[Working draft]

Lendroid: A Decentralized Digital Asset Lending Platform

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Introduction

Lendroid is a trustless, open, peer to peer digital asset lending platform based on the Ethereum blockchain.

The Lendroid marketplace enables borrowers to avail instant low-cost digital asset loans and lenders to earn interest on the digital assets they lend. Additionally, Lendroid support token (LST) holders act as guarantors of these loans by locking up their LSTs as secondary collateral. The Lendroid platform is extensible by design and allows the creation of loan markets on any ERC20 token.

Overview

The objective of Lendroid is to create a loan marketplace where borrowers can raise funds at fair interest rates instantly, and enable lenders to earn fair and continuous returns on the funds they are willing to lend.

This paper introduces three-party loan contracts and loan markets. It also explains how they help achieve the objective stated above.

The three-party loan contract introduces guarantors, borrower and lenders onto a loan contract. The guarantor helps increase the lender's confidence and reduces the collateral burden on borrowers.

Each loan market defines the type of the digital asset and the amount (as a ratio) required as the primary collateral for loans issued on it. The guarantors and lenders can submit offers to the market (signaling their intention to participate in the market) even before any loan requests start flowing in.

With the markets funded, the borrowers choose a market that suit them – instead of having to negotiate the terms of the loan. This process removes the need to approve and arrange funds for each loan individually. The market also encourages competition among lenders. As a result, interest rates are brought down. Loans issued have a fixed expiry. However, the markets never expire.

Concept

Lendroid brings together lenders, borrowers of digital assets, and guarantors who wish to guarantee these digital asset loans. A ‘borrower’ can collateralize a digital asset to borrow another digital asset from lenders for a short period. At the end of the loan period, the borrower has the option to extend the loan by adjusting the collateral locked or repay the loan along with the accrued interest – or he/she stands to lose their collateral. Guarantors can choose to guarantee loans issued by one or more markets they believe will remain solvent by locking up LSTs which act as secondary collateral for a loan.

The guarantors and lenders are expected to understand the financial risks they expose themselves to by participating in the loan markets. The Lendroid platform does not guarantee profits for lenders or guarantors, and expects them to perform their due diligence before deciding to involve in any market.

Role of LST holders

The guarantors hold a responsibility to choose and support markets that they believe will remain solvent. The loan remains solvent as long as the value of the primary collateral locked within the loan is greater than the value of the funds that have been lent. If the value of the primary collateral drops below the value of the funds lent, the borrower will no longer feel encouraged to repay the loan. This structure – of splitting the responsibility of discovering solvent markets – reduces the burden on lenders to be diligent about their choice of market.

The guarantors receive 20% of the interest accrued if the loan remains solvent and is repaid properly. If the loan becomes insolvent, the tokens locked in by the guarantors are auctioned off, in addition to the primary collateral, to fulfill obligations to the lender.

Terminology

- Primary collateral – Digital asset locked up by the borrower within a loan contract
- Secondary collateral – Digital asset locked up by the guarantor within a loan contract. The only digital assets that can act as secondary collateral are LSTs.
- Loan expiry – The date and time before which the loan is expected to close.
- Secondary collateral pool – The pool of secondary collateral funds held under each market, committed by one or more guarantors.
- Loan funds – A digital asset that is lent to the borrower.
- Loan funds pool – The pool of loan funds held by each market, committed by one or more lenders.

Architecture

The Lendroid platform consists of two principal components

- The market contract

- The three party loan contract

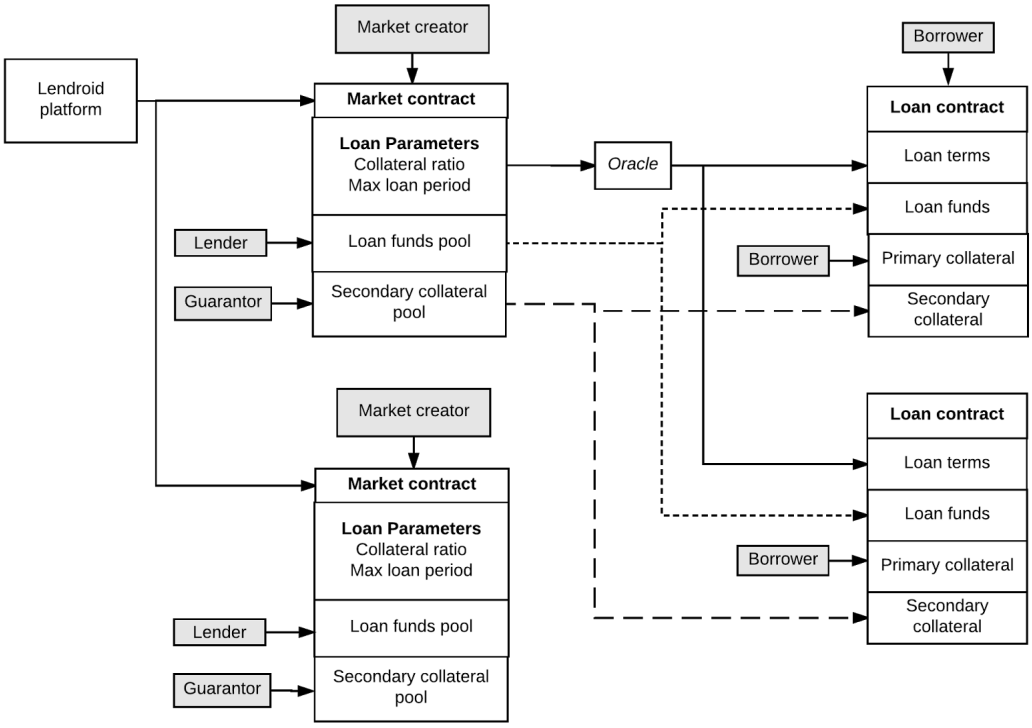

Figure 1. Architecture of lendroid platform

The loan market contract

Any person who holds LSTs can create a new loan market. The primary task of market creators is to judge the demand for various types and levels of collateral the borrowers are willing to put up to avail loans. They also have to design markets whose terms reflect the needs.

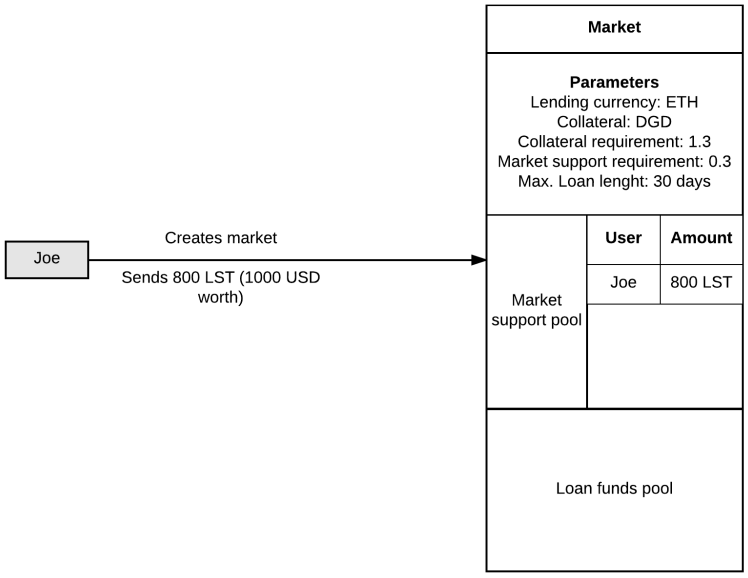

Figure 2. Market creator establishes a new market contract

At creation, the market contract only contains collateral types and collateral ratios that can be used to arrive at the specific loan parameters:

1. The digital asset that is lent out (e.g., ETH, DAI)
2. The primary collateral type (e.g., DGG, REP)
3. The primary collateral ratio requirement (e.g., ‘1.3’ i.e., for every USD 1 of loans funded, USD 1.3’s worth of primary collateral needs to be locked in at the start of the loan period).
4. The secondary collateral ratio requirement (e.g., ‘0.3’ i.e., for every USD 1 of loans funded, USD 0.3’s worth of secondary collateral – in the form of Lendroid support tokens – need to be locked in at the start of the loan period).
5. Maximum loan period –he maximum duration before which the borrower is expected to repay the loan).

Offers from lenders and guarantors

Once a market has been created, guarantors and lenders are free to send offers to the market.

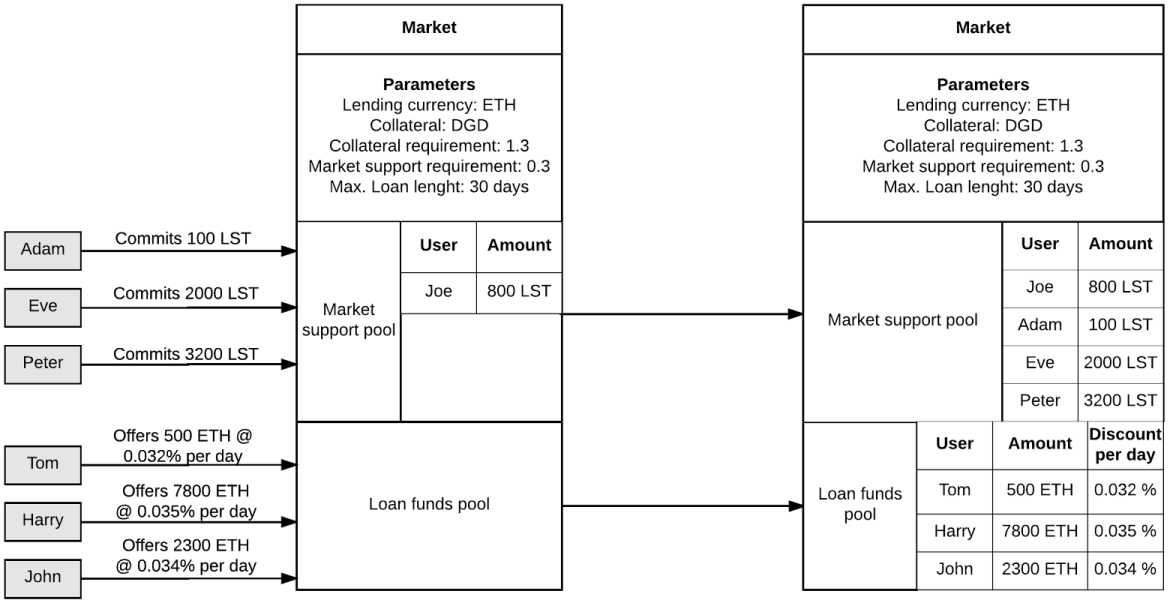

Figure 3. Lenders and guarantors send offers to the market

The guarantors submit offers to the market with the number of LSTs they are willing to commit to various loans. Lenders submit offers – each of which includes the amount they are willing to lend and the expected interest rate. These offers remain open until picked up by a loan or are retracted by the lender/guarantor.

Market contracts are responsible for attracting and holding offers for loan funds and secondary collateral allocated to loans issued on the market. Without either the loan funds or the secondary collateral, no new loans can be granted. The offers can be used up by one or more loans. The lenders and guarantors do not control which loans in particular pick up their offer.

Translation of loan terms

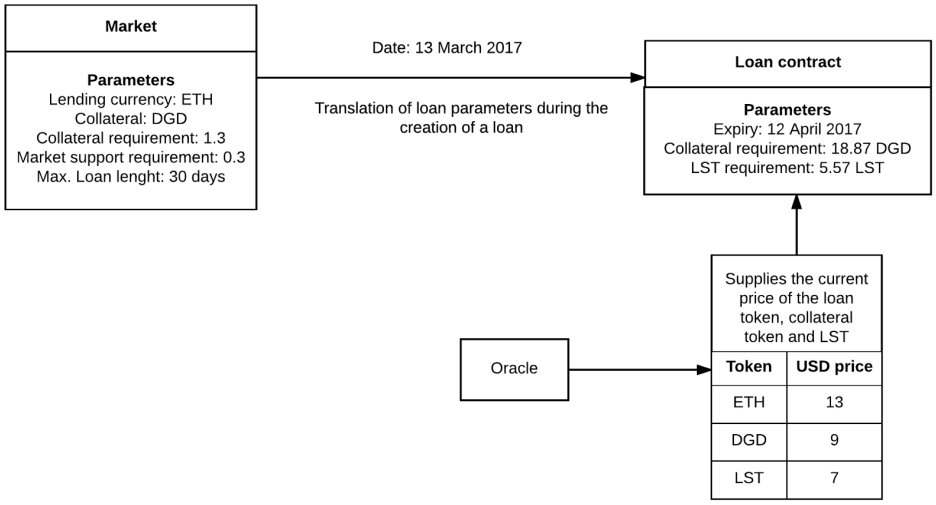

Figure 3. Translation of loan parameters at loan creation

Each market defines its collateral requirements and the maximum period for which each loan issued under the market can stay alive. The collateral requirements are defined in generic ratios. The specific loan terms are established only during the creation of the loan, with the help of an external price oracle. This is a guarantee to lenders as well as guarantors that the loan's terms will reflect the terms defined in the market (when the loans are issued). Lenders ideally assemble around markets that will maximize their earnings. Guarantors ideally gather around markets they believe will remain solvent through the loan period.

Minimum requirements for creating a new loan market

- The primary collateral ratio cannot be less than 1.2
- The secondary collateral ratio cannot be less than 0.2
- The maximum period cannot be more than 30 days

Lendroid allows a market to be created only if it meets these criteria. The first two ensure that borrowers cannot initiate loans that are insolvent on creation. The third ensures that the loan requests cannot remain open without being maintained for extended periods of time – reducing the chances of insolvency.

The three party loan contract

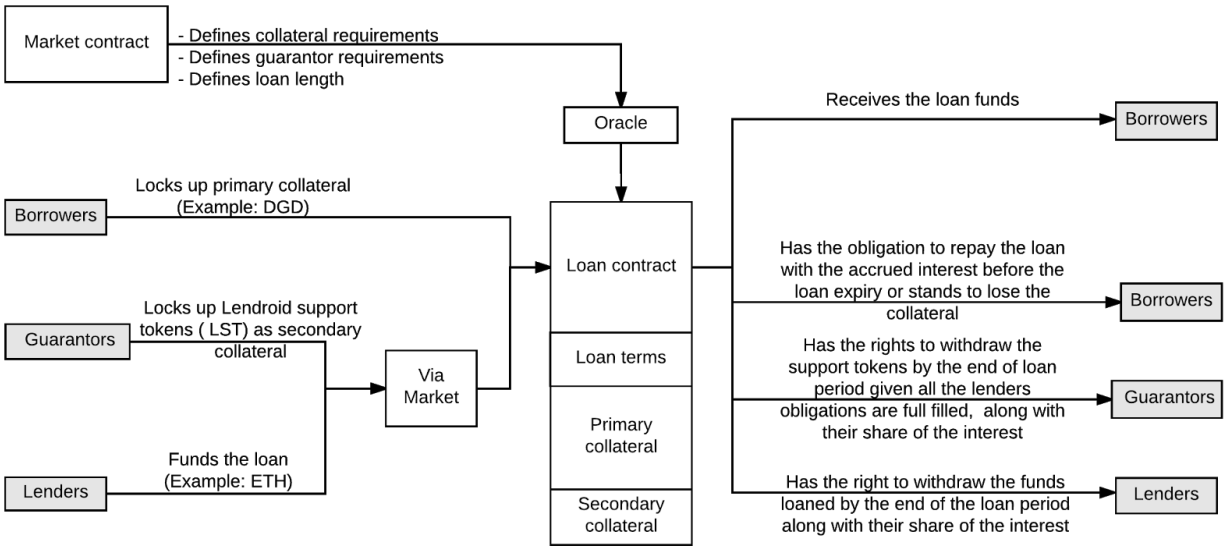

Figure 4. Three party loan contract

Lendroid involves three parties that have to actively participate in the birthing of every loan.

First, lenders who possess a certain amount of funds they are willing to lend to borrowers. However, the burden of finding markets that will issue loans that *will* remain solvent can be tedious. This burden on the lender paves the way for a guarantor who is willing to entrust in the solvency of the loan.

The guarantor does two things: supports only those markets that require the borrower to place a sizable collateral as a sign of his/her ability to repay the loan, and contributes a certain amount of his/her funds as secondary collateral as a display of his/her faith in the loan's solvency.

So, The lenders receive two layers of protection for the funds they lend: one from the value of the primary collateral and another from the value of the secondary collateral. This process increases lender confidence of lenders and reduces their market discovery burden.

The borrowers are more probable of raising funds for their loan with guarantees placed in front of the lenders. Guarantors earn a share of the interest payments for keeping the markets active and solvent.

Market dynamics

In the absence of a unifying platform, the tediousness that accompanies formulating loan terms, seeking interested lenders, negotiating interest rates convincing them to get involved is all too tasking for the borrower. The lender, with numerous loan requests, is bound to feel overwhelmed regarding choosing borrowers and entrusting in them. All in all, a loan establishing process becomes all too cumbersome and prohibitive.

The platform convenes the three key players of the loan under a single roof. Each market, set up by a creator has a specific collateral requirement that either appeals or do not appeal to a guarantor.

The guarantor loses his deposit if the loans they guaranteed become insolvent. This fear of a losing the deposit encourages the guarantor to support markets that require borrowers to lock in a significant amount of the primary collateral. On the other side requesting the borrower to deposit too much collateral would discourage the borrower and would reduce the volume of loans under the market. It is safe to state that only a few specific markets for every collateral type, amongst the many, will be favored by the majority of the guarantors that both protects their deposits and attracts borrowers. This process is known as collateral quantity discovery.

Lenders using guarantors support as a signal and their judgment choose to participate in markets by sending in offers. Competition begins to brew amongst the lenders with regards to taking part in a loan by offering an interest rate that is both economically sensible for the lender, and first in line for the borrower. This process is known as interest rate discovery.

All the borrower has to do now is to choose a market lock the required collateral and collect the funds, as the terms of the loan have been pre-established by the creator, guarantor and lender thereby significantly reducing the burdens that fall on him.

Overall, the discovery dynamics introduced births an efficient market that encourages competition and ensures fair costing instant loans.

The loan process

The loan process diagram describes the complete process from market creation to loan issuance to repayment.

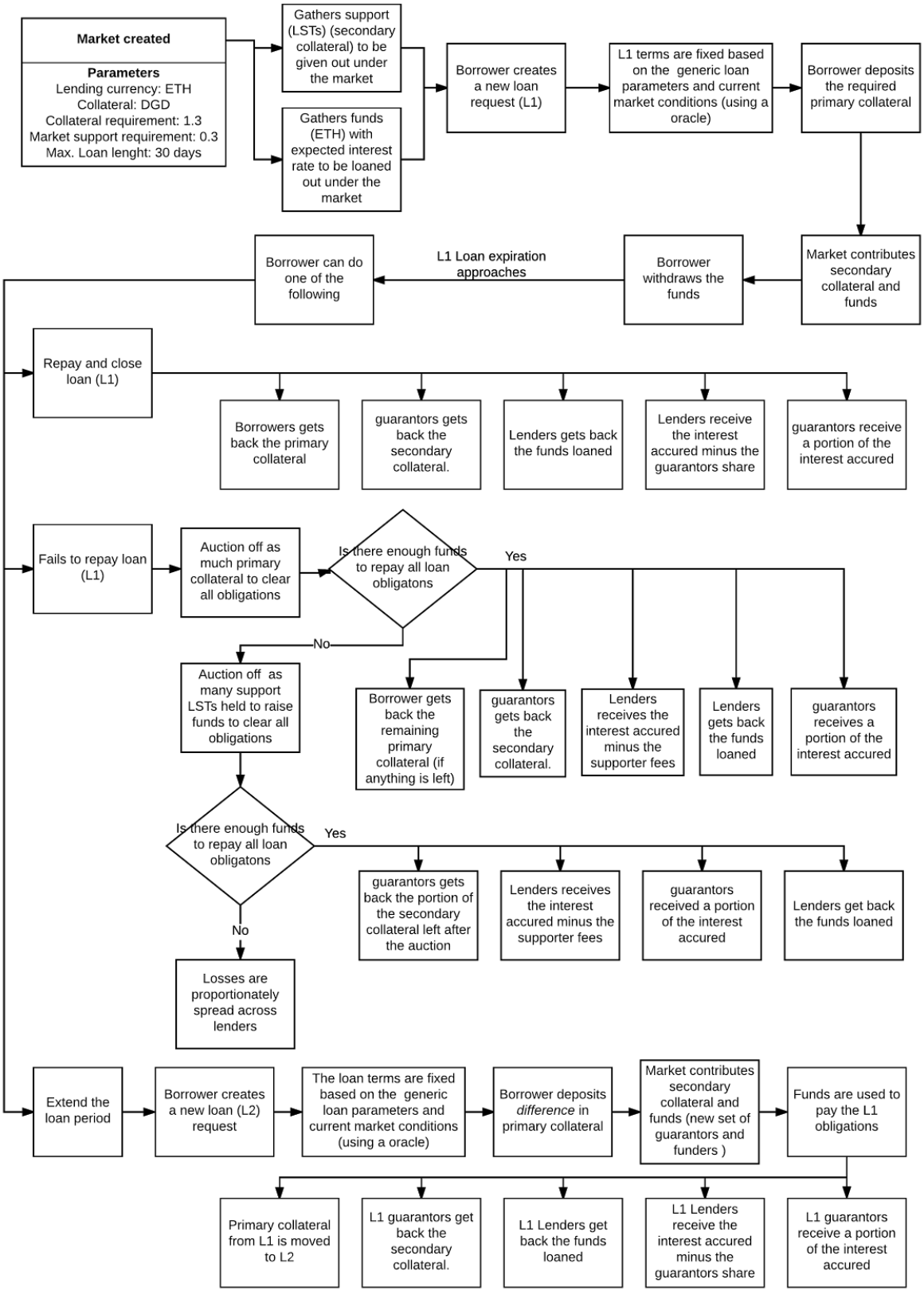

Figure 5. Overview of the loan process

Loan creation

Step 1: Borrower creates a new loan request.

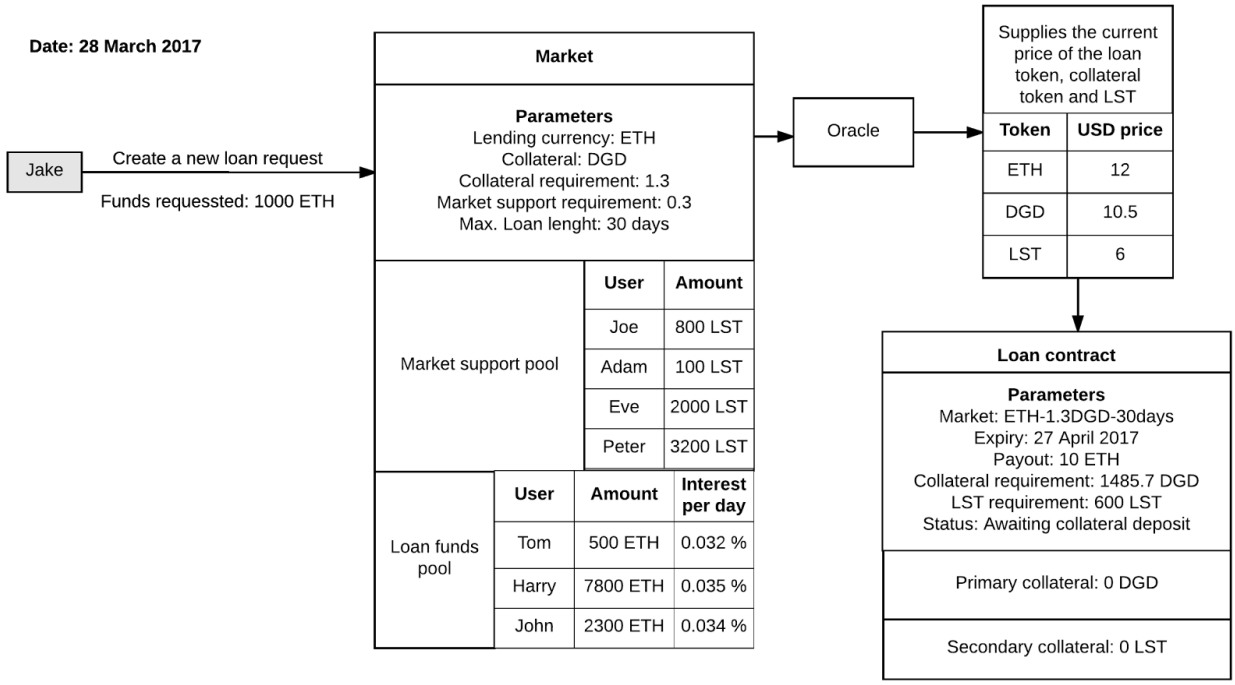

Figure 6. Borrower creates a new loan request

The borrower chooses a market based on the collateral he is willing to lock and creates a new loan application. All the markets are transparent, and the borrower can get an estimate of how much the loan is going to cost.

The loan contract passes a request to an Oracle for current market prices for all the assets involved in the loan. The loan parameters are fixed using the generic parameters from the market and the data received from the oracle.

Step 2: Borrower deposits primary collateral

The loan contract quotes the exact amount required as primary collateral, and the borrower has 1 hour to deposit the same into the loan to activate the loan. If the borrower fails to deposit the primary collateral within this time, the loan request gets canceled.

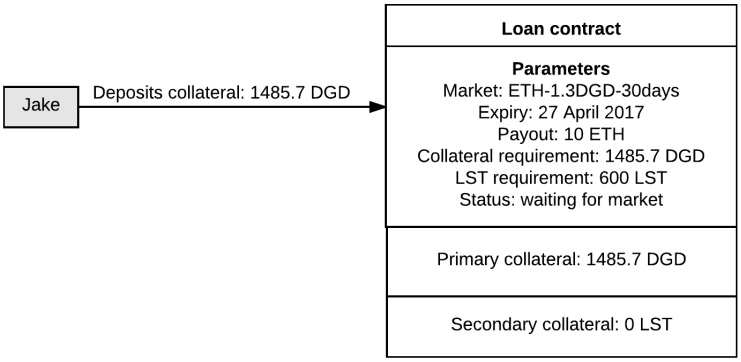

Figure 7. Borrower deposits primary collateral

Step 3: Loan gets funded by the market

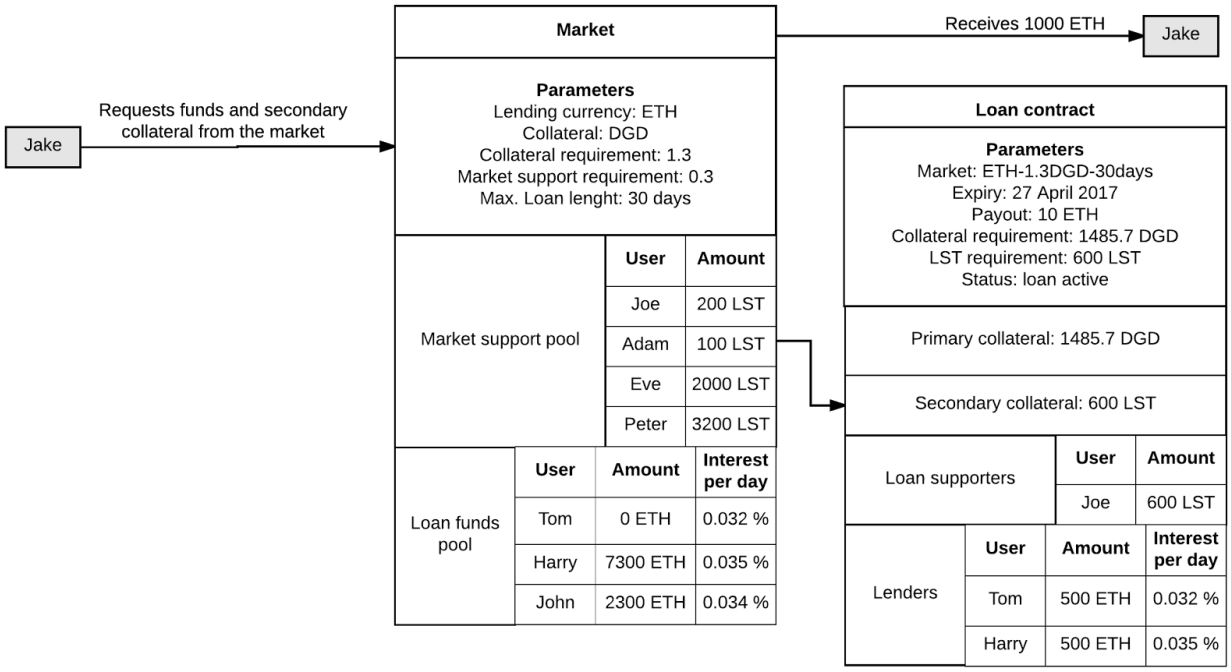

Figure 8. Market funds and guarantees the loan

The borrower locks the primary collateral and presents the loan contract to the market; the market deposits the secondary collateral on behalf of the Guarantors into to the loan contract. The market also sends the funds requested to the borrower on behalf of the lenders.

Loan closure

As the loan nears expiry, defined by the terms of the loan, the borrower has three options:

1. Repay the loan
2. Not repay the loan
3. Extend the loan

Borrower chooses to repay the loan

The borrower can repay the loan anytime before the expiry of the loan. The borrower repays the funds borrowed along with interest accrued during the period of the loan. The interest gets calculated for the period the loan was active. Once the borrower deposits the funds for repayment, the borrower receives their primary collateral back.

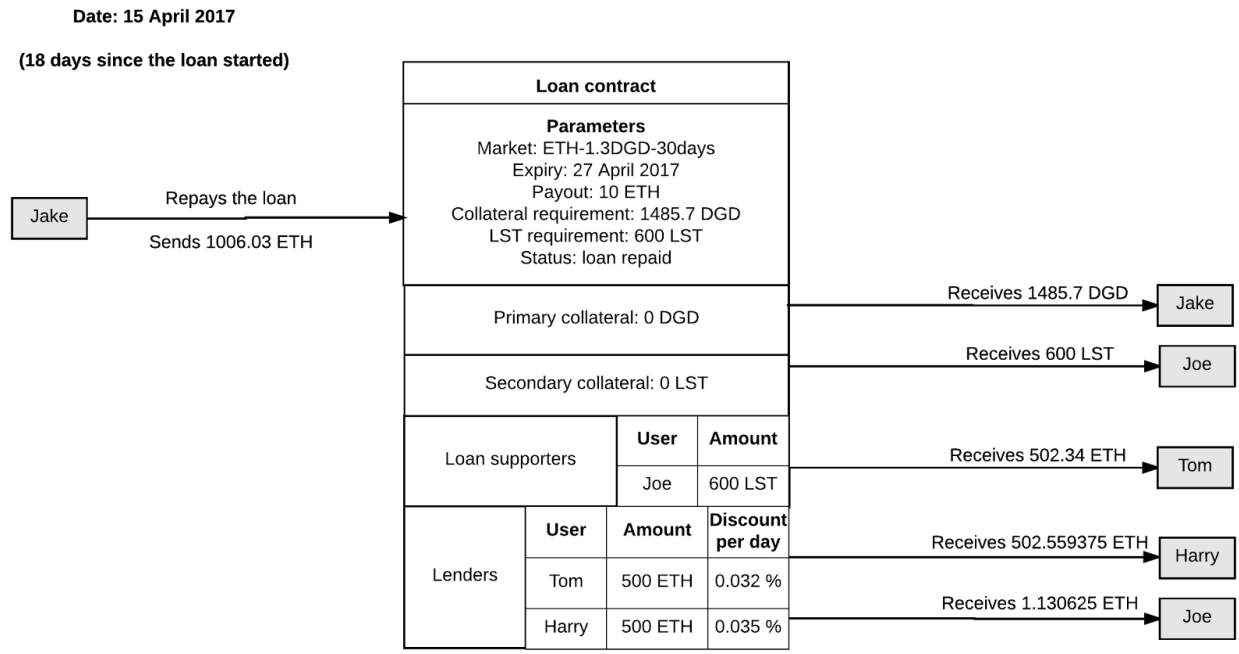

Figure 9. Borrower repays the loan before expiry

The lenders receive the funds they lent along with interest minus the share owed to the guarantors. The guarantors receive 20% of the interest and the LSTs they deposited.

Borrower chooses not to repay the loan.

If the loan expires and the borrowers fail to repay the loan. The primary collateral held in the loan in auctioned off. If the funds raised in the auction is insufficient to clear all obligations as much secondary collateral (Lendroid support tokens) is auctioned off to raise additional funds. If even after auctioning off all secondary collateral locked in the loan there are not enough funds

to repay all the lenders, the losses get spread proportionately across all lenders, and the lenders are paid out.

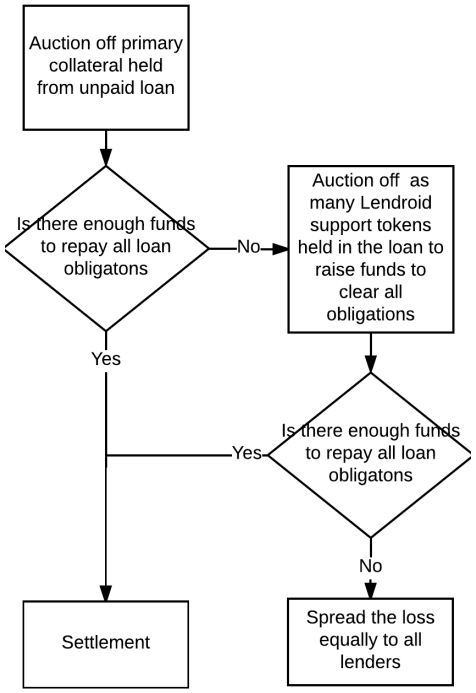

Figure 10. Collateral liquidation process

Extending loans

An additional advantage of having a marketplace is continuous access to funds. This advantage becomes apparent when the borrower decides to extend the loan.

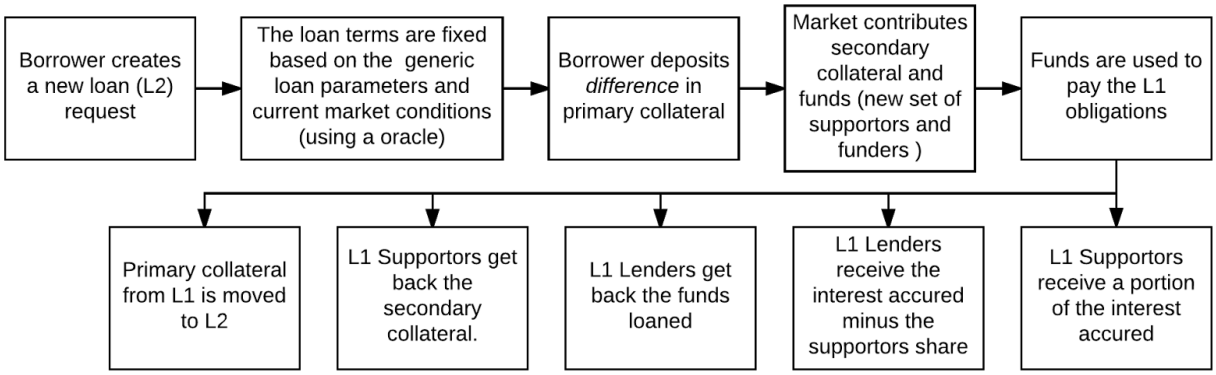

Figure 11. Loan extension process

The borrower creates a rollover request and depending on the current price of various assets involved a new loan contract gets created.

The borrower deposits the difference in the primary collateral required (as a way to maintain collateral health) onto the new loan contract. The market contributes the secondary collateral and the funds, from a new set of guarantors and funders.
The funds raised from the new loan contract is used to repay the obligations of the original loan and the guarantors and lenders from the original loan are relieved from the loan.

The borrower thus receives an extension of time to repay the loan while making sure the loan remains solvent.

Fund flow diagrams

Borrower

The borrower owns some digital asset (say DGD) that they are ready to put up as collateral and is looking to borrow some other digital asset (say ETH). If the borrower fails to repay the loan by the pre-agreed date, the borrower stands to lose the rights over the collateral they locked up.

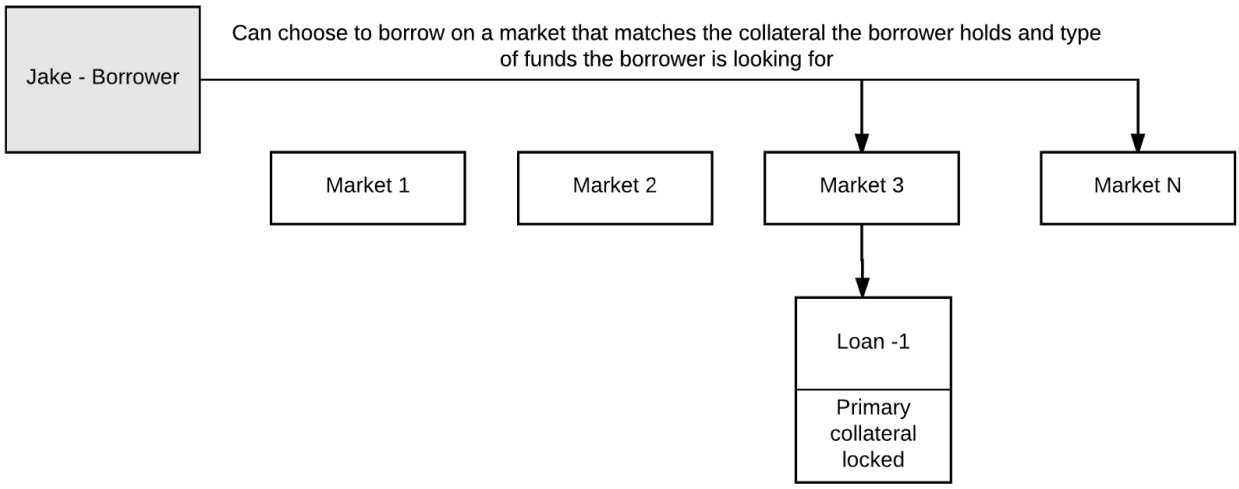

Figure 12. Borrower fund flow during loan request process

The borrower chooses the market from a list of markets based on the type of collateral they hold and depending on the type of funds required. The borrower deposits the primary collateral into the loan contract.

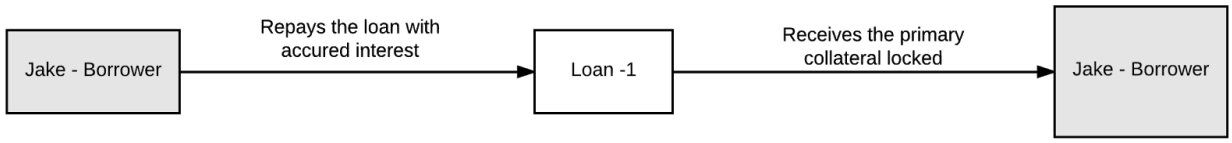

Figure 13. Borrower fund flow during loan repayment process

If the borrower repays the loan with interest accrued before the expiry, they receive the primary collateral they locked in the loan contract

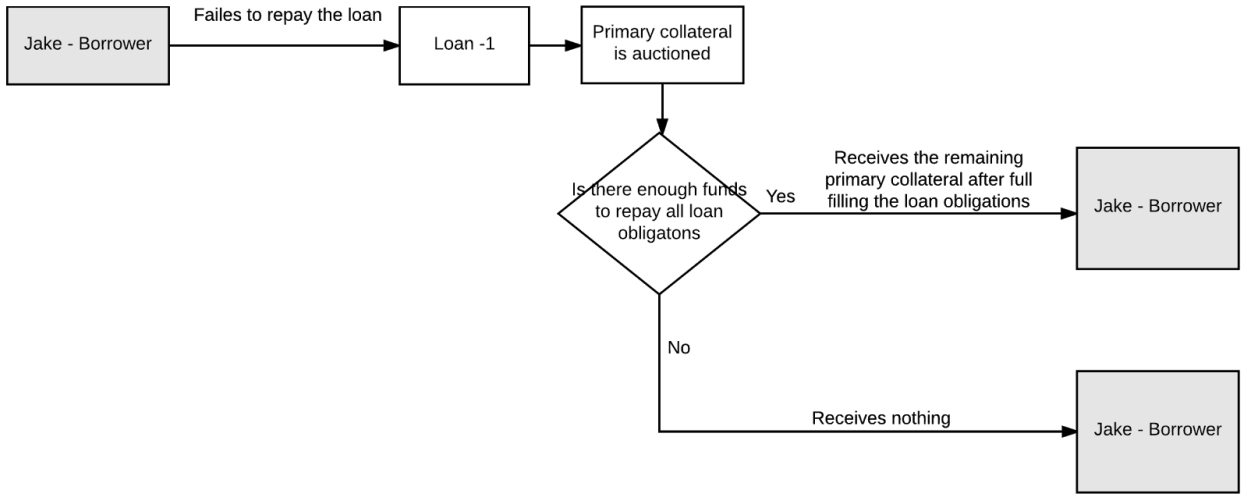

Figure 14. Borrower fund flow during collateral liquidation process

If the borrower fails to repay the loan before the expiry of the loan, the primary collateral held in the loan is auctioned off. If there is any collateral left after fulfilling all the lender and guarantor obligations, the borrower gets to withdraw the remaining collateral.

Guarantor

The guarantor is a third party who owns Lendroid support tokens (LSTs) who is ready to commit a portion of the LSTs to support loan under a one or more markets. The LSTs committed to function as secondary collateral on loan. The LSTs only get liquidated if the borrower fails to repay the loan and the proceeds from liquidating the primary collateral locked by the borrower are not sufficient to cover the loan obligations to all its lenders.

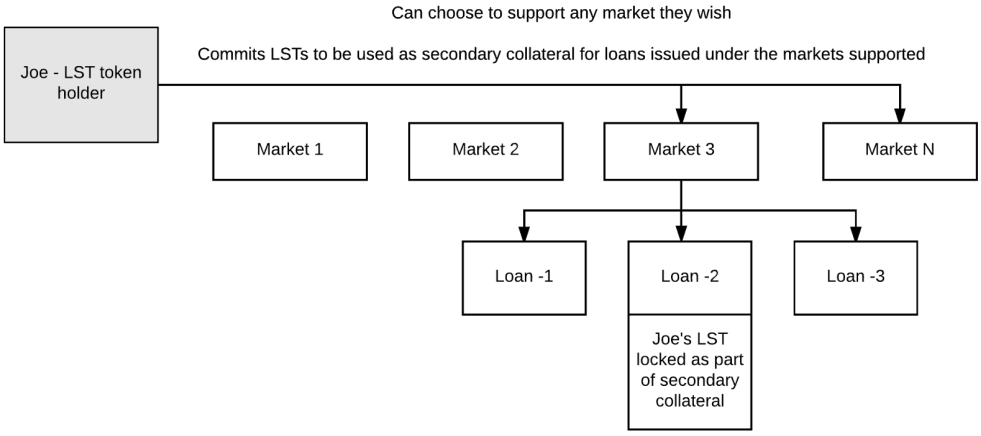

Figure 15. Guarantor send offers to one or more markets

Some loan markets are created each with different collateral requirement according to demand. The lendroid support token holder can survey these markets and can choose one or more markets he wishes to support. The funds are held in a market and only are locked up as and when a loan gets issued on the market.

Once the Lendroid support tokens are locked up as secondary collateral for a loan, the Lendroid support token holder becomes (one of) the guarantor of the loan. LST holders can be guarantors to multiple loans on multiple markets simultaneously. But the LSTs locked in a loan cannot be used or moved until the loan gets repaid or the loan period expires

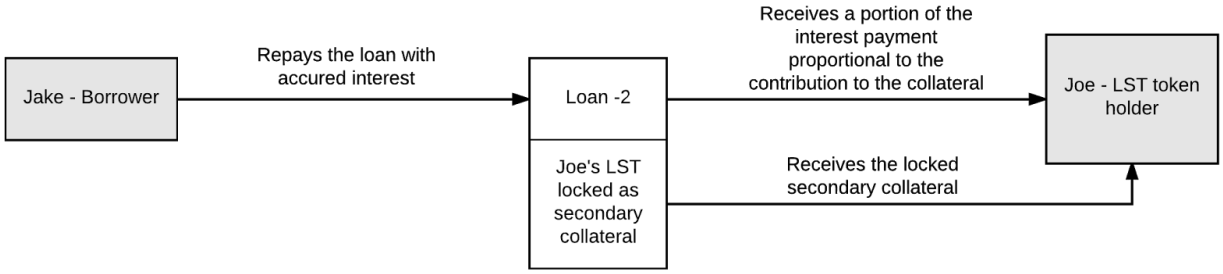

Figure 16. Guarantor fund flow during loan repayment process

When the borrower closes the loan, by repaying the funds along with interest accrued, the guarantors receive their Lendroid support tokens back along with a portion of the interest payment in the form of the repayment token. The guarantor enjoys a profit in this case.

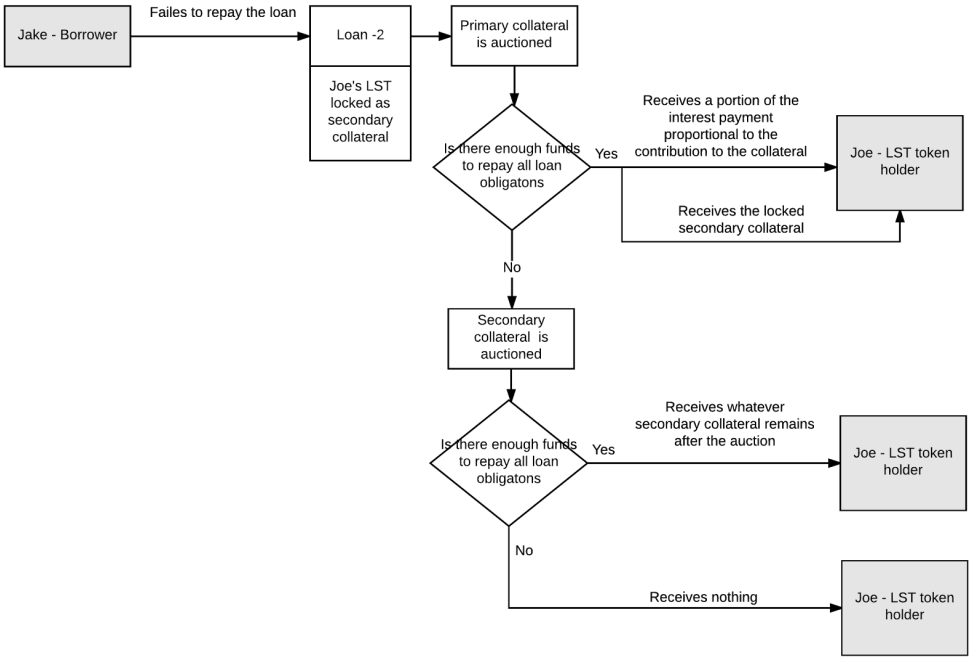

Figure 17. Guarantor fund flow during collateral liquidation process

If the borrower fails to repay and close the loan by expiry the loan becomes a failed loan. In that case, the primary collateral locked by the borrower is first auctioned off.

Case 1: Primary collateral auction raises enough funds to clear obligations

If enough funds are raised from the primary collateral auction to clear the lender obligations, the guarantor receives his LSTs back along with a portion of the interest in the form of the repayment token. The LST holder enjoys a profit in this case.

Case 2: Primary collateral auction fails to raise enough funds to clear obligations

If the primary collateral fails to raise enough funds to clear obligations, the LSTs locked up by the guarantors are put up for auction, and if after clear the lender obligations any LST is left, the guarantor gets back that portion of LSTs that are left. The LST holder suffers a loss in this case.

Lender

Lender owns the digital asset the borrower is looking to borrow and is willing to lend it for a predefined interest rate. Similar to the guarantor lenders can choose to participate in one or more markets.

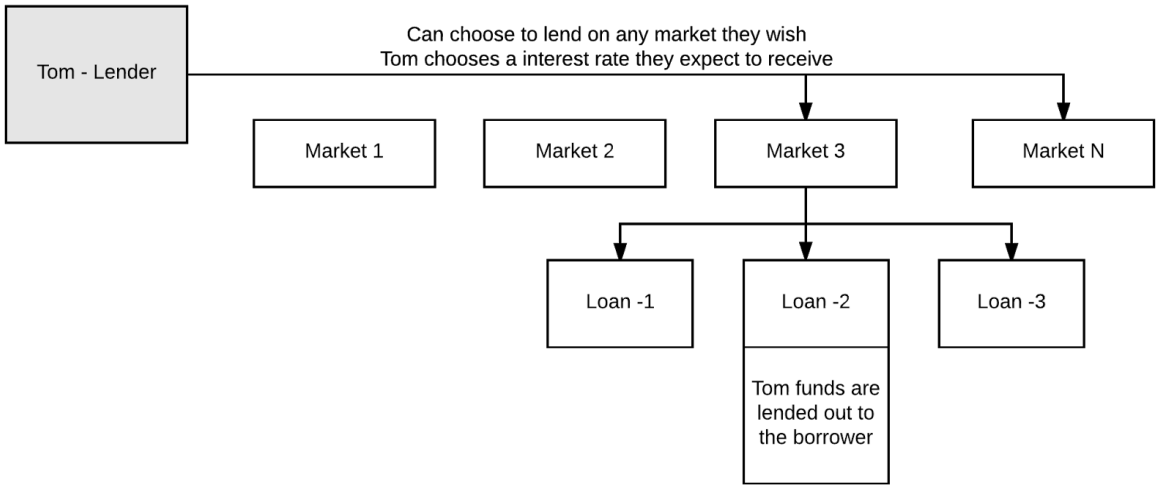

Figure 18. Lender send offers to one or more markets

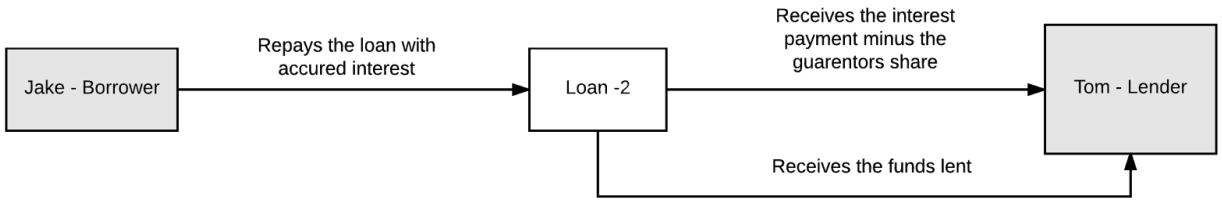

Figure 19. Lender fund flow during loan repayment process

If the borrower repays and closes the loan before the expiry, the lenders get paid back the lent funds along with their share of the interest accrued

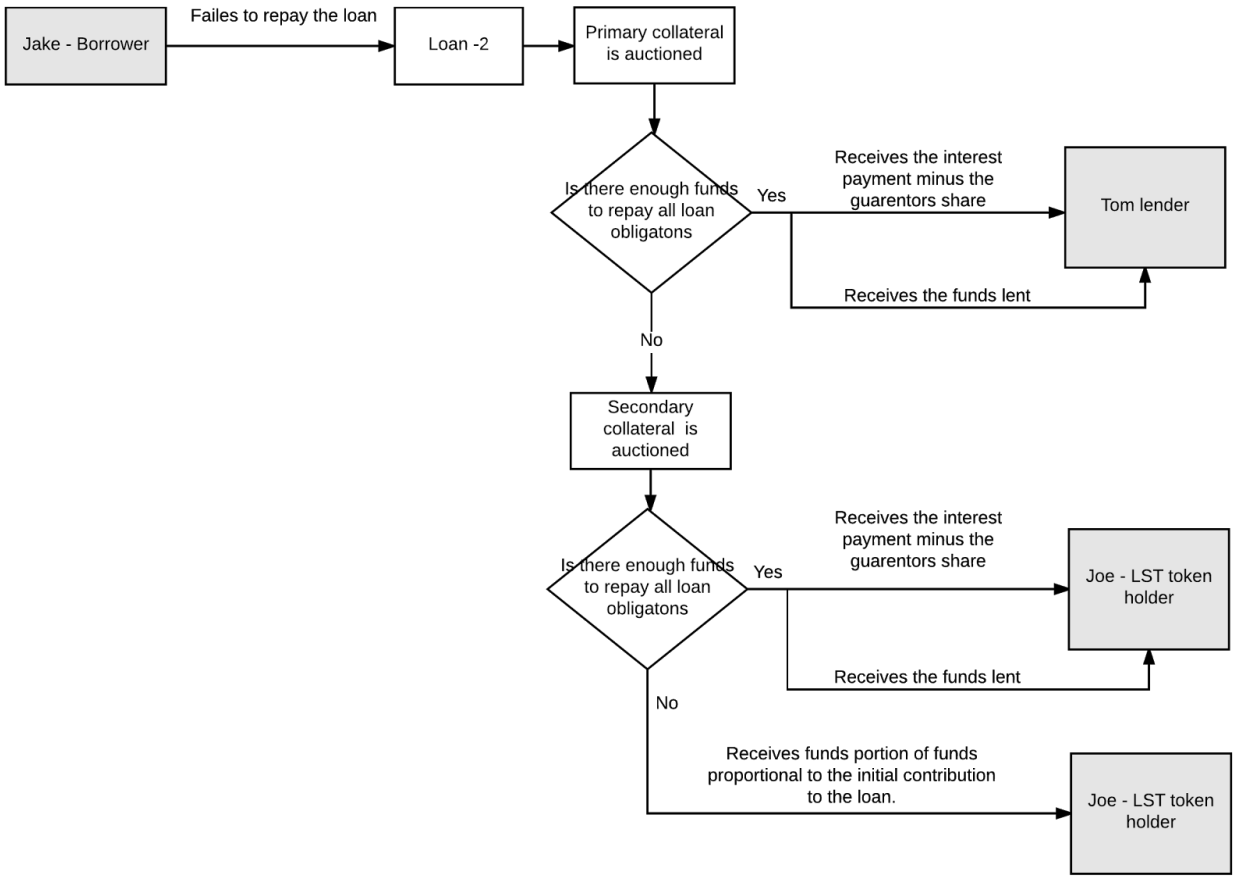

Figure 20. Lender fund flow during collateral liquidation process

Lenders have first rights over repayment of the loan. If the borrower fails to repay the loan, the primary collateral gets liquidated, and the proceeds are paid out to the lender. If the proceeds from the primary collateral liquidation are not enough to cover the obligation, the secondary collateral (LSTs locked by the guarantor) gets liquidated, and the lender is paid out. After both the auctions if there are enough funds to clear the obligations the lenders are paid back the lent funds along with their share of the interest accrued or the losses are spread proportionately across all the lenders.