# Creditcoin

## A Decentralized Credit Network

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**Abstract.** Blockchain technology has enabled us to create objective history—decentralized ledgers represent facts that are backed by verifiable computation, not a bet on the trust in central authorities. Bitcoin[1] proved the value of its financial utility as a decentralized transaction ledger by leading to the creation of a total cryptocurrency market capitalization in excess of $800 billion in early 2018[2].

A large market cap is insufficient to building a self-sustainable financial ecosystem, however. This requires three pillars: savings, payments, and investment. Investment works as a “wormhole” of sorts, connecting “parallel universes” that we call market

According to the IMF, global nominal GDP was $78.5 trillion in 2014. However, Aon pegged the total size of the global capital investment market at $101.1 trillion in June 2013[3]. If this relationship stays the same for the cryptocurrency, then the $445 billion market cap at the end of 2017 means a potential cryptocurrency investment market of $573 billion.

Creditcoin is a decentralized credit network that turns digital wallets into an investment market. The miners of the market earn Creditcoin by mining blocks: The miner of a block collects block reward. The network achieves robustness by decentralizing credit history, while automatically punishing fundraiser default. Investors can select credit history parameters to protect against various risk models.

Creditcoin and its network are designed as a simple blockchain that serves a single purpose extremely well: enabling blockchain-based lending transactions. Since we know blockchain is not a silver bullet, we leave to others related services, such as identification and credit scoring. We also recognize that lending transactions facilitate various business activities. Instead of implementing them within Creditcoin, the blockchain achieves versatility through the creativity of its users and the ability to connect with other blockchain networks.

[1] "Bitcoin: A Peer-to-Peer Electronic Cash System - Bitcoin.org." https://bitcoin.org/bitcoin.pdf. Accessed 5 Feb. 2019

[2] "CoinMarketCap." https://coinmarketcap.com/. Accessed 5 Feb. 2019.

[3] "Global Invested Capital Market - Aon." https://www.aon.com/attachments/human-capital-consulting/2014_Global-Invested-Capital-Market_WP.pdf. Accessed 5 Feb. 2019.

# This whitepaper:

(1) Introduces the vision of Creditcoin.

(2) Illustrates the Creditcoin ecosystem.

(3) Provides a detailed explanation of the Creditcoin protocol.

(4) Explains how Creditcoin gets distributed.

(5) Describes the design philosophy and history of Creditcoin.

# I. Introduction

The fundamental services of finance are savings, payments, and investment. Banks hold funds from savers and make them readily available for withdrawal when needed. At the same time, banks invest unused saver funds, turning dormant capital into working capital for society. When done correctly, such activities can optimize the flow of funds and increase the productivity of the economy.

However, this is not always the case. As seen in financial disasters such as the subprime mortgage crisis, banks often take on far too much risk in an effort to achieve high short-term gains. Since savers cannot get clear information on how banks are redistributing their funds, and the goals of bankers often do not necessarily align with those of savers, decisions contrary to the savers' best interests are often made without their knowledge or permission.

In response to the subprime mortgage crisis, Satoshi Nakamoto invented blockchain technology to bring self-determination to economic activities. Before this invention, it was nearly impossible to measure the objectivity of shared information without a central authority. Today, you can perform financial transactions without having to trust any intermediaries.

Although there are advantages and disadvantages to making one's own investment decisions, this can be a possible defense against credit crises. For example, the focus of credit unions on benefits for their members influences the level of risk that the unions are willing to take on. This might explain why credit unions survived the financial crisis in relatively better shape than traditional banks.

The blockchain market seems very successful, with a $70 billion market cap and $1 billion daily transaction volume for Bitcoin alone in early 2018[4]. However, it is still difficult to use cryptocurrency in the current ecosystem, which is mainly developed for fiat currency use. The long confirmation time, high fees and volatility of cryptocurrency make it hard for people living in the fiat currency ecosystem to adapt cryptocurrency into their lives.

Gluwa and Aella jointly created Creditcoin as an adapter that seamlessly connects the best of the two worlds. It takes the blockchain closer to the original vision of Satoshi Nakamoto: a sound currency for everyone.

[4] "CoinMarketCap." https://coinmarketcap.com/. Accessed 20 Feb. 2019.

# II. Creditcoin Ecosystem

Creditcoin is a blockchain-agnostic investment protocol where investors can lend in any cryptocurrency. The Creditcoin network is a general blockchain for investment activities. The network connects investors and fundraisers with matching conditions. The record of activities lasts forever on the blockchain, and the data could be used for future credit evaluation by any interested parties.

An investment in the Creditcoin network starts by matching offers from investors and fundraisers. A fundraiser posts seeking an amount, interest rate, and due period. If there is an investor with matching conditions, the fundraiser and the investor announce the deal to the Creditcoin network. The system verifies the deal's completion by confirming the transfer of the loan.

A collection of investments goes through a process similar to the investment process. If the fundraiser is ready to return the investment with interest, the fundraiser makes a repayment and announce the repayment to the Creditcoin network. In some cases, the investor of a loan may exempt the fundraiser from repayment of a loan.

Each announcement to the Creditcoin network has Creditcoin as a transaction fee. Fees are locked on the network for roughly for a year and get returned to the user.

Overall, Creditcoins are presently functional in that they have been developed in order to allow Creditcoin Users to: (1) lend, borrow, and repay currency on the Creditcoin network; (2) have direct access to other Users for borrowing, lending, and repaying currency; (3) interact on the network and communicate with other Users for borrowing, lending, and repaying currency; (4) verify and validate transactions of borrowing, lending, or repaying currency that are recorded on the Infrastructure; (5) view and possess a decentralized and public credit history of Users which is recorded and expands with each User transaction; and (6) mine, i.e. validate and verify transactions and receive Creditcoins for such mining. The Creditcoin Network empowers users with all of these functionalities.

Gluwa must make it clear that holders of Creditcoin have no rights to participate in or govern that common enterprise or to share in the profits or losses of Gluwa and do not represent an equity or other ownership interest in Gluwa or any other legal entity. Creditcoin Tokens are not designed or intended to provide holders with any income, dividends or returns based on the activities of the Company or any third persons. Additionally, Creditcoins do not reflect or show the indebtedness of anyone or anything, including but not limited to any person or entity.

A diagram of the Creditcoin network in a lending market is shown in Figure 2.

The details behind the Creditcoin protocol are explained in the next section.

# III. Creditcoin

## 1. Introduction

The Creditcoin blockchain is a network matching investors and fundraisers. A fundraiser posts an offer to the network, pegged with some Creditcoin. The Creditcoin works as a reward to the miners of the network. Investors can use the credit history of a fundraiser on the Creditcoin blockchain to evaluate the risk of potential investment, using a credit-scoring model of their choice. The fundraisers can choose to share more information about themselves in order to receive more favorable terms.

There are several reasons why we need the blockchain of credit investments:

1. Direct link between investors and fundraisers: Removes intermediaries to get better interest rates and enables a variety of investment quantities that was previously infeasible due to cost.
2. Decentralized and public credit history: Allows multiple credit scoring systems and lets investors use the system that fits their market of choice.
3. Creating sustainable cryptocurrency ecosystem: Enables cryptocurrency investment to build a sound financial ecosystem on blockchains. The financial ecosystem is self-sustainable if and only if you can save, pay, and invest.
4. Security: Allow sharing credit history without providing personal information to centralized institutions, which are often the target of hacker attacks.

## 2. User Flow

### Introduction

#### Purpose

This section covers a step-by-step guide on how a Creditcoin user will use the blockchain through a loan-cycle.

#### Scope

This section explains how a user would pay Creditcoin to execute a loan deal. From the perspective of an investor, how to create a loan offer, find a fundraiser for the offer, learn the fundraiser's credit history, and make an investment. For a fundraiser, how a search for a loan offer, request for the loan and make a repayment.

## Overview

Creating a transaction on a blockchain is essentially making an announcement. To get your message recorded on a new block, you pay a transaction fee to the blockchain. Unlike Bitcoin, which only has a send transaction, the Creditcoin network supports a different type of transaction per each step of a loan cycle. Investors and fundraisers pay Creditcoin to the Creditcoin network to process each stage of their loan.

**When Do You Pay Creditcoin?**

The rule of thumb is, any action that adds more information on the Creditcoin network will cost you Creditcoin. On the contrary, a work that does not add information to the blockchain is free.

## Fundraiser's Flow

On the Creditcoin network, a fundraiser is an account that borrows funds from another account.

**I. Find a Loan Offer**

A Fundraiser will start a loan-cycle by creating a bid order describing the loan condition he wants. The bid order is announced to the Creditcoin network and attract potential investors.

1. Create a Bid Order

   A fundraiser can announce the details of his bid order. It includes amount, interest, and maturity. For example, a fundraiser may offer to borrow 100 Bitcoin for a 10% interest per 30 days.

   The fundraiser will pay Creditcoin as a transaction fee to the Creditcoin network to create the order.

   Note that the offer is in Bitcoin, not in Creditcoin. On the Creditcoin network, you are not lending or borrowing in Creditcoin, but a cryptocurrency on another blockchain. Currently, the Creditcoin network supports Bitcoin, Ethereum, and ERC-20 token loans.

2. Find Investment Offers

   If an investor likes the fundraiser's bid order, he can create an offer. The offer information includes a set of one add order and a matching bid order.

   The fundraiser can retrieve a list of offers for free.

3. Create a Deal

   If a fundraiser likes an offer he received, he can accept the offer by sending a corresponding deal to the investor. The deal will have the exact loan condition described in the offer.

   The fundraiser will pay Creditcoin as a transaction fee to the Creditcoin network to send the deal.

**II. Make a Repayment**

A fundraiser can repay the full amount to finish the loan-cycle without the involvement of the investor.

1. Lock a Deal

   Before making a repayment, the fundraiser has to block another account from making any change to the deal. Else, we have a potential concurrency problem. The fundraiser may be closing the deal at the same time as the ownership of the loan is sold to another account. In this case, there may be two transfers registered against the same deal order. The Creditcoin network prevents the problem by requiring a fundraiser to lock the deal before making a repayment.

   The fundraiser will pay Creditcoin as a transaction fee to the Creditcoin network to lock the deal.

2. Transfer the Repayment to the Investor

   A deal includes where the fundraiser would like to receive the investment. Note that the repayment transfer happens on another blockchain (e.g., Bitcoin or Ethereum). The fundraiser may pay a transaction fee on that blockchain, but not on the Creditcoin network.

**III. Make a Repayment with an Exemption**

Optionally, a fundraiser may negotiate with the investor for an exemption.

1. Negotiate for an Exemption

   In some cases, a fundraiser may not be able to repay the full amount but a part of it. If so, the investor may choose to accept partial repayment since it is better than nothing. The investor and the fundraiser can communicate outside of the Creditcoin network and negotiate for an exemption.

   Since the negotiation happens outside of the blockchain, it does not cost any Creditcoin.

2. Send a Partial Repayment

   Once the investor agrees to exempt some of the loan amount, the fundraiser will have to repay the rest. Just like the investment transaction, the repayment transaction also happens on another blockchain (e.g., Bitcoin or Ethereum).

   The fundraiser may pay a transaction fee on that blockchain, but not on the Creditcoin network.

Note that in case of repayment with an exemption, the fundraiser cannot conclude the deal on his own. The investor needs to approve an exemption by registering the partial repayment transaction ID to the Creditcoin network. Learn more about the process in the Investor's Flow.

## Investor's Flow

On the Creditcoin network, an investor is an account that lends funds to another account.

### I. Find an Investment Opportunity

An investor will start a loan-cycle by creating an ask order describing a loan offer. The ask order is announced to the Creditcoin network and attract potential investment deals.

1. Create an Ask Order

   An investor can announce the details of his ask order. The detail includes amount, interest, and maturity. For example, an investor may offer to lend 100 Bitcoin for a 10% interest per 30 days.

   The investor will pay Creditcoin as a transaction fee to the Creditcoin network to create the order.

   Note that the offer is in Bitcoin, not in Creditcoin. On the Creditcoin network, you are not lending or borrowing in Creditcoin, but a cryptocurrency on another blockchain. Currently, the Creditcoin network supports Bitcoin, Ethereum, and ERC-20 token loans.

2. Find Matching Bid Orders

   Using the ID string of an ask order, the investor can search for matching bid orders. Fundraisers create bid orders by describing the desired loan conditions. The investor can retrieve a list of matching orders for free.

3. Review a Fundraiser's Credit History

If an investor is interested in any matching bid order, the investor can retrieve a full transaction history of the fundraiser who created the deal. Each bid order includes an identification string of the fundraiser, a sighash. The investor can use the sighash to retrieve the fundraiser's credit history from the blockchain for free.

4. Create Investment Offers

   If the investor likes the credit history of the fundraiser, he can create an offer. The offer information includes a set of one add order and a matching bid order.

   The investor will pay Creditcoin as a transaction fee to the Creditcoin network to create the offer.

   If the fundraiser likes the offer, he will send a deal to the investor.

**II. Make an Investment**

If an investor likes a deal, he can accept it by registering the investment transaction on the Creditcoin network.

1. Transfer the Investment to the Fundraiser

   A deal includes where the fundraiser would like to receive the investment. Note that the investment transfer happens on another blockchain (e.g., Bitcoin or Ethereum). The investor may pay a transaction fee on that blockchain, but not on the Creditcoin network.

2. Complete the Deal

   Once the investment transaction is confirmed on the blockchain, the investor can make the investment official by registering the transaction ID to the Creditcoin network.

   The investor will pay Creditcoin as a transaction fee to the Creditcoin network to complete the deal.

**III. Collect a Repayment**

A fundraiser can repay the full amount to finish the loan-cycle without the involvement of the investor. However, an investor may choose to exempt a partial amount of the repayment.

1. Negotiate for an Exemption

   In some cases, a fundraiser may not be able to repay the full amount but a part of it. If so, the investor may choose to accept partial repayment since it is

better than nothing. The investor and the fundraiser can communicate outside of the Creditcoin network and negotiate for an exemption.

Since the negotiation happens outside of the blockchain, it does not cost any Creditcoin.

2. Accept a Partial Repayment

   Once the investor agrees to exempt a loan, the fundraiser will have to repay the rest of the loan. Just like the investment transaction, the repayment transaction also happens on another blockchain (e.g., Bitcoin or Ethereum).

   After the repayment transaction is confirmed on the blockchain, the investor can finalize the exemption by registering the repayment transaction ID on the Creditcoin network

   The investor will pay Creditcoin as a transaction fee to the Creditcoin network to register the repayment transaction ID.

**IV. Transfer a Bond**

An investor may choose to transfer the ownership of a loan, bond, to another account. We call the new account a “collector.” Once a bond is transferred to a collector, the repayment of the loan will be sent to the collector. This allows investors to liquidate their bonds before the maturity of their loans.

1. Searching for a Collector

   An investor can find a collector for the bond outside of the Creditcoin network. The blockchain does not support any communication tool for this purpose.

   Since the search and communication happen outside of the Creditcoin network, it does not cost any Creditcoin.

2. Searching for a Repayment Order

   A collector will send a repayment order to the investor to purchase a bond. The investor can search for outstanding repayment orders on the Creditcoin network for free.

3. Accepting a Repayment Order

   A repayment order will include payment for transferring the bond. If the investor likes the repayment order, the investor can transfer the bond by accepting the payment.

   The investor will pay Creditcoin as a transaction fee to the Creditcoin network to accept the repayment order.

## Collector's Flow

On the Creditcoin network, a collector is an account that receives the ownership of a loan from another account.

### I. Purchase a Bond

A collector can buy a bond from the investor to transfer the ownership of a loan, bond, to his account. Once a bond is transferred to a collector, the repayment of the loan will be sent to the collector. This allows collectors to acquire bonds closer to maturity.

1. Searching for a Bond

   A collector can find an investor outside of the Creditcoin network. The blockchain does not support any communication tool for this purpose.

   Since the search is a read-only process, and the communication happens outside of the the Creditcoin network, it does not cost any Creditcoin.

2. Create a Repayment Order

   A collector will send a repayment order to the investor to purchase a bond. The repayment order includes a payment to the investor for the bond. The payment can be in any cryptocurrency supported by the Creditcoin network (e.g., Bitcoin Ethereum, or ERC-20).

   The collector will pay the Creditcoin transaction fee to the Creditcoin network for creating the repayment order.

3. Searching for an Accepted Repayment Order

   The collector can search for accepted repayment orders on the Creditcoin network for free.

4. Close a Repayment Order

   After a repayment order gets accepted by the investor, the collector can finalize the purchase of the bond by registering the payment transaction ID. In other words, the collector closes a repayment order. The payment happens on another blockchain, and the collector may have to pay a transaction fee on the blockchain.

   Once the repayment order is closed, repayment of the loan goes to the new owner - the collector.

   The collector will pay Creditcoin as a transaction fee to the Creditcoin network to close the repayment order.

## Conclusion

Creditcoin network has been built to support various investment scenarios and assists in decision making and transitioning of the relevant artifacts through their lifecycle.

# 3. Software Architecture

## Introduction

### Purpose

This document provides a comprehensive architectural overview of the system, using several different architectural views to depict various important aspects of the system.

### Scope

This Software Architecture Document provides an architectural overview of the Creditcoin system developed by Gluwa, Inc. to provide a decentralized credit network.

## Overview

The Creditcoin system is a decentralized credit network for investors and borrowers and to facilitate efficient and safe transactions between parties. A special cryptocurrency named Creditcoin is used as an aid in performing transactions and incentivizing parties to support, develop and expand the network and keep it operational.

### Architectural Goals and Constraints

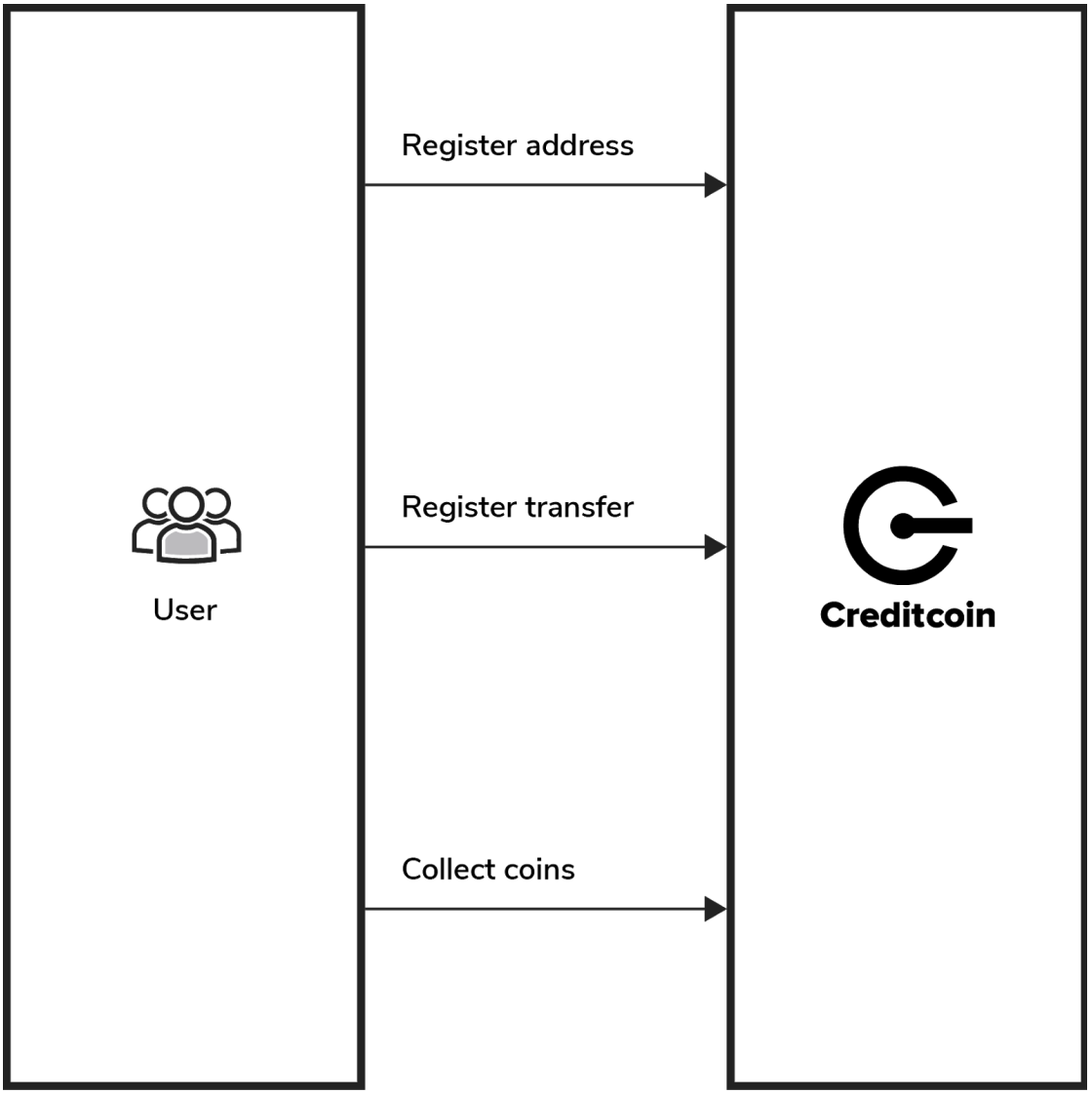
1. To support decentralization, the network is based on blockchain (distributed ledger) technology.
2. To reduce the work required to build a robust and trustworthy foundation for the network, an open source blockchain project was selected based on feature completeness and ease of configuration and modification (Hyperledger Sawtooth).
3. The network supports the booking of investment and borrowing orders in a credit market order book for which canceled or outdated orders are of little interest.

4. The network supports matchmaking, communication between involved parties, and deal booking. The latter is stored permanently on the ledger and may be used for dispute resolution and credit history verification.
5. The network supports interoperability with other cryptocurrencies through a generic gateway that may be customized for use with a particular cryptocurrency.
6. The network uses a special consensus algorithm to incentivize validators and prevent network abuse.
7. All performance, bandwidth and storage requirements were taken into consideration to develop the architecture.

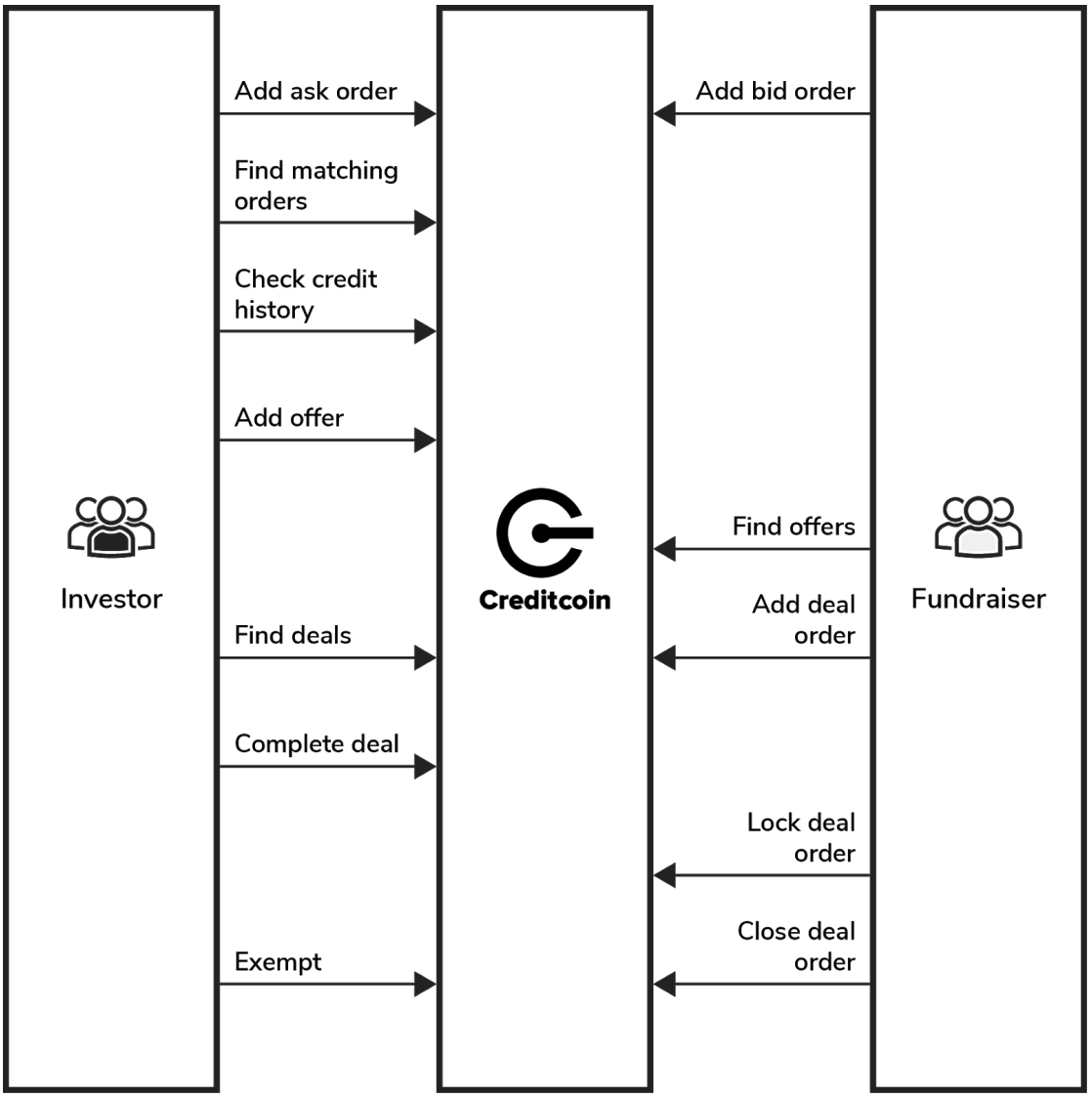
## Use Cases

The figures below summarize the various use cases.

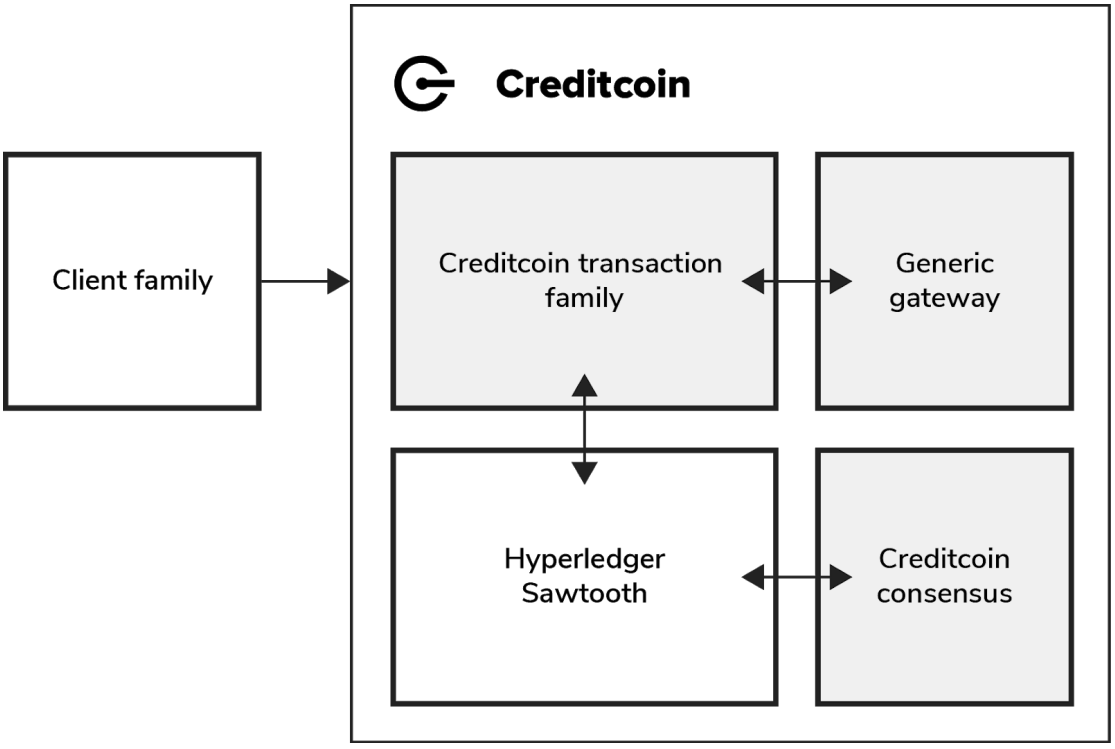
**User Use Cases**



### Investor and Fundraiser Use Cases



## Subsystems and Layering

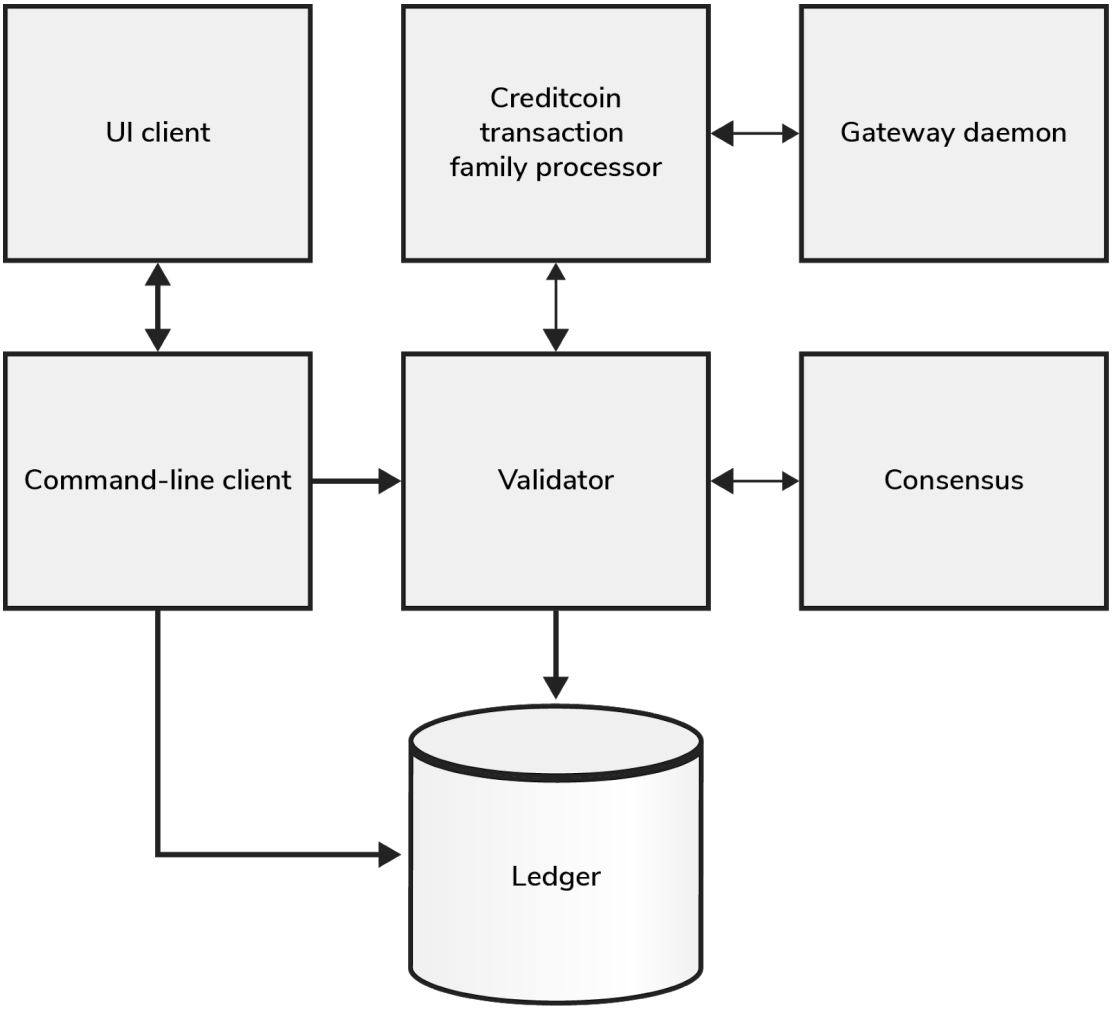



The Creditcoin system is built on top of the Sawtooth project, which provides an implementation of a distributed ledger and interoperation between distributed components of the network. The system provides:

1. **An implementation of the Creditcoin transaction family—a group of operations or transaction types allowed on the ledger—which supports all required operations.**
2. **An implementation of a consensus algorithm to support the requirements.**
3. **An implementation of a generic gateway to interconnect with other cryptocurrency networks, such as Bitcoin, Ethereum, etc.**

A family of client applications was developed for testing and use by end users, which includes a command-line client, a UI client and simulation and load testing clients.

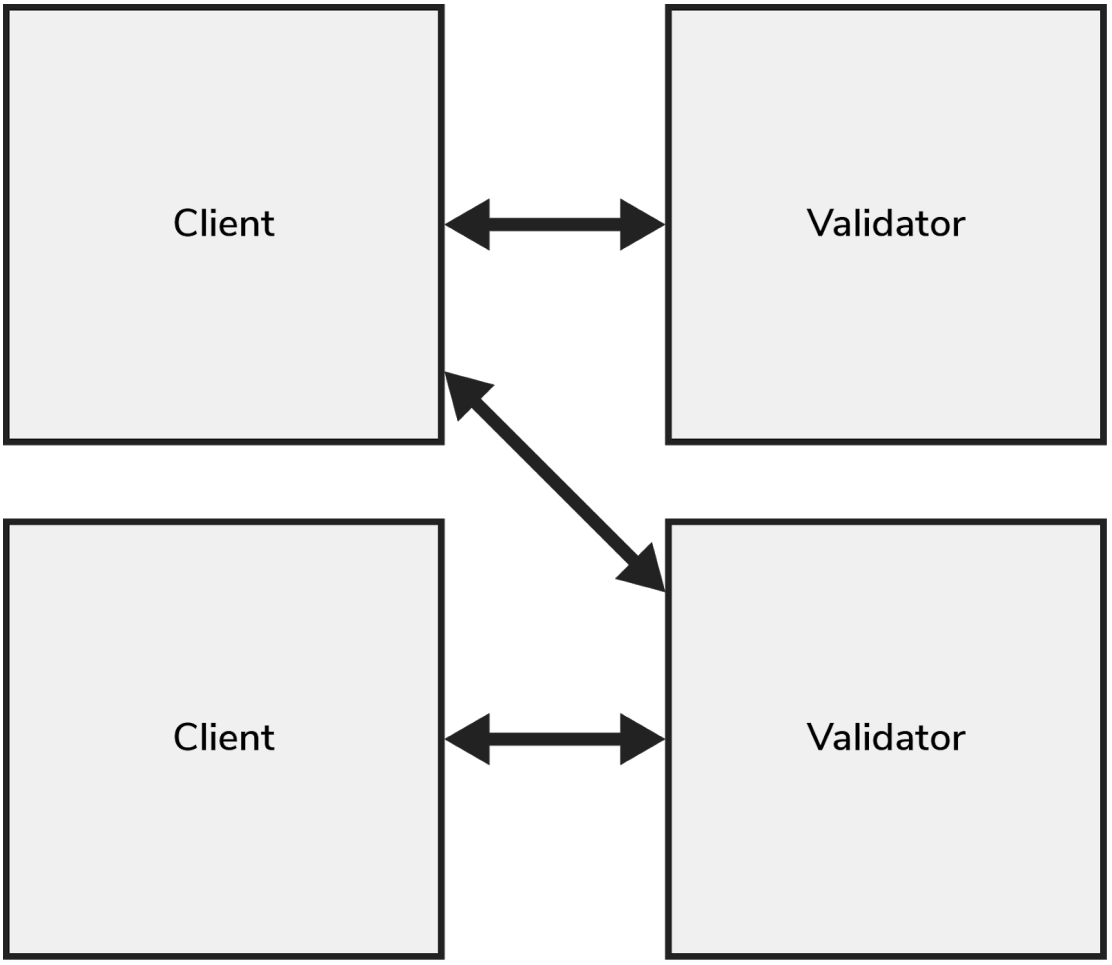
## Processes




Each validator node runs a validator, Creditcoin Transaction Family Processor, Settings Transaction Family Processor (stock, not shown in the diagram), and Creditcoin consensus plugin. A gateway process runs to allow communication with other cryptocurrency networks.

Client applications sends requests to a validator to perform operations on data for a given transaction family; the validator then dispatches the request to a relevant processor. The processor submits the transaction to the ledger. Clients reads the current state of data that has been made persistent by recording it on the ledger.

## Deployment




In the final distributed system, client applications can connect with validators across local or global TCP networks. Any validator accepts transactions from one or more clients and clients sends transactions to one or more validators.

## Implementation Notes

The initial validator network operates on Ubuntu boxes running in Azure. The transaction families were developed and tested on Windows 10, but also runs on Ubuntu. The development language for Creditcoin transaction family is C++; clients are implemented in C#, while the consensus is implemented in Python.

## Configuration Notes

The initial setup runs with a temporary transaction family processor that sets up the Creditcoin components on the ledger. The system is configured to run a predefined set of transaction family processors.

# 4. Creditcoin Workflow

This document covers a step-by-step guide on how you can use the Creditcoin network and Creditcoin through a command-line client. Refer to the User Flow section to understand the what role each command plays in a loan-cycle.

Gluwa Creditcoin is the official implementation of the Creditcoin protocol by Gluwa, a member of the Creditcoin Foundation. The implementation includes a command-line client for Creditcoin users to interact with the network.

Note that you need to pay a transaction fee in Creditcoin per each command.

## Exchange G-CRE to CTC

To start participating in Creditcoin network users need to register their Ethereum addresses and exchange their G-CRE (Gluwa Creditcoin Vesting Token) to Creditcoin (CTC). G-CRE is an ERC20 token used for initial distribution to token sale buyers, Gluwa, and the foundation.

## Register Ethereum Address

G-CRE is transferred from ERC20 by running the 'exchange()' method on the Creditcoin smart contract and collecting the coins on the Creditcoin network.

In the following command:

```
$ creditcoin RegisterAddress ethereum address main
```

'ethereum' is the blockchain, 'address' is a user's ethereum address, and 'main' is the network id.

## Show Address ID of the Registered Address

To find out the address id for the registered address a user can run the following command:

```
$ show Address 0 ethereum address main
```

Where 0 is the sighash that identifies the interactive user and other parameters are the same as provided for registration.

## Exchange G-CRE to CTC

**Using the Registered Ethereum Address**

Now the user can run the following command:

$ ethereum CollectCoins addressId amount

Where ‘addressId’ is the result of the previous show command and ‘amount’ is the amount not exceeding the amount of ERC20 tokens on Ethereum.

**Using the Exchange() Transaction On G-CRE Smart Contract**

Alternatively, the user can manually call ‘exchange()’ on Creditcoin Ethereum smart contract, write down the transaction id and call the following command:

$ creditcoin CollectCoins addressId amount transactionId

Review the Updated CTC Balance

Now the user can display the Creditcoin balance with the following command:

$ show Balance 0

Where 0 identifies the interactive user.

Alternatively, if the user knows a sighash of another user, the user can run the following command:

$ show Balance eccd3cc374e641b8fabf12eff4d5e3506e...

## Create Investment Orders

**Create an Ask Order**

An investor can add an AskOrder with the following command:

$ creditcoin AddAskOrder addressId amount interest maturity fee expiration

Where ‘addressId’ is an id of an address record registered by using ‘creditcoin RegisterAddress’ command, ‘amount’ is the amount for investing in the blockchain identified by the ‘addressId’, ‘interest’ is the interest rate, ‘maturity’ - is a number of blocks to calculate the resulting interest, ‘fee’ is a loan fee and ‘expiration’ is a number of blocks the order is valid for.

**Create a Bid Order**

A fundraiser can add a BidOrder with the following command:

$ creditcoin AddBidOrder addressId amount interest maturity fee expiration

**Search for Matching Orders**

An investor can search for matching orders with the following command:

```
$ show MatchingOrders 0
```

Where 0 is a 0-sighash

For each matching pair of orders, the output will be a list of pairs of the respective order ids:

```
askOrderId bidOrderId
```

**Review Credit History of the Fundraiser**

An investor can check the fundraiser's credit history with the following command:

```
$ show CreditHistory sighash
```

Where 'sighash' is the identifier of the fundraiser.

## Create Investment Offers

**Create an Offer**

An investor can create an offer with the following command:

```
$ creditcoin AddOffer askOrderId bidOrderId expiration
```

Where 'askOrderId' and 'bidOrderId' are the output of the previous 'show MatchingOrders' command and 'expiration' is the number of blocks the offer is valid for.

**Search for Offers**

A fundraiser can check for current offers with the following command:

```
$ show CurrentOffers 0
```

Where 0 is a 0-sighash. The output is a list of offer ids.

## Create Deals

**Create a Deal Order**

A fundraiser can add a DealOrder with the following command:

```
$ creditcoin AddDealOrder offerId expiration
```

Where ‘offerId’ is an id of an offer previously displayed by ‘show CurrentOffers’ command.

**Search for Deals**

An investor can check for new deals with the following command:

```
$ show NewDeals 0
```

Which displays a list of dealIds for the investor.

**Register an Investment Transfer**

To complete a deal Investor has to register a transfer with the following command:

```
$ ethereum RegisterTransfer 0 orderId
```

Where ‘orderId’ is an id of a deal previously displayed by ‘show NewDeals’ command.

This command will create an Ethereum transaction sending the amount of Ether specified in the BidOrder to the address specified in the BidOrder from the address specified in the AskOrder.

Note that the actual transfer can happen elsewhere as soon as it satisfies the requirements, but it still has to be registered with Creditcoin, there is a special form of RegisterTransfer for that - creditcoin RegisterTransfer gain orderId txId (note it's not etherium but creditcoin command and takes additional parameter txid).

**Complete a Deal**

An investor can complete a deal with the following command:

```
$ creditcoin CompleteDealOrder dealOrderId transferId
```

Where ‘dealOrderId’ is the deal being completed and ‘transferId’ is the loan transfer.

**Lock a Deal**

To close a deal Fundraiser has to lock the deal first with the following command:

```
$ creditcoin LockDealOrder dealOrderId
```

Where ‘dealOrderId’ is the deal being closed.

**Close a Deal**

A fundraiser can close a deal with the following command:

```
$ creditcoin CloseDealOrder dealOrderId transferId
```

Where ‘dealOrderId’ is the deal being closed and ‘transferId’ is the repayment transfer.

## Exempt Loans

An investor can exempt a loan with the following command:

> $ creditcoin Exempt dealOrderId transferId

Where ‘dealOrderId’ is the deal being exempted and ‘transferId’ is a partial repayment transfer.

## Transfer Loans

A third party (collector) may offer to transfer the loan ownership by creating a “RepaymentOrder” using the following command:

> $ creditcoin AddRepaymentOrder dealId collectorAddressId amount expiration

Where ‘dealId’ is the id of the deal order, ‘collectorAddressId’ is the address of the new owner, ‘amount’ is the amount offered for transferring the loan.

## Repay Loans

**Search for Repayment Orders**

An investor can check for new RepaymentOrders using the following command:

> $ show NewRepaymentOrders 0

The output is a list of ids.

**Accept Repayment Orders**

An investor can accept a RepaymentOrder using the following command:

> $ creditcoin CompleteRepaymentOrder repaymentOrderId

**Search for Accepted Repayment Orders**

A collector can check for accepted RepaymentOrders using the following command:

> $ show CurrentRepaymentOrders 0

**Close Repayment Orders**

A collector can close the RepaymentOrder by registering a transfer and using the following command:

```
$ creditcoin CloseRepaymentOrder repaymentOrderId transferId
```

## Demonstration

https://www.youtube.com/watch?v=qpvVrChDzZE

Please refer to the live demonstration of the Creditcoin command-line client above for more information.

# IV. Creditcoin Distribution

Distribution of Creditcoins only occurs once Creditcoins achieved the functionalities discussed in this whitepaper. Once Creditcoins are distributed to any user, the user has complete control over its Creditcoins which means users can use the Creditcoin network, exclusive of Gluwa or any other central organization or entity.

### Creditcoin Sale Economics

Total Creditcoin token supply will be 2 billion coins. The token sale is capped at 200 million tokens.

## 1. Token Allocation

Creditcoin tokens are distributed to the four major participant groups of the Creditcoin Network:

- 70% to Creditcoin miners (as mining block rewards) – For providing investment funds, maintaining the blockchain, running contracts, and more.
- 15% to Gluwa, Inc. (Genesis allocation; 6-year linear vesting) – For research, engineering, deployment, business development, marketing, distribution, and more.
- 10% to Investors (Genesis allocation; 6-month to 3-year linear vesting) – For funding network development, business development, partnerships, support, and more. Any unsold coin goes to Creditcoin Foundation with a vesting period of 6 years.
- 5% to Creditcoin Foundation (Genesis allocation; 6-year linear vesting) – For long-term network governance, partner support, academic grants, public works, community building, and more.

## 2. The Creditcoin Token Sale

**Fundraising.** Gluwa, Inc. requires significant funding to develop, launch, and grow the Creditcoin Network. We must develop all of the software required, including mining software, client software, user interfaces and apps, network infrastructure and monitoring tools, software that third-party wallets and exchanges need to support Creditcoin, integrations with other investment software, tooling for web applications and dapps to use Creditcoin, and much more. We must deploy the network, facilitate its large scale growth, market to and bring onboard miners and clients, bring key partners into the ecosystem, and undertake many other tasks.

**Offering of Creditcoin SAFTs.** To raise the necessary funds, Gluwa, Inc. is conducting an offering of SAFTs. This offering is happening in one part:

(1) A private sale for Gluwa, Inc. and Creditcoin community

**Token Sale.** We hope to bring together a large and diverse group of investors from around the world consisting of people who want to work closely with us to build the most powerful cloud credit network. We primarily seek strategic investors who have something high-value and unique to offer to Creditcoin. We also wish to reach as broad of an investor base as possible; we want people and organizations from countries all over the world, who work in many different kinds of industries. We want our investors to represent many different groups so that Creditcoin can quickly come to serve those users and spread across these networks.

We want investors who add value, and who will work with and for the network. We want investors who will share their skills, their knowledge, and their networks to achieve success. We have structured the token sale to reward a large group of people that can help us build the network, by selling Creditcoin at what we think is a much lower price than it will be worth someday. (Caveat: as with any risky investment, of course, we cannot make guarantees or predictions.) We are, unfortunately, legally restricted to involve only accredited investors (global investors accredited to US standards or similar—see the legal section).

**Caps.** A soft cap is the amount received at which your crowd sale will be considered a success. It is the minimum amount required by your project. A hard cap is defined as the maximum amount a crowd sale will receive. This offering has a soft cap of USD 10 million and a hard cap of USD 30 million.

Token Sale Details

- Instrument: Creditcoin SAFTs
- Increasing Price:
    1. As investments are made, the price increases based on the Price Function
- Sale Price Function:
    1. Pre-sale price = min(X, Y) where:
        - X = max($0.85, amountRaised/ $4MM) USD / CTC
        - Y = max($1, amountRaised/ $40MM USD) USD / CTC
    - amountRaised is the actual USD dollar amount that is collected
        - The ETH to USD exchange rate at the time of each individual sale should be used
- Sales Cap: 200 million Creditcoin (unknown how much this is equivalent to in US dollars, as discounts affect the totals) Soft cap USD 10 million. Hard cap USD 30 million.
- Sales Timeline: Private sale starts on September 1st, 2017.

# 3. Vesting and Discounts

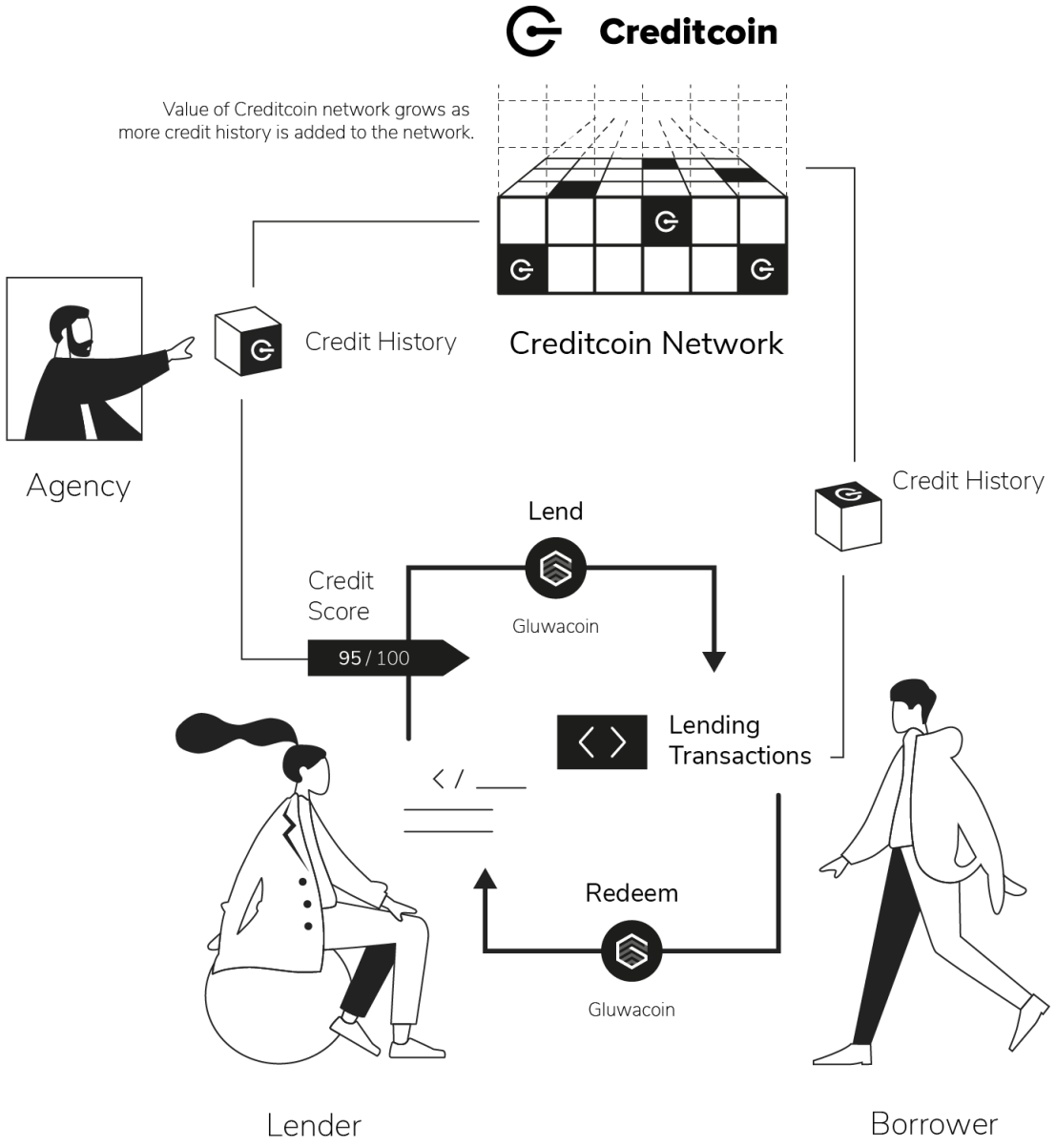
Each group has a different vesting schedule:

- Investors: 6 months minimum
- Gluwa, Inc: 6 years, linear vesting
- Creditcoin Foundation: 6 years, linear vesting
- Miners: Release half-life of 6 years

For investors, the following vesting periods and discounts are available:

- 6 month vesting: 0% discount
- 1 year vesting: 7.5% discount
- 2 year vesting: 15% discount
- 3 year vesting: 20% discount

**Figure 2: Creditcoin Network In Use**



# V. Epilogue - Designing Creditcoin

As James Rickards, the author of Currency Wars, said, “Currency is not only used to buy goods and services... people should be able to lend and borrow to make it a currency.” Although cryptocurrency already has a significant portion of the market (more than $70 billion), it is true that the capital market infrastructure it provides is limited to payment. Cryptocurrency will eventually require a credit network.

People say, “If all you have is a hammer, everything looks like a nail.” Just like with any other technology development project, before we get started with a blockchain project, we have to ask ourselves whether it is the best technology for solving the problem.

The problem we are trying to solve is the vicious cycle that unbanked people experience. We set the unbanked as our target group because they are the stratum that has reason to use cryptocurrency—even with some of the inconveniences associated with the premature ecosystem.

Many people can’t get signature loans from the traditional banking system. As a result, they borrow money using other methods, and banks cannot record these transactions. So, credit records do not accumulate in the banks, which means that people cannot build credit—there is no reason for banks to believe the individual files of lenders. Eventually, the vicious cycle of receiving credit loans again in adverse conditions repeats. To summarize, the credit history of the unbanked does not get objectively accumulated.

The solution is to build a system that stores credit records objectively. As I said earlier, a blockchain is a technology specialized in keeping data objectively. The blockchain is the perfect technology to solve this problem.

Once you decide to use the blockchain, you need to make a choice: Are we using a smart contract, or are we building our proprietary blockchain?

A smart contract is enough to store information on the blockchain. We can save much time if we use a blockchain with a well-established ecosystem as a platform such as Bitcoin or Ethereum. Designing and building a proprietary blockchain is very time-consuming.

However, existing blockchain platforms are slow and expensive. A blockchain is a system that runs the same computation repetitively. Therefore, the best performing blockchain is always less efficient compared to a centralized server. Also, multi-purpose systems like Ethereum are less efficient than single-purpose systems like Bitcoin. Platform blockchains will stay relatively slow and expensive for many years to come.

We have experienced the limitations of the existing blockchain platform.

After designing the Creditcoin, we first built the Creditcoin with ERC-20 standard smart contract of Ethereum to make a proof-of-concept of Creditcoin. Something had happened by the time we finished building the smart contract. At that time, Cryptokitty on Ethereum was becoming popular, and transactions began to accumulate without being processed, which caused the cost of using Ethereum to increase considerably, making it economically impossible for the unbanked to use the smart contract. Our partner, Aella, gets over 1,000 loan requests per hour. We concluded that we could not operate Creditcoin as an Ethereum smart contact.

We finally decided to develop a proprietary blockchain. After reviewing the requirements, we found that Hyperledger Sawtooth was the best for our needs. Our blockchain architect, Vlad, will discuss the details in Session 6.

We decided to develop a blockchain with a single purpose. Creditcoin is only intended for recording credit transactions. In the end, users who want to transact Cryptokitty and others who wish to trade file storage space don't have any reason to compete with each other for limited bandwidth. Blockchains with a single purpose will not interfere with each other's traffic since they are in different markets. User behaviors will determine the cost and the traffic of each blockchain.

During the design process, we were confronted with endless questions (and answers).

At first, we started by defining what a loan is. A loan is essentially a conditional transaction. There are usually dozens of conditions you can set for a loan, and that means there are thousands of possible types of loans. As Creditcoin is not a smart contract platform, it should not support every kind of loan. Then, what is the most basic loan? It is borrowing money and paying it back with more money. In short, it is a contract saying, "I will repay $110 if you lend me $100." You will pay interest even if you pay back earlier than the expiry date. More specifically, it is a non-collateralized bullet loan with a prepayment penalty.

Next, we've defined the types of transactions in the order of creating a loan contract. First, there is a bid, offer, and deal at the stage where both users agree on the conditions of a loan. Then, there are two transactions: an investment transaction for a lender to send money to the borrower and a repayment transaction for a borrower to repay the money back to a lender. At this time, if the lender and the borrower have negotiated the reimbursement amount, the lender may receive only a portion of the money and exempt the rest. The lender may also transfer the receivables to another person as a creditor.

A difference between Creditcoin and Bitcoin is that Creditcoin needs to support a variety of different types of transactions.

There has been much discussion about supporting collateral. In reality, many loans have collateral. If security tokens mature, they will play a useful role as collateral for Creditcoins. For example, you can borrow money with the real-estate security tokens as collateral for loans. However, the standard for the security token does not exist yet, and we do not see any substantial traction of security tokens. Therefore, we

have decided not to implement this idea until the security token establishes a mature ecosystem.

As a public blockchain, we also had to decide on a consensus algorithm. Currently, the industry is struggling with a variety of consensus algorithms. Proof-of-Work represented by Bitcoin, Proof-of-Stake that Ethereum plans to adopt, and Proof-of-Distribution that we designed were on the list. However, Proof-of-Work is the only battle-proven consensus algorithm. We decided not to reinvent the wheel.

Some people criticize Proof-of-Work, saying that it only handles a limited number of transactions and it is slow. If Creditcoin runs into a scalability problem, it means that Creditcoin is very successful. We hope that we can run into such a problem. If another agreement algorithm turns out to be better for our purposes, then we can go for it and implement it. We need a blockchain that we can use today.

Bitcoin only supports a single type of transaction: transfer. However, Creditcoin needs to support seven types of transactions. Each transaction will have a different value depending on the user, and demand for transactions will also vary. What if users ask for extra fees for certain types of transactions? If miners get the transaction fee as Bitcoin miners do, a transaction with more transaction fee attached to it will be a priority for miners. This might cause bottlenecks. For example, although users have made 100 loan agreements, no investment transactions get processed.

So, we decided to see how the market would respond to a wide range of transactions. The initial release of Creditcoin will have a fixed transaction fee. We will collect live usage data to make decisions for future development.

Ideally, users should be able to get a loan on any blockchain. How would Creditcoin know if investment or repayment transactions are done correctly on other blockchains? We use the transaction ID of other blockchains. Creditcoin node operators run nodes of different blockchains and enter transaction IDs to look up transaction details in other blockchains.

Creditcoin currently supports Bitcoin and Ethereum. Creditcoin can support a blockchain as long as a Creditcoin plug-in is developed.

Now Creditcoin is completed. With Creditcoin, you can get non-collateralized bullet loans with a prepayment penalty, and you can transfer loans as well. If you develop a plug-in, you can connect any blockchain to Creditcoin. Creditcoin matches loan orders in the blockchain and verifies the investment and repayment transactions in other blockchains. Welcome to the borderless credit market.

# VI. Regulatory, Compliance, and Legal Considerations Section

Currently, digital tokens are being closely and regularly scrutinized by various regulatory bodies around the world, including but not limited to the SEC, European Securities and Markets Authority, and each individual state in the United States. Law regarding ICO's is an evolving area of law, and there is no clear guidance from regulatory agencies, courts, and laws regarding legally-compliant practices for ICO's. As a result, the future evolution of the law and potential consequences are too speculative for the Gluwa to reasonably foresee and act upon. However, Gluwa has taken good-faith measures to account for the evolving law and rules on ICO's and in an effort to comply with such law, but there is still substantial risk surrounding legal compliance for any ICO in light of the little legal guidance. There is a substantial risk that in numerous jurisdictions, including the United States, Creditcoins may be deemed to be a security, meaning such token must be registered or comply with an applicable exemption from registration. For example, applicable securities laws may limit the ability to hold more than certain amounts of Creditcoins; restrict the ability to transfer Creditcoins; require disclosure or other conditions on you in connection with any sale of Creditcoins; and may restrict the businesses that facilitate exchanges or effect transfers of your Creditcoins. Every user, purchaser, and holder of a Creditcoin is required to make diligent inquiry into determine if the acquisition, possession and transfer of Creditcoins is legal in its jurisdiction and to comply with all applicable laws and any of Gluwa's terms and conditions. Creditcoins and the Creditcoin network may be eliminated by future regulation or legal actions. In response to such action, Gluwa may take actions that adversely impact you and the Creditcoins you hold, including: (a) ceasing operations or restricting access in certain jurisdictions, (b) voiding, refunding or not processing token purchases, or (c) ceasing operations entirely.

Each token holder is: (a) if in the United States, or a U.S. Person (as defined in Regulation S under U.S. Securities Act of 1933 (the "Securities Act")), an accredited investor (as defined in Regulation D under the Securities Act) or (b) if outside of the United States, a non-U.S. Person who is not purchasing for the account or benefit of a U.S. Person (as defined under Regulation S under the Securities Act). Each token holder of Creditcoin is sophisticated in terms of investment, business, and/or blockchain technology, or be able to fend for themselves or have access to the information that can allow such purchaser to fend for themselves with regard to the subject matter of Creditcoins.