

FluidTokens - Peer-to-peer NFT decentralized lending on Cardano

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Abstract

Decentralized Finance (DeFi) and Non Fungible Tokens (NFTs) are the latest big revolutions that the blockchain sector has offered to the public, increasing both the mass adoption of cryptocurrencies and the amount of value flowed into the crypto ecosystems. Cardano has been one of the biggest cradles for NFTs and it's also going to offer DeFi services to keep up with other major blockchains. In this bright scenario, we have created the first ever generalized bridge between NFTs and DeFi: FluidTokens, a peer-to-peer DeFi lending platform where borrowers can use their NFTs as collateral.

1. Introduction

Traditionally, loans are a typical financial instrument used to increase the liquidity of the borrower party for a specified period of time with a promise to the lender party that the provided liquidity will be returned with an additional interest: a premium for the risk that the lender is going to take.

To mitigate the risk taken, the lender also requires a form of collateral which can be currency, properties, stocks and more depending on the contract.

In most cases, in traditional finance the lender is a big institution or a bank, making it a fruitful core business mechanism but staying inaccessible by small groups or single individuals.

Some exceptions now exist, but they remain centralized solutions [\[1\]](#).

Decentralized Finance (DeFi) is born as one of the many byproducts of blockchain technology and it is rapidly revolutionizing the financial world. The adoption of its services across the many existing blockchains grows continuously thanks to the strong earning incentives that are now available to everyone. Additional pros to DeFi are the lack of middle-men - therefore making the processes faster and cheaper - and the possibility to switch from one cryptocurrency to any other - even if there are still some limits [\[2\]](#) - .

New DeFi services pop up every day, improving the existing ones or offering new mechanics to manage the user's portfolio, but as the foundation of the DeFi pyramid we always find Decentralized Exchanges (DEXes) and Lending platforms.

The latter in particular consist of users' liquidity pools that lend cryptocurrencies with similar mechanisms of traditional loans, requiring another cryptocurrency as collateral to mitigate the risk of unsolvable borrowers.

Another blockchain byproduct that has exploded in popularity in the last few years are the Non Fungible Tokens (NFTs): unique crypto tokens with the ability to represent almost anything and to prove the ownership using the blockchain public ledger.

Art, collectibles, game utilities and much more are now strongly connected to NFTs and some pieces have reached an intrinsic value of hundreds of thousands of US dollars (some even millions).

The hidden problem with NFTs - and with expensive art in general - is that it's always difficult to find a strong demand support level for a single highly expensive piece. In other words, the value contained inside each NFT is highly illiquid and it immobilizes an impressive amount of money that could be used to earn additional interests with other financial instruments, such as trading, lending, investing and even buying additional NFTs.

FluidTokens is the first ever DeFi lending platform where borrowers can offer their most valuable NFTs as collateral to borrow cryptocurrency that can be reinvested and repaid under the requirements agreed by both parties.

2. NFT-collateralized P2P lending

1. Benefits of a NFT-DeFi generalized bridge

The crypto world has already moved billions of US dollars from traditional instruments and it's characterized by an extremely fast money traffic among continuously new DeFi services, in the constant attempt to maximize profits. NFTs, on the other hand, are the main mechanic that slows this flow as human interaction is needed to properly choose them and having an extremely valuable NFT doesn't mean you can sell it easily to convert in the corrispective amount of cryptos.

As the crypto community has well established the intrinsic value of many existing NFTs, it makes it legal to transform them from illiquid to liquid assets using them as collaterals for loans.

In most cases and with solid strategies, the earnings from borrowing and reinvesting cryptos outbid the premium paid at the end of the loans. For example, any user could borrow to face unexpected expenses, to trade crypto pairs, to leverage other DeFi protocols interests and to apply arbitrage on DEXes such as MuesliSwap, SundaeSwap and MinSwap.

On the other hand, lending can be a perfect way to diversify the user's investment portfolio, always considering the risks associated with it.

2. Plutus: Cardano environment for Smart Contracts

Cardano blockchain works following the eUTXO model, where the amount of cryptos owned by a user is the mathematical sum of all the unspent transactions outputs that point to the user wallet address.

Leveraging this model, users can mint their own tokens on the blockchain itself and they will participate in the mathematical sum of the funds of each wallet address.

Setting the uniqueness of a single token - making it non-fungible - users are able to mint NFTs and move them univocally in the network.

Cardano also supports Smart Contracts written in Plutus, which is a subset of the Haskell functional language.

In Cardano a Smart Contract is a script that can own tokens at its address and that always checks if any user (or any other Smart Contract) is permitted to spend these tokens in a transaction.

This is different from Ethereum where Smart Contracts are softwares fully loaded on-chain and that support several types of imperative languages constructs such as class inheritance.

As NFTs are real tokens, they can also be locked into a Plutus Smart Contract that will guard them until an authorized wallet will move them to another address.

Additionally, each unspent transaction output can contain custom data called Datum, so users are able to pass and update information along the transactions tree.

In the current state of the art, Plutus has several limitations: the development of the language is still in progress therefore documentation and examples are lacking and setting up the environment is very error prone; there are also Smart Contract size limitations and there are several CIPs that propose improvements to the Plutus framework.

Blockchain congestion due to high traffic is another problem and Smart Contracts don't have any access to Oracles such as [\[3\]](#) to fetch off-chain data.

We expect that with due time Cardano will raise a scalable and strongly adopted blockchain.

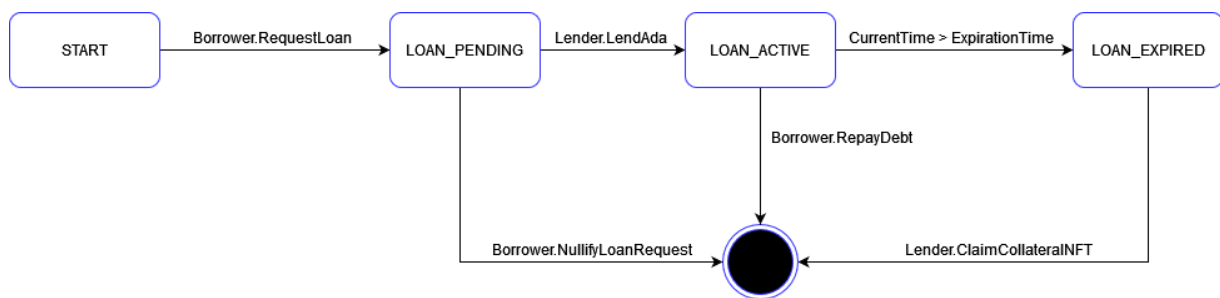
FluidTokens is a series of Smart Contracts written in Plutus where the lending and borrowing logic is fully on-chain, therefore decentralized. The only off-chain part is the frontend that allows to connect with the user wallets and to easily interact with the lending platform.

3. FluidTokens basic interaction flow

FluidTokens loans are peer-to-peer - in other words there's one borrower and one lender - and they are time-based with a deadline for the borrower to repay the debt.

The logic of each possible FluidTokens loan can be represented by a Finite State Machine (FSM) where each internal transition can be executed only if there are all the necessary requirements to make the Smart Contract validator pass the proposed transition.

The FSM of FluidTokens loan Smart Contract can be seen in Figure [1]:



The set of variables during the whole FSM process never change, but their actual value can change at every state transition.

They are defined as follows:

```
{
    "borrower": wallet_address,
    "loan_amount": ada_value,
    "loan_rate": integer,
    "loan_hours": integer,
    "currency_symbol": string,
    "token_name": string,
    "lender": NULL| wallet_address,
    "expiration_time": NULL|POSIXTime
}
```

Let's briefly explain them: "borrower" is the wallet address of the borrower that initiates the new loan request; "loan_amount" is the amount of Ada requested by the borrower; "loan_rate" is the permille value of the interests returned to the lender when the loan will be over; "loan_hours" represents the validity period of the loan, expressed as hours from the moment when the lender lends the required Ada to the borrower; "currency_symbol" and "token_name" are the 2 needed values to univocally identify any Cardano NFT and they must be the values of the NFT used as collateral for the loan; "lender" is the lender wallet address and this variable will be NULL until the lending will actually take place; "expiration_time" is the deadline expressed in POSIX

Time for the borrower to repay the debt with the previously decided interests and when the lend is actually in progress it's defined as:

"expiration_time" = (moment when the lender lent Ada) + ("loan_hours" expressed in milliseconds)

After the "expiration_time" deadline the lender is able to claim the collateral NFT as compensation.

It's important to note the following things:

- No ADA (or any other fungible token) is locked inside the FluidTokens Smart Contract but only NFTs used as collaterals;
- The borrower can in any moment repay the lender and get his/her locked NFT until the lender claims it as compensation. This means that the loan could finish much sooner than the "expiry_time" value and it also means that the borrower could repay the debt and claim the locked NFT also after the deadline if the lender hasn't claimed it yet;
- all involved parties will have to communicate via the Smart Contract (and not privately) to execute the transitions of the FSM.

4. How to properly define time instants in Plutus

Even if the user signs and sends a transaction at a precise point of time, there is no guarantee about when the transaction will be accepted and validated by the blockchain: this is a factor that will depend on network congestion.

As an additional feature, Cardano transactions can be fully tested against Plutus Smart Contracts before being sent to the blockchain to avoid bad transactions and lose money with failed attempts.

One of the most complex aspects of fully validating transactions off-chain is therefore the confirmation that the temporal point when each transaction is submitted respects the Smart Contract temporal constraints.

To allow that, instead of precise moments in time transactions are considered as valid within a temporal slot interval defined by the user creating the transaction itself. If this interval respects the temporal constraints of the Smart Contract then the transaction itself is considered valid. This temporal interval is normally referred to as the validity interval of the transaction.

If the interval starts too far in the future or ends too far in the past, the transaction will never be validated on-chain.

In FluidTokens loans, the lender must define a validity interval of 1 hour to lend money and this interval will contain (with high probability) the time slot when the real blockchain will validate the lend transaction, properly starting the loan period and setting the "expiration_time" variable.

The borrower will be able to repay the lender any time since the start of the loan, so it won't have to set up any particular validity interval for his/her transactions.

If the lender wants to claim the collateral NFT after the loan expiration, he/she will have to set a validity interval with a starting slot greater than the expiration value.

5. Differences from existing DeFi lending platforms

Even if the concept of collateralized loans is the same as in traditional finance, there are important differences from the most common lending platforms existing on Cardano and all the other blockchains:

- Collaterals are NFTs and not other types of cryptocurrencies;
- There are no liquidity pools that users can join with small amounts. It's peer-to-peer meaning that a single user (or organization) must provide all the necessary liquidity requested by the borrower;
- Borrowed positions are not liquidated if the collateral value becomes too low, but the loan must be fully repaid (in a single transaction) within the decided amount of time. Therefore borrowers must remember to correctly close their positions within the deadlines.

6. Lender and borrower incentives

FluidTokens strongly incentivizes lenders to participate in the ecosystem, providing liquidity and earning interests. Lenders do not pay any fee to lend money except for the blockchain transaction fees which are at the time of writing very cheap. There is no limit on the number of lends that each user can activate.

On the borrower side, for the very first time in crypto history NFTs can be seen as collaterals and made liquid. In addition, the borrower has to pay a small fee to FluidTokens proportional to the amount of borrowed Ada. This fee drastically decreases if the borrower owns a minimum amount of the FluidTokens native token, more on that in section 3.

3. Native token for governance, lower fees and visibility

FluidTokens will provide a native Cardano cryptocurrency to incentivize the following aspects:

- Governance: the protocol, the parameters and additional Smart Contracts services may be released in the FluidTokens ecosystem. We want to adopt a DAO form of governance where all the native token owners will be able to propose changes, ideas and vote for the better of the ecosystem;
- Lower borrower fees: owning certain amounts of the native token will allow borrowers to pay less fees on the requested loans. Different tiers will give different discounts;
- Featured loans: a dedicated section on FluidTokens website will prioritize loans that will have burnt a required amount of native tokens to appear as

featured, getting increased visibility and a higher probability of being chosen by lenders.

More use cases for the native token will be investigated with the community and airdrops and collaborations will be used to ensure a big involvement of the Cardano community.

4. FluidTokens upcoming ecosystem

FluidTokens is a revolutionary component of the DeFi world and it gives new life to the beauty of NFTs.

The metrics of the NFT loans on FluidTokens - such as loans volume and highest repaid loan - will support the already existing metrics available in the biggest NFT marketplaces such as CNFT.IO and jpeg.store. These metrics will increase the responsible adoption of valid NFT collections, discouraging the NFTs created with the only purpose of riding the general hype.

Some NFT collections could be found so generally accepted to be used as collaterals by the community that they could become a sort of globally shared currency standard.

We're also looking forward to the creation of investment funds that will collect considerable amounts of Ada to fully lend the most expensive and interesting NFT loans on FluidTokens. Some funds may create algorithms to calculate the risk-reward factor of the available loans and redistribute the earnings to the fund liquidity providers.

When Cardano fully implements Oracles support, we expect fully decentralized funds running Smart Contracts to lend and borrow on FluidTokens.

We will strongly incentivize and support this kind of funds, in order to create a new branch of the DeFi world.

Finally we're looking forward to the official Cardano bridge with Ethereum [4] to provide NFT loans to cross-chain tokens, expanding even more the DeFi use cases.

5. References

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