Neko: DeFi protocol and liquidity layer for RWAs

Fabián Sánchez Durán
fabiansanchezd@outlook.com
Santiago Villarreal Arley
santivillarley1010@gmail.com
Matias Aguilar Vega
aaguilar1x@gmail.com

ABSTRACT

This paper introduces Neko, a liquidity protocol designed to unlock the global value trapped in real-world assets (RWAs) by enabling them to function as on-chain collateral with institutional-grade privacy and verifiable attestations. Neko provides a primitive for the permissionless creation of isolated RWA vaults that tokenize real-estate claims, invoices, and private-equity agreements, allowing users to borrow liquid assets or supply capital into yield-generating RWA markets. Through a hybrid attestation system, off-chain verified RWAs are minted as cryptographic claims, while zero-knowledge proofs ensure sensitive information such as ownership, appraisal values, and legal documents remains private without compromising risk assessment. Built on Soroban within the Stellar ecosystem, Neko combines low-cost execution, fast settlement, and strong asset primitives to support real-world collateral at global scale. By isolating risk per-vault, leveraging market-driven underwriting, and enforcing transparent liquidation guarantees, Neko bridges RWA markets and DeFi liquidity, enabling capital-efficient, privacy-preserving, and scalable credit for SMEs, institutions, and individual asset holders.

I. INTRODUCTION

Real World Assets (RWAs) are the fastest-growing sector in crypto in 2024-2025 BlackRock's BUILD alone is > $3B, Ondo, Centrifuge, Maple, Goldfinch, Credix, Figure, Securitize and dozens of others are pushing hundreds of millions (and in some cases billions) of TVL into tokenized treasuries, private credit, real estate, equities, etc. Yet almost none of this capital is actually in DeFi.

RWAs on Stellar involve tokenizing traditional financial products like treasuries, bonds, equities, and commodities on the blockchain, enabling fast, low-cost transfers and DeFi integration. Stellar's design for payments and asset issuance, thanks to Soroban smart contracts, makes it suitable for this, with built-in compliance tools addressing regulatory needs. As of November 2025, the ecosystem provides access to over $3 billion in RWAs, including stablecoins (like PYUSD). Treasuries dominate at around 95% of the market. This growth aligns with global trends, where tokenized assets jumped from $8.6 billion to over $23 billion in the first half of 2025 alone.

Some good initiatives include Franklin Templeton's BENJI token, representing shares in a U.S. government money fund (FOBXX) invested in securities and cash, now expanded to regions like Luxembourg and Hong Kong. WisdomTree offers 13 digital funds, including private credit tokenized on Stellar, plus a gold token (WTGOLD), tapping into the $1 trillion private credit market with minimum investments as low as $25. Turbo Energy's November 2025 pilot tokenizes debt for hybrid solar-battery projects, aiming at a $74 billion Energy-as-a-Service market via Power Purchase Agreements. Brazilian efforts feature Mercado Bitcoin's $200 million in tokenized assets, Etherfuse's TESOURO bonds, and a

government-backed BRL stablecoin for payments. PayPal's PYUSD stablecoin, live on Stellar since September 2025, supports instant, low-cost global transfers. Chainlink's October 2025 integration brings CCIP for cross-chain transfers, Data Feeds, and Streams, enhancing RWA security and DeFi. Other players like Ondo Finance (USDY yield token), Centrifuge, RedSwan Digital ($100 million real estate), and Wirex with Visa for USDC/EURC settlements round out the landscape.

Stellar's RWA TVL (total value locked) stands at approximately $1.01 billion, primarily in government securities. Q3 2025 had 1 billion operations processed and a 118% year-to-date RWA value increase to $654 million (pre-November updates). Stellar ranks fourth among RWA chains at 112 points, focusing on payments and CBDC pilots.

2025 appears as an inflection year for RWAs, with projections of $10-30 trillion tokenized by 2030. Stellar's role could expand via Soroban ZK updates, more CBDC pilots, and RWA-DeFi protocols like Neko Protocol. Latin America's focus, including Brazil's innovations, positions it as a growth hub, potentially turning volume into everyday velocity. Overall, evidence leans toward sustained adoption of interoperability and regulations align, making Stellar a resilient player in tokenized finance.

II. SYSTEM OVERVIEW

Neko is a non-custodial liquidity protocol that turns off-chain, legally-enforceable claims into on-chain collateral primitives. At the core of the system are isolated RWA vaults: each vault represents a segregated pool of tokenized claims, risk parameters, and creditors, decoupled from the solvency of other vaults.

The high-level components are:

1) RWA vaults: on-chain containers that hold tokenized claims over specific pools of assets. Each vault has its own collateralization ratios, liquidation thresholds, etc.

2) Liquidity suppliers: users who deposit liquid assets (e.g., USDC, XLM, stablecoins) into vault markets to earn yield from borrowers who collateralize RWAs.

3) Borrowers: asset holders or arrangers who deposit RWA claim tokens as collateral and borrow liquid assets against them, subject to vault-specific risk parameters and oracle prices.

5) Oracle and attestation layer: a hybrid system combining off-chain price fetchers, a Soroban-based RWA oracle contract, and eventually zero-knowledge circuits that validate the consistency of feeds and attestations without revealing sensitive details.

6) Swap and routing layer: Soroswap pools and routers used to convert between different on-chain assets (e.g., RWA assets, USDC, XLM) for deposits, repayments, and liquidations.

The basic flow is:

- Off-chain assets are underwritten and tokenized into RWA claim tokens.
- Price and metadata are fed into the oracle.
- Users deposit RWA tokens into a vault and borrow liquid assets.
- Oracle updates and market prices continuously adjust health factors.
- If collateral value breaches thresholds, positions can be liquidated through swaps and auctions.

III. RWA VAULT MODEL

A. Isolated Collateral Pools

Each Neko vault is parameterized by:

- Underlying asset universe: a set of RWA tokens eligible as collateral (for example, tokenized shares in specific equities, short-dated treasuries, or a diversified pool of revenue-sharing agreements).
- Collateralization parameters: maximum loan-to-value (LTVmax), liquidation threshold (LT), and liquidation bonus (LB).

- Currency of account: the base asset in which risk is measured (e.g., USD), aligned with the oracle's base.

For a user (i) in vault (v), with collateral value $C_{i,v}$ (in base units) and borrowed amount $B_{i,v}$, we define:

Health factor:

$$HF_{i,v} = (C_{i,v} \times LT_v) / B_{i,v}$$

where $LT_v \in (0,1)$ is the vault liquidation threshold. Positions are considered:

- Safe if $HF_{i,v} > 1$
- Liquidatable if $HF_{i,v} \leq 1$

B. Tokenization and Claims

The oracle's RWA metadata registry attaches machine-readable descriptors to each asset_id, including:

- Asset type (Stock, Bond, Commodity, RealEstate, Invoice, PrivateCredit, Other).
- Issuer information and regulatory approvals.
- Tokenization contract, circulating supply, and underlying identifiers.
- Optional tags for jurisdiction, etc.

C. Market-Driven Underwriting

Rather than imposing a global risk model, Neko allows vault creators to define:

- Which RWAs are accepted and at what LTVs.
- Interest rate curves for borrowing and supplying.
- Liquidation mechanisms and fees.

IV. ORACLE AND ATTESTATION LAYER

A. Architecture at a Glance

The RWA oracle stack has three main layers:

1) Off-chain feeder (Node/TypeScript):

- Fetches RWA prices from multiple web APIs (e.g., AlphaVantage and Finnhub for now)..
- Normalizes prices into a common base (USD) using a fixed decimal scaling (1e7).
- Builds Poseidon-style commitments over [price, timestamp, asset_id] for auditability.
- Submits prices as Soroban transactions to the on-chain oracle.

2) On-chain oracle (Rust/Soroban):

- Implements a SEP-40–style price store keyed by Asset::Other(Symbol) identifiers (e.g., "TSLA").
- Maintains RWA metadata including asset type, issuer, regulatory and tokenization data.
- Exposes read-only interfaces for other contracts (vaults, tokens, routers).

3) On-chain RWA token (Rust/Soroban):

- Wraps RWA pricing data for minting/burning operations.
- Enforces basic compliance gates on transfers using oracle metadata (e.g., checking regulation flags).
- Stores mint metadata and, in future, references to commitments and proofs.

B. Data Model

Key types include:

- Asset identifier: SEP-40 Asset::Other(Symbol) for external RWAs, such as ***TSLA***.
- Base asset: a single configured base (e.g., USD) used for all price normalization.
- Price: an i128 integer scaled by oracle_decimals (intended default: 7 decimal places), stored as price(asset, timestamp).
- Price history: per-asset map from timestamp → price with last_timestamp cached for fast reads.
- RWA metadata:
  - asset_id, name, description
- asset_type: Stocks, etc
- issuer and regulatory information (approval server, compliance status, licensing)
- tokenization info (token contract, supply, underlying instrument, relevant dates)
- arbitrary key-value metadata (Symbol, String)
- created_at, updated_at timestamps

Token contracts store:
- Admin addresses and oracle contract references.
- Pegged asset symbol and metadata (name, symbol, decimals).
- Balances and allowances with TTL.
- Authorization and clawback flags for regulated setups.

Commitments are off-chain Poseidon hashes of:
- price
- timestamp
- asset_id_as_int

These commitments are currently logged off-chain, with roadmap plans to persist and verify them on-chain.

V. LENDING, BORROWING AND SWAPS

A. Deposits and Borrowing
Within each vault:
- Users deposit RWA tokens as collateral.
- Oracle prices determine the base value of each position.
- Users may borrow allowed assets (e.g., a stablecoin or token like XLM) subject to $HF_i, v > 1$.

B. Integration with Soroswap
Neko integrates Soroswap as the primary swap and routing layer to:
- Swap between stablecoins and RWA assets for deposits and withdrawals.
Soroswap's pools and routers become the liquidity backbone for:
- Converting liquidated RWA tokens to stablecoins.
- Allowing lenders to enter/exit positions in their preferred currencies.
- Potentially routing between Neko vault tokens and external DeFi primitives.

C. Liquidation Flow
When a borrower's health factor $HF_i, v \leq 1$:
1) Any keeper or liquidator can call a liquidation function.
2) A portion of the borrower's collateral is seized and transferred to the liquidator.
3) In return, the liquidator repays part (or all) of the borrower's debt, plus a small premium.
4) The seized collateral can be swapped via Soroswap for the base debt asset.

This mechanism:
- Ensures that undercollateralized positions are promptly resolved.
- Transfers risk and execution costs to specialized actors.
- Keeps vault solvency intact, even under volatile market conditions.

IX. IMPLEMENTATION ON SOROBAN AND STELLAR

Neko leverages specific properties of Soroban and Stellar:
- Low fees and fast finality suitable for frequent oracle updates and liquidations.
- Native asset issuance and trustline mechanisms, mapping naturally to RWA tokens and vault shares.
- Interoperability with stablecoins and payment rails (e.g., PYUSD, USDC, regional stablecoins).
- Emerging ZK-friendly primitives and potential integration with cross-chain interoperability layers.

Core contracts are implemented in Rust for Soroban:
-rwa-oracle: SEP-40–style oracle and RWA metadata registry.
-rwa-token: token contract integrated with oracle-based compliance gates.
-vault and market contracts: handle deposits, borrowing, interest accrual, and liquidation; maintain per-vault risk parameters.
-integration adapters: Soroswap router integration, future CCIP/bridge adapters.

XI. ROADMAP

Short-term milestones:

- Introduce ZK circuits validating multi-feed consistency and aggregation for the oracle.
- Integrate Soroswap more deeply for one-click repay, leverage, and liquidation flows.

Medium-term:

- Expand asset coverage to real estate, renewable energy projects, and SME credit in Latin America.
- Introduce per-vault governance and whitelisting mechanisms.
- Add cross-chain access to Neko vaults via bridges and messaging protocols.

Long-term:

- Develop standardized RWA metadata and proof formats, enabling interoperability with other RWA and DeFi protocols.
- Advance privacy-preserving attestations using ZK and secure enclaves.
- Position Neko as a neutral liquidity layer for institutional and retail RWA credit globally.

XII. CONCLUSION

Tokenized RWAs are moving millions of value onto public ledgers, but the majority of that value still sits idle, locked in wrappers that do not meaningfully interface with DeFi credit. At the same time, borrowers, from SMEs in emerging markets to institutions holding private credit or infrastructure assets, lack capital-efficient, privacy-preserving ways to borrow against these claims.

Neko proposes a modular, Soroban-native liquidity protocol that treats RWAs as first-class on-chain collateral. Through isolated vaults, a hybrid attestation and oracle layer, zero-knowledge privacy, and integration with swap infrastructure like Soroswap, Neko connects RWA markets to on-chain liquidity without sacrificing risk management or confidentiality.

By giving originators a way to create specialized vaults, lenders a way to supply capital into transparent, parameterized markets, and borrowers a way to unlock the value of their assets, Neko aims to turn the growing stock of tokenized RWAs into a dynamic flow of credit. If the tokenization wave is inevitable, Neko's goal is to make that wave actually useful: transforming static RWA balances into a resilient, global liquidity layer.