Loom Finance v1

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Abstract

Loom Finance introduces a new class of financing primitive that bridges traditional markets and decentralized finance (DeFi). By enabling the tokenization and distribution of predictable real-world cash flows, the protocol expands access to non-dilutive capital for businesses while creating yield-bearing assets for investors.

Loom establishes a general framework for channeling future productivity into on-chain financial instruments. This shift lays the foundation for scalable, composable, and globally accessible markets where value is secured not only by collateral, but by the productive capacity of real-world economic activity.

1 Introduction

1.1 Motivation

Access to capital remains a structural bottleneck for small and medium-sized enterprises (SMEs) worldwide. Traditional financing channels often impose collateral requirements, introduce ownership dilution, or involve complex approval processes. These constraints pose particular challenges to enterprises with consistent revenue flows that fall outside of conventional financing criteria.

Revenue-based financing (RBF)[1] offers a promising alternative: upfront liquidity in exchange for a share of future revenues. By linking cash flow distribution directly with revenue performance, the model introduces a more adaptive and non-dilutive approach to capital access. Despite its advantages, adoption has remained confined to centralized private markets. Legal complexity, operational friction, and lack of standardization have collectively limited scalability, transparency, and, most importantly, access to the liquidity of capital allocators.

Concurrently, crypto markets hold a large—and growing—stock of idle stablecoin liquidity that seeks transparent real-world yield. The supply of stablecoins has already proven its scalability and is expected to expand significantly in the coming years. Sending capital via stablecoins is faster, cheaper, and less frictional than through the traditional banking system—where providers face persistent operational and compliance bottlenecks. This creates a structural opportunity: crypto rails are not only a more efficient settlement

layer, but also a natural channel to unlock the massive pool of underutilized liquidity that remains parked on-chain.

DeFi has demonstrated the viability of permissionless capital markets, though most existing protocols primarily cater to crypto-native users and rely on overcollateralized lending models that exclude off-chain entities.

Loom Finance bridges these worlds by enabling real-world businesses to tokenize and sell claims on future revenues to a decentralized pool of capital. Through programmable smart contracts, legally structured agreements, and a hybrid crypto-fiat settlement layer, the protocol introduces a new primitive for financing based on future productivity rather than existing on-chain collateral.

The first use-case Loom Finance will bring online is the financing through RBF for Recurring Revenue. The predictability of future cashflows of subscription based companies, enables a simple yet powerful testing ground. Our partnership with Levenue [2] that operates as a pivotal financial platform designed to empower recurring revenue businesses, encompassing a broad spectrum of industries such as Software as a Service (SaaS), diverse subscription-based models, and direct-to-consumer (D2C) brands. At its core, Levenue's mission is to facilitate access to non-dilutive financing, a crucial alternative to traditional equity funding.

The mechanism is straightforward yet powerful: Levenue enables these businesses to convert their predictable, recurring future revenues—such as monthly subscriptions, annual contracts, or consistent product sales—into immediate, accessible cash. This innovative approach addresses a common challenge faced by high-growth businesses: the need for capital to scale without diluting ownership or incurring restrictive debt.

Levenue's financing solution is characterized by its remarkable flexibility. Unlike venture capital or traditional bank loans that often come with strict covenants, equity demands, or lengthy approval processes, Levenue's model is tailored to the unique revenue streams of modern businesses. This flexibility allows companies to draw funds as needed, aligning with their growth cycles and operational expenditures.

By providing immediate liquidity, Levenue directly contributes to accelerating growth. Businesses can utilize this capital for various strategic initiatives, including but not limited to:

- Customer Acquisition: Investing in marketing and sales efforts to expand their customer base.

- Product Development: Funding research and development to enhance existing offerings or launch new ones.

- Operational Expansion: Scaling teams, improving infrastructure, or entering new markets.

- Working Capital Management: Bridging cash flow gaps and ensuring smooth day-to-day operations.

The key benefit is that businesses can achieve rapid scaling without surrendering valuable equity. This means founders retain full control and ownership, allowing them to benefit entirely from their company's increased valuation as it grows. Furthermore, by optimizing their financial structure, businesses can operate more efficiently, making strategic decisions based on their growth objectives rather than immediate capital constraints.

In essence, Levenue acts as a growth catalyst, transforming future potential into present financial power, enabling recurring revenue businesses to achieve their growth ambitions faster and with greater financial autonomy.

1.2   Challenges in European Corporate Lending

- Significant Funding Gap: European companies with revenues exceeding €10 million face a substantial yearly financing deficit of €400-600 billion, affecting approximately 180,000 businesses. Over 85% of lending volume is concentrated in sponsor-backed companies, leaving a large number of high-quality companies underserved.

- Post-2008 Basel Regulatory Impact: Stricter banking regulations enacted after 2008 have constrained traditional lending capacity. This disproportionately affects startups with strong fundamentals and operating companies with robust cash flows but limited tangible assets, making it difficult for them to secure debt financing.

- Misaligned Risk Pricing: Current lending institutions consistently misprice risk, creating a market opportunity for new products that can accurately automate and assess risk.

- Disconnection between Crypto and Real-World Assets: Crypto investors lack efficient mechanisms to deploy capital into real-world assets and private credit.

- Inefficient Legacy Lending Models: Outdated lending and investment structures remain inefficient and lack automation, exacerbating the existing financing gap.

- Effective risk management: through advanced analytics and automated early risk flagging. This proactive strategy provides real-time insights, enabling swift decision-making to protect assets and ensure secure capital deployment.

- Speed: Slow capital deployment hinders lenders, causing missed opportunities. Our technology stack eliminates these inefficiencies through streamlined processes and automation, enabling rapid capital deployment. This speed and agility offer a crucial competitive edge.

1.3   DeFi Lending Landscape

DeFi lending protocols such as Aave[3] or Compound[4] established the foundation for overcollateralized lending using liquid crypto assets, enabling capital formation without intermediaries. Morpho Blue[5] introduced a modular, peer-to-peer architecture that delegates underwriting to curators and enables isolated lending markets with customizable parameters. These systems, however, remain inaccessible to real-world borrowers due to their reliance on crypto-native collateral.

Protocols such as Goldfinch[6] and 3Jane[7] expanded DeFi's lending architecture by moving beyond overcollateralized models. Goldfinch enables on-chain access to institutional private credit, while 3Jane facilitates unsecured lending to crypto-native borrowers based on attestations of off- and on-chain financial data. Yet, both architectures fall short in supporting dynamic repayment models and do not yet fully bridge the gap between real-world businesses and decentralized capital markets.

Loom Finance builds on this foundation by introducing a new approach that enables off-chain companies to access on-chain liquidity. This approach allows companies to raise capital through on-chain instruments tied to their income, without the constraints of traditional collateralization.

1.4 Protocol Overview

In the first phase, the protocol will facilitate revenue-based financing by enabling the issuance and settlement of tokenized claims on future cashflows. It operates through a sequence of on-chain and off-chain steps that together form a transparent, automated and scalable framework.

The process begins with the structuring of a Revenue Purchase Agreement (RPA). A business seeking capital —*the Sell-Side Client*— defines the terms of a future repayment obligation based on its existing subscriber base and their future revenue flows. This agreement outlines the repayment schedule, amount, and duration, and serves as the foundation for the financing arrangement. Investors —*the Buy-Side Client*— are invited to submit private bids, each specifying the amount of capital they are willing to deploy and the discount rate (price) at which they propose to purchase the revenue claim.

Following the review of submitted bids, the Sell-Side Client selects the preferred offer. The agreed-upon claim of future cashflow streams is then tokenized and allocated to the investor's wallet. This token encodes the core terms of the RPA and represents the investor's right to receive future payments from the business.

Upon settlement, investor funds are routed on-chain and off-ramped into fiat through regulated infrastructure providers. The business receives liquidity in its operating currency, enabling immediate capital access with minimal friction.

Throughout the repayment period, the business's claimed monthly cash flows are legally assigned to the purchaser and automatically redirected through the settlement infrastructure. The incoming fiat revenues are on-ramped into stablecoins and routed back on-chain, ensuring that the buyer receives the monthly cash flows to which they hold legal rights. Distributions are executed by a centralized settlement module, designed to optimize gas efficiency and reduce exposure to operational risk.

This architecture enables real-world businesses to access decentralized capital markets under flexible terms, while maintaining operational efficiency and minimizing risk exposure for all participants.
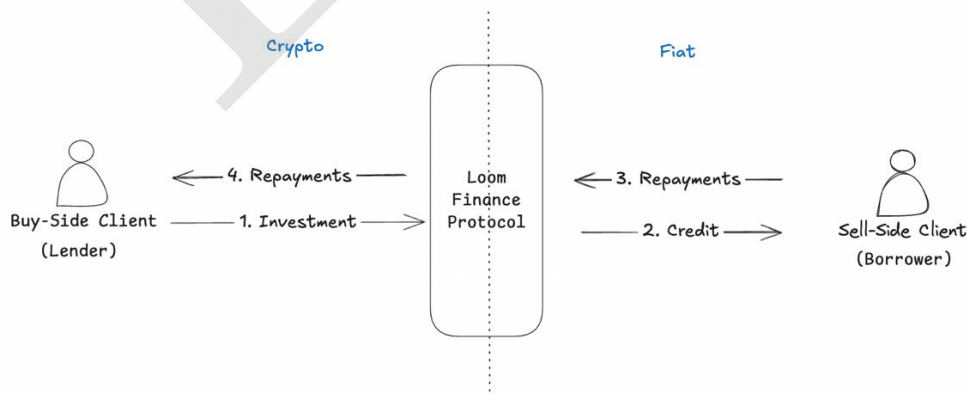

Figure 1: Loom Finance

2   Actors & Definitions

Sell-Side Client A subscription-based business seeking to finance working capital needs by selling a portion of its future cashflows via the Levenue platform.

Buy-Side Client A crypto-native investor who bids on a portion of a Sell-Side Client's projected 12-month recurring revenue, purchasing it at a discounted price using the stablecoin of their choice.

Revenue Purchase Agreement (RPA) A legally binding agreement signed between the Buy-Side and Sell-Side Clients after a bid is accepted. It outlines the terms of sale, including the purchase amount, discount rate, the individual future casflows being sold and schedule of monthly returning cashflows..

Trading Limit The maximum amount of future cashflow a Sell-Side Client is permitted to sell through the Levenue platform, as determined by its underwriting process. It is typically capped at 33% of the company's forward-looking Annual Recurring Revenue (ARR) in a specific currency.

Funding Request The amount a Sell-Side Client seeks to raise during an auction. It must remain within the company's approved Trading Limit and is always denominated in the same currency as the underlying future cashflows that are being sold.

Bid A commitment submitted by a Buy-Side Client that includes the proposed investment amount and discount rate. Bids are submitted blind by default unless the Sell-Side Client enables visibility.

3   Protocol Architecture

Loom Finance is architected in two interdependent layers: the **Off-chain Layer** and the **On-chain Layer**. Together, these components coordinate Web2 infrastructure with Web3 smart contract logic, enabling secure, seamless interactions between investors, companies, and the decentralized funding process.

3.1   Off-chain Layer

The off-chain layer orchestrates business logic, external service integration, and backend coordination. It acts as the main bridge between traditional systems and decentralized infrastructure, mediating processes for both Sell-Side Clients (companies) and Buy-Side Crypto Clients (investors).

Core Responsibilities

- Coordinate off-chain and on-chain operations

- Provide APIs for managing users, funding proposals, and subscriptions

- Handle user authentication, identity verification (KYC), and bot protection

- Manage funding timing, scheduling, and funding caps

- Aggregate and present company KPIs and investment opportunities

- Interface with smart contracts for funding proposal deployment and tracking

- Optionally support fiat rails and stablecoin conversion via payment processors (e.g., Stripe, PayPal, Adyen)

Components

1. Levenue Platform   The backend system exposes API endpoints for core entities:

- Buy-side clients

- Funding Proposals

- Bids

- RPAs (Revenue Purchase Agreements)

2.   Watchers   Automated services that maintain state coherence between on-chain activity and backend logic:

- **Buyers Watcher:** Handles buyer identity registration and verification, including wallet whitelisting via the Market contract after KYC approval.

- **Funding Watcher:** Monitors new funding proposals submitted to the platform and triggers on-chain deployment of corresponding FundingProposal contracts.

- **Bids Watcher:** Listens for bid submissions on-chain, updates backend status, and initiates settlement when a bid is accepted.

3. KYC Provider   An external identity verification service responsible for onboarding and approving new Buy-Side Crypto Clients.

This layer ensures secure coordination between platform events and smart contract execution, while preserving compliance and operational traceability.

3.2   On-chain Layer

This layer consists of modular Ethereum smart contracts that govern the funding proposal lifecycle, bidding mechanisms, capital custody, and settlement workflows. Buy-Side Crypto Clients interact with this layer directly through their wallets.

Core Responsibilities

- Implement Loom market and funding proposal logic

- Lock buyer funds upon bid submission

- Allow sellers to accept or reject incoming bids

- Execute settlements and trigger fund distribution

- Support programmable repayment events (e.g., revenue-linked triggers)

- Enable direct interaction via wallet-based authentication

- Emit on-chain events related to bid submission, settlement, refunding, and agreement status

Each FundingProposal contract validates that a buyer has passed KYC by checking their whitelisting status in the Market contract. When a bid is submitted, the contract locks the funds, emits an event, and makes the bid available for settlement. Once a bid is accepted off-chain, the Watcher initiates an on-chain settlement process that results in a signed Revenue Purchase Agreement (RPA) and the transfer of funds to a designated FIAT exchange wallet. If a bid is not accepted after the proposal expires, the buyer can trigger a trustless refund process entirely on-chain.

On-Chain Offer Settlement. All bid offers are recorded and held directly on-chain, with funds escrowed in smart contracts. This ensures transparency, verifiability, and automated enforcement of business logic, including offer acceptance, rejection, and expiration. Once submitted, funds are locked, and all subsequent outcomes—such as settlement transfers or refund eligibility—are governed entirely by the contract logic.

This design guarantees that Buy-Side clients can interact with the system without relying on intermediaries for trust or approval. Settlement, fund release, and refund actions are fully managed and triggerable on-chain, offering crypto-native users the expected guarantees of autonomy, auditability, and self-custody control.

This architecture ensures trust-minimized, auditable, and permissionless execution of financial commitments.

Deployment Environment

The protocol is deployed on a dedicated **Layer 2** using a *validium-style appchain* to improve scalability, reduce fees, and enhance privacy. Key features include:

- Customizable execution logic and gas metering

- Significantly higher throughput and lower latency compared to Ethereum mainnet

- Configurable data availability and access controls (state is not posted to L1)

3.3 Funding Process Flow

The funding process encompasses the full lifecycle of a funding proposal, from creation to bid settlement and agreement finalization.

1. Funding Request Creation

A Sell-Side Client submits a Funding Request through the Levenue Platform, specifying the desired capital amount and the currency they wish to receive. The requested amount must fall within their pre-approved Trading Limit, which is determined during the underwriting process.

2. Funding Proposal Deployment

The Fundings Watcher detects the new request and deploys a corresponding Funding-Proposal smart contract on-chain. The deployment is executed via the Market contract using a factory pattern. This contract will manage incoming bids and the settlement logic.

3. Bid Submissions by Buy-Side Clients

Buy-Side Clients interact directly with the on-chain FundingProposal contract to place bids. Upon submission, the bid amount is locked in the smart contract, and the buyer's wallet is verified via the Market contract to ensure KYC compliance. A bid submission event is emitted.

4. Bid Locking Period

All bids remain locked for a fixed window of 72 hours. During this time, the Sell-Side Client can review incoming offers and decide which to accept. Bids can remain private unless the seller opts to make them visible.

5. Bid Acceptance and Settlement

The Sell-Side Client accepts one or more bids at their discretion through the Levenue Platform. The Bids Watcher detects each accepted bid and initiates a separate settlement transaction on-chain:

- The FundingProposal contract emits a `PendingRPA` event.

- The Buy-Side Client signs the Revenue Purchase Agreement (RPA).

- The contract emits `SignedRPA` and `BidSettled` events.

- The locked funds are transferred to a designated crypto/fiat exchange.

- The crypto/fiat exchange converts the funds and initiates a fiat payout to the seller's bank account.

6. Agreement Finalization

After settlement, both parties retain a signed Revenue Purchase Agreement (RPA) that formalizes the terms of the transaction, including repayment schedule, discount, and legal responsibilities.

7. Bid Refunding

After the funding period ends, Buy-Side Clients whose bids were not accepted can trigger an on-chain refund. The contract verifies eligibility and returns the locked funds to the buyer in the same transaction, emitting a `RefundIssued` event.

3.4 Sequence Diagrams

Sequence diagrams visually describe protocol interactions. Each diagram captures the messaging between off-chain services, smart contracts, and the frontend.

These diagrams highlight:

- Integration of Web2 and Web3 components

- Message ordering and responsibilities

- Roles of KYC services, Watchers, smart contracts, and UI
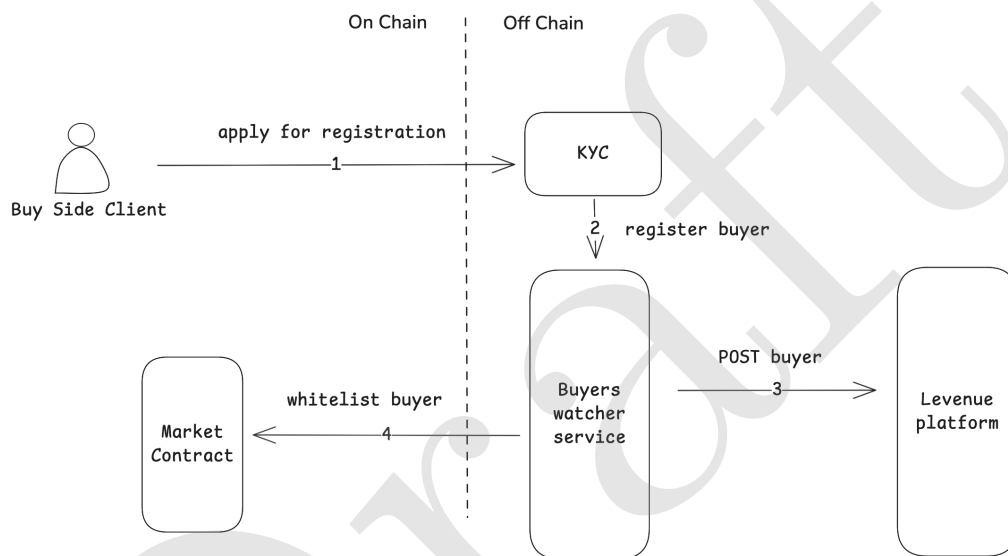
Buyer Registration

Figure 2: Sequence diagram: Buyer Registration

1. The Buy Side client initiates the registration process by submitting their information and completing identity verification through an external KYC provider.

2. Once KYC is approved, the provider notifies the Buyers Watcher service.

3. The Buyers Watcher registers the verified buyer on the Levenue platform by calling the internal API.

4. The Buyers Watcher then updates the Market smart contract by whitelisting the buyer's wallet address, enabling on-chain participation.
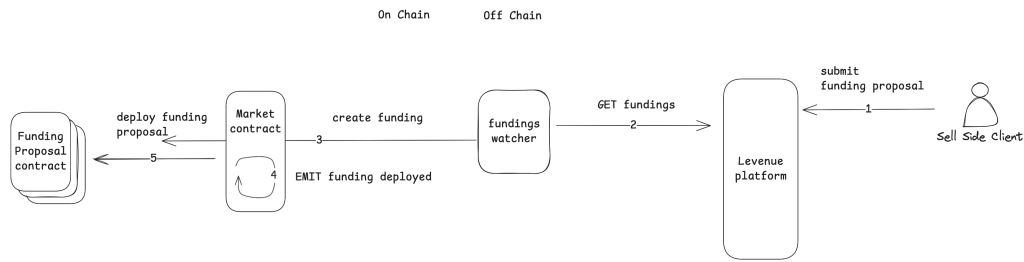
Funding Proposal Creation

Figure 3: Sequence diagram: Funding Proposal Creation

1. The Sell Side client submits a funding proposal through the Levenue platform, specifying the amount they wish to raise, expected revenue terms, and related metadata.

2. The Fundings Watcher service polls the Levenue API, retrieving new funding proposals submitted by Sell Side clients.

3. When a new proposal is detected, the watcher triggers an on-chain call to the Market contract to initiate the creation of the corresponding funding instance.

4. The Market contract emits a FundingDeployed event, recording the request and signaling the deployment of a new on-chain contract.

5. The Market contract deploys a new instance of a FundingProposal smart contract, which will manage bid submissions and on-chain settlement for that specific funding opportunity.
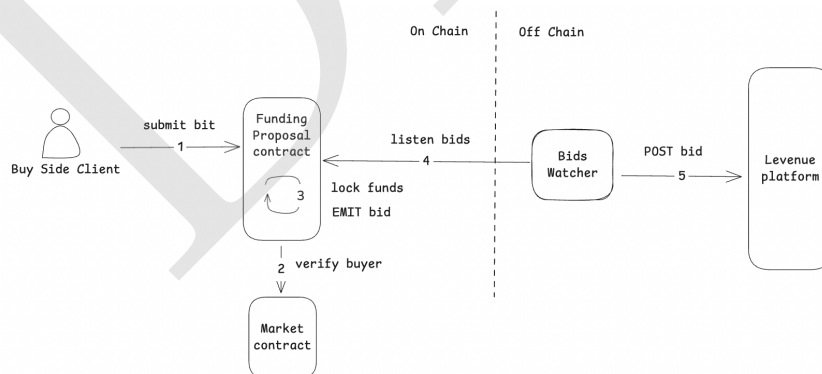
Bid Submission

Figure 4: Sequence diagram: Bid Submission

1. The Buy Side client selects a funding proposal and submits a bid to the corresponding FundingProposal smart contract, including both the bid data and the associated funds.

2. The FundingProposal contract calls the Market contract to verify that the buyer's address is whitelisted — confirming that they have passed KYC and are authorized to participate.

3. Once verified, the contract locks the submitted funds and emits a BidSubmitted event containing the bid details.

4. The Bids Watcher service listens for new bid events on-chain, capturing relevant data from the FundingProposal contract.

5. The watcher then forwards the bid to the Levenue platform via a secured API, making it available for Sell Side clients to view and evaluate.
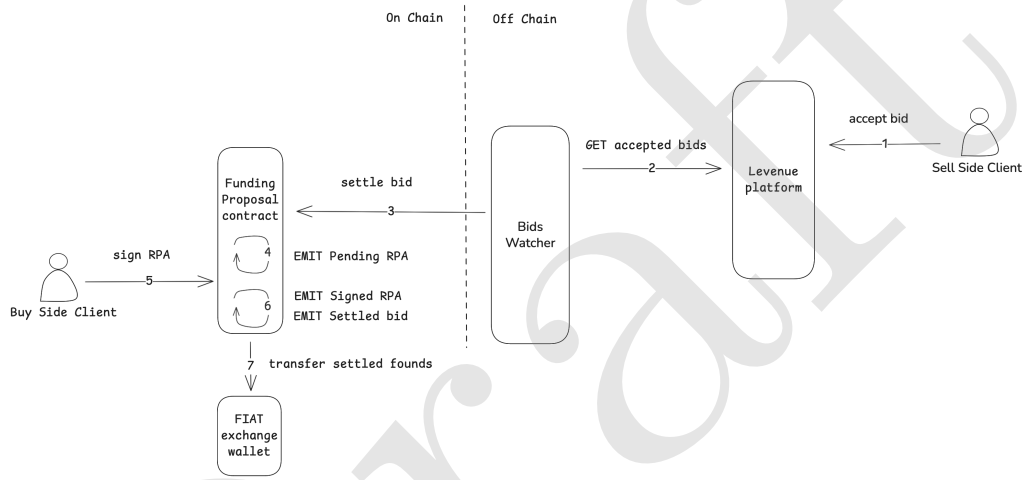
Bid Settlement

Figure 5: Sequence diagram: Bid Settlement

1. The Sell Side client accepts a bid offer through the Levenue platform, selecting a single Buy Side participant for the funding proposal.

2. The Bids Watcher service polls the Levenue API for newly accepted bids and detects the selected bid for settlement.

3. The watcher initiates the settlement process by sending an on-chain transaction to the corresponding FundingProposal smart contract.

4. The smart contract emits a PendingRPA event, indicating that an agreement is ready to be signed by the buyer.

5. The Buy Side client signs the Revenue Purchase Agreement (RPA), confirming their commitment to the funding terms.

6. The smart contract emits two events:

   (a) SignedRPA, indicating buyer confirmation.

   (b) BidSettled, confirming the on-chain finalization of the funding agreement.

7. The settled funds from the buyer are transferred from the smart contract to the designated FIAT exchange wallet for conversion and off-chain payout to the Sell Side client.
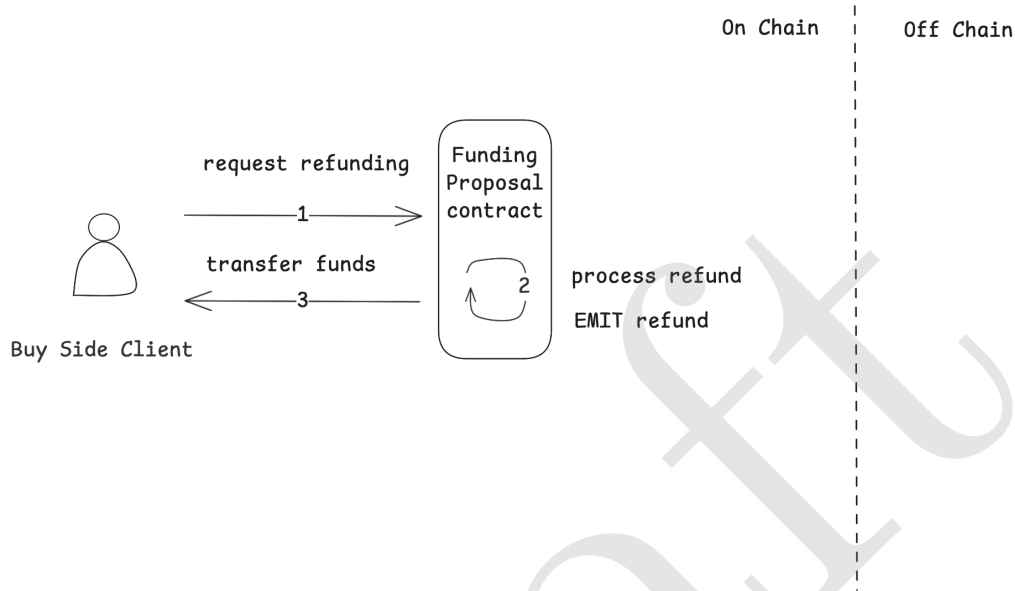
Bid Refunding

Figure 6: Sequence diagram: Bid Refunding

1. The Buy Side client initiates a refund request by calling the FundingProposal smart contract.

2. The contract verifies refund eligibility, ensuring that:

   (a) The funding proposal's bidding period has ended.

   (b) The 's offer was not selected during settlement.

   If both conditions are met, the contract updates internal state to prevent duplicate claims, emits a RefundIssued event, and prepares the refund.

3. The smart contract transfers the locked funds back to the Buy Side client in the same transaction.

4 Linking RPA Risk Mitigation to Smart Contracts

4.1 Events of Default: Triggers and Process

In the Revenue Purchase Agreement, the key triggers for an event of default include:

- **Failure to make payments on time.**
  The procedure is initiated if payment is delayed by 48 hours and there is no evidence provided to confirm its completion.

- **Revocation or cancellation of access to the payment provider or the SEPA mandate.**
  The procedure is initiated at the moment it is revoked, changed or canceled.

- **Stopping Levenue access to subscription management software, accounting software, or bank accounts for more than 6 hours.**
  The Sell Side is obligated to continuously maintain the Levenue Platform's view-only access. If new systems or accounts are adopted, they must be connected prior to transition. Disconnection beyond 6 hours automatically triggers the default procedure.

- **A decrease in revenue of 50% or more during any 6-month period.**
  Initiation of insolvency procedures for the Sell Side, or if one entity is under legal procedure or unable to pay its debt.

- **Re-sale or pledging of already sold receivables.**
  If such case happens, it should be remedied (other contract canceled) within 20 days.

- **False representation and warranties.**

- **Misleading information.**

- **Change of business by the Sell Side or ceasing operations under the initial contract (e.g., no more subscription sales).**

Most of these Events of Default are detectable through Levenue's integrations with the client's finance infrastructure. Consequently, they trigger automatically set up processes that can also be embedded in Loom smart contracts.

4.2 Official Procedure for a Confirmed Event of Default

The Revenue Purchase Agreement operates on a recourse model, minimizing investor risks. The Sell Side is responsible for ensuring that payments equivalent to the remaining amounts are made to the investor from its bank account, following the original payment schedule as if no subscription cancellation or non-payment had occurred. A key assurance for investors lies in (1) the legal nature of the contract and (2) the overcollateralization. The contract implies that the underlying cashflows are transferred to the investor, and are overcollateralized with 100 percent, meaning that for every "acquired subscription" the investor has a legal claim on another subscription.

In such scenarios, the investor is entitled to directly receive payments from subscribers, bypassing the Sell Side if an event of default occurs.

Upon the occurrence of an event of default, Levenue promptly notifies the investor. The investor then has the option to revoke the company's authority to collect any or all the purchased receivables (trade subscriptions).

Subsequently, the investor may issue a notice of assignment to all relevant clients of the company and declare that the entirety or a portion of the obligations are immediately payable.

The notice of assignment refers to the communication issued by the Buy Side to the end users. This notice informs the end user that the relevant sold subscriptions

and claimed subscriptions have been transferred to the Buy Side by the terms of this agreement and that the subscriptions should be paid on the Buy Side's bank account directly.

Once a notice of assignment is issued, the investor gains exclusive rights, to the extent allowed by law, to collect the relevant purchased receivables and exercise all associated rights of the company concerning these receivables.

If the company receives any payments related to these purchased receivables after the notice of assignment is issued to the relevant customer, it is obligated to promptly transfer an equivalent amount to the investor's account.

In summary, the Levenue RPA grants the investor authority to:

- Request immediate payment of the total amount owed,

- Notify subscribers of receivable transfers,

- Collect payments directly.

4.3   Mediation Strategies Following an Event of Default

Whenever feasible, Levenue prioritizes mediation.
Mediation is initiated for:

- **Failure to make payments on time:** The aim is to understand the cause of delay and estimate the time needed for future payments.

- **Revocation or cancellation of access to the payment provider or the SEPA mandate:** The objective is to determine whether these issues are errors or real account changes.

- **Stopping Levenue access to subscription management software, accounting software, or bank accounts for more than 6 hours:** The mediation seeks to understand and resolve the cause of disconnection (change of tool, error, server issue, etc. can be solved for instance).

- **Re-sale or pledging of already sold receivables:**Mediation seeks to cancel any other conflicting contracts, which are typically legally accepted.

- **Initiation of insolvency procedures for the Sell Side or one entity is under legal procedure or unable to pay its debt:** Mediation aims to expedite repayment to the Buy Side, potentially securing funds before the official legal procedure occurs.

- **Misleading information:** Mediation can correct the misinformation and clarifies the situation to the Buy Side (depending on the level of misleading elements)

- **A decrease in revenue of 50% or more during any 6-month period:** The mediation would typically have taken place multiple times prior to the occurrence. If there is an unforeseeable one-month revenue drop, the inherent risk emerges, making mediation a valuable tool to restructure the repayment terms, whether in full or partially.

- **Change of business by the Sell Side or the business ceases to operate under the initial contract (for instance, no more subscription sales):** Mediation can facilitate achieving full repayment at the time of change.

Mediation is not viable for:

- **Misrepresentation and warranties:** These lead directly to default without negotiation room as the trust is lost and Levenue should protect its own interest and cannot act in a mediation.

- **Critical misleading information:** In cases like KYC discrepancies, trust erosion precludes mediation.

- **Ongoing legal proceedings:** Legal complexities require formal legal intervention, not mediation.

4.3.1 Mediation Procedure

Each mediation will occur in several steps.

1. Upon identifying a default, Levenue engages with the Sell Side's key financial executives (with signing power) to understand the issue and formulate a resolution plan. An email and a call should be organized with the Sell Side (person with the signing power) and Levenue (Head of Operations).

2. Levenue informs the Buy Side about the situation and proposed solutions, seeking their input on the subsequent actions. According to that decision, either the procedure of default is launched or the mediation.

3. A confirmation meeting or communication is held to finalize the mediation agreement, outlining clear responsibilities and deadlines.

4. Non-adherence to the agreed plan triggers the default process.

Potential mediation resolutions include:

- Agreement on delayed payments (with a clear deadline) the first month for justified reasons with consensus from all parties

- Structuring a repayment plan that aligns with anticipated revenues or funding for the next 3 months.

- Tolerating temporary non-compliance to the RPA, provided it does not affect financial obligations and a resolution deadline is set (for instance, if a software is disconnected but the repayments are made on time).

- In severe cases, renegotiating the repayment terms to extend deadlines or modify terms of the RPA (eg. extending the repayment period to 15 months instead of 12 months).

- For companies nearing insolvency but monitored closely, a negotiated partial repayment plan may be established for the near term.

4.4 Collection Policy

If a default event is verified, the Buy Side has several mechanisms at its disposal to facilitate payment collection, with Levenue offering comprehensive support throughout the process:

1. Initiating contact with all key personnel at the Sell Side, typically reaching out to positions like the CEO, CFO, or Head of Finance.

2. Facilitating a meeting between both sides to discuss and potentially resolve the issue.

3. Distributing a notice of assignment to all subscribers with purchased subscriptions via email.

4. Communicating with and involving subscribers who have not yet redirected their payment allocations to the Buy Side's bank account.

5. Assisting in the collection of all outstanding subscriptions through a partnership with a collection agency working with Levenue.

6. Providing access to legal advisory resources.

Levenue's collection procedure is performed in several steps. On the first day following a confirmed default event, Levenue reaches out to the Sell Side's contacts (CEO, CFO, Head of Finance usually) to gather information and find a solution. Concurrently, Levenue checks the list of active and sold subscriptions. If the subscription manager is offline, the most recent extract is retrieved to secure all sold subscription data. A default event can be triggered six hours post the subscription manager's disconnection, ensuring Levenue has up-to-date information.

Levenue also verifies the latest transactions in the Sell Side's bank account. If there's no response within 24 hours or if the replies confirm the default, the money equivalent to the payment of sold subscriptions can be pulled from the Sell Side bank account (SEPA mandate) or the Payment Provider. Simultaneously, a notice of assignment is sent to all active subscribers (sold subscriptions). Subsequent steps involve monitoring the next payment cycle. If payments fail, Levenue (representing the Buy Side) contacts the backup list of subscribers (claimed subscriptions), followed by reaching out to the broader subscriber base. If necessary, Levenue can coordinate with a collection agency to manage these activities on behalf of the Buy Side, ensuring a structured and effective collection process.

5 Numerical Example

Consider a business aiming to sell a portion of its projected revenue. An investor submits a bid offering $90,000 in exchange for $100,000 to be repaid over 12 months. This corresponds to a 10% discount on the revenue claim.

The repayment schedule is as follows:

- Total repayment amount: $100,000

- Investment amount: $90,000

- Monthly payments: $8,333.33

- Duration: 12 months

Simple Discount vs IRR The simple "discount return" $(F - P)/P = 11.11\%$ ignores timing and assumes the principal is static. With amortization, average deployed capital is lower than P, so the capital-weighted return (IRR) is higher. A quick heuristic is to compare gains to the *average* outstanding exposure; a full accounting uses the IRR below.

Return Measurement (IRR) Because principal is returned over time via level monthly distributions, the appropriate yield metric is the internal rate of return (IRR) on amortizing cash flows. Let P be the purchase price, A the monthly distribution, n the number of months, and r_m the monthly IRR. Then:

$$P = \sum_{t=1}^{n} \frac{A}{(1 + r_m)^t} \quad \Longleftrightarrow \quad A = P \cdot \frac{r_m}{1 - (1 + r_m)^{-n}}.$$

For $P = \$90{,}000$, $A = \$8{,}333.33$, $n = 12$, the solution is $r_m \approx 1.659\%$ per month. The nominal APR is $12r_m \approx 19.91\%$, and the effective annual rate is

$$\text{EAR} = (1 + r_m)^{12} - 1 \approx 21.83\%.$$

If interim distributions are reinvested, realized performance tracks the EAR. Without reinvestment, the nominal APR remains a convenient benchmark while IRR remains the correct time-weighted measure.
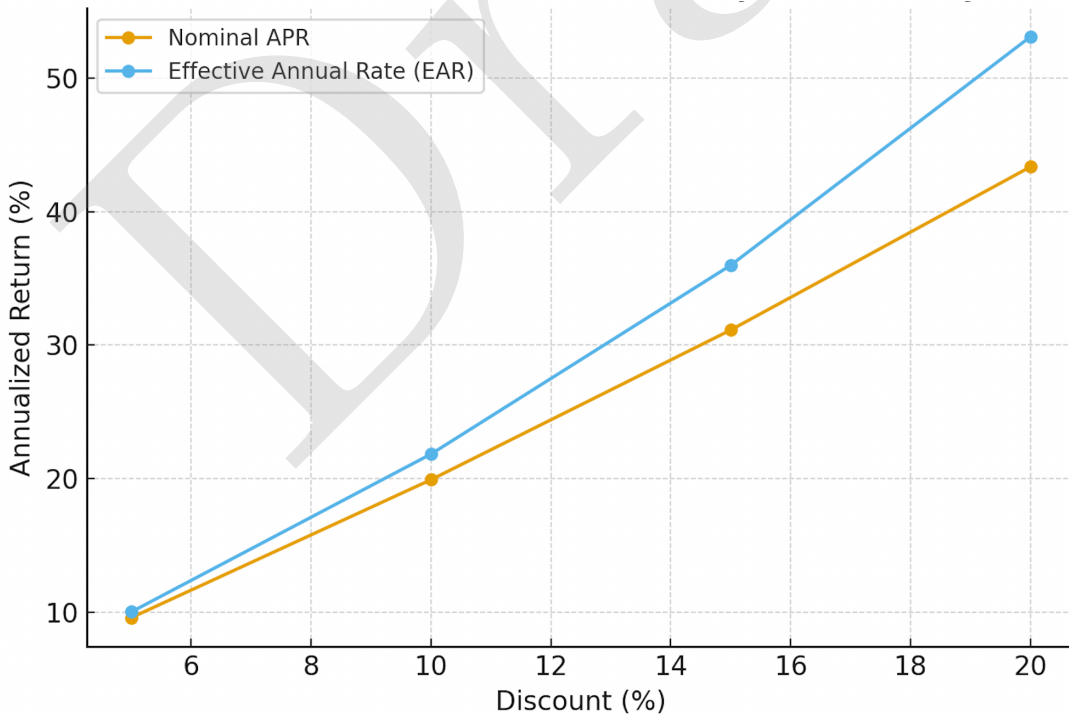

Figure 7: APR vs EAR for Different Discount Rates

The table reports nominal APR $= 12r_m$ and EAR $= (1 + r_m)^{12} - 1$.

Discount (%)	Purchase (per \$1)	Nominal APR (%)	EAR (%)
5	0.95	9.58	10.01
10	0.90	19.91	21.83
15	0.85	31.12	35.97
20	0.80	43.34	53.08

6 Future Work

6.1 Other Financing Products Aligned with the Loom Model

Besides the first use-case of Revenue based financing in partnership with Levenue, we have identified 3 other financing products that could benefit from the Loom Protocol to bridge "real world financing needs" to the Crypto world. These different Financing products have been identified based on the criteria necessary for automated processes: (1) Automated underwriting possibility, (2) Periodic cashflowing, (3) Easy execution of underlying securities.

1. **Invoice Factoring:** USD 3 Trillion estimated Global Financing Gap, is an even more simple version of revenue based financing, using invoices send out to clients as the underlying security for a very short term advance by the buyers. The estimated USD 3 trillion global financing gap highlights a critical need for innovative financial solutions, particularly for small and medium-sized enterprises (SMEs) and businesses operating with extended payment terms. One powerful and increasingly popular method to bridge this gap is revenue-based financing, often simplified to an even more accessible form through invoice financing. Invoice financing, at its core, leverages invoices already sent out to clients as the underlying security for a very short-term advance provided by specialized buyers or financial institutions. This mechanism allows businesses to convert their accounts receivable into immediate working capital, rather than waiting for customers to settle their invoices, which can often take 30, 60, or even 90 days. This immediate liquidity is crucial for maintaining operational efficiency, seizing

2. **Asset-backed SME Lending:** The global financing gap for asset-backed SME lending is currently estimated at a staggering USD 4.7 billion. This significant shortfall highlights a critical issue within the financial landscape, particularly in Europe, where a dramatic shift has occurred in financing strategies since the 2008 financial crisis. Following the 2008 crisis, banks in Europe have largely pivoted their focus almost entirely towards sponsor-backed companies. While this approach provides a seemingly safer and more predictable lending environment for financial institutions, it has inadvertently created a substantial void for the vast majority of non-sponsor-backed companies. Approximately 70% of these businesses now find themselves without the necessary capabilities to secure financing for growth and expansion. Ironically, many of these non-sponsor-backed SMEs are inherently strong and financially robust, with balance sheets capable of supporting substantial debt.

These are businesses that possess clear, tangible assets with discernible market values. Despite their inherent creditworthiness, they are being "starved of financing" due to the prevailing lending models that prioritize sponsor backing over asset-based security. Underwriting an asset with a clear value on a balance sheet and subsequently securing a part of the cashflows generated by those assets presents a highly automatable underwriting procedure. The process involves assessing the collateral's liquidation value, analyzing historical and projected cash flow generation, and establishing robust security mechanisms. This type of lending, often referred to as asset-based lending (ABL), offers a viable and secure pathway for banks and lenders to provide "gap funding" to deserving SMEs. Despite the inherent efficiencies and risk mitigation potential of automated asset-based underwriting, only a minuscule 5% of all lending currently approaches full automation. This represents a significant missed opportunity for financial institutions to broaden their reach, reduce operational costs, and serve a crucial segment of the economy. The future of SME financing hinges on the widespread adoption of automated, asset-backed lending practices by banks and other financial intermediaries. By embracing technological advancements in underwriting and risk assessment, lenders can unlock the immense potential of non-sponsor-backed SMEs, thereby stimulating economic growth and innovation.

3. **Cashflowing Real Estate Lending:** The global real estate market is currently facing a significant financing gap, estimated at a staggering USD 700 billion. This deficit is exacerbated by recent changes in European regulations, which have capped bank lending for commercial real estate at 55% Loan-to-Value (LTV). This new regulatory environment creates a substantial challenge, considering that the majority of current outstanding loans in the market sit at a 65% LTV. The looming maturity wall presents an even greater concern: within the next 1-3 years, over 80% of these existing loans will come due. Without readily available traditional financing solutions, many investors face the unenviable prospect of injecting additional equity into their transactions. This not only strains their capital reserves but also places immense pressure on their overall business operations and financial stability. Amidst this challenging landscape, a compelling opportunity emerges in the realm of cashflowing real estate lending, particularly for properties with mid to long-term lease or rent contracts. This type of real estate offers an attractive and relatively straightforward underwriting proposition for potential investors. The inherent stability of such assets stems from two key factors:

   - **Underlying Asset Value:** The fundamental value of the real estate itself provides a strong foundation for financing.

   - **Predictable Income Streams:** The consistent and predictable income generated through long-term rent or lease agreements offers a reliable claim on future cash flows.

These combined elements create an interesting liquidity profile, making such investments appealing to a diverse range of investors seeking stable, income-generating opportunities in the real estate sector. The clear visibility of income allows for more precise financial modeling and a lower risk profile compared to speculative real estate ventures. This environment fosters a demand for alternative financing

solutions that can bridge the existing gap and capitalize on the robust fundamentals of income-producing real estate.

6.1.1 Potential Financing Providers for the Protocol

The intricate and diverse nature of originating and underwriting a wide array of financing products for SMEs has become exceedingly complex for universal banks to handle efficiently and profitably. This complexity stems from several factors: the need for deep industry-specific knowledge, the continuous evolution of financial products, the granular risk assessment required for a heterogeneous group of businesses, and the increasing regulatory burden. As a consequence, there has been a remarkable surge in the proliferation of specialized lender platforms.

These platforms are typically established by teams with a focused expertise, allowing them to excel in two critical areas:

1. **Originating Deals within Specific Finance Niches:** Unlike large, generalist banks, these specialized lenders concentrate their efforts on particular segments of the SME financing market. This could involve specific industries (e.g., tech startups, real estate development, healthcare), types of financing (e.g., revenue-based financing, venture debt, supply chain finance, asset-backed lending), or even specific company stages. By narrowing their focus, they can cultivate deep market understanding, build targeted networks, and develop efficient deal sourcing mechanisms tailored to their niche. This specialization enables them to identify and attract suitable borrowers more effectively than traditional banks with broader mandates.

2. **Underwriting Risk with Specialized Models:** The "one-size-fits-all" underwriting models often employed by large banks are frequently inadequate for the nuanced risk profiles of SMEs across various sectors and financing products. Specialized lenders, on the other hand, develop and leverage sophisticated, niche-specific underwriting models. These models incorporate granular data points, industry benchmarks, and often employ advanced analytics and machine learning techniques to assess creditworthiness and predict default probabilities with greater accuracy for their targeted borrowers. This tailored approach to risk assessment allows them to price risk more effectively, offer more competitive terms, and ultimately make more informed lending decisions than generalist financial institutions.

In essence, the banking landscape is experiencing a disaggregation of functions, where the core capital provision remains with large balance sheets, while the intricate, labor-intensive, and specialized aspects of originating and underwriting credit for diverse SME needs are increasingly outsourced to agile, focused, and technologically advanced platforms. This structural change is driving innovation and efficiency in the SME financing ecosystem.

Company	Niche/Specialty	Region	Brief Description
Capchase	Revenue-based financing for SaaS companies	US	Provides non-dilutive capital by advancing future subscription revenue, using specialized models to underwrite based on real-time SaaS metrics.
Clearco	Revenue-based financing for e-commerce	US/Canada	Offers funding tied to online sales performance, originating deals for digital retailers with AI underwriting on e-commerce data.
Pipe	Trading future revenue streams for SaaS and digital businesses	US	Originates upfront capital by purchasing recurring revenue, with niche models analyzing subscription and payment data.
Lighter Capital	Revenue-based financing for tech startups	US	Specializes in growth capital for software and tech SMEs, underwriting via revenue forecasts and alternative data without equity dilution.
BHG Financial	Loans for professionals and healthcare practices	US	Focuses on originating working capital and term loans for doctors, dentists, and similar, using industry-specific risk models.
Camino Financial	Financing for Latino and immigrant-owned businesses	US	Originates loans for underserved ethnic SMEs, with bilingual services and models tailored to credit-challenged entrepreneurs.
Upright	Real estate fix-and-flip loans	US	Specializes in short-term property rehab financing for real estate investors, underwriting based on project specifics and market data.
Channel Partners	Equipment financing and leasing	US	Originates deals for machinery and equipment purchases in various industries, with risk models focused on asset value and depreciation.
NeoGrowth	Unsecured loans for small retailers	India	Uses digital payments data for underwriting, originating flexible repayment loans for retail SMEs in emerging markets.
Siembro	Loans for agriculture	Argentina	AI-powered instant approvals for agribusiness SMEs, focusing on machinery and crop financing in underserved rural areas.
Allica Bank	Asset financing for SMEs	UK	Provides up to £1M in equipment and vehicle loans, using tech for quick origination and local expertise for underwriting.
Validus	Growth financing for underserved SMEs	Southeast Asia	All-in-one platform using AI and data analytics to originate fast loans for SMEs in niches like trade and supply chain.

Ebury	International payments and lending for SMEs	UK/EU	Specializes in FX-linked financing for cross-border businesses, underwriting with global trade data.
Live Oak Bank	Industry-specific loans	US	Originates SBA-backed loans for over 35 niches, using specialized teams and models for high-concentration industries.
Ampla	Financing for direct-to-consumer brands	US	Provides growth capital for DTC e-commerce, with underwriting based on sales and inventory APIs.
Wayflyer	E-commerce revenue-based financing	US/Global	Originates advances against future sales for online sellers, using real-time data integrations for risk assessment.
Panacea Financial	Loans for physicians	US	Digital platform originating practice loans and refinancing for doctors, with niche models for medical professionals.
GreenSky	Home improvement point-of-sale loans	US	Facilitates instant financing at point of sale for renovations, underwriting via merchant networks and consumer data.
iwoca	Flexible unsecured loans and credit lines for SMEs	UK Germany	Originates fast loans up to £500K using machine learning on alternative data (e.g., accounting integrations like Xero).
Funding Circle	P2P lending for business expansion	UK/EU	Connects SMEs with investors for loans £10K–£500K; specializes in originating term loans with proprietary credit models.
OakNorth	Customized term loans for growth SMEs	UK	Provides loans £0.5M–£25M with data-driven underwriting via its ACORN platform, focusing on sector-specific models.
CapitalBox	Working capital and installment loans	Nordics EU	Originates fast financing for SMEs using digital data sources; specializes in underwriting for cash-flow challenged businesses.
Floryn	Unsecured business loans with daily repayments	Netherlands	Uses bank transaction data and AI for instant origination; niche in flexible financing for Dutch SMEs in trade and logistics.
Spotcap	Credit lines for established SMEs	Germany Spain	Originates loans based on real-time financial data; specializes in underwriting for mid-sized firms in manufacturing and tech.
Silvr	Flexible loans for digital businesses	France	Provides €5K–€1M funding with quick origination; niche in e-commerce and SaaS, using performance metrics for specialized risk scoring.

SME Finance	Multi-product financing (loans, factoring)	Lithuania EU	Marketplace originating deals for innovation and sustainability-focused SMEs; uses AI and EIF-backed models.
Kreos Capital	Venture debt for tech startups	UK/EU	Originates non-dilutive debt for Series A+ SMEs; specializes in underwriting based on IP and growth metrics.
Boost&Co	Structured growth capital	UK	Focuses on originating deals for scaling SMEs in tech and services; uses bespoke models for revenue forecasts.
Uncapped	Revenue-based financing for SaaS	Poland	Advances against MRR with API-driven origination; niche underwriting for subscription businesses using churn and cohort analysis.
Finom	Integrated lending within digital banking	Netherlands	Originates loans via AI-powered platforms for freelancers and SMEs; specializes in real-time underwriting.
Wealthon	Software-embedded financing	Poland	Provides loans integrated with business tools; niche in originating for micro-SMEs with models based on operational data.

6.2 DeFi-Native Product Extensions

While Loom Finance provides a robust foundation for revenue-based financing onchain, several directions for future development could significantly enhance its functionality, scalability, and composability within the broader DeFi ecosystem.

One promising avenue involves the introduction of modular risk pricing mechanisms inspired by curator-based architectures such as those pioneered by Morpho. In this model, a decentralized set of actors—underwriters or assessors—could participate in the validation and pricing of revenue agreements. These participants may adjust discount rate bounds dynamically, contribute to credit scoring heuristics, or signal underwriting preferences based on on-chain reputations and market data, thereby enhancing the protocol's ability to scale trust-minimized capital formation.

The tokenization of repayment claims also opens the door to secondary market formation. Enabling these tokens to be traded on permissionless marketplaces would provide liquidity for investors seeking early exits and establish market-based price discovery for real-world revenue streams. This evolution would not only enhance capital efficiency but also contribute to the maturation of on-chain fixed income instruments.

Loom Finance could also explore integrations with structured yield protocols such as Pendle[8], or develop native mechanisms for tranching cash flows. By doing so, it would allow investors to gain exposure to specific yield profiles—fixed or variable—and to structure risk in line with their portfolio mandates. This layer of composability could catalyze the emergence of new financial primitives built on top of recurring revenue flows.

To address repayment risk, future iterations of the protocol may include [9]insurance or protection features. These could be implemented through native reserve mechanisms, third-party coverage, or integrations with decentralized insurance protocols. Such tools would allow investors to hedge against partial defaults, delayed repayments, or systemic shocks affecting SME cash flows, thereby improving the protocol's attractiveness to risk-averse capital.

Finally, as the protocol scales and the number of tokenized agreements grows, the creation of indexable portfolios or revenue-backed ETFs may become viable. These instruments would enable passive strategies, improve diversification, and contribute to the development of benchmarks for tokenized cash flow assets—bridging the gap between traditional credit markets and decentralized finance.

6.3 Infrastructure/Protocol improvements

Fully Homomorphic Encryption (FHE) [10] allows parties to compute over encrypted data, without having to decrypt it first. For example, two parties could each post their respective bids in encrypted form, and the smart contract could show that one bid is larger than the other without having to disclose the values or having a trusted party first decrypt. This would allow all the bidding process to be conducted fully on-chain and increase the overall privacy of the protocol. The protocol could also provide performance and risk metrics from encrypted data provided by companies without disclosing critical information.

Currently, companies need to disclose a lot of information to provide evidence of their revenue. Using zkTLS, they could connect with payment service providers and generate a cryptographic proof that shows their total revenue flows without having to disclose every transaction or provide additional information. These proofs can, moreover, be efficiently verified and avoid disclosing unnecessary details. This results in a twofold advantage, both for the protocol, and companies. On the company's side, they do not have to trust the protocol by giving all their revenue information, reducing the friction of onboarding new businesses to the protocol. On the other hand, the protocol gets verifiable information from payment service providers, reducing the auditing costs and having to connect to third-party APIs.

7 Conclusion

Loom Finance demonstrates that revenue-based financing can evolve from a niche, off-chain instrument into a scalable and composable DeFi primitive. By tokenizing claims on real business cash flows and embedding them into smart contracts, the protocol enables investors to access non-dilutive yield opportunities while providing businesses with flexible growth capital.

The design goes beyond overcollateralized crypto lending: flows are legally assigned to investors and automatically redirected through the settlement infrastructure, aligning traditional enforceability with on-chain automation. This combination reduces friction, increases transparency, and expands the scope of real-world financing that can be integrated into decentralized markets.

As adoption of real-world assets (RWAs) in DeFi continues to accelerate, Loom Finance positions itself as part of a broader shift: moving capital markets from collateral-dependent lending towards productivity-based financing. By bridging predictable revenue streams to permissionless capital pools, Loom contributes to building the next generation of fixed-income products on-chain—transparent, programmable, and globally accessible.

Ultimately, Loom is not only a financing tool for SMEs, but also a building block for the maturing RWA narrative in DeFi. It showcases how future productivity, rather than static collateral, can serve as the foundation for decentralized capital formation.

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Appendix

A   Risk Analysis and Simulations

Risk management is essential for ensuring the sustainability of the protocol financing model. This section presents quantitative simulations based on real repayment data provided by Levenue. By leveraging the Default Risk Score, we assess systemic risks, treasury resilience, investor exposure, and liquidity conditions.

Each section outlines the methodology, mathematical framework, and simulated outcomes to provide insight into the system's robustness.

A.1   Exploratory Data Analysis (EDA)

A.1.1   Data Sources and Processing

To ensure our risk simulations are based on real historical, we conducted an exploratory analysis of the available datasets. The key data sources include:

- **Trades Dataset**: Contains executed contracts and their financial parameters.

- **Repayments Dataset**: Includes historical payment records associated with each contract.

Key pre-processing steps included:

- Cleaning repayment amounts by removing currency symbols and converting to float.

- Standardizing date formats to ensure correct time-based analysis.

- Linking repayments to their respective trades via the Trade ID.

A.1.2   Default Risk Score Calculation

To quantify the likelihood of default for each borrower, we introduce the **Default Risk Score**, a metric derived from historical repayment behavior. This score provides an empirical estimation of a borrower's risk level based on past payment patterns.

The Default Risk Score is computed using the historical repayment records from the dataset. The key steps are:

1. **Identify Payment Status:** Each repayment is categorized as either:

   - *On Time*: Payment was received on or before the due date.
   - *Late Payment*: Payment was delayed by more than 4 days.
   - *No Payment*: No record of repayment within the contract period.

2. **Calculate Late Payment and Default Frequency:** For each trade, we compute:

$$\text{Late Payment Rate} = \frac{\text{Number of Late Payments } (> 4 \text{ days})}{\text{Total Expected Payments}} \times 100 \tag{1}$$

$$\text{Default Rate} = \frac{\text{Number of No Payments}}{\text{Total Expected Payments}} \times 100 \tag{2}$$

3. **Compute Default Risk Score:** The final score is a weighted combination of late payments and full defaults:

$$\text{Default Risk Score} = (\text{Late Payment Rate} \times w_1) + (\text{Default Rate} \times w_2) \qquad (3)$$

where w_1 and w_2 are weight parameters that prioritize full defaults over late payments. Empirically, we set $w_1 = 0.5$ and $w_2 = 1.0$ to reflect the increased severity of missed payments.

The interpretation is as follows

- A **Default Risk Score close to 0** indicates a borrower with a strong repayment history.

- A **Score approaching 100** signifies a high-risk borrower with frequent defaults or delays.

The 4-day threshold for labeling a payment as 'Late' was selected based on Levenue's operational timelines, which consider weekends, potential banking delays, and internal coordination before initiating borrower follow-up.

A.1.3 Key Risk Metrics

Payment Status Distribution

To better understand borrower behavior, we analyzed the distribution of repayment statuses across all contracts.
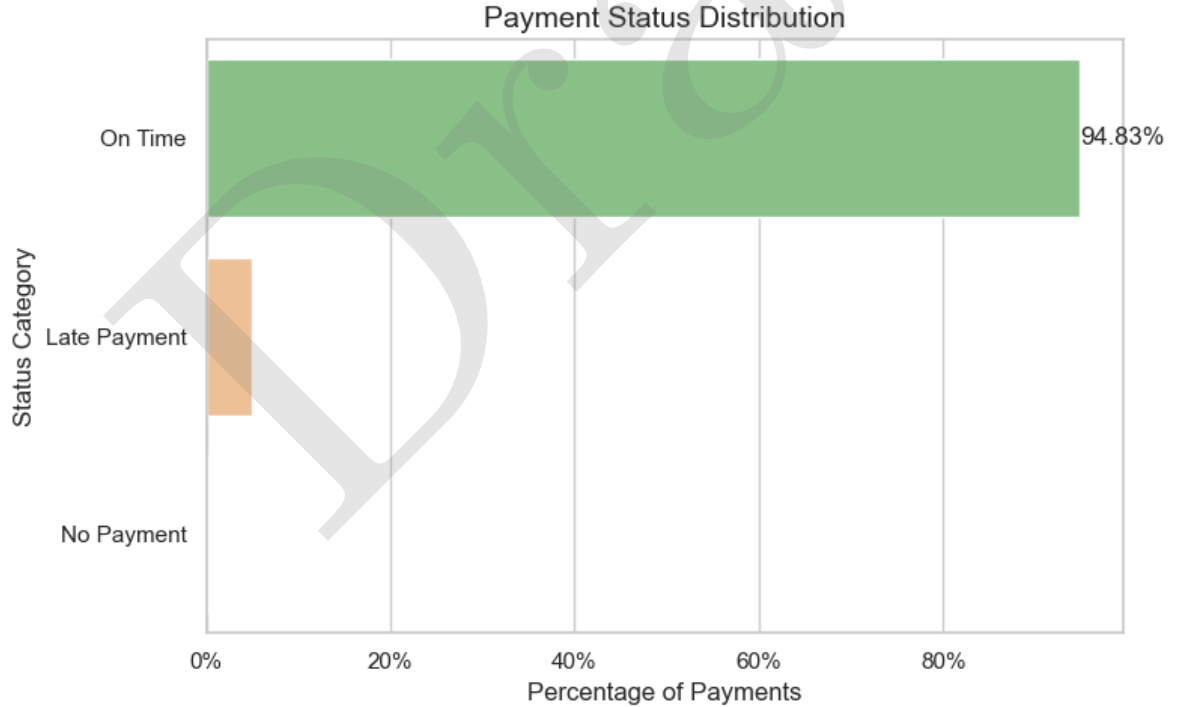

Figure 8: Distribution of Payment Status Categories

Figure 8 illustrates the proportion of payments categorized as *On Time*, *Late Payment*, or *No Payment*.

- **94.83% of payments were made on time**, indicating strong borrower discipline.

27

- **4.97% of payments were late (more than 4 days)**, requiring closer monitoring.

- **0.2% of payments were entirely missed (No Payment)**, representing potential defaults.
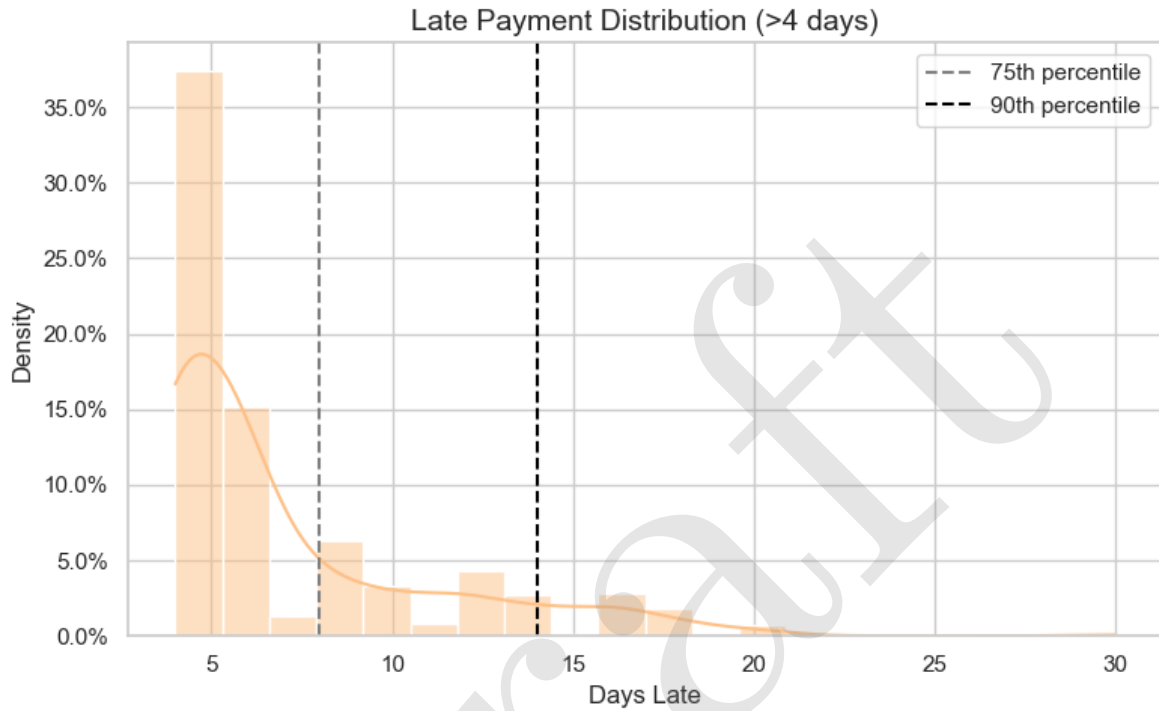
Late Payment Trends

Figure 9: Distribution of Late Payments (Only > 4 days)

Figure 9 illustrates the frequency of late payments among borrowers. We specifically analyze delays greater than 4 days. This highlights a critical threshold where repayment behavior changes significantly. We have that 75% of late payments are made in less than 8 days; and that 90% of late payments are made in less than 14 days.
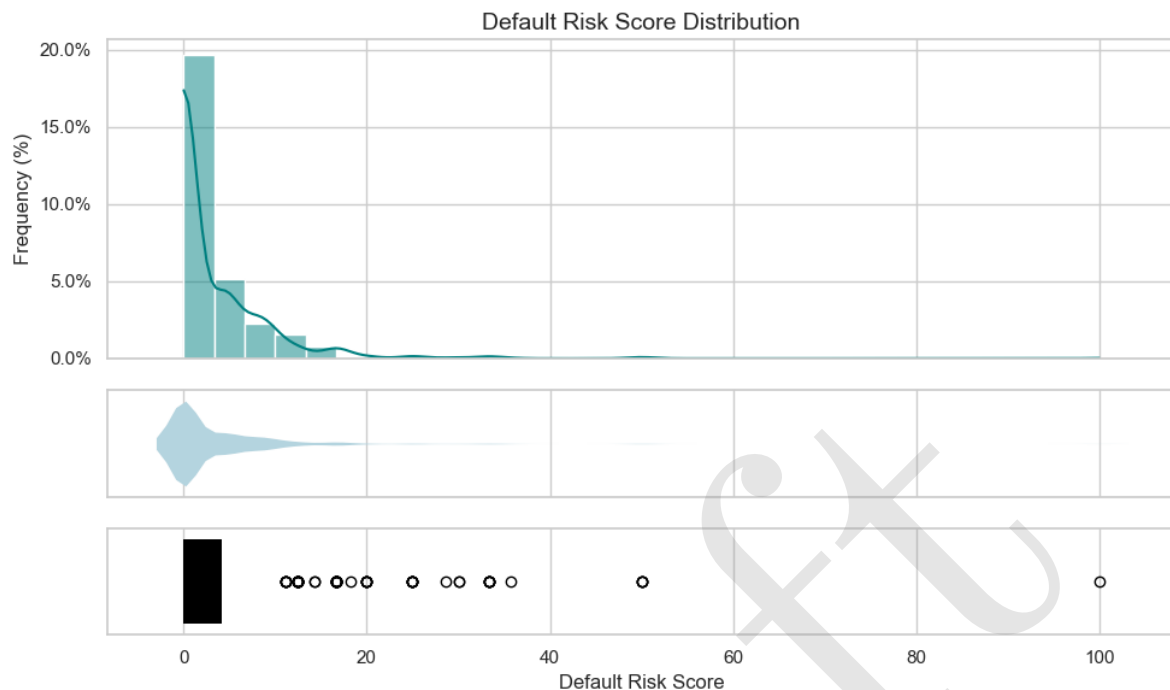
Default Risk Score Distribution

Figure 10: Default Risk Score histogram, violin plot and boxplot

Figures 10 reveal that the distribution of the Default Risk Score is highly skewed toward low-risk values. Most loans exhibit very low default risk, with the majority of scores concentrated near zero.

We display both a violin plot to visualize the shape of the distribution and a boxplot to highlight outlier behavior. The boxplot highlights the presence of a few outliers representing higher-risk loans. However, these are relatively rare cases. Specifically, the analysis of the 99$^{\text{th}}$ percentile shows that 99% of the loans have a Default Risk Score below 29,54. This indicates that only a small fraction of the loans carry a significantly higher risk.

Overall, this risk profile suggests that the portfolio is predominantly composed of low-risk loans, with isolated high-risk cases that should be monitored more closely.

A.2 Risk Composite Score (RCS)

To assess systemic risks within the Loom protocol, we propose a *Risk Composite Score (RCS)* that combines key risk dimensions inspired by the Payment Control System and calibrated with the borrower payment dataset provided by Levenue.

A.2.1 Risk Factors Considered

The RCS aggregates three primary stochastic risk factors:

- **Churn Impact** (C): Models the probability of subscription loss impacting revenue streams.

- **Fail Impact** (F): Captures the likelihood of a borrower missing several repayments before settling.

- **Instability Impact** (S): Reflects revenue volatility based on payment behavior instability.

Each component is simulated as a Bernoulli (Binomial) trial per simulation run, meaning that in each iteration, the risk event either occurs or not, reflecting realistic binary outcomes (event/no-event) of market risks.

The current model uses binomial draws for simplicity and interpretability. However, for a more realistic risk modeling approach, future extensions could incorporate continuous probability distributions (e.g., Beta or Normal) to reflect varying impact levels of each risk component, enabling a richer stress-testing framework.

A.2.2 Calibrated Probabilities from Data

To compute the risk probabilities used in the Risk Composite Score (RCS), we leverage the historical dataset provided by Levenue, specifically the payment status and delay information associated with each trade. The rationale for each probability is as follows:

- **Churn Probability** (p_{churn}): Calculated as the average percentage of late payments across all trades:
$$p_{churn} = \text{mean}(\text{Late Payment \%})$$

  This captures the likelihood of revenue streams being interrupted due to client churn or inconsistent payment behavior. A higher proportion of late payments signals potential churn risk.

- **Failure Probability** (p_{fail}): Estimated as the average Default Risk Score scaled to probability terms:
$$p_{fail} = \text{mean}\left(\frac{\text{Default Risk Score}}{100}\right)$$

  This reflects the risk of companies failing to meet their payment obligations entirely. A higher Default Risk Score indicates a history of significant delays or missing payments, hence a higher failure probability.

- **Instability Probability** ($p_{instability}$): Approximated as the standard deviation of the Late Payment percentage:
$$p_{instability} = \text{std}(\text{Late Payment \%})$$

  This captures the variability or volatility in payment behavior, serving as a proxy for revenue instability. Higher variance suggests irregular cash flows and increased instability risk.

These values represent the observed frequency of payment irregularities and form the basis for our Monte Carlo simulation.