Hashstack Finance

Open protocol

Non-custodial, DeFi's only under-collateralised lending protocol enabling 3x loans to collateral.

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Abstract

Decentralised finance[hereafter defi] has enabled millions around the world with better access to capital, & a means for alternative income streams. This surge however paved the way for its own unique set of challenges. Challenges that can be narrowed down to one word, inefficiency. While there has been no dearth in innovation in decentralised finance, the majority of the existing solutions are far from comparable to their centralised counterparts. One such niche, the present day defi struggles with is, Lending. Defi lending in its current state is broken. It serves a niche use-case, and is sub-par in comparison with the centralised services. While the technology to build a much more efficient product is available, unfortunately, it is not implemented yet. We propose Open protocol. An autonomous lending framework with multi-chain interoperability, providing under-collateralized loans upto 1:3 collateral-to-debt ratio[hereafter cdr], at predictive interest & yield rates.

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Hashstack Finance

Mission

To build an ecosystem of trustless, borderless decentralised financial infrastructure providing a uniform banking experience to 7.9 billion people around the world.

Open protocol

The problem

In traditional finance(hereafter tradfi), when you deposit funds to your bank account, you earn a fixed interest against your savings. Depending on the nature of savings, the apy[1] varies. In most economies, the apy is a determinant of government's economic policies & the central bank norms; which is often a reflection of the prevailing inflation rate. Banks make money by lending it to the borrowers, investing in capital markets & through fees. This diversification helps banks generate money through alternative financial services, thereby improving the probability of providing a fixed apy to the depositors.

In comparison, DeFi's inability to effectively utilise the available assets, creates volatility in the interest rates, and a significant gap between the APY offered, and APR charged. One of the primary reasons for this variability stems from the reason Defi lending of today relies entirely on the loan books for generating returns. Naturally, efforts must be made to increase the asset utilisation so that the demand can be maintained and stable returns can be generated for all the depositors.

DeFi lending of today offers over-collateralized secured loans. It means, the borrower must provide excess collateral than the amount they intend to borrow. This form of restrictive lending addresses a handful of niche use-cases such as,

1. Enabling the borrower to meet the immediate cash needs without the need to sell their assets.
2. Traders can finance new ICO investments by borrowing Ether/USDT, using their existing portfolio as collateral.

Over-collateralised lending in decentralised finance ignores the primary intent of a borrower. That is, the borrower requires liquid funds in excess, or equal amounts to that of their collateral. In tradfi, the banks determine the permissible loan amount based on the borrower's credit worthiness. This is estimated by the borrower's recurring income, financial health & repayment capability. Effective credit under-writing in DeFi is still a distant future, something that could be possible 5 years from now. Since, the present day defi lenders do not offer under-collateralized loans, their ability to offer predictable yield & interest rates dwindle. This makes defi lending unattractive to an average retail borrower.

[1] Annual percentage yield

At Hashstack, we have designed an autonomous lending framework that improves upon the known inefficiencies in the present day decentralised finance through a three pronged approach.

1. Clear compartmentalisation of apy, apr of deposits & loans with that of their minimum commitment periods.
2. Effective asset utilisation through diversification of the assets under management through lending, & facilitating trading capital.
3. Providing under-collateralized loans.

The concept

Hashstack's Open protocol encourages productive lending. Productive lending is when the money is borrowed to boost personal finances. When Hashstack lends, it assumes that the borrowers use the funds productively to earn a profit so that they can repay the protocol while keeping some extra earnings to themselves. An outstanding loan is an asset for Hashstack & its depositors, while a liability (debt) to the borrower. When a loan is repaid, the assets and liabilities disappear, & the transaction is positive for both the borrower and creditor.

Open protocol permits a collateral-to-debt ratio[hereafter CDR] of upto 1:3, i.e. a borrower can seek a loan upto three times the collateral provided. CDR is a simple ratio calculated as,

$$CDR = C_{usd} \div L_{usd}$$

- $CDR = Collateral\ to\ debt\ ratio$
- $C_{usd} = Collateral\ value\ in\ US\ dollars.$
- $L_{usd} = Loan\ value\ in\ US\ dollars.$

Open protocol is developed on the Binance Smart Chain. It supports WBTC, USDT, USDC, BNB, HASH as primary markets(tokens) in the initial versions. On Open, the supported markets are classified into primary & secondary markets. While the deposits & loans are facilitated in the primary markets only, the borrowed loan can be swapped to & from secondary markets. Based on the initial traction & governance proposals, Hashstack will expand the list of primary markets. On Open, an epoch = 3 seconds.

How it works

As with any financial system, a user must establish a relationship with Hashstack inorder to use any of its services. This can be achieved by connecting any supporting wallets such as metamask, with Hashstack's web application - app.Hashstack.finance. After an account is successfully connected, the decentralized application(hereafter referred to as dapp) will detect & display any outstanding deposits, loans, accrued yield & interests against the user. On Open, the user will be able to deposit the supported assets, earn annualized percentage yield in return, or borrow funds at predictable interests.

Deposit flow

The process of depositing an asset on Open is straight-forward. The entire process consumes as little as a minute. To deposit, the user selects the primary market, deposit amount, & minimum commitment period; followed by the transfer of funds to the protocol's reserve contract. On Open, a deposit can be classified as either of

1. Fixed deposit.
2. Flexible deposit.

Fixed deposits are further compartmentalised into three categories based on their minimum commitment period.

Minimum commitment period (MCP)	Fixed Annual percentage yield(FAPY)
2 weeks(14 days), or 403,200 epochs)	10%
1 month(30 days), or 864,000 epochs)	15%
3 months(90 days), or 2,592,000 epochs)	18%

This compartmentalisation of fixed deposits will improve systemic predictability on the asset availability, utilisation on the Open protocol, while the users benefit from an option selecting an to choose a suitable mcp[2] that serve their needs best.

In effect, the deposit process involves three simple steps.

1. Connect account.
2. Select the deposit market, deposit-type[3], minimum commitment period(if applicable).
3. Transfer funds to the protocol's reserve contract.

In the fixed deposit type, a 3 day time-lock is applied on the withdrawal requests. This means, a depositor will be able to withdraw their fixed deposits after the withdrawal time lock is fulfilled. A withdrawal time-lock is triggered when a withdrawal request is placed. A withdrawal time lock provides Open a buffer time to free any deployed liquidity to meet the withdrawal requests.

Fixed deposits help Open maintain a predictive state of asset availability. This strengthens the Hashstack's ability to utilise the assets effectively. In exchange, Open further incentivises the fixed deposits with a secondary yield stream in the form of Dividends aka Variable apy. The protocol offers dividends when the net difference of monthly yield with that of mpy[4] obligations are positive.

[2] Minimum commitment period
[3] Deposit-type: 1) fixed deposit; 2) flexible deposit.
[4] Monthly percentage yield

Both the fixed apy and variable apy(dividends) are denominated in the same market as that of the deposit. A fixed deposit does not accrue any interest between the time of withdrawal request & the deposit release.

This is primarily because, when a withdrawal request is placed, Open recovers the deployed liquidity to make it available for withdrawal. Any interest accrued in this time period will be utilised to meet the apy obligations the protocol has towards its depositors. Any excess yield will be distributed as dividends.

Minimum commitment period (MCP)	Fixed Annual percentage yield (APY_f)	Variable apy / Dividends (APY_v)
2 weeks(14 days), or 403,200 epochs	10%	Upto 2.1%
1 month(30 days), or 864,000 epochs	15%	Upto 3.6%
3 months(90 days), or 2,592,000 epochs	18%	Upto 6%

Flexible deposits have zero mcp. That is, flexible deposits do not have minimum commitment periods. Because of this, withdrawal time lock is not applicable on the flexible deposits. The withdrawals are instant. A user can withdraw their flexible deposits anytime. Unlike fixed deposits, a flexible deposit does not earn dividends. A flexible deposit earns a fixed apy of 7.8%. The earned interest for both the fixed & flexible deposits is in the same denomination as of the underlying(deposited) market. Eg: A fixed deposit of 100 USDT with a 3 month mcp earns a fixed apy of 18 USDT as accrued yield at the end of 12 months. While, a flexible deposit of the same 100 USDT earns a fixed apy of 7.8 USDT as accrued yield towards the end of 12 months.

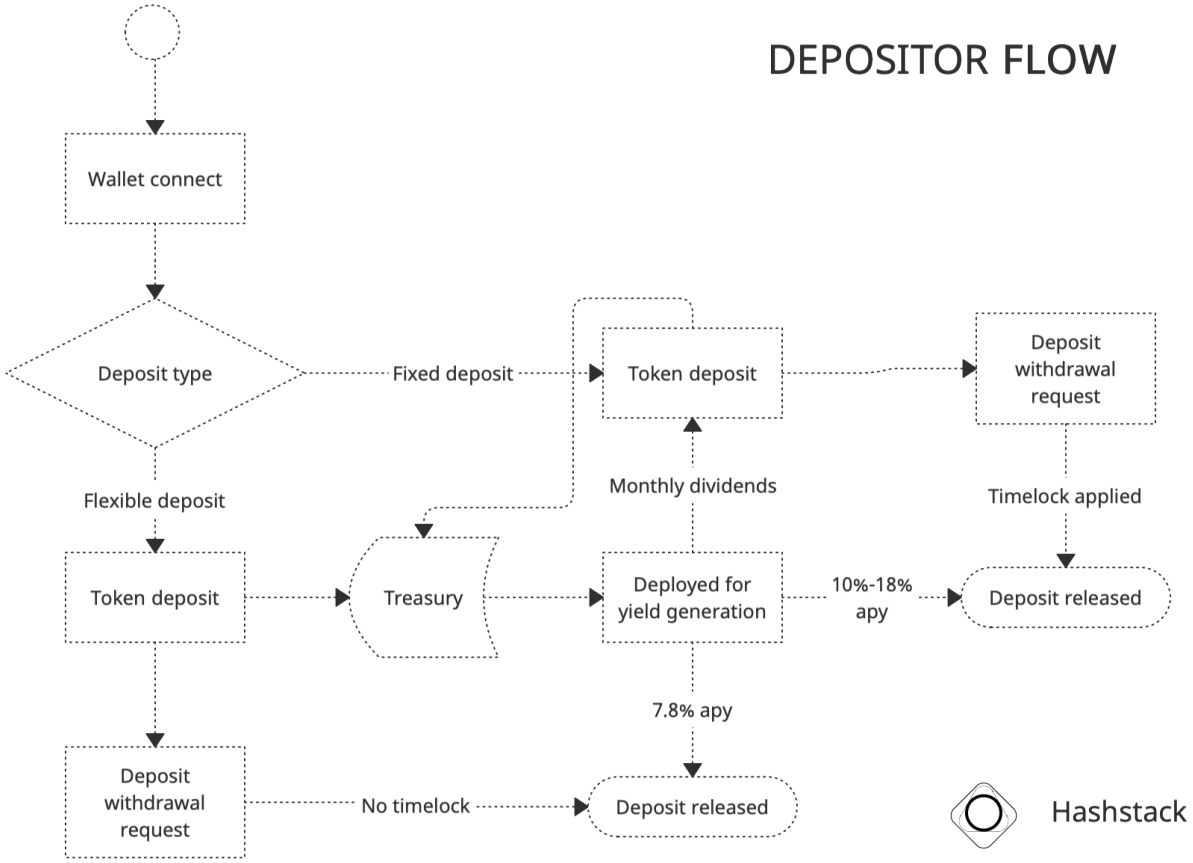
	Fixed deposit	Flexible deposit
APY	Enjoys a minimum 10% apy	Earns a flat 7.8% apy
Withdrawal	Time-lock applied	Instant
Dividends	2.1% to 6%	Not applicable
Preclosure charges[5]	0.36%	Not applicable
Withdrawal fees	0.1%	0.1%

Dividends

As briefly covered under the fixed deposits, dividends aka variable apy is a secondary yield layer designed to incentivise fixed deposits. Dividends offer a dynamic yield dependent on the demand the underlying token currently has. Hashstack estimates to generate a yield of 1.5% - 2% from the AUM in a given month. Open protocol only needs 1.5% monthly returns on an asset to meet its apy obligations. It is not pragmatic

[5] Pre-closure charges are applied when a fixed deposit is withdrawn during the minimum commitment period

to presume Open can deploy 100% of the deposits into loans, or other financial services at any given time. To address this, a healthy rate gap is created between the apy offered, and apr charged.



Primary use case

1. By depositing the tokens on Open protocol, instead of holding them on an exchange wallet or cold wallet; a depositor sets herself up for upto double digit percentage in fixed annual yields... If the underlying token appreciates in bitcoin/US dollar value during the deposit period, the gains are compounded as the accrued yield adds to an already appreciating asset. In comparison, holding the same token on centralised exchanges, or cold wallets earn zero returns.

Borrower flow

Hashstack's open protocol facilitates under-collateralized loans upto 1:3 collateral-to-debt ratio. This means, a borrower can seek a loan of up to $300 USDT against a $100 USDT collateral.

Similar to the deposit flow, a borrower must establish a relationship with the Hashstack before a loan is sought. To achieve this, the loan seeker(hereafter borrower) connects a compatible wallet with Hashstack's web application. In-order to secure a loan, the borrower must provide collateral in excess, or equal to 33.33% of the intended borrow market(s) value in usd.

With adequate collateral, the borrower can select the market(s) to borrow, the amount, & the loan type[6]. If the usd value of cdr is within the permissible range, the loan is issued.

1. Fixed loans
2. Flexible loans.

Unlike the compartmentalisation of the fixed deposits, fixed loans have a single minimum commitment period of 30 days (864,000 epochs). The protocol automatically deploys the collateral securing the fixed loan as a fixed deposit with 2 week mcp, thus earning 10% fixed apy on the borrower's collateral. Such deposits however do not earn dividends. Fixed loans pay an annual interest rate of 15%, while the flexible loans pay a fixed 18% apr.

Both the fixed and flexible loans can be repaid any time. A loan can be repaid two ways

1. Repay by swapping the collateral, and the debt held on the protocol into the actual loan market.
2. Repay by transferring the loan amount & the loan market to the protocol.

Similar to the withdrawal time-lock on deposits, a 3 day(86,400 epochs) timelock is applied on the collaterals of the fixed loans. The time-lock window enables the protocol to retrieve the deployed collateral for release/withdrawal. Any interest that might be accrued during this time period will be utilised to meet the apy obligations Open protocol has towards its depositors. Any excess yield will be distributed as dividends. The collaterals of the flexible loans are released instantly, after the loan repayment.

Additionally Hashstack's Open protocol enables a borrower to swap the loan market(s) into other secondary market[7](s) without the need to switch the dapp through Paraswap integration.

Explaining this through a simple example, Let us say, a borrower deposited 100,000 USDT ($1 per token) as collateral, in exchange for 400 BNB ($500 per token). The borrower can swap the borrowed BNB which is a primary market[8]; to another primary market, or a secondary market like SXP, or CAKE. This is facilitated by Open through Paraswap integration. If the swapped market appreciates in usd value in comparison to the actual borrowed tokens, the borrower can swap the secondary market asset(s) back to the primary market(s) through the same in-app AMM integration. Repay the loan, & keep the profits to themself.

Permissible withdrawal

Permissible withdrawal means, the value(in usd) a borrower is permitted to withdraw from the loan sanctioned. The permissible withdrawal amount on a loan is determinant of the lesser usd value between that of 70% collateral value, & 100% loan value.

For example: A borrower with 100,000 USDT(Notional value, US $1) as collateral borrows 400 BNB(token price, $500). CDR in this case is 1:2.

[6]Fixed loan, or flexible loan
[7] Non base toke(s) are the tokens not supported by Open protocol for deposit/borrow.
[8]Token(s) accepted by Open for deposits/loans.

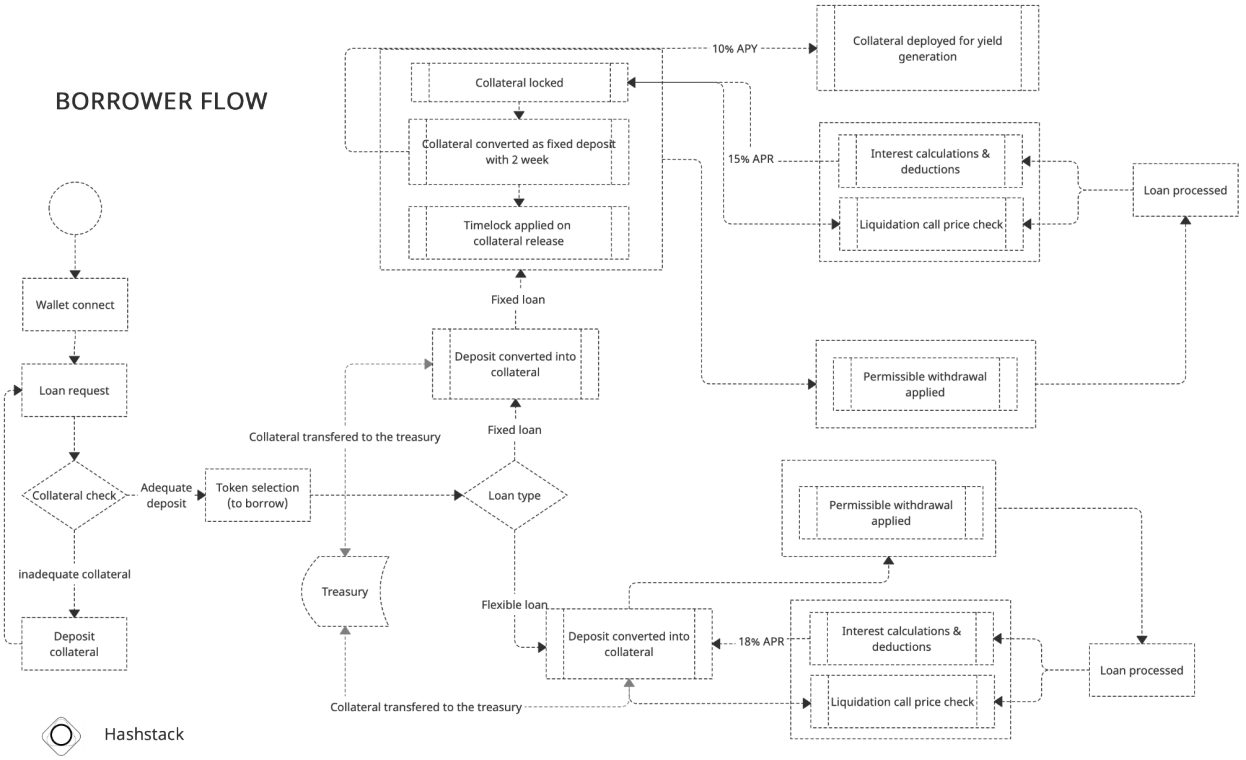
$$(100000) \div (400 \times 500) = 1 \div 2$$

Here,

- usd value of 70% collateral = $70,000.
- usd value of 100% loan = $200,000.

In this example, the borrower is permitted to withdraw funds from the sanctioned loan to the tune of $70,000 in USD value. The borrower can withdraw upto 140 BNB, as long as the usd value equivalent is less than or equal to $70,000.

To repay a debt, the borrower must deposit the asset(s) in the same denomination as that of the borrowed token(s). The borrower can repay the debt partially, or at-once.



Interest calculation

Open protocol maintains a flat & predictive apr & apy. This provides stabler yield & interest expectations for both the depositors & borrowers. A predictive apy, apr structure is a deliberate departure from the method of determining interest rates solely based on asset deployment through loans. Hashstack aims to effectively utilise the aum[9] available through open protocol for consistent yield generation. During the first operational quarter, the interest rates, fees & charges are revised by the comptroller contract each month. Thereafter, the rates are set on a quarterly basis.

[9] Assets under management

When a debt is active, the deductible interest from the borrower's collateral is calculated per epoch. The collateral balance is updated every time the borrower interacts with the protocol; on the other hand, all outstanding loans are monitored off-chain.

The accrued yield

Similarly, the accrued yield is calculated per epoch. The balances are updated every time the depositor interacts with the protocol. This contextual updation lightens the protocol's process effectively reducing the operational cost.

Similarly, the accrued yield on the deposits is calculated in the same denomination as that of the underlying deposits. The calculated yield/interest is translated into USDT equivalent. Any imbalances in the accrued yield against deposits or interest against the loans are rebalanced every 86,400 epochs.

The formula to calculate the per epoch interest rate is easy to calculate. Here is an example:

18% APR on a flexible loan translates to $1.712328767123288 \times 10-6$ %per epoch. Similarly, 10% apy on a fixed deposit with 2 week mcp translates to $9.512937595129376 \times 10-7\%$ per epoch.

To reiterate, yield & interest per block are calculated in the same denomination as that of the underlying deposit, or a debt. For debt, the usd equivalent value is deducted from the collateral.

Below example explains the implementation methodology for calculating the Interest.

In a flexible loan, the borrower provided a collateral of 100 BNB(coin price, $500) to borrow 100,000 USDT(notional value USD $10). The 18% apr when determined to an epoch, amounts to $1.712328767123288 \times 10-6$ %. This percentage when applied to the debt, equates to $0.001712328767123 US dollars. This is the deductible amount from the collateral per epoch.

Liquidation

On Open, all loans are characterised under one of the three debt categories - DC1, DC2, DC3. This categorisation is based on the CDR range of the loan at the time of borrowing.

Debt category 1(DC1)	CDR ≥ 1	Collateral > Debt
Debt category 2(DC2)	0.5≤ CDR < 1	Loan is higher than the collateral, but less than 200% of the collateral value(in usd).
Debt category 3(DC3)	0.333 ≤ CDR < 0.5	Loan exceeds collateral by 200% in usd value, but is less than 300% of the collateral value(in usd).

Liquidation call

When a collateral nears its liquidation price, a notification is sent to the borrower through in-app. Additionally, the borrower can enable email & sms notifications for ease. A liquidation call is triggered at a price determined by the formula

$$Lc = Lp + 0.03(Cusd)$$

- Lc= Liquidation call price(in usd)
- Lp = Liquidation price(in usd)
- $Cusd$ = Collateral value(in usd)

The 0.03, or 3% multiplier to the $Cusd$ is the protocol's trigger that a loan is inching towards liquidation. The borrower can provide additional collateral, to maintain a healthy CDR, or repay the loan upon receiving the notification. Inaction implies the loan could get distressed and eventually liquidated.

Liquidation price

Liquidation price is the price at which the collateral is liquidated. The category specific liquidation price is determined by the calculations mentioned in the below table. Any outstanding loan is automatically liquidated by Open protocol, when they reach the liquidation price.

Loan category	CDR Range	Liquidation price formula
DC1	CDR ≥ 1	$Lp = Lusd + 0.06(Cusd)$
DC2	0.5≤ CDR < 1	$Lp = Lusd + 0.084(Cusd)$
DC3	0.333 ≤ CDR < 0.5	$Lp = Lusd + 0.108(Cusd)$

$$Lp = Liquidation\ price(in\ usd);\ Lusd = Loan\ value(in\ usd);\ Cusd = Collateral\ value(in\ usd).$$

Liquidation price formula is calculated based on a loan's debt category. When the collateral+loan value equates to the liquidation price formula, the loan is regarded as distressed. Distressed loans enter liquidation, to be liquidated by the liquidators.

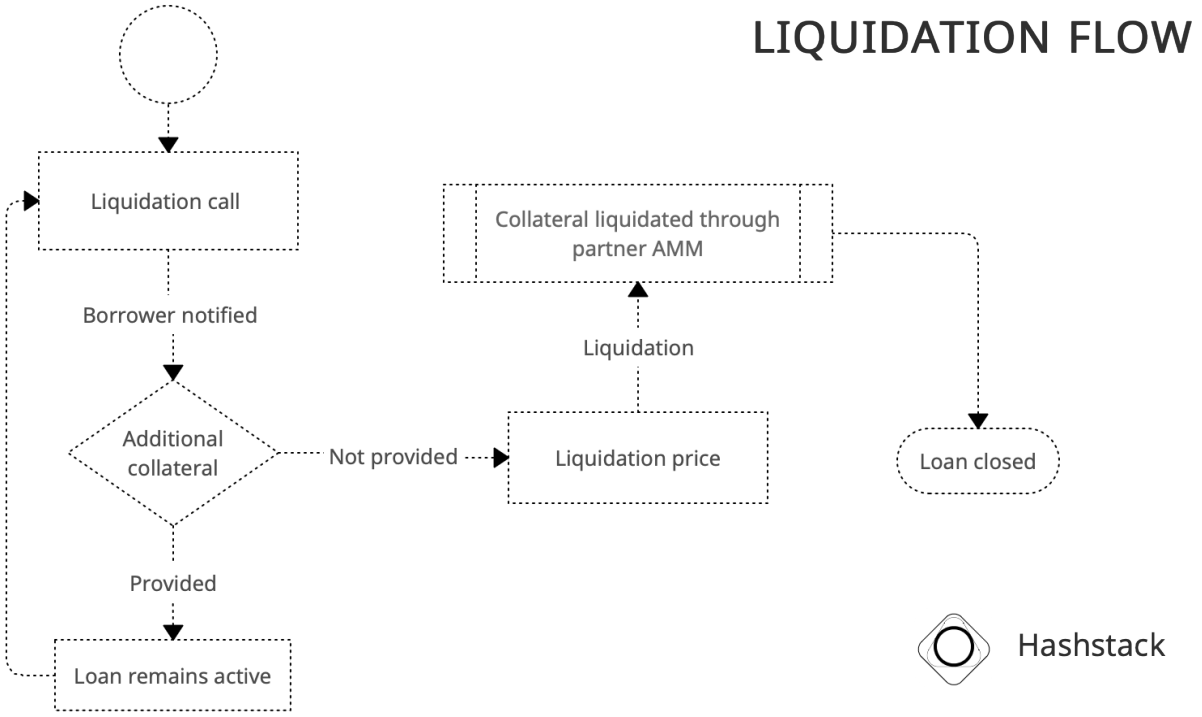
Liquidator

On Open, any stakeholder can become a liquidator if they have adequate HASH deposits as a 3 month mcp[10]. The minimum deposit amount will be determined & communicated to all the stakeholders during the Mainnet(beta). Higher debt category implies increased risks to the protocol. To mitigate this, the discount applied is also incremented by 2.4% of the collateral value at each stage. The increased discounts provide better incentives to the liquidators to prioritise the liquidations of over leveraged loans, while nudging the borrowers to be mindful of the risk exposure.

Additionally, Open protocol practices a fail-safe liquidation mechanism, to ensure all the distressed loans are timely liquidated. This method involves automated liquidation of the distressed loans by Open, in an event the collateral offset(liquidation discount) drops by 25% with no takers.

Discount sharing

For liquidator processed liquidations, the applied discount is shared between the protocol & the liquidator in the ratio of 3:7, with the liquidator's share as 70% . There is no discount sharing on the protocol processed liqudiations.



[10] Minimum commitment period

Open price feed

The Open price feed provides the price data for the Open protocol. The protocol's Comptroller contract uses it as a source of truth for the prices.

The Open price feed provides two price types.

1. Open price.
2. Fair price.

In both the types of prices, chainlink price feeds are used to source the prices. The Open price provides the general price perspective of the market. Open protocol assumes Chainlink price feeds as a generally accepted price.

Fair price on the other hand represents an accurate price of the market in a given context. This means, if the market(token) is to be traded on an exchange. It is estimated to fetch a price closer to the fair price. Protocol interactions involving transactions & balance manipulation activities such as loan request, repayment, CDR, APR & APY calculations, enabling market swaps between primary & secondary markets, liquidation call, & liquidations rely on the fair price to intricately determine the price of the market in a specific context.

Fee structure

	Context	Fees
Deposit	Deposit (new/add-on)	0%
	Pre-closure charges(fixed deposit)	0.36%
	Withdrawal	0.1%
Loan	New loan	0.1%
	Pre-closure charges(fixed loan)	0%
	Swap loan[11]	0.05%
	Swap to loan	0.05%
	Repay loan	0.05%
	Withdraw collateral(pre-closed loan)	0.36%
	Withdraw collateral	0.1%

The comptroller sets apy, apr as well as the fees for various protocol interactions. Initially, the fees structure

[11] Applied on top of swap transactions cost

Primary use-cases

In this section, we try to highlight some of the key benefits a depositor and borrower can enjoy by using Hashstack's lending product - Open protocol.

A fixed loan is best suited for long-term investors & position traders, who prefer to hold an asset that is expected to perform good, over a period of a month to a year. A position trader can avoid sitting on the sidelines, by leveraging Hashstack's fixed loans; to earn yield on otherwise dormant funds. The trader can invest the borrowed funds into another asset most likely to yield better returns in a shorter time period. With fixed loans, the borrower enjoys the below benefits.

1. Free-up the liquidity locked in an asset[for example: Bitcoin, Ethereum] to invest in other assets.
2. Earn an annualized yield of 10% on the dormant assets[deposited as collateral].
3. Secure any profits earned through the investment of the borrowed funds, to themselves.

Here is an example: David owns 100 BNB[market price: $500]. David plans to invest in Bitcoin, but not at the expense of BNB. As a solution to this problem, David deposits 100 BNB on Hashstack's Open protocol as collateral, & borrows $100,000 USDC as fixed loan at a 1:2 cdr. David withdraws the permissible $35,000 USDC. He swaps the remaining loan value of $65,000 USDC to Bitcoin. A month later, Bitcoin appreciates 30% in value, effectively converting David's $65,000 into $84,500; while his alt coin positions return a 20% return. David swaps bitcoin into USDC to repay 84.5% of his loan. His $35,000 turned into $42,000. Of which he repays $15,500 back effectively closing the loan. All the while, his BNB collateral earned him 10% apy. So, in effect, David ended up earning $26,500 in addition to 1.5% interest on his BNB coins. This is a possibility not seen in any of the existing decentralised financial solutions.

A flexible loan is tailored for the day traders, swing traders & smaller investors. A flexible loan can be deemed as a source of the trading capital. This loan provides an opportunity to the borrower to continue holding a token, while freeing up trading capital to invest in other tokens, yield compound returns.

Glossary

1. Collateral: A token(s) deposited by a borrower as a security deposit in-order to secure a loan.
2. Primary markets: Primary tokens supported by Hashstack's lending protocol, Open. These are WBTC, USDT, USDC, BNB, HASH.
3. CDR: Collateral to debt ratio, is the proportion of collateral provided by a borrower against the loan amount. CDR relies on US dollars as a base currency to determine the ratio. For example: A user with the collateral of 200 BNB, at a fair price of $500 can borrow funds of utmost $300,000 in USD value.
4. Depositor aka maker aka creditor: A user who provides liquidity to the Open protocol.
5. Borrower aka taker: A user who borrows from the protocol.
6. APR: An annual percentage rate (APR) is the annual rate charged on the collateral against the borrowed amount.

7. APY: An annual percentage yield (APY) is the annualized rate of interest earned against the deposits.
8. Collateral-check: An off-chain verification performed to determine if the borrower has adequate collateral to maintain loan security.

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