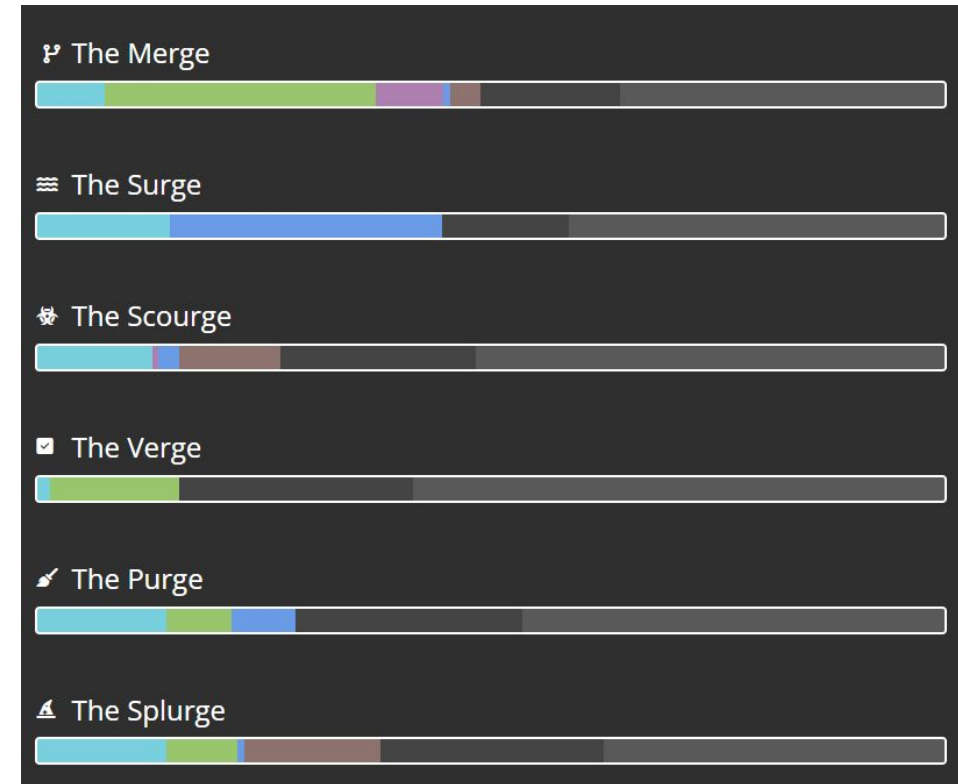Session: Ethereum and Programmable Blockchains

# Ethereum's Roadmap

# Ethereum Roadmap (1/2)

- Ethereum's roadmap for the coming years is organized into several major phases, each marked by significant upgrades and hard forks.

- These phases aim to improve scalability, efficiency, and user experience while supporting the growth of the Ethereum ecosystem.

- The updates are structured as a series of coordinated milestones, ensuring the network continues evolving in a secure and sustainable way.



Source: https://ethroadmap.com/
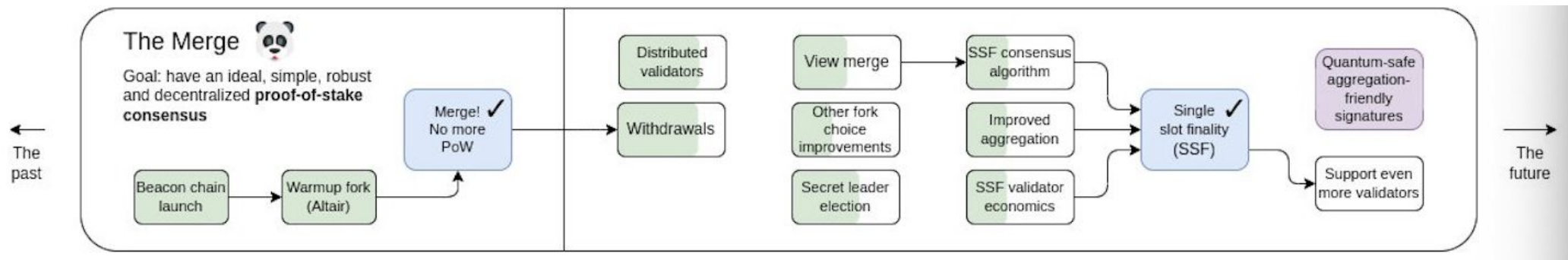
# Ethereum Roadmap (2/2)

| Phase | Details |
|---|---|
| The Merge | Upgrades related to the transition from PoW to PoS. Ongoing research continues to explore further improvements and optimizations to PoS. |
| The Surge | Upgrades focused on scalability, including rollups and data sharding, with the goal of achieving 100,000 transactions per second and beyond. |
| The Scourge | Upgrades addressing decentralization concerns, minimizing the risks of MEV (Maximal Extractable Value), and increasing censorship resistance. |
| The Verge | Upgrades designed to make block verification easier, including the implementation of SNARKs (Succinct Non-interactive Arguments of Knowledge). |
| The Purge | Upgrades aimed at reducing the computational and storage costs of running nodes by clearing old history and simplifying the protocol. |
| The Splurge | Miscellaneous upgrades that don't fit into the other categories, addressing remaining protocol improvements and enhancements. |

Source: https://ethroadmap.com/

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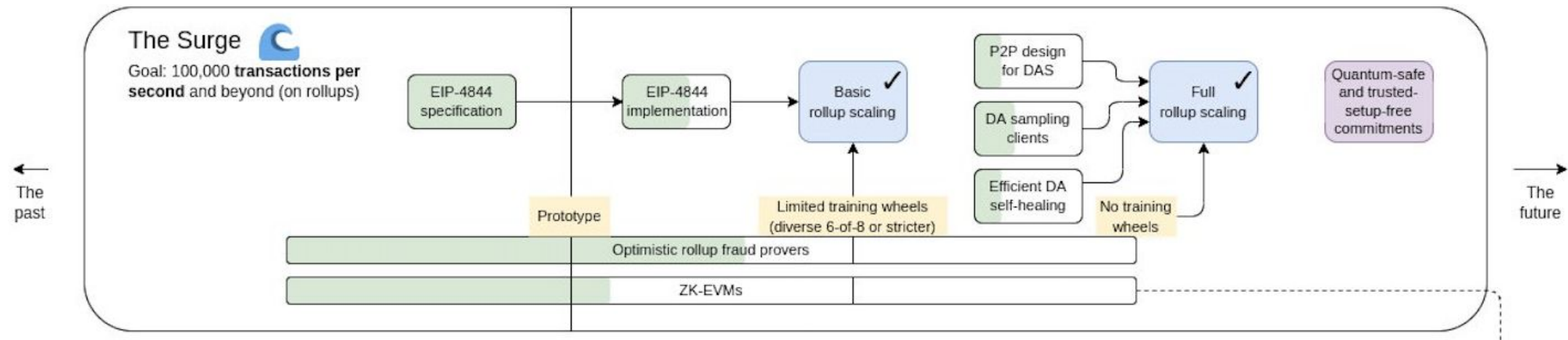# The Merge: Laying the Path for the Future of Ethereum

Ethereum is moving faster than Bitcoin in terms of development:

- **Paris Upgrade:** The Merge marked a significant milestone in Ethereum's evolution. The Paris upgrade was implemented on this date, and its major feature was the switch-off of the PoW consensus mechanism. The Ethereum mainnet merged with the separate PoS Beacon chain, consolidating into a single chain. This integration marked a fundamental shift in Ethereum's consensus mechanism.

# The Surge: Increasing Scalability

The Surge is an advancement aiming to increase scalability to 100,000 transactions per second while maintaining security. It introduces "proto-danksharding" to achieve this. Proto-danksharding shifts the focus from Ethereum's execution layer to its data layer for securing rollup transactions. This prevents direct competition between rollup and mainnet transactions. The technical aspect involves dividing transaction data into smaller shards, each handling a subset of transactions. This optimizes resource usage, enabling Ethereum to process a higher volume of transactions simultaneously, significantly improving scalability without compromising security.

# Fusaka Upgrade (03 December 2025)

The Fusaka upgrade follows Pectra, enhancing Ethereum's scaling, security, and user experience. It combines the **execution layer upgrade Osaka** and the **consensus layer upgrade Fulu star**, pushing Ethereum toward future growth. Key improvements will include:

- PeerDAS (Peer Data Availability Sampling) and scale blobs, that will allow nodes to store **only a portion of L2 data**, which significantly increases network scalability.

- Blob parameter-only forks and base-fee controls that will enable **gradual blob scaling** and help maintain predictable fees for L2 activity.

- **L1 improvements** including: history expiry, adjusted MODEXP gas costs, block size limits, and transaction gas caps to enhance efficiency and security.

- User experience that will add deterministic proposer lookahead (nodes can predict which validators will propose upcoming blocks, improving scheduling), CLZ opcode, and secp256r1 precompile for faster computation, predictable block proposals, and native passkey support.

- The eth_config JSON-RPC method that will ensure **that all nodes and validators will remain synchronized**, reducing the risk of misconfiguration during the upgrade.
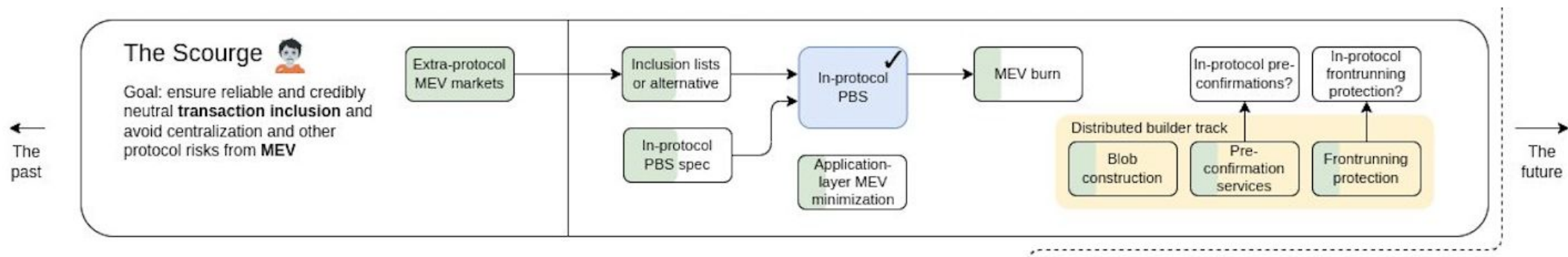
# Amsterdam & G-Star Upgrade (End of 2026)

The Amsterdam and G-Star upgrades build on previous Ethereum improvements, focusing on optimizing node resource usage, state storage, and transaction verification while ensuring smooth deployment across all clients. Key improvements will include:

- Stateless gas cost improvements that will **reduce resource requirements for nodes** and streamline transaction processing.

- Verkle tree implementation and preimage retention that will optimize state storage and **improve client efficiency**.

- Verkle precompile that will add native support for Verkle proofs, enabling **faster verification** of large state changes.

- Increased hash function cost and other protocol adjustments that will ensure **fair resource usage** and prevent abuse.

- Deployment will coordinate all changes across **both the execution and consensus clients f**or a smooth network upgrade.
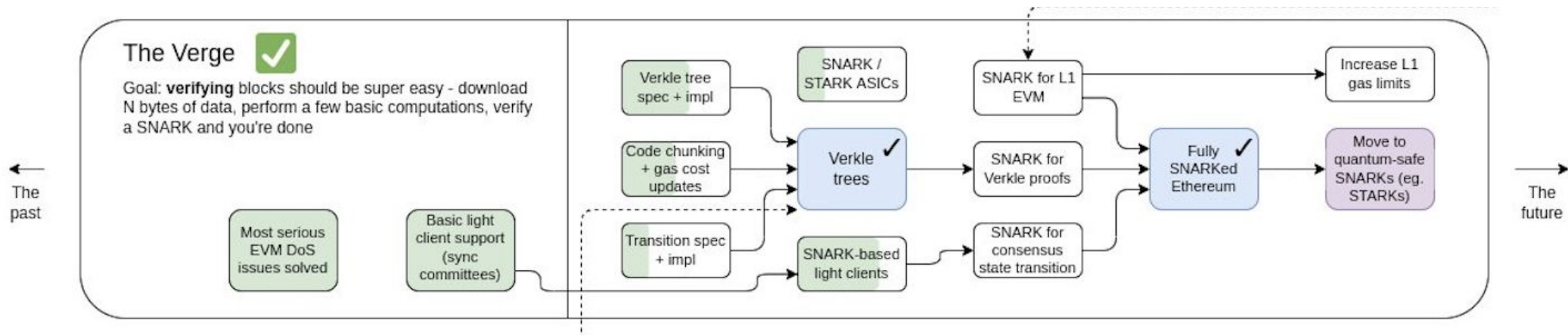
# The Scourge: Addressing Censorship

The Scourge addresses censorship resistance and decentralization concerns in Ethereum by tackling Miner Extractable Value (MEV) and front-running. The technical approach includes optimizing consensus mechanisms and smart contract execution to reduce MEV incentives, altering transaction execution order, implementing private transactions, and fair ordering mechanisms. Additionally, it promotes decentralization through decentralized oracle networks and governance mechanisms, reducing reliance on central entities. These measures enhance Ethereum's resilience against censorship, protect transaction integrity, and align with the network's core principles of security and decentralization.
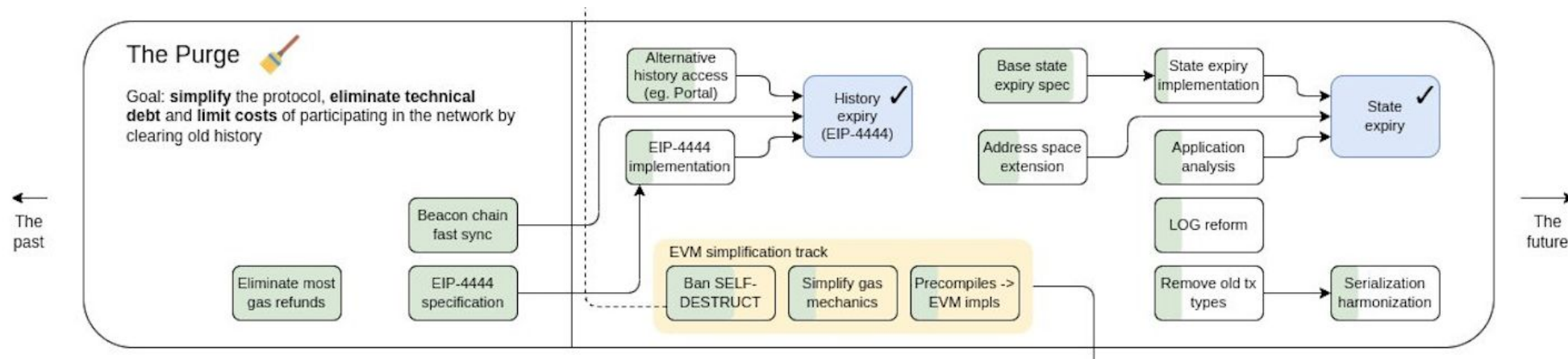
# The Verge: Facilitating Efficiency

The Verge aims to introduce a Verkle tree structure to replace the current data storage format. This innovation aims to streamline the verification process of blocks. By utilizing Verkle trees, Ethereum can efficiently verify blocks, reducing the computational overhead required for this task. In essence, Verkle trees enhance the network's scalability and efficiency by optimizing the way data is organized and accessed.
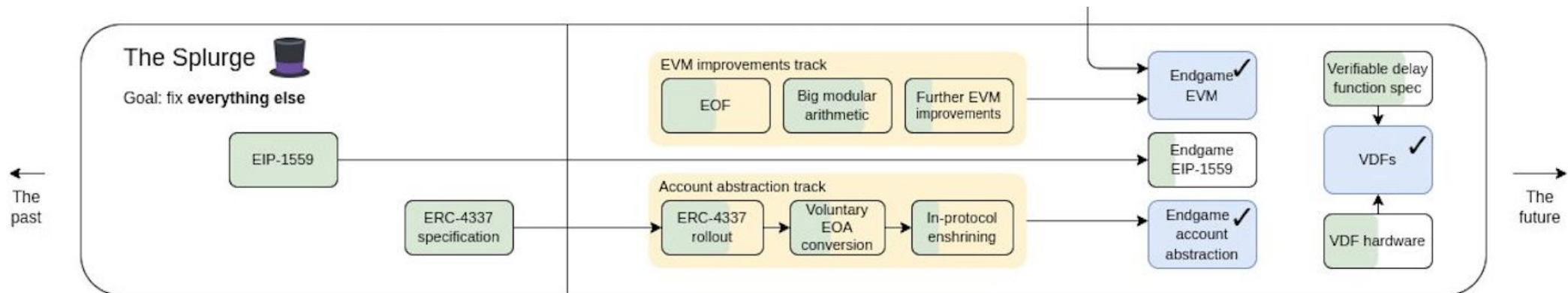
# The Purge: Simplifying Ethereum

The Purge will focus on optimizing the Ethereum network by reducing computational burdens and simplifying the protocol. One of its key objectives is the introduction of history expiration. This change means that not all node operators are obligated to store the complete historical data of all previous blocks. By allowing for more flexible data retention, The Purge aims to make running Ethereum nodes more accessible and cost-effective. This optimization helps in decentralizing the network further, as it becomes more manageable for a wider range of participants.
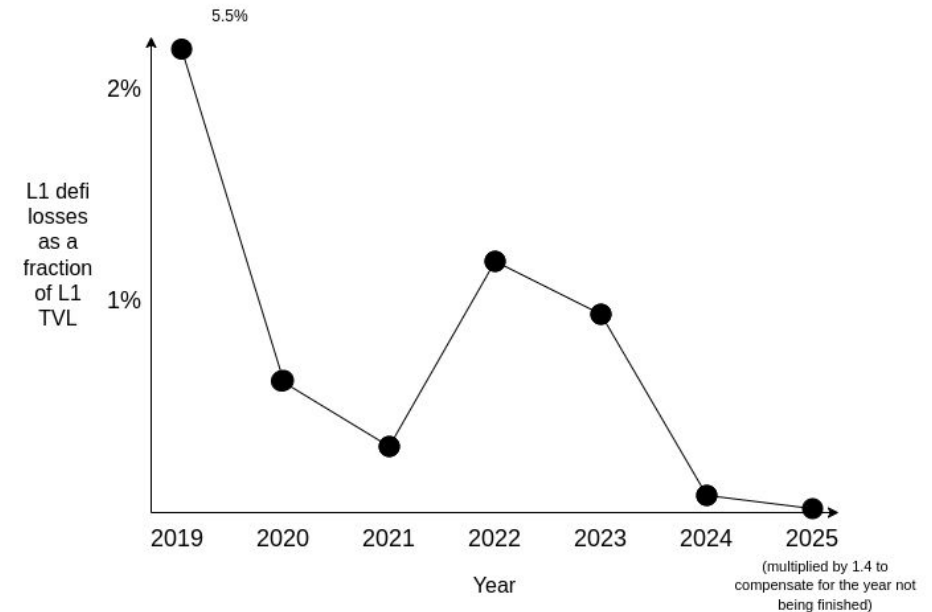
# The Splurge: Fixing everything else

The Splurge encompasses various fixes and improvements that do not fall neatly into the previous categories. Among its key technical changes, it includes "Account Abstraction," which reduces External Owned Accounts (EOAs) and Contract Accounts to a single account type. Additionally, it introduces "Proposer/Builder Separation" (PBS), a mechanism that differentiates between block builders and block validators. These technical adjustments enhance Ethereum's overall efficiency and flexibility while addressing issues that don't neatly fit into other upgrade categories, contributing to the network's evolution and optimization.

# The Importance of <u>Low Risk DeFi</u> for Ethereum's future

- Ethereum has historically faced tension between revenue-driven applications like NFTs and memecoins and mission-driven applications like ENS, Lens, and privacy tools.

- Low-risk DeFi, including payments, savings, and collateralized lending, can sustain Ethereum economically in a way similar to how search drives revenue for Google.

- As protocols have matured, DeFi has become safer, enabling sustainable use cases instead of purely speculative activity.

- Low-risk DeFi provides global, permissionless access to mainstream assets, supports ETH, and aligns with Ethereum's open and positive-sum culture.

- This ecosystem lays the groundwork for reputation-based lending, prediction markets, and alternative stable assets beyond USD.

- Low-risk DeFi sustains Ethereum financially today while supporting long-term innovation and social impact.



Source: https://vitalik.eth.limo/general/2025/09/21/low_risk_defi.html

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# Questions?

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