Etamurho Index Token (EIT)

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Abstract The Etamurho Index Token (EIT) is a collateralized, index-based asset designed to provide balanced exposure to Etamurho[2] – a decentralized game-theoretic protocol on Ethereum. Each Etamurho Index Token (EIT) unit represents an equal-weighted position of 1 ETA + 1 MU + 1 RHO (at a 1:1:1:1 ratio), dynamically priced according to the Etamurho Index (EI), which is defined as the current aggregate market value of the three tokens. Each Etamurho Index Token (EIT) unit is minted by depositing a USD-pegged stablecoin (DAI) amount equal to the current Etamurho Index (EI) value. The system then acquires ETA, MU, and RHO in proportional amounts and vaults them. Redemption burns the EIT units and returns the equivalent stablecoin amount by unwinding the underlying position at market rates. As a result, Etamurho Index Token (EIT) abstracts Etamurho protocol exposure into a single asset that is pegged to the Etamurho Index (EI) as base value.

1. Introduction

The Etamurho protocol introduces a novel triptych asset structure composed of three tokens – ETA, MU, and RHO – each launched with identical fundamentals and designed to diverge in market value over time through endogenous dynamics. While this architecture fosters internal balance and oracleless rebalancing, direct interaction with all three tokens can present operational complexity for participants.

The Etamurho Index Token (EIT) addresses this by introducing a single-token abstraction: a collateralized, index-based asset that provides equal-weighted exposure to the Etamurho protocol.

The Etamurho Index Token (EIT) simplifies access to Etamurho and enables exposure to the protocol macroeconomic behavior. As a result, the Etamurho Index Token (EIT) embodies the Etamurho vision of a protocol being treated as an 'investable asset': instead of engaging with ETA, MU, and RHO individually, participants interact with the Etamurho protocol as a composite whole via the Etamurho Index Token (EIT).

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[1] Elevado Labs, contact@elevado.xyz

[2] https://www.elevado.xyz/Etamurho.pdf

2. Etamurho Index (EI)

The value of each Etamurho Index Token (EIT) unit is derived from the Etamurho Index (EI), a floating metric representing the aggregate spot market value of the three tokens (ETA, MU, and RHO) that compose the Etamurho protocol.

The Etamurho Index (EI) reflects the current spot price of a 1:1:1 composite of the protocol's three native tokens (i.e., 1 ETA + 1 MU + 1 RHO).

Formally, the Etamurho Index at time t is defined as:

$$EI_t = P_{ETA}(t) + P_{MU}(t) + P_{RHO}(t)$$

Where each $P_i(t)$ is the prevailing price in USD of token i at time t. This value is deterministically computed based on observable liquidity pools data and is used to govern both minting and redemption operations within the Etamurho Index Token (EIT) system.

3. Token Design

Etamurho Index Token (EIT) is implemented as a standard-compliant ERC-20 token with key modifications to reflect its index-like nature. Most notably, the token is indivisible – implemented with zero decimal places – so that Etamurho Index Token (EIT) can only be minted or transferred in whole units. This reflects its design as a discrete claim on a full portfolio allocation (akin to a fund share), and prevents partial collateralization or fractional ownership that could undermine systemic balance.

Each Etamurho Index Token (EIT) unit represents an equal-weighted portfolio consisting of exactly 1 ETA, 1 MU, and 1 RHO, acquired at market prices at the time of issuance and vaulted under the protocol's custody. The EIT token's value at any given moment corresponds precisely to the Etamurho Index (EI) value.

4. System Design

The Etamurho Index Token (EIT) system is composed of three primary on-chain modules: (1) the Etamurho Index Token (EIT) token contract, (2) the Etamurho Index Token (EIT) vault contract, and (3) the system controller contract. These components modularly interact within a tightly defined framework to enable issuance, redemption, collateral tracking, and price integrity of the Etamurho Index Token (EIT).

The Etamurho Index Token (EIT) token contract governs the issuance of EIT tokens, allowing mint operations to be executed exclusively by the Controller address.

The Controller address executes all financial logic. Upon receiving a stablecoin deposit equivalent to the current Etamurho Index (EI) value multiplied by the desired number of Etamurho Index Token (EIT) units, the system controller contract routes this capital into the open market to acquire the underlying assets in equivalent distribution. Once ETA, MU, and RHO are acquired, these tokens are transferred to the vault contract. Simultaneously, the system controller instructs the Etamurho Index Token (EIT) token contract to mint the corresponding number of Etamurho Index Token (EIT) units, which are then transferred to the user.

During redemption, the system controller contract receives and burns the submitted Etamurho Index Token (EIT) units. It then sends a request to the vault contract to liquidate the associated 1:1:1 token set

(ETA, MU, RHO) at prevailing market prices and returns the resulting stablecoin proceeds to the user. All minting and redemption operations are executed atomically, ensuring consistency between token supply, underlying collateral, and overall protocol state.

5. Minting and Redemption

The EIT system consists of two primary operations: minting (conversion from stablecoin to EIT) and redemption (conversion from EIT to stablecoin).

In the minting process, a user initiates a request to create n EIT tokens via the user interface. The system queries live prices for ETA, MU, and RHO, computes the current index value:

$$EI_t = P_{ETA}(t) + P_{MU}(t) + P_{RHO}(t)$$

The user must deposit:

$$DAI_{total} = n \cdot EI_t$$

This deposit is then proportionally split into three suballocations:

$$DAI_i = \frac{DAI_{total}}{P_{ETA}(t) + P_{MU}(t) + P_{RHO}(t)} \quad \text{for } i \in ETA, MU, RHO$$

The system executes trades to acquire the required number of each token at market price, secures them, and mints n EIT tokens. EIT tokens minted are sent to the requester, while the ETA, MU, and RHO tokens acquired are transferred to the system vault.

Redemption follows the inverse process. A user submits n EIT tokens to the system via the user interface. The tokens are burned (i.e., sent to the 0x000…000 address), the vault batch sell the tokens and returns the full DAI equivalent to the requester:

$$DAI_{return} = n \cdot EI_t^{\text{sell}}$$

Where EI_t^{sell} reflects the executable market prices at the time of unwinding.

6. The 1:1:1:1 Ratio

The Etamurho Index Token (EIT) is governed by a deterministic 1:1:1:1 collateral model, wherein each unit of EIT is collateralized by exactly one unit of ETA, one unit of MU, and one unit of RHO, held in the system vault.

This model defines a strict, asset-level correspondence across four components: one composite token (EIT) backed by three indivisible and symmetric component tokens (ETA, MU, RHO).

Formally, the reserve structure is defined as:

$$1 \text{ EIT} \longleftrightarrow 1 \text{ ETA} + 1 \text{ MU} + 1 \text{ RHO}$$

At the system level, for a total circulating supply of $S_{EIT}(t)$ EIT tokens at time t, the system's vault must hold:

$$\mathbf{R}(t) = S_{EIT}(t) \cdot [1,\ 1,\ 1]$$

Where:

- $\mathbf{R}(t) = [R_{ETA}(t),\ R_{MU}(t),\ R_{RHO}(t)]$
- $R_i(t)$: Quantity of token $i \in ETA,\ MU,\ RHO$ held in reserve at time t

For illustrative purposes:

if $S_{EIT} = 1{,}000$, then by design the vault holds exactly:

$$R_{ETA} = 1{,}000, \quad R_{MU} = 1{,}000, \quad R_{RHO} = 1{,}000$$

The system enforces this structure modularly. EIT tokens cannot be minted unless the controller contract successfully acquires one full unit of each backing asset per EIT requested. Similarly, redemption is prohibited unless one unit of each can be liquidated and returned. These conditions are enforced atomically, preventing misalignment between circulating supply and vaulted reserves.

This model ensures real-time, verifiable solvency, as any observer can query on-chain data to verify and attest:

$$R_{ETA}(t) = R_{MU}(t) = R_{RHO}(t) = S_{EIT}(t)$$

By expressing the collateral structure as 1:1:1:1, the system provides a clear and enforceable mapping between the composite asset and its underlying components. Unlike traditional index mechanisms that rely on floating weights or periodic rebalancing, this structure ensures that EIT delivers fixed, symmetric exposure to the Etamurho protocol's internal token economy – mathematically constrained and immune to drift.

Thus, the 1:1:1:1 reserve model guarantees full collateral integrity, enforces macro-level portfolio balance, and enables EIT to function as a trustless, protocol-native representation of aggregate system value.

7. Proof of Reserve (PoR)

The Etamurho Index Token (EIT) is designed to be a fully collateralized asset, maintaining a 1:1:1:1 backing ratio. To uphold trustless integrity, the system provides a transparent Proof of Reserve (PoR) concept based on on-chain, publicly accessible data.

This reserve structure guarantees that for each EIT token in circulation, there exists precisely one unit of each collateral token (ETA, MU, and RHO) securely held in the system vault.

7.1. Formal definition

Let:

- S_{EIT}: Total circulating supply of EIT tokens
- R_{ETA}: Total ETA units held in the EIT vault
- R_{MU}: Total MU units held in the EIT vault
- R_{RHO}: Total RHO units held in the EIT vault

The system is considered perfectly collateralized if and only if the following equality holds:

$$R_{ETA} = R_{MU} = R_{RHO} = S_{EIT}$$

Equivalently, the full reserve vector must satisfy:

$$\mathbf{R}(t) = [R_{ETA}(t), R_{MU}(t), R_{RHO}(t)] = S_{EIT}(t) \cdot \mathbf{1}$$

Where $\mathbf{1} \in \mathbb{Z}^3$ is the unit vector $[1, 1, 1]$. This represents a one-to-one mapping between each EIT token and the exact portfolio $[1, ETA, 1, MU, 1, RHO]$.

8. Conclusion

The Etamurho Index Token (EIT) introduces a novel financial abstraction layer to the Etamurho protocol.

By representing equal-weighted exposure to the Etamurho protocol's endogenous tri-token structure, Etamurho Index Token (EIT) enables participants to engage with the protocol as a coherent macroeconomic entity. Etamurho Index Token (EIT) provides collateral-backed issuance, atomic redemptions, and transparent valuation. In the end, Etamurho Index Token (EIT) embodies the vision of Etamurho as a protocol-level macro-asset.

A. Mathematical formalizations

A.1. Etamurho Index (EI)

The Etamurho Index (EI) at time t is defined as:

$$EI_t = P_{ETA}(t) + P_{MU}(t) + P_{RHO}(t)$$

Where:

- $P_{ETA}(t)$: USD-denominated market price of ETA at time t
- $P_{MU}(t)$: USD-denominated market price of MU
- $P_{RHO}(t)$: USD-denominated market price of RHO

This function computes the aggregate value of one unit of each token at current market rates.

A.2. Token collateralization mapping

Each EIT token is a direct 1:1:1 portfolio of the underlying protocol assets. Its internal structure is:

$$EIT = [1, 1, 1]^T \in \mathbb{Z}^3$$

This maps the EIT token to the vector of underlying assets, implying a one-to-one ownership claim on:

- 1 unit of ETA
- 1 unit of MU
- 1 unit of RHO

This structure is discrete and indivisible, consistent with the system's zero-decimal token standard.

A.3. Minting function

Let $n \in \mathbb{N}$ be the number of EIT tokens a user wishes to mint. The required DAI input at time t is:

$$DAI_{in} = n \cdot EI_t$$

This capital is then proportionally partitioned for execution:

$$DAI_i = \frac{DAI_{in}}{P_{ETA}(t) + P_{MU}(t) + P_{RHO}(t)}, \quad \forall i \in ETA, MU, RHO$$

Each DAI_i is routed to acquire Q_i units of token i, such that:

$$Q_i = \frac{DAI_i}{P_i(t)}$$

The system targets a quantity $Q_i \to 1$ per token. If market execution deviates from this target due to price shifts, minting may fail, revert, or execute with a slippage guard.

A.4. Redemption function

Given n EIT tokens submitted for redemption, the underlying position is unwound as:

$$\text{Sell: } n \times 1\ ETA, 1\ MU, 1\ RHO$$

Assuming market prices $P_i(t)$ at the time of redemption, the resulting DAI output is:

$$DAI_{out} = n \cdot EI_t^{sell}$$

Where EI_t^{sell} reflects executable trade values, potentially inclusive of fees and slippage.

A.5. Slippage considerations

Let δ_i denote the slippage factor for token i, defined as:

$$\delta_i = \frac{P_i^{exec}(t) - P_i^{spot}(t)}{P_i^{spot}(t)}$$

The effective index value under slippage becomes:

$$EI_t^{adj} = \sum_{i \in ETA, MU, RHO} P_i(t) \cdot (1 + \delta_i)$$

Where $\delta_i < 0$ indicates adverse execution. This value bounds both minting feasibility and redemption returns.

B. Portfolio variance and risk metrics

This appendix presents a formal quantitative analysis of the volatility properties of the Etamurho Index Token (EIT), modeled as a static equal-weighted portfolio of three underlying assets: ETA, MU, and RHO.

By design, each EIT token represents an indivisible and symmetric position in the three tokens:

$$\mathrm{EIT} = \frac{1}{3} \cdot \mathrm{ETA} + \frac{1}{3} \cdot \mathrm{MU} + \frac{1}{3} \cdot \mathrm{RHO}$$

This structure implies a constant weight portfolio, which allows application of classical portfolio theory, particularly the Markowitz variance model.

We show below that the variance (and thus volatility) of EIT is generally lower than the average variance of the individual tokens, owing to diversification and imperfect correlation among components.

B.1. Mathematical formulation

Let:

- σ^2_{EIT}: Variance of the EIT token
- Σ: Covariance matrix of the base tokens [ETA, MU, RHO]
- w: Portfolio weight vector $w = \begin{bmatrix} \frac{1}{3} & \frac{1}{3} & \frac{1}{3} \end{bmatrix}^T$

Then:

$$\sigma^2_{\mathrm{EIT}} = w^T \Sigma w$$

More explicitly, let:

$$\Sigma = \begin{bmatrix} \sigma^2_{\mathrm{ETA}} & \rho_{\mathrm{ETA,MU}}\sigma_{\mathrm{ETA}}\sigma_{\mathrm{MU}} & \rho_{\mathrm{ETA,RHO}}\sigma_{\mathrm{ETA}}\sigma_{\mathrm{RHO}} \\ \rho_{\mathrm{ETA,MU}}\sigma_{\mathrm{ETA}}\sigma_{\mathrm{MU}} & \sigma^2_{\mathrm{MU}} & \rho_{\mathrm{MU,RHO}}\sigma_{\mathrm{MU}}\sigma_{\mathrm{RHO}} \\ \rho_{\mathrm{ETA,RHO}}\sigma_{\mathrm{ETA}}\sigma_{\mathrm{RHO}} & \rho_{\mathrm{MU,RHO}}\sigma_{\mathrm{MU}}\sigma_{\mathrm{RHO}} & \sigma^2_{\mathrm{RHO}} \end{bmatrix}$$

Where:

- σ_i is the standard deviation (volatility) of asset i
- $\rho_{i,j}$ is the correlation coefficient between assets i and j

B.2. Portfolio variance expansion

The variance of the EIT portfolio can be expressed explicitly as:

$$\sigma_{\mathrm{EIT}}^2 = \frac{1}{9}\left(\sigma_{\mathrm{ETA}}^2 + \sigma_{\mathrm{MU}}^2 + \sigma_{\mathrm{RHO}}^2 2\rho_{\mathrm{ETA,MU}}\sigma_{\mathrm{ETA}}\sigma_{\mathrm{MU}} 2\rho_{\mathrm{ETA,RHO}}\sigma_{\mathrm{ETA}}\sigma_{\mathrm{RHO}} 2\rho_{\mathrm{MU,RHO}}\sigma_{\mathrm{MU}}\sigma_{\mathrm{RHO}}\right)$$

This reflects the weighted sum of all variances and covariances between the constituent assets.

B.3 Diversification effect

If the three assets are not perfectly correlated (i.e., $\rho_{i,j} < 1$), the cross-terms in the above expansion reduce the total variance. As a result:

$$\sigma_{\mathrm{EIT}} < \frac{1}{3}(\sigma_{\mathrm{ETA}} + \sigma_{\mathrm{MU}} + \sigma_{\mathrm{RHO}})$$

This inequality demonstrates a key diversification principle: the volatility of the portfolio is strictly less than the average volatility of its uncorrelated (or partially correlated) components.

Thus, EIT exhibits a reduced volatility profile compared to the individual base assets, especially in scenarios where the underlying tokens exhibit asynchronous price behavior (low or negative correlations).

B.4. Illustrative case (hypothetical parameters)

Let:

$$\sigma_{\mathrm{ETA}} = 0.40, \quad \sigma_{\mathrm{MU}} = 0.30, \quad \sigma_{\mathrm{RHO}} = 0.20$$
$$\rho_{\mathrm{ETA,MU}} = 0.4, \quad \rho_{\mathrm{ETA,RHO}} = 0.2, \quad \rho_{\mathrm{MU,RHO}} = 0.1$$

Then:

$$\sigma_{\text{EIT}}^2 = \frac{1}{9}\left(0.40^2 + 0.30^2 + 0.20^2 2 \cdot 0.4 \cdot 0.40 \cdot 0.302 \cdot 0.2 \cdot 0.40 \cdot 0.202 \cdot 0.1 \cdot 0.30 \cdot 0.20\right)$$
$$= \frac{1}{9}(0.16 + 0.09 + 0.04 + 0.096 + 0.032 + 0.012) = \frac{1}{9}(0.43) = 0.0478$$
$$\sigma_{\text{EIT}} = \sqrt{0.0478} \approx 0.2186$$

Compare with average individual volatility:

$$\frac{1}{3}(0.40 + 0.30 + 0.20) = 0.30 > 0.2186$$

B.4.1. Conclusion

In this case, the volatility of EIT is 27% lower than the average volatility of its underlying tokens – validating its risk-mitigating construction.

C. On macroeconomic symmetry and capital invariance

C.1. Closed-system monetary neutrality

The Etamurho protocol operates under a quasi-closed capital system, in which EIT issuance does not inflate aggregate wealth, but rather transforms capital composition from fiat-stable collateral (DAI) into protocol-native risk.

Let:

- M_t: Total DAI capital deposited into the protocol at time t
- S_t: Circulating supply of EIT tokens at time t
- EI_t: Etamurho Index value at time t

Then, total capital flow satisfies:

$$M_t = S_t \cdot EI_t$$

As EIT is redeemed, the process reverses, ensuring capital neutrality:

$$\frac{dM}{dt} = -\frac{dS}{dt} \cdot EI_t \quad \text{(for redemptions)}$$

This implies a monetarily invariant system, where the quantity of value inside the protocol is exactly mapped to DAI collateral outside. There is no endogenous value creation – only structural transformation.

C.2. Vectorial capital invariance

Define the vault vector $V_t \in \mathbb{R}^3$:

$$V_t = \begin{bmatrix} \eta_t \\ \mu_t \\ \rho_t \end{bmatrix} = \text{total ETA, MU, RHO held}$$

Then:

$$V_t = S_t \cdot \mathbf{1} \quad \text{where} \quad \mathbf{1} = \begin{bmatrix} 1 & 1 & 1 \end{bmatrix}$$

This ensures vectorial capital parity: each EIT token corresponds to an identical vault vector of backing assets. No deviations or excess reserves are tolerated.