ETHx

by Stader

Litepaper

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Executive Summary

Stader, a multi-chain, non-custodial liquid staking protocol with ~100mn $+ in TVL, will soon launch its liquid staking token, ETHx.

While the Ethereum staking ecosystem is mature with multiple protocols and entities providing services, an evaluation of the current state of Ethereum staking highlights some key challenges:

- High concentration of ETH staked with few entities
  - Top 3 entities have >50% of ETH staked through them
  - Top liquid staking protocol has ~90% market share and delegates to permissioned operators
- LSDs that work with permissionless node operations have struggled to keep up with user demand
- LSDs, beyond the top protocol, are yet to achieve meaningful DeFi acceptance

ETHx has been thoughtfully designed to address these challenges:

- **Home stakers will be the backbone of ETHx with only 4 ETH required for bonding:** Stader did an extensive data analysis in collaboration with SSV on the bond requirement and concluded 4 ETH is sufficient to cover key tail risks that impact staked funds.

- **Scalability and Resilience:** ETHx will have a multi-pool architecture that includes permissionless and permissioned pools solving for decentralization and scalability at the same time. In the future, ETHx will also support a dedicated Distributed validator technology (DVT) pool that will improve node operator resilience.

- **Best-in-class staking yield** to users with exposure to staking rewards, MEV and tips at a competitive commission of 10% (to be shared equally between node operators and Stader)

- **Full fledged DeFi,** leveraging Stader's expertise from building DeFi ecosystems for its liquid tokens across 6 chains. Stader has 40+ protocols supporting its LSDs including AAVE v3 (Polygon market), Balancer, Beefy, Quickswap, Apeswap, BeethovenX and more!

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The table below summarizes ETHx's unique value proposition, addressing key challenges faced by ETH staking ecosystem today.

ETHx: Unique value proposition

	ETHx	Top LSD	LSD with permissionless node operators	CEX issued LSD	Other LSDs
Reducing concentration of staked ETH	✓	✗	✓	✗	✓
Permissionless node operators	✓	✗	✓	✗	✗
Scale with user demand	✓ Multipool design incl. permissioned pool	✓	✗ Scaling challenges due to high bond	✓	✓
Best-in-class staking yield	✓	✓	✗ High commission	✗ High commission	✓
Best-in-class DeFi	✓ Mulit-chain DeFi expertise	✓	✗ Limited DeFi partnerships	✗ Limited DeFi partnerships	✗ Limited DeFi partnerships

✓ Projected

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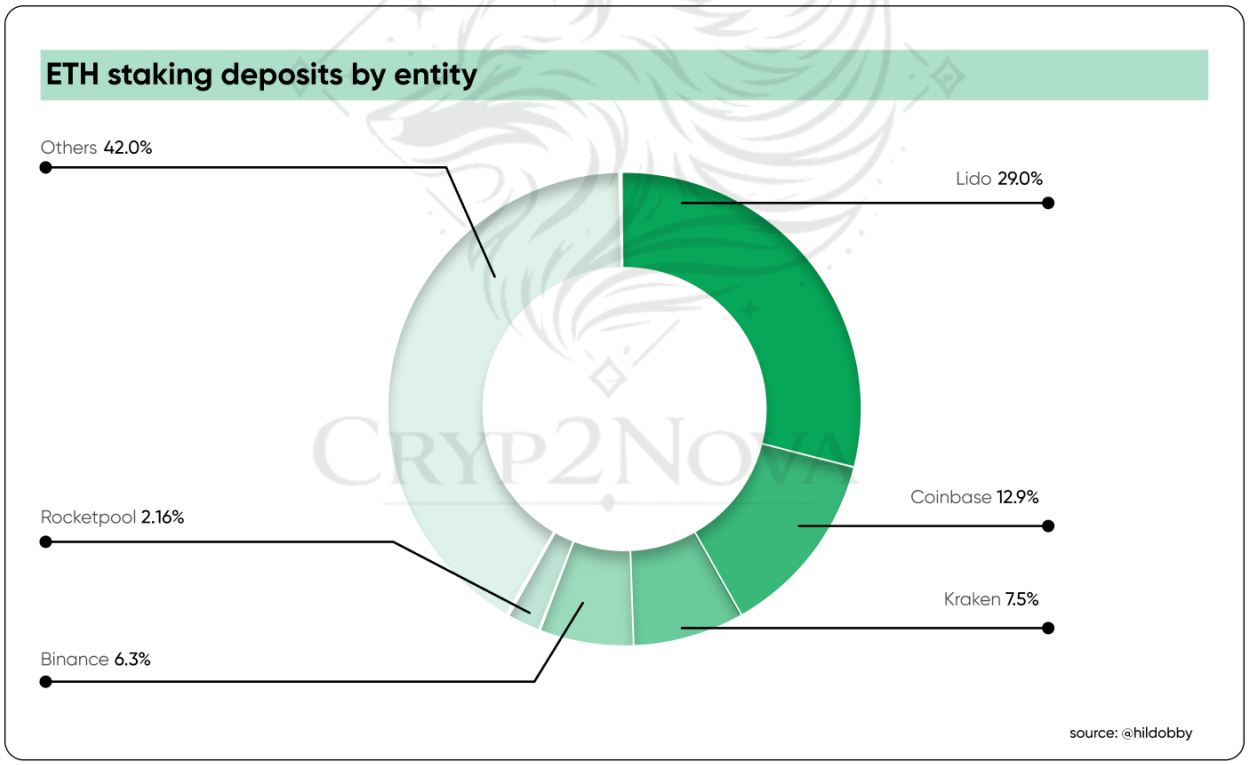
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Background: State of Ethereum staking

Ethereum switched over to proof of stake with the Merge in September. Currently, there is 16 M ETH, worth about ~$20 bn, deposited on the beacon chain through ~500k validators. This represents ~13% of ETH supply. With the upcoming Shanghai upgrade, that will enable withdrawals, it is expected that staked ETH will grow materially.

Liquid staking has emerged as the preferred way to stake on Ethereum with ~33%+ share of all staked ETH. This is closely followed by CEXs (~29% of all staked ETH) as the next preferred option.

And within the liquid staking ecosystem, there's a single protocol that has a dominant share of ~90%. Adding the top 2 exchanges to this protocol, ~50% of all staked Eth flows through just these 3 entities. This clearly highlights the need for more robust alternatives.



Protocols offering permissionless node operations faced significant scaling challenges due to 16 ETH bonding requirements.

Many other liquid staking protocols have also had limited Defi integrations in the past, reducing their utility/attractiveness to some users.

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Introducing Stader

Stader is a multi-chain, non-custodial liquid staking protocol, currently live on six chains including Polygon (scaling suite for ETH), Fantom, BNB, NEAR, Hedera and Terra 2.0. Stader has ~100 mn $ in TVL across chains and over 25k+ unique wallets staking on the platform. Stader is supported by a 150k+ member strong community across chains.

Stader's mission is to bring 1 BILLION people to staking and DeFi . Aim to achieve this by simplifying staking & offering the best yield opportunities through staking and DeFi.

Stader has deep expertise in building out full-fledged Defi ecosystems for its liquid tokens with 40+ protocols supporting our LSDs including AAVE v3 (Polygon market), Balancer, Beefy, Quickswap, Apeswap, BeethovenX and more!

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Introducing ETHx

Stader's intent with its liquid staking token, ETHx, is to create an LSD with a unique value proposition to users and node operators while also adding to the diversity of LSDs on ETH.

In one of the previous sections, an overview of the current state of Ethereum staking was shared. To reiterate the key challenges that were readily apparent are:

- High concentration of ETH staked with few entities
  - Top 3 entities have >50% of ETH staked through them
  - Top liquid staking protocol has ~90% market share and works exclusively with permissioned node operator
- LSDs that work with permissionless node operations have struggled to keep up with user demand
- LSDs, beyond the top protocol, are yet to achieve meaningful DeFi acceptance

Before presenting the detailed breakdown of ETHx design, here's a summary of the unique value proposition that Stader will bring to the ETH community with ETHx:

ETHx: Unique value proposition

	ETHx	Top LSD	LSD with permissionless node operators	CEX issued LSD	Other LSDs
Reducing concentration of staked ETH	✓	✗	✓	✗	✓
Permissionless node operators	✓	✗	✓	✗	✗
Scale with user demand	✓ Multipool design incl. permissioned pool	✓	✗ Scaling challenges due to high bond	✓	✓
Best-in-class staking yield	✓	✓	✗ High commission	✗ High commission	✓
Best-in-class DeFi	✓ Multi-chain DeFi expertise	✓	✗ Limited DeFi partnerships	✗ Limited DeFi partnerships	✗ Limited DeFi partnerships

✓ Projected

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This section will cover the key aspects of Stader's ETH liquid staking token, including:

- ETHx Design
- Unique value proposition
- DeFi

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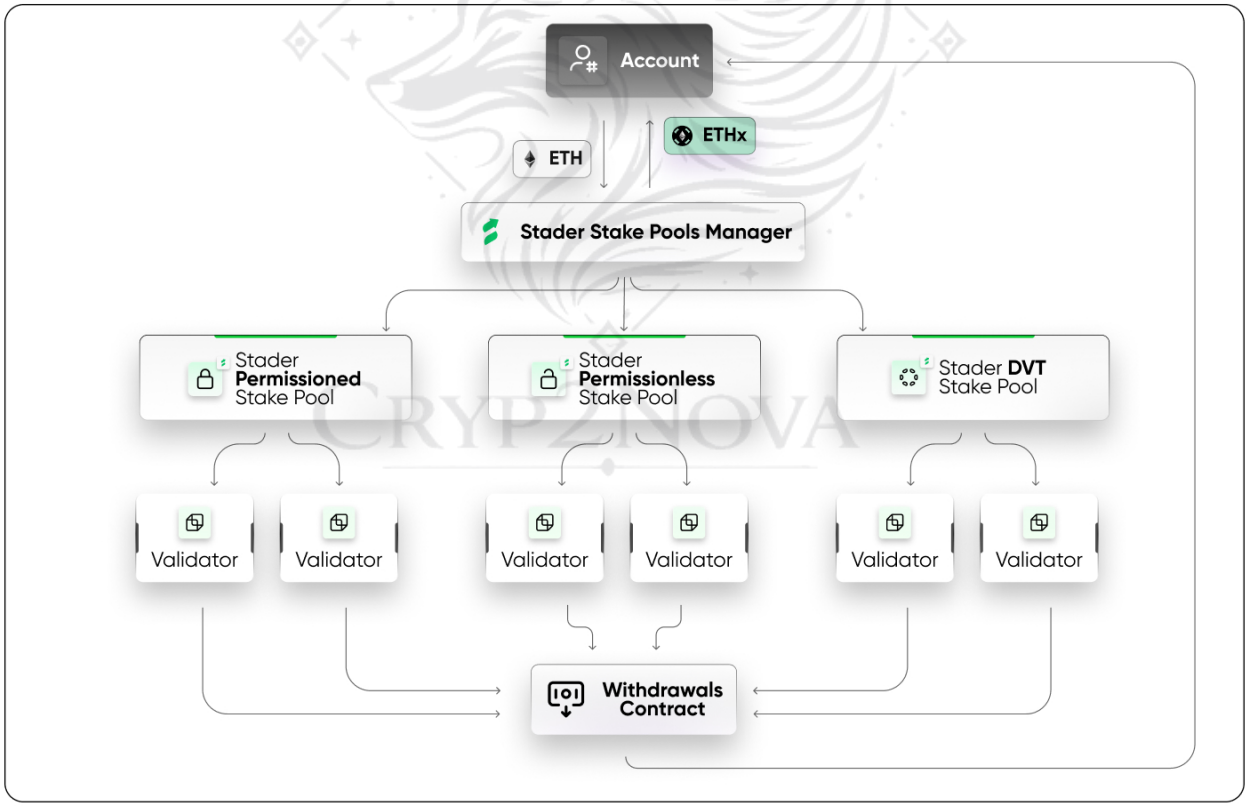
ETHx Design

Multi-pool architecture:

Designed for Decentralization, Scalability & Resilience

ETHx will have a multi-pool architecture for the node operator layer. This is critical to ensure that the node operations for ETHx can be decentralized, scalable and resilient.

ETHx will have a permissionless pool, allowing anyone to operate nodes, and a permissioned pool, with curated validators with consistent performance in phase I.



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Soon as Distributed validator technology (DVT) is established as a stable technology, we will be early adopters and initialize dedicated DVT-based stake pools in phase II. We are one of the early grant recipients to build on top of SSV and are already live on testnet.

This modular, multi-pool architecture has the flexibility to support additional pools, which could emerge with the evolution of the ETH staking ecosystem, in the future.

Permissionless pool with home stakers

Decentralization is one of the core goals of ETHx. Home stakers/independent node operators will be the backbone of our node operations as part of our permissionless operator set.

Here are 2 key features of ETHx to empower home stakers:

#1: From day 1, **anyone can permissionlessly run nodes** for Stader's ETHx. No whitelisting required!

#2: 4 ETH bond - Lowest bond requirement in the ecosystem. Detailed simulations, run by Stader in collaboration with SSV Network, show that 4 ETH bond is sufficient to protect users' staked funds from key tail risks. The key tail risks evaluated include both poor validator performance and adverse network conditions such as inactivity leak, higher degree of correlated slashing in the network. More details on the simulation results can be found in the appendix.

Permissioned node operators

As mentioned above, driving decentralization would be at the heart of ETHx. Scaling permissionless nodes to support billions of dollars in staked assets will be a journey, rather than something that happens overnight. Scalability being compromised by this has been observed with other decentralized LSDs not being able to support user demand, sometimes for months.

To avoid such a scenario, Stader will supplement the permissionless pool with a set of curated, community-approved list of permissioned operators. These permissioned operators will be reputed entities already running nodes and have a track-record of consistent high performance and non-malicious intent. These partners will not have any bonding requirements, in line with the status quo for permissioned operators in the ecosystem, given their track record and permissioned nature. More specific details on the curation process will be shared with the community in the coming weeks.

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Distributed validator technology (DVT) pools

Distributed Validator Technology (DVT) allows the duties of a validator to be distributed among multiple nodes, as opposed to a single machine, leveraging threshold cryptography. The fault tolerance possible with DVT technologies can materially reduce the probability of slashing/penalties, thereby, reducing the potential bond requirement needed from permissionless node operators. Stader will actively review the development of DVT technology and adopt DVT as soon as the technology has been proven to be stable. We have a grant from the leading DVT protocol, SSV network, and are already on testnet with them. We are also exploring integrations with other players across such emerging areas to also leverage their infrastructure.

ETHx token design: Token type and yield

Stader's liquid staking token, ETHx, will be a cToken which increases in value as staking rewards, MEV and tips accrue to user's staked ETH. It will not be a rebasing token. The cToken model is easier to integrate with the wider Defi ecosystem and is also more tax-efficient in certain jurisdictions.[1]

When users stake with Stader, they get access to both consensus layer (staking rewards) and execution layer (MEV, priority fees) rewards. The execution layer rewards, which are liquid, will be restaked to auto-compound and generate higher yield for users. There will be a standard 10% fee on both consensus and execution layer rewards, that will be equally distributed between node operators and Stader.

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[1] Not tax advice, Kindly check with a certified practitioner in your jurisdiction.

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ETHx: Unique value proposition

This section will cover the unique value proposition to key stakeholders, namely home stakers, professional node operators and liquid staking users.

Home stakers

For home stakers, Yield (including commissions) and the actual bond required per validator is critical since they have a significant bearing on profitability and capital requirements.

With ETHx's design requiring only a 4 ETH bond, home stakers get commission on a higher user deposit relative to the bond supplied, improving yield. Even with standardized 5% commissions for home stakers, running nodes for ETHx is expected to be the top yield opportunity in the ecosystem. On top of this, with lower capital requirements to participate, home stakers with smaller capital can also start participating and obtain this enhanced yield.

ETHx: Low bond, high yield for home stakers

	ETHx	Other LSDs - Current	Self-stake 32 ETH
Bond/self-stake	4	16	32
Staking pool contribution	28	16	0
Commission %	5%	15%	NA
Staking APR	5%	5%	5%
Yield from commissions	1.75%	0.75%	0.00%
Total yield	6.75%	5.75%	5.00%

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Professional node operators

Professional node operators can be part of the curated, community approved permissioned pool. Stader will be announcing the criteria for selection to this pool so it's transparently available to both the community and professional node operators.

The node operators in the permissioned set will not have to put up any bond and will earn a competitive commission of 5% on staking rewards, MEV and tips.

Professional node operators can help supplement the home stakers working with ETHx and even help the home staker ecosystem scale up by sharing best practices and providing guidance/mentoring where required.

Liquid staking users

Liquid staking users look for best-in-class staking yield and DeFi opportunities when choosing a liquid staking provider. Further, whether an LSD leads to further centralization or decentralization of the ETH ecosystem is also a consideration.

ETHx is designed for users keeping the above preferences in mind. We will work with node operators to ensure high adoption of MEV to provide best-in-class yield for users. ETHx will also have a competitive commission rate of just 10% of yield generated.

In addition to this, Stader will bring full-blown DeFi to ETHx, in line with the 40+ DeFi integrations currently live for its other liquid staking tokens from AAVE to Balancer to Apeswap and more!

ETHx: Proposition for liquid staking users

	ETHx	Top LSD	LSD with permissionless node operators	CEX issued LSD	Other LSDs
Best-in-class staking yield	✓	✓	✗ High commission	✗ High commission	✓
Best-in-class DeFi	✓ Multi-chain DeFi expertise	✓	✗ Limited DeFi partnerships	✗ Limited DeFi partnerships	✗ Limited DeFi partnerships
Reducing concentration of staked ETH	✓	✗	✓	✗	✓

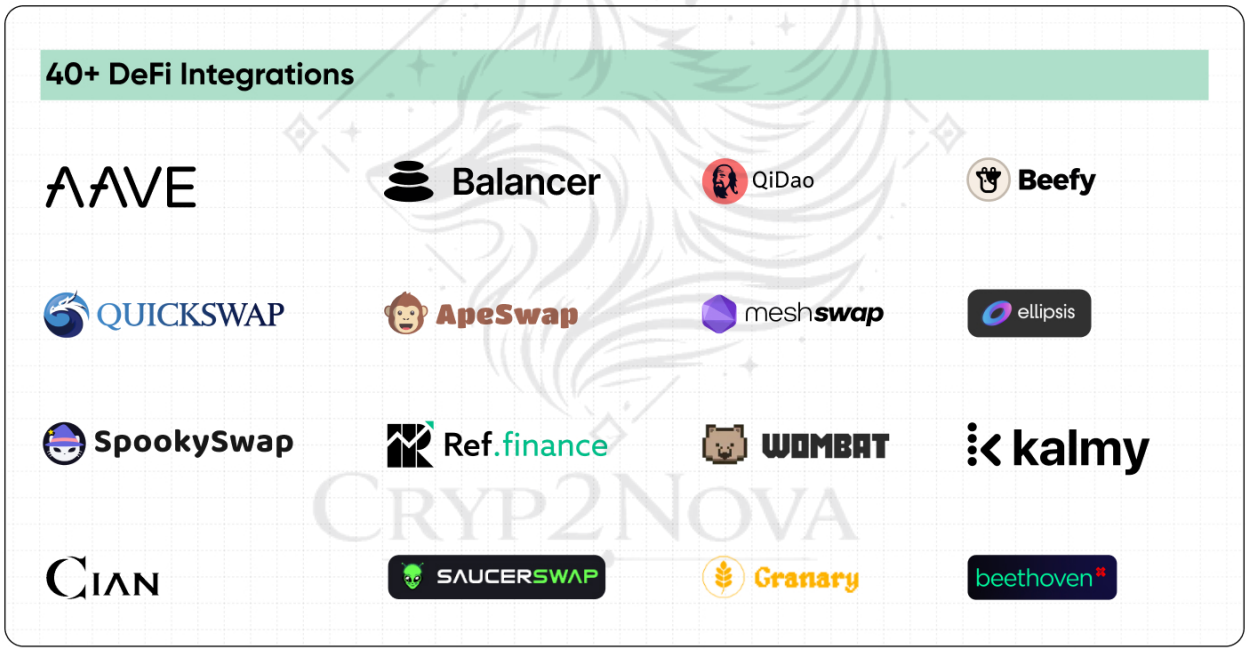
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DeFi: Developing a full-fledged ecosystem for ETHx

At Stader, we understand that the utility of our liquid staking tokens are incomplete without full-fledged Defi. For our liquid staking tokens across chains, we have over 40 Defi integrations, including blue chip protocols like AAVE (v3 market on Polygon), Balancer (on Polygon), Beefy (across chains), QiDAO (on Polygon), Apeswap (BNB), BeethovenX (Fantom), Ref finance (Near) and more! We have everything from lending protocols to DEXs to leverage yield farming to yield aggregators to Defi option vaults and more!

We look forward to building out a fantastic Defi ecosystem for ETHx with focus on unlocking instant liquidity through DEXs, use of ETHx as collateral on lending protocols & overcollateralized stablecoins, leveraged staking vaults, DeFi option vaults and more.



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Tokenomics

SD (Stader's governance token) is critical to the functioning of the Stader platform. Stader community (SD holders, stakers) gets to participate in the governance of the Stader platform. With SD staking expected to go live in a few weeks, SD stakers are expected to receive a share of Stader protocol revenues.

Node operators across ecosystems (especially Ethereum) are crucial for the long term sustenance of the Stader protocol. It is henceforth critical to align interest and incentives between node operators (both permissioned and permissionless) and Stader protocol. Keeping in mind our decentralization ethos and reducing barriers to entry for home stakers, Stader protocol will implement a sophisticated tokenomics model that creates a win-win for node operators and the protocol. Further details will be shared along with timelines for implementation.



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Conclusion

ETH staking ecosystem needs better distribution of stake across a wider set of participants compared to the current situation of top 3 entities holding ~50% of all staked assets.

Stader's ETHx will provide users a robust alternative that will have best-in-class staking yield (access to MEV+tips, competitive commission), strong DeFi. ETHx's multi-pool architecture will help it scale up smoothly with user demand.

In addition to this, ETHx will allow anyone to run nodes in a permissionless way, with the lowest bond requirement of just 4 ETH! This sets up ETHx to truly build the home staker ecosystem to be the backbone of its node operations by reducing capital inefficiencies and improving yield.

More information on tokenomics and security architecture will be shared with the community in the coming weeks.

Stader looks forward to feedback from the ETH community to further refine ETHx so we can together advance the journey towards a more decentralized Ethereum network.

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Appendix

ETHx: Deep-dive on bond requirement

In this section, a high level overview of the analysis to find the right bonding requirement for home stakers/permissionless node operators for ETHx is covered. Dedicated blog with all the details to be published shortly for those looking to understand more.

This important analysis was carried out in collaboration with SSV Network and we are also grateful to have received feedback and suggestions from Stakin.

In order to find the right bonding requirements for home stakers, it's important to clearly outline the factors that can affect user's staked funds and then simulate how user's staked funds are affected under these conditions. Both the key risk factors and simulation results are identified and summarized in this section.

Firstly, a user's staked funds on Ethereum are subject to the risk of being penalized or slashed or both. The severity of these risks is dependent on 3 key factors: Validator performance, network conditions and infrastructure.
The following conditions have been chosen with the objective of finding an aggressive estimate of the risk to user funds:

1. **Validator performance**: Cohort of permissionless node operators that represent a worst case scenario for ETHx have to be considered for the simulation. To achieve this, the bottom 20th percentile node operators from a representative sample set have been chosen. (Referred to as "Home stakers - bottom performers" in the text below)
2. **Network conditions:**
   a. **Inactivity leak of 7 days,** considering the highest inactivity leak lasted for 5 days on the medalla test net
   b. **Isolated slashing event -** this is the norm on ETH given slashing events are rare on Ethereum with only 224 all-time slashing events
   c. **Non-isolated slashing event** represents the scenario of one of the largest slashing events on ETH, from Feb'21, where 96 validators were slashed in 36 days
3. **Infrastructure: Non-DVT versus DVT** infrastructure to highlight the potential improvements in a DVT-set up

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Based on the above, detailed simulations were run for all key scenarios outlined above, with the validator's performance at the level of the cohort "Home stakers - bottom performers" identified above. Here is the key finding: **4 ETH bonding requirement is sufficient to cover key tail risks**
and key takeaways are summarized below.

Simulation results: 4 ETH bond covers key tail risks

#	Scenarios	Validator balances after 180 days		Bond required to cover risk	
		Non DVT	DVT	Non DVT	DVT
1	Normal network conditions	32.563	32.6	0	0
2	Inactivity leak for 7 days	31.007	31.847	0.993	0.153
3	Isolated slashing event	30.916	30.916	1.084	1.084
4	Non-isolated slashing event	30.829	30.829	1.171	1.171
5	Isolated slashing event followed by inactivity leak for 7 days	28.042	28.042	3.958	3.958
6	Non-isolated slashing event followed by inactivity leak for 7 days	27.964	27.964	4.036	4.036

Note:

1. In scenarios #1 and #2, a validator operating in a DVT network will leverage the efficiencies of fault-tolerance by achieving higher uptime, and consequently incurs lower penalties.
2. In scenarios #3 to #6, assumes that the DVT validator is offline even though DVT significantly reduces the probability of the validator being offline.
3. Given the Shanghai Upgrade is expected to launch in March 2023, a 180 day window for force-exiting validators provides a sufficient buffer for any delays in the Shanghai upgrade or from the exit queue being long.
4. Execution layer rewards were excluded (MEV & priority fees) to provide a conservative view

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Risk of MEV theft to user yield

Non-sharing of MEV rewards/priority fees by node operators will not affect the user's staked balance but it is a possible risk to yield. We have analyzed the MEV per day for participating validators using flashbots' MEV relay as the source. Given ETHx design will have recourse to the node operator bond for MEV theft cases, the expected potential loss of user yield could come from cases of daily MEV > bond requirement. It is to be noted that this analyzes the worst-case possibility given nowhere near 100% of operators will display this behavior.

The potential loss has been calculated for:

1. 4 ETH: Bonding requirement identified as sufficient to protect user's staked ETH
2. 8 ETH: 2x the 4 ETH bond, to test if the potential loss from MEV theft is significantly mitigated

It was observed that 79% of MEV is protected with the 4 ETH bond with a minimal difference of 0.05% of yield loss due to MEV theft versus an 8 ETH bond

Worst-case MEV loss

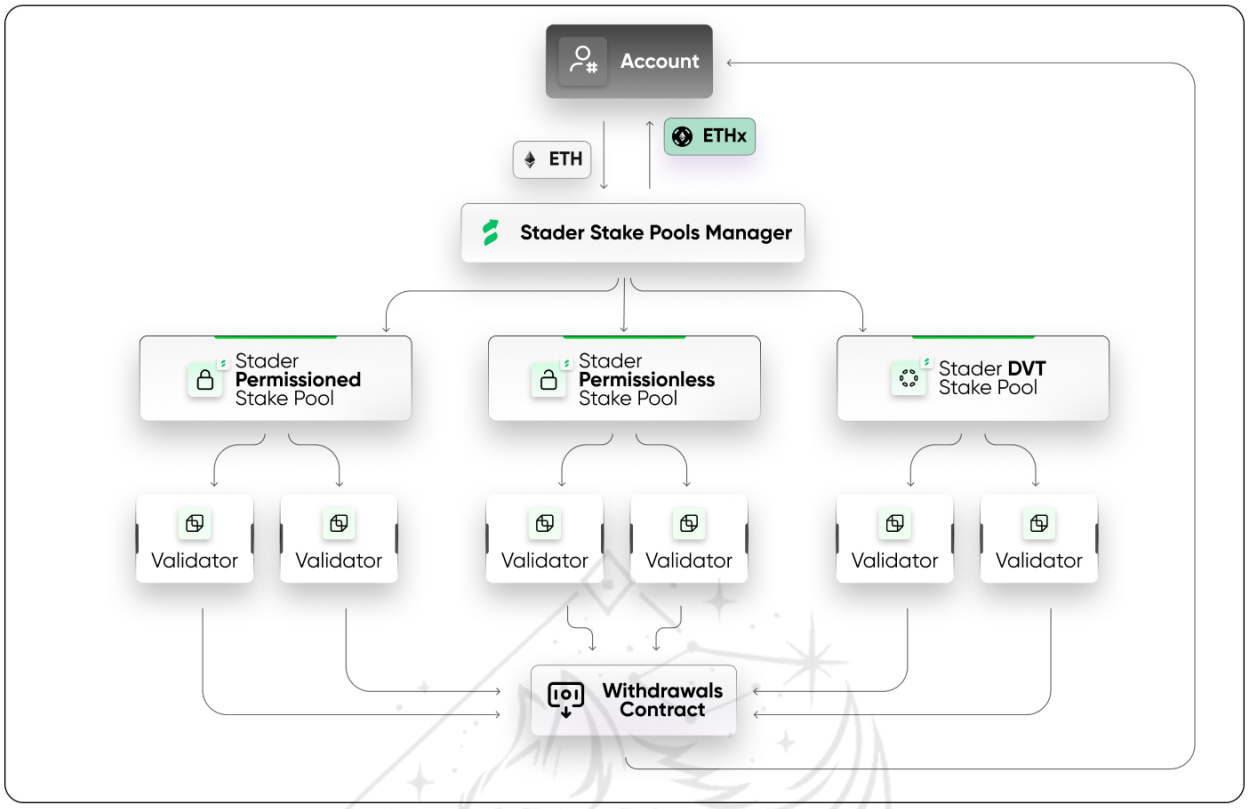
a	MEV estimate as % staked Assets	1%	
		4 ETH Bond	**8 ETH Bond**
b	% MEV loss (3 month weighted avg)	21%	16%
c	MEV protected (1-b)	79%	84%
d	% Yield loss (a*b)	0.21%	0.16%

Other mitigation measures

While MEV values can change with network conditions, the same will be closely monitored and if required, the approach will be modified. With the ability to force exit validators becoming available as an option post the upcoming Shanghai upgrade, there will be further deterrence to such short-term behavior given the opportunity costs.

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ETHx: Architecture and smart contract design



In this section, we will provide an overview of the key components that are represented in ETHx architecture.

ETHx Token

Stader's liquid staking token, ETHx, will be an OpenZeppelin standard ERC-20 token. ETHx will be a cToken which increases in value as staking rewards, MEV and tips accrue to user's staked ETH. It is not be a rebasing token. Stader's ETHx will therefore be expected to grow in value relative to ETH over time, as rewards are earned. ETHx will also be usable across L2s, other chains seamlessly.

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Stader Stake Pools Manager

This is the main contract which the user interacts with for depositing, withdrawing and redeeming ETH. It is the only minter and burner of the ETHx ERC-20 token. It follows the EIP-4626 specification and also contains all the account level bookkeeping, including ETHx exchange rate.

Users deposit ETH in Stader Stake Pools Manager smart contract and mint ETHx at the prevailing exchange rate. The deposited ETH is deployed by Stader stake pool manager to one of the stake pools, that in turn deposits ETH to the beacon chain with a validator and earns rewards.

Stader Stake Pools

We will launch ETHx with Stader Permissioned Stake Pool and Stader Permissionless Stake Pool in phase I.

- Stader Permissionless Stake Pool - This is the smart contract that manages operators from the permissionless pool, where any operator can bond 4 ETH to participate in this stake pool. No whitelisting required to become a part of the permissionless pool.
- Stader Permissioned Stake Pool - This is the stake pool contract that manages Stader-curated, community approved set of reputed operators.

Apart from this, as DVT technologies prove themselves to be reliable on ETH mainnet, Stader will be adding dedicated DVT stake pools in phase II.

Withdrawals Smart Contract

Stader's withdrawal credentials will point to the withdrawals smart contract instead of a BLS key. All validator deposits will always point to the withdrawals smart contract.

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