



# LendLedger Technical Paper

June 2018

## **Growing Financial Markets with Blockchain**

LendLedger is a trusted open network to solve trillion-dollar credit gaps.



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# 1. About LendLedger

## 1.1 The Problem

In most emerging markets, a relatively small number of households and businesses borrow from banks. Most potential Borrowers are too small and/or operate in the “informal sector.” They usually have no official credit history or traditional financial documentation. Even if financial institutions want to serve these Borrowers, it’s generally unviable. The cost of collecting and verifying information about them (the origination cost) is too high.

The loans which informal and small business Borrowers want from institutional Lenders, but cannot get, are valued at trillions of dollars. This “credit gap” is sometimes filled by friends, family, and local moneylenders at a high cost. They offer amounts which may be inadequate, they place a heavy social cost to borrowing, and they often charge onerous interest and security. More commonly, would-be Borrowers simply avoid informal borrowing altogether, and deplete savings or forego the spending they planned.

Banks and other regulated institutions could unlock this global, multi-trillion-dollar market and out-compete informal Lenders, but first they need low-cost, reliable ways to assess Borrowers.

A solution is on the horizon: informal Borrowers seeking small loans now use services that capture and store their financial data. For instance, Borrowers seeking small loans in India, Kenya, and China are increasingly accepting electronic payments. When a customer pays with a debit or credit card, or mobile wallet, the sale is recorded. Similarly, when a small business pays a supplier electronically, a record of the inventory expense is stored.

Hundreds of electronic payment networks, including giants such as Paytm, bKash, Alipay, and WeChat Pay, are amassing troves of sales and expense data for informal customers and small businesses. Supplier networks and e-commerce sites are doing the same. If shared, this data could help Lenders assess the creditworthiness of informal Borrowers. Yet this data is not accessible to most Lenders, nor is it shared with credit bureaus.

Gradually, Lenders in some markets are forming bilateral partnerships with Data Providers. But the slow, uncompetitive nature of the process limits the scale of this lending and excludes both smaller data sources and specialized Lenders.

## 1.2 LendLedger

LendLedger connects Lenders with untapped data to bridge the multi-trillion-dollar gap between financial institutions and informal Borrowers. It brings together Borrowers, Data Providers, and Lenders in an open and secure global ecosystem built on distributed ledger technology.

Through the LendLedger Protocol, anyone can join lending markets. The protocol’s APIs<sup>1</sup> allow parties that don’t know each other to exchange data and value. And it uses Stellar’s blockchain technology to capture loan disbursement and repayment records in real-time. This gradually results in transparent and irrefutable reputations for all participants. By looking at the blockchain, Lenders can see Borrower behavior and price risk appropriately.

LendLedger will help small businesses and informal Borrowers secure affordable credit from financial institutions. Its open standards and trusted shared ledger will increase data sharing, market interactions, and lending volumes. LendLedger enables a more efficient, affordable, and inclusive lending market.

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<sup>1</sup>Application Programming Interface or API is a dedicated URL that receives requests and sends data responses.



## 2. The LendLedger Protocol

### 2.1 What It Is

The LendLedger Protocol is a suite of Open APIs that connects participants in lending markets. It is an open alternative to central intermediaries and lending platforms.

Borrowers, Lenders, Data Providers, and other service providers use the APIs to share data and transfer value. The protocol records every such interaction on the Stellar decentralized ledger. This means that there is a permanent, transparent record that parties can trust, even if they don't trust each other.

When a gatekeeper or market-maker is out of the picture, lending costs are lower, transactions have less friction, and market players interact in more creative ways.<sup>2</sup> The LendLedger Protocol's open architecture lays a foundation for Lenders and Borrowers to structure almost any loan type, and for virtually any type of data or service provider to participate.

### 2.2 Design Requirements

The LendLedger Protocol has been designed to ensure maximum transparency and openness, while giving each market participant total control over their data and reputation. Key requirements are:

1. All financial transactions between parties are permanently recorded.
2. Every party has total control over who can see its data and profile.
3. All credit data about the Borrower (household or business transaction data) is kept confidential.
4. Anyone can be a Data Provider or Lender, subject to national regulation.

### 2.3 Building Blocks

The LendLedger Protocol has four components that work together to create an open, transparent, and trusted platform.

#### **1. Data APIs**

These APIs define how data is passed between parties. They define the format in which data is stored on the blockchain, how it is requested, and how it is sent. The data APIs specify formats for business data (used for credit decisions), KYC data, and credit evaluations. Over time, the community may add Data APIs to handle more types of data.

#### **2. Transaction APIs**

These APIs govern how value is transmitted. They are the building blocks from which smart contracts for loan and service provider agreements can be built.

#### **3. Loan Smart Contract Templates**

These are template smart contracts for common small business loan products. Over time, the community can use Transaction APIs to build smart contracts for less common loan types.

#### **4. LOAN Digital Asset**

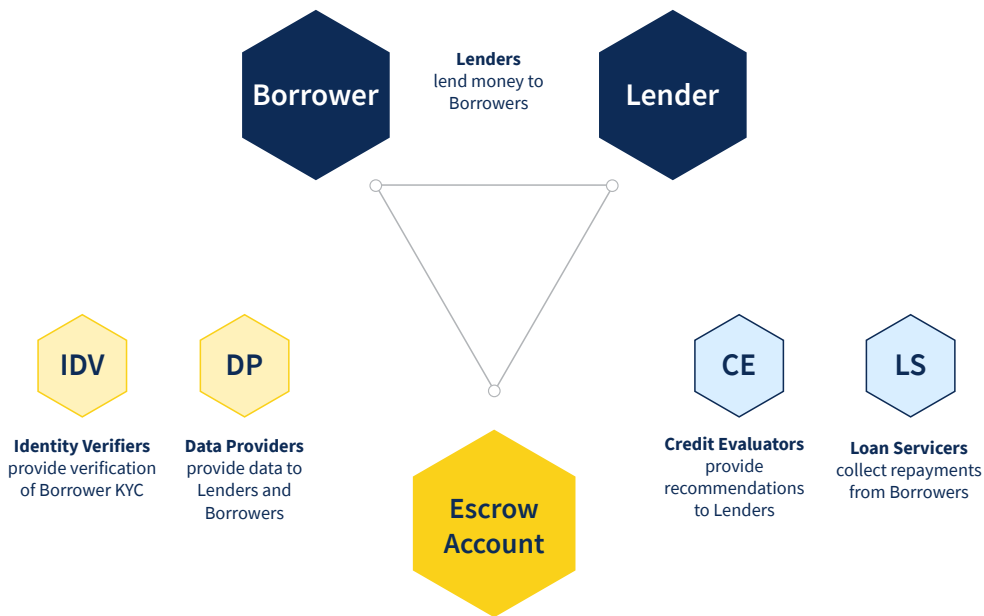
LOANtokens are LendLedger's digital asset. When staked by a Credit Node (described below), they release LedgerCredit. LedgerCredit is the protocol's internal accounting unit. It is denominated in terms of government-issued (fiat) currency and acts as an IOU on the part of the issuer.

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<sup>2</sup>For more information on the rationale for such a protocol and the use of distributed ledger technologies, see the LendLedger "Overview" document.

## 2.4 LendLedger Users

Here is how each lending market participant will use LendLedger.



|                           |  |
|---------------------------|--|
| <b>Lenders</b>            | Originate loans using credit data made available by Data Providers. Sign loan contracts with Borrowers and disburse loans to them.     |
| <b>Data Providers</b>     | Provide credit data they accumulate on households and businesses to Lenders and Borrowers.   |
| <b>Borrowers</b>          | Acquire their personal or business credit data from Data Providers. Identify loan offers from Lenders and apply for and receive loans. |
| <b>Credit Evaluators</b>  | Provide loan decision recommendations based on loan applications shared by Lenders.  |
| <b>Identity Verifiers</b> | Contract with Lenders to provide verification of Borrowers' KYC data.  |
| <b>Loan Servicers</b>     | Collect loan repayments from Borrowers on behalf of Lenders.   |

As the ecosystem grows, more roles are likely to emerge. Loan Originators may help identify prospective Borrowers, and Marketers may specialize in crafting messages to potential Borrowers.

Some entities will take on multiple roles. A Point of Sale provider (PoS) may not only be a Data Provider, but may also provide Know Your Customer (KYC) info as an Identity Verifiers (IDV), or collect repayments as a Loan Servicer.

## 2.5 Credit Nodes

Credit Nodes play three roles within the LendLedger Protocol. They stake LOANtokens to issue the fiat-pegged LedgerCredit used by Lenders, Borrowers, and other Participants to transact on the network. They also redeem LedgerCredit for fiat currency. And lastly, they ensure that Lenders have a license to lend under local regulation. More on Credit Nodes in Section 5.



## 3. Exchanging Data

LendLedger grows lending to underserved segments by unlocking new sources of digital credit data. Borrowers obtain their credit data from Data Providers and share it with Lenders so that Lenders can assess the Borrower's creditworthiness.

The LendLedger Protocol's Data APIs define how credit data and other data vital to the lending process is shared among participants. They also ensure that data stays secure and trusted.

### 3.1 Data Formats

Data APIs cover how the following information is exchanged:

- Business or other credit data used for credit decisions
- Loan terms and conditions
- Credit recommendations by Credit Evaluators
- KYC data used for identity verification
- Identity certification by ID Verifiers

Within these categories, the types of data will expand over time. For example, the Data API parameters will initially cover transaction data from point-of-sale devices and mobile wallets. This data is already used by Lenders to make loan decisions. But data-driven lending is maturing steadily. As Lenders seek new sources of data (e.g. farm yields, satellite imaging) to assess loan applications, the community will be able to define further formats.

## 3.2 Data Exchange

In the LendLedger Protocol, data is exchanged using transactions on the Stellar decentralized ledger. These transactions act as a messaging system. Each transaction has a memo field in which LendLedger participants embed data requests and responses.

But the data itself (e.g. credit data shared between a Borrower and Lender) is too large to store on the blockchain. So it is stored on IPFS (InterPlanetary File System)<sup>3</sup> and referenced by a Stellar transaction. Using encrypted data on IPFS also ensures that data is only accessible by parties authorized to see it.

Here's an example of how a small merchant might obtain access to her credit data, using LendLedger:

1. The merchant uses a web or mobile app to create a Stellar transaction.
2. In the transaction's memo field, she inserts a request for sales data.
3. She sends this transaction to her Data Provider (a PoS network).
4. The Data Provider validates her request and fetches her historical sales data from its systems.
5. It stores her sales data on IPFS after encrypting it, using her public key.<sup>4</sup> (This gives only her access).
6. IPFS generates a hash of the encrypted data file and sends it to the Data Provider.
7. The Data Provider creates another Stellar transaction, inserting the IPFS hash in the memo field.
8. The Data Provider sends this transaction back to the merchant.
9. The merchant's app uses the IPFS hash to fetch the file from IPFS and decrypts it.

All LendLedger data exchanges work in this way, such as when Borrowers send data to Lenders, or Lenders share it with Credit Evaluators. Data formats for credit decisions and ID certifications may differ from the formats for credit data, but all data exchanges happen through the same mechanisms.

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<sup>3</sup>IPFS is a protocol and network for decentralized, peer-to-peer sharing of files. More at <https://ipfs.io/>

<sup>4</sup>For more on participant public keys, see Section 6 on Identity and Reputation.



## 4. The Loan Process

Loans are made and recorded using Transaction APIs. Loans can be structured using the Loan Smart Contract Templates provided for common loan types, or by combining the Transaction APIs into new smart contracts to accommodate less common loan structures.

While details may vary, making loans generally follows a common flow, in four stages:

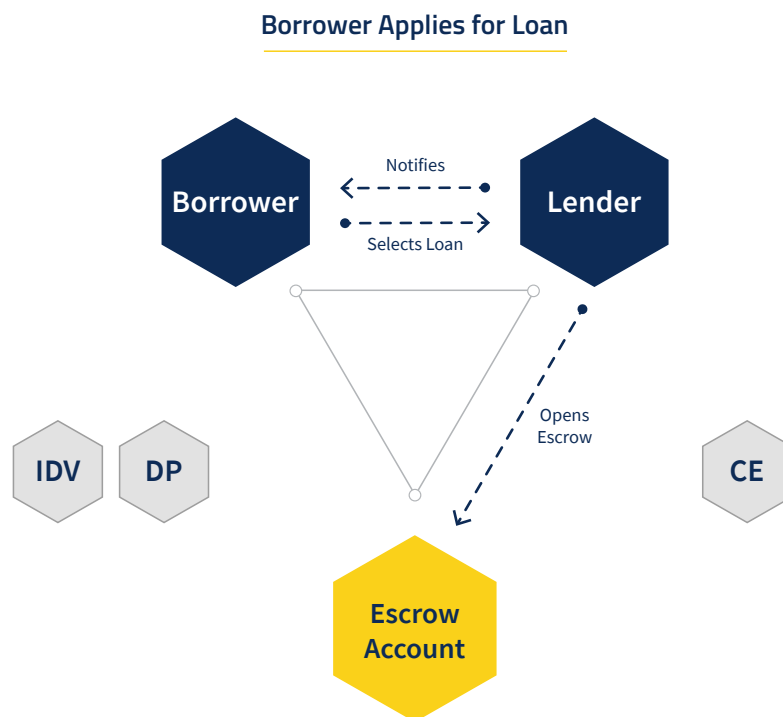
1. Application
2. Credit decision and loan agreement
3. Loan funding and disbursement
4. Repayments

### 4.1 Application

Borrowers apply for loans in a variety of ways. Some seek out a loan and use a mobile app or web interface to find Lenders and loan offers. Others are shown an ad or loan offer by a Lender that has pre-identified them as a prospective Borrower.

#### **1. The Borrower applies for a loan offer.**

The Borrower selects a loan to apply for and notifies the Lender. The Lender responds by creating an “Escrow Account” on the Stellar ledger. This is an account that must be signed by multiple parties (“multi-sig”) that performs all transactions related to the loan. It specifies the Escrow Account signatories as itself (the Lender), the Borrower, and any relevant Service Providers. It then notifies the Borrower of the account’s location.

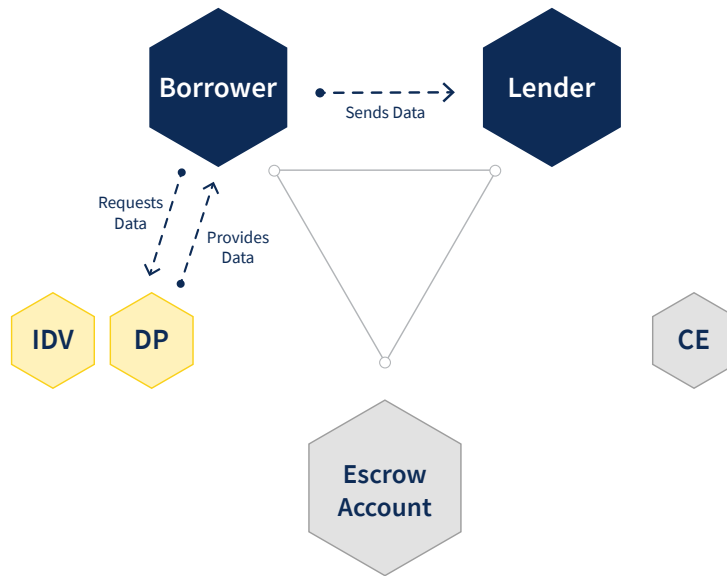




## **2. The Borrower provides credit data to the Lender.**

The Borrower supplies required information to the Lender. The first requirement is usually credit data. The Borrower requests data from a Data Provider that has relevant business or credit data him (e.g. a PoS company that processes credit card transactions for the Borrower's shop). The Borrower receives this data from the Data Provider, and then sends it to the Lender. (See Exchanging Data for more details on these exchanges.)

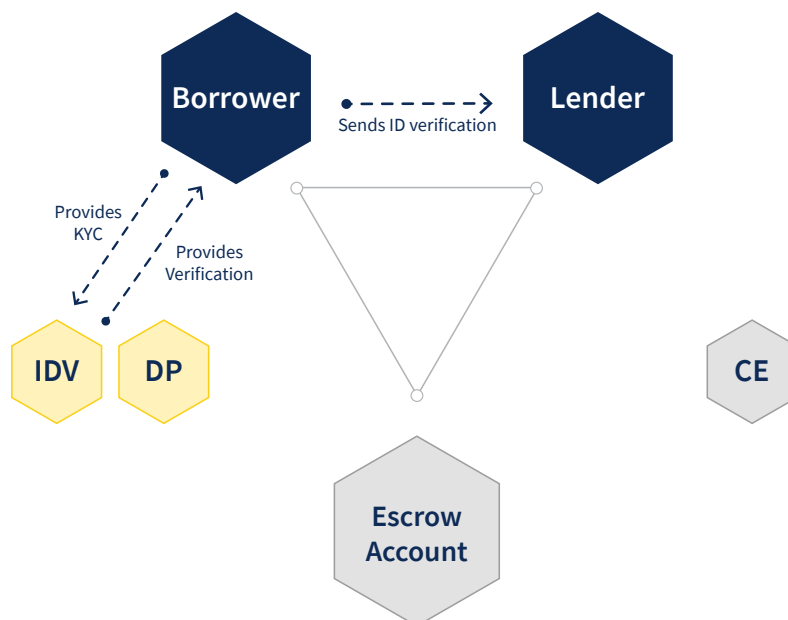
### **Borrower Provides Credit Data**



## **3. The Borrower supplies further ID verification if necessary.**

If the Lender requires ID verification beyond what the Data Provider supplies, the Borrower works with an ID Verifier. The Borrower sends KYC data to the ID Verifier and receives back certification of his identity. He shares this with the Lender.

### **Borrower ID Verified**

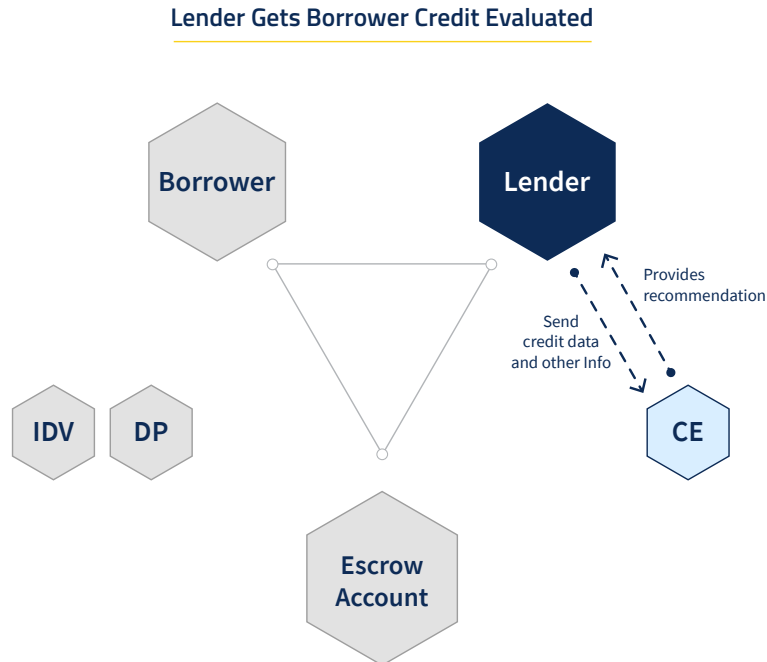


## 4.2 Credit Decision & Loan Agreement

After the application stage, the Lender must make a credit decision and set up a loan agreement.

### **4. The Lender can evaluate information from the Borrower by itself, or it can use a Credit Evaluator.**

The Lender sends the credit data, KYC, and other relevant information to the Credit Evaluator (CE). The CE evaluates this info and the Borrower's existing credit profile (if any) on LendLedger to make a credit recommendation. This is either a denial, or an approval that specifies the rate, term, and amount of credit the Lender should extend to the Borrower. The recommendation is sent to the Lender.

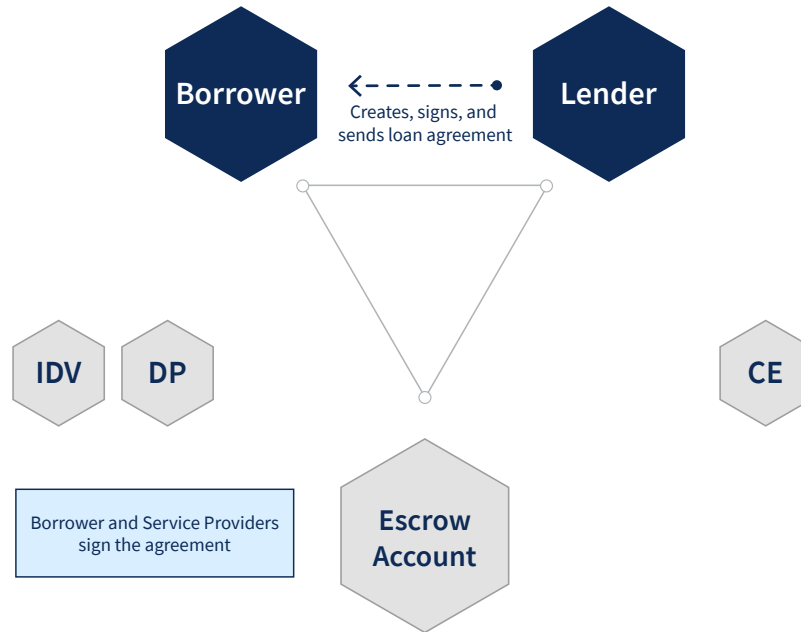


**5. The Lender funds the Escrow Account and circulates a loan agreement for signature.**

The Lender creates a Loan Agreement Smart Contract to govern the Escrow Account. This smart contract consists of all transactions related to the loan: disbursement, repayments, and potential default transactions. Embedded in these transactions are also the appropriate fee payments for the Service Provider.

The Lender signs and sends the Loan Agreement to the Borrower for his or her signature. The Borrower signs the agreement—pre-authorization of the transaction set. As signatories to the Escrow Account, the Service Providers sign off as well, after inspecting the transactions to ensure they are being compensated correctly.

Lender Funds Escrow, Offers Loan: Borrower Signs & Submits

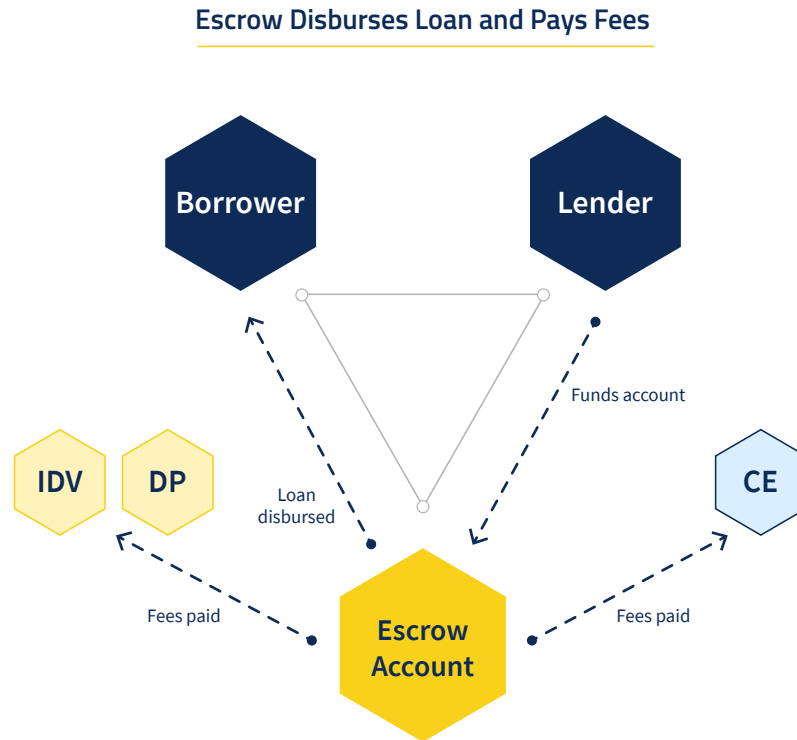


## 4.3 Loan Funding and Disbursement

After the loan agreement is signed by all parties, the loan can be funded and disbursed.

### **6. All that remains is loan disbursement.**

The Lender funds the Escrow Account with the appropriate amount of LedgerCredit (loan plus fees), then submits the pre-signed loan disbursement transaction. The Escrow Account disburses the LedgerCredit for the loan to the Borrower, and for the fees to the Service Providers.



## 4.4 Loan Repayments

The repayment schedule is created as part of the Loan Agreement Smart Contract. The Transaction APIs allow for a wide range of repayment structures. In signing the Loan Agreement, the Borrower pre-authorizes each repayment transaction needed to pay back the loan. These transactions specify an amount as well as a date for each repayment.

On each repayment date the Borrower funds the Escrow Account with the amount of LedgerCredit due, either directly or through a Loan Servicer. When the repayment transaction is then submitted, it distributes LedgerCredit to the Lender and to any Service Providers involved in the loan.

## 4.5 Delinquencies and Defaults

If a Borrower has not adequately funded the Escrow Account, the subsequent repayment transaction will fail. If this occurs, after any grace period the Lender can pursue collections or declare default.

A default cancels all subsequent repayment transactions and hands control of the Escrow Account over to the Lender. This allows the Lender to structure a new repayment schedule if they and the Borrower can agree to terms on a resolution.



## 5. LedgerCredit, LOANtokens, and Credit Nodes

For LendLedger to be a trusted yet decentralized lending network, there are several requirements:

1. **Trusted Reporting** — All participants must trust that transactions happened as reported. A Lender and Borrower cannot be allowed to disagree on whether a loan was disbursed or repaid.
2. **Stable Value** — Transactions within the network must happen in a currency that is stable relative to the fiat currency Lenders and Borrowers use every day. Volatility in the value of a transaction can make a loan non-viable for a Borrower or Lender.
3. **Authorized Use** — Borrowers and other participants should be protected from the risk of dealing with Lenders that are not authorized under regulation.
4. **Decentralized Access** — Rights to access the network should be universally available to any authorized lender. No central authority should control or restrict this access.

The LendLedger Protocol satisfies the first two requirements by use of an internal accounting unit called LedgerCredits. It satisfies the second two requirements by combining an external tradable token, LOAN, with a special kind of network participant called a Credit Node.

### 5.1 LedgerCredit

LedgerCredit is the denomination in which all transactions (including loan disbursements, repayments, and fees) are conducted. Because all transactions take place in LedgerCredit and are recorded in real time on the blockchain, participants can trust the transaction record.

If a Lender and Borrower transacted off-chain via cash or bank wires and reported the results afterwards, there would be the potential for doubt. What if a Borrower reported late? Or the two parties reported different results? Using LedgerCredit guarantees trust.

LedgerCredit also ensures stable value. For participants to rely on an asset for lending or borrowing, it must be stable relative to the fiat currency in which they conduct business. Due to their volatility, currencies like Bitcoin or Ethereum are not suitable: a Borrower might find herself repaying many times the fiat value of a loan if the BTC or ETH rate spiked.

LedgerCredit, in contrast, is pegged to local fiat currency, and is non-fungible (has no external value and is usable only within the network). So it is not subject to external influence.

## 5.2 Issuing LedgerCredit Using LOANtokens

Rather than give any entity a special right to issue LedgerCredit, issuance is programmed into the protocol. This ensures decentralization and avoids the costs, friction, and trust issues associated with a centralized actor.

LedgerCredit issuance is programmed into the protocol through the LOAN digital asset. LOANtokens are traded on open markets. The price of a LOANtoken floats relative to fiat and therefore relative to LedgerCredit.

When a particular type of market participant (a Credit Node) stakes LOANtokens, LedgerCredit is released. To stake LOANtokens, the Credit Node sends them to the LedgerCredit Smart Contract. It includes the public key address of the Participant acquiring the LedgerCredit, and a unique Loan ID to tie the LedgerCredit issued to a specific loan.<sup>5</sup>

For example, say a Lender wants to issue a \$100 loan, and the current price of LOANtokens is \$0.20 USD per token. To receive \$100 of LedgerCredit to disburse to the Borrower, the Lender sends \$100 in fiat to a Credit Node, which stakes 500 LOANtokens ( $\$100 \times \$0.20$ ) to the LedgerCredit Smart Contract. The LedgerCredit Smart Contract then disburses \$100 USD in LedgerCredit to the Lender.

## 5.3 Credit Nodes

For all loan transactions on LendLedger, Lenders need to be licensed or otherwise authorized to make loans in the Borrower's jurisdiction. The network also needs to be secured from other potentially fraudulent or illegal uses.

For this reason, the network restricts issuance of LedgerCredit to a special type of participant called the Credit Node. We expect Credit Nodes to operate in a single lending jurisdiction (usually a country). Within that jurisdiction they are tasked with a few activities, for which we expect them to charge a fee. However, the critical role of Credit Nodes within the LendLedger network also means that organizations with a mission of driving financial inclusion may be drawn to operating a Credit Node.

First, Credit Nodes help secure the network from fraud or illegal lending. Any Lender who wants to participate in the LendLedger network must first register with a Credit Node and provide proof of its lending authorization (i.e. a license). The Credit Node certifies the Lender and shares this certification with other Credit Nodes. They only issue LedgerCredits to Lenders that have been certified.

Note: Lending license issuance and verification vary country by country. In some countries all licensed Lenders are publicly listed by the regulator. In others, there is a web of state or province-wide regulation. A Credit Node needs to have a process for obtaining and verifying licenses according to the regime in place.

Second, Credit Nodes convert fiat currency into LedgerCredit. For each loan, a Lender sends local fiat currency to the Credit Node in return for an equivalent amount of LedgerCredit.<sup>6</sup> After the Lender disburses this LedgerCredit (i.e. loan) to the Borrower, the Borrower redeems the LedgerCredit for fiat currency with the Credit Node.

As an example, here is how a Credit Node helps with loan disbursement:

1. A Lender sends fiat to a Credit Node.
2. The Credit Node stakes the appropriate amount of LOANtokens with the LedgerCredit Smart Contract and specifies which Lender account should receive the LedgerCredit.
3. Having received LedgerCredit, the Lender disburses it to the Borrower through an Escrow Account (see The Loan Process).
4. The Borrower prefers fiat over a disbursement of LedgerCredit, so they send the LedgerCredit to the Credit Node, redeeming it for fiat.
5. The Credit Node in turn sends the LedgerCredit back to the LedgerCredit Smart Contract, and this releases the LOANtokens it initially staked.

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<sup>5</sup>The Loan ID references the Escrow Account for the loan and the transaction in which it was created.

<sup>6</sup>If a Lender owns LOANtokens, they can send that instead of local fiat currency.

## 5.4 Solving Counterparty Risk Related to Credit Nodes

At several points in the process above, the Credit Node could intentionally withhold fiat or LedgerCredit, failing to meet its obligation to a Lender or Borrower (counterparty risk).

This could happen because the value of LOAN has fallen relative to fiat. In this case, the Credit Node has an incentive to keep fiat received from a Participant and not redeem the corresponding LedgerCredit. (The fiat is worth more than the LOAN staked.) Or this could happen because the Credit Node accepts fiat with no intention of returning LedgerCredit, or decides not to redeem LedgerCredit for fiat due to insolvency concerns.

To mitigate the counterparty risk, LendLedger takes a three-pronged approach: a) Credit Node **selection**, b) **incentives** aligning Credit Node and network interests, c) **limiting the scope** for fraud.

### Credit Node selection

The process for selecting Credit Nodes will be decentralized, will ensure that the Credit Nodes selected can perform their obligations, and will result in Credit Nodes that have a long-term commitment to LendLedger and can withstand short-term volatility in the price of LOAN.

Key criteria for Credit Nodes include:

1. Sufficient capital. Credit Nodes must make a sizeable minimum LOAN investment and have the capital to acquire further LOAN on the open market as lending volumes grow.
2. Technical capability. The Credit Node must run an efficient process to ensure Lenders are authorized.
3. Mission alignment. LendLedger is nascent and will rapidly evolve. Credit Nodes must be prepared to trade off short-term profit opportunities for the chance to help build a large, long-term network.

### Aligning incentives

Each time it issues LedgerCredit, a Credit Node must stake LOANtokens to a Surety Bond Smart Contract. The Surety Bond acts as an incentive to the Credit Node to fulfill its obligations. If it does not, its entire Surety Bond may be forfeit.

The Surety Bond is maintained at all times in an amount proportional to the Credit Node's issuance activity (e.g. 10%). So, if a Lender gives \$100 USD to a Credit Node, the Credit Node would stake \$100 USD worth of LOANtokens to the LedgerCredit Smart Contract and \$10 USD worth of LOANtokens to the Surety Bond.

The Surety Bond Smart Contract holds the Surety Bond amount for the term of the loan. This ensures that the Credit Node always has a proportionally significant amount of value staked in the system, and acts as an incentive for the Credit Node to fulfill its obligations.

### Limiting scope for fraud

We expect that the timeframe for most loan disbursements and other payments will be relatively short (e.g. seconds). Because of this, the Credit Node will have access to a limited amount of fiat currency from customers at any given moment. Thus, the amount to be gained by defrauding a few customers should pale in comparison to both the long-term value of acting as a Credit Node, and the amount locked up in the Surety Bond.



## 6. Identity and Reputation

### 6.1 Identity

On the LendLedger Protocol, every Participant has a public key which is their unique identifier. In every transaction, the parties are identified using their public keys. So a Participant's "on-network identity," in an abstract sense, is really their public key and the record of all transactions linked to that public key.

For some types of Participants, this on-network identity within LendLedger may be sufficient for others to have the confidence to do business with them. A Credit Evaluator's track record of loan recommendations may speak for itself. But for many lending market Participants, a verified "off-network identity" is essential to give others the confidence to transact:

#### **Lender off-network identity**

A Credit Node certifies each Lender. Other Credit Nodes audit that certification. Certification verifies the Lender's identity and ensures they are authorized by regulation to lend in the given jurisdiction.

#### **Borrower off-network identity**

Data Providers and ID Verifiers (IDVs) both verify a Borrower's off-network identity. Borrowers identify themselves to Data Providers using an account number and password, or other means specified by the Data Provider. When the Data Provider supplies credit data in response, it is certifying that the data supplied belongs to that Borrower. ID Verifiers, at the request of a Lender, can provide further certification of a Borrower's identity. Borrowers submit pieces of required KYC data and the IDVs certify these.

#### **Service Provider off-network identity**

Unlike Lenders, most Service Providers are unlicensed. Unlike Borrowers, most do not submit identification information to business partners. So there is limited "off-network" information for Participants to assess before transacting with a Service Provider. To solve this, LendLedger requires Service Providers to stake LOANtokens.

As blockchain-based identity solutions mature, we would anticipate leveraging Service Providers to improve identification processes on the LendLedger network.

### 6.2 Reputations

Within LendLedger, a Participant's transaction history determines their reputation. All transactions—such as loans disbursed, repayments made, and defaults incurred—are recorded in real time on the blockchain. This allows Borrowers to build up a credit history. Similarly, a Data Provider will accumulate a track record for loans based on its data. Other Participants will even be able to calculate the return on investment (ROI) of loans made based on the Data Provider's information. The same applies to Credit Evaluators, Loan Servicers, ID Verifiers, and others.

LendLedger Participants can easily view each other's reputations. Using native Stellar APIs designed for this purpose, they can pull historical transactions related to any account (i.e. any public key). From there, Participants can form a view as to the reputation of another party using whatever criteria they deem fit. Some Participants like Credit Evaluators may apply quite complex and proprietary algorithms to make these appraisals. Others may rely on third-party evaluations or "scores." It is likely that a class of Credit Evaluators that provide a single reputation score—similar to credit bureaus—will emerge.





## 7. Software for Lenders, Data Providers, and Credit Nodes

After launch, we will offer simple web-based software so Lenders and Data Providers can easily use the LendLedger Protocol. Over time, we will develop interfaces for other Service Providers such as ID Verifiers, Loan Servicers, and Credit Evaluators.

We are currently developing two products: L-Lend (for Lenders) and L-Data (for Data Providers).<sup>7</sup> These will be offered under a pay-as-you-go, software-as-a-service (SaaS) license, and are intended to be usable without any technical expertise. Market participants may also build their own front-end applications as interfaces for the LendLedger Protocol, or contract with third parties for this functionality.

### 7.1 Common Features of L-Lend and L-Data

Both systems will provide:

1. Connection: connect via the LendLedger Protocol to send and respond to API requests
2. Account Management: registration, configuration, and ongoing management
3. Crypto Management: send and claim payments; exchange fiat for LedgerCredit
4. Analytics: performance monitoring and optimization

### 7.2 L-Lend

L-Lend solves three key functions for Lenders: origination of loans through LendLedger, loan management, and tracking finance and accounts.

| Functions and Features                                    |                                      |   |
|---|--------------------------------------|---|
| <u>Origination</u>  | <u>Loan management</u>               | <u>Finance and accounting</u>           |
| Managing loan offers and applications                     | Product configuration                | Managing fiat and token transactions    |
| Web / Android application interfaces for Borrower clients | Performance monitoring and analytics | Basic compliance and accounting reports |
| Contracting   | User support channels                |   |
|   | KYC / document management            |   |
|   | Basic loan servicing                 |   |

Lenders will evaluate the software based on volume and freshness of leads, flexibility of products that can be created, and marketing/engagement analytics and capabilities.

<sup>7</sup>Basic versions of our software are currently in use by ArthImpact in India.

## 7.3 L-Data

L-Data solves three key functions for Data Providers: data marketplace, data analytics, and technical/integration portal.

| Functions and Features  |   |   |
|---|---|---|
| <u>Data Marketplace</u>                                       | <u>Data Analytics</u>                                   | <u>Integration &amp; Interface</u>          |
| Offer data to Lenders: description, price, level of anonymity | Performance monitoring: individual Borrowers or cohorts | Multiple options for sharing/uploading data |
| Respond to data requests                                      | Borrower segmenting                                     | Slack, alerting, and other integrations     |

Data Providers will evaluate the software based on the demand for, and revenue potential of, their data, ease of technical integration, as well as analytics and insights that can aid their business.

## 7.4 Credit Node Software

As described in Section 5, Credit Nodes play an essential role in the LendLedger network, by staking LOANtokens and identifying licensed Lenders. To encourage more Credit Nodes to emerge, the LendLedger team will develop and open source Credit Node software that others can also adopt. As part of this Credit Node software, we will create a marketplace where Credit Nodes can compete on rate and availability for the work offered by Lenders, Borrowers, and other Participants.



## 8. Roadmap

### 8.1 Milestone 1 (at Token Generation Event)

A first lending partner will run a portion of their lending activities using the LendLedger Protocol.

We expect the first partner to be ArthImpact Finserve Pvt Ltd in India. For a small set of loans, the contracting, disbursement, and repayment will occur through the protocol and use the LOANtoken digital asset. Other portions of the protocol (e.g. data exchange, credit evaluation) will still function in a centralized fashion until a subsequent milestone. (Milestone 1 is a validation of the on-chain portions of the protocol).

| Milestone 1   |  |
|---|--|
| <u>LendLedger Protocol</u>  | <u>Ecosystem Development</u>           |
| Transaction APIs published and in use by ArthImpact                 | Geography: India (pilot)               |
| Loan Smart Contract Templates – one published and in use            | One Credit Node operated by LendLedger |
| Data APIs – formats for at least one data type published and in use |  |
| LOANtoken – generated and used for the above lending activity       |  |

### 8.2 Milestone 2

The full LendLedger Protocol will be released in a first version. All lending activity of a single Lender will take place through the LendLedger network

| Milestone 2   |  |
|---|--|
| <u>LendLedger Protocol</u>                                  | <u>Ecosystem Development</u>                   |
| Loan Smart Contract Templates – additional templates in use | Geography: India (live), others in development |
| Data APIs – additional data formats published and in use    | LendLedger to operate multiple Credit Nodes    |
|   | Development with other potential Credit Nodes  |

### 8.3 Milestone 3

The first partner Credit Node will be live.

This milestone focuses on further decentralization, as well as upgrading the systems by which ecosystem participants access and use the network.

| Milestone 3                              |  |
|--|--|
| <u>Data Provider and Lender Services</u> | <u>Ecosystem Development</u>           |
| <u>V1 of L-Data and L-Lend live</u>      | Geography: at least two countries live |
|  | First standalone Credit Evaluator live |
|  | First partner Credit Node live         |