Ethereum Improvement Proposal (EIP): Enhancing Ethereum's Scalability with ETH Liquidity Staking Tokens (LST) and Layer 3 Temporary (L3T) Chains

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Abstract

This proposal introduces the **ETH Liquidity Staking Token (LST)** as a fundamental mechanism for scaling the Ethereum ecosystem, incentivizing validators, and enabling **multi-layer scalability** across Layer 2 Ethereum Virtual Machine (EVM) solutions. The **LST system** integrates key elements such as **native staking**, **dynamic rewards**, and **incentivized computational markets**, allowing Ethereum to efficiently allocate computational power and resources while providing increased liquidity and utility for users.

The proposal outlines the integration of three primary layers:

- **Layer 1 (L1)** – ETH staking on the Ethereum mainnet, which ensures network security and provides a base yield for stakers.
- **Layer 2 (L2)** – Ethereum Virtual Machine-compatible Layer 2 solutions that enhance scalability and increase transaction throughput.
- **Layer 3 Temporary (L3T) Chains** – Event-driven, temporary chains designed to handle high-demand computational tasks without overburdening L2 networks.

Through this framework, **LST** will underpin the **validator incentive structures**, **computational markets**, and **cross-layer integration** that are essential to improving scalability, security, and operational efficiency throughout Ethereum's Layer 2 ecosystem. By settling L3T chain transactions in LST tokens, we enhance LST utility and align economic incentives across developers, validators, and users.

This proposal aims to provide a comprehensive solution to the challenges of validator incentives, computational resource distribution, and liquidity management, thereby enhancing Ethereum's scalability and efficiency.

1 Motivation

Ethereum's rapid growth has led to significant scalability challenges, including network congestion, high gas fees, and inefficient resource allocation. While Layer 2 solutions have alleviated some of these issues by processing transactions off-chain, they still face limitations:

- **Validator Incentives**: There is a lack of effective incentive structures to attract and retain validators within L2 networks.

- **Computational Resource Distribution**: Existing mechanisms do not efficiently allocate computational power to areas with the highest demand, leading to inefficiencies during peak usage times.
- **Liquidity Management**: Ensuring sufficient liquidity within L2 networks is critical for smooth transaction processing and DeFi activities. Fragmented liquidity hinders user participation and limits DeFi effectiveness.
- **Economic Incentive Alignment**: Misaligned incentives among developers, validators, and users can undermine network performance and scalability.

This proposal aims to address these challenges by introducing **ETH Liquidity Staking Tokens (LST)** and **Layer 3 Temporary (L3T) chains**:

- Enhance validator incentives through dynamic rewards using LSTs.
- Optimize resource allocation by enabling validators to prioritize high-demand areas.
- Improve liquidity management by providing liquid staking derivatives within L2 networks.
- Align economic incentives across all network participants.
- Manage high-demand events efficiently through the implementation of L3T chains.

2 Ethereum's Architecture: Current State

Ethereum operates across multiple layers:

- **Layer 1 (L1)**: The Ethereum mainnet, which secures the network using Proof of Stake (PoS) and acts as the settlement layer.
- **Layer 2 (L2)**: EVM-compatible solutions that enhance scalability by processing transactions off-chain and reducing the load on L1.

However, challenges remain in effectively integrating these layers to optimize performance, scalability, and economic cohesion.

3 Proposal Components

3.1 ETH Liquidity Staking Tokens (LST)

3.1.1 Mechanism Overview

The **ETH Liquidity Staking Token (LST)** system involves the following steps:

1. **Bridging ETH to Layer 2**: Users bridge their ETH from the Ethereum mainnet (L1) to an L2 network, transferring ETH into the L2 environment.
2. **Staking ETH Natively in L2's Staking Nodes**: The bridged ETH is staked natively within the L2's staking nodes, enhancing security and performance by supporting transaction validation and consensus mechanisms.

3. **Aggregated Staking Back to Layer 1**: L2 staking nodes aggregate the staked ETH and stake it back into the Ethereum mainnet (L1), contributing to the overall security of Ethereum's PoS system while earning staking rewards.

4. **Issuance and Utility of Native LST Tokens**: Users receive native LST tokens representing their staked ETH. These tokens are fully liquid within the L2 environment and can be unwrapped natively on-chain into the L2's native gas token.

5. **Active Participation in Network Activities**: Users can trade, transfer, or utilize LST tokens within various dApps and DeFi protocols on the L2 network.

3.1.2 Benefits

- **Enhanced Liquidity and Usability**: LST tokens provide immediate liquidity within the L2 network, facilitating active participation in network activities without bridging assets back to L1.
- **Optimized Staking Rewards**: Users earn staking rewards from both the L2 network and the Ethereum mainnet's PoS system, enhancing overall returns.
- **Improved Network Performance**: Native staking within L2 improves transaction validation and network security, contributing to better performance and scalability.
- **Seamless User Experience**: Users manage their staked assets and liquidity entirely within the L2 network, reducing complexity and transaction costs.

3.2 Layer 3 Temporary (L3T) Chains

3.2.1 Concept and Functionality

Layer 3 Temporary (L3T) chains are event-specific, temporary chains designed as one-to-one replicas of the L2 chain, augmented with event-specific data. They handle intensive computational tasks independently and, upon completion, summarize and integrate essential data back into the L2 chain before being dissolved.

1. **Initialization**:
   - **Event Trigger**: An anticipated high-demand event triggers the creation of an L3T chain.
   - **Chain Replication**: The L3T chain is instantiated as an exact replica of the current L2 chain state.
   - **Event Integration**: Event-specific smart contracts and data are deployed on the L3T chain.

2. **Independent Processing**:
   - **Isolation**: The L3T chain processes all transactions related to the event independently.
   - **Validator Incentivization**: Validators are incentivized with enhanced LST rewards to allocate resources to the L3T chain.

3. **Summarization and Settlement**:
    - **Data Summarization**: The L3T chain summarizes transactional data into a concise proof or state update upon event completion.
    - **Integration with L2**: Summarized data is securely integrated back into the L2 chain.
4. **Dissolution**:
    - **Resource Release**: The L3T chain is dissolved, freeing up computational resources.
    - **Data Pruning**: Non-essential data is discarded to maintain network efficiency.

3.2.2 L3T Chains as Incentivized Computational Markets

L3T chains introduce a novel concept where developers and product makers can incentivize the creation and validation of temporary blockchains to handle specific computational demands:

- **Developer Empowerment**:
    - Developers deploy L3T chains for their applications, customizing the environment for optimal performance.
    - By offering LST incentives, they attract validators to allocate resources to their L3T chain.
- **Economic Alignment**:
    - Settling L3T chain transactions in LST tokens enhances LST utility beyond representing staking power.
    - Creates a computational marketplace governed by economic incentives.
- **Utility Enhancement for LST Tokens**:
    - Increased demand for LSTs drives their value and utility.
    - Validators and users are economically motivated to participate, aligning interests with network performance.

3.2.3 Benefits

- **Scalability and Flexibility**: L3T chains allow dynamic scaling in response to varying computational demands without overburdening the L2 chain.
- **Reduced Complexity and Enhanced Cohesion**: By summarizing event data back into the L2 chain, L3T chains maintain a unified economic model centered around LST tokens.
- **Empowered Developers and Users**: Developers optimize performance without impacting the broader network; users benefit from improved transaction speeds and reduced fees.

3.3 LST-Backed Validator Incentives

3.3.1 Dynamic Reward Mechanism

Validators are incentivized through enhanced LST rewards:

- **Real-Time Adjustments**: Rewards adjust based on network conditions like transaction volume and congestion.
- **Resource Allocation**: Motivates validators to allocate resources efficiently between L2 and L3T chains.

3.3.2 Integration with L3T Chains

- **Settlement in LST Tokens**: Validators earn additional LST rewards by participating in L3T chains, settling transactions in LST tokens.
- **Incentive Alignment**: Aligns validator incentives with network performance and scalability.

3.4 Managing Liquidity and Token Dynamics

3.4.1 Enhancing LST Utility through L3T Settlements

- **Increased Demand for LSTs**: Settling L3T chain transactions in LST tokens increases demand and utility.
- **Economic Incentives for Validators**: Encourages validators to allocate resources efficiently, enhancing network security and stability.

3.4.2 Maintaining Token Stability and Value

- **Dynamic Supply Mechanisms**: Adjusting token supply through mechanisms like token burns or minting tied to network activity.
- **Governance and Community Involvement**: Decentralized governance allows stakeholders to influence economic policies.

3.5 Aligning Economics and Incentives

By integrating LST tokens deeply into the operation of L3T chains, economic incentives are aligned across all network participants:

- **Developers**:
  - Access scalable computational resources via L3T chains.
  - Incentivize validators using LSTs.
- **Validators**:
  - Receive enhanced rewards for participating in L2 and L3T chains.
  - Allocate resources where needed, motivated by economic incentives.

- **Users**:
  - Benefit from improved network performance and lower fees.
  - Utilize LSTs across various applications, increasing utility.

3.6 Advantages of the Enhanced Model

- **Economic Cohesion**: Settling L3T chains in LSTs ensures all network layers are economically interconnected, strengthening overall economic health.
- **Increased LST Demand and Utility**: LST tokens evolve into versatile assets integral to network operations.
- **Scalable and Sustainable Growth**: Efficient resource management and incentivized participation support sustainable network growth.

3.7 Technical Implementation Considerations

3.7.1 Technical Complexity

- **L3T Chain Deployment and Management**: Developing standardized, user-friendly protocols for L3T chain lifecycle management.
- **Tools and Frameworks**: Providing accessible tools to encourage adoption by developers.

3.7.2 Security Measures

- **Smart Contract Robustness**: Comprehensive audits and ongoing security assessments for LST and L3T chain contracts.
- **Validator Accountability**: Implementing mechanisms to ensure ethical conduct by validators.

3.7.3 Economic Balancing

- **Token Value Stability**: Mechanisms to prevent excessive volatility in LST token prices.
- **Supply and Demand Balance**: Economic models must effectively balance supply and demand, considering added utility from L3T settlements.

3.7.4 Community Governance

- **Inclusive Decision-Making**: Governance structures that allow broad participation to align network evolution with stakeholder interests.
- **Transparency**: Clear communication and transparent processes to foster trust and collaboration.

4 Potential Challenges and Considerations

4.1 Technical Complexity

Implementing L3T chains and integrating them with LST tokens introduces technical challenges:

- Developing robust protocols for L3T chain deployment, operation, and dissolution.
- Ensuring compatibility and security across L2 and L3T layers.

4.2 Security Measures

Security is paramount:

- Smart contracts must undergo thorough audits.
- Validators must be held accountable through slashing conditions or reputation systems.

4.3 Economic Balancing

Maintaining token stability and value requires careful economic planning:

- Mechanisms to prevent excessive volatility.
- Responsive adjustments to supply and demand dynamics.

4.4 Community Governance

Effective governance ensures the network evolves sustainably:

- Inclusive decision-making processes.
- Adaptive policies that respond to community feedback and market conditions.

5 Conclusion

The integration of **ETH Liquidity Staking Tokens (LST)** and **Layer 3 Temporary (L3T) chains**, with L3T chains settled in LST tokens, presents a powerful solution to Ethereum's scalability and resource management challenges. By:

- **Enhancing LST Utility**: Transforming LSTs into versatile tokens integral to network operations and economic incentives.
- **Creating Incentivized Computational Markets**: Allowing developers to deploy event-specific chains and incentivize validators.
- **Aligning Economic Interests**: Ensuring that developers, validators, and users are economically motivated to support network performance and scalability.

This model fosters a resilient and adaptable network capable of meeting diverse user needs and supporting innovative applications.

Implementing this vision will require collaborative efforts across the Ethereum community. By addressing technical, security, and economic challenges together, we can realize a network that not only meets current demands but is also poised for future growth and innovation.