Compound-Uniswap Liquidator V1 Design Doc

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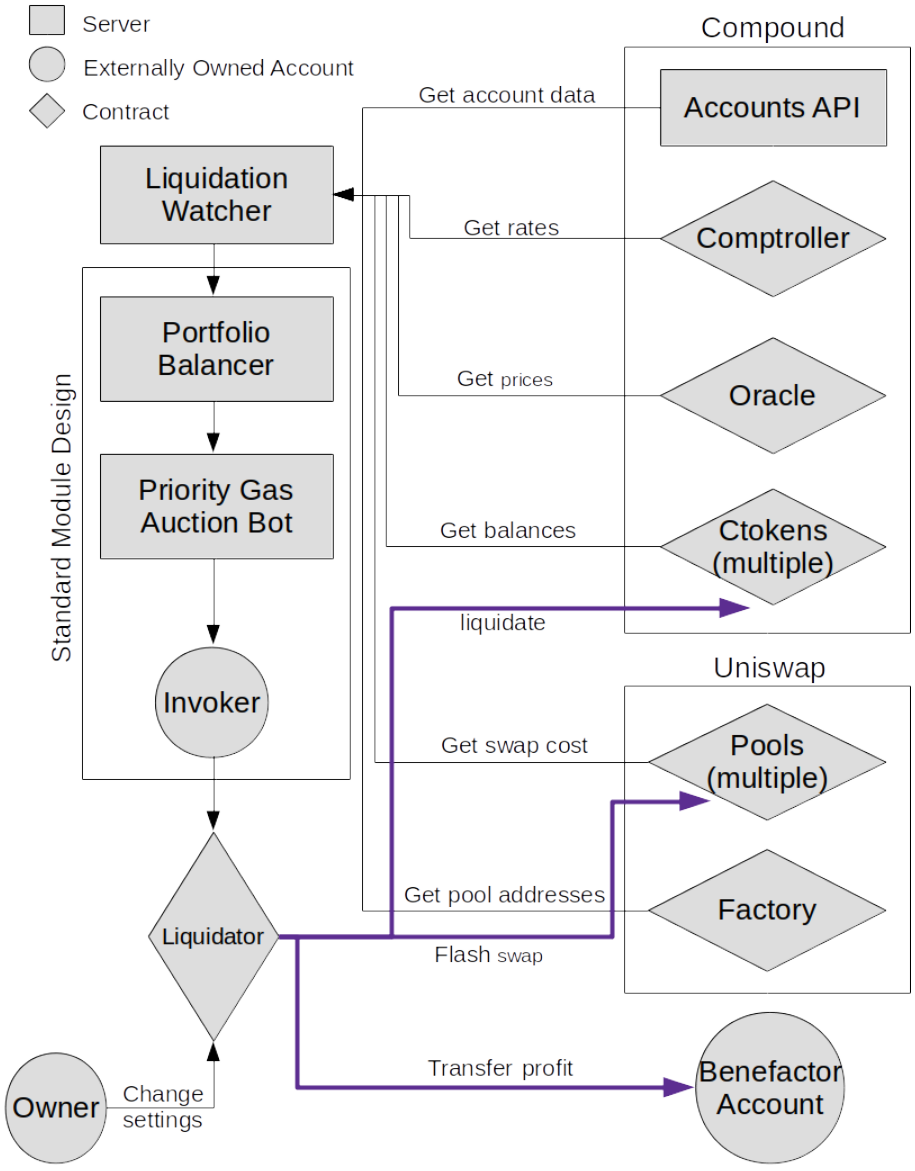
Abstract

This system liquidates underwater accounts on Compound. A webserver pulls data from multiple sources to calculate the Revenue of liquidating an account, then a transaction is submitted to a smart contract which bundles some actions together to create a pure revenue transaction. The transaction calls Uniswap for a flash loan, then it uses the newly borrowed tokens to liquidate a loan on Compound, next it swaps the tokens it seized in the liquidation back to the tokens it took out the flash loan in and pays back the flash loan. Finally it does some checks to make sure it hasn't lost money in the transaction and reverts the whole process if it has lost money.

This whole process ensures that all transactions that do not fail will only make money, that is to say they are *Pure Revenue Transactions*. The system can only lose small amounts of money by paying transaction fees on transactions that revert.

Architecture



In Depth Breakdown

Liquidation Watcher

The Liquidation Watcher watches the block chain for liquidations. It pulls accounts sorted by collateralization from compound's api and calculates the revenue from liquidating them in order of least collateralized first (after checking to make sure they are not dust). If it finds an account it can liquidate it then passes information to the Transaction Handler in the following JSON format:

```
{
  String: ethRevenue //Eth Revenue from swapping (in wei),
  String: ethCost //from not swapping (in wei),
  String: tokenRevenue //from not swapping (in atomic),
  String: liquidateAddress //The address of the account to liquidate,
  String: repayToken //letter code (ETH, REP, DAI,...),
  String: seizeToken //letter code of CToken (CETH, CREP, CDAI,...),
  String: repayAmount //The amount of token being repaid (in atomic)
}
```

Transaction Handler

See Transaction handler Documented separately for in depth detail.
The Transaction handler decides whether or not to swap tokens based on a portfolio balancer. It also conducts priority gas auctions to get the most transactions through at the lowest price. The initial version of this liquidator will run without any portfolio balancing and a simple blind raise strategy for the priority gas auction. Other components in this system are designed with these additional features in mind though.

Liquidator

The liquidator grants permissions to 3 accounts: Invoker, Owner, and Benefactor. The Owner can change the liquidator's settings. The Invoker can call liquidations. The Benefactor can withdraw funds.
Liquidation consists of the following steps:

- The Invoker calls the liquidate function
- The Liquidator notes it's current balances
- The Liquidator gets a flash loan from Uniswap
- The Liquidator uses the loan to liquidate the account passed in
- The Liquidator seizes CTokens in a different currency as collateral
- The Liquidator redeems CTokens for their underlying token (or not if we omit swapping)
- The Liquidator repays Uniswap with the redeemed tokens (or with its own balance of the original if we omit swapping)
- The Liquidator compares its new balance to its old balance and reverts if it lost money
- A gas token optimization is called if the gas price was sufficiently high

Variable Definitions

R : Revenue from a successful transaction (measured in ETH), derived from formula below

T_s : Tokens seized in liquidation, derived from formula below

T_r : Tokens repaid in liquidation, derived from formula below

I : Liquidation incentive. The discount on tokens seized in liquidation, pulled from *Comptroller:liquidationIncentiveMantissa()* (scaled by 1e18)

C : Close factor. The percent of an accounts borrowed tokens that can be liquidated in a single transaction, pulled from *Comptroller:closeFactorMantissa()* (scaled by 1e18)

P_s : Price of seized token in ETH, pulled from *PriceOracle:getUnderlyingPrice(tokenAddress)* (scaled by 1e18)

P_r : Price of repaid token in ETH, pulled from *PriceOracle:getUnderlyingPrice(tokenAddress)* (scaled by 1e18)

L_b : Largest borrowed asset in ETH, calculated by calling *CToken:borrowBalanceCurrent(accountAddress)* on each CToken and *PriceOracle:getUnderlyingPrice(tokenAddress)* to calculated the largest position in ETH

L_c : Largest collateral asset in ETH, calculated by calling *Comptroller:getAssetsIn(accountAddress)* to see which assets are used as collateral, and then measuring each one by checking the balances of each CToken that account is entered into

Q : Available flash swap liquidity, pulled from *UniswapPair:getReserves*

$f_u(T_r)$: Uniswap cost function. Always takes T_r as input, available through the uniswap SDK

Formula Definitions

$$R = (T_s - f_u(Tr)) * P_s$$

$$T_s = \frac{I * P_r * T_r}{P_s}$$

$$T_r = \begin{cases} Q, & T_r \leq Q \\ \frac{L_c * P_s}{P_r * I}, & L_b * C * I > L_c \\ L_b * C * I, & L_b * C * I \leq L_c \end{cases}$$