HFC COIN

White Paper Frameworks

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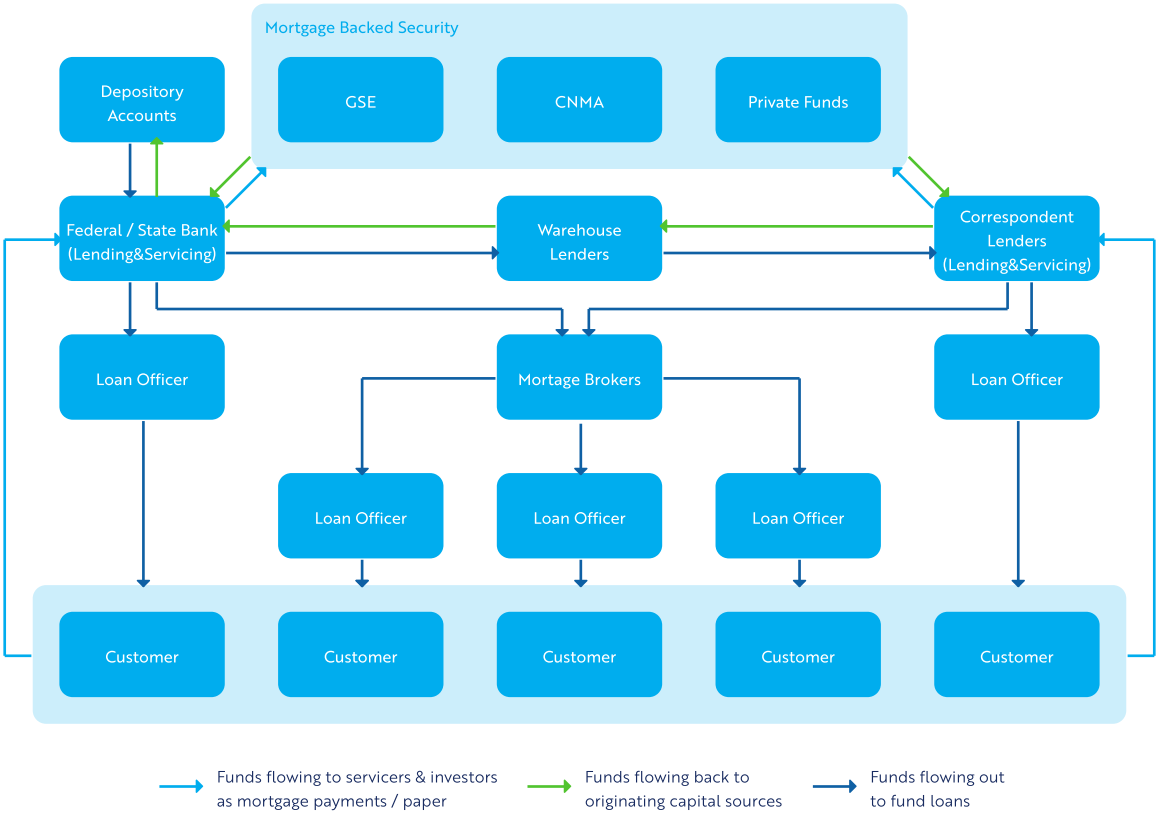
HFC Blockchain Platform Overview

Purpose and Key Markets

The HFC blockchain and artificial intelligence platform is a tokenization solution designed to reduce the costs and inefficiencies of the mortgage process while providing transparency and innovation in mortgage-backed securities (MBS). The financial crisis of 2008 revealed major flaws in the mortgage industry. The HFC blockchain platform will bring trust, transparency, and profitability to all stakeholders in the mortgage process through the tokenization and collateralization of mortgages using artificial intelligence and blockchain technology.

Figure 1. *Structure of mortgage lending in traditional economy*



The mortgage industry is plagued by various issues:

- Regulation. More than ten federal agencies oversee the industry, leading to higher costs to comply with their requirements. These expenses are passed on to customers.
- Unnecessary intermediaries. A typical retail mortgage will be touched by over 11 different people from origination to closing.
- Illegible contracts with vague descriptions of rights and ownership-transfer limitations.
- Slow decision-making.
- Exorbitant fees and charges.

Other organizations and institutions have begun to address these challenges. However, they are hindered from true innovation by legacy costs associated with the retail mortgage process, which consists of brick-and-mortar branches and human resources. Additionally, MBS markets are currently outside their scope.

The HFC platform will eliminate legacy costs by creating the AI Loan Officer. As a result, savings will be passed on to customers and investors, thereby increasing market share and driving value for HFC Coin owners.

Derivatives are pure abstractions of financial assets in a risk-based economy, and they are one of the most complex financial products. Mortgage-backed securities are derivatives that combine high-risk mortgages with low-risk mortgages to mitigate loss and increase return on investment. Decisions about the sale of a mortgage into a secondary market (the mortgage-backed securities market) are made without notifying mortgage holders, and sometimes without proper transference of ownership.

Decomposition of mortgage-backed securities is a complex process with obligations that require the agreement of numerous stakeholders. Another issue is that these derivatives are not widely available via traditional investment methods, such as stock exchanges. This effectively prohibits the average investor from participating in the mortgage-backed securities market.

The mortgage industry can be transformed by digital tools upholding the rights of all stakeholders in the mortgage process: the lender, the investors and the customer. The HFC platform will deploy an artificial-intelligence/blockchain solution to introduce transparency to the MBS market with the appropriate level of confidentiality and privacy.

With advanced cryptography to protect privacy, blockchain enables a complete and verifiable history of events related to the creation and transfer of any security or asset with a dedicated token. To ensure public access to the mortgage market and remain compliant with KYC/AML regulations, the HFC platform uses a combination of public and consortium Ethereum blockchains. This hybrid model allows for the complete digitization of the mortgage-backed securities market.

The key goals of the HFC blockchain platform for customers are:

- Reduce costs associated with mortgage lending, and pass the savings on to customers
- Create the fastest and most efficient mortgage application process for consumers
- Provide traceability and transparency for customers as their mortgages transfer into the secondary/mortgage-backed securities market
- Respect the rights of mortgage customers while their mortgages are collateralized with other mortgages in a mortgage-backed security

HFC's goals for investors include:

- Open access to Mortgage Backed Securities markets for a wider investment community
- Decentralize Mortgage Backed Securities markets
- Ease the process of MBS decomposition and conventional mortgage creation
- Secure rights and enforce obligations of all stakeholders in the mortgage process
- Integrate out-of-exchanges market of derivatives into one secured, blockchain based platform

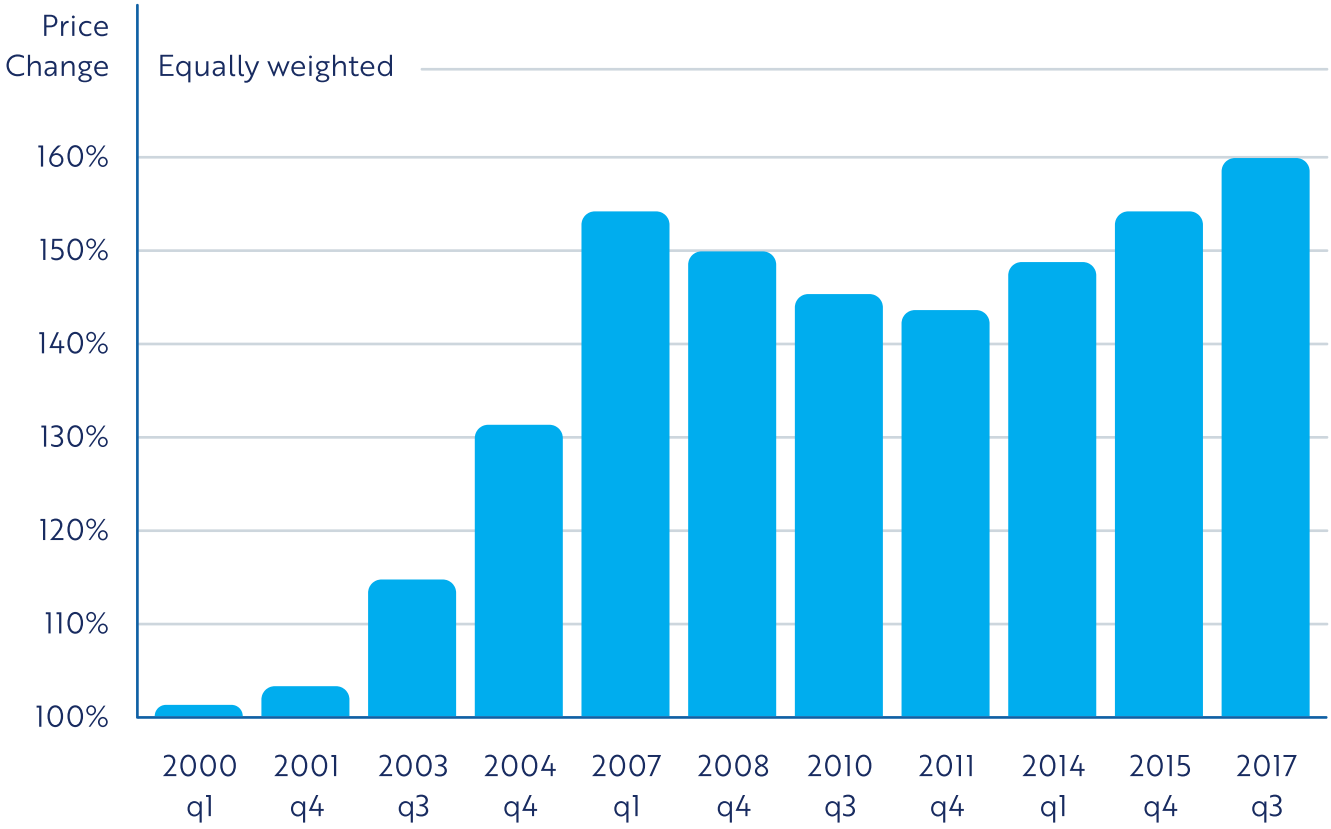
A critical component to achieving these goals is the tokenization of lending agreements. HFC will be the first comprehensive solution for tokenizing mortgages and performing business operations using smart contracts. The HFC platform will integrate both public and private Ethereum tokens.

Market Analysis

The U.S. is currently the largest mortgage market, and is saturated with financial instruments. The HFC platform can help, with the tokenization of new and existing derivatives in order to revitalize the market with blockchain technology through application of new technology tools.

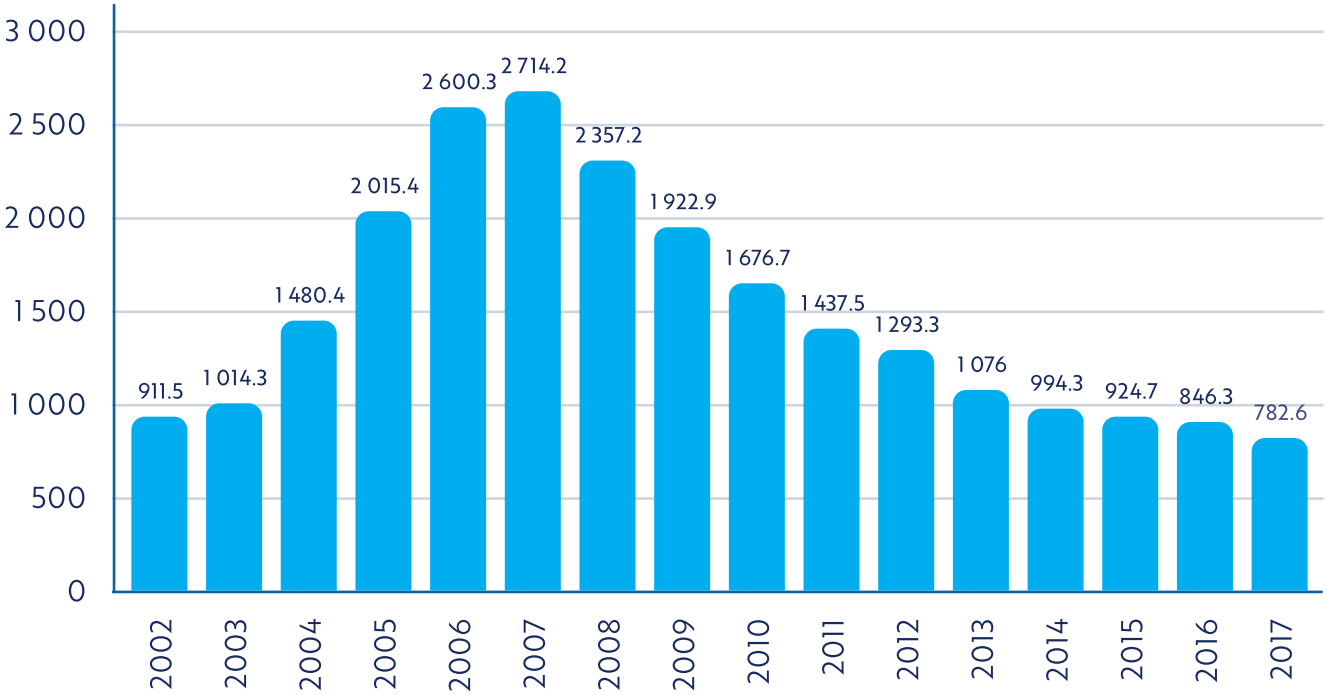
The global mortgage market is growing in value, and the house price index is growing, according to the International Monetary Fund.

Figure 2. *Global House Price Index[1] dynamics*



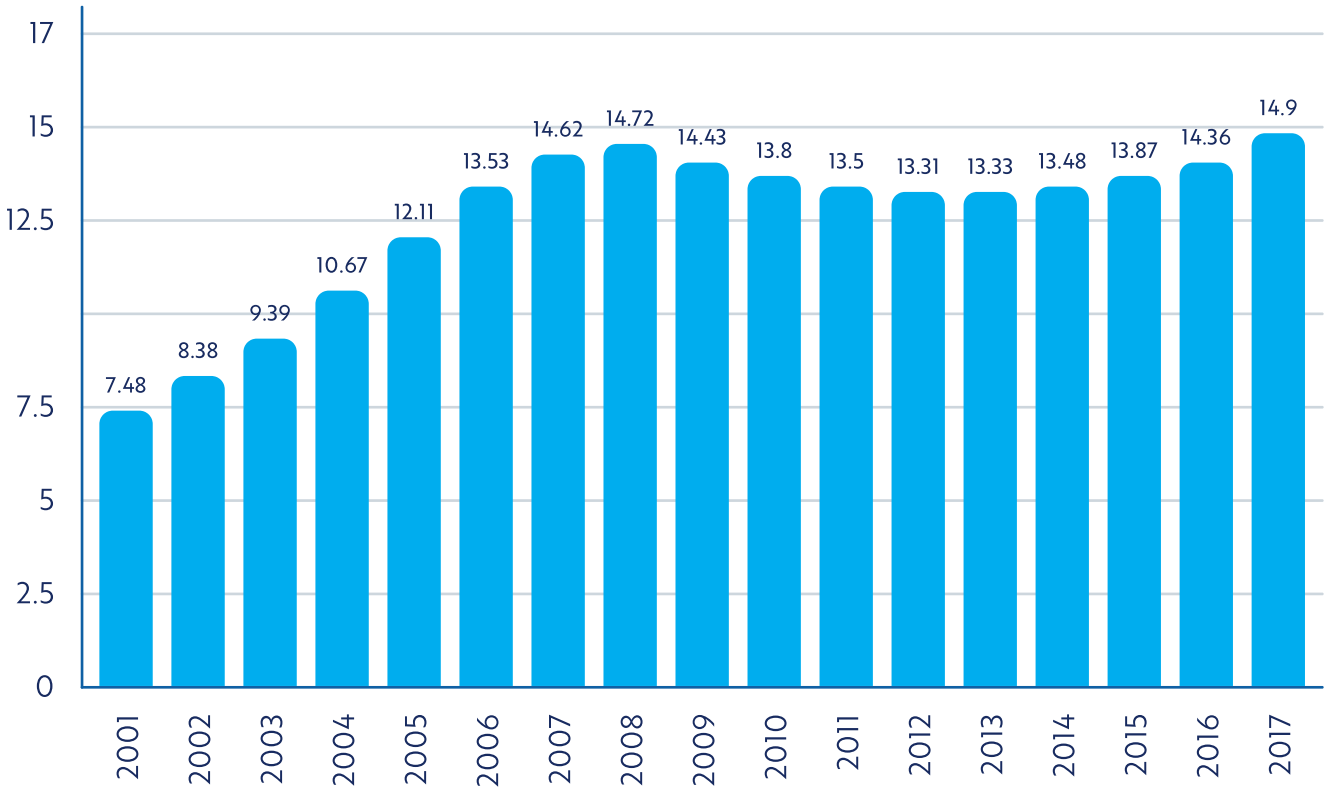
1. The Global House Price Index indicates real price changes on residential estate around the world, according to year and weighted on purchasing power parity and nominal GDP growth in countries included in the index.

Figure 3. *Residential mortgage-backed security issuance in the United States from 2002 to 2017 (in billions of U.S. dollars)*



In 2017, the MBS market totaled $782.6 billion. There is a reason for the decrease in value of MBS, and it is currently a specter haunting the market. According to Bloomberg, more that 40% of newly-issued MBSs come from unaffiliated mortgage companies (UMCs). This reveals a strong need for transparency, and a solid rationale for HFC Coins.

Figure 4. *Value of outstanding mortgage debt in the United States from 2001 to 2017 (in trillions of U.S. dollars)*



The total outstanding mortgage debt in 2017 was $14.9 trillion. These debts are prolonged with CDOs.

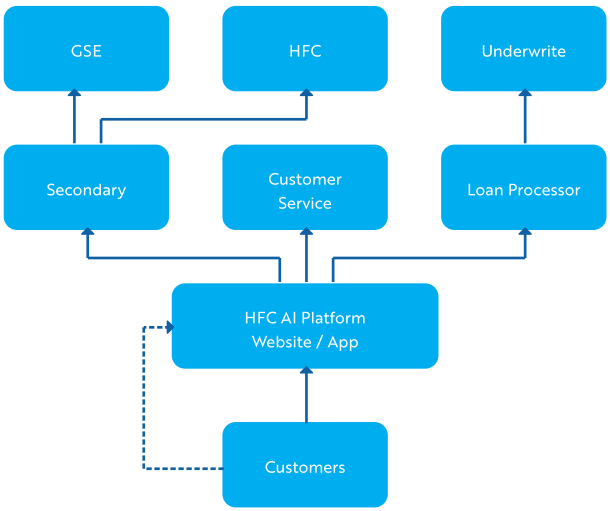
Collateralized debt providers have up to $364 billion in revenue (according to IBIS statistics), with a projected growth of 5% annually until 2025. To prevent volatility, HFC's supply of tokens should feature inflation mechanisms.

Business Model

The HFC blockchain platform is a comprehensive system based on a hybrid model of public and consortium blockchains and off-chain, non-distributed systems. The hybrid platform will automate financial operations related to mortgages for customers, investors, institutions, and the lender.

The main objective of the platform is to establish simple communication operational channels for all stakeholders with minimal transactional cost. The system relies on a web-based point of entry, accompanied by an AI Loan Officer and enhanced with machine learning for scoring.

Figure 5. *HFC off-chain AI/ML system business model*



Loan Officer AI

The platform has two purpose:

1) Provide a unique investment platform for the mortgage market.

2) Eliminate as many people from the loan origination process, specifically the Loan Officer (sakes person).

Replacing the Loan Officr with AI will expedite the process and reduce the cost of origination loans.

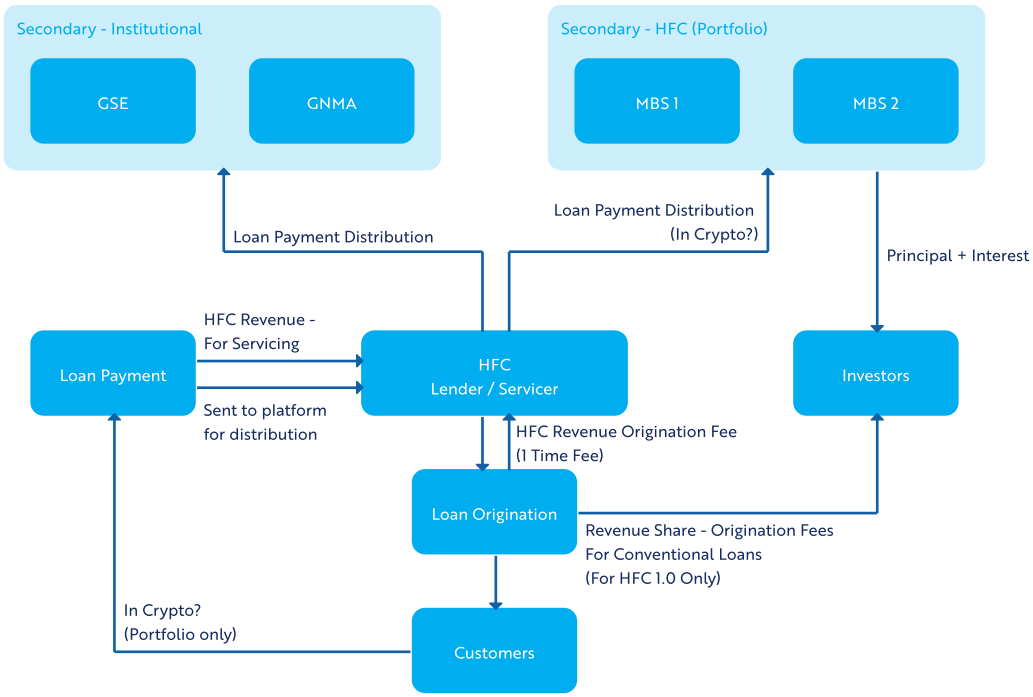
HFC off-chain elements will include web and application interfaces to provide a single point of entry for customers. At this stage, AI Loan Officer and Machine Learning software is used to simplify the creation of agreements, scoring of customers, prediction of applicable mortgage products, and prediction of required documentation. This will reduce mortgage pre-approval time to just a few minutes while providing key data required for the future tokenization of mortgages. The data is also used for customer support services, as well as loan processing and underwriting.

After a mortgage is closed, HFC receives revenue from the origination and servicing of mortgages. Regardless of the type and destination of the mortgage (conventional, GSE, portfolio, etc.), the mortgage is tokenized. To provide transparency, traceability, and security for the process, the HFC platform relies on a hybrid system of public and consortium chains.

As customers close a new mortgage, HFC will receive a one-time fee called the origination fee. All HFC Coin holders will receive a reward (in crypto or fiat) from every mortgage originated on the HFC platform, regardless of the type or secondary destination of the mortgage.

As customers make monthly payments on mortgages, HFC will generate revenue through service fees. Service fees are applied to all mortgages, regardless of where they are held in the secondary market. Payments are automatically distributed to investors in the secondary market, including investors on the HFC platform.

Figure 6. *HFC platform blockchain-based system in the business revenue stream*

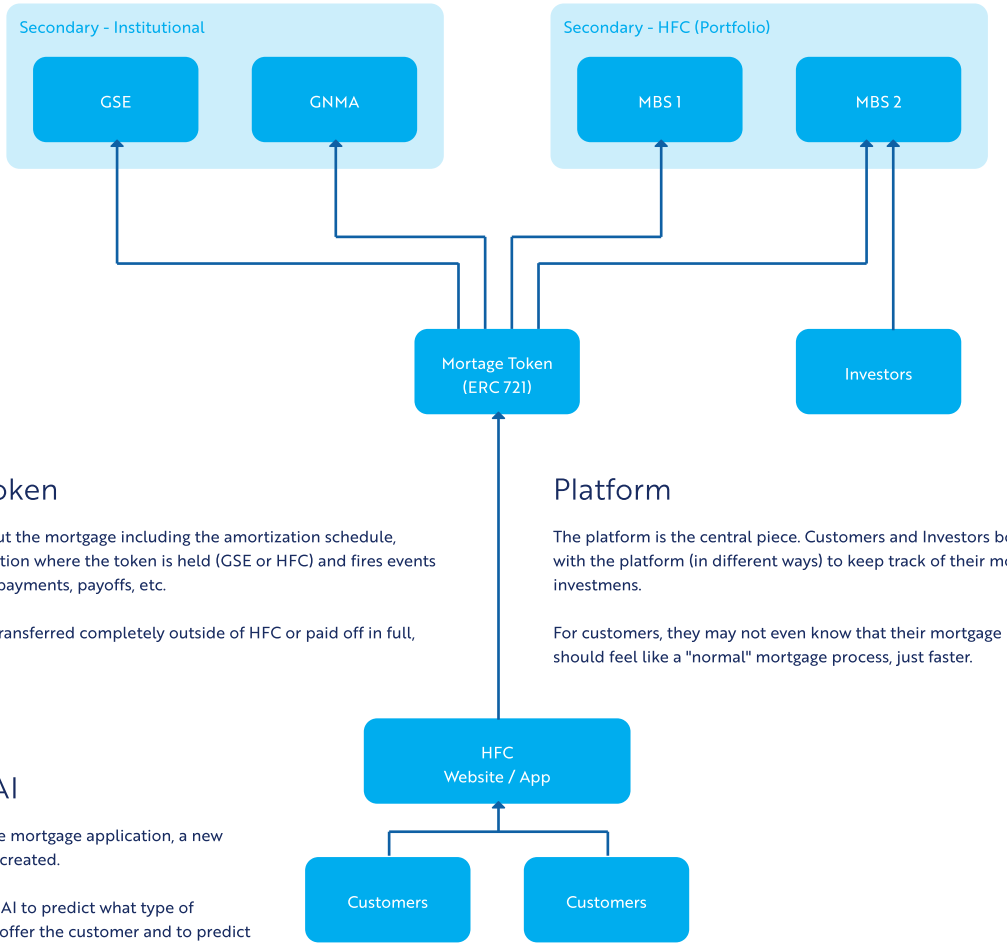


HFC as the lender/servicer in this process is using its blockchain platform to provide trust in the process of mortgage provisioning, investment, return distribution, and government control. To facilitate this, HFC relies on two major types of tokens to store the required data in the blockchain platform.

Figure 7. *HFC Platform token flow in the business process*

Mortgage Token

Tokens will keep track of who holds the mortgage in thr secondary market, HFC or Government Institutions. If the mortgage is held in an HFC MBS, when payments are made on the platform, events will be triggered to make payments to owners of HFC Coin 1, 2, etc., depending on which MBS the mortgage is



Mortgage Token

Tracks all details about the mortgage including the amortization schedule, payment history, location where the token is held (GSE or HFC) and fires events that are triggered by payments, payoffs, etc.

When a mortgage is transferred completely outside of HFC or paid off in full, the token is archived.

Platform

The platform is the central piece. Customers and Investors both will interact with the platform (in different ways) to keep track of their mortgages and investmens.

For customers, they may not even know that their mortgage is tokenized. It should feel like a "normal" mortgage process, just faster.

Products / AI

As customers start the mortgage application, a new ERC721 token will be created.

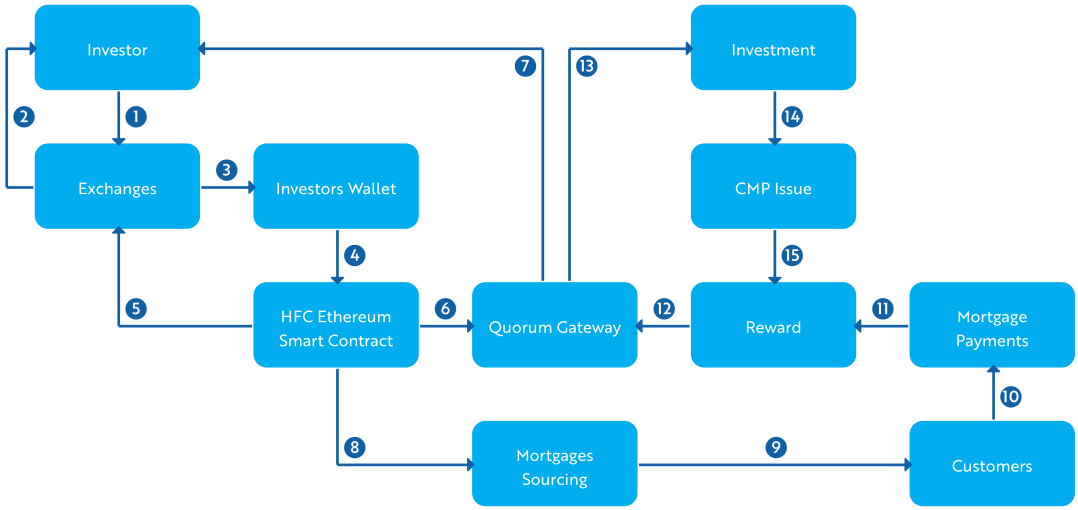
The platform will use AI to predict what type of mortgage product to offer the customer and to predict what documents are going to be required to complete the mortgage process.

These products will be built with a predetermined secondary destination.

As documents are added and stored on the blockchain, no one is able to fraudulently tamper with the documents.

The consortium chain does not allow direct communication with the Ethereum Mainnet, and does not allow distribution of sidechain tokens through public exchanges. To ensure market penetration and ease of access for investors, the HFC Coin on the public Ethereum Mainnet will be used as an entry point to the platform and key public asset. With this approach, HFC relies on its token flow process, which consists of public token balances and cross-balance transactions inside the consortium chain.

Figure 8. *Token flow process of public and consortium-based tokens*



1. Investors purchase HFC Coins at public exchanges to obtain access to investment opportunities
2. Investors could obtain rewards with crypto instead of fiat through public exchanges
3. Investor receive his HFC Coins on his wallet where he can store it or invest in CMP
4. To invest in CMP, Investor provide his HFC Coins to platform public Smart contract
5. HFC provide HFC Coins to public exchanges that allow new investors to join to investment process
6. Amount of invested HFC Coins are transmitted to Quorum
7. HFC Platform distribute reward in fiat currencies to investors
8. HFC use invested fund in HFC Coins to source mortgages for tokenization of them
9. Mortgages in fiat currencies provided to Customers
10. Customers pay for mortgages and source Rewards for investors
11. Customers pay for mortgages and source Rewards for investors
12. Rewards and amount of investments distribution transmitted to Gateway
13. Quorum provide on investor account ERC20 tokens in amount related to invested HFC Coins based on USD parity - despite of HFC Coins market price, platform provide amount that equal to exact amount of USD based on market price
14. Investors have a order book - amount of invested funds to CMP ERC721 token unique credential. This allow to invest in different CMPs during platform work by one investor with ability to track each of them independently
15. Amount of rewards dedicated to each CMP controlled by collateralization smart contract

The entire token-flow process consists of 2 elements: the HFC Coin and sidechain tokens.

HFC Coin flow:

1. HFC Coins are available on public exchanges and must be purchased by investors to begin the investment process.
2. All invested HFC Coins are contributed to the HFC smart contract on the Ethereum Mainnet.
3. HFC Coins are used to obtain fiat currency from public exchanges to source mortgages.
4. Sidechain tokens are used to activate blockchain-system transactions to introduce transparency and trust into the MBS investment process.

Because HFC Coins allow investment in MBSs based upon USD parity, the market price of the HFC Coin is not limited by the potential level of investment in MBSs.

To ensure this process, the HFC platform uses the public Ethereum MainNet and Quorum for a consortium chain backed up by Proof-of-Stake consensus.

Blockchain Architecture

Key Role Types

The HFC blockchain platform is a multi-stakeholder system dedicated to managing complex mortgage and derivative-related operations. In comparison with traditional financial markets, this solution avoids arbitration roles in the process with distributed, transparent technology. The platform does not fully eliminate arbitration roles, but transforms their responsibilities and obligations. Examples of these roles include loan processors, underwriters, and compliance officers.

Platform roles exist as digital instances inside the platform and define permissions with regard to operations with tokenized assets.

The key roles are:

- **Customer**

  The Customer is an individual applying for a real mortgage and a signed agreement that will be tokenized. The Customer begins the application process and the system starts building information to store in the blockchain while analyzing the Customer's inputs using the AI Loan Officer/ML to predict applicable mortgage products and required documents. When the Customer finishes the application, the system creates an ERC721 token that contains the mortgage object data. Customers only have access to mortgage agreements in which they are a party, and in which they have rights to their information.

  Once a mortgage is closed, the Customer can only make payments to the mortgage. The Customer will never need to directly interact with the ERC721 object that represents their mortgage. When a payment is made, the system automatically triggers the events for the ERC721 token.

- **Investor**

  The Investor uses HFC ERC20[2] in-platform tokens to invest in ERC721 tokens. The Investor receives tokens equal to their percentage of ownership in the collateralized ERC721 mortgages created by the platform. The Lender uses the funds invested by the Investor to fund mortgages. As mortgage payments are made to the Lender, a smart contract distributes principal and interest payments back to the Investors who own a part of that particular mortgage.

  The Investor will use tokens (HFC Coins) to represent their stake in the collateralized mortgages. Investors will have to be on-boarded and whitelisted through KYC/AML compliance. Investors are able to buy or sell their stake in collateralized/conventional mortgages within the platform via fiat or cryptocurrency. For this, investors have no need to deal with public exchanges, as HFC arranges everything inside the platform.

  The Investor can inspect the underlying mortgages of a mortgage-backed security (MBS) according to permissions to determine the risk associated with their stake in the MBS. The Investor can buy or sell their stake in each MBS.

- **Lender / Servicer / Platform provider**

  The lender is the HFC platform itself, which gathers all the required documents for a mortgage. HFC will be a licensed lender in its regions of operation, and will be fully compliant with mortgage laws and regulations. Once a mortgage is approved and closed, the Lender sends the borrowed funds collected from Investors to the closing agency for distribution to third parties. After closing, the Lender services the mortgage, accepts mortgage payments from the Customer, and distributes payments to Investors. The Lender is a consortium of all arbitration parties that are part of the Lender's process for generating a mortgage, e.g. loan officers, account executives, loan processors, underwriters, and compliance officers.

  If the Customer defaults on the mortgage, the Lender will foreclose and will then own the property attached to the mortgage. The Lender will make efforts to recoup the principal for the Investors by selling the property. Once it is sold, the proceeds will be paid back to the Investors as a lump payment. Results are stored in blockchain as a hash value.

2. These tokens will have a platform value according HFC economic consensus. To avoid issues with in-platform Gas fees, which are used to protect the system from DDoS attacks and inconsistent smart contracts, the consortium Ethereum (Quorum) native currency (Ether) is distributed to users freely in order to allow creation of Gas fees for transactions. For this reason, the platform launches ERC721 tokens and ERC20 tokens that have no value and are used only for the protection of the system.

Platform Architecture Outline

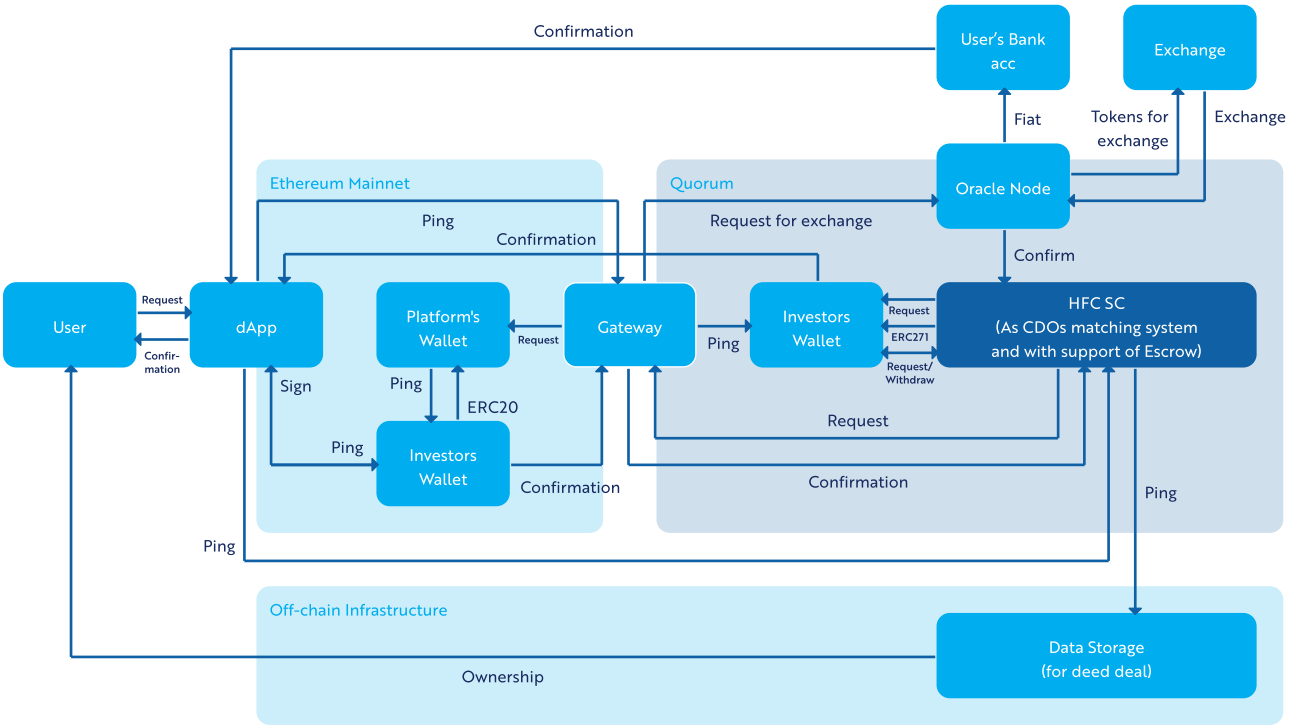
HFC provides users with the unique ability to use, trade, and invest with fungible tokens (namely ERC20 standard tokens) on the public Ethereum Mainnet.

The main idea behind this is that users can invest in other in-platform non-fungible tokens and receive returns on investment by redeeming HFC Coins. To fund rewards, HFC lends capital for mortgages and tokenizes these mortgage agreements inside the platform. This keeps the token price as stable as mortgage/derivative valuation. Moreover, the mortgages and derivatives generate additional revenue, which is distributed between investors in two ways:

- Revenue from mortgages leads to an increase in the price of public HFC Coins on the
- market.
  Revenue from mortgages and derivatives is distributed via mapping of HFC Coins owners. Tokens represent value storage, and can be used by investors to re-invest in new rounds of MBS.

This approach requires the launch of a full cycle of MBS/CDO creation, from mortgage tokenization to the creation of a blockchain-based market for collateralized investment instruments — without the need for cross-institution closed connections. This introduces transparency for collateralized investment tools and traceability down to the actual owner of a mortgage/asset.

Figure 9. *Overall description of HFC Platform architecture*



Operational flow:

1. The customer decides to obtain a mortgage through the HFC platform, which requires registration with KYC/AML and a dedicated decentralized application (DApp) on the platform back-end. This allows for the creation of a customer digital footprint in blockchain and enables them to interact with blockchain.

2. DApp communicates with Quorum through the Gateway node, which ensures synchronization and equalization of balances on both platform elements.

3. HFC as the Lender deploys a smart contract in the Quorum environment by creating ERC721 tokens. These include (tokenize) mortgage-agreement data which is collateralized in the MBS - CMP token according to the ERC721 standard.

4. Investor creates claim to obtain a CMP ERC721 token share

5. Inside the HFC platform, smart contracts are deployed with the following features:

    a. Mapping of the ERC721 token (collateralized mortgage product/CMP) with investors
    b. Locking of Investors' ERC20 tokens

c. Receiving Lenders' transfers to the smart contract to reflect the Customer's principal and interest payments
d. Releasing returns from principal and interest payments to Investors,
e. Informing gateway to release public ERC20 tokens to Investors
f. Receiving confirmation of payments

6. Platform establishes a channel with the Oracle node to execute exchange operations when Investors want to receive returns in either crypto or fiat currencies.

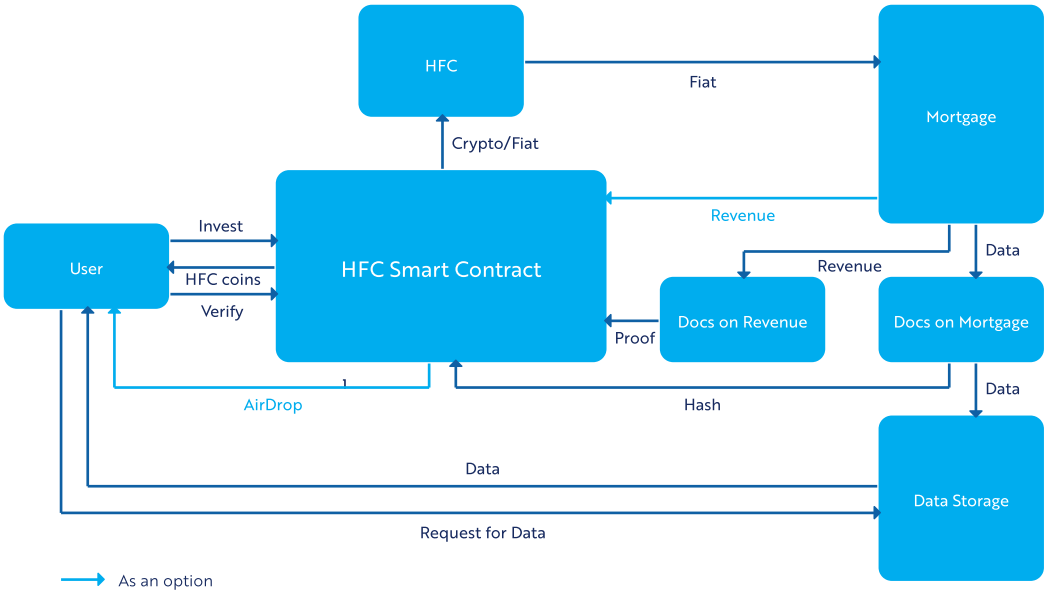
Public Ethereum blockchain

HFC has extensive experience with the mortgage and derivatives markets. This allows HFC to choose to invest with minimal risk and maximum profitability. When an investment is executed by the HFC blockchain, all documentation is stored in HFC data storage, and the hash value of this data is stored with an HFC Coin transaction in the Ethereum Mainnet, so it is impossible to change or obtain this data without the permission of all stakeholders. Each user who invests in the HFC Quorum platform receives the equivalent amount of internal ERC20 tokens. Investors have the right to mortgage or derivative returns, depending upon the amount of their investment (crypto or/and fiat) and at the exchange rate at the moment of investment.

If investors want to receive confirmation regarding a mortgage object, they send a request to data storage using their DApp. HFC Coins can be traded on crypto exchanges because the HFC Coin is a public token and allows P2P payments, as well. Moreover, the HFC Coin is stable, as it is backed-up with mortgage agreements, making it very attractive as a holding instrument.

To provide security and transparency to the whole process, the HFC Coin uses the Ethereum Mainnet as the main platform for the first stage.

Figure 10. *Stage 1 - Public token architecture description*



Operational flow:

- Investor invests in the HFC Coin during the token sale event (TGE).
- A smart contract in the Ethereum Mainnet sends HFC Coins to the Investor's wallet.
- HFC receives all necessary documentation for the mortgage(s).
- HFC creates the mortgage(s) and initiates the tokenization process.
- The platform sends data to HFC data storage and also stores hash data of documents on the Ethereum Mainnet.
- If the Investor wants to verify mortgage objects in hashed agreements, he/she sends a request for the data to data storage. After verification of signatures, the investor receives access to documents.
- Data storage sends mutable data to the Investor with verification of digital signatures.

It is critical to arrange a proofing mechanism behind the hashes.For this purpose, all parties of the lending/mortgage/derivative agreement must sign with digital signatures based on the same private key that controls user balance in the Ethereum blockchain. As Ethereum uses the same elliptical curve for cryptography as Bitcoin, a digital signature is compliant with common digital signature security requirements, and is valid in most countries.

The process of verification is as follows:

1. The lending/mortgage agreement is concluded in the traditional way as a legal document in digital form.

2. Parties to the agreement sign it with digital signatures based upon their private key.

3. The signed document is stored in off-chain storage, and parties to the agreement obtain a hash provided by the back end of the platform.

4. The hash is included in metadata of the HFC Coin transaction in the Mainnet from customer to lender (HFC platform). Bth provide their signatures for the transaction.

5. The hash is made available in the public blockchain, but access to a mutable form of the agreement is granted only if the transaction from the previous step contains the hash in the metadata of the signatures included in the agreement.

This approach brings the following advantages to HFC investors:

- **Proof of mortgage back-up.** This keeps the token price stable on the crypto market.

- **Coin price tied to the number of tokenized mortgages and MBS.** This is the basis of token economics.

Quorum Consortium Sidechain

HFC provides its users with a unique opportunity to invest in mortgages and mortgage-backed securities using crypto and fiat funds without the need for third parties, arbitration, or hidden fees.

This feature is available on the Ethereum Mainnet, but to reduce transaction fees and respect compliance requirements, HFC is developing this platform as a sidechain to the Ethereum Mainnet by developing the Quorum[3] sidechain. This reduces transaction costs through an agreement between nodes that they support HFC's platform with Gas fees for transaction/ smart contract execution in prices defined between HFC and all nodes. As a result, operational costs are optimized. Additionally, it provides higher speed to the system, as nodes serve the HFC platform's operations only, and are not stressed by overflow of the other tokens launched on the Ethereum Mainnet.

3. Quorum is a framework for the development of the Ethereum consortium sidechain introduced by J.P. Morgan (www.jpmorgan.com/global/Quorum) to ease the process of enterprise-scale Ethereum development.

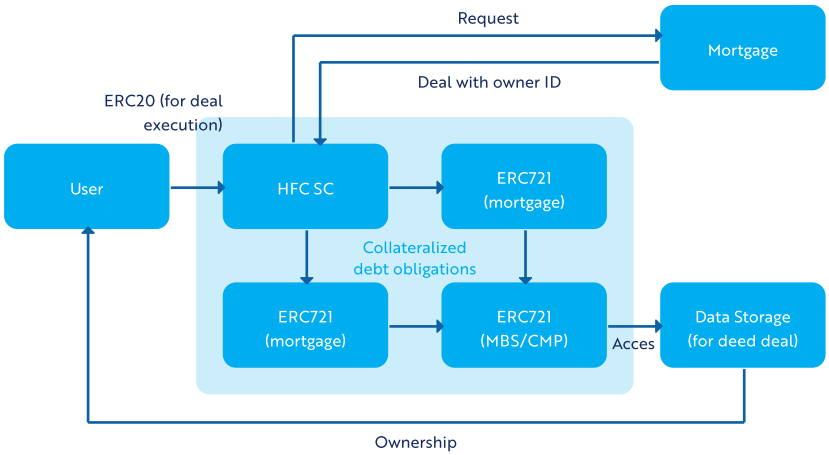
For mortgage tokenization and collateralization, the platform uses ERC721 tokens, which allow for the mortgage agreement description and factors influencing price to be stored inside the blockchain token. The price is set in HFC coins. As for securities, ERC721 can be filled with other ERC721 tokens, but with a new value based upon the derivative price formula.

ERC721 tokens include an owner_ID and token transaction parties. This implements security, tracking, and transparency.

Mortgage deals are arranged with smart contracts that contain ERC721 and accept fiat as payment (principal and interest payments). Smart contracts have timestamps that lock ownership of the ERC721 token until the Customer returns a certain amount of ERC20 under the lending procedure.

During this stage, HFC smart contracts will introduce different ERC721 tokens representing mortgages into one ERC721 token.

Figure 11. *Stage 2 - The HFC platform's operational workflow*



Operational flow:

1. The Customer decides to obtain a mortgage for an object via the HFC Coin platform.

2. The Customer and the Lender sign the mortgage agreement, which is stored in off-chain storage. The Lender puts the hash of the agreement in a ERC721 token with a value equal to full principal and interest payments.

3. The Customer makes payments, and the Lender converts the payments into ERC20 tokens in the HFC Quorum. These transfer to the smart contract holding the ERC721 token.

4. The HFC smart contract receives data about mortgage objects and fills the ERC721 token related to the Customer.

5. The HFC Smart Contract combines MBSs from different ERC721 tokens into one ERC721. This leads to a change in collateralized ERC721 token value, which uses the MBS approach to estimate collateralized debt value and returns. This data is defined in the token, and is visible to investors.

6. When the initial mortgage is fulfilled, the Lender runs the process of collateralized token decomposition to extract the mortgage ERC721 and annihilate it.

7. Ownership over documents is transferred from the Lender to the Customer, stored in data storage, and hashed in the Ethereum blockchain to provide proof of transfer.

As Quorum itself was developed prior to the introduction of EIP721 to Ethereum, the HFC development team is using Quorum and Ethereum open-source approaches to directly import ERC721 standard libraries from the related EIP with the Quorum framework after sidechain deployment. This ensures the security of the sidechain by avoiding references to Ethereum MainNet Solidity libraries.

Hybrid Model Communication Elements

The HFC platform uses a combination of public and consortium Ethereum chains in a hybrid model. The platform arranges the communication process of these systems for the following purposes:

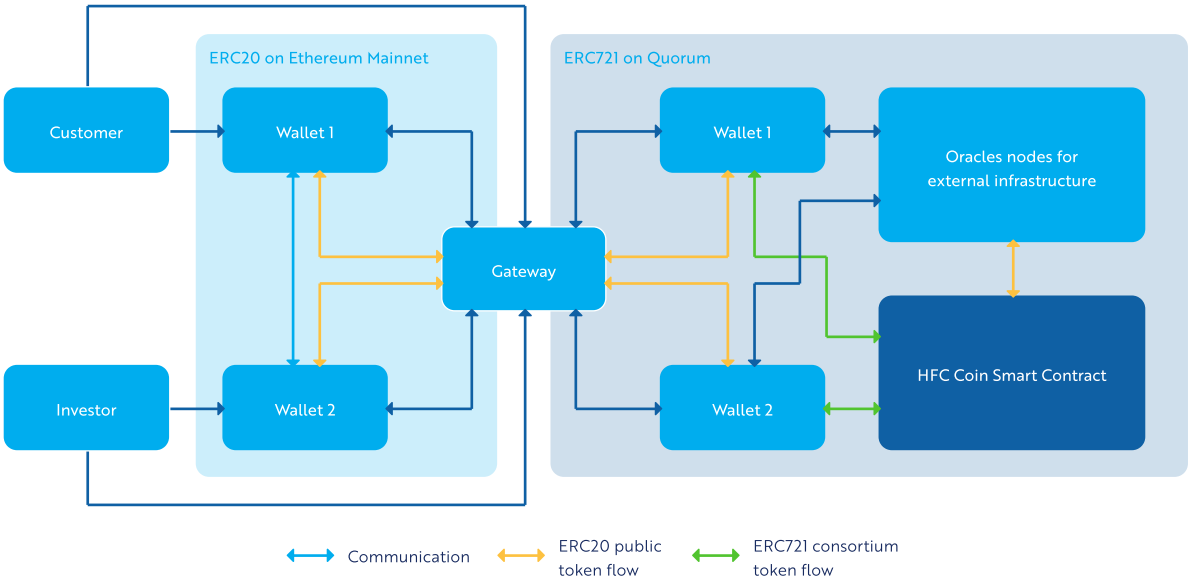
1. Allows ERC20 HFC Coin to exist on the Ethereum Mainnet to incentivize investors with a token that has value on private markets and/or public exchanges.

2. Reduce Gas fees for operations with ERC20 and ERC721 tokens inside the platform via consortium Ethereum.

3. Allow the Lender to perform in-platform accounting with the ERC20 Quorum token without constraints of limited supply. This prevents any price fluctuations caused by in-platform token flow or the need for a fork to extend the platform in the future.

4. Remove operational cost constraints from mortgage-backed securities and conventional mortgage development.

Figure 12. *Public and Quorum communication architecture*



Operational flow:

1. Investors interact through DApps (wallets) with the system, but deal only with an ERC20 token, called the HFC Coin, on a public network; or make direct payments processed through the payment gateway of Quorum.

2. Investors can freely transact public tokens (HFC Coin) on the Ethereum Mainnet, with Gas fees payable by them.

3. Investors can also exchange public tokens (HFC Coin) on exchanges that list it, with the same transaction fees in Gas.

4. A specialized gateway in Quorum will obtain users' public Ethereum wallet addresses and read the amount of ERC20 public tokens (HFC Coin) or the amount of paid sums at a rate settled by the HFC platform for the consortium token. These gateways will also be used for equalization of balances on the public blockchain, and vice-versa.

5. The Oracle node allows uploading of platform data in the quazi-blockchain environment, where off-chain operations are actively monitored with Quorum for events related to token transfer. All other activities will be fully centralized and operated off-chain.

6. To ensure token economics, the gateway node will listen to the platform wallet. With this activity, the gateway allows mirroring of off-platform transactions with public ERC20 token balances.

7. A dApp will be available for investors inside the HFC platform. This is connected with off-chain data, and allows investors to perform activities within a described solution. Investors will use ERC721 and ERC20 consortium tokens for operation in smart contracts related to mortgage tokenization or collateralized tokens.

8. All dApps inside the platform communicate with off-chain data through the Oracle node (or nodes), as this is the only way to provide required data to them.

9. The gateway will listen to Quorum wallets and collect data about current account balances of ERC20 and the value of ERC721 Quorum tokens.

10. Data from Gateway will be transmitted to the Platform wallet and activate an ERC20 public token transfer (HFC Coin) in 1-to-1 parity with the current value of the ERC20 Quorum token.

11. If the Investor accepts the transaction in Quorum to receive HFC Coins, the Platform wallet releases the ERC20 public token (HFC Coin), which equalizes the balance of publicly-tradable tokens to the Investor's public address.

Summary of user processes:

- An Investor or Customer makes payments to the Platform wallet or account.

- An Investor makes transactions within the platform with tokens to buy/sell shares of ERC721 tokens.

- The Platform wallet releases public tokens to the Investor in the amount indicated in their in-platform balance.

At the moment of Quorum deployment, the platform is equipped with the following technical tools:

- Front-end HFC Platform for off-chain elements - Java (**Jdk1.8.x/Jre1.8.x**); open-source Java libraries - robust, secure and platform independent; **Java script** for UI libraries to design front-end components), **Django** (administration of front-end), **Web3.js** (communication with Ethereum blockchain/sidechain and smart contracts)

- Databases - **MongoDB/RocksDB** (database management), **Apache Kafka** (database and other system communication)

- Agreements for off-chain storage - **MongoDB/RocksDB** (database management), **Apache Kafka** (database and other system communication)

- Back-end of off-chain elements - **Spring** (support development stack at each level, whether that's security, messaging, or data handling), **Hibernate** (ORM tool to map Java classes to database tables).

- Communication with third-party provider systems - **JSON RESTful API**, **Docker.**

- Every communication channel used within the platform (between nodes, data storage, users dApp, etc.) is encrypted and secured by SSL/TLS certificates, establishing fully encrypted channels within on/off-chain infrastructures.

Because the HFC platform uses Gateway and Ethereum at its core, with selected tools, it will be possible to easily integrate any other project related to tokenization of mortgages based in Ethereum. This will require integration of mortgage data collection and verification processes, but there is no need to make changes to existing ERC20 tokens.

Gateway allows for the integration of mortgage tokenization platforms based upon other types of blockchain (e.g., Bitcoin or PoW consensus algorithms), but in order to operate with tokens, an Oracle node is required in both blockchains. With the development of the Plasma project, this requirement could be dismissed sometime in the future, but at the current level of integration, it must be kept.

With this approach, the HFC platform aims to create a unified platform for operations with CMP rather than just tokenization of mortgages. It extends market coverage and integrates fragmented efforts. Under this umbrella, it is possible also to integrate other asset-backed tokens that comply with the HFC platform requirements and enable the creation of collateralized derivatives, whether CMP or CDO (for example, real estate, gold, or security-backed tokens could be transformed into collateralized derivatives under the same logic as CMP).

Quorum Consensus Motivation

Quorum allows for the introduction of various consensuses behind its platform. Despite the ability of Proof-of-Work (PoW) consensus to provide higher security in public blockchains, the HFC platform will never be a large-scale network in terms of nodes. This raises concerns about whether PoW will be strong enough to protect the sidechain, especially if taking into consideration the fact that the value of each ERC721 token could be higher than the cost of the equipment necessary to obtain more than 51% of the sidechain computational power needed to attack the system.

To protect the sidechain from a 51% attack by consortium members, the HFC team decided to rely upon Quorum native Proof-of-Stake (PoS) consensus: QuorumChain. This allows for an increased cost of node attacks in average-sized networks with high-value tokens. With PoS, nodes must put real value at stake for the right to verify their share of the transaction. This is implemented as a reserve system in the current financial market.

The amount of required stake will grow with time on a weekly basis, based upon the average value of minted ERC721 tokens. As the stake cannot be more than the discounted value of node revenues in the network, probability formulas with appropriate AI scoring will be applied. All consortium members and node holders must agree to stake value growth.

Formula of staking growth:

$$Stake = (\sum_{0}^{n} ERC721_n \div n) \times R,\ R < 1$$

$$Stake_m \div \sum_{1}^{m} Stake_m < 1/3$$

Where n - number of tokenized mortgages, m - number of stakers (nodes) within Quorum,ERC721n - value of an ERC721 token, R - risk of node misbehavior based on AI/ML scoring model.

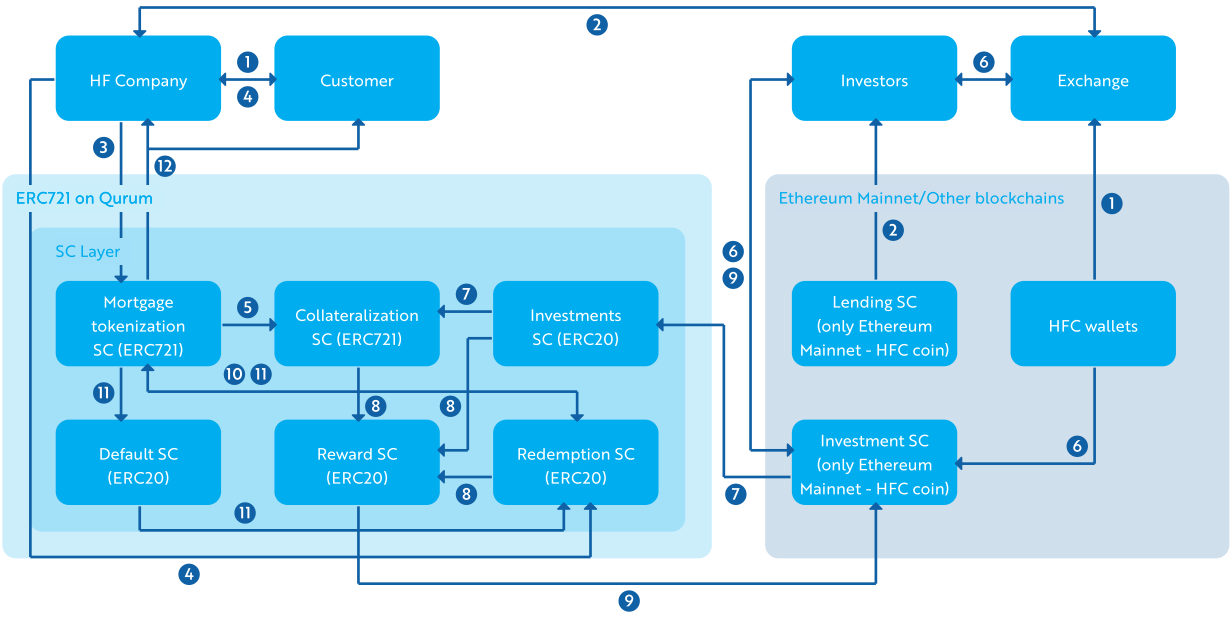
The HFC platform requires at minimum three stakers, as each share of a node cannot be more than ⅓ of network value.

Staking will be done in the Quorum version of Ether, and will not be related to operational ERC20 tokens.

Smart Contracts

The HFC platform can deal with both mortgage tokenization and MBS operations. Smart contracts are deployed inside the HFC Quorum to arrange the processes.

Figure 13. *Smart-contracts connection at HFC Quorum*



Operational flow:

1. Customers obtain a mortgage from HFC. Mortgage agreements are executed with physical signatures and converted to digital form signed by the Lender (HFC) and Customer. The Lender provides funding to the Customer in fiat currency.

2. The mortgage agreement is hashed and stored inside the ERC721 token with the digital signature of the Customer, and contains the Lender's public address as Owner_ID of the token. The ERC721 token price with the mortgage inside is defined as the mortgage price with the amount of agreed-upon return and represented in ERC20 tokens of Ethereum Quorum in a parity of 1-to-1 with USD for ease of accounting.

3. Customers provide payment to the Lender in fiat. The Lender mints tokens in Quorum and transfers them to the smart contract to collect principal and interest payments for accounting purposes. This continues until the Customer pays the entire sum of the

4. The mortgage smart contract mints ERC721 tokens with tokenized mortgages locked inside the collateralization smart contract. That creates the opportunity to issue a new ERC721 token representing MBS for investment and connection with tokenized mortgages.

5. Investors invest in MBS with the HFC Coin, which can be obtained from public exchanges and/or from HFC directly.

6. The Quorum Oracle node tracks all HFC contributions to the investment smart contract in the Ethereum Mainnet, and immediately releases Quorum ERC20 tokens with an investment smart contract in a permissioned chain with the addresses of investors to map rewards. The investment smart contract in the consortium maps investors' addresses with selected MBS inside the collateralization smart contract.

7. The collateralization smart contract provides information on return on investment for each MBS to the reward smart contract. The reward smart contract obtains the investor's address, mapping from the consortium investment smart contract and collecting the required amount of paid mortgage principal and interest from the redemption smart contract.

8. This data, with the consortium Oracle node, is transmitted to the investment smart contract in the Ethereum Mainnet to release returns to investors.

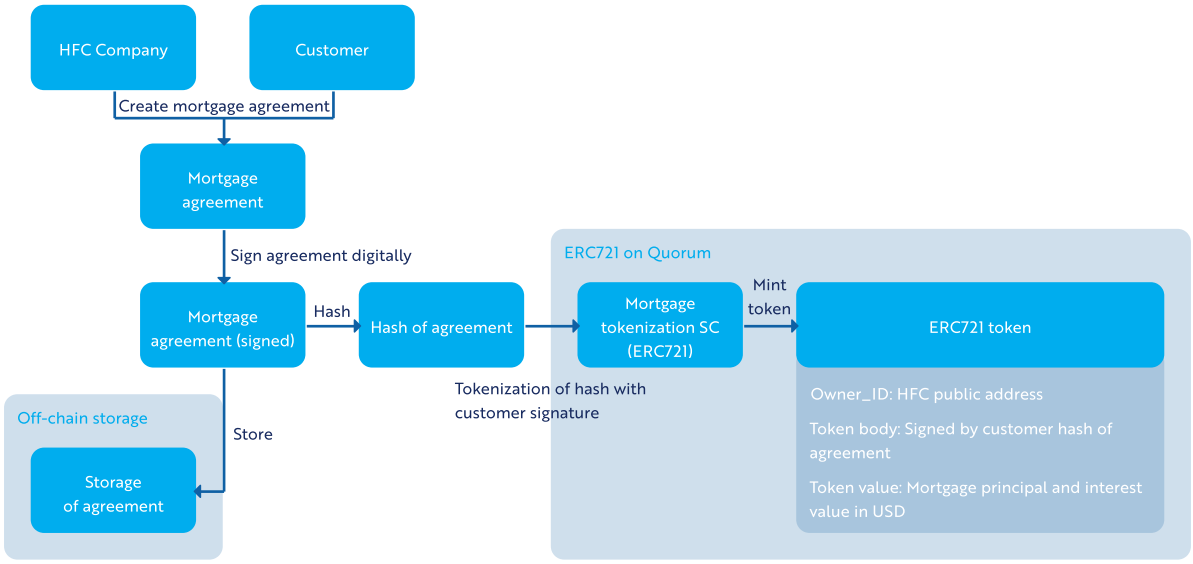
9. When the mortgage is paid off, the redemption smart contract transmits the event to the mortgage smart contract, which changes the Owner_ID of the ERC721 token with the mortgage from the Lender's public address to the Customer's public address. As a result, the mortgage is treated as invalid, and the ERC721 token includes a signed hash of confirmation that the mortgage is closed. This data is stored inside the blockchain. It also triggers the decomposition process of the MBS to exclude the tokenized mortgage from the collateralized token.

10. In case of mortgage default, a default smart contract creates the required amount of consortium ERC20 tokens to close the mortgage for other smart contracts and provide new reward distributions for investors with time a stamp signifying the number of potential tokens that will be provided after object realization.

11. In case of a closed mortgage agreement (paid off or defaulted), the mortgage smart contract changes the Owner_ID to the Customer or annihilates the ERC721 token to withdraw default from the system and obtain tokens from object realization.

Mortgage Smart Contract

Figure 14. *Mortgage tokenization smart-Contract flow*



Operational flow:

1. The Lender and the Customer create a general mortgage agreement and physically sign it. It is then created in digital form and signed by the Lender and Customer with their private digital signatures to create a tokenized agreement.

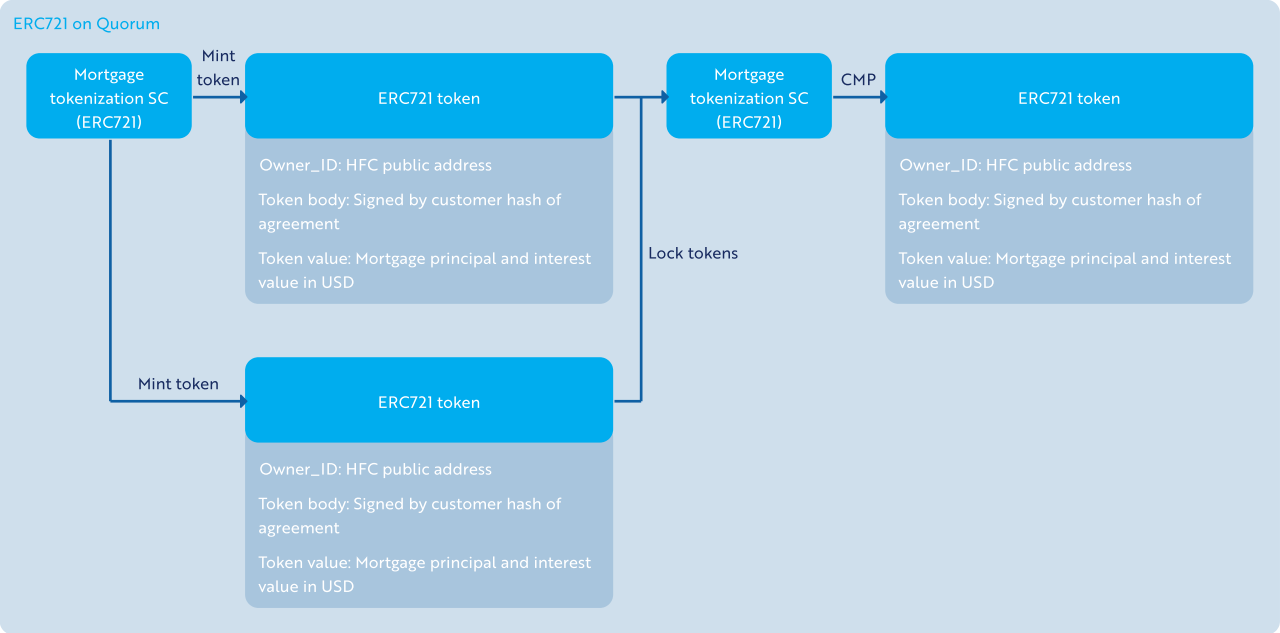
2. The agreement is hashed and signed with the customer's signature once more. The unhashed agreement is stored in off-chain data storage and accessed only with the private signature of the customer and the ERC721 Owner_ID.

3. The hashed agreement with signature is used to create an ERC721 token with this data inside along with the Lender's public address as Owner_ID. The value of the token is defined as the mortgage value of the principal and interest in USD/HFC Coin parity (depending on agreement).

This process allows for a tokenization process for mortgage agreements and introduces base ERC721 tokens for MBS creation.

Collateralization Smart Contract

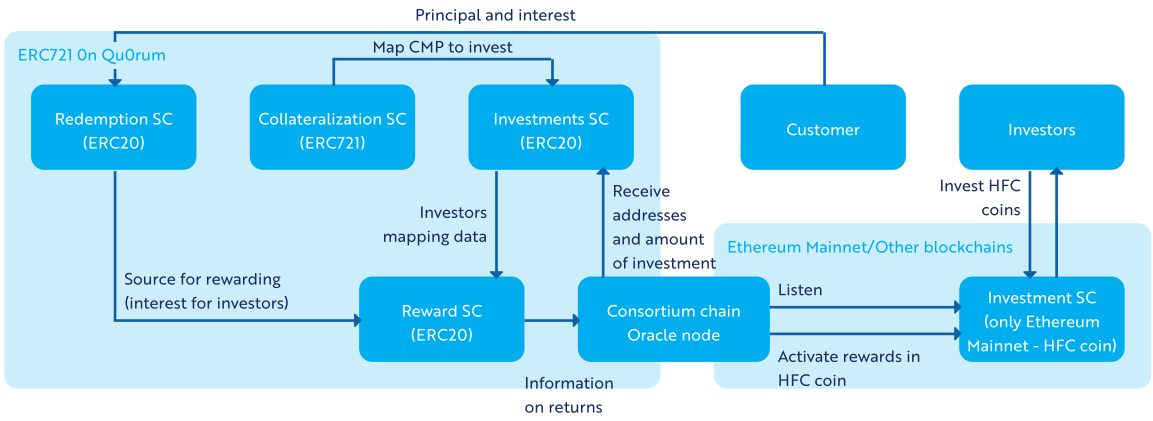
Figure 15. *Collateralization smart-contract flow*



Collateralization smart contracts work by locking ERC721 tokens as tokenized mortgages into one smart Contract and then minting a new ERC721 token that represents the MBS of the Lender and connects with investment and reward contracts.

Consortium Investment Smart Contract

Figure 16. *Investment smart-contract flow*



Consortium investment Smart Contracts are basically mapping contracts used to collect information on investor contributions. These Smart Contracts have an oraclization feature that collects investor addresses and contributions used for MBS investments.

HFC Coin is used for investment- and returns-on-investment tracking with the enforcement of the public Ethereum Mainnet. The Quorum ERC20 token is used only for accounting purposes, and for managing operations with MBS in the form of ERC721.

Redemption and default smart contracts are used only to store statements. Customer payments are tokenized with ERC20 tokens and passed through a redemption smart contract that stores the history of payments. ERC20 tokens are transferred from HFC wallets to reward smart contracts through redemption smart contracts. This minimizes the number of listen and call functions.

Default smart contracts hold a certain amount of consortium ERC20 tokens in reserve, which must be enough to initiate decomposition of MBS for a defaulted mortgage and inform investors of changes in principal and interest distribution. This contract only listens to redemption smart contracts, and is used for call functions inside investment smart contracts.

Reward Smart Contract

An additional feature proposed to the HFC platform's users is a reward and bonus system. This will provide motivation to users to utilize the platform, which will increase the value of HFC on the market as well as the HFC Coin price.

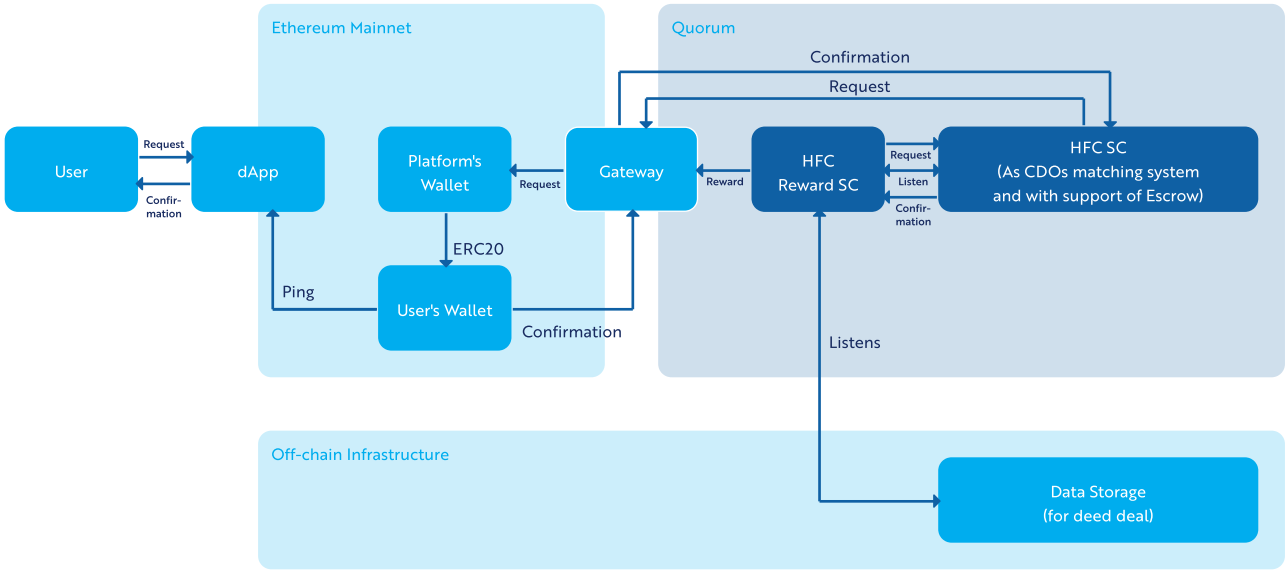
This feature is provided by a special HFC Reward smart contract that is placed on HFC Ethereum Quorum. The HFC Reward Smart Contract is developed with predefined conditions, and its role is to listen to user activity through an HFC operational smart contract by verifying data with HFC data storage in a decentralized manner. When the predefined conditions are met by the user, the HFC Reward smart contract catches this activity and pings an HFC operational smart contract to reward users.

There are several possible types of rewards:

- **Operational activities** - By dealing with the platform (mortgage, investment, MBS trading, etc.), users will be rewarded with HFC Coins, which will provide further motivation to execute deals.

- **Referral programs** - When a deal is successfully executed within the HFC platform, users will be able to share this information with friends, family, and the community. When someone else comes to the HFC platform using the referral link and makes a purchase, both users will receive HFC coins that can be used for a discount with the next purchase. One more way to utilize this bonus is through its monetization. Users will be able to trade HFC coins on crypto exchanges or use them for P2P transactions.

Figure 17. *Description of an HFC reward smart contract*



Operational flow:

1. User connects to the HFC platform via dApp.

2. HFC reward smart contract listens to HFC data storage and operational SC regarding the number of interactions with the platform obtained by the User.

3. Based on predefined conditions in HFC Reward SC, it sends requests to the HFC operational smart contract.

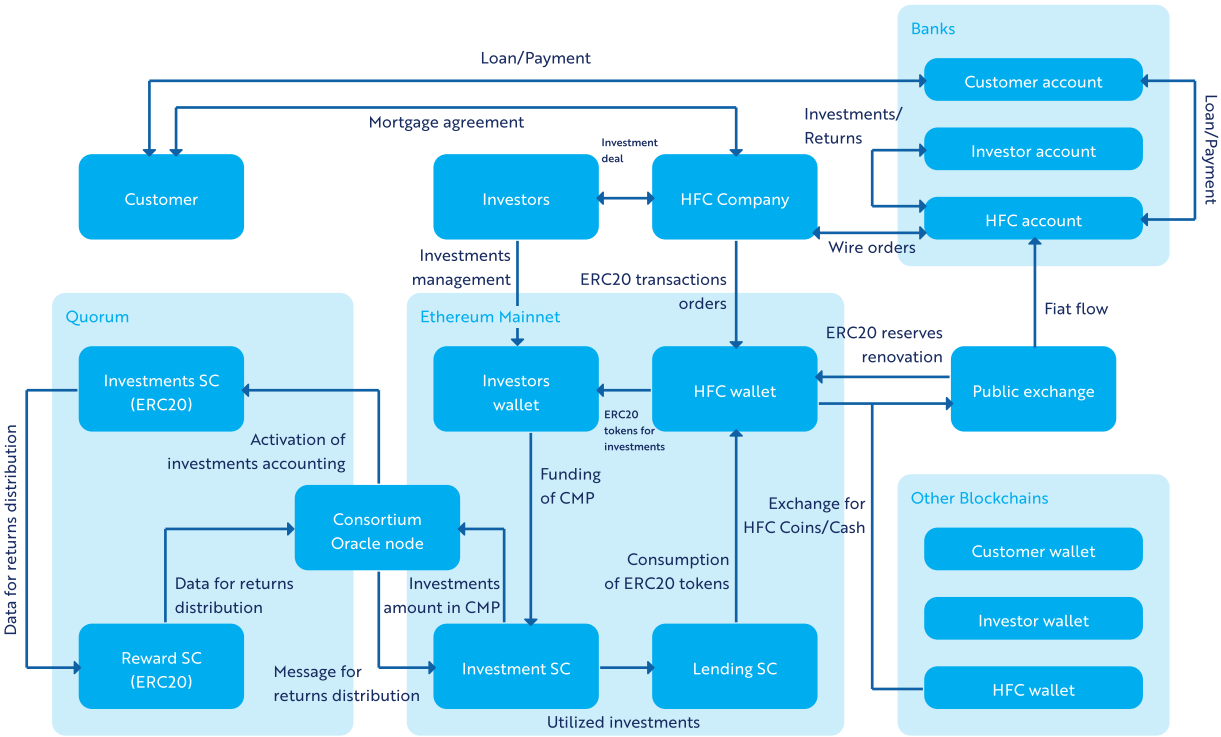
4. The HFC operational smart contract sends a request for a reward to the platform's wallet (it could be ERC20 tokens as a reward, or subscription discounts, etc.)

5. The platform's wallet sends ERC20 tokens as a reward to the User's wallet.

6. User receives notification of the received token via dApp.

Public Ethereum Smart Contracts

Figure 18. *Smart-contracts flow in Mainnet*



To activate investments in MBS and source mortgage agreements, HFC issues HFC Coins on the public Ethereum Mainnet. This allow it to activate the logic behind investment smart contracts in the following ways in the Quorum sidechain:

1. The HFC platform uses available HFC Coins to distribute within the market and receives fiat currencies to source mortgages and activate the tokenization process. Fiat currencies are provided to customers, who can, in the future, make mortgage payments in fiat to the Lender.

2. The lending smart contract in the public Ethereum Mainnet is used to track the amount of sold HFC Coins for the sourcing of mortgages, and to provide an additional level of comfort for token investors.

3. The investment smart contract is a management tool for investors that allows them to choose which MBS they want to invest in (when several MBSs are launched) for portfolio development. Each MBS will have its own investment smart contract address on the Mainnet for appropriate mapping of returns distribution.

4. HFC sends a wire (or sends a ETH/BTC transaction from its wallet) to distribute returns to investors from its bank account and obtain HFC coins from investment smart contracts. New investors can join by purchasing HFC Coins from public exchanges or directly from the HFC platform.

From a platform point of view, it will use the same internal tokens that are related to investors' wallets. This allows for an accounting system for investors at each serial issue of CMP.

Token Economics

Token Specifications

ERC20 Tokens on Public Ethereum - HFC coin

The ERC20 tokens on the public Ethereum Mainnet are used for the following purposes:

1. Public ICO for fundraising
2. Listing on public exchanges
3. Direct transactions between users outside the HFC platform
4. Access to the HFC platform,
5. Burning of redeemed tokens

The key features of token economics are:

1. Initial distribution of token with ICO
2. Token price reduction with fees payable in ETH
3. Stable price of HFC Coin

When new ERC20 tokens are introduced on public Ethereum, holders of HFC Coins from previous rounds who don't want to redeem them are allowed to swap old tokens for new ones. Prior to the TGE, old tokens would be delisted from exchanges that limited their turnover to redemption or swapping on the HFC platform.

ERC721 Token on Quorum

ERC721 Tokens on the Private Ethereum chain are used for the following purposes:

1. Storing documentation on mortgage objects

2. Storing unique user ID (Owner_ID) in the ERC721 token's metadata so that it will be impossible to sell or move mortgage ownership to another user without the owners' involvement

3. Storing the value of mortgage objects that define the appropriate number of ERC20 tokens on the Ethereum Mainnet

The key features of token economics include:

1. Unlimited deployment of ERC721 tokens with no additional fees

2. Zero fees for running ERC721 tokens within Quorum. Gas fees will be in the ETH wallet on the consortium to protect smart contracts from DDoS attacks

ERC721 tokens on Ethereum Quorum will be used for the following purposes:

1. For each platform user who invests, a particular ERC721 token will be assigned

2. The value of the ERC721 token is in equivalent ERC20 HFC Coins, and depends upon the mortgage object

3. User can sell the mortgage object (ERC721 token) at any time on the HFC platform (on Quorum)

This type of token will also incur Gas fees. However, HFC can set the fee to zero for transaction execution, as this is allowed by Quorum as one of its features.

ERC721 tokens will allow HFC to deploy as many tokens as needed. When a token is sold and there is no further need for it, HFC can burn it by erasing the metadata in the ERC721 token and then assigning its account number to the last minted ERC721 token. This will result in the burning of the sold ERC721 token.

After that, HFC assigns the user a new ERC721 token.

ERC20 Token on Quorum

ERC20 tokens on Quorum are used for the following purposes:

1. Accounting of investments and returns on balances for equalization of balances in HFC coins

2. Direct transactions between users inside HFC platform

3. Management of CMP/conventional mortgages and mortgage investment flow inside the platform

The key features of token economics include:

1. Distribution based upon public Ethereum balances
2. Token price is zero
3. Transactions fees are zero
4. Automation of processes related to CMP creation and decomposition

ICO Economics and Specifications

ICO will contain only ERC20 HFC coins in the Ethereum Mainnet.

Token type	ERC20
Fees	Gas of Ethereum
Access	Public
Max supply	65,000,000
ICO supply with vesting	52,000,000
Team reserve for vesting	6,500,000
Vesting period	3 years
Accepted contributions	ETH - yes
	BTC - yes (LTC, ...?)
	Fiat (USD) -

Distribution of tokens from token-generation event:

HFC Coin - Token Distribution		
Founding Team	6,500,000	10%
Reserve for 3 year vesting	6,500,000	10%
Referral bonuses	6,500,000	10%
Token sale	45,500,000	70%
Total	65,000,000	100%

HFC Coin - ICO funds	
Hard Cap	$40,000,00
Soft Cap	$4,000,00

Distribution of ICO token supply:

HFC Coin - Sale Stages				
Stage	**Tokens**	**Discount**	**Dates**	**Price**
Early/Seed stage	2,275,000	–	–	–
Stage 1	2,275,000	30%	TBD	$0.7
Stage 1	4,550,000	25%	TBD	$0.75
Stage 3	4,550,000	20%	TBD	$0.80
Stage 4	4,550,000	10%	TBD	$0.90
Public Sale	27,300,000	0%	TBD	$1.00

Distribution of funds received from ICO:

HFC Coin - Funds Allocation	
Operations	10%
Legal	5%
Marketing	20%
Technology R&D	10%
Mortgage Lending	50%
Reserves	5%
Total	100%

Additional estimations for token economics evaluation:

HFC Coin - General distribution	
Founding Team	10%
Reserve for 3 year vesting	10%
Referral bonuses	4%
Advisors	6%
Token sale	70%

HFC Coin - Token sale distribution and discounts		
Private sale	5%	Negotiable
Stage 1/Pre-sale	5%	30%
Stage 2	10%	25%
Stage 3	10%	20%
Stage 4	10%	10%
Public sale	60%	0%

Public sale	$1.00

Stage	Tokens	Capitalization	Price
Private sale	2,275,000	–	–
Stage 1	2,275,000	$1,592,500	$0.70
Stage 2	4,550,000	$3,412,500	$0.75
Stage 3	4,550,000	$3,640,000	$0.80
Stage 4	4,550,000	$4,095,000	$0.90
Public sale	27,300,000	$27,300,000	$1.00
Total token sale	45,500,000	$40,040,000	–
Total supply	65,000,000	–	–
Founding Team	6,500,000	–	–
Reserve for 3 year vesting	6,500,000	–	–
Referral bonuses	2,600,000	–	–
Advisory board	3,900,000	–	–

Project Timeline

Stage 1. HFC Coin TGE starts on [date]:

1. Deployment of TGE smart contract on the Ethereum Mainnet,
2. HFC Coin market/distribution process
3. Post-TGE marketing campaig
4. Listing on public exchanges

Stage 2. HFC Platform Proof-Of-Concept and initial tokenization process:

1. HFC Platform test-net with Ethereum Consortium chain under Proof-of-Authority consensus
2. Tokenization of initial financed mortgages
3. Solidity smart contracts for TGE of ERC721 and ERC20 tokens within consortium chains
4. Public testing of smart contracts and security audit
5. HFC Platform front-end and back-end finalization

Stage 3. HFC Platform deployment with Quorum:

1. Setup of nodes to launch Quorum Chain consensus
2. Initial testing of node overflow and stress testing
3. Migration of EIP721 standard to Quorum
4. Migration of smart contracts from PoC to Quorum
5. Ethereum Mainnet addresses implementation to Quorum
6. Gateway maintenance and full scale deployment

Stage 4. Full-scale HFC Platform launch:

1. Collateralization smart-contract deployment
2. MetaMask and Infura JSON APIs and custom wallet deployment
3. Launch of first CMP ERC721 token for collateral investment
4. First round of reward distribution

Stage 5. Scaling of HFC Platform:

1. SDKs for tokenized asset integration to HFC platform for collateralization
2. New rounds of CMP creation
3. Distribution of licences for mortgage tokenization service vendors
4. Scaling of nodes amount within platform consortium agreement
5. Payment gateways for integration of new payment methods for investors
6 Integration of public Ethereum smart contracts with 0x, Bancor, and Graphene to ease the process of dealing with decentralized exchanges

Team and Advisors

Bryan Stone

CEO, HFC Coin

Bryan Stone is an experienced entrepreneur with more than 17 years of experience in the financial services and mortgage industry. After maintaining a successful mortgage branch through the mortgage crisis of 2008, Bryan founded his own mortgage brokerage, Stone Home Loans, in 2012.

James Lopez

CTO, HFC Coin

James Lopez is a multidisciplinary software developer, technology enthusiast, and entrepreneur. James has over 15 years of experience in full stack development, software project management, and database architecture.

Ott Sathngam

Senior Software Architect / Engineer

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Ott has worked as an electrical and software engineer for more than three decades. His extensive work product spans multiple industries and disciplines. He has been lead engineer on multiple defense contracts and has also worked as software architect / engineer on several private sector projects.

Alan Johnson

Advisor, Founder at LoanXEngine

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Alan Johnson has spent his career at the forefront of loan origination technology and software. Alan is an expert in loan origination automation, and has created software that combines the essential services of lead management, product pricing and eligibility, and customer relationship management workflow into a single, easy-to-use platform.

Grant Gulovson

Advisor, Attorney, Blockchain Consultant

LinkedIn: https://www.linkedin.com/in/gulovsen/

Grant is a licensed U.S.-based intellectual property attorney with over 15 years' experience in a wide variety of different practice areas. He started investing in Bitcoin in 2013, and is the legal advisor to several blockchain startups. Grant only works with projects that he believes in, and that are sophisticated enough to recognize how important it is to have legal counsel that understands the law, technology, and the marketplace.

Ihor Pidruchny

Advisor, CEO at Applicature

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An experienced technology manager and advisor on blockchain, Ihor has been involved in many blockchain projects and ICOs as well as technical development projects located in Silicon Valley.

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- the risk that the Company or the HFC Platform may be unable to execute or implement its or their business strategies and future plans;

- changes in interest rates and exchange rates of fiat currencies and cryptocurrencies;

- changes in the anticipated growth strategies and expected internal growth of the Company or the HFC Platform;

- changes in the availability and fees payable to the Company in connection with its respective businesses and operations and/ or the HFC Platform;
- changes in the availability and salaries of employees who are required by the Company to operate the respective businesses and operations and/or the HFC Platform;
- changes in preferences of the customers of the Company or the HFC Platform;
- changes in competitive conditions under which the Company or the HFC Platform operates, and the ability of the Company or the HFC Platform to compete under such conditions;
- changes in the future capital needs of the Company or the HFC Platform and the availability of financing and capital to fund such needs;
- war or acts of international or domestic terrorism;
- occurrences of catastrophic events, natural disasters and acts of God that affect the businesses and/or operations of the Company and/or the HFC Platform;
- other factors beyond the control of the Company;
- and any risks or uncertainties associated with the Company and its business and operations and the HFC Platform.