and 2% over 3 years. The distribution will comprehensively consider the exchange frequency, exchange amount, and the relationship to trigger internal swap pair arbitrage.

4 FeSwap swap pair NFT

Creation of the FeSwap swap pair and 60% of platform share of the swap pair exchange profit are controlled by the corresponding swap pair NFT owner.

The swap pair NFT is sold by public auction. The first bidding transaction creates the swap pair NFT, and the highest price bidder within the next two weeks wins the NFT. The detailed bidding rules are as follows:

1. Feswap creates swap pair NFT smart contract based on Ethereum. One NFT corresponds to one swap pair, and the initial price of each NFT is 0.2 eth, and FeSwap has the right to modify the initial price.
2. Anyone can bid for a swap pair NFT as long as the bidding price is equal to or higher than the initial price. In the first successful bidding, the swap pair NFT is created, and the bidder of this transaction will receive 1000 FESW for free;
3. Within the two weeks after the creation of NFT, any person can bid with a higher price:
    1. When the NFT price is less than 1 ETH, the price increase shall be at least 0.1 ETH;
    2. When the NFT price is higher than 1 ETH, the price increase shall be at least 10%.
    3. Each bidder who bids for an NFT will receive 500 FESW free of charge, and 10% of the bid price increase will be sent to the former bidders of the NFT
4. If the following two conditions are both met, the bidding for a swap pair NFT ends, and the final bidder gets the NFT:
    1. Current time since the NFT creation is more than: 2 weeks
    2. Current time since the last bidding is more than: 2 hours
5. The successful bidder of an NFT becomes the owner of the NFT and will receive the number of FESW corresponding to the bidding price at the ratio of 1 ETH = 20,000 FSW;

4.1 FeSwap NFT owner rights

The NFT owner can create the corresponding token swap pair by the Feswap exchange router contract, and set or modify the recipient address of the part of the swap pair's exchange profit, which is 5% of the total exchange profit.

NFT owners can also sell their own NFT at a specified price by FeSwap NFT smart contract, anyone else can get the NFT with this price.

4.2 Usage of the NFT bidding income

All the income from NFT bidding will be used for the development and maintenance of the FeSwap exchange, and FeSwap will regularly publish the fund usage information.

The bidding mechanism of swap pair NFT can help improving the decentralization characteristics of the FeSwap exchange. Feswap can introduce a large number of NFT token owners to participate in FeSwap governance while transferring most of the exchange income to the NFT token owners.

Considering their own interests, NFT token owners, on one hand, will put forward requirements for the development and management of the FeSwap exchange; on the other hand, they are willing to take the initiative to use their own resources to introduce more users to provide liquidity and conduct token swap in FeSwap. It will benefit their self, and at same time make FeSwap bigger and stronger.

5 Milestones

FeSwap target milestones:

Milestone No.	Publish time	Milestone target
1	2021.04	Finish the development and testing of swap related and governance-related smart contract, and pass the third-party security audit
2	2021.06	Finish the development and testing of FeSwap exchange user interface application, and release for online operation
3	2021.12	Release FeSwap on ETH layer-2 network, and/or some other blockchain network with higher performance
4	2022.06	Release stable coin lending service based on FeSwap liquidity token collateral
5	2022.12	Release FeSwap on ETH 2.0 mainnet

6 conclusion

FeSwap embraces heartfully the tenet of decentralized governance and will implement this tenet in various community governance aspects including swap pair creation, liquidity provision, token exchange, governance voting, swap income allocation, technical development, product promotion, and so on. FESW, as the governance token, all are distributed for free to realize the decentralized building and decentralized governance.

By setting up two one-way swap sub-pools for each pair of tokens, FeSwap utilizes the inevitable fluctuation of the token price for internal automatic arbitrage to make profits for liquidity providers, and further provide a completely free token exchange service to the cryptocurrency exchange users.

The FeSwap dual sub-pools setting can not only solve the problem of miner's first-running problem [3] existing in current AAM DEXs, but also provide a more sensitive price response to market information compared with current single swap pair setting.

In the future, with the gradual maturity of Ethereum's layer-2 network, and the release of ETH2.0, FeSwap will be able to provide users with much cheaper and liquidity-better cryptocurrency exchange service than current centralized exchanges, and finally, attract more users to flock into the decentralized exchange and embrace the new decentralization world.

Reference

[1] https://www.binance.com/

[2] https://uniswap.org

[3] Vitalik Buterin, **Let's run on-chain decentralized exchanges the way we run prediction markets**, https://www.reddit.com/r/ethereum/comments/55m04x /lets_run_onchain_decentralized_exchanges_the_way.

[4] Daoru Lu, **FreeSwap Decentralized Exchange Protocol**, http://www.fortswap.com