

# Sikoba – home of the IOU economy

## Green Paper

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“Credit and credit alone is money.”  
— Alfred Mitchell-Innes

Sikoba is a decentralised money platform based on peer-to-peer IOUs and built on blockchain technology. Participants who know and trust each other in real life grant each other credit lines in the Sikoba system. They can then pay each other without using fiat money. These peer-to-peer credit relationships are governed by contracts with specific conditions, fee structures and repayment rules. Using credit conversion, payments between participants who do not trust each other become possible. Fiat money or cryptocurrencies are used when there are no credit links between participants, or to repay outstanding balances when needed.

This Green Paper provides an overview of the project’s functional aspects and will serve as one of building blocks of our future Whitepaper.

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## 1. Project background

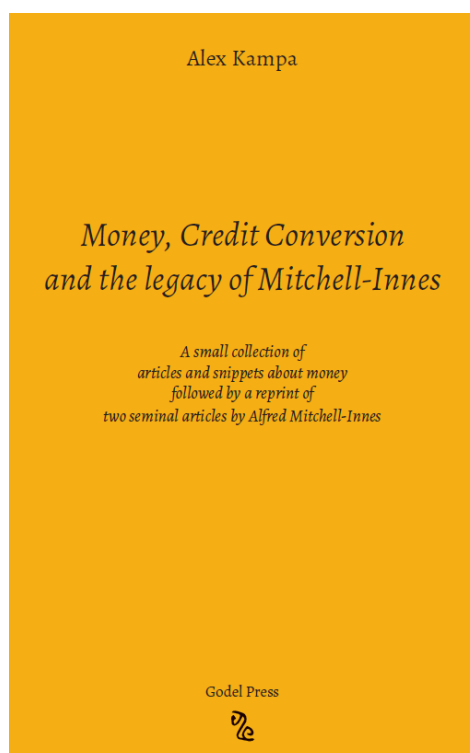
I discovered the credit theory of money in 1987, from the books of the German publicist and writer Paul C. Martin<sup>1</sup>. This was just after a rather disappointing encounter with economics, a subject I had chosen as my 3<sup>rd</sup> year specialisation at the Ecole Centrale de Paris. The way economics was taught there I did not find very convincing. As to the approach to money, with a focus on M1, M2 and M3 monetary aggregates, it made even less sense. What I read in PC Martin's writings mostly did.

The next two and a half decades were spent working in various ventures, all related to financial markets, banking, IT and Internet. However, I never lost interest in monetary theory, and discovering the writings of Alfred Mitchell-Innes in the early 2000s rekindled my desire to do some useful work in this area.

The call to action finally came after I got involved with blockchain technology in early 2015. Here, finally, was an ideal substrate for realizing my ideas. Money and credit could get created on the blockchain, live on the blockchain and finally get cancelled on the blockchain.

In late 2015, a first project focusing on secondary currencies did not take off. The idea of applying *credit conversion*<sup>2</sup> to IOUs emerged circa January 2016. A legal entity, Sikoba Ltd, was created in July 2016 with a modicum of seed funding. A small book "Money, Credit Conversion and the legacy of Mitchell-Innes" came out in December 2016. A first attempt at a token presale failed, another is under way. We have started to work on POC code. Some issues, such as the best to handle linked exposures in clearing, are still partly unresolved.

Despite only marginal funding and the usual uncertainties faced by start-ups, the project continues to be carried by a strong sense of purpose.



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<sup>1</sup> He calls this theory "debitism"

<sup>2</sup> A concept from the *Credit Conversion Theory of Money* [\[link\]](#)

## 2. Project Summary

(from [https://www.reddit.com/r/sikoba/wiki/docs/summary\\_en](https://www.reddit.com/r/sikoba/wiki/docs/summary_en))

Sikoba is a global and decentralised credit platform based on peer-to-peer IOUs and built on blockchain technology. The project, which is the brainchild of monetary systems expert Alex Kampa, is currently performing a token presale to fund work on specifications and the development of a proof-of-concept. A crowdsale is planned for late 2017 to fund the development of fully operational system, to be rolled out in the third quarter of 2018.

### Vision

P2P payments are already above \$1 trillion annually. From almost nothing 10 years ago, P2P lending has grown to \$26bn in 2015 (excluding China) and is expected to reach \$900bn in 2024. We believe that P2P IOU systems have a similar potential and that they will soon become the next frontier in finance.

### Concept

Participants who know and trust each other will be able to use the Sikoba network to extend lines of credit, denominated in currencies of their choosing, to each other. These credit relationships will be capable of including fees, repayment rules and other conditions specified via “credit scripts”. In turn, these credit lines established between trusted parties will allow Sikoba network participants who do not trust each other to pay using trusted credit intermediaries and credit conversion, a configurable rippling algorithm which automatically adapts and optimises the credit terms to the expanded trust circles.

Sikoba's basic and most important rule is that a user will only ever have credit exposure to those he has expressly chosen to trust.

The major advantage of Sikoba compared to lending or value transfer platforms is that participants can pay each other with IOUs even in the absence of fiat money, cryptocurrencies or other assets. Whenever possible, debts are erased by a process of clearing, which is a system of ongoing compensation between participants. Fiat money or cryptocurrencies will be used when there are no credit links between participants, or to repay outstanding balances when needed.

Sikoba is being designed as a decentralised system with the goal of eventually becoming independent and self-organising. As a “federated blockchain”, a permissioned mining model where only authorised nodes add blocks to the blockchain, the Sikoba federation will be self-governing, meaning that members will be chosen by the Sikoba users themselves.

The Sikoba platform will enable people and businesses to efficiently create and manage credit relationships within an emerging IOU economy. The platform will be accessible via web and mobile interfaces with biometric authentication.

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## Examples

In a simple, one-on-one credit relationship, if Bob trusts Alice, he can open a credit line to her. This means that he is willing to accept her IOU as payment, instead of bank money, in a given currency and up to a given amount. If Alice chooses to pay Bob that way for a given transaction between them, this will be recorded on the Sikoba blockchain as a debt of Alice towards Bob.

Suppose Alice wants to pay Charles using Sikoba, but does not know him personally. However Bob and Charles know each other, and Charles accepts Bob's credit. The Sikoba system can automatically route Alice's payment through Bob (assuming Bob has agreed to this), with the result being that Alice will have a debt towards Bob, and Bob a debt towards Charles. This is called credit conversion and enforces Sikoba's basic rule that a user will only ever have exposure to those he has expressly chosen to trust. Applying this mechanism successively, Alice gains the ability to transact with a large number of users even if she does not know them. Note that at each step, a user granting credit lines and allowing credit conversion fully controls the terms of the credit relationships he/she is prepared to enter.

Finally, if Alice has issued an IOU to Bob, Bob to Charles and Charles back to Alice, the Sikoba system will automatically offset of such debts and leave only residual balances.

## Business model

Small transaction fees will be charged for using the platform, for which users will need to purchase Sikoba's SKO tokens. The system will be designed to keep transaction fees permanently low, while SKO tokens should tend to become more valuable as transaction volume grows. The marketing will focus on existing networks, business or social.

### Use case #1 : B2B and trading-company credit system

Sikoba will provide an efficient and inexpensive solutions for the B2B trade credit system. It will allow groups of companies, that do business with each other on a regular basis, to do so on credit without the traditional costs associated with bank credit or factoring. The system will allow companies to create cross-company credit systems, registering invoices into the system and only paying residual balances after periodic clearing. This should also result in a much more efficient trade credit system.

### Use case #2 : Alternative for micro-credits

Micro-credits carry very high interest rates, sometimes over 50% annualised. They are also difficult to obtain, especially in areas where the next bank is far away. Bank money will always be needed for some purchases, such as specialised equipment. By using the Sikoba platform, however, artisans and merchants can start using their own credit for local trade, thus decreasing their reliance on bank money and micro-credits.

## 3. Introduction to credit mechanisms

### 3.1. Money Primitives

The three “primitive” monetary operations are the following:

1. **Issuance** : this is when a money token (in whatever form) is transferred from its issuer to another party – it is the moment when money is created
2. **Transfer** : when money is transferred between two parties, none of which is its issuer
3. **Redemption / cancellation** : when the money token returns to the issuer, thereby ceasing to be money (but possibly retaining some value, as with a coin)

To that we can add a fourth operation, which is the exchange of tokens:

4. **Exchange** : a simultaneous transfer of money between two parties

### 3.2. A simple credit system

A few centuries ago, most trade in small communities was done on credit. People knew each other, and when they transacted they generally did it on credit, very little actual money changed hands. At regular periods, debits and credits were tallied and cleared.

We can model this by the issue of tokens, assuming all tokens are equivalent and expressed in a common unit of value. Here is an example of a simple chain of transactions of equal values:

[T1] Simple transaction chain	A	B	C
A buys from B by issuing a new token of 10 units		A#10	
B buys from C using A's token			A#10
C buys from A using the same token	A#10		
A cancels out his own token	-		

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In reality, most credits and debits were recorded in writing. It would therefore be more exact to represent this with a new token issue for each transaction. In that case, the number of tokens issued is also equal to the volume of transactions made.

[T2] Another transaction chain	A	B	C
A buys from B for #10		A#10	
B buys from C for #8		A#10	B#8
C buys from A for #12	C#12	A#10	B#8

After this, "clearing" can take place in two ways. The first method is by exchanging tokens, for example:

[T3] Clearing of debts by token exchange	A	B	C
Initial holdings	C#12	A#10	B#8
A and B exchange #10	C#2 A#10	C# 10	B# 8
B and C exchange #8	C# 2 A#10	C# 2 B#8	C# 8
Own tokens get cancelled	C# 2 <del>A#10</del>	C# 2 <del>B#8</del>	<del>C# 8</del>
Result:	C#2	C#2	

Much more practical, especially with a larger number of counterparties, is the tallying of assets and liabilities (a token issued by one party is an asset for the holder, but a liability for the issuer), and to compute the resulting difference.

[T4] Clearing of debts by summation	A	B	C
Initial holdings (assets)	C#12	A#10	B#8
Tokens issued (liabilities)	A#10	B#8	C#12
Result:	2 CR	2 CR	4 DB

Whichever the method used, this debt clearing was often done during the seasonal fairs, when all would congregate in the same place. Remember that this would only have worked if all credits were considered equivalent. Residual credits and debits would either be carried over, or settled with actual money.

## 3.3. Transacting beyond one's network

There will of course be situations where a seller of good or services will not know, or trust, a buyer enough to extend credit. Let's look at transactions between two parties who do not have a direct credit relationship with each other.

Say A and C have no credit link, but A is trusted by B, who in turn is trusted by C, which can be represented as follows:

$A \rightarrow B \rightarrow C$

In order to pay C, A might use his trust relationship with B:

[T5] Using an intermediary	A	B	C
A exchanges tokens with B	B#10	A#10	
A buys from C using B's tokens		A#10	B#10

Another way of looking at this is that B agrees to let A use his credit – something that we will also call “credit conversion”. It is equivalent to B agreeing to have his credit attached to A's token.

Adding fees

However, even if B accepts A's credit, there may be a fee involved. For example, B may have a higher credit rating than A and require 10.3 of A's tokens for 10 of his:

[T6] Using an intermediary, with a one-time fee	A	B	C
A exchanges tokens with B at a discount	B#10	A#10.3	
A buys from C using B's tokens		A#10.3	B#10



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So far so good, but what if B is a banker and, in addition to an up-front fee, also requires an interest payment? This cannot be easily represented with just tokens any more:

[T7] Using an intermediary: fee + interest	A	B	C
A exchanges tokens with B at a discount ...	B#10	A#10.3	
... and agrees to pay interest		%%	
A buys from C using B's tokens		A#10.3	B#10

Finally, let's look at a slightly more complex situation, in which two steps are necessary to transact between A and C, each of them subject to fees and interest payments.

A → B1 → B2 → C

Imagine that B1 is a local bank, B2 is a regional bank, and C is a prominent merchant who demands payment in regional bank money. To transact, A needs to borrow from B1, who in turn needs to borrow from B2. Whatever costs B1 has of using B2's credit will need to be included in the agreement between A and B1.

[T8] Using two intermediaries	A	B1	B2	C
A asks B1 to exchanges tokens with B2		B2#10	B1#10.2	
Lending agreement between B1 and B2			%%	
A and B1 exchange tokens	B2#10	A#10.506	B1#10.2	
Lending agreement between A and B1		%%		
A buys from C using B2's tokens		A#10.506	B1#10.2	B2#10

Note that although transactions like the one just described do not normally occur in developed countries today, something quite similar was still occasionally occurring in the USA as late as the beginning of the 20<sup>th</sup> century, before the creation of the Federal Reserve, as reported for example by Mitchell-Innes.

## 4. The Sikoba credit system

### 4.1. Credit acceptance

#### 4.1.1. Overview

The entire edifice of Credit Mechanics rests on the concept of *credit acceptance*. The desire of an economic agent to issue credit means nothing without the presence of other economic agents willing to accept that credit.

In the normal, unconstrained course of business, credit acceptance is voluntary. Governments can however impose laws of legal tender. In developed economies, this does not constitute any impediment. Legal tender money is generally backed by government credit which is the highest credit available and would be accepted even without legal tender laws<sup>3</sup>.

#### *Specific credit acceptance*

In general, before a credit relationship can exist, economic agents need to know each other and have an established trust relationship. The decision to accept a counterparty's credit is then based on specific information about that counterparty's circumstances and creditworthiness.

#### *Generic credit acceptance: high-credit institutions*

Certain organisations acquire a notoriety such that their credit becomes widely accepted in the marketplace. Such organisations have generally obtained a credit rating from one or more reputable rating agencies, which enables them, for example, to issue publicly traded debt instruments.

Many economic agents will be prepared to accept the credit of such high-credit institutions based on their credit rating rather than on a direct trust relationship.

#### *Generic credit acceptance: money-grade institutions*

Banks are a special case of high-credit institutions because, by definition<sup>4</sup>, their credit is money and is therefore universally accepted. In most countries, the credit of the central government and of certain government agencies is of equal, if not higher, creditworthiness.

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<sup>3</sup> it is useful to keep in mind that a) legal tender laws are of no material importance to a functioning money system, viz England 1979-1820 and China for most of its history b) it was not unusual for kings and princes to devise draconian punishments to force an unwilling public to accept their coins c) government credit was by no means always the highest one.

<sup>4</sup> "by definition" because when a bank's credit declines so far that it is no longer money, then it ceases to be a bank.

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## 4.1.2. Credit acceptance in Sikoba

The basic concept is simply this: a user can choose to accept another user's credit, or IOU. That credit line will need to have certain mandatory characteristics, such as currency and amount. It can also have optional features and conditions.

Let's say Bob decides to accept Alice's credit up to the amount of €500. This means that he is willing to accept Alice's IOU as payment, instead of money, up to the amount of the credit limit. This can be represented as:



To be more precise, we can include the credit limit and the indication that there is no outstanding obligation yet:



In this relationship, Bob is the “**credit acceptor**” (potential creditor) and Alice the “**credit issuer**” (potential debtor).

It is important to note the fundamental asymmetry in the roles of Alice and Bob. Bob is active at the beginning: he decides to accept Alice's credit. Then Bob and Alice negotiate credit terms. Once that is done, Alice has the initiative: she can decide whether and when to use the credit line. Note that this asymmetry will even out in the case of bilateral credit agreements.

Suppose Alice visits Bob's shop and decides to buy a widget costing €200. Of course, Alice could just pay Bob in cash if she wanted to. But she could also choose to use her credit line, in which case the result could be represented so:



Note that Bob could potentially grant Alice multiple credit lines, with different credit terms.

### 4.1.3. Negotiation of credit terms

A credit line between two users is created following a negotiation process. Suppose Bob and Alice do not yet have a credit relationship in Sikoba, and Bob wants to grant Alice a credit line. This will be done in two steps: creation of a context, followed by the creation of the credit line itself.

#### *Credit context*

Bob will first set up a context, which will specify general conditions for all credit lines to be granted to Alice. These conditions must include a general cap on exposure across all credit lines, and may include requirements to receive some information on Alice's credit exposure, or knowledge of her KYC status.

If none of the conditions require Alice's consent, the context is created immediately.

Some of these conditions may require Alice's consent. In that case, Alice will be notified and can decide whether to accept or reject Bob's requirements. She can also ask Bob to modify the conditions. The context is created only after Alice has given her consent.

#### *Credit line*

Bob then defines specific terms for a credit line and proposes it to Alice. Although terms can be of arbitrary complexity (cf "credit scripts" below), it is likely that in most cases simple terms will be chosen: a credit limit, a repayment target, maybe an interest rate, maybe an interest-free period.

Alice can accept or reject, or negotiate with Bob changes to the terms. In any event, the credit line will only become active once Alice specifically agrees. Any even then, it will be her decision whether to use it or now.

### 4.1.4. Modifying credit terms

Modification of credit line terms by mutual consent will of course be possible. From a technical perspective this will, with some minor exceptions, mean closing an existing credit line, reopening another, and similarly closing/reopening any relevant IOUs.

When the terms of the new credit line are, in all of the possible aspects, equal or more favourable to the credit issuer, the procedure may be done unilaterally by the credit acceptor.

## 4.1.5. Managing and cancelling credit lines (credit issuer)

### *Weighting credit lines (credit issuer)*

The credit issuer will be able to decide how available credit lines are used. One of the tools available will be a weighting between 0 and 10, determining the priority which should be given to a credit line when making a payment. A weighting of 0 means the line will never be used. That will be a way of silently refusing a credit line<sup>5</sup>.

### *Cancelling credit lines (credit issuer)*

Credit lines can be cancelled by the credit issuer if the credit line is unused. If there is an exposure on that credit line, it must be removed. This can be done by repaying any outstanding IOUs linked to that the credit line.

There may be cases where the line cannot be cancelled or the debt repaid right away because of contractual conditions attached to it<sup>6</sup>. In that case, the credit issuer can propose a cancellation together with a payment, which the credit acceptor will be able to accept or reject.

### *Withdrawing credit lines (credit acceptor)*

In general, a credit line can be reduced or withdrawn by the credit acceptor, although this may be limited by contract<sup>7</sup>. Also, any outstanding IOUs will not be immediately affected by this. Even if the credit terms gave the credit acceptor the right to unilaterally cancel the credit line, the credit issuer will have a certain time to cover any existing exposure. This will be specified in the terms of the credit line, and there will also be a system default

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<sup>5</sup> There are people whom we know, but with whom we do not wish to have business dealings. Out of politeness we may not want to reject a credit line if offered, but might not want to ever use it, except maybe as a last resort.

<sup>6</sup> Example: a bank grants a credit line to a company for 12 months, with the contract stipulating that an unused line fee of 1% annualised must be paid every month. If the company wanted to cancel that credit line after 6 months, the bank will probably insist on the payment of the unused line fee for all or at least part of the remaining 6 months.

<sup>7</sup> Example: a bank has granted a credit facility of US\$ 1,000,000 to a company for 12 months, at a set interest rate of 4%. At signing, the company has paid the bank a flat fee of US\$ 10,000 for the facility. After six months, the bank notices that the credit line is never actually used, which makes it unprofitable for the bank. It offers to reimburse the client US\$ 6,000 and close the credit facility line.

## 4.2. Credit Terms

Credit is rarely granted without any conditions whatsoever. Bank credit (especially central bank credit, including banknotes) comes close to unconditional credit – which can be used for “final payment”. Most other credit will have a requirement for settlement within a certain timeframe.

Because a credit line represents a contract, almost any condition can be programmed. We can distinguish pre-conditions, settlement terms and credit terms as such. In Sikoba, these will be configurable via “credit scripts.”

### 4.2.1. Pre-conditions

Even if a participant is prepared, in principle, to extend credit, some restrictions may apply.

For example, the credit acceptor may want to reduce his incoming credit lines when his own credit condition is getting tight, and he does not want to lose his ability to draw on his remaining credit lines: “a cash-strapped person is less willing to lend money to friends and business partners.”

Another reason to restrict credit given is the exposure level of the credit issuer. If the credit issuer is overextended, i.e. has drawn on too many existing lines at once, the credit acceptor will be less inclined to provide credit. A simple situation may simply be “I give you a credit line of #1,000, but only as long as your total exposure does not exceed #20,000.” Note that if the credit issuer accepts this condition, the system may not allow him to exceed a total exposure of #20,000 if he uses that credit line.

### 4.2.2. Credit terms

Between friends, credit may be given informally and without any specific fees attached, but with the expectation of either reciprocity or repayment within a “reasonable” time.

Between business partners, however, things can get more complex. The credit line that Bob grants Alice could for example specify: “2% discount if paid cash within 5 business days, payable in full within 30 calendar days, interest accruing at 5% p.a. if payment after 30 days.” We can indicate the presence of such credit terms like so:



When a bank (or equivalent institution) is involved, there is a variety of possible fees. First, there may be a fee to just grant the line, then an annual fee to maintain it. Then there may be a fixed fee every time the corporation draws on the line, and interest on the amount outstanding. The interest rate itself may depend on the credit rating of the company: if a downgrade occurs by a predetermined rating agency, the interest rate may increase automatically.

### 4.2.3. Settlement terms

A credit line must specify settlement terms, i.e. a way to cancel or repay an obligation. In most cases, bank credit (i.e. fiat money) in the same currency that the IOU is denominates with will be accepted, although Sikoba participants will be able to define other settlement terms, including settlement outside of Sikoba.

In general, a credit line will also specify a settlement delay, i.e. the number of days (or weeks or months) after which a debt must be settled.

For example, suppose Bob accepts Alice's IOUs for 30 days. Alice paid €200 to Bob, but 30 days later there was no offsetting transaction. The Sikoba system will then automatically look for assets that Alice can use to settle the obligation. Let's say Alice has a €500 credit balance with a bank. This can be used to settle accounts with Alice as follows:



Another possibility is that Alice pays Bob €200 outside the Sikoba system. Bob would then cancel the corresponding IOU in Sikoba.

Note that a debt may not always be settled at any time. Some credit arrangements may be for fixed periods, and must be covered at maturity, not before.

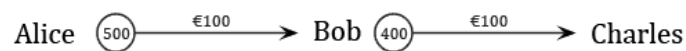
### *Payment finality*

When a payment is done using a sufficiently high credit, such as bank money or government money, the payment is usually final. This is because the token received can be used with little or no restrictions for further payments.

## 4.3. Credit Conversion and Optimal Payment Paths

In the Sikoba system, as in the real world, users will only be asked to accept the types of credit that they specifically choose. Money, being the highest credit, is accepted by all, and there may also be some other well-known entities whose credit will be widely accepted. But otherwise, if a user could only have credit interactions with his trusted network, this would significantly limit the number possible of credit interactions in the system.

For that reason, we use the age-old method of going through trusted intermediaries. In Sikoba, we call this mechanism *credit conversion*. Credit conversion occurs when one participant allows another to use one of his credit lines<sup>8</sup>. If Alice wants to pay Charles, but does not have a credit relationship with him, she may be able to use the credit line that Charles has granted Bob.



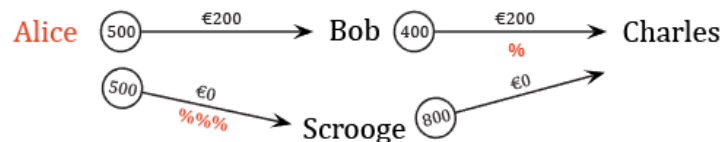
Applying the mechanism of credit conversion successively, Alice gains the ability to transact with many users even if she does not know them.

Users have full control of the credit conversion process. For each credit line granted to him, a participant will be able to decide whether that credit line will be available for credit conversion, to whom, up to what amount and on what terms. In the example above, Bob may have decided to make available to his network €200 of his credit line to Charles, for at most 30 days and at 1% annualised interest.

Note that Bob would have made this decision beforehand. He would not need to take any action when the transaction between Alice and Charles occurs.

### *Optimal Payment Paths*

Multiple payment paths between two users may be available, with different associated costs. The shortest path need not be the least expensive. The Sikoba system will automatically find the least expensive payment path.



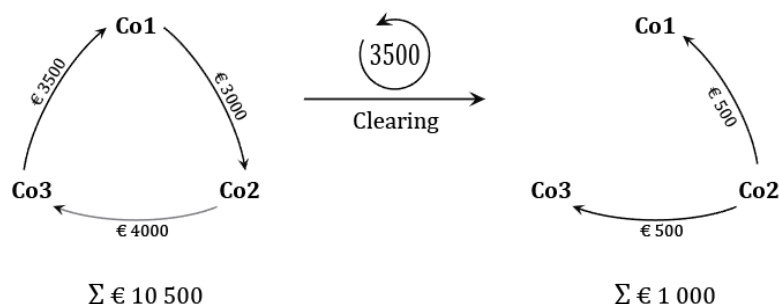
<sup>8</sup> Users who allow credit conversion will be rewarded by the system and receive part of the commission paid by the user who initiates the transaction.



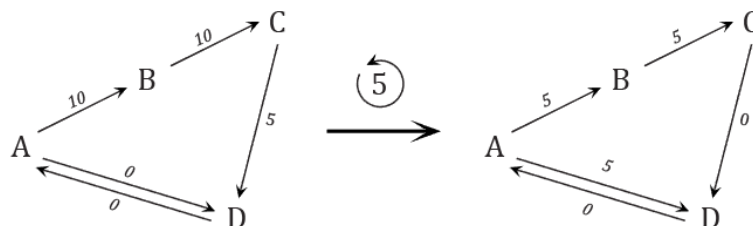
## 4.5. Clearing

Clearing consists of finding closed transaction loops that reduce the overall cost of credit in the system. When two states with the same cost can be achieved, then the state with the least outstanding credit will be preferred.

In the following simple example, exposures totalling €10,500 are reduced to a mere €1,000 via a single clearing cycle.



In some cases, a clearing event will create new exposures between users, where no exposure existed before, as shown in the following example.



For this to happen, D must have previously agreed to the possibility of new exposures being created by clearing events. Note that for most credit communities, agreeing to accept such transactions will almost certainly be part of the rules, as it would otherwise hinder efficient clearing.

For a clearing cycle to be valid, the overall combined cost of the credit exposures should be lower to or equal to the cost before clearing (the issue of defining cost is a separate issue.) We can have situations where the overall cost goes down, but one or more users in the clearing loop start paying more. In the example above, if A pays more for the exposure to D than to B, then the result of the clearing may be that B and C pay less but A pays more. There are two possible ways to deal with this:

- 1) We do not allow such clearing cycles

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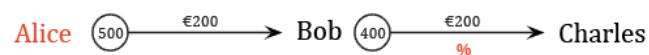
- 2) or we introduce a mechanism by which the “losers” of the clearing are compensated by the “winners”, so that everyone ends up a winner.

Because of the potential complexity involved, the first option may be chosen at first, but with the possibility of implementing a compensation mechanism later.

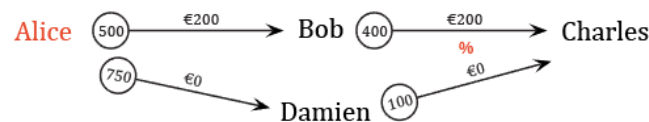
Also note that there will be optimisation issues, as one can easily imagine situations where starting with the clearing at the wrong place will make further clearings impossible. For example, doing a small clearing loop first may prevent the system from doing a much larger loop later. Multi-currency clearing will also be challenging.

## *Optimisation of payment paths*

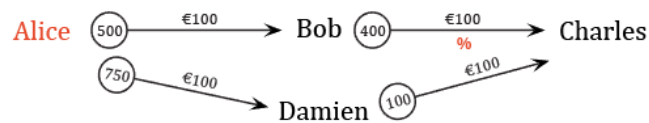
Clearing will, as a side-effect, optimise existing payment paths. For example, suppose Alice has paid Charles via Bob (she is by the way responsible for the fees that Bob must pay to Charles):



Damien then joins Sikoba, with Charles opening a credit line to Damien and Damien opening a credit line to Alice like so:



It now makes sense to shift part of the payment, as it will reduce the fees paid by Alice.



We see that this is simply the result of applying a clearing cycle which reduces Alice's cost, while reducing Charles's income.

## 4.6. Other considerations & challenges

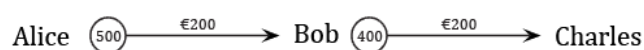
There are many issues that this document has not properly dealt with, a summary of some of them is given here.

### *The time factor*

Credit conversion cash flows linked to credit agreements can be of various types: some will have a cost, others will generate an income. One-time cash flows, resulting from fees, commissions or exchange rates, are easy to model. But when using of credit lines with time-dependent cash-flows, the optimal path may depend on the estimated time horizon of the credit issuer.

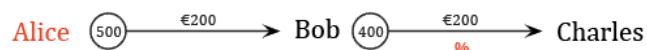
### *Linked exposures*

Consider the case when Alice pays Charles via Bob, and the credit lines do not have any fees or conditions attached, as would for example be the case for credit lines between friends.



The exposure between Alice and Bob, and the one between Bob and Charles can be treated separately, there is no link between them. One way to express it is that this payment can be *tokenised*.

Now consider the case where the credit line that Charles granted Bob calls for interest payments:



Clearly, the exposure between Bob and Charles remains attached to Alice, who is responsible for paying the interest. Consider a potential clearing event that would reduce or eliminate that exposure, without involving Alice. There are several ways to handle this, and we have been working on a concept of fee/cost splitting to resolve this.

### *Multi-currency clearing*

Clearing of exposures in different currencies brings certain challenges that we have only started to explore.

### *Multilateral credit arrangements*

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Groups of participants of roughly equivalent credit rating will be able to create credit networks with standard rules, credit arrangements will be bilateral or multilateral. The typical example of multilateral agreements will be local trading networks, where participants agree to grant each other credit.

## *Banks as credit providers*

Most individuals and companies will accept a bank's credit, which is also called bank money. Therefore, most users will want to hold bank credit as a means of payment of last resort, and to repay debt. The system will interface with the existing financial system via gateways, which will typically be banks holding fiat money or other financial assets for use within Sikoba.

## *Credit grouping*

Participants can join forces and create groups to whom they allocate part of their credit. This could be done, for example, to create a local currency. The resulting credit will usually be significantly higher than the credits of the individual persons and/or companies constituting the group.

## *Custom currencies*

Groups of users will be able to create their own currencies. This will be especially relevant for running local or secondary currencies.

## *Market makers*

The system will need to attract market makers to provide liquidity between different currencies.

## *Invoicing and payment requests*

In Sikoba, invoicing will be done by issuing payment requests, which, once acknowledged by the receiver, become normal obligations.

## 5. Technology

The Sikoba blockchain is being designed as a *Federated Blockchain*, a self-governing and permissioned mining model. Federation members will be elected based on their reputation and technical ability.

We have proposed the concept of *Optimisation Consensus Protocol*, which can be summarised as follows: “In the context of a blockchain-based decentralised application that has a potentially hard-to-solve optimisation problem, it makes sense to try and leverage the distributed processing power of the nodes. We run the optimisation independently on each node, and reach consensus based on the best solution.”

The blockchain platform on which we will build Sikoba has not yet been chosen. Hyperledger Fabric could be an option, but we do not exclude building our own blockchain based on existing open source code, for example Scorex.

Two relevant documents are available on our [\[reddit wiki\]](#)

- + Optimisation Consensus Protocol (Alex Kampa, 8 May 2017)
- + The technical side of Sikoba: a short introduction (Eyal Ron, 24 March 2017)



This document is necessarily incomplete, some of the information it contains is fragmentary at best, and maybe not always completely accurate. However, we are where we are, and we do not plan any significant updates to this document in the coming weeks as we focus on coding the POC.

To keep track of the project, please visit:

<http://www.sikoba.com>

<https://www.reddit.com/r/sikoba/wiki/index>

## Appendix: “Credit graph” and “Clearing graph”

The *credit graph* is a representation of credit relationships between users. Given a world-state, the *clearing graph* is a representation of the possibility of direct payments between users.

Simplified representation	Credit graph meaning	Clearing graph meaning
Alice $\longrightarrow$ Bob	Bob has granted Alice a credit line	Alice can pay Bob directly
Alice $\longleftrightarrow$ Bob	Alice and Bob have granted each other credit lines	Alice and Bob can pay each other directly
Alice $\longleftarrow$ Bob	Alice has granted Bob a credit line	Bob can pay Alice directly
Alice $\cdots\cdots\cdots$ Bob	d.n.a.	No payments are possible (even though there is some credit relationship)

As we shall see, any of the first three scenarios on the credit graph can correspond to any of the four representations on the clearing graph. To see why, we will consider the case where Bob grants Alice a credit line, but Alice does not reciprocate:



This may give the impression that it is only Alice who can pay Bob directly, but that is not so. We actually have three main cases, depending on whether the credit line is not used, partly used or fully used.

1 - if Alice has not yet any debt towards Bob, then only Alice can pay Bob directly. However, there may have been conditions attached to the credit line, for example depending on Alice’s net debt. If Alice has too many obligations, she may not be able to use the credit line at all.

2 - if Alice already used part (not all) of the credit line, then a direct payment in both directions is possible. For example, say we have:



Alice now still has the capacity to pay Bob for the amount of \$30, but Bob can now also pay Alice for \$20. There is actually an interesting asymmetry in this relationship: unless otherwise agreed in advance, Bob will be able to withdraw from the credit arrangement, in which case Alice will not be able to use the

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remaining \$30 of the credit line. On the other hand, Bob's capacity to pay Alice the amount of \$20 remains no matter what.

Note that in this case also, Alice may be precluded from using the remaining \$30 of her credit line because of some other debts she has taken on.

3 - if Alice has used all her credit line, she has no more capacity left to pay Bob, but Bob is obviously able to pay Alice.

This can be summarised as:

Credit situation	Clearing graph view
Alice (50) $\xrightarrow{0}$ Bob	Alice $\longrightarrow$ Bob or sometimes Alice ..... Bob
Alice (50) $\xrightarrow{20}$ Bob	Alice $\longleftrightarrow$ Bob or sometimes Alice $\longleftarrow$ Bob
Alice (50) $\xrightarrow{50}$ Bob	Alice $\longleftarrow$ Bob

The other cases are similar.