NFTLoan: A Protocol to Create and Secure NFT Backed Loans

Matt Scott, Roland Afzelius, Liam Potts
scottfe@bc.edu, afzelius@bc.edu, pottsw@bc.edu

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Abstract

Securitization of loans has seen mass adoption in traditional finance, but has seen slow adoption on-chain. One reason for this is because securitization of on-chain peer-to-peer loans such as the loans that lending protocols like Aave and Compound utilize, create no value for investors. These loans are all over-collateralized and the protocol ensures that a loan will be automatically liquidated if the collateral falls below a certain value. Because of this lenders take on no risk when lending. Therefore there is no need for the risk diversification that comes with collateralization of these loans. We propose a system of securitized NFT backed loans.

1 Introduction

1.1 Overview

Volume across NFT markets has risen exponentially within the last few years. It is important that market participants are able to leverage the positions they have in NFT's in order to diversify risk, and create a more efficient market. Creating a system of collateralized NFT backed loans will create value for both intermediary lenders, borrowers and investors. The value

of NFTs are highly speculative and by securitizing loans backed by NFTs, lenders would be able to diversify their risk over a basket of NFTs rather than just a singular NFT. We propose a protocol that will allow for the creation of securities that are comprised of NFT backed loans.

1.2 Definition of an NFT

NFT is short for "Non-Fungible Token." These are tokens which can be used to represent ownership of unique items such as art, collectibles, and many more. This ownership is secured by blockchain to ensure that there can only be one owner. "No one can modify the record of ownership or copy/paste a new NFT into existence." (https://ethereum.org/en/nft/)

1.3 Definition of an NFT collection

When we refer to a collection, we mean a basket of NFT's that were designed by a singular party, which include similar features and styles. A popular NFT collection is the Crypto which is a collection of 10,000 NFT's. An example of a CryptoPunk is seen below. We will use the CryptoPunk collection to give examples later in our paper. As of writing, the average market price of a CryptoPunk is around $120,000 USD.

1.4 NFT's accepted as collateral

It is imperative to the stability of our protocol that the NFTs accepted as collateral are the most liquid NFTs. To ensure that the market for any NFT that we accept as collateral is liquid, our protocol will only allow NFTs which have been within the top 25 NFT collections by volume for over a month. We will use OpenSea, the world's largest NFT marketplace, to keep track of collections that fit this criteria in real time. To do this, we will collect statistics using the OpenSea API. Since the NFT market is always changing we expect that there will be around 5-10 collections that fit this criteria at any given moment. This will ensure that the NFTs that borrowers are able to put up as collateral are in the most stable NFT collections possible as to limit the number of liquidations from larger price swings that are much more common with more illiquid collections.

If a collection falls out of this criteria while being used as collateral this will be ok, however, no new loans will be given using an NFT in that collection until it fulfills this criteria again.

1.5 Fair value of an NFT

NFTs in a collection will not all be worth the same and in the case of the top 25 most popular NFT collections, some NFTs in these collections can differ in value by tens to hundreds of thousands of dollars. To ensure our protocol will generate a fair value for an NFT at the time of borrowing, we will use the OpenSea API to compare recent NFT sales with the rarity of that NFT in that collection. Rarity will be determined by the Rarible NFT ranking protocol. This protocol factors in the rarity of specific features in an NFT. For example, a rare CryptoPunk has more “features” than other CryptoPunks. One feature of a CryptoPunk is the color of the background, or the color of the hair. Some colors are more rare and thus more desirable. This is the best way to price NFTs, as the rarer NFTs will always be worth more. Features are specific to each NFT collection, but within the collection determine the rarity of a given NFT which then translates to price.

Using the OpenSea API to gather price data from the previous 30 days and the Rarible API to track the most up to date rarity of the NFTs, we find the average change in price per change in rarity over the 30 days. This will allow us to create a fair valuation for an NFT by finding the NFT that has sold within the last 7 days with the closest rarity to the one being lent, and use our 30 day average change in price/change in rarity to calculate a current fair value for the NFT.

1.6 Definition of Smart Contract

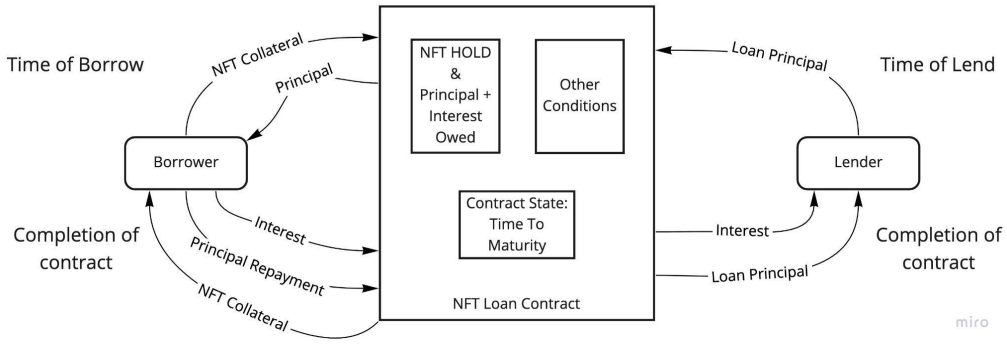
A smart contract is a piece of code that executes on the Ethereum blockchain. Smart Contract programs are stored at a specific address on the Ethereum blockchain. Once the smart contract is created, its terms are immutable and are executed automatically. The loans and securities which our protocol generates are stored in smart contracts.

2. NFT Backed Loans

2.1 General NFT Loan contract

NFT collateralized loans consist of two parties - the lender and the borrower. The lender/liquidity pool distributes loan principal to a smart contract, and at the end of the term receives interest and the loan principal in return. If the borrower defaults and does not pay the principal or the interest back, the lender will receive the NFT collateral automatically at the end of the term. At the time of borrowing the borrower puts up an NFT as collateral which is locked in the smart contract and receives the principal to use as they please until the end of the term. At the end of the term if the borrower has the money to pay back the loan and interest they do, and

will get the NFT back. In this scenario the lender will receive the promised interest and get the principal back.



2.2 Term of loans

The term of each loan will be 90 days, with 3 interest payments due every 30 days. Even though 90 days is much shorter than multiple year long terms in traditional lending markets, 90 days is standard for NFT backed loans. This shorter loan term helps offset the volatility of NFT valuations.

2.3 Interest Calculation

Interest for the NFT loan will be calculated using the following method. At all times, the protocol will store a live updated list of all NFT collections that are currently accepted (see section 1.4 for description of accepted collections). This list will be ranked by quality using OpenSea API and the fair value formula described in section 2.1. Each collection will have a unique interest rate depending on the collection's current rank.

For NFT's in the best ranked collection (at the time the smart contract is created), the interest rate is determined by calculating rate r=14.5+(.5)*(rank of collection) with the best collection being rank 1. The total amount of interest owed is therefore r/100 * Value of Loan.

For example, if the active list of acceptable NFT collections is [CyberKongz, Mutant Ape Yacht Club, Lazy Lions, The Sandbox, CryptoPunks] ranked from best to worst, then the interest would be calculated using the formula above with r=15 for an NFT from CyberKongz, r=15.5 for an NFT from Mutant Ape Yacht Club, r=16 for Lazy Lions etc. By design, there is no hard cap on the interest rates because this depends on how many valid collections our protocol accepts.

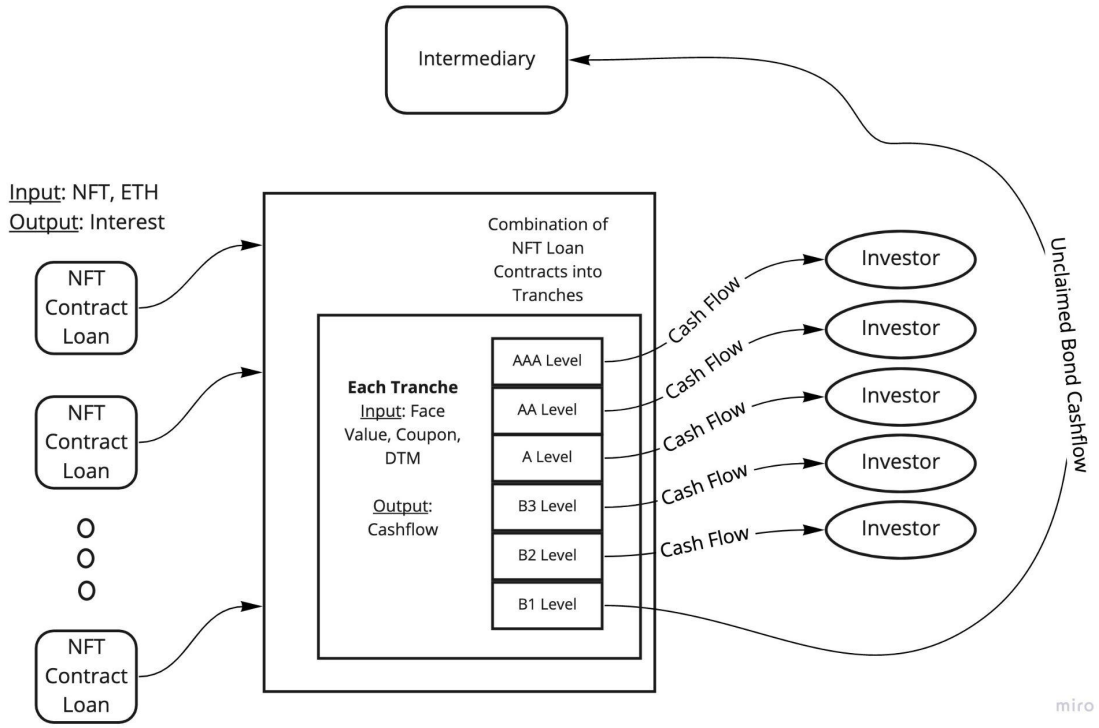
3. The Lending Pool

The lending pool is the source of the loans that back the securities created by the protocol. The intermediary who implements and oversees the entire protocol provides the initial liquidity in the form of Ether (ETH) for lending. When borrowers attempt to borrow from the pool, the first check that happens is to check the amount of available ETH in the pool. The ratio of (available liquidity - amount to be lent) / initial liquidity must be greater than 10%, or the protocol will refuse a loan. This is to ensure the intermediary does not entirely deplete their

reserves. Loans that are successfully constructed are stored in smart contracts as diagrammed above. These smart contracts are added to the security pool for the assembly step as explained below.

4. The NFT-Backed Security

As a note, all values below are shown in dollars, but in implementation would be valued as ETH



4.1 Description of the Security

A security, in the simplest terms, is a collection of bonds with set terms that derive their payments from an underlying pool of assets such as loans. As mentioned above, all created loans are placed into the security pool, from which they are assembled into securities. The objective in assembly is to create a significant pool of Ether to distribute amongst investors. The NFTs we allow have a wide range of fair values, but we estimate that the average value we are considering is the Ethereum equivalent of $50,000 USD. Since we have a limited number of collections of NFTs we accept as collateral, there is little differentiation between our loans so there is no need to add an extra layer of logic in what sorts of loans are compiled into the security.

4.2 Assembling the Security

With this in mind, assembly is a rather simple process: randomly select 30 loans and bundle them together. Assuming an average fair value of $50000 and an average interest rate of

17%, the total future value will be on average around $2,400,000. The following formulas are relevant in the steps below:

Future Value = P * (1 + interest on loan)^n

P is generally either principal or amount lent

Present Value = P / (1 + coupon)^n

From here, the security is subdivided into tranches, each of which simulates a bond. A-Level tranches have the same principal and different coupon rates, whereas B-Level tranches have the same coupon rate and different principals. This logic is consistent with other securities. The process for setting principals and coupons is as follows:

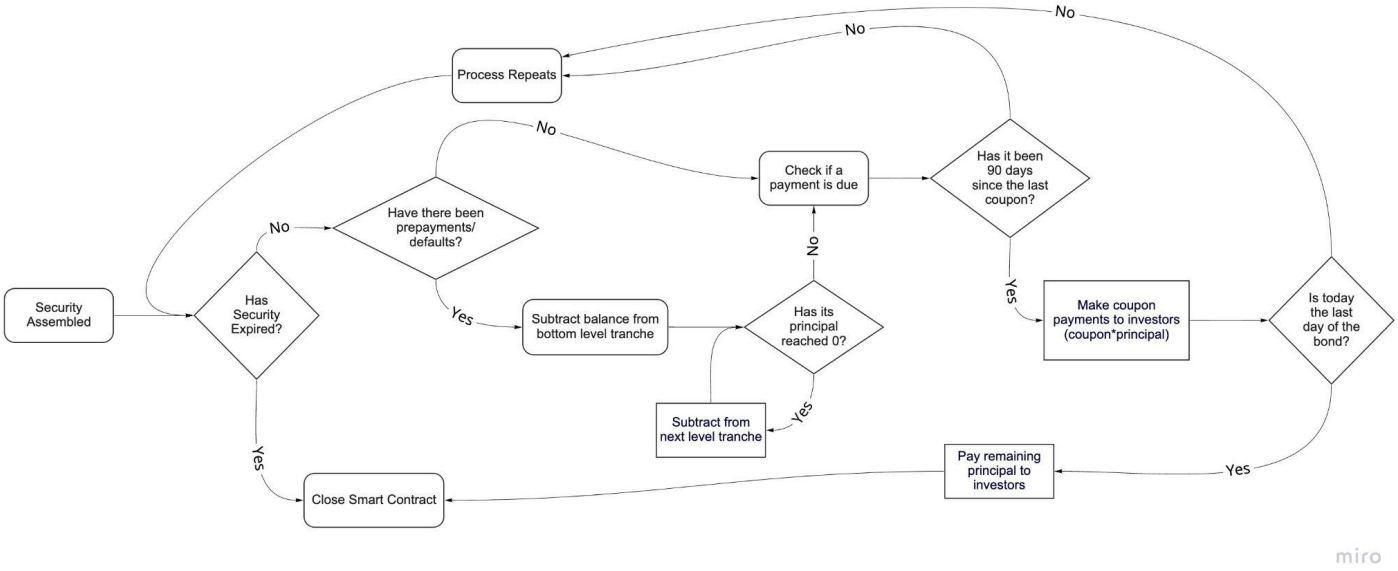
1. Total FV = ∑ Value of loan i * (1 + interest on loan)^3.
2. The principal for each A-Level tranche is calculated as ⅙ * Total FV.
3. Coupons are fixed in order of increasing risk at 1.45%, 1.85%, 2.2%
4. The future value of the A-Level segment is calculated as a sum of each tranche's future value, ∑ Principal * (1 + coupon/4)^8.
5. The remaining future value to be distributed is as follows:
    a. Remaining FV = Total FV - A-Level FV
6. The principal to be distributed in the B-Level is calculated using a present value formula:
    a. Principal for top B-Level = ([(Total FV - A level FV)/(1 + coupon/4)^8] + 3*4.5)/3
    b. Each B level security is separated from its neighbor(s) by 4.5 ETH, or ~$20000
    c. Principal for each subsequent B-Level going down = Principal of level above - 4.5

The rates we selected for each tranche were consistent with rates that are used in mortgage bonds. The logic by which these rates are set is so convoluted that they are essentially arbitrary; therefore it is valid to fix them. Finally, the present value of each bond as a function of principal and coupon, which sets a price that each bond will be initially sold at.

Below is an example of how $1,000,000 in loans, all lent with a one time 5% interest payment are securitized into our 6 level model.

Class	Coupon	Principal	Initial Allocation (FV)	Price (PV)
AAA	1.45%	$200000	$205874.12	$194293.48
AA	1.85%	$200000	$207520.90	$192751.66
A	2.2%	$200000	$208971.27	$191413.86
B3	3.72%	$145869	$157081.55	$135456.80
B2	3.72%	$125869	$135544.20	$116884.41
B1	3.72%	$105869	$114006.86	$98312.02

4.3 Lifetime of a Security



Each loan pays into a payment pool associated with the security. Each bond pays coupon interest every 30 days to its holder for the length of the bond (2 years), the funds for which come from the payment pool. Coupon interest is calculated as the principal*coupon. If a tranche is not purchased, the bond is considered to be owned by the intermediary and payments are sent to the intermediary. Additionally, 200 basis points (2%) of the security are given to the intermediary as a service fee for building the security. At the end of the security's term, the amount of principal specified in the bond is paid to the owner, provided this amount is not 0.

If a borrower pays off their loan, it is treated as a failure in the security and follows the steps outlined below, except the auction step is skipped because the cash owed has been paid in full.

If a borrower fails to meet the terms of their contract, it is liquidated and ownership of the NFT is transferred to the pool. Acquired NFTs will be automatically posted to Open Sea at a 5% discount to the fair value (as explained in section 1). This discount will increase the likelihood that the NFT is quickly sold, ensuring the best chance that the protocol does not carry the risk of the NFT for an extended period of time. If the NFT does not sell it will automatically be discounted an additional 3% each day that it doesn't sell. 3% will ensure that our protocol does not incur too big a loss on liquidated collateral, while also incentivizing market participants to quickly buy it off the open market. The collected funds are distributed in one of two ways.

1. The smart contract was in a security

   The proceeds are collected in the payment pool for the security. The lowest-level 'living' security is compensated for the loss as a lump sum payment. Since this process removes potential payments from the payment pool, its value is deducted from the principal of the

compensated bond (i.e. bond B-3 with p = $1000, $3500 collected reduces p to $6500 and the holder of bond B3 is paid $3500). When p = 0 in a bond, it is considered 'dead' and losses transfer to the next bond in the tower. For our 6 bond security, the order in which payments are received is: B1, B2, B3, A, AA, AAA. Any payment that is greater than the principal of the lowest level tranche will be deducted from as many tranches in order as is necessary to handle its loss, with each tranche being subtracted to zero before the next level takes on a loss.

2. The smart contract was not in a security
   The risk of the contract was still held by the intermediary. Proceeds from the sale are returned to the lending pool.

5. Incentives For Parties Involved

5.1 Investor Incentives

The incentive for the investor is the transformation of a variable and risky, yet untapped, cash flow into a stable fixed income asset that can be added to their portfolio. Bonds and bond equivalents are popular because calculating key components such as risk, present and future value, and fair price is trivial which in turn simplifies the process of comparing assets and evaluating the overall performance of a portfolio. Additionally, the automated nature of our lending protocol gives transparency to the underlying loans in the security so investors can be sure they are investing in the security they think they are – contrast this with subprime CDOs in the 2008 housing crisis which were intentionally convoluted so investors and regulators could not see the poor quality of the underlying loans their investment was backed by.

5.2 Borrower Incentives

There are three main incentives for the borrower to join the procol. The first incentive is simply that the borrower wants money immediately. They could use this money for a downpayment on a house, to pay for a medical emergency requiring cash, or anything else. This is exactly the same reason why most people borrow money in general. The second incentive for the borrower to use our protocol instead of simply going to a bank is that our protocol offers them access to 110% of the fair value of their collateral. This is competitive and even slightly higher than what most banks offer for something such as a mortgage loan. The final incentive for the borrower to use our protocol is that once the term of the loan terminates and the interest is paid, the borrower gets to retain their NFT. In this situation, not only does the borrower get access to the money they need, but they also get to keep their NFT. If the borrower believes the value of their NFT will grow, this protocol is a great choice because they can borrow money, invest the money they borrowed, and then earn returns on those investments without sacrificing their NFT.

5.3 Intermediary Incentives

There are also three main incentives for the intermediary liquidity provider to join the protocol. The first incentive is that the intermediary is entitled to collect service fees on the created securities. These fees are 200 basis points or 2% of the cash flows from the security. The second incentive is that the intermediary is able to collect these service fees with limited risk due to the majority of risk being passed off to investors through the securitization process. If the loans that make up the securities start to default, it is not the intermediary that loses but rather the investors of said security. Finally, the intermediary also collects interest from any smart contracts not included in any security as well as tranches that are not purchased. While these cash flows are riskier than the service fees, they also provide higher returns.

6. Conclusion

In this whitepaper, we have proposed a protocol for creating and securitizing NFT backed loans. Starting with the definitions of NFTs and NFT collections, we explained how these loans would be created and fairly valued. Once the foundation of NFT loans was explained, we then described how these loans could be securitized. Finally, we clearly walked through the incentives for all parties involved.

With this in mind, there are a few problems which are inherent with the use of NFT's as collateral in loans and creating a security with them. To name the two biggest problems - large price fluctuation and no intrinsic value. In our whitepaper we have outlined steps which our protocol takes to mitigate risk related to these factors. However, without decades worth of data on NFT price and value, many of the mathematical solutions we have created are somewhat arbitrary and are rather based on the research which we have done within the space and from participating in these markets. Within this emerging market we expect securitization to be discussed, and feel that given what is publicly known about securitization and what data is available for NFTs and lending protocols, we have designed the sturdiest system we possibly could.

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