Helix Labs Litepaper

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Abstraction

The Helix Vault System is designed to unlock the full economic potential of staked assets across multiple Layer 1 (L1) ecosystems. By integrating **EigenFi**, a liquidity vault enabling cross-chain restaking, Helix provides a **capital-efficient mechanism** for stakers to maximize their yield while contributing to decentralized security. Through the use of **Actively Validated Services (AVS)**, EigenFi enables **L1 token holders to retain their native staking rewards while earning additional yield through restaking**.

A key innovation in this system is **Chain Fusion**, which allows for **trustless, decentralized asset movement across multiple blockchains without the need for wrapped assets or traditional bridges**. This ensures that stAssets (e.g., stADA, stICP) remain within their native ecosystems while becoming liquid and interoperable on **EigenFi Ethereum**, where they participate in DeFi markets and contribute to AVS security.

By addressing key inefficiencies in traditional staking models—including **capital fragmentation, liquidity silos, and limited AVS participation beyond Ethereum**—Helix aims to redefine how staked assets interact with the broader DeFi ecosystem. This paper outlines the technical framework, economic incentives, and strategic roadmap for integrating EigenFi with Chain Fusion to create a unified liquidity layer for cross-chain staking and decentralized security.

Terminology

- **AVS (Actively Validated Services)** – Decentralized validation services secured through restaked assets, extending economic security beyond standard staking.
- **AVS Operator** – Entities that run validation services within AVS, earning rewards for providing decentralized security.
- **EigenFi** – A liquidity vault system that enables cross-chain restaking, allowing L1 stakers to earn additional yield while retaining native staking rewards.
- **L1 (Layer 1)** – Base blockchain networks such as Ethereum, Cardano, ICP, and Aptos, which provide security and consensus.
- **Movement** – A modular execution layer that enhances interoperability and capital efficiency within cross-chain environments.
- **LST (Liquid Staking Token)** – A tokenized representation of staked assets, enabling liquidity while earning staking rewards.
- **LRT (Liquid Restaked Token)** – A tokenized version of restaked assets, allowing for flexible liquidity deployment while securing AVS.
- **Chain Key / Chain Fusion** – Interoperability technology from ICP that enables decentralized, bidirectional communication between multiple blockchains without traditional bridges.

Introduction

Context & Importance of Staked Asset Efficiency

Staking secures billions of dollars across multiple L1 blockchains, ensuring network security and consensus. However, the current staking landscape is plagued by **capital inefficiency** and **liquidity fragmentation**, limiting the economic utility of staked assets. Token holders face a **trade-off between network security and liquidity**, as staked assets remain locked within their respective chains, restricting their ability to earn additional yield or participate in broader DeFi activities.

While liquid staking protocols have attempted to address these challenges, their reliance on **wrapped assets, centralized bridges, and limited cross-chain functionality** introduces security risks and liquidity inefficiencies. Furthermore, **AVS remain largely constrained to Ethereum**, preventing other L1 staked assets from contributing to decentralized security models. The result is a fragmented ecosystem where **stakers miss out on yield opportunities, AVS lacks diverse economic security, and cross-chain capital movement remains inefficient.**

Key Challenges in Current Staking & Restaking Models

Despite the increasing adoption of staking and restaking, several inefficiencies persist:

- **Low APYs & Opportunity Cost** → Many L1 staking models offer **suboptimal yields** compared to other DeFi yield strategies. For example, ADA staking provides **1.78% APY**, while ICP and BNB staking range from **7% to 12%**, often lower than stablecoin lending yields.
- **Fragmentation Across L1s** → Each blockchain operates its own staking framework, preventing **seamless liquidity transfer** between networks. This isolation limits **cross-chain economic participation and capital efficiency**.
- **Limited AVS Integration Beyond Ethereum** → EigenLayer has pioneered restaking for Ethereum, but **other L1 staking assets (stADA, stICP, etc.) remain excluded**, preventing a more diverse and resilient security model.

The Role of Helix & EigenFi

Helix introduces **EigenFi**, a cross-chain liquidity vault designed to address these inefficiencies:

- **EigenFi Vaults enable L1 token holders to maximize their yield** by earning additional rewards through AVS participation while maintaining their native staking benefits.
- **Restaked assets (LRTs) become liquid and interoperable**, allowing users to access DeFi strategies without compromising security commitments.
- **Chain Fusion facilitates trustless asset movement**, ensuring **secure cross-chain staking participation without centralized bridges or wrapped assets**.

By integrating these innovations, EigenFi provides a **capital-efficient mechanism** that enables broader participation in **restaking, DeFi, and AVS security models**, unlocking new economic opportunities for stakers and network validators alike.

Transition to the Problem Statement

The following section will outline the **specific inefficiencies in current staking models, the constraints of AVS beyond Ethereum, and how EigenFi provides a solution by leveraging cross-chain liquidity vaults and decentralized security mechanisms.**

Problem Statement

Staking Today: High Participation, Low Capital Efficiency

The staking economy secures billions of dollars across multiple L1 ecosystems, yet these assets remain **underutilized** beyond their primary staking function. Token holders face **limited flexibility** and **missed yield opportunities** due to existing structural inefficiencies:

- **Aptos & SUI:** 77% of total supply is staked, but assets remain siloed within their chains.
- **Ethereum:** 28% staked, yet yields remain **low (2.55% APY)**.
- **Cardano:** 60% staked, offering just **1.78% APY**, highlighting poor capital efficiency.
- **BNB & ICP:** Higher staking yields (~7-12%), but **these assets remain locked**, unable to be used in broader DeFi.

The **core issue** is that stakers **cannot maximize yield without unstaking**, preventing them from leveraging their assets for additional economic activity.

Economic Inefficiencies in Restaking & Liquidity Fragmentation

Restaking has emerged as a solution to maximize capital efficiency, yet **it is currently constrained by liquidity fragmentation and risk exposure**:

- **Yield disparities** → APYs vary widely (**1.78% for ADA vs. 12% for ICP**), indicating inefficiencies in capital allocation.
- **Locked capital** → Stakers must **unstake or wrap assets to move liquidity**, creating **friction and inefficiencies**.
- **Liquidity silos** → L1s operate independently, preventing **seamless staking across multiple ecosystems**.

  These inefficiencies prevent stakers from earning **optimal returns** and **restrict cross-chain capital flows** that could enhance **decentralized security**.

AVS Security is Over-Reliant on Ethereum

AVS introduce **a new decentralized security model**, but adoption is hindered by **Ethereum-centric staking dependency**:

- **EigenLayer only supports ETH-based assets** → stETH, rETH, cbETH.
- **No other L1 staking assets (stADA, stICP, etc.) contribute to AVS security**.
- **AVS operators must rely solely on Ethereum restaking**, creating **centralization risks and liquidity bottlenecks**.

Without broader participation from **non-Ethereum staking assets**, AVS growth remains **limited**.

EigenFi: Unlocking Staked Liquidity

Overview

EigenFi is a **liquidity vault system designed to maximize the utility of staked assets across multiple L1 ecosystems**. By enabling token holders to **retain native staking rewards while earning additional yield through AVS participation**, EigenFi enhances both **capital efficiency and decentralized security**.

Through **Chain Fusion**, EigenFi eliminates the reliance on traditional bridges, allowing for **seamless, trustless cross-chain asset movement**. Staked assets remain within their native networks while being **tokenized as ERC-20 LRTs on EigenFi Ethereum**, making them interoperable with DeFi markets.

EigenFi Vault Mechanics

EigenFi operates using a **two-layer staking model**:

1. **User Deposits Assets** – Token holders stake their assets into **EigenFi Vaults** on supported L1s (Cardano, ICP, Movement, BNB Chain, Aptos, SUI, BitLayer, etc.).
2. **Chain Fusion Transfers Assets to Ethereum** – ICP's Chain Fusion enables **direct, trustless movement of assets to Ethereum**, eliminating the need for wrapping.
3. **Restaking in EigenLayer** – Assets deposited into EigenLayer secure AVS, generating additional yield beyond native PoS rewards.
4. **Yield Distribution** – EigenLayer rewards are transferred back to **Helix Vaults**, allowing users to claim **PoS + AVS yield**.

This model allows EigenFi to function as a **cross-chain restaking liquidity hub**, optimizing both **yield generation and security provisioning**.

Economic Incentives & Yield Strategy

EigenFi introduces an **efficient staking model** that combines:

- **Base APY from L1 staking (e.g., ADA 1.78%, ETH 2.55%, ICP 7-12%)**
- **Restaking APY from AVS (~4%)**
- **Oracle-based security income (0.5% - 0.7%)**
- **Cross-chain security income (~0.1%)**
- **Projected AVS expansion (12%-20% APY in a bull market)**

By aggregating these sources, EigenFi provides a **sustainable, high-yield alternative to conventional staking strategies**, unlocking new capital efficiency mechanisms.

EigenFi general overview:

EigenFi's LRTs can be integrated into various DeFi ecosystems, including:

- Lending & Borrowing Markets – Use LRTs as collateral.
- Liquidity Pools & AMMs – Provide LRT pairs in DeFi exchanges.
- Perpetuals & Leverage Trading – Use LRTs as margin collateral.
- Stablecoin Issuance – Mint stablecoins backed by EigenFi LRTs.
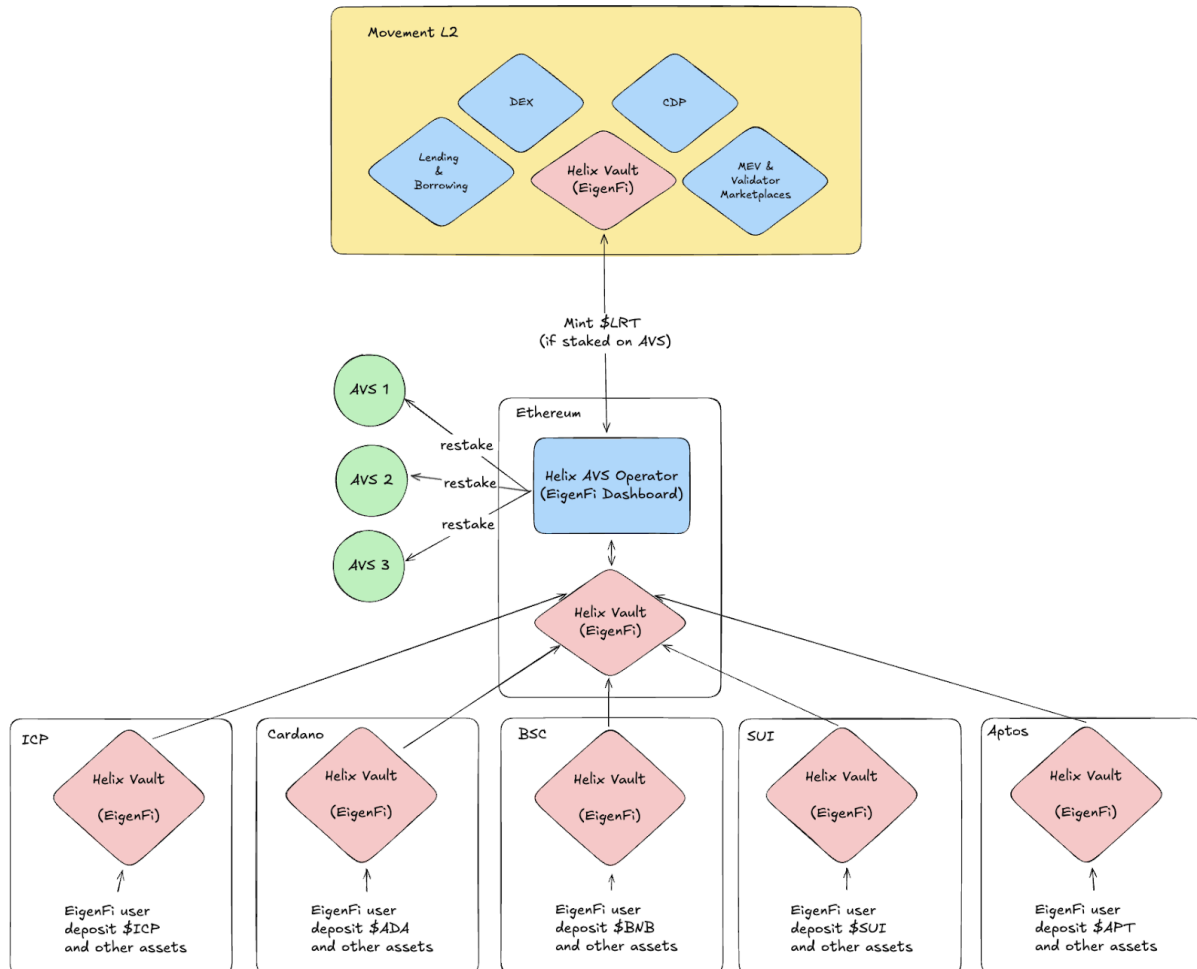
By expanding its DeFi integrations, EigenFi further enhances the capital efficiency of staked assets while ensuring sustainable long-term growth.

Helix Protocol: Unified Liquidity

The Role of Helix Protocol

Helix Protocol serves as the **coordination layer for cross-chain liquidity**, ensuring that restaked assets remain **highly efficient and composable** across various blockchain networks. It provides:

- **A unified framework for staking, restaking, and DeFi participation.**
- **Liquidity optimization mechanisms** that allocate capital where it is most effective.
- **AVS-enhanced security**, ensuring decentralized validation across multiple networks.

EigenFi's Role Within Helix

EigenFi operates as the **core liquidity engine** within Helix Protocol:

- **Staked assets enter EigenFi vaults**, where they are tokenized as LRTs.
- **LRTs integrate into AVS and DeFi,** allowing for additional yield opportunities.
- **Helix coordinates liquidity flows** to ensure optimal capital utilization across chains.

Integration with DeFi & Restaking Models

EigenFi's LRTs interact with DeFi in multiple ways:

- **Lending & Borrowing** – LRTs can be used as collateral for stablecoin minting.
- **Liquidity Pools & AMMs** – LRTs are deployed in decentralized exchanges.
- **Yield Optimization Strategies** – Helix Protocol ensures capital moves where yield is highest.

Economic Impact & Security Model

Helix ensures that liquidity distribution remains **secure, decentralized, and economically sustainable**:

- **Multi-asset restaking support** enhances AVS security models.
- **Slashing & governance mechanisms** prevent validator misbehavior.
- **Capital allocation strategies** ensure that liquidity is directed efficiently.

This section outlines the **role of Helix as the liquidity backbone**, ensuring EigenFi's integration into **staking, AVS, and DeFi**.

Chain Fusion: Enabling Trustless Cross-Chain Liquidity

Overview of Chain Key Technology

Chain Key technology, developed within the ICP ecosystem, allows for **secure, decentralized, bidirectional communication between multiple blockchains**. Unlike traditional bridging solutions, which rely on centralized intermediaries or wrapped assets, **Chain Fusion facilitates direct interactions between chains**, ensuring **fast finality and reduced counterparty risks**.

How Chain Fusion Integrates with EigenFi

- **Native Asset Transfers** → Enables staked assets to be **moved seamlessly across chains without wrapping**.
- **Trustless Execution** → Eliminates the need for custodial bridges, ensuring **decentralized governance of asset flows**.
- **Automated Smart Contract Interactions** → Allows **cross-chain staking, lending, and DeFi participation without intermediaries**.

Security & Scalability Benefits

- **No Wrapped Assets** → Reduces exposure to bridge exploits and token depegging.
- **ICP's Decentralized Execution** → Ensures **transparent, immutable transaction processing** across networks.
- **Interoperable Staking Models** → Expands **AVS security participation beyond Ethereum**, enabling **L1 stakers from multiple ecosystems to contribute**.

ICP Smart Contracts & Execution Capabilities

ICP smart contracts, known as **canisters**, offer **advanced compute and storage capabilities** beyond what is available on traditional blockchains. Canisters benefit from:

- **Randomness Generation** → Native on-chain randomness for applications requiring fairness and unpredictability.
- **Automated Execution (Timers)** → Smart contracts can schedule and trigger actions periodically without external input.
- **Web2 Integration** → Canisters can both **expose HTTP interfaces** and **call external APIs**, enabling seamless interaction with traditional web services.

Key Management & Threshold Signing

One of the **core security innovations of ICP's Chain Fusion** is its **threshold signing capability**. This cryptographic feature allows canisters to control accounts on external blockchains securely:

- **Private key shares are distributed among subnet nodes**, ensuring that no single entity holds the full key.
- **Threshold signing enables decentralized transaction signing**, removing single points of failure.
- **Chain Key Cryptography** secures interactions, ensuring asset control without traditional custody risks.

Integration Mechanisms with External Blockchains

ICP offers two primary integration models for interacting with external blockchain ecosystems:
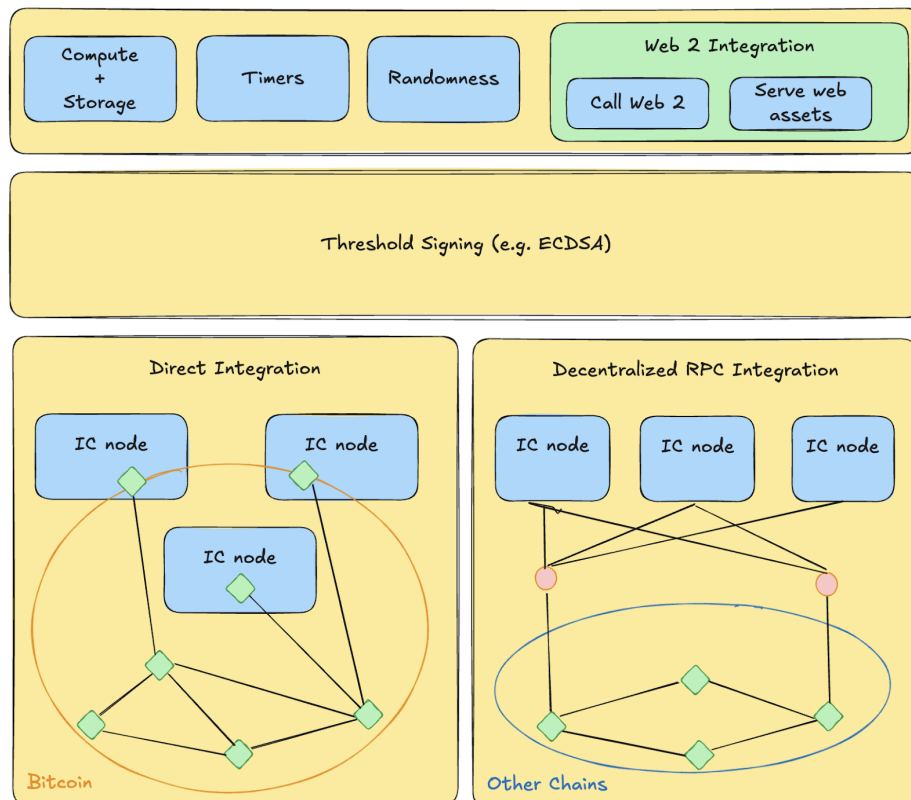
- **Direct Integration** → Used in **Bitcoin interoperability**, where ICP nodes act as **native Bitcoin nodes**, ensuring direct and decentralized interactions.
- **Decentralized RPC Integration** → Applied in **Ethereum interactions**, where ICP queries **multiple RPC providers** (such as Ankr, BlockPI, and Alchemy) to fetch chain state and submit transactions securely.

Trust Model & Security Assumptions

The security of ICP's **Chain Fusion** model is based on decentralized governance:

- **Honest Supermajority of Subnet Nodes** → Trust is placed in the consensus of ICP's decentralized network of verified node operators.
- **Direct Chain Integration (Bitcoin)** → Requires trust only in ICP nodes running the Bitcoin adapter, minimizing external dependencies.
- **Decentralized RPC Integration (Ethereum)** → Relies on **multiple independent RPC providers**, ensuring fault tolerance and transparency.

A World with Helix Protocol

The Future of Unified Liquidity

The Helix Protocol establishes a world where **staked assets are seamlessly restaked, traded, and secured** across multiple L1 blockchains. EigenFi's role as a liquidity coordination layer ensures that **staking capital is no longer idle but fully optimized** through DeFi, AVS security, and trustless interoperability.

The Impact on Stakers and DeFi Participants

- **Stakers Gain Maximum Yield** → Token holders earn **staking rewards, AVS restaking yield, and DeFi incentives simultaneously**.
- **DeFi Ecosystems Expand** → LRTs enhance liquidity pools, lending markets, and trading strategies, unlocking new yield opportunities.
- **AVS Security Grows Beyond Ethereum** → Multi-chain staked assets secure AVS, reducing reliance on Ethereum-native assets.

A Fully Decentralized Financial Infrastructure

Helix introduces a future where **cross-chain staking is secure, capital-efficient, and entirely decentralized**. By leveraging EigenFi and Chain Fusion, the Helix Protocol aligns incentives between **stakers, AVS operators, and DeFi markets**, creating a scalable and self-sustaining decentralized financial system.

Summary

The Helix Vault System presents a transformative solution for unlocking the economic potential of staked assets through **EigenFi, AVS security models, and ICP's Chain Fusion interoperability**. By addressing liquidity fragmentation, optimizing staking capital, and enhancing decentralized security, Helix provides a sustainable framework for cross-chain staking and DeFi expansion.

Key Takeaways

1. **Capital Efficiency** → EigenFi ensures that staked assets remain productive, maximizing APY through multi-layered staking strategies.
2. **Decentralized Security** → AVS expands beyond Ethereum, introducing a **multi-chain economic security model**.
3. **Interoperability without Bridges** → Chain Fusion enables trustless cross-chain asset transfers, reducing reliance on centralized intermediaries.
4. **Scalable DeFi Integration** → EigenFi's LRTs unlock lending, borrowing, stablecoin minting, and trading opportunities.

With these innovations, **Helix paves the way for a unified financial infrastructure**, where **staking, restaking, and decentralized liquidity coexist efficiently**. The continued evolution of EigenFi, AVS, and cross-chain coordination will shape the next generation of DeFi and blockchain security.

Next Steps & Roadmap

Deployment Milestones

- **Phase 1:** Testnet deployment of EigenFi vaults across Cardano, ICP, Movement, Aptos, and Ethereum.
- **Phase 2:** Chain Fusion integration for seamless cross-chain transactions.
- **Phase 3:** Full AVS security expansion beyond Ethereum-native staking assets.
- **Phase 4:** Mainnet launch and scaling of EigenFi into broader DeFi applications.

Future Research & Development

- **Enhanced LRT utility** → Expanding EigenFi's impact in collateralized lending and DeFi derivatives.
- **Decentralized Governance** → Implementing a community-driven decision-making process for protocol evolution.
- **Advanced Risk Management** → Strengthening slashing protection, validator security, and liquidity safeguards.

The Helix Protocol stands as a **new paradigm for staking and cross-chain liquidity**, aligning economic incentives between **stakers, DeFi participants, and AVS operators** to build a **scalable and decentralized financial future**.