Protocol Overview

What is Hedgex?

Hedgex is a decentralized margin trading protocol built on Ethereum.

How Hedgex works?

There are 3 ecosystem participants in Hedgex.

Traders, who can borrow from the pool to trade with margin to achieve hedging purpose or to leverage trading returns.

Market makers, who invest funds into the pool. The pool will take over the trader's position and bear the trades' profit and loss. At the same time, the hedging pool can obtain transaction fees and funding interests from the traders, and distribute the gain to market makers. There is also a hedging mechanism to decrease the risk of the potential loss of hedging pool.

Arbitrageurs, who detect that the trader's account has reached the risk boundary conditions, has the opportunity to be rewarded.

2 Kinds of pools

There are 2 kinds of hedging pools in Hedgex.

The main pool is created for margin traders to trade multiple main coins, like BTC, ETH etc. Traders can trade with cross margins. The market makers provide fund into a single main liquidity pool so that the fund can be used more efficiently to generate higher return.

The sub pools can be created by any market maker at any time. A sub pool provides fund to margin trader to trade any single currency. The creation of sub pool is more flexible.

Concepts related to the main pool and market makers

Core logic of the pool

When a trader conducts a margin trade, he borrows funds from the hedging pool to trade in spot swaps and obtain a position. Specifically, the hedging pool takes over the trader's position and bears the trader's profit and loss. Simultaneously, Hedgex will use the funds in the hedging pool to place an order on Swaps to hedge the position. Since long positions and short positions can offset each other for the hedging pool, Hedgex will not hedge each transaction, but will dynamically adjust the number of hedged positions based on the sum of the user's net positions. Moreover, when the sum of the user's net position is within a certain range, no hedging is performed. Through the above methods, which we call as NMM (Net-Position Market Making), the balance between product experience and risk control is achieved.

Revenue settlement method for market makers

Hedgex uses the LP token held by the market maker to settle the gain or loss of the hedging pool and the market maker. When the market maker deposits funds into the hedging pool, Hedgex will issue a new LP token to the market maker. When the market maker withdraws funds from the hedging pool, Hedgex will take the LP token and destroy it. Anyone can act as a market maker, and LP token corresponds to the market maker's share. Assuming that the number of LP tokens held by a user is n, the total number of LP tokens issued by the current hedge pool is M. The share of the user in the hedge pool accounts for n/M. When the net value of the hedging pool assets fluctuates, the user's equity will also change proportionally.

The initial total number of LP tokens is 1 Million, and the total amount is 1 Million USD. After the quota is full, Hedgex launches.

When user A add funds to the hedging pool, assuming that the original net value of the hedging pool = net, the total number of LP tokens held by the user is M0.
User A deposits funds x in the hedging pool, Hedgex will issue (M0 * x / net) new LP tokens to user A, and the total number of LP tokens issued by the hedging pool M1 will be changed to M0 + M0 * x / net.

When user B withdraw funds from the hedging pool, assuming that the original net value of the hedging pool = net, the total number of LP tokens held by the user is M0. User B returns n LP tokens and withdraws assets worth (net * n / M0) from the hedge pool. Hedgex will destroy the returned LP tokens, and the total number of LP tokens issued by the hedge pool M1 will be changed to M0-n.

The assets of the hedging pool

The assets of the hedge pool consist of 3 parts:
1) USD (USD Stable coin)
The initial USD is transferred in by the market maker. After that, the market maker can deposit or withdraw funds. When a trader settles with the hedge pool, the actual profit and loss of the trader will become the loss and profit of the hedge pool respectively, including transaction fees and interest. During settlement, the amount of USD in the hedge pool will change accordingly.

2) Each hedging currency
When a trader's position changes, hedging risks. Hedgex will go to the Swaps to buy or sell hedging products. At this time, the USD hedge pool will also decrease or increase accordingly. Value of hedging currency = Σ amount of currency held in the hedge pool * currency price

3) Unrealized profit and loss of hedge pool
When a trader has positions, the hedge pool as a counter-party will also have unrealized profits and losses.
Trader's total unrealized profit and loss = Σ each trader's unrealized profit and loss
Unrealized profit and loss of the hedge pool =-Total unrealized profit and loss of the trader

Net value of the hedging pool = USD hedging pool + value of hedged currency + unrealized profit and loss of hedging pool

In order to reserve enough funds for withdraw or settlement in the hedge pool, there will be an upper limit on the value of the hedged currency held in the hedge pool.
* In particular, when the unrealized profit and loss are large, the USD hedging pool might be negative.

4) Hedging pool withdrawal limit
The hedging pool takes up a user's position and requires a certain margin. Since the long positions held by some users in the same currency can be hedged against the short positions held by other users, the net position of the currency is used to calculate the margin required for the hedging pool,
Used Margin = Σ Currency Net Position * Currency Standard Price
When the net value of the hedge pool-used margin> 0, the amount can be withdrawn.
The present value of the hedge pool can be withdrawn = min (net value of the hedge pool-margin occupied, net value of the hedge pool-value of the hedged currency, net value of the hedge pool * 10%)
When the net value of the hedge pool-used margin <= 0, the withdrawal is not possible.
Although it is not possible to withdraw cash at this time, a market can be opened up in

the future, and users can trade the LP token of the hedge pool to solve the liquidity problem.

Concepts related to Traders and Positions

Transaction Proof
Traders can obtain transaction proof when they hold positions. Hedgex uses transaction proof to settle assets for traders. The information in the transaction proof includes:
1) Margin
When a user opens a position, a certain amount of USD margin will be transferred to the smart contract. Actions such as adding, closing, liquidating, collecting interest, transferring into margin, transferring out margin, will affect the amount of margin.
2) Positions
The positions info contains several sets of position information, each set of information includes currency, position direction, average open price of positions, and size of the positions. In the same currency, positions in the same direction will be merged.

User assets can be calculated based on transaction proof,
unrealized profit and loss = Σ currency long position * (standard price-average open price) + Σ currency short position * (average open price-standard price)
Account Equity = user margin + unrealized profit and loss.
*User margin can be negative in theory.

Parameters to open a position
Hedgex provides market price order execution. If the order is executed, it is executed at the market price, but the transaction price does not exceed the acceptable slippage ratio of the target price. Otherwise, the transaction fails. The following parameters needs confirmation to execute an position-opening order.
1) Currency
2) Transaction direction
3) Transaction amount
4) Target price
5) Acceptable slippage

Restrictions to open or close a position
For a certain trading asset on Hedgex, some users hold long positions and some users hold short positions. For hedging pools, the risks of positions can be hedged against each other. For the part of the net position that cannot be hedged, the risk is taken by the hedging pool. Hedgex uses the net position ratio to measure net positions,
User net position = Σ user long position- Σ user short position
Net position ratio = user net position * currency price / hedge pool net value * 100%
*The net position ratio has a positive or negative sign. When the value is positive, it means that there are more long positions than short positions; otherwise, it means that there are more short positions than long positions.

Currency that is traded on Hedgex can be divided into two categories:,
T1 currency. No additional hedging can be performed on the net position.

T2 currency. Additional hedging for long positions is possible, but no additional hedging for short positions. For example, on the ETH network, USD in the hedge pool can be used to buy ETH in Swaps to hedge a long ETH position. For each currency, the parameter R will be configured and the system will limit the total net position (the sum of the net positions of each currency).

Since the net short positions of all currencies cannot be additionally hedged, for each currency:
1) When the net position ratio of one currency is lower than −R, no new short positions can be opened.
2) When the total net position ratio is lower than −20%, no new short orders can be opened.
For all currencies:
3) When the total net position ratio is higher than 65%, no new long position can be opened.
Since long net positions in T1 currencies cannot be hedged additionally, for T1 currencies:
4) When the currency net position ratio is higher than R, no new long position can be opened;
5) When the total net position ratio of T1 currencies is higher than 20%, no new long orders can be opened.
There are no restrictions on closing positions.
*There are no restrictions on closing positions. However, in order to control the risk of the hedging pool, when total net position is too large, the risk will be reduced by price shifting.

Amount limit for one single transaction
Single transaction trading amount <= hedge pool net value * 3% / standard price;

Transaction price
Hedgex obtains transaction prices from external channels:
For T1 currencies, the price comes from oracle, such as chainlink.
For T2 currencies, prices come from hedging platforms, such as Swaps.
The standard price of the currency = the spot price obtained from the channel
The standard buying price of the currency = standard price + $\triangle p$
The standard selling price of the currency = standard price − $\triangle p$
Among them, $\triangle p$ is the parameter of the system configuration. When calculating the nominal value, net value, and liquidation conditions of the position, the calculation is based on the standard price.

Price shifting
If one currency has a net position that is too large, it will pose a risk to the system. In this case, Hedgex will dynamically adjust the price shifting.
For T1 currencies,

net position ratio = −R, or net position ratio = R, as the boundary condition,
T2 currencies,
net position ratio = −R, or net position ratio = (R + currency actual hedge rate), as the boundary condition.
When the net position ratio is within the boundary conditions, the price shifting rate = 0.
When the net position ratio shifts from the boundary conditions within 0.5*R, the price shifting rate = abs (net position ratio−boundary ratio) / 5.
When the net position ratio shifts more than 0.5*R from the boundary conditions, the price shifting rate = R / 10 + (abs(net position ratio−boundary ratio)−0.5*R) / 2.5.
When shifting upward, the buying price *= (1 + price shifting rate), and the selling price remains unchanged.
When shifting downward, the selling price * = (1−price shifting rate), and the buying price remains unchanged;

Calculations of terms

Open a position
Calculate the used margin by the user's positions.
Required Margin = Σ Currency Position * Currency Standard Price / Leverage, where long and short positions do not offset each other;
1) If account equity-required margin> 0, the user can open a position with the fund in the account, and the open position P0 = (account equity-required margin) * leverage / opening price. When the user needs to open more positions, you need to use the funds in the wallet.
2) When the account equity-required margin <=0, only the funds in the wallet can be used to open positions. The total open position P1 = (wallet balance + account equity-required margin) * leverage multiple / open price.

When the contract is executed, due to changes in price and account equity, the actual margin required might be different. At this time, the transaction amount required will be executed in priority. The asset needed to be transferred into the margin is calculated according to the transaction amount.
When the asset in the account and wallet is insufficient,, the wallet balance will be transferred in as the margin, and the actual transaction amount will be calculated.

Transaction fee = transaction fee rate * opening quantity * opening price;

Changes of the trader transaction proof,
User deposit += deposit transferred from wallet,
Position amount += new opened position amount,
Average price of the position = (original position amount * average price of original position + new position* opening price) / position amount,
User margin -= transaction fee

Changes of the hedging pool,
Hedging pool USD += transaction fee;

Close a position
For any currency,
The position available to close = open position

When a position is closed, the position amount changes and the actual profit and loss of this part of the position is calculated. The user's unrealized profit and loss changes based on the closing position amount. The unrealized profit and loss of the hedge pool will automatically change accordingly. At the same time, the settlement between the user and the hedging pool will be based on actual profit and loss. For users and the hedging pools, it is a process of converting unrealized profits and losses into realized

profits and losses. which are transformed into user margin and hedging pool USD changes in correspondence.

If the long position is closed,
realized profit and loss = closing position amount * (closing price-average opening price),
If the short position is closed,
realized profit and loss = closing position amount* (average opening price-closing price),
Transaction fee = transaction fee rate * closing position amount* closing price;

Changes of the transaction proof,
User margin += actual profit and loss,
Position amount -= position amount to be closed,
User margin -= transaction fee

Changes of the hedging pool,
USD hedging pool -= actual profit and loss,
Hedging pool USD += transaction fee

Liquidation

Maintenance margin = Σ currency position * currency standard price / 30, maintenance margin of long and short positions will be calculated separately. When account equity <= maintenance margin, liquidation will be automatically triggered.

Liquidation detection function will be open to external arbitrageurs. When an arbitrageur detects from the external source, an off-chain source, that an account has reached a liquidation condition, it will call the liquidation contract. The contract internally detects the liquidation conditions again, and the liquidation will be executed if the condition remains.

When the position is liquidated, all positions are gradually closed. The user's floating profit and loss will become 0, and the floating profit and loss of the hedge pool will automatically change accordingly.

If the account equity is> 0 after the positions are closed, the equity balance is divided equally between the external arbitrageur and the hedge pool. If the account equity is <0, the loss is borne by the hedge pool.

The gas cost of the process is paid by the arbitrageur.

The specific process of liquidation is as follows.

All positions are closed in sequence, and assets are dealt with in the manner of closing positions. When all positions are 0 (the remaining user margin <> 0 at this time), the remaining margin is processed as follows.

1) If user remaining margin> 0, 1/2 * user deposit is paid to the arbitrageur and hedging pool USD += 1/2 * user margin. If user remaining margin <0, Hedging pool USD += user margin;

2) User remaining margin = 0;

Position Funding Cost

When a currency has more long positions than short positions, or more short positions than long positions, a funding interest will be applied to the traders holding the majority position, and the cost is collected daily at UT 0.

When the long position is the majority position, the long position pays interest, User's actual funding rate = base daily interest rate * (total long position in this currency-total short position in this currency) / total long position in this currency Position

When the short position is the majority position, the short position pays interest, User's actual funding rate = base daily interest rate * (total short position in this currency-total long position in this currency) / total short position in this currency Position

Funding Cost = user's actual funding rate * user's position in this direction * standard price

Actually, each currency only charges the interest of the net position part, which is borne by all users who hold the majority position.

Changes of the transaction proof,
User deposit -= funding cost,

Changes of the hedging pool,
Hedging pool USD += funding cost

Add asset to or withdraw from the margin

In order to avoid liquidation, users can add more asset into the margin from the wallet to the contract at any time. When adding asset into the margin, the changes the transaction proof,
User margin = += amount transfer into the margin,

When the account equity> the used margin, part of the margin can be withdrawal from the contract to the wallet. When the user withdraw, changes the transaction proof,
User margin = -= amount transfer out of the margin

When the withdrawal is being executed, due to changes in price and account equity, the actual amount available to withdraw might change. The priority is to proceed the withdrawal at the amount specified by the user. When the actual margin is insufficient to withdraw the amount specified by the, the withdrawal = account equity-used margin.

Add asset to or withdraw from the hedging pool

The market maker can transfer any amount of funds from the wallet to the hedging pool at any time. If market maker want to withdraw from the pool, the amount available are calculated according to the number of LP tokens returned by the market maker.

When market makers add fund into the hedging pool,
Hedging pool USD += transferred funds,

When market makers withdraw from the hedging pool,
USD hedging pool -= transfer out funds,

When the withdrawal is being executed, due to changes in price and net value of the hedging pool, the amount available to withdraw might change. The priority is to proceed the withdrawal at the amount specified by the user. When the actual amount that can be transferred out is insufficient, the maximum amount that can be withdrawn will be proceeded.

The liquidation of the hedging pool

Hedging pool maintenance margin = Σ currency net position * currency standard price / 5
When the net value of the hedging pool <= the maintenance margin of the hedge pool, the liquidation occurs. In the process, the system will no longer accept new positions. The account of position holder will be settled in sequence, starting from the majority position of the currency with the largest positio, until all positions are closed and settled.

Position Hedging on Swaps

Hedging ratio

Hedging ratio = hedged position * standard price / net value of hedge pool * 100%

Expected hedge ratio

Hedging long positions in T2 currencies,
1) When net position ratio of a certain currency <= R,
the currency expected hedge rate = 0.

When the currency net position ratio> R,
the expected hedge ratio of the currency = the currency net position ratio−R.
2) When the total net position ratio <= 20%, the total expected hedge ratio = 0; When the total net position ratio> 20%, the total expected hedge ratio = the total net position ratio−20%

In addition, in order to retain funds for settlement with traders and withdrawals of market makers, the maximum expected hedging rate is 66% (at this time, the corresponding total net position ratio is 86%). When the total net position ratio is> 65%, new positions in the same direction cannot be opened, which leaves a certain buffer.

Standard hedge rate
Under specific conditions, Hedgex will calculate the current reasonable position for each currency as below.
Here is the assumption.
The net position ratios of T2 currencies are: $r_1, r_2, \cdots, r_n$, let $R' = r_1 + r_2 + \cdots + r_n$.
The expected hedging rate of T2 currency is: $x_1, x_2, \cdots, x_n$, let $X' = x_1 + x_2 + \cdots + x_n$.
The total expected hedge rate is X.

If X'> X and X' <66%,
then the standard hedging rate of the currency shall be $x_1, x_2, \cdots, x_n$;
Else if R' <X and R'<66%,
then the standard hedging rate of the currency shall be $r_1, r_2, \cdots, r_n$.
Else if if X'<= X <= R' and X <66%, then the standard hedge rate T = X.
The standard hedge rate T = 66%

For 3) and 4), the standard hedge rate of currency is $x + (T-X') / (R' - X') * (r-x)$

Hedging adjustment
When there is a certain deviation between the actual hedged position of the currency and the correct hedging position, it is automatically adjusted. If a currency abs (actual hedging rate−standard hedging rate) >= 2.5%, adjust the hedging position to the standard hedging rate. Otherwise, maintain the current hedge position.

Changes of the hedging pool funds.
When the hedging pool buys a certain currency, the USD in the hedge pool will decrease and the currency holdings in the hedge pool will increase.
When the hedging pool sells a certain currency, USD in the hedge pool will increase, and the currency held in the hedge pool will decrease;

Market maker withdrawal simulation
Assuming the hedging is based on the total expected hedging rate, here is the change in hedging amount when the market maker withdraws from the hedge pool.

The net value of the original hedge pool is n0,
The total hedge rate is rh0,
The nominal value of the hedged position vh0 = n0 * rh0,
Net position ratio rn0 = rh0 + 20%, The nominal value of the net position vn0 = n0 * (rh0 + 20%),

When a user withdraws assets in the hedge pool that account for the net value p of the hedge pool,

The net value of the hedge pool n1 = n0 * (1-p),
Net position ratio rn1 = vn0 / n1 = (rh0 + 20%) / (1-p),
The total hedge rate rh1 = rn1-20%,
The nominal value of the hedged position vh1 = n1 * rh1 = rh0 * n0 + 20% * n0 * p,

Hedging position change value = vh1-vh0 = 20% * n0 * p,
Relative net worth change rate = 20% * p,

According to the withdrawal limit of the hedge pool, p <= 10%, so the relative net value change rate is <2%.

Parameter configuration

Currency type and R

BTC, T2, R = 15%;

ETH, T2, R = 10%;

EOS, T1, R = 5%;

DOT, T1, R = 5%;

Leverage

BTC 10 times;

ETH 7 times;

EOS 5 times;

DOT 5 times;

Transaction rates and funding rates

Transaction fee rate: 0.3%;

Basic daily interest rate: 0.1%, user actual interest rate [0, 0.1%];

Sub Pool, a single-trading-pair pool

A single currency pool means that only one trading pair can be traded in the pool. Any currency in the trading pair can be used as the base currency (settlement currency).

1) Single currency pool can be simplified in the logic of liquidation.
Since the pool contains only one currency, there is only one price variable for the user's net asset value, therefore the liquidation price can be directly calculated. There is no need to carry out complex liquidation detection, as long as the position that triggers the liquidation price is liquidated when the underlying price changes.

2) No hedging is applied. All single currency pools are regarded as T1 currencies and are not hedged.