MATRIX: DECENTRALIZED RESERVE CURRENCY

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Matrix presents decentralized, over-collateralized and capital-efficient reserve protocol using Cosmos SDK. Matrix enables liquid, capital efficient convertibility between stable assets and collateral using front-running resistant oracle to achieve the swapping.

I. INTRODUCTION

Decentralized Finance stablecoins can help 1.7 billion adults who lack access to the banking system. Current stablecoin protocols remain incomplete. USDT and USDC, which have the largest market capitalization, are supported by centralized projects. Decentralized protocols that mint and burn stable assets with collateralized debt positions can be unstable with discretionary choices of parameters. Stablecoin designs that are algorithmic, under-collateralized, and overly capital efficient have experienced bank-run situations and liquidity crises.

Currently, there is no protocol for a Cosmos-native decentralized reserve currency. Matrix protocol allows swaps at oracle value between speculative assets and collateral. The volatility of the collateral in the reserves is hedged using perpetual futures.

Matrix achieves stability by transferring collateral volatility to third party users seeking leveraged long exposure with no funding rates. Matrix aims for over-collateralization by incentivizing two types of Liquidity Providers (**LPs**): Leverage Agents (LAs) and Insurance Agents (IAs). These agents bring extra collateral to the protocol and help protect against liquidation risks.

Summary - Paper Sections

- **II Neo Token**: Explains the importance of the Neo token.
- **III Liquidity Providers**: Introduces the two types of LPs in the Matrix Protocol.
- **IV Matrix DAO**: Presents the Matrix DAO, which is designed to incentivize LPs and drive both the value and utility of the Neo token.
- **V Major Contributions**: Highlights the major contributions of the Matrix protocol.

II. NEO TOKEN

The goal of the Matrix protocol is to mint stable assets tradable on the Cosmos ecosystem. Matrix will mint NEO, a stablecoin pegged to USD that will use OSMO as collateral at genesis. Matrix will let users mint stablecoins with the collateral of their choice and exchange stablecoins for collateral at oracle value with minimal fees. From a user's perspective, minting and burning NEO with the protocol will feel just like a swap. Depositing collateral to the protocol mints NEO, and withdrawing collateral from the protocol burns NEO.

A. Mint and Burn

1. To mint NEO, a stable asset, a user must send Matrix whitelisted collateral. Oracles determine how many NEO tokens are minted and given to the user. For example, if the oracle price for OSMO is $10 and the protocol has a 0.3% transaction fee, a user depositing 1 OSMO will receive 9.7 NEO from the Matrix.

2. A user that intends to swap NEO for collateral specifies the desired kind of whitelisted collateral and exchanges the assets based on oracle price. The NEO received by the protocol is burnt.

3. The mint and burn transactions are executed without slippage on the price, regardless of the size of the transaction. The reason there are fees on Matrix transactions is to remunerate LPs as they guarantee the robustness of the system.

4. Direct arbitrage opportunities arise whenever NEO trades at a price that differs from its peg. If 1 NEO trades at a price above $1. The incentive is to mint NEO for $1 worth of collateral and then sell these newly minted NEO for more than $1 on the market, reducing the price of NEO closer to $1. Opportunities for arbitrage are reduced when there are transaction fees.

5. A stable seeker will use Matrix to convert collateral to NEO, however Matrix does not need over-collateralized loans.

B. Need for LPs

If the protocol has 1 OSMO worth $10 and 10 NEO is minted, the collateral ratio is 100%. If the price of OSMO decreases to $5, the collateral ratio is now 50%.

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A user could now swap 5 NEO for 1 OSMO from Matrix. This would reduce the exchange collateral and leave the user with 5 NEO, lowering the intrinsic value of NEO below \$1. To enable swapping collateral against stablecoins and stablecoins against collateral, Matrix protocol aims for over-collateralization by incentivizing Liquidity Providers (**LPs**).

III. LIQUIDITY PROVIDERS (LPS)

A. Leverage Agents (LAs)

When a stable seeker gives 1 OSMO to the Matrix protocol, the protocol is subject to the volatility of OSMO. To insure the protocol against the volatility of the collateral backing the stablecoins, Matrix creates a way to transfer the volatility to other actors willing to get leverage on collateral: the Leverage Agents (**LAs**).

LAs get perpetual futures from the Matrix protocol. These futures give LAs leveraged exposure on the collateral backing NEO. **LAs** insure Matrix against drops in collateral price by helping guarantee that the protocol has enough reserves to reimburse stable holders. The **LAs** bring some collateral, and choose the leverage ratio to insure the amount of collateral from stable seekers.

Let's say that stable seekers bring c_{matrix} collateral (e.g. OSMO) to the Matrix Protocol and LAs choose to cover an amount, c_{LA}. The quantity,

$$\frac{c_{\text{matrix}} + c_{LA}}{c_{\text{matrix}}},$$

is the leverage multiplier for this LAs position because LAs receive gains or pay for losses from the covered colalteral, c_{LA}. The value of an LA position with the protocol is given by:

$$\text{position\_value} = c_{\text{matrix}} \cdot \left(1 - \frac{\text{price\_initial}}{\text{price\_current}}\right) + c_{LA}.$$

This implies that an LA gets liquidated if the price drops to

$$\text{price\_current} = \text{price\_initial} \times \left(\frac{c_{\text{matrix}}}{c_{\text{matrix}} + c_{LA}}\right).$$

Example: If 1 OSMO is worth \$10, the **LAs** brings $c_{LA} = 10$ and covers $c_{\text{matrix}} = 50$, then the **LAs** takes the variation of 50 OSMO (c_{matrix}) with their 10 OSMO (c_{LA}). If OSMO goes to 12\$, the **LAs** will earn a leveraged return of $10 + 50 \times (1 - 10/12) = 18.33$ OSMO. On the other hand, if the price of OSMO drops to $\frac{50}{60} \times 10 = \$8.33$, the **LA** will have lost her investment, which will be absorbed by the protocol to help it stay collateralized. **LAs** will not be able to back-any amount greater than the collateral brought by stable-seekers.

***LAs** pay transaction fees when they enter and exit positions.* Matrix does not incentivize the **LAs** with funding rates like centralized exchanges. Entry and exit costs to the protocol depend on the coverage ratio on the collateral from stable seekers. Low coverage ratios make it expensive to enter/exit the protocol.

***LAs** positions cannot be modified.* A single address can own multiple **LA** positions within the same pool or within different pools of the protocol. **LA** positions are locked after each update to prevent **LAs** from taking advantage of potential oracle failures or advantages.

There may be cases where **LAs** fail to fully insure the protocol collateral brought by stable seekers. Matrix proposes a new type of liquidity provider to account for these temporary imbalances and serve as a buffer between stable-seekers and the leverage agents. These agents are called Insurance Agents (**IAs**).

B. Insurance Agents (IAs)

Insurance Agents (**IAs**) act as a buffer for the moments when Leverage Agents do not fully insure the protocol's reserves (collateral brought by users). **IAs** entrust Matrix with their liquidity so that they can accrue interest on it. The risk for an insurance agent is to incur slippage when the protocol is not well collateralized.

1. Incentive Design

Since **IAs** are taking a risk when lending money to over-collateralize the protocol, they should be incentivized for this risk:

1. A fraction of the transaction fees obtained when minting or burning NEO are redistributed to IAs in proportion to how much they contribute to the protocol. **IAs** will be able to stake their positions to receive governance tokens.

2. **IAs** earn interests not only on the collateral they lent but also on the collateral brought by stable seekers[1].

[1] For the **IAs** to get the extra yield, part of the Matrix reserves need to be transferred for getting yield on it (i.e., lending to protocols). Suppose the protocol owns 1.5 OSMO out of which 1 comes from users who minted and 0.5 comes from **LPs**. If the whole protocol reserves are put into lending strategies, **LPs** will be receiving interests on 1.5 OSMO although they just brought 0.5 OSMO: they receive 3 times more interests than they would get by lending directly to other protocols. Because of the multiplier effect the Matrix protocol can guarantee higher yield to **IAs** than other lending platforms. The transaction fees, governance tokens and interests which the **IAs** receive is based on the over-collateralization ratio of the Matrix protocol.

3. Not all the transaction fees and lending returns are given to IAs. The Matrix DAO decides on the distribution of the fees between the **LPs** and the treasury.

4. **IAs** receive tokens for contributing to a collateral pool. An **IA** that brings OSMO to the protocol receives sNEO for its share of the OSMO-NEO pool. The amount of sNEO received is based on the current exchange rate, which is dictated by an oracle price. On issuance of sNEO, an **IA** earns interest and rewards from (1) transaction fees that arrive to the pool and (2) interest from collateral being lent. **IAs** only receive transaction fees for the pools they contribute to.

5. **IAs** ensure the collateralization of the protocol in the situations when there are no perfect matches between users and **LAs**. If the protocol is under-collateralized, **IAs** incur slippage and may be at risk of not being able to get all of their money back. For example, suppose that 100 NEO tokens are minted with 10 OSMO backing them as collateral. Thus, 1 OSMO is worth 10$ and the protocol is fully collateralized. Then an **IA** brings 1 OSMO to the protocol. She will accrue fees from transactions and yield on the 11 OSMO available. In the event OSMO price drops to $8, the protocol would be under-collateralized and the **IA** would not be able to get all her money back when exiting the **IA** position.

6. With a slippage of 90%, an **IA** willing to cash out 1 OSMO would only be able to get 0.1 OSMO. The slippage factor is a piecewise linear function of the collateral ratio, making the risks predictable for **IAs** while still incentivizing them to stay in the protocol. Having a continuous function is also necessary to limit front-running effects. The smaller the collateral ratio, the bigger the slippage. Above a certain collateral ratio (for instance 120%), no slippage will be set for **IAs**.

IV. MATRIX DAO

Matrix DAO uses an incentive pendulum for the optimal allocation of the rewards (fees, yield governance tokens) between the **LPs** and an Insurance Fund (**IF**) to make sure the protocol is stable and the users can get their collateral back during market stress events.

A. Incentive Pendulum

The objective of the design is to prevent the Matrix DAO from becoming **inefficient**, (majority of rewards to **LPs** and not enough funds in the (**IF**) for payout during bear markets) or **under-utilized** (majority of assets in the (**IF**), increasing bankruptcy risk due to under-collateralization). The on-chain redistribution of the assets and the rewards between the (**LPs**) and the (**IF**) is automated. The IF is a reserve fund created and seeded at genesis in the DAO to guarantee payouts to (**LPs**). At Genesis, the IF is seeded and the assets in the DAO are divided between the LPs and the IF. The genesis allocation to LPs depends on user validation and delegation.

Scenario	LP Assets	IF Assets	Ξ	LP Rewards	IF Rewards
Optimal	67%	33%	3	67%	33%
Under-utilized	50%	50%	-	0	100%
Inefficient	100%	0	1	100%	0

TABLE I. Incentive Pendulum: Allocation of the capital between the LP and the IF, where $\Xi = \frac{LP+IF}{LP-IF}$; LP = LP assets, IF = IF assets.

The DAO profit split is calculated as (Ξ) where $\Xi = \frac{LP+IF}{LP-IF}$; LP = LP assets, IF = IF assets. The DAO uses the inverse of the Ξ to distribute the funds between LP and IF. The incentive pendulum monitors the distribution of the assets and rewards between the LP and the IF to make Matrix operate and allocate between the following states.

Table(I) provides the split between SF and IF at genesis.

Optimal, $\Xi^{-1} = \frac{1}{3}$: The desired state, where 67% of the assets are provided by LPs and 33% are provided by the IF. The rewards from the protocol are split with the same proportions.

Under-utilized, $\Xi^{-1} = 0$: An unsafe state. Here, both LPs and the IF provide 50% of the assets each. 100% of the rewards go to the IF (i.e. no rewards go to LPs). If the protocol is under-utilized, stakers have no incentive to validate the block-chain. This scenario needs to be explained in further detail to completely understand the design of the DAO; the balances of Matrix in the Insurance Fund is a function of the bankruptcy risk[2].

Inefficient, $\Xi^{-1} = 1$: LPs provide 100% of the assets and receive 100% of the protocol rewards. When the protocol becomes inefficient, capital and rewards are reallocated by the DAO between LPs and the IF to bring about additional investment yields, moving the protocol closer to optimality. The Matrix incentive pendulum will help maintain the protocol at near-optimal states. Ultimately, Matrix stakers can vote to re-capitalize the Insurance Fund.

[2] At Genesis, IF will be initialized with a percentage of the Matrix tokens. Matrix tokens will be utilized to update the weighted capital allocation policy between the LP and IF periodically through on-chain governance (proposal and voting-based governance mechanism).

B. Governance

A core principle of Matrix Protocol is to maintain its decentralized nature. The Matrix DAO will work on this objective from the beginning. Matrix DAO is responsible for helping the protocol realize its full potential, improving its design, and making a valuable building block in the DeFi space. The DAO will be responsible for parameter tuning, for deploying new stablecoins, for protocol upgrades and integrations, and voting to accept new collateral for a given stablecoin.

1. The governance token of the protocol is vNEO. The idea with Matrix's governance token is to make the protocol decentralized and to distribute vNEO to community members that most use the protocol and/or collateralize it as IAs or LAs. The exact token distribution is likely to change.

2. Governance tokens will be distributed through staking contracts and through a bonding curve, letting people buy governance tokens using the protocol's stablecoins [3].

3. The only situation in which the total supply is likely to inflate is when governance needs to be able to sell more tokens through the bonding curve to collateralize the protocol.

4. Governance can choose to use the bonding curve to make it cheapr to burn stablecoins against vNEO, enabling the protocol to collateralize itself. There is a collateral settlement process that freezes transactions at the current oracle value, allowing stable holders, IAs, and LAs to claim the collateral that's owed to them [4].

V. MAJOR CONTRIBUTIONS

Matrix is a decentralized protocol designed to create reserve currency in a capital efficient way. It aims to improve over centralized designs as well as over over-collateralized and under-collateralized decentralized designs. Matrix innovates by proposing full convertibility at a 1:1 rate between stable assets and collateral. Collateral can always be swapped against stablecoins, and stablecoins can always be swapped against collateral at oracle value. The protocol involves 3 agents which all benefit from Matrix: Stable Seekers and Holders who issue and use stable assets, (**LAs**), who get perpetual futures from the protocol while insuring it against the variability of the collaterals' prices and (**IAs**), who help the protocol have enough liquidity at all times, even when the protocol is not fully covered by LAs.

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[3] The price at which governance tokens are sold is an increasing function of the number of tokens already sold through this mechanism. The bonding curve is a cheap way to increase the collateral ratio of the protocol. Governance token distribution will be used to incentivize people to contribute more to one people than another. It may not be directly activated at protocol launch.

[4] Details of the design of the incentive pendulum and the distribution/bonding of the governance token will be published.