Orbit Finance
The Undercollateralized Money Market Protocol

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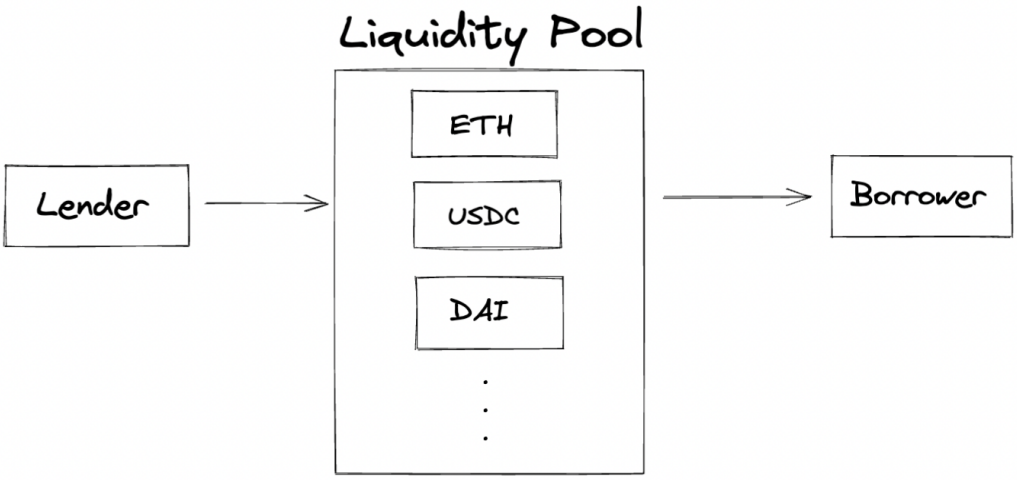
Abstract

Orbit is a permissionless, non-custodial credit protocol implemented for the Ethereum Virtual Machine. It introduces secure under-collateralized borrowing in Decentralized Finance (hereafter Defi). Enabling this increases the capital efficiency of the supplied assets and opens up new use-cases of borrowing in Defi. A higher capital efficiency optimizes rates for both lenders and borrowers.

1. Introduction

Financial systems revolve around the ability to lend & borrow efficiently. Hence, credit market protocols are a crucial component of Defi. There are many talks about how the current on-chain financial system (Defi) can replace traditional finance (hereafter tradfi). Though, some problems bottle-neck the mass adoption.

The heart of a lending-borrowing protocol is its liquidity pool. Lenders supply assets to fill up this liquidity pool. Assets in this liquidity pool are lent out to borrowers to earn yields. These yields are distributed to the lenders.



The current Defi credit market is hinged on an over-collateralized system (Collateral value > Debt value). Although existing solutions provide un(der)collateralized lending, they come with security measures such as KYC and credit checks which don't justify the term decentralized. The key reason behind such a system is to minimize the risk of borrowers not paying back loans (hereafter default risk). This risk is amplified in an anonymous world like web3.

An over-collateralized system seems to be a potential solution but has some associated problems. Let's discuss the major ones.

Firstly, it only addresses a handful of use cases of borrowing, such as,

- It helps users meet immediate cash needs without selling their assets.
- Allows users to invest in market opportunities, using their existing portfolio as collateral.

Secondly, it promotes capital inefficiency. Defi is a market with many people who want to lend and earn yields and a relatively less number of people who want to

borrow. On average, the capital efficiency of current over-collateralized solutions is 40%; this means that 60% of assets are sitting in the pool, doing nothing.

Institutional under-collateralized platforms try to solve the latter by offering un/under-collateralized loans to whitelisted users but compromise on some other things:-

- They are not permissionless.
- They still have default risk to some extent.
- They compromise users' privacy, with the need for KYC before borrowing.

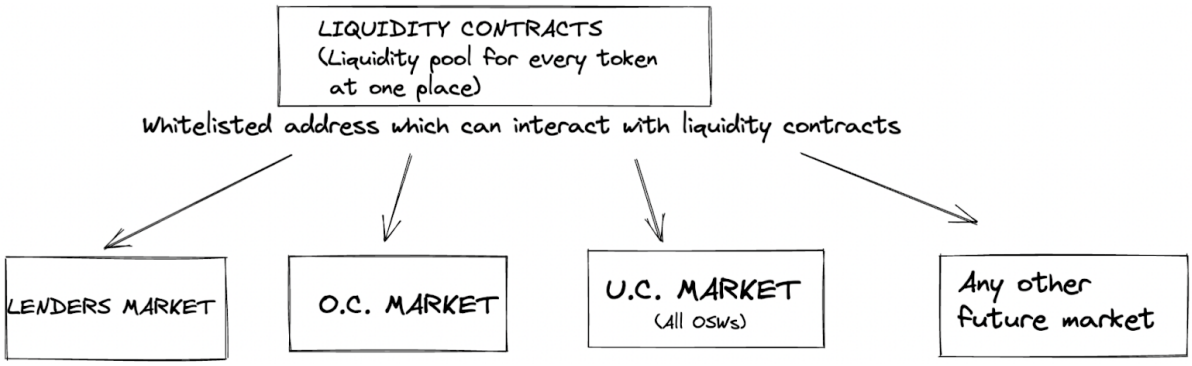
This paper introduces a decentralized un(der) collateralized money market protocol on Ethereum Virtual Machine. It also describes how Orbit protocol works and highlights new features and innovations that help to set it apart.

2. The Orbit Protocol

This is a simplified introduction to the Orbit Protocol. We are working on a fully detailed Yellow Paper and hope to release it by Oct 2022.

Orbit is a protocol that offers permissionless under-collateralized loans without compromising on security and the use cases of borrowing.

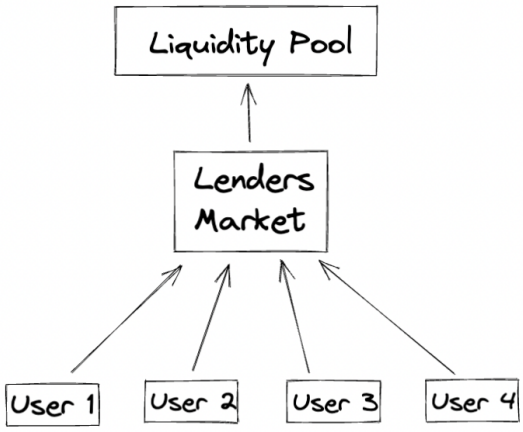
Orbit Protocol is divided into three separate markets with specific use cases for each. A lender market, an over-collateralized market, and an under-collateralized market. All these markets are built on top of a common liquidity pool.



2.1. Lenders Market

The Lenders market is the most simple of all markets. It's an easy-to-use market for lenders. Users can deposit their assets to

orbit's liquidity pool and earn yields.



Why a separate market for lenders?

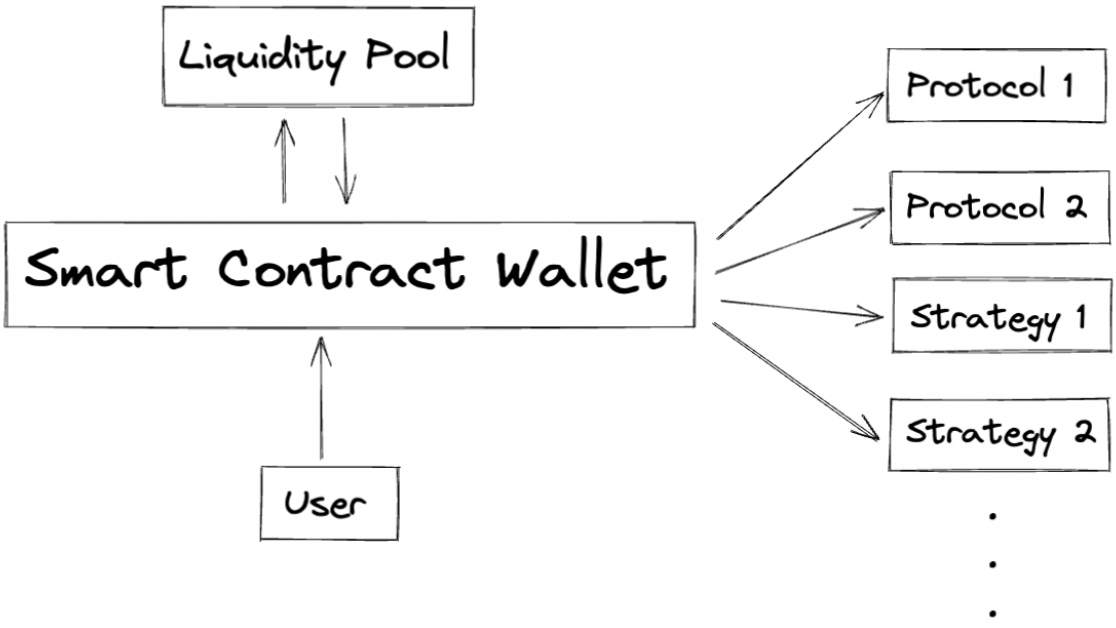
Lenders are significantly more than borrowers in any financial system. Defi is no different. Defi protocols get very complex and fast for an average user. It makes sense to make a separate and simple supply-withdraw market for lenders, skipping all the extra complexities introduced for borrowers.

Also, protocols often introduce rewards (liquidity mining) to attract users, but some users take advantage of this by simple leverage to amplify their yields. This ultimately puts the protocol at a loss. A separate lender market solves this problem, as rewards(if any) will be introduced in the lender market that users can't leverage.

2.2. Under-collateralized Market

This market enables users to get under-collateralized loans, opening up new use-cases of borrowing in Defi. It also increases the capital efficiency of the common liquidity pool, optimizing the rate of the whole system. Let's discuss how it works in detail.

To eliminate the default risk, Orbit allows users to interact with the under-collateralized market using 'smart contract wallets'.

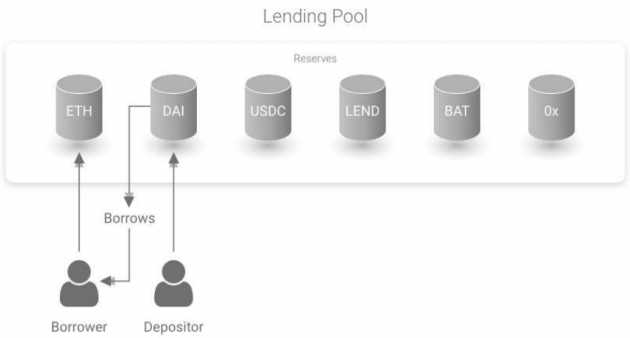


This indirect interaction allows orbit to limit users' access to the loan funds. They can interact with whitelisted protocols and perform enabled strategies but cannot take the funds outside the Orbit's ecosystem.

Smart contract wallets are a middle layer between users and orbit protocol. It gives users delegated access to the loan funds and also allowed orbit a way to recover its loan in case a user violates orbit's parameters.

2.3. Over-collateralized Market

This market is similar to existing credit protocols in Defi. Borrowers will have to lock collateral of more value than their debt. The under-collateralized market optimizes rates of the overall system, making this market more efficient compared to existing over-collateralized credit protocols.



Why is a separate over-collateralized market needed?
The under-collateralized market provides better debt access to users but keeps the funds inside the orbit's ecosystem to maintain solvency. Protocols/Strategies in the under-collateralized market will be enabled after an extensive risk analysis. It might happen that orbit as a protocol might not consider a protocol/strategy safe enough to whitelist, but a user might want to use it. The over-collateralized market is introduced to allow users to take loan funds outside the orbit's ecosystem.

3. Balance Sheet

Let's now discuss the parameters orbit considers to maintain solvency.

Firstly, let's differentiate between what is considered collateral and debt.
Debt:- Loan given by Orbit to the user.
Collateral:- Assets can be used to recover the user's debt.

For the **over-collateralized** market, they are simple to differentiate:
Debt is the loan the user took, and collateral is the assets users lock to get loans.

For the **under-collateralized** market:-
Debt is the loan user took, and collateral can be at three different places.

1. It can be locked in orbit's liquidity pool earning interest for the user.
2. It can be inside the user's 'smart contract wallet.' (the loan funds)
3. It can be inside a protocol. Protocol which the user is using with the loan funds.

Orbit Protocol is solvent in case:-

Value of collateral >= Value of debt. ... eq(1)

This means that a user should be liquidated before the above formula violates.
Orbit protocol uses three parameters to quantify the solvency of a position. Let's discuss these:-

3.1. Collateral Factor

The collateral factor is used to normalize (decrease) the collateral's value, which helps keep a safe margin from the insolvency point. It is an asset-based factor majorly based on its past volatility.

3.2. Debt Factor

The debt factor is used to normalize(increase) the value of debt which further contributes to keeping a safe margin from the insolvency point. It is also an asset-based factor majorly based on its past volatility. For the under-collateralized market, it helps in deciding max borrow limits, thus also depending upon past trends of the utilization of the asset.

3.3. Protocol Factor

The protocol factor is an extra normalizing layer for the under-collateralized market. Protocols that are a part of the orbit's ecosystem will have different risks associated with them. This parameter will quantify those risks and further normalize (decrease) the value of the collateral if it is inside a protocol. It is a protocol-based factor based on the 'max loss per block.

Equation (1) will be used along with the above factors to calculate a single factor to quantify the safety of a position, called the **health factor**. A position's health factor should be greater than or equal to 1. A health factor of less than 1 means the position is liquidatable. Let's see how it is calculated for a position:-

For the Over-collateralized market:-

$$Health\ Factor\ = \frac{\sum(C_i * PC_i * CF_i)}{(\sum(D_i * PD_i) \div DF_i)}$$

Where,

C_i = Amount of i^{th} collateral
PC_i = Price of i^{th} collateral
CF_i = Collateral Factor of i^{th} collateral
D_i = Amount of i^{th} debt
PD_i = Price of i^{th} debt
DF_i = Debt Factor of i^{th} debt

For under-collateralized market:-

$$Health\ Factor\ = \frac{\sum(CL_i * PCL_i * CLF_i) + \sum(CW_i * PCW_i * CFW_i) + \sum\sum(CP_i * PCP_i * CFP_i * PF_j)}{(\sum(D_i * PD_i) \div DF_i)}$$

Where,

CL_i => Amount of i^{th} collateral locked
PCL_i => Price of i^{th} collateral locked

CFL_i => Collateral Factor of i^{th} collateral locked
CW_i => Amount of i^{th} collateral inside smart contract wallet
PCW_i => Price of i^{th} collateral inside smart contract wallet
CFP_i => Collateral Factor of i^{th} collateral inside smart contract wallet
CP_i => Amount of i^{th} collateral inside the j^{th} protocol
PCP_i => Price of i^{th} collateral inside the j^{th} protocol
CFP_i => Collateral Factor of i^{th} collateral inside the j^{th} protocol
PF_j => Protocol Factor of j^{th} protocol
D_i => Amount of i^{th} debt
PD_i => Price of i^{th} debt
DF_i => Debt Factor of the i^{th} debt

4. Liquidation

As discussed above, if the health factor of a position goes below 1, the position becomes liquidatable. Anyone can liquidate any position and get incentivized to do so. Liquidators will have to engage in a dutch-auction to liquidate a position. This means that liquidation incentives depend on how “under-water” a position is. For example, a liquidator will be incentivized more to liquidate a position with a health factor of 0.95 compared to a position with a health factor of 0.98.
This ensures that a user will get liquidated (at a minimum loss) as soon as a liquidator becomes profitable and chooses to liquidate.

Orbit will also enable ‘absorb-liquidations’ which will allow liquidators to absorb a violator's debt and collateral into their position, provided they have enough collateral to back the position. This will decrease the gas of the liquidation transaction. A liquidator might choose to absorb many positions and collect profits at the end from the combined position, skipping unnecessary token transfers in between.

5. Deposit Types

Orbit supports three types of deposits meant for separate use cases. Let's discuss them one by one:-

5.1. Alpha deposit

Deposit earns interest and is used as collateral.

- The deposit goes inside the liquidity pool, funds from which will be lent; hence it earns interest.
- The deposit will be used as collateral for any borrows, hence will be within reach of the protocol in a liquidation call.

5.2. Sigma deposit

The deposit doesn't earn interest but is used as collateral.

- The deposit doesn't go inside the liquidity pool, hence doesn't earn interest. It doesn't have any protocol risk.
- The deposit will be used as collateral for any borrows, hence will be within reach of the protocol in a liquidation call

5.3. Gamma deposit

Deposit earns interest but isn't used as collateral.

- The deposit goes inside the liquidity pool, funds from which will be lent; hence it earns interest.
- Deposit won't be used as collateral for any borrows, hence won't be in reach of the protocol in a liquidation call

6. Reactive Interest Rates

Current credit protocols use straight line (kinked or piecewise linear) interest rate models, which are static. These work well with well-tuned parameters and a dedicated team to monitor them continuously and update them if needed. This is a redundant and inefficient process for a fast-paced market like Defi.
Orbit Protocol will use control theory to get reactive interest rates, which will be able to adapt to market conditions in real-time. It will use a PID controller for the same.

A mixture of these three factors will determine interest rates:-

6.1. Proportional Factor

This is the most basic factor analogous to a straight-line model. It promotes higher interest rates for higher utilization and lowers interest rates for lower utilization.

6.2. Integral Factor

This factor helps to remove “constant errors.” A constant difference between current and optimal utilization will promote the interest rate to minimize the difference.

6.3. Derivative Factor

This factor minimizes “overshoots.” For example:- Due to interest rate or market conditions, the utilization is decreasing/increasing very fast (high slope). This will promote the interest rates such that the slope decreases so that the current utilization doesn’t cross optimal.

7. Oracle

Orbit will use Uniswap v3's decentralized time-weighted average price (TWAP) along with ChainLink to assess the solvency of users.

Let’s discuss the reasons to justify the selection:

- TWAPs are resistant to price manipulation attacks. It cannot be manipulated within a transaction or block because it's calculated using historical data.
- TWAPs smooth nature helps to remove the impact of price shocks on borrowers. During a large trade, the current price on Uniswap can be moved significantly. Arbitrage bots will quickly converge this to the broader market value, so the maximum deviation of the TWAP will only be a fraction of the temporary price movement. This prevents needless liquidations
- To further decrease the risk of price manipulation, ChainLink oracle will be used as an added layer of security. For example, governance can set that Uniswap TWAP price should be +-1% of Chainlink’s price (this should be set by analyzing the history between Chainlink price & Uniswap TWAP)

8. EXTRA FEATURES

8.1. Defi ToolBox

Orbit will support an inbuilt Defi toolbox enhancing the user experience. Users will be able to perform complex transactions in single clicks.

Some of the tools are listed below:-

Collateral Swap

- Debt Swap
- Leverage

- Develverage
- Uniswap v3 rebalancing
- Protection Automation

8.2. Strategy Vaults

Orbit will support inbuilt vaults, which will perform and manage complex yield-earning strategies for users.

Some of the strategies are mentioned below:-

- Advanced pseudo-delta neutral strategy
- Steth <> Eth leverage

8.3. Batch Transactions

Orbit will allow users to batch transactions with checks at the end. This will allow users to perform complex transactions without needing external tools like flash loans.
This feature can also act as a zero-fee flash loan by batching borrow-payback.